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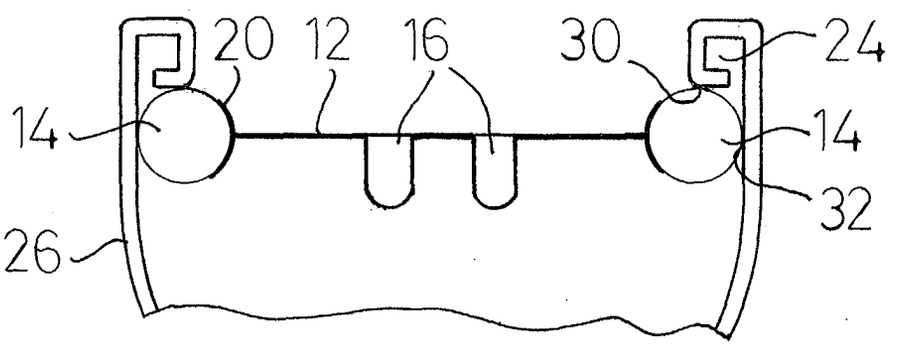
(54) Backflow seal

(57) A backflow seal (10), and in particular a seal which can be inserted into the pan (26) of a toilet to seal the pan and seek to prevent the backflow of liquid therefrom. The backflow seal (10) comprises a cover member (12) adapted to cover a part of the pan (26) of a toilet and a seal member (14) adapted to seal the gap between the cover member and the edge of the pan.



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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a backflow seal, and in particular to a seal which can be inserted into the pan of a toilet to seal the pan and seek to prevent the backflow of liquid therefrom.

BACKGROUND TO THE INVENTION

[0002] The soil pipe of a toilet is usually connected directly to the sewerage system, it being arranged that the water level in the toilet is higher than that in the sewerage system so that the water and sewerage naturally flows from the toilet into the sewerage system. In conditions of flood, however, the water pressure in the sewerage system can increase and can cause backflow of water and sewage into the pan of a toilet. In severe floods the backflow can cause the toilet pan to overflow contaminating the building in which the toilet is located, and presenting a serious health threat to persons present therein.

DESCRIPTION OF THE PRIOR ART

[0003] Many devices are known to seek to prevent the ingress of flood water into a building, these devices seeking to seal the openings through which the water may enter the building, such as around the doors and through the airbrick or other building ventilators.

[0004] It is also known to fit a non-return valve onto the soil pipe of a toilet so as to prevent the backflow of liquid into the toilet pan. However, such devices are not always acceptable because they provide a restriction to flow out of the toilet pan in normal use, and can provide a trap for solids within the soil pipe.

SUMMARY OF THE INVENTION

[0005] It is an object of the present invention to provide a backflow seal which avoids or reduces the likelihood of the backflow of water and sewage overflowing the toilet pan, and yet also avoids the problems associated with the non-return valves described above.

[0006] According to the invention there is provided a backflow seal comprising a cover member adapted to cover a part of the pan of the toilet and a seal member which is adapted to seal the gap between the cover member and the edge of the pan.

[0007] The backflow seal of the present invention is therefore fitted into the pan rather than the soil pipe. As such, it is designed to be fitted by the user as and when required, i.e. when flood conditions exist or are likely. The backflow seal can be used to close off the pan and prevent the passage of water and sewage therethrough. By closing off the pan the present invention can prevent the overflow of any backflow therefrom. It will therefore be understood that it is not necessary to prevent backflow altogether, but the present invention can reduce the backflow which will occur, and can maintain the backflowed water (and sewage) within the pan.

[0008] If, as is intended, the present invention will provide a total seal at the pressures involved, backflow will only occur until the pressure within the pan (underneath the cover member) matches the back pressure in the sewerage system. The back pressure is not likely to be too great, for example 7,500 Pa (equivalent to a head of water 0.75 m high), it being recognised that few floods exceed the height of the toilet pan by more than 0.75 m, and those floods which do are usually catastrophic in any event.

[0009] Preferably, the cover member is slightly smaller than the rim of the toilet pan; preferably also the seal member is sufficiently flexible to allow the backflow seal to pass the rim of the toilet pan. Accordingly, the backflow seal can be located under the rim, so that the backflow pressure presses the backflow seal against the underside of the rim and the seal is not required to be maintained in position by friction alone.

[0010] Desirably, the seal member is inflatable, and can pass the rim in its deflated condition, but cannot pass the rim in its inflated condition. Ideally, the backflow seal, when the seal member is inflated, is adapted to lie immediately beneath the rim of the toilet pan, the seal member engaging the underside of the rim and the periphery of the toilet pan. The seal member is therefore able to seal against two surfaces at the edge of the toilet pan.

[0011] Preferably, the seal member is tubular and has a valve means by which it may be inflated and deflated. Desirably, the valve means is a Schrader valve.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Fig.1 is a plan view of the backflow seal according to the invention; and

Fig.2 is a cross-sectional view of the backflow seal of Fig.1 fitted into a toilet pan.

DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

[0013] The backflow seal 10 comprises a cover member 12 and a seal member 14. The cover member 12 is a substantially flat plate into which are formed two depressions 16 which allow the ingress of the fingers and thumb of a person's hand, and by which the backflow seal 10 can be manipulated and moved.

[0014] The cover member 12 also has a peripheral channel 20 (see also Fig.2) which can accommodate the

seal member 14 as described below. In this embodiment the seal member 14 is secured to the channel 20 by an adhesive bond, but in less-desirable embodiments it can be retained by friction, e.g. the seal member can be stretched to fit into the channel and the resilience of the seal member is sufficent to retain it within the channel under the back pressures involved.

[0015] The cover member 12 is continuous and is suitably of a chemically resistant plastic such as ABS. Preferably the cover member 12 is formed by a vacuum thermal forming process or by injection moulding. Other materials are known to be suitable for the cover member, including metals, wood, other plastics materials and composites.

[0016] The seal member 14 is a tube of flexible and resilient material which is also chemically-resistant. Butyl has been found to be a suitable material for the seal member 14, though other materials are also expected to be suitable.

[0017] The tubular seal member 14 has a relaxed cross-sectional diameter of around 3 cm, but can expand to a diameter of around 8 cm. To effect this expansion, the seal member is fitted with a Schrader valve 22 through which air or other gas can be introduced into (or released from) the seal member 14. The Schrader valve passes through a hole formed in the channel 20, so that the channel 20 provides some support for the valve 22 during deflation and particularly inflation.

[0018] In the embodiment shown the cover member 12 has a width w of around 20 cm and a length 1 of around 25 cm. The ends of the cover member are part-circular, with a radius of curvature of around 10 cm. Other sizes of cover member could of course be used, and it is not necessary that the ends of the cover member be part-circular, or that the ends have the same curvature. All that is required is that the cover member be slightly smaller that the rim 24 of the toilet pan 26 so that the backflow seal 10 can pass the rim when the seal member 14 is deflated. Also, the cover member 12 should ideally span a large proportion of the toilet pan 26 adjacent the rim 24 so that the seal member 14 can be of relatively small cross-sectional diameter.

[0019] Whilst the size and shape of toilet pans vary somewhat they are all substantially similar in size and shape, and it is expected that a backflow seal 10 having a cover member 12 of this size, and a seal member 14 which can expand as indicated, will fit the majority of toilet pans. Thus, if necessary the seal member 14 can expand by different amounts around its length so as to fit the particular dimension of the toilet pan 26. Clearly, if particular regions which are susceptible to flooding have toilet pans of a particular size and shape the backflow seal can be made of a suitable size and shape to fit those toilet pans.

[0020] In the fitted condition of Fig.2 the backflow seal is shown in its preferred position undereath the rim 24 of the pan 26. In this position, when the seal member 14 is expanded as shown, it will engage the underside 30 of the rim 24, and also the periphery 32 of the pan 26. It will be understood that the underside 30 of the rim 24, and the periphery 32 of the pan 26, are designed to be smooth surfaces and so are susceptible to forming a good seal with the (similarly smooth-surfaced) seal member 14. By creating a seal against two surfaces at the edge of the toilet pan, the likelihood of leakage between the seal member 14 and the toilet pan 26 is much reduced, and tests have shown that leaks can be eliminated altogether at the back pressures encountered in the majority of floods.

[0021] In addition, the adhesive bond between the seal member 14 and the channel 20 prevent any leaks occuring between the seal member 14 and the cover member 12, and the cover member 12 is itself impervious.

[0022] Accordingly, when a flood is expected the backflow seal 10 can be inserted into the toilet and the seal member 14 inflated. The cover member 12 can be manipulated (by way of the depressions 16) during inflation to ensure that the seal member 14 engages the underside 30 of the rim 24 and the perphery 32 of the pan 26 so as to maximise the seal obtained. Should a flood occur and back pressure be created within the sewerage system, backflow of water and sewerage will occur into the pan 26; however, since neither air nor liquid can escape the pan 26 backflow will only occur until the pressure within the pan 26 matches that of the sewerage system, so that only a small volume of liquid will be forced into the pan 26.

[0023] If, for example, the back pressure in the sewerage system is 7500 Pa and the area of the backflow seal 10 is approximately 600 cm^2 (0.06 m^2), the force acting upon the backflow seal is approximately 450 N (equivalent to 45 Kg). This force must be opposed by the pressure within the sealing member 14, and in particular the force which that pressure exerts upon the underside 30 of the rim 24 (though there will also be a frictional force acting upon the periphery 32 of the pan 26). If the length of the periphery of the seal member 14 when it engages the rim 24 of the toilet pan 26 is approximately 80 cm, and the seal member engages the underside 30 of the rim 24 across a width of approximately 1 cm around its length, then the area of contact is approximately 80 cm^2 (0.008 m^2). To provide a counteracting force of 450 N across this area (i.e. ignoring the frictional force acting upon the periphery 32 of the pan 26 and assuming that the sealing pressure acts only against the rim 24) requires a pressure within the seal member 14 of approximately 56,000 Pa. This pressure is only slightly greater than 0.5 atmospheres and so the pressure in the seal member 14 must be elevated to 0.5 atmospheres above atmospheric pressure, which can easily be accommodated by a tubular seal member of butyl.

[0024] In Fig.2, the cross-sectional shape of the seal member 14 is shown as being substantially circular; as the seal member 14 is fully expanded it will distort so that part of its surface lies across a part of the periphery

32 of the pan 26, and another part lies across a part of the underside 30 of the rim 24, this distortion creating a longer sealed path through which air and liquid must pass to escape the pan.

[0025] In the embodiment shown the cover member is of a different material to the seal member, but in other embodimments the same material can be used for both, and if desired the seal member and cover member can be integral, i.e. the seal member can be an extension of the cover member and vice versa.

Claims

1. A backflow seal (10) comprising a cover member (12) adapted to cover a part of the pan (26) of a toilet and a seal member (14) which is adapted to seal the gap between the cover member and the edge of the pan.

2. A backflow seal according to claim 1 in which the cover member (12) is slightly smaller than the rim (24) of the toilet pan (26).

3. A backflow seal according to claim 1 or claim 2 in which the seal member (14) is flexible so as to allow the backflow seal to pass the rim (24) of a toilet pan (26).

4. A backflow seal according to any one of claims 1-3 having a first condition in which it can pass the rim (24) of a toilet pan (26) and a second condition in which it cannot pass the rim, the seal member (14) sealing the backflow seal against the pan (26) in its second condition.

5. A backflow seal according to any one of claims 1-4 in which the seal member (14) is inflatable.

6. A backflow seal according to claim 5 in which the backflow seal, when the seal member (14) is inflated, is adapted to lie immediately beneath the rim (24) of the toilet pan (26), the seal member engaging the underside (30) of the rim and the periphery of the toilet pan.

7. A backflow seal according to claim 5 or claim 6 in which the seal member (14) is tubular and has a valve means (22) by which it may be inflated and deflated.

8. A backflow seal according to claim 7 in which the valve means (22) is a Schrader valve.

9. A backflow seal according to any one of claims 1-8 in which the cover member (12) has a peripheral channel (20) which can locate a part of the seal member (14).

10. A backflow seal according to claim 9 in which the seal member (14) is adhered within the channel (20).

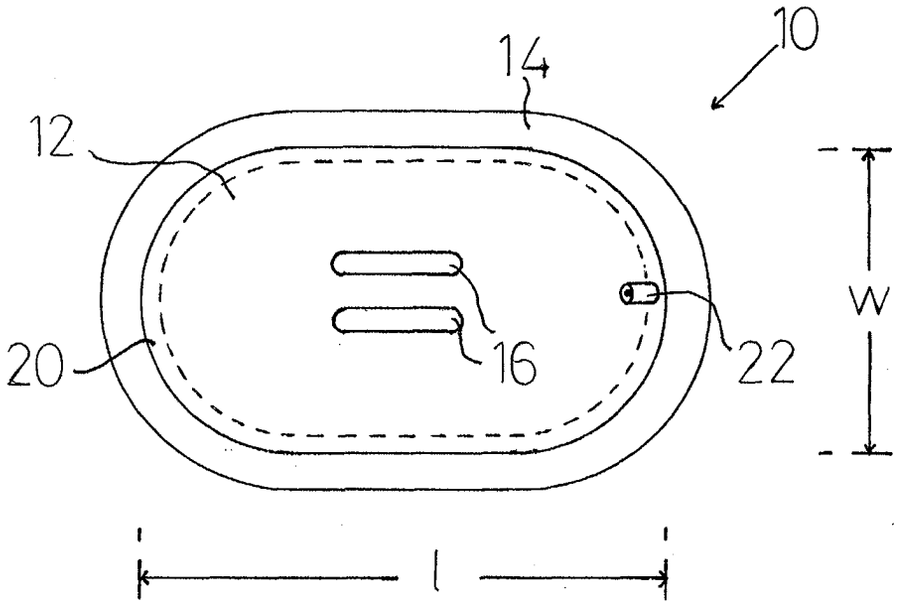

FIG 1