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SIPHONIC UNIT FOR FLUSHING CISTERNS

This invention relates to a siphonic unit for flushing cisterns and is particularly concerned with siphonic units of the kind comprising an inverted generally U-shaped duct having an upleg and a downleg, the upleg of which is provided with an enlarged chamber which receives a vertically displaceable piston by means of which, in use, a siphonic action can be initiated in a well known manner, the downleg of said duct forming an outlet at a position offset laterally with respect to the chamber.

Siphonic units of this kind are in general manufactured as plastics mouldings and the piston incorporates a flexible diaphragm of for example rubber or plastics material which acts as a oneway valve. Such a siphon unit is hereinafter referred to as "a siphon unit of the kind referred to".

In practice, the outlet end of the duct terminates in a connector arrangement whereby the outlet end can be secured to the base of the cistern in registry with a water delivery pipe or passage leading to a lavatory pan. This connector arrangement also serves to mount the remainder of the siphonic unit within the cistern with the downwardly presented open mouth of the piston chamber spaced slightly above the cistern base to permit admission of water into the siphonic unit.

From time to time the diaphragm may have to be replaced and with conventional siphonic units, this tends to be a time consuming task especially in the case of close-coupled suites because the cistern must first be dismantled from

the pan and then the entire siphon unit has to be removed from the cistern in order to gain access to the diaphragm. As a general rule, this is a relatively difficult task for the average householder and is best left to a plumber.

The object of the present invention is to provide a syphonic unit of the kind referred to wherein access to the piston chamber is considerably simplified thereby permitting diaphragm replacement or other repairs to be carried out easily and simply and at minimum cost by relatively unskilled persons. This will enable cisterns to be maintained in good working order at greatly reduced expense and will be of particular benefit to property owners such as Local Authorities.

According to the present invention we provide a syphonic unit of the kind referred to in which the unit comprises at least two portions which are releasably connected together in such a way that one portion including said chamber can be disconnected from the other portion or portions when the unit is in situ within a cistern, and in which means is provided for transmitting the force acting on the chamber to the cistern during operation of the piston without any substantial transmission of force via the joint or joints between the portions of the syphon unit.

Preferably the connection between the two portions will be located at a position where, in normal usage of a cistern incorporating the unit, the joint is above the water level within the cistern, i.e. as defined by a float-controlled inlet valve which controls the amount of water that can be admitted into the cistern. With such

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an arrangement access to the connection is facilitated and said one portion may be disconnected from the other portion and removed entirely from the cistern without the need for draining and subsequently
5 refilling the cistern. In this manner, replacement of the diaphragm is considerably simplified.

In one embodiment of the invention, the downleg of the siphon unit comprises two telescopically related sections one of which is united with the
10 upleg and said chamber and the other of which is adapted to be connected to the outlet of the cistern in the manner of a stand pipe, the releasable connection between the stand pipe section and
15 said one section being located at or adjacent the upper end of the stand pipe section. This is conveniently achieved by arranging for said one section to telescope within the stand pipe section.

In a second embodiment the unit comprises
20 two releasably interconnected portions of which the one comprises the chamber and the upleg section of said duct with the remainder of the duct being constituted by the other portion.

Although the joint between the two portions
25 may conceivably be provided at any point along the length of the duct, preferably the joint is made in the section of the U which joins the two legs of the U shaped duct and in one convenient embodiment the plane of the joint may extend substantially
30 vertically and may be located substantially midway between the two legs.

The joint is conveniently of a spigot and socket nature, possibly with the interposition

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of a fluid tight seal. The spigot and socket may be arranged to fit together as a friction or wedge fit and/or they may be held together by some form of connector such as a clip which
5 may extend peripherally around the joint. The joint need not however, be of the spigot and socket type; for example the portions may have opposing surfaces at the joint which are held together
10 (with the possible interposition of a seal) by connector means, such as one or more clips or screwthreaded fasteners, which may for example engage with flanges on the two portions.

The invention is not limited to a siphon unit comprising two portions as described above.
15 The syphon unit may comprise three portions and in a particularly advantageous embodiment the three portions may comprise a first portion including the chamber and an upwardly projecting section of the duct, a second portion comprising the down
20 leg section of the duct and a third portion forming the bight of the U, the third portion being in telescopic relation with the upleg and downleg duct sections in the manner of a trombone slide and being releasably connectable to the upleg
25 and/or downleg duct sections. In addition to allowing ready access to the piston chamber, such an arrangement has the important advantage that the overall height of the siphon may be adjustable thereby obviating the need to manufacture the
30 units in different sizes, as has been the practice hitherto.

The trombone like third portion is conveniently sealingly but slidably engaged with the first and second portions and means may be provided
35 for holding it in a selected position of adjustment.

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To ensure a smooth and uninterrupted passage for water flow, the upleg portion will conveniently fit inside the contiguous telescopic part of said third portion and the third portion will fit inside the contiguous telescoping part of the downleg portion.

A potential difficulty with producing a siphon unit in two portions stems from the forces brought into play when the piston is lifted to initiate siphoning in that the force acting on the piston is transmitted to the chamber walls and may as a consequence tend to stress the joint or joints between said portions of the siphon unit with the possibility of developing a faulty seal and interruption of the siphoning action. For example, in a two-part unit with the joint located in the region of the bight of the U, the lifting force will tend at least in part to be transmitted along the upleg and will be counteracted by a reaction force due to the downleg being secured to the base of the cistern with consequent stressing of the joint. The above problem is overcome in accordance with the invention by the provision of said means for transmitting the force acting on the chamber to the cistern without any substantial transmission of force via the joint or joints between the portions of the siphon unit. Thus the joint or joints are effectively bypassed by providing a separate force transmission path from the chamber to the cistern. The force transmitting means may serve to couple the portion including the chamber to the portion including the outlet end of the duct so that the force is transmitted from the chamber to the cistern via the outlet region of the duct without any substantial stressing of the joint or joints. Such force transmitting

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means may comprise a pair of abutments provided on respective portions of the unit to transmit force from one portion to the other. Thus, for example, one abutment may be provided on the exterior of the chamber wall and the other abutment may be provided on the exterior of the downleg duct section in the vicinity of its outlet end.

In the previously mentioned embodiment in which the joint extends generally vertically in the bight region of the U, the abutments may act as a fulcruming arrangement so that, when brought into contact, they allow the portion comprising the chamber and the upleg duct section to pivot towards and away from the downleg duct section. Thus, in this example, the downleg duct section is first installed in the cistern and the portion comprising a chamber and the upleg duct section are then pivoted (after bringing the fulcruming abutments together if necessary) until the joint making ends of the upleg and downleg sections engage whereupon the two sections are secured together either by frictional interengagement or by a connector device or devices. To separate the one portion for diaphragm replacement the reverse procedure is followed and the abutments are separated to enable the portion including the chamber to be removed from the cistern.

The abutments in one convenient arrangement may comprise a projection on one portion and a projection receiving recess on the other portion and the recess and projection may have a releasable snap fit or frictional or wedging type engagement with each other. Thus, for example, the one portion may be moulded with a generally horizontal lug or web of material and the other portion may be

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moulded with a generally vertical web of material in which a horizontal slot is formed for reception of the horizontal lug or web. The horizontal web may be indented to form a seat on which a formation on the vertical web may seat to facilitate fulcruming and possibly also to provide some resistance to separation of the two abutments.

Embodiments of the invention are illustrated in the accompanying drawings to which reference is now made:

- Figure 1 is a schematic view of a first embodiment;
- Figure 2 is a fragmentary section view of the joint between the two portions of the siphon unit of Figure 1;
- Figure 3 is a transverse sectional view of the joint shown in Figure 2;
- Figure 4 is a fragmentary view of an abutment arrangement between the two portions in the siphon unit of Figure 1;
- Figure 5 is a view similar to Figure 2 of a modified form of joint;
- Figure 6 is an enlarged view of part of the joint in Figure 5 showing the snap action catch for securing the joint;
- Figure 7 is a similar view to Figure 6 showing a modified form of catch; and
- Figure 8 is a transverse section showing the use of a band clamp to ensure proper location of the upleg and downleg portions.

Referring to Figures 1 to 4, the siphon unit illustrated comprises a generally conventional upleg 10 with an enlarged chamber 12 accommodating a piston 14 incorporating a flexible diaphragm 16. The piston 14 is connected to a rod 18 which,

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in turn, may be connected to an operating handle and linkage (not shown) in conventional manner to enable the flush to be initiated by displacing the piston 14 upwardly. The connection between
5 the piston rod 18 and the lifting linkage is conveniently by means of a hook or a split pin or some other form of quick release connection (as opposed to a screwthreaded fastener).

The siphon unit is generally similar to a
10 conventional plastics moulded siphon unit except that it comprises two portions joined at the bend at the top of the unit. Thus, one portion comprises the upleg 10 and chamber 12 (with piston 14 and diaphragm 16 operated in conventional fashion)
15 and the other portion comprises the downleg 40 which is fastened directly to the outlet in the base 26 of the cistern in conventional manner. The two portions may be secured in airtight fashion at the joint 42 by various means such as one or
20 more screwthreaded fasteners clamping together abutting flanges of the two portions.

Figures 2 and 3 illustrate the provision of a clamp for securing the joint in a particularly expedient manner. As shown, in the vicinity of
25 the joint, the upleg 10 is provided with a spigot 46 of generally conical configuration and the downleg 40 has a mating socket 44 to provide an airtight seal when the spigot 46 is inserted therein. On their outer peripheries, the ends of the upleg
30 section 10 and downleg section 40 are formed with outwardly extending peripheral formations having generally conical surfaces which, when the spigot 46 and socket 44 are interengaged, together afford a generally V-shaped ridge which is received within
35 a V-shaped peripheral groove in the clip 50.

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The arrangement is such that, when the clip is tightened around the joint by means of a fastener 52 engaged with apertured lugs 54 of the clip, cooperation between the groove and the ridge urges the spigot 46 firmly into the socket 44.

The clip 50 may conveniently be manufactured as a one-piece plastics moulding comprising two generally semi-circular halves 56 integrally united by a reduced section web 58 which forms a hinge between the two halves to enable them to be manipulated during assembly around the joint 42. Instead of the screwthreaded fastener 52, the two halves of the clip may be secured together tightly around the joint 42 by other means.

As explained previously, operation of the piston 14 imparts an upward thrust to the siphon unit. To eliminate or at least minimise the stresses that would otherwise arise in the joint between the two portions of the siphon unit, the upleg portion 10 is connected to the downleg portion 40 at a position such that the upward thrust is absorbed by the downleg portion without stressing the joint 42. The connection comprises a pair of abutments 60,62 so arranged that the upward thrust is transmitted through the abutments to provide a counterbalancing reaction via the connection between the downleg 40 and the cistern base 26. As shown, the abutment 62 is superimposed above the abutments 60 for this purpose.

To aid proper registry between the abutments 60,62 they conveniently interfit by means of for example a generally conical boss 64 and a complementary recess 66. During assembly of the upleg portion

10 to the downleg portion 40, the boss 64 will first be engaged in the recess. The upleg portion can then be manipulated using the connection between boss 64 and recess 66 as a fulcrum to bring the spigot 46 into registry with the socket 44 and thereafter the clip 50 can be assembled and tightened to secure the joint.

When assembled in the manner shown in Figure 1 the siphon unit functions in conventional manner. When however it is desired to replace the diaphragm 16, the present invention makes this possible in a very simple manner since that portion of the unit comprising the upleg 10 and the chamber 12 can be removed by disconnecting the clip 50 manoeuvring that portion bodily to disengage the abutments 60, 62. The downleg 40 can be left undisturbed so that replacement of the diaphragm can be carried out without draining the cistern and shutting off the water supply. Moreover, since the connection at the outlet of the cistern base 26 does not have to be undone it is unnecessary to dismount the cistern from the pan as will be the case in a close coupled suite. After the diaphragm 16 has been renewed, the removable portion of the siphon unit is replaced with the abutments 60, 62 interengaged and the clip 50 is reinstalled.

Figures 5 and 6 illustrate an alternative form of clip to that shown in Figures 1 to 3. In this case, one of the contiguous flanged ends of the upleg and downleg portions has a clip 70 hingedly connected thereto through the agency of a reduced section web 72. The other end is provided with a keeper formation 74 for snap engagement by a hook or claw 76 on the clip 70 when the clip is hinged to the position shown in Figure 6. The

arrangement is such that with the clip 70 engaged the ends of the upleg and downleg portions 10, 40 are brought firmly together to form an airtight seal. In Figures 5 and 6, the ends of the upleg and downleg portions 10, 40 are shown without any spigot and socket connection but such a connection may be employed if desired, for example in similar manner to that shown in Figure 2. With this embodiment, more than one clip 70 may be employed and in this event the clips may be spaced uniformly about the periphery of the joint. For example, where two clips 70 are used, they may be located at opposite sides around the joint periphery conveniently in substantially the same horizontal plane.

Conveniently the clip 70 will be designed so as to be self-engaging with the keeper 74 as the spigot and socket formations of the portions 10, 40 are pushed firmly one into the other. This may be implemented in similar manner to the modification shown in Figure 7 in which the portion 40 is formed with a bevelled surface 80 for co-operation with an inclined face 82 on the claw 76 and in which the clip 70 is moulded so that, in its free unstressed condition, it extends downwardly at a small angle to the horizontal. As the spigot 84 enters the socket 86, the face 82 on the claw 76 rides up the surface 80 thereby lifting the clip 70 upwardly and stressing the same in the region of its hinge 88 to provide a resilient restoring force. Continued insertion of the spigot into the socket causes the claw to ride across the top of the keeper until the claw 76 can snap back, under the action of the restoring force, into engagement with the re-entrant face of the keeper 74. To aid release of the clip 70, it is conveniently provided with an extension or tab 90 to enable the clip to be lifted with the finger.

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As a precaution against failure of the clip through for example repeated use, the portions 10 and 40 may be provided with lugs in the region of the joint to enable the joint to be clamped with the aid of a fastening, such as a nut and bolt. For example, in the embodiments of Figures 5-7, the clip and keeper assembly may be flanked on either side by a pair of apertured lugs for reception of bolts to enable the lugs to be clamped together to secure the joint.

To strengthen the unit and afford additional security against leakage at the joint between the portions 10 and 40, means may be provided for holding the portions 10, 40 in fixed relation immediately beneath the joint. Such means could be in the form of lugs extending from the portions 10, 40 so as to overlap in the gap between portions 10, 40, the lugs having registering apertures to enable them to be secured in fixed relation by a fastening such as a nut and bolt. However, a more expedient means is illustrated in Figure 8 comprising a moulded plastics clamping band having an integral reduced section hinge web 94 and a snap engaging clip and keeper assembly 96, 98. The band is intended to be secured around the portions 10, 40 immediately below the U-section of the siphon. The band 92 also incorporates divider walls 100, 102 so as to ensure proper location of the portions 10, 40 relative to one another. If desired, the band may additionally include apertured lugs for use in securing the ends of the band together by a suitable fastening in the event of failure of the clip and keeper assembly.

From the foregoing, it will be seen that the various embodiments of the invention allow the diaphragm to be replaced with relative ease

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without the need to disconnect the cistern from the pan in a close coupled suite or to disconnect the siphon unit at the cistern outlet or to shut off the water supply.

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CLAIMS



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1. A syphonic unit of the kind referred to in which the unit comprises at least two portions which are releasably connected together in such a way that one portion including said chamber can be disconnected
5 from the other portion or portions when the unit is in situ within a cistern, and in which means is provided for transmitting the force acting on the chamber to the cistern during operation of the piston without any substantial transmission of force
10 via the joint or joints between the portions of the syphon unit.
2. A unit as claimed in Claim 1 in which the releasable connection between said portions is located at a position above a predetermined water level within
15 the cistern, as determined by a float controlled water inlet valve of the cistern.
3. A unit as claimed in Claim 1 or 2 in which the releasable connection includes one or more clip devices securing the two portions together.
- 20 4. A unit as claimed in Claim 3 in which the or each clip device extends around the periphery of the joints between the two portions.
5. A unit as claimed in Claim 3 or 4 in which the or each clip comprises two halves hingedly connected
25 together at one side with means being provided for connecting them together releasably at the opposite side.
6. A unit as claimed in Claim 5 in which the or each clip is moulded from plastics material with
30 said halves integrally united by a reduced section web which constitutes the hinge between



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the two halves.

7. A unit as claimed in any one of Claims 3 to 6 in which the or each clip device and said portions, in the vicinity of the joint therebetween, are provided with cooperating formations which, when the clip is assembled, urge the two portions together at said joint.

8. A unit as claimed in Claim 3 in which the or each clip device is adapted to extend across the joint between said portions.

9. A unit as claimed in Claim 8 in which the or each clip device is hingedly connected to one of said portions and is adapted to snap engage with a formation on the other portion.

10. A unit as claimed in Claim 9 in which the or each clip device is integrally united with said one portion by a reduced section web which forms the hinge connection.

11. A unit as claimed in Claim 1 or 2 in which the releasable connection includes one or more screwthreaded fasteners securing the two portions together.

12. A unit as claimed in Claim 11 in which said fastener or fasteners secure the two portions together with a clamping action.

13. A unit as claimed in Claim 11 or 12 in which each such fastener comprises a nut and bolt.

14. A unit as claimed in Claim 11 or 12 in which each such fastener engages in a tapped hole provided on one of said portions.



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15. A unit as claimed in any one of Claims 1 to 14 in which said portions are flanged at the joint therebetween and the releasable connection is made with the aid of said flanges.

5 16. A unit as claimed in any one of Claims 1 to 15 in which one of the portions is provided with a spigot which fits within the other portion.

10 17. A unit as claimed in Claim 16 in which the external periphery of the spigot is of conical configuration and mates with a complementary female formation in said other portion.

15 18. A unit as claimed in Claim 1 in which the down leg of the unit comprises two telescopically related sections one of which is united with the up leg and said chamber and the other of which is adapted to be connected to the outlet of the cistern.

20 19. A unit as claimed in Claim 18 in which the releasable connection between said telescopically related sections is located at or adjacent the upper end of said other section.

25 20. A unit as claimed in any one of Claims 1 to 17 in which the joint is made in the section of the U which joins the two legs of the U-shaped duct.

21. A unit as claimed in Claim 20 in which the plane of the joint extends substantially vertically and is located substantially midway between the two legs.



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22. A unit as claimed in Claim 1 wherein the unit comprises three portions, the first portion including the chamber and an upwardly projecting section of the duct, a second portion comprising the down leg of the duct and a third portion forming the bight of the U, the third portion being in telescopic relation with the up leg and down leg duct sections.

23. A unit as claimed in Claim 22 in which the third portion is sealingly but slidably engaged with the first and second portions and means is provided for holding it in a selected position of adjustment relative to the first and second portions.

24. A unit as claimed in any one of Claims 1-23 in which the force transmitting means couples the portion including the chamber to the portion including the outlet end of the duct so that the force is transmitted from the chamber to the cistern via the outlet region of the duct without any substantial stressing of the joint or joints.

25. A unit as claimed in Claim 24 in which the force transmitting means comprises a pair of abutments provided on respective portions of the unit to transmit force from one portion to the other.

26. A unit as claimed in Claim 25 in which said abutments comprise a projection on one portion and a projection receiving recess on the other portion.

27. A unit as claimed in Claim 25 or 26 in which the abutments form a fulcrum whereby one portion



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may be pivoted relative to the other about the fulcrum provided by said abutments while bringing said portions together to form the joint therebetween.

28. A unit as claimed in any one of Claims 3-10
5 in which the or each clip device is arranged so as to snap engage automatically when said portions are brought together to form the joint.

29. A unit as claimed in any one of Claims 1-28
10 in which releasable means is provided for securing the upleg and downleg portions together across the gap therebetween.

30. A unit as claimed in Claim 29 in which said releasable means comprises a clamping device adapted to embrace said portions.

15 31. A unit as claimed in Claim 30 in which said clamping device includes a snap engaging clip for securing its free ends together.

32. A unit as claimed in Claim 31 in which said clamping device includes a pair of locating dividers
20 which extend into the gap between said portions to hold them apart by a preselected spacing.

33. A siphon unit of the kind referred to, substantially as hereinbefore described with reference to any
25 one of the embodiments illustrated in the accompanying drawings.
