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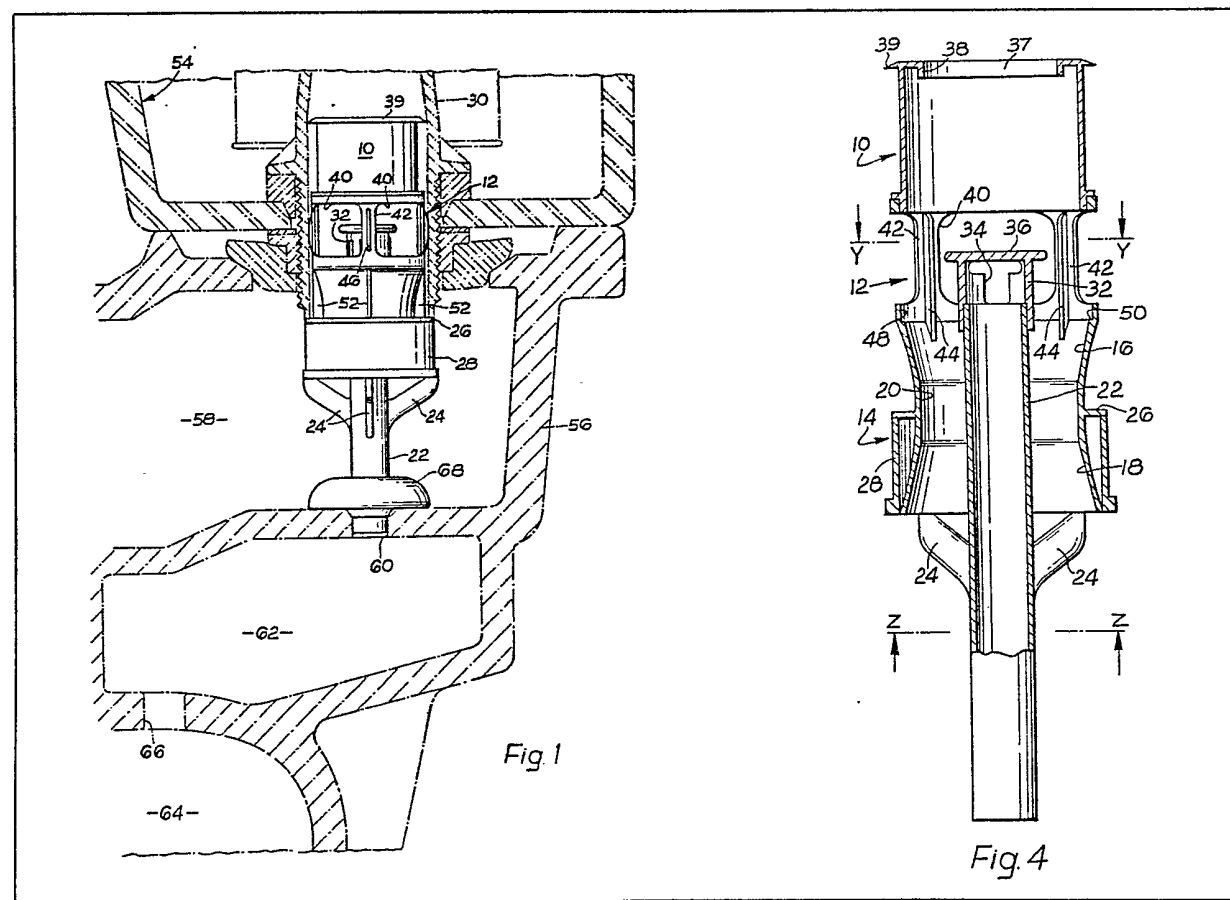
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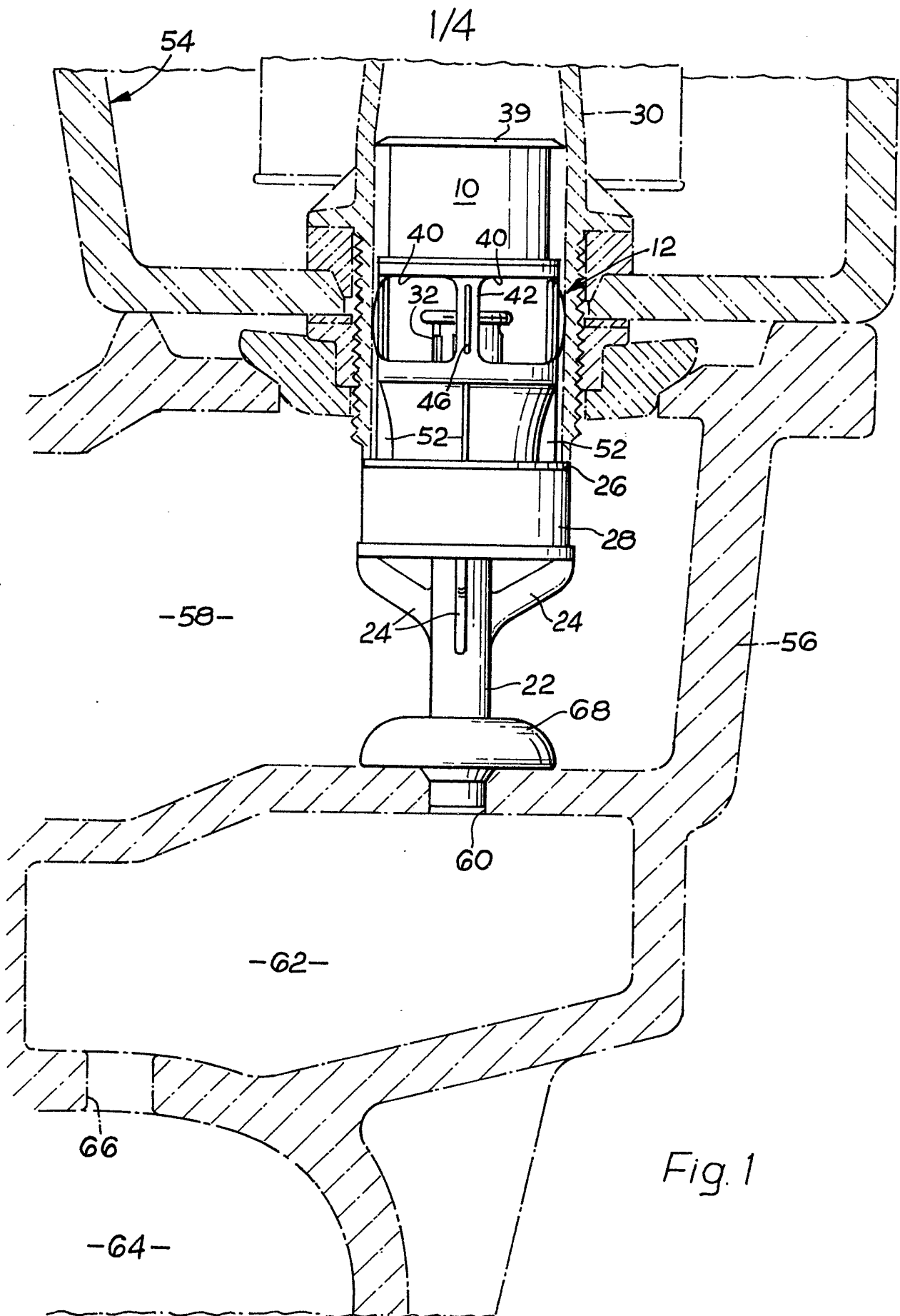
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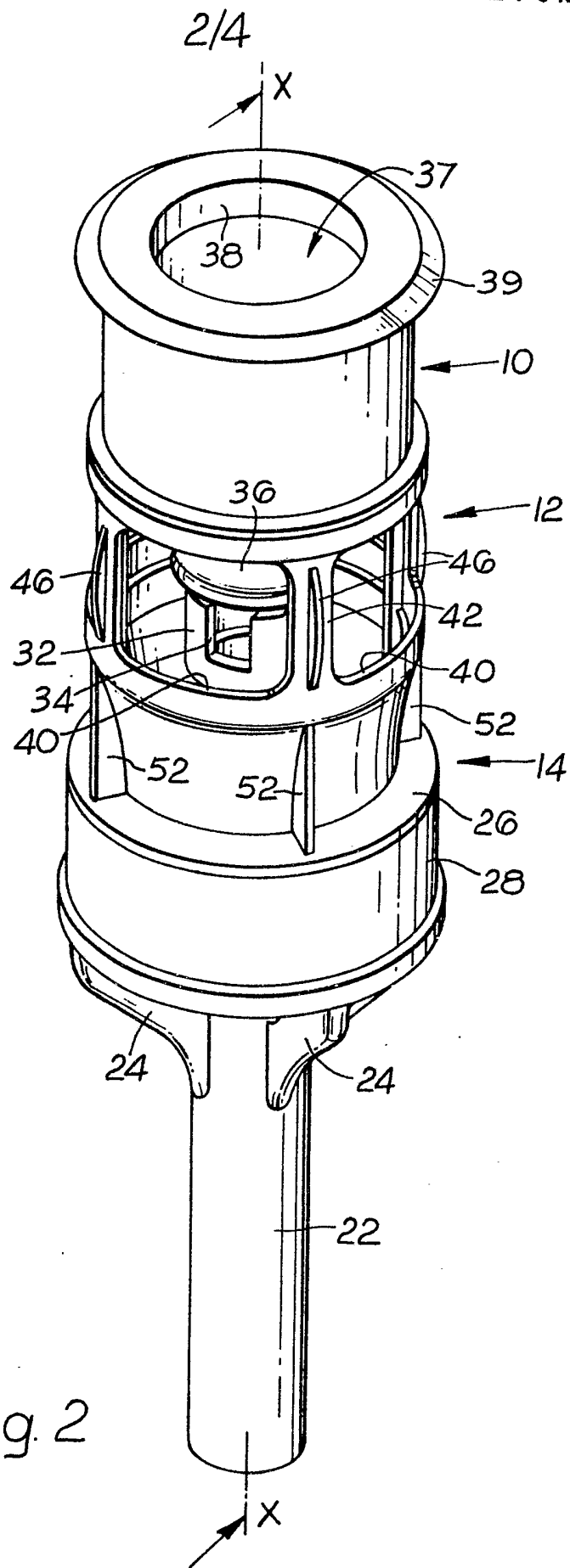
(54) Air extraction device for a
water closet

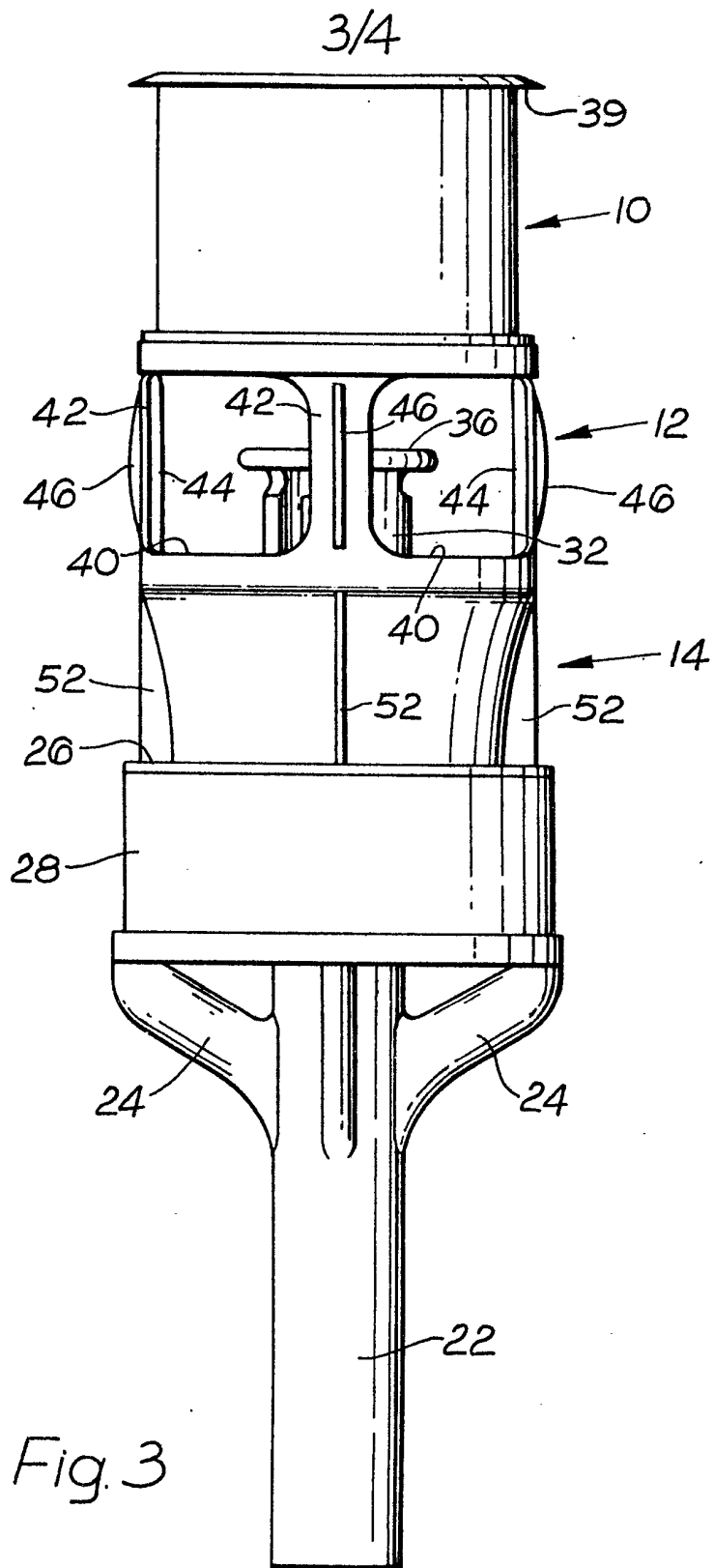
(57) A device for extracting air from
the region 64 between the two traps
of a double-trap w.c. pan, to promote
siphonic discharge, comprises a
tubular body (10) insertable into the
downleg 30 of a flushing siphon and
includes a suction pipe (22)
terminating in an apertured cap (36)
whereby the flow of flushing water

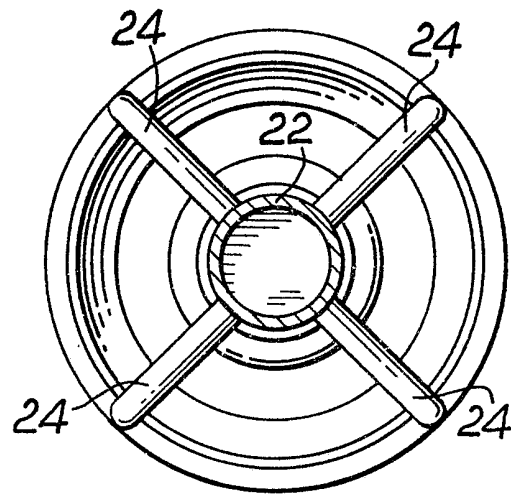
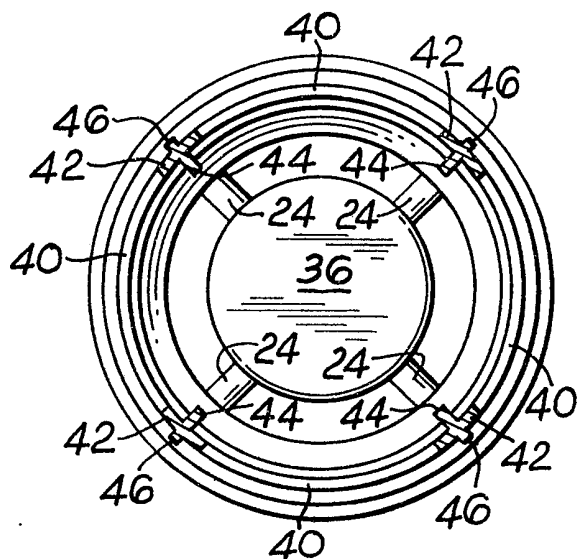
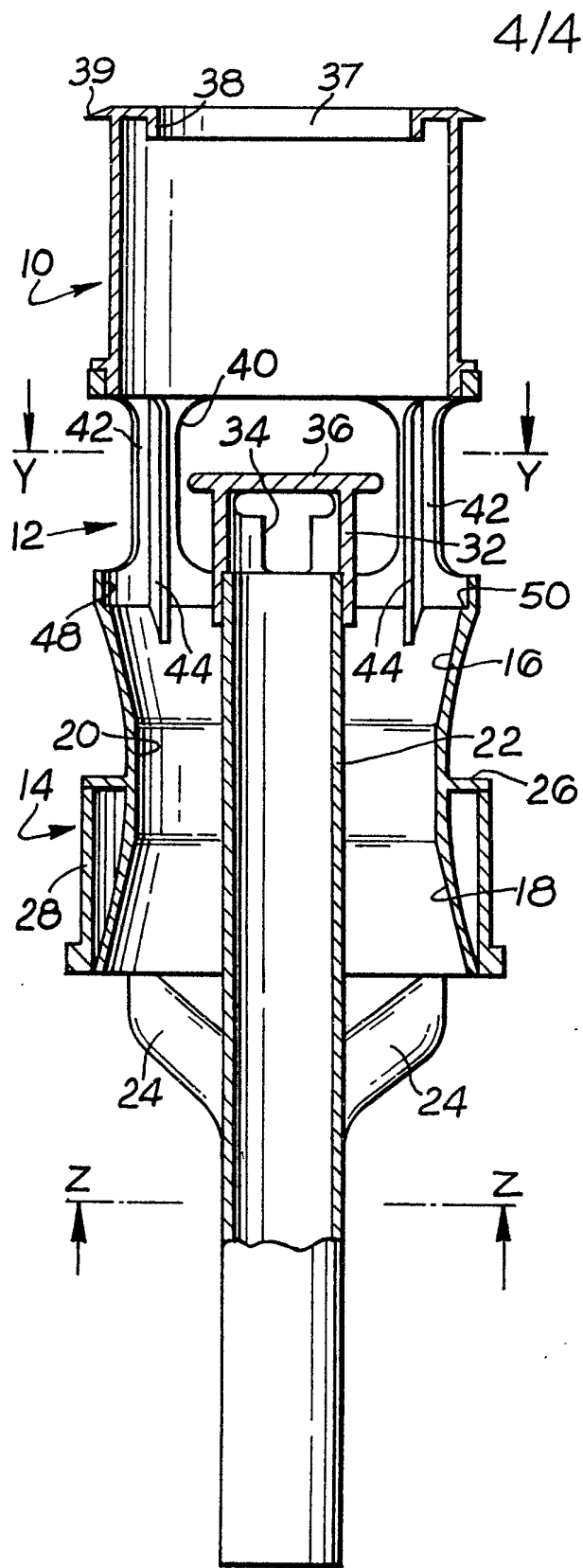
through the body (10) is effective to
suck air upwardly through the pipe
(22). At its upstream end, the body
(10) has an opening (37) bounded by
an inwardly projecting flange (38). The
body (10) may be maintained in
position in the downleg by a resiliently
deformable seal (39) and/or flexibly
deformable wall portions (42)
provided with outwardly projecting
formations. A shoulder (26) limits the
extent to which the body (10) can be
inserted into the downleg. The wall
portions (42) are constituted by areas
between apertures (40) in the body
(10), which apertures effectively
expand the cross section of the device
to the same cross section as the
downleg in that region so as to
improve suction efficiency.











SPECIFICATION

Air extraction device

This invention relates to so-called air extraction devices for use with w.c. pans of the type having
5 two traps whereby use is made of the flushing water supplied from the cistern to the pan to extract air from the intertrap space and thereby effect siphonic discharge from the pan.

The object of the present invention is to provide
10 an improved air extraction device for this purpose.

In general, the air extraction device with which the invention is concerned comprises a tubular body for insertion in the flush passage extending between the cistern and a w.c. pan so that the
15 flushing water passes through the tubular body, a pipe supported within the tubular body so as to project beyond the body for communication with the intertrap space of the pan, that part of the pipe within the body being provided with one or more
20 openings whereby an air flow path between the intertrap space and the interior of the tubular body is provided, and the means for creating suction in the vicinity of said opening or openings in response to passage of flushing water through the
25 body.

In a known air extraction device, the tubular body is of considerable longitudinal extent and comprises a generally cylindrical section extending upstream of the openings in the pipe preceded by
30 an elongate conical section which extends a substantial distance into the downleg of the flushing siphon of the cistern, the upper end of this conical section being adapted for sealing engagement with the interior of the downleg.

According to an advantageous aspect of the present invention, that section of the tubular body which extends upstream of the opening or
35 openings in the pipe is provided with an orifice via which the flushing water enters the body, said orifice being bounded by a flange which projects internally of the body.
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It has been found that this flange, which need only be several millimeters in depth, allows that
45 part of the body which extends upstream of the opening or openings in the pipe to be relatively short.

Sealing engagement may be achieved by means of a radially outwardly projecting sealing member extending around the periphery of the
50 tubular body adjacent its upstream end. The sealing member is conveniently designed so as to resiliently engage within the downleg with a wedge-like action when the body is pushed into the downleg and thereby resist withdrawal of the
55 body.

This holding action provided by the sealing member may be supplemented by one or more flexibly deformable wall portions of the body provided with outwardly projecting formations for
60 contacting the internal wall of the downleg. Alternatively, the holding action may be provided solely by the latter formations in which event the sealing member will be designed to merely for the purpose of providing the required seal.

To enhance the suction effect, according to another advantageous aspect of the invention, the wall of the tubular body is conveniently formed with a number of apertures in the vicinity of the openings or openings in the pipe so that, in this
70 region, the cross sectional area surrounding the pipe is effectively increased to the inside diameter of the downleg of the flushing siphon. The relationship between the apertures in the wall of the body and the opening or openings in the pipe is preferably such that at least a major part, and preferably the whole, of each opening is above the downstream or bottom edges of the apertures.
75

Downstream of the apertures in its wall, the tubular body is conveniently formed with a venturi section; in practice it has been found important to provide a small cylindrical bore section between the apertures and the upstream taper of the venturi section otherwise the suction effect is reduced.
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Advantageously the extraction device should be located in the lowest region of the siphon downleg and to this end the tubular body is preferably formed with abutment means for positively limiting the extent to which it can be pushed up
85 into the downleg, the arrangement being such that the previously mentioned holding means becomes fully effective to maintain the body in position after the latter has been inserted to the limit defined by the abutment means. The abutment
90 means may comprise an annular flange extending around the periphery of the body, conveniently the region of the venturi throat, and reinforced by a sleeve encircling the body.
95

Where the wall of the body is apertured as
100 aforesaid, the areas between adjacent apertures may constitute the previously mentioned flexibly deformable wall portions provided with outwardly projecting formations for engagement with the interior of the downleg. In this event, the
105 formations may comprise external ribs formed integrally with the wall portions. The latter may be of reduced thickness compared with the remaining sections of the body in order to increase their flexibility and to compensate for any weakness
110 resulting from the reduced thickness, these wall portions may be provided with internal reinforcing ribs.

In order to promote further understanding of the invention, one embodiment thereof will now be described by way of example only with reference to the accompanying drawings, in which:
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Figure 1 is a view showing the air extraction device assembled with a close coupled w.c. suite;
120 Figure 2 is a perspective view of the device;
Figure 3 is a side view of the device;
Figure 4 is a sectional view of the device on line X—X in Figure 2;
Figure 5 is a cross section on line Y—Y in Figure 4; and
125 Figure 6 is a cross sectional view on line Z—Z in Figure 4.

Referring now to the accompanying drawings, the device comprises a tubular body having a first

generally cylindrical upstream section 10 followed by a suction producing region 12 and a downstream section 14 in the form of a venturi with tapering sections 16 and 18 leading to and from the Venturi throat 20. A pipe 22 is supported within the body by a number of angularly spaced arms 24 so that the upper end of the pipe 22 terminates in the suction producing region 12. The pipe 22 extends for a substantial distance beyond the lower end of the body and is provided with a rubber seal 68 adjacent its lower end.

In the vicinity of the Venturi throat 20, the body is formed with an external shoulder 26 reinforced by a sleeve 28 and acting as an abutment to limit insertion of the body into the downleg 30 of a siphon, as shown in Figure 1. The upper end of the pipe 22 is closed by a cap 32 which is formed with a pair of diametrically opposed T-shaped slots 34 which are located within the suction producing region 12. The top 36 of the cap 32 projects radially outwardly to form an extended surface against which the flushing water can impinge so as to be deflected sideways.

At its top end, the section 10 includes an orifice 37 which, it will be observed, is bounded by an internally projecting flange 38 which extends partly into the section 10. As mentioned previously, the presence of this flange has been found to allow the overall height of the device to be reduced substantially. Around its outer periphery, the section 10 is provided with an annular sealing lip 39 which terminates in a feather-edge so as to be flexibly deformable.

The suction producing region 12 of the body is of larger internal diameter than the section 10 and is formed with a series of windows 40 (four are shown in the illustrated embodiment) spaced apart from each other by wall portions 42. The material section is reduced in this region so as to increase the flexibility of the wall portions 42. To avoid the risk of breakage in this area, the wall portions 42 are reinforced by internal ribs 44. Externally, the wall portions 42 carry ribs 46 whose function will be described below. The relative positioning of the slots 34 and the windows 40 is preferably such that at least a major part of the area of each slot is above the level of the lower edges of the windows 40. As shown, the slots are wholly above this level.

It will be observed also that the tapering section 16 of the Venturi does not commence at the level of the lower edges of the windows; instead there is a small transition 48 of generally cylindrical section and an internally projecting shoulder 50. This transition 48 has been found to be of significance in terms of the suction efficiency of the device. In the region of the Venturi section, the body is formed with a series of external axial ribs 52.

In use, as shown in Figure 1, the device is inserted into the downleg 30 of the siphon which is housed within the cistern 54. When the device has been inserted up the downleg to the extent determined by the shoulder 26, the sealing lip 39 will be firmly engaged with a slight taper of the

downleg and the wall portions 42 and ribs 46 will be deflected inwardly to some extent and thereby, by virtue of their inherent resiliency, exert a holding action which may supplement that of the lip 39 in maintaining the device in the position shown. Alternatively the design may be such that the holding action is provided primarily by the ribs 46 in which case the lip 39 need only provide a sealing function. Another possibility is for the lip 39 to be deflected resiliently to such an extent that it alone provides the necessary friction grip to maintain the device in position and, in this event, the ribs 46 may be omitted.

The suite as illustrated is of the close coupled type in which the cistern is seated directly on an extension 56 of the w.c. pan. The extraction device extends into the flush water passage 58 of the pan so that the lower end of the pipe 22 registers with the hole 60 which leads to a cavity 62 which, in turn, communicates with the intertrap space 64 of the double trap outlet of the pan via a hole 66. The rubber seal 68 attached to the pipe 22 serves to seal the passage 58 from the cavity 62.

In this way, communication is provided between the space 64 and the suction producing region 12 of the extractor device. When the siphon of the cistern is actuated a flow of water takes place via the downleg 30 through the body of the extractor device, into the passage 58 and thence into the basin of the pan. The water impinges against the top 36 of the cap 32 and spreads in umbrella fashion towards the sides. At this point, it will be noted that the cross section available for the water flow increases substantially by virtue of the presence of the windows 40 and is effectively bounded by the wall of the downleg rather than by the tubular body. As a result, a partial vacuum is created in this region whereby air is sucked from the intertrap space 64 to initiate a siphonic discharge in the outlet of the pan.

CLAIMS

1. An air extraction device comprising a tubular body for insertion into the flush passage extending between the cistern and a W.C. pan so that the flushing water passes through the tubular body, a pipe supported within the tubular body so as to project beyond the body for communication with the intertrap space of the pan, that part of the pipe within the body being provided with one or more openings whereby an air flow path between the intertrap space and the interior of the tubular body is provided, and means for creating suction in the vicinity of said opening or openings in response to passage of flushing water through the body, characterised in that the section of the tubular body which extends upstream of the opening or openings in the pipe is provided with an orifice via which the flushing water enters the body, said orifice being bounded by a flange which projects internally of the body.

2. A device as claimed in Claim 1 in which said body is provided with a radially outwardly projecting sealing member extending around the

periphery of the tubular body adjacent its upstream end.

3. A device as claimed in Claim 2 in which the sealing member is designed so as to resiliently engage within the downleg with a wedge-like action when the body is pushed into the downleg whereby the sealing member resists withdrawal of the body.

4. A device as claimed in Claim 1, 2 or 3 in which said body includes one or more flexibly deformable wall portions provided with outwardly projecting formations for contacting the internal wall of the downleg so as to resist withdrawal of the body from the downleg.

5. A device as claimed in any of Claims 1 to 4 in which the wall of the tubular body is formed with a number of apertures in the vicinity of the opening or openings of the pipe so that, in this region, the cross sectional area surrounding the pipe is effectively increased to the inside diameter of the downleg of the flushing siphon.

6. A device as claimed in Claim 5 in which the relationship between the apertures in the wall of the body and the opening or openings of the pipe is such that at least a major part of each opening is above the downstream or bottom edges of the apertures.

7. A device as claimed in any one of Claims 1 to 6 in which the tubular body is formed with abutment means for positively limiting the extent to which it can be pushed up into the downleg.

8. A device as claimed in Claim 7 in which the abutment means comprises an annular flange extending around the periphery of the body.

9. A device as claimed in Claim 5 is appendant to Claim 4 in which the areas between adjacent apertures constitute the flexibly deformable wall portions.

10. An air extraction device comprising a tubular body for insertion into the flush passage extending between the cistern and a W.C. pan so that the flushing water passes through the tubular body, a pipe supported within the tubular body so as to project beyond the body for communication with the intertrap space of the pan, that part of the pipe within the body being provided with one or more openings whereby an air flow path between the intertrap space and the interior of the tubular body is provided, and means for creating suction in the vicinity of said opening or openings in response to passage of flushing water through the body, characterised in that the wall of the tubular body is formed with a number of apertures in the vicinity of the opening or openings in the pipe so that, in this region, the cross section area surrounding the pipe is effectively increased to the

inside diameter of the downleg of the flushing siphon.

11. A device as claimed in Claim 10 in which the relationship between the apertures in the wall of the body and the opening or openings of the pipe is such that at least a major part of each opening is above the stream or bottom edges of the apertures.

12. A device as claimed in Claim 10 or 11 in which the areas between adjacent apertures constitute said flexibly deformable wall portions.

13. An air extraction device comprising a tubular body for insertion into the flush passage extending between the cistern and a W.C. pan so that the flushing water passes through the tubular body, a pipe supported within the tubular body so as to project beyond the body for communication with the intertrap space of the pan, that part of the pipe within the body being provided with one or more openings whereby an air flow path between the intertrap space and the interior of the tubular body is provided, and means for creating suction in the vicinity of said opening or openings in response to passage of flushing water through the body, characterised in that holding means is provided for resiliently engaging the inner surface of the downleg to hold the body in position, the tubular body being formed with abutment means for positively limiting the extent to which it can be pushed up into the downleg and the arrangement being such that said holding means becomes fully effective to maintain the body in position when the latter has been inserted to the limit defined by the abutment means.

14. A device as claimed in Claim 13 in which the holding means is constituted by a radially outwardly projecting sealing member extending around the periphery of the tubular body adjacent its upstream end.

15. A device as claimed in Claim 13 in which said holding means comprises one or more flexibly deformable wall portions of the body provided with outwardly projecting formations for contacting the internal wall of the downleg.

16. A device as claimed in Claim 15 in which the wall of the tubular body is formed with a number of apertures in the vicinity of the opening or openings of the pipe so that, in this region, the cross sectional area surrounding the pipe is effectively increased to the inside diameter of the downleg of the flushing siphon, the areas between adjacent apertures constituting said flexibly deformable wall portions.

17. An air extraction device substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.