Apparatus and methods provide for an air gap fitting to be installed between various equipment drains and a sewer connection. The apparatus includes a body with an inlet at a receiver. A supply of waste is provided to the device through the inlet and the waste then flows through a channel in the body. The apparatus also includes a plurality of axially disposed apertures about a perimeter of the body such that the plurality of axially disposed apertures are in fluid communication with the channel and the plurality of axially disposed apertures collectively extend a majority of the perimeter of the body. Waste exits the body through an outlet at which point the waste flows through into the sewer system by way of a waste receptor pipe. The presence of the apertures allows waste to flow through them rather than allow contaminated sewage to reach upstream piping or equipment.
FIG. 5
AIR GAP FITTING

REFERENCE TO CO-PENDING APPLICATION

This application claims priority to U.S. Provisional Patent Application Ser. No. 60/690,438, filed Jun. 15, 2005, entitled “PVC air gap coupling”. The entire disclosure of this earlier application is hereby incorporated by reference.

TECHNICAL FIELD

The present invention relates to drainage systems and more particularly to an air gap fitting for drainage systems. Even more particularly, the present invention relates to backflow prevention devices, more specifically to a plumbing fixture for connection between an appliance or equipment drain or drains and a sewer line for preventing backflow by interposing an air gap therebetween.

BACKGROUND

Nearly every commercial establishment utilizes a number of sinks and other equipment which are a source of waste. This waste is typically carried through various pipes to a sewer. An inherent danger arises in connecting these drains to the sewer in the event of a back-up due to a clog in a line, back siphoning or some other cause. If a backup occurs, there is a danger that sewer fluids might make their way back through the drain lines and into the equipment to contaminate it. In order to prevent such backups, many governmental entities have established plumbing codes that require that there be a gap between equipment drain line and the sewer system in order to prevent backflow from reaching the equipment. By inserting this gap, the lines are often considered to be “indirect” lines as opposed to direct lines which do not include air gaps.

Air gap fittings are therefore useful, and often times required, to meet these public health and safety concerns. Unfortunately, conventional prior art air gap fittings are often complicated and expensive to manufacture or install and otherwise fail to meet the needs of society.

SUMMARY

Embodiments of the present invention address these issues and others by providing air gap fittings that include various features absent in earlier fittings. For example, features of some embodiments provide for the support of upstream piping such that a separate pipe support is not needed. Features of some embodiments provide for the device to be pivotable upon installation such that there is a certain amount of play in the orientation in order to be able to adjust the fitting to accommodate existing piping. Features of some embodiments provide sufficiently sized openings or apertures in the fitting such that drain and sewer lines can be cleaned without removing or dismantling the air gap fitting.

One embodiment of an air gap fitting includes a body with an inlet, an outlet and a channel in between. The inlet may be positioned at a receiver and waste is passed from upstream piping through the inlet, into the channel and ultimately out the outlet. The air gap fitting also may have a central axis which may or may not align with a central axis of the inlet/receiver. The air gap fitting also includes a plurality of axially disposed apertures which are positioned about a perimeter of the body of the air gap fitting. The plurality of axially disposed apertures is in fluid communication with the channel so that in the event of a backflow, the waste will flow out of the apertures and will not flow back up into the upstream piping.

Another embodiment is an air gap fitting with a body that includes an inlet at a receiver for receiving waste, a central axis, a channel in fluid communication with the inlet, a plurality of axially disposed apertures about a perimeter of the body such that the plurality of axially disposed apertures are in fluid communication with the channel and such that the plurality of axially disposed apertures collectively extend at least 60% of the perimeter of the body, and an outlet in fluid communication with the channel for allowing the waste to exit the body. In accordance with such an embodiment, waste flows into the inlet, passes to the channel and ultimately passes out of the fitting through an outlet and into downstream sewer piping.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of a prior art drainage pipe installation.

FIG. 2 is a side view of an exemplary embodiment of the present invention in an exemplary installation.

FIG. 3 is a perspective view of an embodiment of the present invention.

FIG. 4 is a front elevational view of the embodiment.

FIG. 5 is a side elevational view of the embodiment.

FIG. 6 is a front sectional view along lines A-A of FIG. 5 of the embodiment.

DETAILED DESCRIPTION

Embodiments of the present invention include air gap fittings and associated methods of using air gap fittings in order to clean associated piping upstream and/or downstream of the fitting. Certain embodiments of air gap fittings include various features such as eccentric components so that the air gap fitting can be pivoted as necessary to allow a certain amount of play as might be useful in a given installation to fit existing pipe locations without the need to cut the existing pipe. Certain embodiments of air gap fittings include axially disposed apertures that permit a technician to use a snake or other cleaning device to clean the internal portions of an air gap fitting and associated piping without the need to remove the air gap fitting. Furthermore, certain embodiments of air gap fittings are able to support upstream piping such that additional pipe supports are not necessary to support the piping.

FIG. 1 shows a prior art drainage systems and FIGS. 2-6 show various views of an illustrative embodiment.
Fig. 1 illustrates an exemplary installation in which multiple tubs or sinks 10 each allow waste to flow through a respective drain 12 to a respective drain pipe 14 and then to a collector pipe 16. In this exemplary installation, waste would flow by gravity along collector pipe 16 through elbow 18 and then drop through vertical drain pipe 20 so that the waste is then received by hub drain 22 and waste receptor pipe 24 which is shown to extend under ground 26 in the figure. Waste carried by waste receptor pipe 24 may be carried to a sewer or septic system or otherwise disposed of.

Typically, one or more pipe supports 28 are positioned along collector pipe 16 in order to support the weight of the piping and the waste flowing through the piping. As illustrated, one exemplary method of supporting the piping is to utilize one or more pipe supports 28 which are connected to corresponding pipe support rings 30, note that such pipe supports 28 are typically anchored to the floor or wall. Typically installation of these pipe supports and rings is very time consuming for a plumber and may take thirty minutes or more to install each support. One reason that pipe supports 28 may be installed is that many governmental entities and plumbing codes require that there be a gap between the top of the hub drain and the bottom of the pipe carrying the waste to the hub drain. As illustrated in the exemplary embodiment, lower edge 21 of vertical drain pipe 20 is separated by a distance H from a top surface 23 of hub drain 22. Although the code requirements of a given jurisdiction may vary, typical distance H requirements are about twice the diameter of the source pipe, vertical drain pipe 20 in FIG. 1.

[F0017] Fig. 2 illustrates an exemplary embodiment of the present invention in an exemplary installation. Fig. 2 illustrates an installation in which waste first flows down drains 12 from respective tubs or sinks 10, then into a respective drain pipe 14 and finally to a collector pipe 16. In this exemplary installation, waste would then flow by gravity along collector pipe 16 through elbow 18 and then drop through vertical drain pipe 20 to air gap fitting 40 and finally to waste receptor pipe 24. In this exemplary embodiment, vertical drain pipe 20 is received by a receiver 44 of air gap fitting 40. In this embodiment, there is a solid connection from ground 26 to waste receptor pipe 24, then to air gap fitting 40 and finally to vertical drain pipe 20 such that the upstream piping (piping such as vertical drain pipe 20, elbow 18 and collector pipe 16) may individually or collectivily be referred to as “upstream piping” or “upstream piping”) is fully supported and there is no need for additional supports 28 as shown in FIG. 1, (i.e., the prior art). An additional feature shown in this exemplary embodiment is that a receiver access axis 45 for receiver 44 may be situated at an offset to a central axis 48 of air gap fitting 40 such that there is a given amount of play in installing the air gap fitting depending on the horizontal location of vertical drain pipe 20. By simply rotating air gap fitting 40 prior to permanently affixing it to waste receptor pipe 24, the location of the receiver may be varied to receive vertical drain pipe 20. As further discussed below, air gap fitting 40 also includes a body 42 and a plurality of vents or openings or ports or axially disposed apertures 46. Axially disposed apertures 46 allow waste to flow through them in the event of a backup or clog in waste receptor pipe 24 so that the waste doesn’t flow back up into vertical pipe 20. In another exemplary embodiment, at least one of axially disposed apertures 46 may be sufficiently sized to allow a plumbers snake, sewer cleaning cable, braided steel cable or other tool (with or without cutting heads) in order to remove or clear obstructions in upstream or downstream pipes or conduits. In an exemplary cleaning, a person may insert a 0.5 cm diameter plumbers snake, or without a cutting head, through an aperture 46 in air gap fitting 40 wherein aperture 46 is dimensioned to accommodate the plumb plumb snake such as an aperture 46 with an opening of 0 cm by 10 cm. By appropriately sizing such an aperture, it is not necessary for a plumber to remove or dismantle air gap fitting 40 in order to clear the obstruction. After inserting the plumb plumb snake into the air gap fitting 40 by way of an aperture 46, the user is then able to direct the plumb plumb snake into waste receptor pipe 24 and other downstream piping (i.e., “p traps”) in order to clear any clogs or debris. A user may similarly utilize these basic steps in order to clean piping upstream of air gap fitting 40.

[F0018] Air gap fitting 40 may be affixed to waste receptor pipe 24 by any appropriate means including, but not limited to, screw fit, friction fit, screwing, gluing or with use of one or more gaskets (for example rubber). Air gap fitting 40 may be snugly (if not permanently mounted) to waste receptor pipe 24 such that no fluids or waste can escape through the joint and that any backflow from waste receptor pipe 24 only flow out of the plurality of axially disposed apertures 46.

[F0019] FIGS. 3-4 illustrate a perspective view and a side view, respectively, of an exemplary embodiment of air gap fitting 40. Air gap fitting 40 comprises a body 42 with an inlet 56 at receiver 44 for receiving waste from upstream piping (see for example FIG. 2). Receiver 44 may be positioned as desired on top surface 54 of air gap fitting 40 though, in the exemplary embodiment illustrated, axis 45 of receiver 44 is not coaxial with central axis 48 of air gap fitting 40. As mentioned above, by positioning receiver 44 off-center, an installer may pivot the air gap fitting to fit a given pipe installation. Receiver 44 may include a top surface 60 which may include a beveled surface 62 to provide a rounded surface for installing a vertical drain pipe as illustrated in FIG. 2. The exemplary embodiment is such that an interior surface 64 of receiver 44 would accommodate an outer surface of a pipe, such as vertical drain pipe 20 as illustrated in FIG. 2.

[F0020] Receiver 44 may also include a lip 82 which provides a convenient stop when installing vertical drain pipe 20. Note that although illustrated as receiving a pipe on the interior of receiver 44, receiver 44 may also be configured such that the pipe was received on an exterior of receiver 44. The illustrated embodiment may have an advantage in that it may provide for easy installation and minimize the risk of waste and other fluids escaping through the joint of the piping and the receiver. Further, receiver 44 and the upstream piping, for example, vertical drain pipe 20, may be joined in any appropriate means including, but not limited to, slip fit (with or without gaskets or washers), gluing, screwing, bonding, welding, etc. In addition, a join 58 between receiver 44 and top surface 54 may be of any suitable method, partially depending on how air gap fitting 40 is constructed, i.e., if the entire device is injection molded, the device would be unitary and there would be no joint. If, on the other hand, air gap fitting 40 is not integrally constructed, then receiver 44 may be attached to top surface 54 by gluing, gluing, screwing, bonding, welding, etc.
Though not shown, receiver 44 could also be comprised of a hole in top surface 54 in upper plate 50 of air gap fitting 40. Such a configuration could have disadvantages in that it would not be as well suited to support the weight of upstream piping as the illustrated configuration can provide.

The exemplary embodiment also includes a plurality of axially disposed apertures arrayed around perimeter 86 (dashed line in FIG. 3) of air gap fitting 40 with a corresponding plurality of struts 52 positioned between adjacent apertures 46. Though illustrated with apertures 46 being almost rectangular in configuration, the shape of apertures 46 can be of any suitable shape including, but not limited to, oblong, rectangular, round, triangular, etc. The shape of struts 52 is similarly variable. The shape and mechanical properties of the materials utilized in designing the struts and other parts of air gap fitting 40 will depend on a particular installation and include such factors as the amount of flow expected through the fitting and what types of forces and loads will be placed on the fitting from waste flow as well as from dead loads from upstream piping, for example. As an example, if the loads placed on the fitting, both live and dead loads, is very high, the thickness 74 of struts 52 may be increased to allow for such loads whereas if the loads are lower, the thickness 74 will not have to be as high.

Interior surface 70 of body 42 may be sized to fit onto an exterior surface of waste receptacle pipe 24 though it may be sized and configured as appropriate. For example, body 42 could be constructed such that it fits inside of waste receptacle pipe 24. A lip may also be included within this lower interior portion of air gap fitting 40 such that it would provide a convenient stop when installing air gap fitting 40 over waste receptacle pipe 24. The fit between air gap fitting 40 and waste receptacle pipe 24 may be of any suitable method, including but not limited to, gluing, welding, bonding, slip fit, screw fit, etc. Care should be taken to ensure that waste cannot escape between the joint between air gap fitting 40 and waste receptacle pipe 24 irrespective of the method used to attach fitting 40 to waste receptacle pipe 24. As shown in the various figures, there is a continuous flow path from the upstream piping, for example vertical drain pipe 20, to inlet 56, then to channel 72, then out outlet 78 and finally into waste receptacle pipe 24.

Also illustrated in FIGS. 3-6 is an exemplary inner pipe portion 66 which may have the same inner diameter as that of the upstream piping, for example vertical drain pipe 20 and/or inlet 56. An interior of inner pipe portion 66 is in fluid communication with inlet 56 such that waste flowing out of inlet 56 flows into the interior of inner pipe portion 66 and then into channel 72. Inner pipe portion 66 may be located adjacent receiver 44. In one embodiment, inner pipe portion 66 may be integral with receiver 44. In another embodiment, inner pipe portion 66 may be constructed separately from receiver 44 and/or body 42 and subsequently placed inside body 52. In another exemplary embodiment, inner pipe portion 66 may be integral with vertical drain pipe 20 such that vertical drain pipe 20 extends through top surface 54 of body 42 and into an interior of air gap fitting 40. Lower edge 68 of inner pipe portion 66 may be angled in order to provide better flow and to prevent splashing. In one embodiment angle θ (see FIG. 6) of edge 68 may be between about 0 degrees and about 90 degrees, when measured to a horizontal. In another embodiment, angle θ may be between about 30 degrees and about 60 degrees. In yet another embodiment, angle θ is about 45 degrees.

FIG. 5 shows an exemplary embodiment wherein it can be seen that central axis 48 may be situated at some distance from receiver axis 45, though they may also be coaxial. In one illustrative embodiment, overall air gap width W1=10.00 cm (3.94 inches), receiver outer diameter width W2=5.72 cm (2.25 inches), width W3=3.02 cm (1.19 inches), width W4=1.27 cm (0.5 inches), and thickness 74 of struts 52 is 1.27 cm (0.5 inches). Various heights are also shown for the exemplary embodiment in which height H1=14.61 cm (5.75 inches), overall height H2=16.83 cm (6.63 inches), plate thickness H3=0.64 cm (0.25 inches), aperture height H4=10.16 cm (4.0 inches), and lower portion height H5=3.81 cm (1.5 inches). In one embodiment, aperture height H4 may be approximately twice the diameter of the source pipe supplying waste to air gap fitting 40, i.e., vertical drain pipe 20 in FIG. 2 and/or inlet 56. Thus, if the inner diameter of vertical drain pipe 20 is 2 inches, aperture height H4 may be approximately 4 inches or more. In another exemplary embodiment, aperture height H4 may be greater than two times the diameter of the source pipe to allow for the impediment to flow, should a back-up occur, due to the presence of struts 52. Thus, if struts 52 are very narrow and the apertures cover a large majority of perimeter 86, then the aperture height H4 could be lower than if the struts were relatively wide in comparison to the apertures.

FIG. 6 illustrates a cross-sectional view of exemplary embodiment air gap fitting 40 along section line A-A of FIG. 4. In this embodiment, lip 82 provides a step for a pipe, such as vertical drain pipe 20, (not shown) inserted into receiver 44 such that an interior surface of the pipe would align with surfaces 90 such that waste flowing through the pipe would flow unobstructed vertically down receiver 44 past surfaces 90 and into channel 72. As discussed above, lower edge 68 of inner pipe portion 66 may be angled such that in one exemplary embodiment, angle θ may be between about 0 degrees and about 80 degrees. In another exemplary embodiment, angle θ may be between about 30 degrees and 60 degrees. In another exemplary embodiment, angle θ may be about 45 degrees. Such angling of this surface reduces splashing and aids in maintaining laminar flow through air gap fitting 40. Also illustrated in FIG. 6 are inner surface 92 of inner pipe portion 66 as well as a gap 94 which is present in this embodiment as a space between outer surface 98 of inner pipe portion 66 and inner wall surface 96 of air gap fitting 40. The dimensioning, or even lack of, gap 94 is dependent on the design specifics and is therefore variable. For example, in a particular embodiment, receiver 44 may be situated coaxially with central axis 48 such that gap 94 could be relatively large. On the other hand, in another embodiment, receiver 44 may be situated closer to an edge of air gap fitting 40 such that gap 94 could be relatively small.

Air gap fittings made in accordance with the present invention are economical to manufacture at low unit costs, efficient and practical in operation and satisfy the requirements of governmental entity codes requiring indirect drain line connections between draining or discharging equipment and the sewer system. Thus, it will be appreciated that various embodiments of the present invention may provide a simple, effective, inexpensive and practical air
gap-type backflow prevention device for equipment which drains or discharges waste liquid to a sewage system.

[0028] Devices constructed in accordance with the above paragraphs may be comprised of any suitable materials including, but not limited to, metal, steel, aluminum, plastic, wood, rubber, and combinations thereof. In an exemplary embodiment, material for air gap fitting 40 is polyvinyl chloride (PVC).

[0029] While the invention has been particularly shown and described with reference to various embodiments thereof, it will be understood by those skilled in the art that various other changes in the form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. An air gap fitting, comprising:
   a body having:
   an inlet at a receiver for receiving waste;
   a central axis which is not coaxial with an axis for said receiver;
   a channel in fluid communication with said inlet and wherein at least a portion of said channel is along said central axis and wherein said waste flows by gravity from said inlet to said channel;
   a plurality of axially disposed apertures about a perimeter of said body wherein the plurality of axially disposed apertures are in fluid communication with said channel; and
   an outlet for allowing said waste to exit said body.

2. The air gap fitting of claim 1, wherein said plurality of axially disposed apertures collectively extend at least 60% of said perimeter about said body.

3. The air gap fitting of claim 1, wherein said body is comprised of a material selected from the group consisting of metal, steel, aluminum, plastic, wood, rubber, and combinations thereof.

4. The air gap fitting of claim 1, wherein at least a portion of the device is comprised of polyvinyl chloride (PVC).

5. The air gap fitting of claim 1, wherein said plurality of axially disposed apertures are substantially rectangular.

6. The air gap fitting of claim 1, wherein at least one of said plurality of axially disposed apertures is large enough to allow cleaning of said body without removing said body.

7. The air gap fitting of claim 1, wherein a height of said plurality of axially disposed apertures is approximately twice a diameter of said inlet.

8. The air gap fitting of claim 1, further comprising an upstream pipe for supplying said waste to said body, and wherein said body is able to support said upstream pipe without need of any additional support, and said upstream pipe is received by said receiver.

9. An air gap fitting, comprising:
   a body having:
   an inlet at a receiver for receiving waste;
   a central axis;
   a channel in fluid communication with said inlet and wherein at least a portion of said channel is along said central axis and wherein said waste flows by gravity from said inlet to said channel;
   a plurality of axially disposed apertures about a perimeter of said body wherein the plurality of axially disposed apertures are in fluid communication with said channel and said plurality of axially disposed apertures collectively extend at least 60% of said perimeter wherein said perimeter is orthogonal to said central axis; and
   an outlet for allowing said waste to exit said body.

10. The air gap fitting of claim 9, wherein said receiver has an axis that is not coaxial with said central axis.

11. The air gap fitting of claim 9, wherein said plurality of axially disposed apertures collectively extend at least 80% of said perimeter about said body.

12. The air gap fitting of claim 9, wherein said body is comprised of a material selected from the group consisting of metal, steel, aluminum, plastic, wood, rubber, and combinations thereof.

13. The air gap fitting of claim 9, wherein at least a portion of the device is comprised of polyvinyl chloride (PVC).

14. The air gap fitting of claim 9, further comprising a waste receptor pipe in fluid communication with, and downstream of, said channel, wherein at least one of said plurality of axially disposed apertures is sized to allow cleaning of said channel and said waste receptor pipe without removing said body, and wherein a plunger's snare of at least 0.5 cm diameter is used for the cleaning.

15. The air gap fitting of claim 9, wherein a height of said plurality of axially disposed apertures is approximately twice a diameter of said inlet.

16. The air gap fitting of claim 9, further comprising an inner pipe portion which is positioned at least partially inside of said body and adjacent said receiver, and wherein said inner pipe portion is cut at an angle of approximately 45 degrees to said central axis.

17. The air gap fitting of claim 9, further comprising an upstream pipe for supplying said waste to said body and wherein said body is able to support said upstream pipe without need of any additional support, said upstream pipe is received by said receiver, and a height of said plurality of axially disposed apertures is approximately twice an inner diameter of said upstream pipe.

18. A device comprising:
   a body having:
   an inlet at a receiver for receiving waste;
   a central axis;
   a channel in fluid communication with said inlet and wherein at least a portion of said channel is along said central axis and wherein said waste flows by gravity from said inlet to said channel;
   an inner pipe portion which is positioned inside of said body and adjacent said receiver;
a plurality of axially disposed apertures about a perimeter of said body wherein the plurality of axially disposed apertures are in fluid communication with said channel; and

an outlet for allowing said waste to exit said body.

19. The device of claim 18, further comprising an upstream pipe for supplying said waste to said body, and wherein said body is able to support said upstream pipe without need of any additional support, said upstream pipe is received by said receiver and a height of said plurality of axially disposed apertures is approximately twice an inner diameter of said upstream pipe.

20. The device of claim 19, wherein said plurality of axially disposed apertures collectively extend at least 60% of said perimeter about said body.