

[54] **VALVE MEANS FOR CONTROLLING
DISCHARGE OF WASTE LIQUID INTO
PNEUMATIC SEWAGE DISPOSAL
SYSTEM**

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[22] Filed: **Nov. 12, 1970**

[21] Appl. No.: **88,539**

[30] **Foreign Application Priority Data**

Nov. 13, 1969 Sweden.....15590/69

[52] U.S. Cl.....137/395, 137/403, 137/492.5

[51] Int. Cl.....F16k 21/18, F16k 31/12

[58] Field of Search.....137/188, 205, 236, 395, 397,
137/403, 413, 414, 492.5; 4/100, 101

[56]

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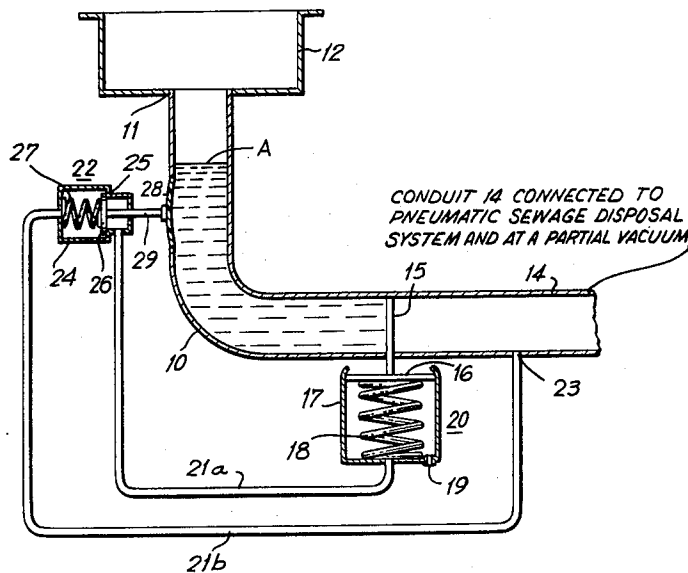
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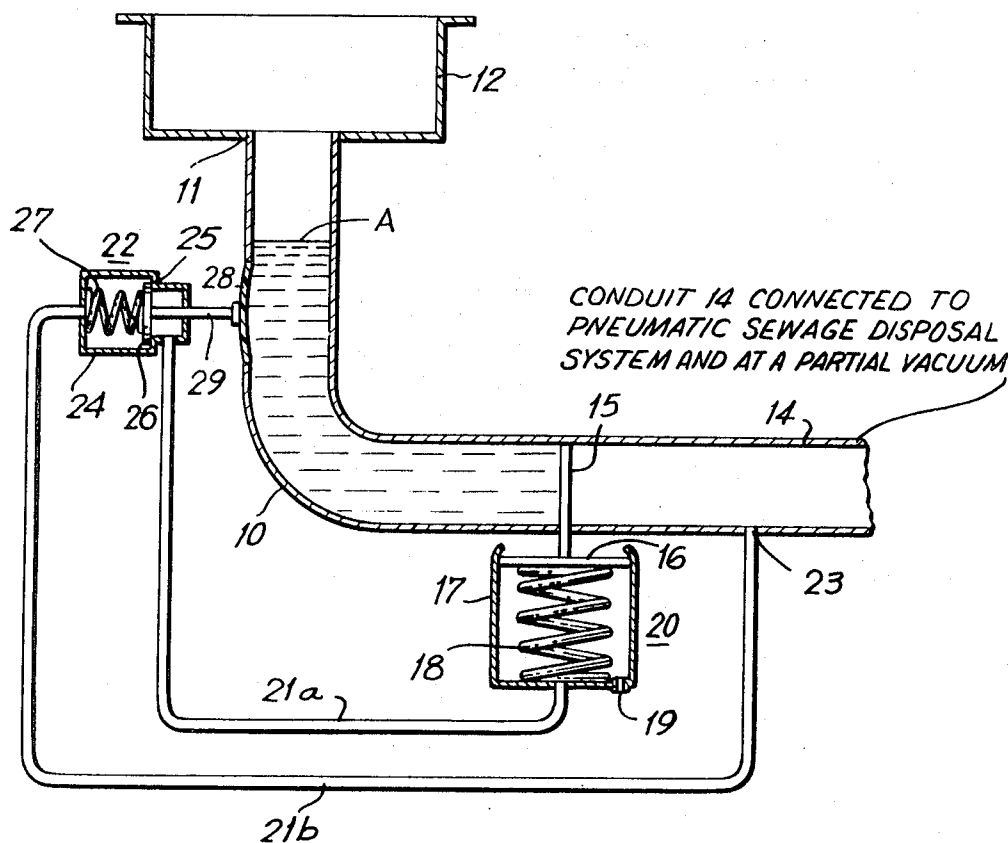
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ABSTRACT

Waste liquid is discharged into a pneumatic sewage disposal system from a drain conduit into which such liquid flows from a place in a kitchen or laundry or a fixture in a bathroom like a bathtub or wash basin, for example. A main valve of valve structure, which is operatively associated with the drain conduit for controlling flow of waste liquid into the sewage system, moves from its closed position toward its open position and back to its closed position with increase and decrease, respectively, in the hydrostatic pressure of waste liquid in the drain conduit.

11 Claims, 1 Drawing Figure





VALVE MEANS FOR CONTROLLING DISCHARGE OF WASTE LIQUID INTO PNEUMATIC SEWAGE DISPOSAL SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

In a pneumatic sewage disposal system provision must be made for controlling the discharge of waste liquid flowing into such a sewage system from places in kitchens and laundries and fixtures in bathrooms like bathtubs and wash basins, for example.

2. Description of the Prior Art

It is customary to employ a main valve and operating mechanism therefor for controlling the flow of waste liquid from a drain conduit into the pneumatic sewage disposal system. It has been the practice either to actuate the valve operating mechanism manually or automatically responsive to the partial vacuum prevailing in the sewage system.

Such prior art arrangements have the drawback that the main valve moves to its fully open position even when relatively small quantities of waste liquid flow into the drain conduit for discharge into the sewage system. There also is the likelihood that the main valve cannot move to its closed position before or at the same time that the waste liquid stops flowing at the region immediately ahead of the main valve.

When the aforementioned conditions occur, the partial vacuum prevailing in the sewage system is extended upstream to the zone ahead of the main valve in which ambient air at atmospheric pressure is present. This is objectionable because the partial vacuum for the sewage system at the downstream side of the main valve can be reduced to such an extent that it will be ineffective to suck out waste liquid from the upstream side of the main valve.

It also has been proposed to employ a float-operated main valve which is operatively associated with mechanism actuated by the partial vacuum in the sewage system. Such float-operated main valves, in addition to being complicated and relatively expensive, create pollution and clogging problems in the float chamber which also is objectionable.

All of the prior art arrangements referred to above produce an annoying sound when the control valve is operating, which is objectionable.

SUMMARY OF THE INVENTION

My invention relates to controlling the discharge of waste liquid from places in kitchens and laundries and fixtures in bathrooms like bathtubs and wash basins, for example, into a pneumatic sewage disposal system and has for its object the provision of improved valve means that includes a normally closed main valve that moves from its closed position toward its open position and back to its closed position responsive to increase and decrease, respectively, in the hydrostatic pressure of waste liquid in the conduit into which such liquid drains.

I accomplish this by providing in a discharge conduit, which is adapted to be maintained at a partial vacuum and through which waste liquid from a drain conduit is discharged into a pneumatic sewage disposal system, a main valve and operating means therefor which functions to open the main valve responsive to a partial vacuum and is urged to its closed position when no longer influenced by such partial vacuum.

The main valve operating means is connected to a region of the discharge conduit at a partial vacuum by conduit means provided with a control valve. Further, I provide pressure sensing means which is influenced by a pressure condition affected by the hydrostatic pressure of waste liquid in the drain conduit. The pressure sensing means is operatively connected to the control valve so the latter will move between its fully open and closed positions responsive to the pressure condition to which the pressure sensing means is subjected.

An important feature of my invention is that the control valve can move from its closed position to its fully open posi-

tion responsive to or partly increase in the hydrostatic pressure of waste liquid in the drain conduit. The control valve moves from its closed position responsive to increase in the hydrostatic pressure of waste liquid in the drain conduit. The main valve moves from its closed position responsive to the position of the control valve which in turn determines the ability of the partial vacuum to influence the position the main valve will assume. Since the main valve moves from its normal closed position to its fully open position and back to its closed position with changes in the hydrostatic pressure of waste liquid in the drain conduit, the main valve will operate silently and without noise.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing the single FIGURE is a vertical sectional view more or less diagrammatically illustrating valve means and pneumatic operating mechanism therefor which embodies my invention for controlling the discharge of waste liquid into a pneumatic sewage disposal system responsive to the hydrostatic pressure of such waste liquid flowing into a drain conduit from a place having an outlet.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the drawing I have shown my invention embodied in a pneumatic sewage disposal system for controlling the discharge of waste liquid into the system responsive to the hydrostatic pressure of a body of such waste liquid in its path of flow to the sewage disposal system. Waste liquid flows by gravity through an L-shaped drain conduit 10 from the outlet 11 of a place 12 in a kitchen or laundry or a fixture in a bathroom like a bathtub or wash basin, for example. The waste liquid flows from the drain conduit 10 into a discharge conduit 14 which is adapted to be connected to a pneumatic sewage disposal system and maintained at a partial vacuum.

A valve 15 is operatively associated with the discharge conduit 14 for controlling flow of waste liquid thereto from the drain conduit 10. The valve 15 comprises a valve member or blade which functions to control flow of waste liquid from the place 12 to the pneumatic sewage disposal system and is movable between a fully open position and a closed position at the inlet end of the discharge conduit 14, as illustrated in the drawing. The valve member 15 is fixed to a piston 16 movable within a casing 17 and is biased to its normally closed position by a compression spring 18. The casing 17 is provided with an opening 19 for bleeding ambient air therein to promote movement of the valve blade 16 from an open position to its closed position, as will be explained presently. In view of the foregoing, it will be understood that the casing 17 and movable piston 16 therein and spring 18 constitute means 20 for operating the valve member 15.

The casing 17 is connected by a conduit section 21a, a control valve 22 and a conduit section 21b to a region 23 which is at a partial vacuum and downstream from the valve member 15. The control valve 22 comprises a hollow casing 24 formed to provide a seat 25 for a valve member 26. The valve member 26 is movable toward and from its seat 25 and is biased to its closed position by a spring 27.

In view of the foregoing, it will now be understood that when the valve member 26 of the control valve 22 is removed from its seat 25 and in an open position, the conduit sections 21a and 21b and the passageway formed therebetween by the hollow casing 24 constitute means for connecting the valve operating means 20 to the region 23 of the discharge conduit 14 which is at a partial vacuum. When the casing 17 is connected to the region 23 at a partial vacuum under these conditions, downward movement will be imparted to the piston 16 against the biasing action of the spring 18 whereby the valve member 15 will be moved downward to an open position from its closed position illustrated in the drawing.

Conversely, when the valve member 26 of the control valve 22 is closed and positioned against its seat 25, the valve 15 no longer will be in communication with the region 23 at a partial

vacuum and the spring 18 will be effective to urge the valve member 15 to its closed position. Such upward movement of the valve member 15 will be promoted by ambient air at atmospheric pressure which bleeds into the casing 17 through the small opening 19 in the valve operating means 20.

In accordance with my invention I provide pressure sensing means 28 for regulating the valve operating means 20, the sensing means being influenced by a pressure condition affected by the hydrostatic pressure of waste liquid in the drain conduit 10. In the preferred embodiment illustrated, the sensing means 28 is upstream from the valve 15 and comprises a flexible diaphragm fixed in the wall of the drain conduit 10 which is responsive to increase and decrease, respectively, in the hydrostatic pressure of waste liquid in the drain conduit 10.

The diaphragm 28 desirably can be formed of elastomeric material like rubber or a suitable plastic like Teflon, for example. The diaphragm 28 is operatively connected to the valve member 26 of control valve 22 by an elongated member 29 so that the valve member 26 will assume any position between and including its fully open and closed positions depending upon the pressure condition to which the diaphragm 28 is subjected.

In the drawing the valve member 15 coupled in the discharge conduit 14 and the valve member 26 of the control valve 22 are both illustrated in their closed positions. These are the normal positions of the valve members 17 and 26 when no waste liquid is flowing from the place 12 into the pneumatic sewage system. Under these conditions the liquid surface level of the column of liquid in the drain conduit 10 is at A and the diaphragm 28 is subject to a hydrostatic pressure which is insufficient to move the valve member 26 from its closed position at the seat 25. With the valve member 26 closed the valve operating means 20 is disconnected from the region 23 at a partial vacuum and the spring 18 will be effective to urge the valve member 15 to its closed position.

When waste water now is discharged from the place 12 into the drain conduit 10 the liquid surface level at A will rise. At a predetermined liquid level in the drain conduit 10 the hydrostatic pressure at the region of the diaphragm 28 will be sufficient for the latter to impart movement to the elongated member 29 to effect opening of the valve member 26. The extent to which the valve member 26 opens will be dependent upon the rate at which waste liquid flows from the place 12 into the drain conduit 10. Stated another way, the valve member 26 will open by degrees when waste liquid commences to flow into the drain conduit; and, if only a relatively small quantity of waste liquid is introduced into the drain conduit, the valve member 26 will move to a partially open position which can be rather small.

Assuming that the valve member 26 only provides a small opening in the passageway formed in the control valve 22, the valve operating means 20 will now be in communication with the region 23 at a partial vacuum. This will effect downward movement of the piston 16 and the valve member 15 fixed thereto. It will be understood that, since the valve member 26 is in a partially open position which is relatively small, the valve member 15 also will be in a partially open position that is small and dependent upon the extent that valve member 26 is open. In the event a large quantity of waste liquid now flows from the place 12 into the drain conduit 10, and the hydrostatic pressure at the region of the diaphragm 28 is sufficient, the valve member 26 very well can move to its wide open position which will render the valve operating means 20 operable to move valve member 15 in turn to its wide open position.

When the flow of waste liquid from the place 12 into the drain conduit 10 stops and the liquid surface level in the latter falls back to the level A shown in the drawing, the valve member 26 and diaphragm 28 will return to their original positions which means that the valve member 26 will be in its closed position and the hydrostatic pressure acting on the diaphragm will be ineffective to move the valve member 26 from its closed position. The valve operating means 20 now is

disconnected from the region 23 at a partial vacuum and the spring 18 will be operable to urge the valve member 15 to its closed position, as explained above, with the aid of ambient air at atmospheric pressure which flows into the casing 17 through the small opening 19.

In view of the fact that the valve member 15 is moved gradually from its normal closed position to its wide open position and back to its closed position with increase and decrease, respectively, in the hydrostatic pressure of waste liquid in the drain conduit 10, the valve 15 will operate silently and without noise. There never is any danger that the valve member 15 will move to its full open position when a relatively small quantity of waste liquid flows into the drain conduit 10 from the place 12. And the valve member 15 will always move to its closed position before the liquid surface level of the column of waste liquid in the drain conduit 10 falls below a predetermined level which, in the embodiment illustrated and described above, is the level indicated at A.

The opening 19 in the casing 17 is of such size that the ambient air passing into the casing will promote upward movement of the piston 16 at the desired rate to close the valve member 15 when the control valve 22 closes. Further, the opening 19 may be positioned anywhere in the conduit section 21a between the casing 17 and the seat 25 for the valve member 26 of the control valve 22.

By providing the diaphragm 28 in a vertical position in the wall of the drain conduit 10, as shown in the drawing, the likelihood that sediment will accumulate on the diaphragm to such a degree that it will not function properly is negligible.

I claim:

1. The combination with a pneumatic sewage disposal system, of

- a. a drain conduit for draining waste liquid from a place having an outlet,
- b. a discharge conduit which is connected to said drain conduit and adapted to be maintained at a partial vacuum and through which waste liquid from said drain conduit is discharged into the sewage disposal system,
- c. structure comprising a valve which is movable between closed and open positions and coupled in said discharge conduit for controlling flow of waste liquid from said drain conduit to said discharge conduit,
- d. said valve normally being closed,
- e. means urging said valve closed,
- f. means moving said normally closed valve from its closed position toward its fully open position responsive to partial vacuum, and
- g. means regulating said last-mentioned valve moving means to effect movement of said valve from its closed position toward its fully open position and back to its closed position responsive to increase and decrease, respectively, in the hydrostatic pressure of waste liquid in said drain conduit.

2. The combination with a pneumatic sewage disposal system, of

- a. a drain conduit for draining waste liquid from a place having an outlet,
- b. a discharge conduit which is connected to said drain conduit and adapted to be maintained at a partial vacuum and through which waste liquid from said drain conduit is discharged into the sewage disposal system,
- c. structure comprising a valve which is movable between closed and open positions and coupled in said discharge conduit for controlling flow of waste liquid from said drain conduit to said discharge conduit,
- d. said valve normally being closed,
- e. means urging said valve closed, and
- f. means moving said normally closed valve from its closed position toward its fully open position responsive to increase in the hydrostatic pressure of waste liquid in said drain conduit.

3. The combination with a pneumatic sewage disposal system, of

- a. a drain conduit for draining waste liquid from a place having an outlet,
 - b. a discharge conduit which is connected to said drain conduit and adapted to be maintained at a partial vacuum and through which waste liquid from said drain conduit is discharged into the sewage disposal system,
 - c. structure comprising a first valve which is movable between closed and open positions and coupled in said discharge conduit for controlling flow of waste liquid from said drain conduit to said discharge conduit,
 - d. means biasing said first valve to its closed position,
 - e. means defining a place at a partial vacuum,
 - f. means responsive to a partial vacuum for moving said first valve to an open position against said biasing means, said last-mentioned means including conduit means connected to said place,
 - g. a second valve coupled in said conduit means, and
 - h. pressure sensing means responsive to the hydrostatic pressure of waste liquid in said drain conduit,
 - i. said pressure sensing means being operatively connected to said second valve to effect movement thereof between its fully open and closed positions responsive to the hydrostatic pressure to which said pressure sensing means is subjected.
4. The combination with a pneumatic sewage disposal system, of
- a. a drain conduit for draining waste liquid from a place having an outlet,
 - b. a discharge conduit which is connected to said drain conduit and adapted to be maintained at a partial vacuum and through which waste liquid from said drain conduit is discharged into the sewage disposal system,
 - c. structure comprising a first valve which is movable between closed and open positions and coupled in said discharge conduit for controlling flow of waste liquid from said drain conduit to said discharge conduit,
 - d. said first valve normally being closed,
 - e. means urging said first valve closed,
 - f. means operative to cause said normally closed first valve to move to an open position responsive to a partial vacuum, said last-mentioned means including conduit means connected to a region of said discharge conduit downstream from said first valve,
 - g. a second valve coupled in said conduit means, and
 - h. pressure sensing means influenced by a pressure condition affected by the hydrostatic pressure of waste liquid in said drain conduit,
 - i. said pressure sensing means being operatively connected to said second valve to effect movement thereof between its fully open and closed positions responsive to the pressure condition to which said pressure sensing means is subjected.
5. The combination with a pneumatic sewage disposal system, of
- a. a drain conduit for draining waste liquid from a place hav-

- ing an outlet,
 - b. a discharge conduit which is connected to said drain conduit and adapted to be maintained at a partial vacuum and through which waste liquid from said drain conduit is discharged into the sewage disposal system,
 - c. structure comprising a valve which is movable between closed and open positions and coupled in said discharge conduit for controlling flow of waste liquid from said drain conduit to said discharge conduit,
 - d. said valve normally being closed,
 - e. means urging said valve closed,
 - f. means moving said normally closed valve from its closed position toward its fully open position responsive to a partial vacuum, and
 - g. means upstream from said valve responsive to increase in the hydrostatic pressure of waste liquid in said drain conduit operative to regulate said last-mentioned valve moving means to move said valve from its closed position.
6. The combination with a pneumatic sewage disposal system, of
- a. a drain conduit for draining waste liquid from a place having an outlet,
 - b. a discharge conduit which is connected to said drain conduit and adapted to be maintained at a partial vacuum and through which waste liquid from said drain conduit is discharged into the sewage disposal system,
 - c. structure comprising a first valve which is coupled in said discharge conduit for controlling flow of waste liquid from said drain conduit to said discharge conduit,
 - d. means operatively connected to said first valve for operating the same responsive to partial vacuum, said last-mentioned means including conduit means connected to a region at a partial vacuum,
 - e. a second valve coupled in said conduit means,
 - f. pressure sensing means upstream from said first valve influenced by a pressure condition affected by the hydrostatic pressure of waste liquid in said drain conduit, and
 - g. said pressure sensing means being operatively connected to said second valve to effect movement thereof between its fully open and closed positions responsive to the pressure condition to which said pressure sensing means is subjected.
7. Apparatus as set forth in claim 6 in which said pressure sensing means comprises a flexible diaphragm.
8. Apparatus as set forth in claim 7 in which said flexible diaphragm is subject to the hydrostatic pressure of waste liquid in said drain conduit.
9. Apparatus as set forth in claim 8 in which said flexible diaphragm is disposed in a wall of said drain conduit.
10. Apparatus as set forth in claim 6 in which said means for operating said first valve responsive to a partial vacuum is provided with an opening for bleeding ambient air therein.
11. Apparatus as set forth in claim 6 in which said conduit means responsive to partial vacuum is connected to a region of said discharge conduit downstream from said first valve.

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