No. 848,365. PATENTED MAR. 26, 1907.

J. F. HARRIGAN.

SIPHON.

APPLICATION FILED SEPT. 9, 1905.

Fig. 1.

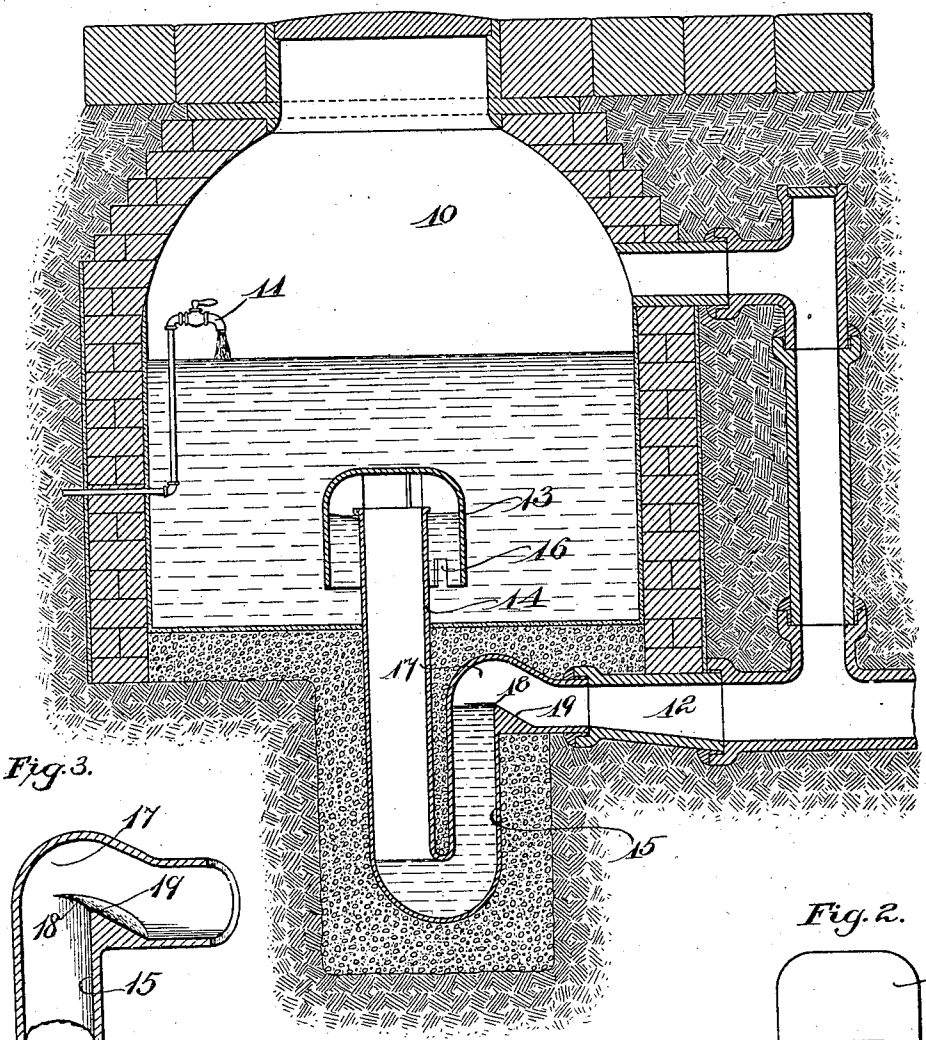
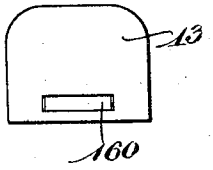


Fig. 3.

Fig. 2.



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SIPHON.

No. 848,365. Specification of Letters Patent. Patented March 26, 1907.

Application filed September 9, 1905. Serial No. 277,642.

To all whom it may concern:

Be it known that I, JOHN F. HARRIGAN, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Siphons, of which the following is a specification.

This invention relates to siphons of the automatic intermittent type, and has particular reference to siphons of this character which employ no moving parts, the siphon being especially adapted or use in flushing sewers, although equally capable of use for other purposes.

One of the objects of this invention is to provide an improved construction of the discharge portion of the siphon whereby a more rapid removal of the water will take place.

Another object of the invention is to provide an air-aperture in the bell or shorter limb of the siphon to avoid all chance of clogging said aperture under any circumstances.

Another object of the invention is to provide an improved structure of the upper end of the outlet or discharge limb of the trap, so as to provide an easy passage for the water to the drain and to insure the stream of water following the escape of air from the upper end of said limb.

To these ends the invention consists in the construction and combination of parts substantially as hereinafter described and claimed.

Of the accompanying drawings, Figure 1 represents a sectional view of a flush-tank provided with a siphon embodying my invention. Fig. 2 is a detail elevation representing a modified form of the air-opening in the bell. Fig. 3 is a detail perspective view of a portion of the invention hereinafter described.

The reservoir of tank is indicated at 10, said tank having a supply-pipe 11 of any ordinary or preferred type.

The drain or sewer is indicated at 12.

The bell or shorter limb of the siphon 13 is supported by the upper end of the inlet limb or leg 14 of the trap. The trap comprises the inlet or longer limb 14 and the outlet or discharge or shorter limb 15, said limbs being connected by the usual bend in which is located the lowest portion of the trap. As usual, the two limbs extend in the same direction from the bent portion. As shown, the limbs 14 and 15 are in the form of pipes, the diameters of which are unvaried from end to end with respect to the straight or vertical portions thereof, thereby eliminating liability of a clogging of the trap to an extent which would prevent the siphonic action, the clogging material having a free passage from the upper end of the pipe 14 to the lowest part of the trap where, owing to the enlarged space due to the meeting of the two limbs, such material would lodge without preventing the lowering of the liquid contents below the level at which the seal is complete.

The air-aperture 16, formed in the bell 13, is formed with a straight or horizontal top or with straight or vertical sides. It may open at the lower edge of the bell, as shown in Fig. 1, or the lower side of the aperture may be closed, as indicated in Fig. 2, in which said aperture is represented as horizontally elongated at 160. The horizontal slot 160 (represented in Fig. 2) presents an opening of considerably greater area than the vertical recess 16. (Shown in Fig. 1.) The object of the straight sides of the air-aperture will be pointed out hereinafter.

The invert of the upper end of the shorter limb or leg 15 of the trap is formed with a horizontally-extending shoulder 18, from which the metal is inclined or sloped at 19, so as to carry the water escaping from the upper end of the short limb 15 easily downward to the drain without breaking the continuity of the escaping stream. The shoulder 18 does not follow the curvature of the horizontal portion of the invert, but, as shown in Fig. 3, extends across this portion of the invert at a point above the bottom thereof, the edge of the shoulder being in a substantial horizontal plane, following the curvature of the vertically-extending portion of the outlet-arm of the seal or trap. In other words, the shoulder conforms to the inner edge of a cross-section of the outlet-arm of the seal or trap. The incline 19 and shoulder 18 might be termed a "dam," the edge of which permits the initial flow of liquid to extend substantially across the diameter of the invert, thereby insuring an initial maximum overflow, the structure being such that the cross-sectional area of the outlet-arm of the seal or trap, as well as that of the invert 17 is not materially altered at any portion of its length, therefore providing a continuous channel for the escape of water. As the invert 17 is rounded to form the continuous channel, it will be obvious that the contents will be directed toward and over the shoulder 18 into the outlet to the sewer or drain, there-

by preventing any tendency to clog at this point.

To obtain the best results, the siphon intake or bell should contain between the top of the air-aperture and the top of the inlet-limb of the trap a certain percentage of air-space greater than that contained in that part of the trap holding the seal and having the largest diameter. The trap should be filled with liquid, and as the liquid rises in the reservoir or tank the air in the bell is forced into the inlet-limb of the trap, gradually driving the liquid in the trap into the sewer or drain until an equilibrium is established, which takes place when the liquid in that part of the trap forming the longer limb has been forced to substantially the lowest part of the trap from which its depth of seal is measured, at which time the water in the reservoir will balance the column of water in the outlet-leg of the trap, due to the resistance offered by the liquid in said outlet-leg. This also tends to compress the air within said longer limb; but with the slightest increase of the water in the reservoir, with a resultant increase in pressure, some of the compressed air in the inlet-limb of the trap is driven into and through the column of liquid in the bend of the trap in the form of bubbles, which having no outlet other than through the outlet-leg pass therein, tending to increase the contents of said outlet-leg, with the obvious result that a portion of such contents is forced over the shoulder 18, immediately disturbing the equilibrium by decreasing the height and quantity of liquid in the column, as well as decreasing the resistance offered by such column, so that there would be an inequality in the pressures that existed between the liquid in the trap and in the reservoir. The liquid in the reservoir then rushes through the siphon to the sewer, resulting in lowering the level of the liquid in the reservoir to a point below the top of the air opening or aperture in the bell or short limb of the siphon. When the siphon is filled with air that enters by way of the aperture in the bell, the siphonic action is broken and the tank or reservoir fills and repeats the operation.

The fact that the longer limb or intake portion of the trap is of greater diameter than the shorter limb or outlet portion of the trap insures a highly-sensitive siphon, which sensitiveness will vary according to the relative proportions of these two members. In other words, the greater the difference between the two diameters mentioned the greater is the sensitiveness of the siphon, since the increased area of the liquid surface in the longer limb of the trap provides a greater quantity of compressed-air bubbles at the instant the surface of the liquid in such longer limb passes to a point where the air may pass to the outlet-leg, so that more air will be driven into and through the column of liquid in the short limb of the trap at the same time, resulting in a greater amount of liquid escaping over the shoulder or dam 18 at the time the seal is broken. Furthermore, this sensitive action of the siphon is obtained not only by reason of the greater area of the inlet limb or arm of the trap, but from the fact that said inlet-arm has its diameter unvaried from end to end, thereby practically retaining the air-bubbles in close contact and causing them to cling together to form a compact mass of bubbles which will move together, the increasing pressure of the liquid in the tank causing this action, a result which would not be obtained were the diameter of this arm increased or decreased toward the trap, as when the diameter is increased the bubbles would become scattered and pass into the trap singly with practically no effect. In addition, the fact that all bubbles must move in the same direction prevents any liability of the movement of scattered bubbles toward the outlet-arm of the trap counteracting each other in effect. When the diameter is decreased, the size of the bulk of the body of air-bubbles will be smaller, and consequently less effective. This sudden removal of a large percentage of the liquid in the trap sets the siphon into instantaneous action, and it will be readily understood that with sufficient increase in the diameter of the longer limb or intake part of the trap over the diameter of the shorter limb or outlet part of the trap almost the whole column of liquid in the trap can be suddenly removed. This result is brought about by the increased amount of compressed air which is in contact with the liquid surface in the longer arm or limb at the time such liquid surface passes below the top of the seal formed in the bend of the trap, which air is that which is forced into and through the liquid column in the shorter limb, as above explained.

By the construction of the shoulder 18 and incline 19 of the invert or highest part of the shorter limb of the trap, as illustrated in the drawings, the liquid disturbed by the passage of air through the column of liquid in the outlet portion of the trap finds an easy passage to the sewer or drain, and the stream of liquid from the reservoir following the escape of the air is kept intact, insuring a maximum speed of discharge.

By forming the sides of the aperture with straight lines several advantages are obtained that add to the efficiency of the siphon: First, the aperture can be made so large without adding to the size of the bell that the chances of its becoming clogged by foreign substances are minimized; secondly, an air-aperture with straight-line sides, preferably horizontal at the highest portion of the openings, will always free itself of liquid if the si-

phon has not been thoroughly emptied of air, which result cannot be obtained with a circular or oval form of aperture. Moreover, if a crack is formed in the siphon-bell near its lower end or if the entrance of foreign matter of any bulk into the siphon, so as to obstruct the passage of liquid at the entrance to the longer limb of the trap, would prevent all of the air from leaving the siphon a thin film of liquid would cover the opening or air-aperture if said aperture were small and had a curved upper edge. This form of construction is of especial advantage where sewage or other liquids of a pasty consistency are received by the siphon and also in very cold places where the water in the reservoir or tank sometimes freezes, the ice when broken oftentimes preventing the removal of all the air from the siphon during its period of discharge, the opening being of such a length that the curvature of the bell will prevent solid substances from entirely closing said opening or aperture.

Having now described my invention, what I claim as new is—

1. A siphon comprising a siphon intake or bell, and a trap having a seal, the surface-level of the contents of the trap being controlled by pressure from without the intake or bell, the area of the surfaces of the liquid contents of said trap being unequal, the area at the discharge or outlet end of the trap being less than that at the inlet end thereof, the liquid-surface area being unvaried throughout the length of that portion of the trap between its inlet and its lowest part.

2. A siphon comprising a siphon intake or bell, and a trap formed of a long and a short limb with a bend or seal connecting said limbs, the surface-level of the contents of the trap being controlled by pressure from without the intake or bell, the diameter of the longer limb at its juncture with the bend being greater than is the diameter of the shorter limb, the area of the liquid-surface being greater in said longer limb than in the shorter limb, the liquid-surface area of the longer limb being unvaried throughout the length of that portion thereof between the inlet end and the lowest part of the trap, whereby an increased and compact body of air is forced into and through the contents of the trap at the instant the liquid-surface of the longer limb passes below the top of the seal of the trap.

3. A siphon comprising a siphon intake or bell and a trap provided with a bend that connects the long and short limbs thereof, the surface-level of the contents of the trap being controlled by pressure from without the intake or bell, the longer limb of the trap being of greater diameter than the short limb of the trap, the diameter of the straight portion of each of said limbs being unvaried from end to end.

4. A siphon comprising a siphon intake or bell, and a trap provided with a bend or seal that connects the long and short limbs of the trap, the surface-level of the contents of the trap being controlled by pressure from without the intake or bell, the longer limb of the trap and that side of the bend connecting with said longer limb, being of greater diameter than the short limb of the trap, the diameter of the straight portion of each limb being unvaried from end to end.

5. A siphon comprising a siphon intake or bell, and a trap having a continuous unbroken channel with smooth sides, said trap having two arms and an intermediate bend or seal, the surface-level of the contents of the trap being controlled by pressure from without the intake or bell, the diameter of said two arms being unequal, the diameter of the discharge end of the trap being less than that of the inlet end thereof, the diameter of the inlet-arm being the same from its highest point to the lowest part of the trap within the bend and the diameter from said lowest part of the trap to the point of juncture of the bend and outlet end of the trap gradually diminishing to meet and coincide with the diameter of the outlet-arm, the diameter of the latter remaining the same throughout its entire length.

6. A siphon comprising a siphon intake or bell, and a trap formed of a long and short limb with a bend or seal connecting said limbs, the surface-level of the contents of the trap being controlled by pressure from without the intake or bell, the diameter of the longer limb being unvaried throughout its length and greater than that of the shorter limb which also is unvaried throughout its length, the area of the liquid-surface being greater in said longer limb, whereby an increased and compact body of air is forced into and through the contents of the trap at the instant the liquid surface in the longer limb passes below the top wall of the seal of the trap.

7. A siphon having the invert of the pipe leading from the seal or trap formed with a shoulder extending horizontally across the invert, said shoulder conforming to the inner edge of a cross-section of the outlet-arm of the seal or trap, the portion of the invert above the horizontal plane of the shoulder being curved in a manner to retain the shape and size of the outlet-arm to a point beyond the shoulder, whereby the uniformity of the water-surface area in the outlet-arm of the seal or trap will be preserved.

8. A siphon having the invert of the pipe leading from the seal or trap formed with a shoulder extending horizontally across the invert at a point above the normal bottom level of the horizontal portion of the invert, said shoulder conforming to the inner edge of a cross-section of the outlet-arm of the seal

or trap, the portion of the invert above the horizontal plane of the shoulder being curved in a manner to retain the shape and size of the outlet-arm to a point beyond the shoulder.

9. A siphon having the invert of the pipe leading from the seal or trap formed with a shoulder extending horizontally across the invert, said shoulder conforming to the inner edge of a cross-section of the outlet-arm of the seal or trap, the portion of the invert above the horizontal plane of the shoulder being curved in a manner to retain the shape and size of the outlet-arm to a point beyond the shoulder, and an inclined portion leading from said shoulder to the normal bottom level of the invert.

10. A siphon having the invert of the pipe leading from the seal or trap formed with a shoulder and extending horizontally across the invert at a point above the normal bottom level of the invert, said shoulder conforming to the inner edge of a cross-section of the outlet-arm of the seal or trap, whereby the uniformity of the water-surface area in said outlet-arm will be preserved, and an inclined portion leading from said shoulder toward the normal bottom level of the invert, that portion of the invert above the plane of the shoulder being curved to connect the outlet-arm and the portion of the invert at the lower end of the inclined portion, such intermediate portion of the invert being substantially arched in cross-section, and merging into and coinciding with the shape of the invert at the lower end of the inclined portion.

In testimony whereof I have affixed my signature in presence of two witnesses.

JOHN F. HARRIGAN.

Witnesses:

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C. F. BROWN.