April 1, 1930. N. SWINDIN 1,752,620

SIPHON

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Fig. 1.

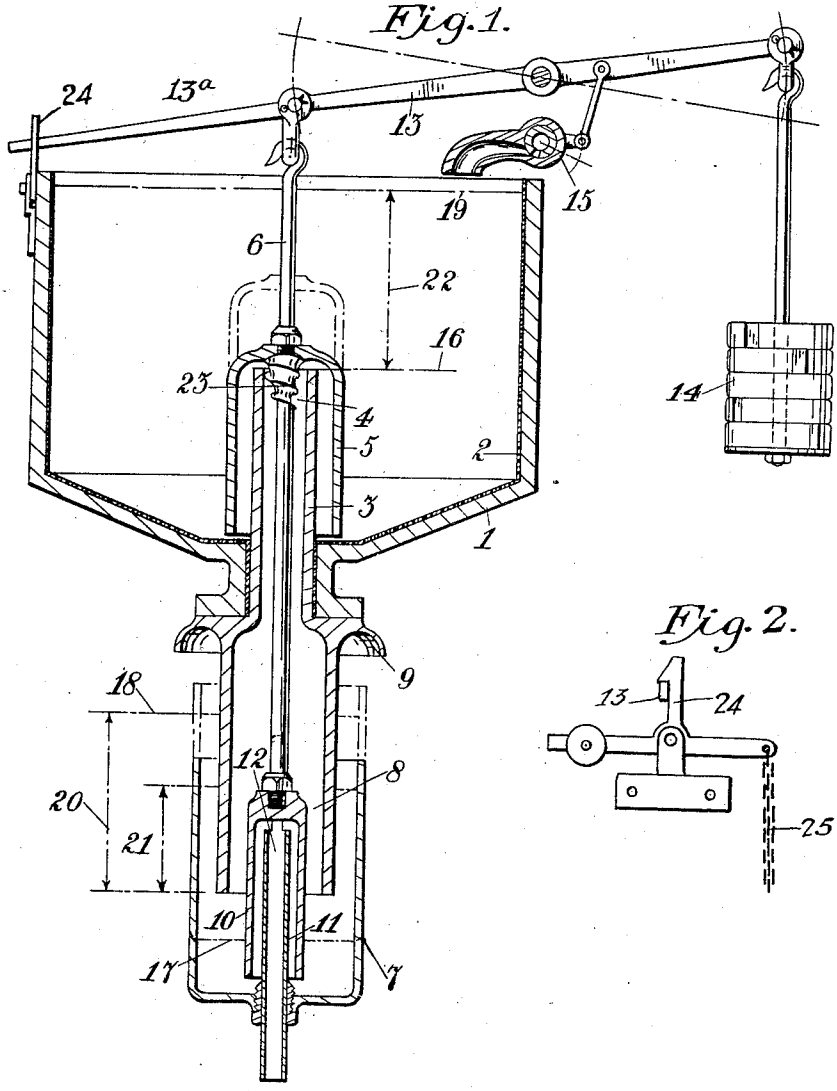



Fig. 2.




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## SIPHON

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This invention is for improvements in or relating to siphons such as are used for withdrawing liquid from a tank or other vessel, and has for its object to provide an improved construction of the same whereby the priming of the siphon is easily and certainly effected, and the invention further provides an automatically-acting siphon which can readily be arranged to serve as a liquid meter.

According to this invention, there is provided in a siphon, the combination with the down-flow pipe, of a bucket to carry a liquid seal for the lower end of said pipe, and means for lowering or permitting lowering of the bucket relatively to the pipe, to reduce the air pressure in the pipe and thereby prime the siphon.

According to another feature of this invention, the movable bucket aforesaid is applied to a siphon of the type wherein the up-flow pipe is constituted by a bell enclosing the upper end of the downflow pipe, and this bell is movable with the bucket; with this arrangement, when the bucket is lowered to prime the siphon, the bell also is lowered, reducing the overall height of the siphon pipe, and the downward movement of the bucket is adjusted to such a magnitude that the consequent diminution of hydrostatic pressure of the seal in the bucket permits the priming of the siphon by the pressure of the liquid in the tank.

According to another feature of this invention the bell may carry a plug which is so disposed on it as to enter the down-flow pipe and restrict the orifice thereof when the bell is lowered. With this arrangement the flow of water, when the siphon operates, more easily entrains the air in the siphon pipe and withdraws it so as to ensure the priming.

According to another feature of this invention, the plug aforesaid may be substantially conical in form, arranged so that its narrow end first enters the down-flow pipe, and it may be provided with a spiral groove or grooves on its conical surface to facilitate the entraining of the air by the water.

As above stated, this invention may be used to provide an automatically-operating siphon, and according to this feature of the invention the lip of the siphon (over which the liquid is to flow) is immersed in the vessel to be emptied to such depth as to supply a small flow of liquid to the bucket to provide the liquid seal therein, and the bucket is counter-balanced in such a manner that it is lowered by the presence of a predetermined weight of water in it and returns to its upward position when it is emptied. The bucket is itself provided with a siphon or is otherwise arranged to ensure its emptying with each operation.

The movement of the bucket may be used to operate a valve which controls the filling of the main vessel, the arrangement being such that when the bucket falls to prime the siphon and empty the vessel, the valve is closed and when the bucket rises again the valve is opened to refill the tank.

A siphon as hereinbefore described may be used as a liquid meter by providing some form of counting device which registers or records the number of movements of the bucket.

This invention may also be modified to adapt it for manual operation, by arranging that the siphon would operate automatically, but providing also a detent which engages the bucket or a part moving therewith, to retain it in its lower position, such detent being manually released at will to permit raising of the bucket and operation of the siphon.

In the accompanying drawing Fig. 1 illustrates an automatically-acting siphon in accordance with the present invention applied to a tank for acid solutions Fig. 2 being a detail. The tank 1 is lined with a coating of rubber or other suitable acid-resisting material 2, and the pipe through which it is emptied, namely the down-flow pipe of the siphon, is constituted by a tube 3 of hard rubber extending through the bottom of the tank with its upper open end 4 situated at any convenient height within the tank. A bell 5 encloses the upper end of the pipe 3 and is mounted on a rod 6 which extends centrally through it and down through the pipe 3 to the lower end thereof. Upon the lower end

of this pipe there is secured a bucket 7 which is so positioned and dimensioned as to enclose the lower end 8 of the pipe 3. In the particular construction illustrated, the lower end of the pipe 3 is enlarged in diameter immediately below the tank 1, and it is also provided with a downwardly-curved flange 9 to act as a splash-guard. This enlargement of the diameter of the pipe is provided to accommodate a bell 10 which is carried on the lower end of the rod 6 and surrounds a discharge-pipe 11 which extends through the bottom of the bucket 7. This construction provides a siphon device for emptying the bucket 7 after it has been filled to a predetermined level. All these parts are preferably made of vulcanite or other hard rubber, and the rod 6 is provided with a similar acid-resisting coating. The bell 10 is screwed on to the end of the rod, and the pipe 11 is secured to the inner end of the bell by portions 12 which permit access to the interior of the pipe from the interior of the bell. The bucket 7 is in turn secured on the pipe 11 so that all these parts are supported by the rod 6, and all move in unison with the bell 5 in the vessel 2.

The rod 6 is hung on a rocking-beam 13 which carries a counter-balance-weight 14 at its other end, this weight being sufficient to maintain the bucket 7 and other parts carried by the rod 6 in their uppermost position when empty; when the bucket 7 is filled with liquid it overcomes the counter-balance-weight, and by providing accommodation for additional weights the quantity of liquid which will cause the bucket to descend can be predetermined.

The rocking-beam 13 is preferably coupled to a valve 15 on the pipe which supplies the tank 1, and the parts are so arranged that when the bucket 7 is in its lower position, as illustrated, the valve 15 is closed, but when the bucket 7 rises to its upper position the valve 15 is opened, and liquid is supplied to the tank 1.

The upper end 4 of the down-flow pipe 3 of the siphon is situated at such a height in the tank 1 that it is below the level of the minimum quantity of liquid which it is required to discharge therefrom.

The operation of the device will now be described, and it will be assumed that there is no liquid in either the tank 1 or the bucket 7. In this state of affairs the weight 14 will lift the bucket 7 and bell 5 to the position indicated in chain lines, and the movement of the lever 13 will open the valve 15, thereby supplying liquid to the tank 1. The liquid continues to flow in until it reaches the level of the upper lip of the down-flow pipe 3, i. e. the level indicated at 16, and as the level of the liquid rises higher some liquid flows over the lip and down the pipe 5 into the bucket 7. The bottom of the bucket is indicated by the line 17 and as soon as sufficient liquid has been collected in the bucket it forms a liquid seal therein around the lower end of the down-flow pipe, thereby trapping the air contained in the down-flow pipe and in the bucket 5 above the lip of the down-flow pipe. As still more liquid flows into the tank 1, increasing the hydrostatic head on the compressed air, more liquid will flow over the lip and down the pipe 3 so as to raise the level in the bucket and provide a corresponding hydrostatic head at the lower end of the down-flow pipe. This is shown on the drawing with the hydrostatic head in the bucket indicated by the line 18 and an equal hydrostatic head in the tank at 19. When sufficient liquid has been accumulated in the bucket 7 to overcome the counter-balance-weight 14, the lever 13 swings over and the parts all assume the position shown in the drawing.

Since the bucket falls relatively to the lower end of the down-flow pipe 3 the depth of the liquid seal indicated at 20 is reduced to a value indicated by 21, and at the same time the bell 5 is moved downwards. Consequently the pressure of the air trapped in the down-flow pipe 3 is reduced at the lower end while still being maintained at the upper end by the hydrostatic head 22, so that the air is forced out and liquid from the tank 1 can flood the bell 5 to prime the siphon. As is usual with such siphons the liquid entrains a considerable quantity of air in its downward movement and effects the entire removal of the air from the bell 5 so that the siphon continues to operate until the liquid in the tank 1 falls below the lower lip of the bell 5. The liquid discharged through the down-flow pipe 3 enters the bucket 7 and fills it, and in so doing primes the siphon constituted by the bell 10 and down-flow pipe 11, so that it commences to discharge liquid from the bucket 7 downwards. If the siphon is not of sufficient size to accommodate the whole of the flow, the excess liquid can overflow at the upper edge of the bucket, and the splash-guard 9 hereinbefore referred to is provided to prevent any splashing of such liquid.

The operation continues until the tank 1 is emptied as above mentioned, and then the siphon 10, 11 continues in operation until it empties the bucket 7 down to the level of the lip of the bell 10. When the bucket is thus emptied, the counter-balance-weight 14 becomes operative to lift the bucket 7 and associated parts so that the whole cycle of operations will be automatically repeated. It will be appreciated that when the bucket 7 falls to initiate the emptying of the main tank 1, the valve 15 is automatically closed and prevents the supply of any more liquid to the tank 1 until the valve is opened again by the lifting of the bucket 7. It will be appreciated that the movement of the bucket 7 is determined by the magnitude of the counter-bal-

ance-weight 14, and also that the depth of the liquid seal in the bucket is determined by the level of the liquid in the main tank, so that adjustment of the weights 14 determines the depth of liquid in the tank at which the siphon operates, so that the device can be very simply calibrated to deliver different predetermined amounts of liquid, the predetermination being effected by selection of the weights 14.

In order to assist in the priming of the siphon constituted by the bell 5 and pipe 3, there may be provided on the rod 6 a plug 23 which is so situated as to enter the open end of the down-flow pipe 3 and restrict the orifice thereof, thereby facilitating the entraining of the air with the liquid at the beginning of the discharge. It is desirable that the plug should be tapered or conical, and a feature of this invention consists in providing such plug with a spiral groove or grooves on its surface, as indicated in the drawing, in order to render it more effective. A pivoted detent 24 may be provided adapted to engage the extended part $13^a$ of the lever 13 so that the bucket may be retained in the down position after discharge. The detent may be released manually by pulling on the chain 25.

It will be understood that this invention is not limited to the specific constructions hereinbefore described, for various modifications may be made in various details and all such are held to lie within the scope of the present invention.

Having now described my invention what I claim as new and desire to secure by Letters Patent is:—

1. A siphon comprising a down-flow pipe, a bucket associated with the lower end thereof to form a liquid seal therefor, means for lowering the bucket to prime the siphon, a bell enclosing the upper end of the down-flow pipe to constitute an up-flow pipe and an operative connection between the bucket and bell whereby the bell is raised and lowered with said bucket.

2. A siphon as claimed in claim 1, wherein the bell is provided with a plug which is substantially conical and is provided with a spiral groove in its surface for the purpose described.

3. A siphon as claimed in claim 1, and wherein the bucket is counterbalanced in such a manner as to be lowered by the presence of a predetermined weight of liquid therein.

4. A siphon comprising a down-flow pipe, a bucket associated with the lower end thereof to form a liquid seal therefor, means for lowering the bucket to prime the siphon, a bell enclosing the upper end of the down-flow pipe to constitute an up-flow pipe and an operative connection between the bucket and bell whereby the bell is raised and lowered with said bucket, and wherein the bucket is counterbalanced in such a manner as to be lowered by the presence of a predetermined weight of liquid therein, the bucket being operatively connected to a valve controlling the supply of liquid to the main vessel.

5. A siphon comprising a down-flow pipe, a bucket associated with the lower end thereof, to form a liquid seal therefor, means for lowering the bucket to prime the siphon, a bell enclosing the upper end of the down-flow pipe to constitute an up-flow pipe and an operative connection between the bucket and bell whereby the bell is raised and lowered with said bucket, and wherein the bucket is provided with a siphon to ensure emptying of said bucket with each operation.

6. A siphon comprising a down-flow pipe, a bucket associated with the lower end thereof, to form a liquid seal therefor, means for lowering the bucket to prime the siphon, a bell enclosing the upper end of the down-flow pipe to constitute an up-flow pipe and an operative connection between the bucket and bell whereby the bell is raised and lowered with said bucket, and wherein a detent is provided to retain the bucket in its lower position, and manually operable means for releasing such detent.

In testimony whereof I have signed my name to this specification.

NORMAN SWINDIN.