J. W. COX.

ALTERNATING SIPHON.

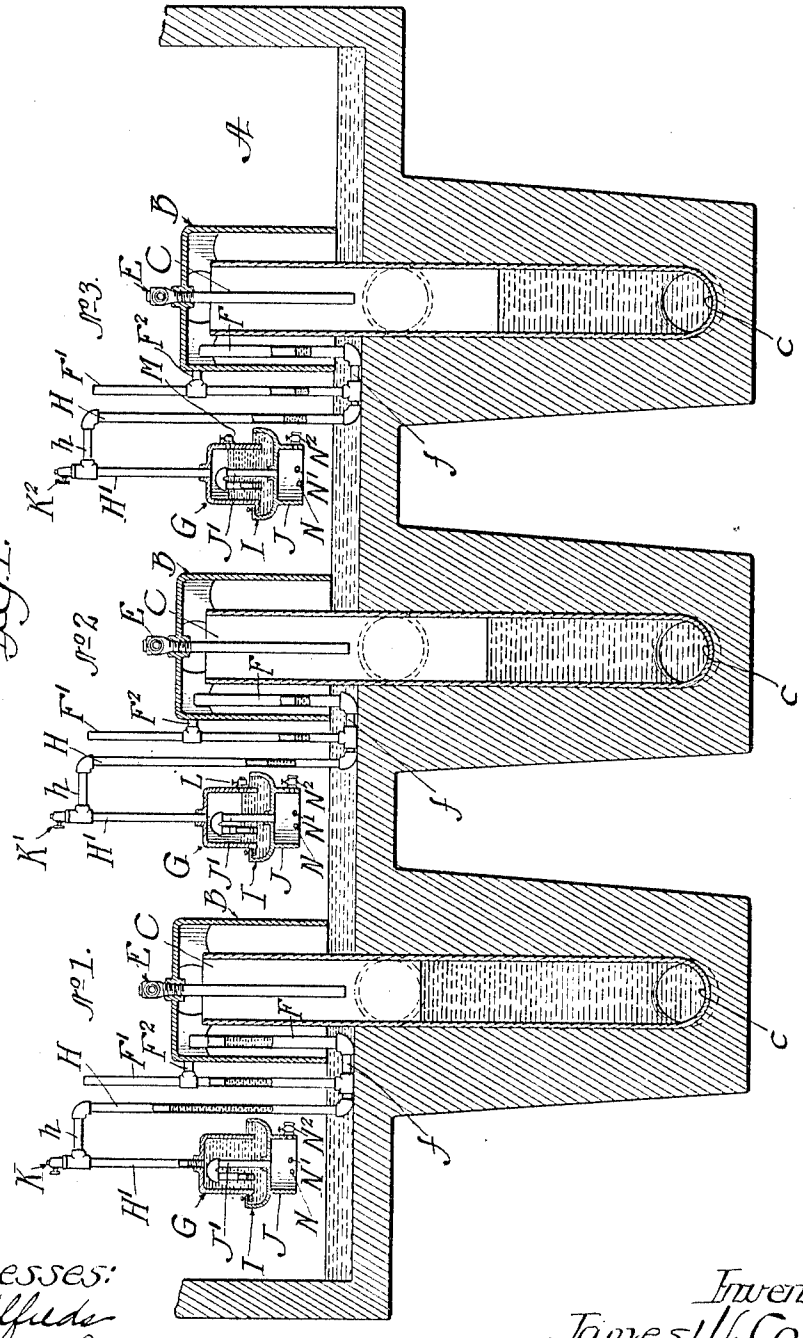
APPLICATION FILED APR. 29, 1912.

1,040,640.

Patented Oct. 8, 1912.

2 SHEETS—SHEET 1.

Fig. 1.



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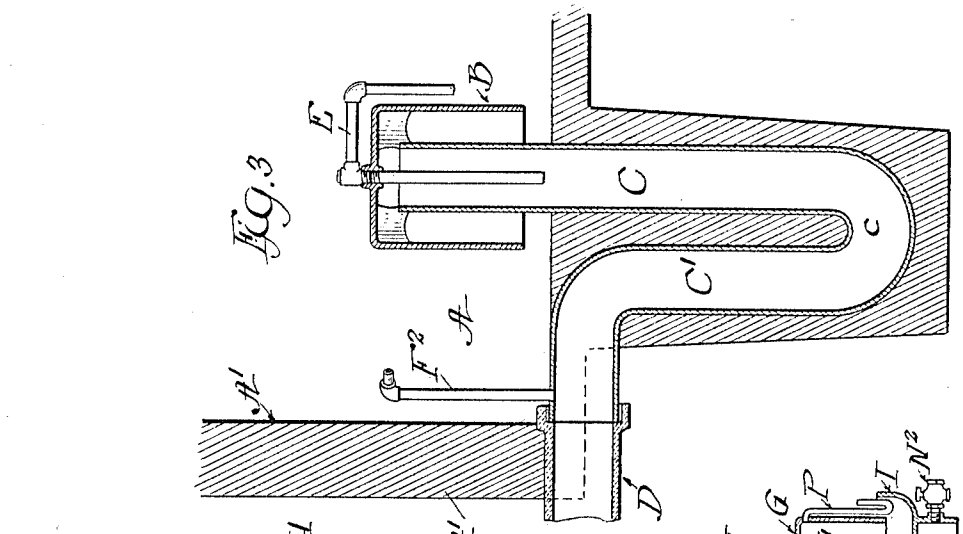

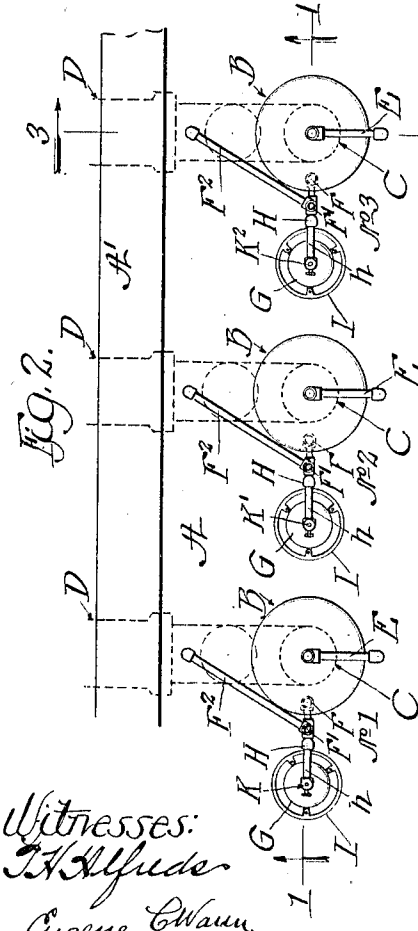

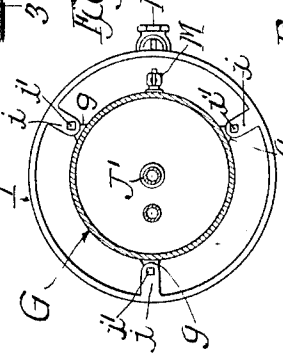

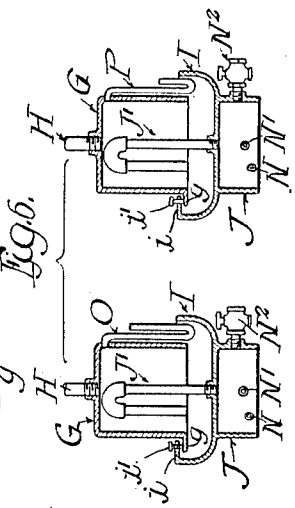

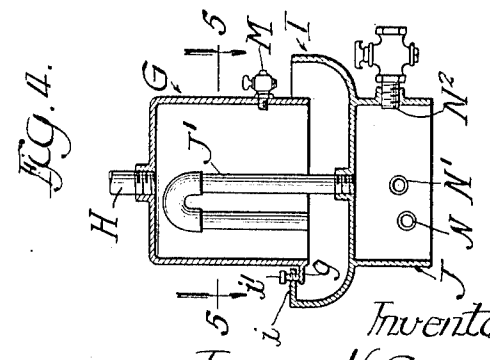

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UNITED STATES PATENT OFFICE.

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ALTERNATING SIPHON.

1,040,640. Specification of Letters Patent. Patented Oct. 8, 1912.

Application filed April 29, 1912. Serial No. 693,810.

To all whom it may concern:

Be it known that I, JAMES W. COX, a citizen of the United States, and a resident of Wilmette, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Alternating Siphons; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to an apparatus designed for controlling the flow of liquid from a main tank, intended to be intermittently emptied or discharged, into a plurality of receptacles, so that such receptacles may be filled or charged in a predetermined rotative order from said main tank or receptacle.

My improved controlling apparatus may be used wherever it is desired to distribute liquid from a central tank in a predetermined or rotative order to a plurality of receptacles or other places for the disposal of the liquid. The invention has been designed more especially for use in connection with a system for septic treatment of sewage for purifying the same; said apparatus, when so used, being located between the septic tank and the contact or filter beds so as to withdraw the sewage from the septic tank and properly distribute the same to said contact or filter beds; but it will be understood that such apparatus may be used wherever it is desirable to distribute a liquid in the general manner stated.

An apparatus embodying my invention embraces a plurality of deep seal siphons, such as are shown in the prior patent to M. J. Adams, No. 760,770 of May 24, 1904, and in the prior patent to S. W. Miller, No. 857,355, dated June 18th, 1907. In the devices shown in these prior patents, the operation of the several siphons in predetermined rotative order is secured by means of pipe connections between the several siphons, and the principal object of the present invention is to provide for the operation of the plurality of such siphons in rotative order without the employment of any connecting means between the siphons, or by a construction in which each siphon operates independently of the operation of the other siphons of the series.

The invention consists of the matters hereinafter described and more particularly pointed out in the appended claims.

As shown in the accompanying drawings—Figure 1 is a view in central vertical section taken on line 1—1 of Fig. 2, of three siphons and associated parts constructed in accordance with my invention; Fig. 2 is a plan view of said siphons; Fig. 3 is a detail section taken on line 3—3 of Fig. 2; Fig. 4 is an enlarged detail section taken through the starting bell and air compression bell belonging to one of the siphons; Fig. 5 is a detail sectional plan view, taken on line 5—5 of Fig. 4. Fig. 6 represents two detail sectional views taken through the starting bell and air compression bell and showing a modified form of air venting means applied thereto.

As shown in the drawings, A indicates a tank which may be termed a main distributing or dosing tank, and which is adapted for connection with any source supplying liquid thereto. The tank when filled is designed to be emptied into a plurality of separate receptacles, or to a plurality of different places, such as filter-beds, through the medium of a plurality of deep seal siphons, each consisting of a downwardly opening bell B supported over the upper end of a pipe C forming the longer leg of the siphon. Said bell and the upper part of the pipe C constitute the shorter leg of the siphon, as common in devices of this kind. Said longer leg C of each siphon communicates at its lower end with a deep seal trap *c* having an upturned outlet leg C′, from the upper end of which the contents of the tank, flowing through the siphon and the trap, is discharged into a pipe or conduit D leading to a suitable place for the disposal of the liquid. The several siphons, as shown in the accompanying drawing, are arranged in a straight line near one wall A′ of the tank A, with the discharge pipes D thereof at right angles to said wall. Each of the siphons is provided with a vent pipe E of familiar construction adapted for the purpose of venting the siphon after each operation thereof, in a fa-

miliar manner. Each of said siphons is provided with a blow-off trap of the kind shown in the prior patents to S. W. Miller No. 727,991, dated May 12, 1903, and No. 857,355 dated June 18th, 1907; the siphon being brought into operation by pressure from a starting bell which is connected with the blow-off trap, such pressure acting on the blow-off trap to force or blow the seal of the latter. As shown, the blow-off trap of each siphon comprises an upright receiving leg F rising into and opening at its upper end into the upper part of the bell, or shorter leg of the siphon, at a distance above the upper end of the longer leg C of the siphon, an outer or discharge leg F′ connected at its lower end with the inner leg by a short transverse pipe *f* and opening at its upper end into the atmosphere at a point above the maximum liquid level in the tank, and a drain pipe F^2 is connected with the leg F′ below the upper end of the latter and discharging into the outlet from the deep seal trap. Each blow-off trap also has connected with it an upright pressure-transmitting pipe H, connected at its lower end with the lower ends of the pipes F and F′, through which pressure is applied to the blow-off trap to force or break the seal of the same.

Pressure for breaking the seal of the blow-off trap is furnished by means of a starting bell G, which is located in the tank A, and with the top of which the pipe H is connected by means of a pipe H′ which rises from the top of the bell G and is connected by a horizontal pipe *h* with the upper end of said pipe H. Said starting bell G is constantly or permanently sealed by means of liquid held or contained in a cup I, supported beneath and adjacent to the lower margin of the bell G. The side margins of said cup rise above the lower margin of said bell G, so that the said lower margin of the bell extends downwardly into the liquid in said cup and the bottom of the bell is constantly sealed by such liquid. In connection with the starting bell G thus arranged, is employed an air compressing bell J, also located in the tank A, and having connected with its top an air discharge pipe J′ which rises vertically within the starting bell, to a point near the top of the same, and is then extended downwardly and has its open end located below the level of the upper edge of the cup I.

While the air compressing bell J may be located at any suitable point in the tank, below the level of the starting bell, in the particular construction shown in the drawings, such air compressing bell is formed by a cylindric flange extending downwardly from the bottom of, and made integral with, the sealing cup I. These parts are so arranged that each time the water rises in the tank, air compressed in the top of the bell J by the rising of the water therein, passes therefrom through the pipe J′ and is delivered into the starting bell. The air discharged from said pipe J′ rises through the water contained in the starting bell and accumulates in the top of said bell, displacing the water in said bell, so that the water level in the bell descends or is depressed to a certain extent each time the water rises in the main tank. As the water in the starting bell is depressed, the air pressure therein increases, until there is produced in the pressure-transmitting pipe H of the blow-off trap, the degree of pressure required to break the seal of said blow-off trap and start the main siphon in operation, as will be hereinafter more particularly described.

The three main siphons shown, indicated in the drawings, as No. 1, No. 2 and No. 3, are alike and each similarly equipped with a blow-off trap, a starting bell and an air compressing bell, arranged and connected as above described.

Referring now to certain differences in the construction of the starting bells of the three siphons shown, the starting bell of siphon No. 2 is provided with an air cock L located at its side at a distance from the bottom equal to one-third of the vertical height of the bell, and the starting bell of siphon No. 3 is provided with an air cock M located in its side wall at a distance from its bottom equal to two-thirds of the height of the bell. In the operation of the three siphons, these air cocks are kept closed and the same are used only in preparing the three siphons for operation alternately or in rotation, as hereinafter described. Air cocks K, K′, K^2 are also provided at the upper ends of the pipes H′ of the several siphons. Said air cocks K, K′, K^2 are kept closed in the usual operation of the apparatus and are employed only to permit one of the siphons to be thrown out of action when desired, the opening of one of said air cocks preventing the operation of its associated starting bell. It is to be understood in this connection that the two starting bells Nos. 2 and 3 in the apparatus shown, are provided with air vents or cocks located in the vertical relation stated, because of the fact that in such apparatus three main siphons, designed for alternative or rotative operation, are employed, but that, where a greater or less number of siphons is used, the several starting bells will have their air vents arranged to communicate with the interior of the bells severally at vertically spaced points corresponding with the number of siphons in the apparatus. With only two starting bells one of them will have its air vent located midway of its height, but where four siphons are used, three of the bells will have air vents located one at three-fourths, one at one-half, and the other

at one-fourth of the height of the bell from the level of the bottom of the same.

As shown in the drawings, each of the air compressing bells J is made deeper than required for the operation of its associated starting bell and is provided with one or more valved vents, as N, N′, N², in its side wall, either of which, when open, will prevent any compression of air in such air compressing bell, as the water rises in the tank, until the level of the water reaches the level of the open vent. This construction provides for throwing one of the main siphons out of operation when desired, as will hereinafter appear.

The drawings, Figs. 4 and 5, show a convenient construction in means for adjustably supporting the sealing cup I, and compressing bell J, from the starting bell G; such supporting means consisting of outwardly extending lugs *g*, *g* on the lower margin of the bell G, inwardly extending arms *i*, *i* on the upper margin of the cup I, arranged with the inner ends above and overlapping the lugs *g*, *g*, and set-screws *i′*, *i′* inserted vertically through said arms and bearing at their lower ends on the lugs. This construction provides for accurately adjusting the level of the top margin of the cup relatively to that of the bottom margin of the starting bell, so as to afford the necessary depth of seal in said cup to prevent the entrance of air to, and the escape of water from, the sealing bell, when the tank is empty.

The operation of a series of alternating siphons embracing the features of construction above described, is as follows: In order to prepare for operation the starting bells of the three siphons shown, all of the bells being empty, and all of the blow-off traps and all of the main siphons being filled or sealed with liquid, one of the bells is filled one-third full of water, another one two-thirds full and the third is left empty; it being understood that, as each starting bell is sealed by the water in the cup into which its lower edge dips and as the pressure-transmitting pipe connected with the top of each starting bell is sealed by the water in the blow-off trap, so that air cannot enter the top of the bell, the water introduced into either starting bell before starting the apparatus will be retained therein by atmospheric pressure. Different quantities of water may thus be introduced into the starting bells of siphons Nos. 2 and 3, in any desired manner, but in the construction shown, the two air cocks L and M, on said starting bells, located in one instance in the side of the starting bell at a distance one-third of the height of the bell from its bottom, and in the other instance two-thirds of the distance from the bottom are utilized for introducing the desired quantities of water into said starting bells during the operation of filling the main tank the first time. Assuming that the main siphons and blow-off traps have been primed, and the air cocks L and M of siphons Nos. 2 and 3 are open, if water be allowed to flow into the main tank, as its level rises therein, it will overflow the edges of the cups and seal the three starting bells. As the level of the water rises, after the cups have been filled and the starting bells sealed, the water will rise only a short distance in the starting bell of siphon No. 1, because of the fact that the escape of air from that bell is prevented by its sealed blow-off trap, but in the case of the starting bells of siphons Nos. 2 and 3, the air will at this time escape through the air cocks L and M, and the water will rise equally in said starting bells and in the tank. When the level of the water in the starting bell of siphon No. 2 reaches the air cock L, that air cock will be closed by hand to prevent further escape or entrance of air, and the blow-off trap being sealed, the air held in the bell will prevent any more water entering the same. Likewise in the case of the starting bell of siphon No. 3, having its air cock M at two-thirds of the distance from its bottom, when the water in the bell reaches the level of the said air cock the same will be closed by hand and no more water will enter the said bell. The three starting bells of siphons Nos. 1, 2 and 3 will now be prepared for the first operation of the apparatus in emptying the tank. In the case of the starting bell of siphon No. 1, in which the water rises in the bell only a short distance, as stated, the further rise of the water in the tank after the sealing of the bell, will have the effect of compressing the air therein to a degree corresponding with the height of the water in the tank, and when the water reaches its maximum level, the pressure developed in said starting bell of siphon No. 1, will be sufficient to break the seal of its associated blow-off trap and start said siphon No. 1 in operation. Each starting bell is so arranged or its lower edge is located at such distance below the maximum level of water in the tank, that a sufficient air pressure to break the seal of the associated blow-off trap will be obtained when the level in the water in the starting bell is depressed to a point near the bottom edge of the bell; that is to say, before the main siphon will be vented, the column of water in the pipe H of the blow-off trap must be lowered until its top reaches the lower end of said blow-off trap. As the water is depressed in the pipe H, it will rise in the pipe F′ and escape through the drain pipe F², and when the level of the water in said pipe reaches the lower bend of the blow-off trap, the water will be forced from said blow-off trap, so as to break the seal therein, and

air will then escape from the main siphon through the blow-off trap, and such main siphon will be started in operation, as is usual in the operation of such blow-off traps. It will be understood that in this first operation of the apparatus, the compressing bells will not come into operation, because, the starting bells being empty, when the water first rises in the compression bells, the air will freely escape therefrom through the pipes J'. As soon as the blow-off trap of siphon No. 1 is unsealed, as described, the air in the starting bell of said siphon will escape therefrom through the blow-off trap, and water will instantly enter and fill said starting bell, entering the bottom of the same through the sealing cup, and immediately upon the starting of the main siphon, by the venting of the same through the blow-off trap, water will enter the blow-off trap through the top of its receiving leg F, thereby again sealing the said blow-off trap. It follows that, as the level of the water in the tank subsequently descends in the emptying of the same, and after the tank is empty the starting bell of siphon No. 1, will remain filled with water. This is the condition of the apparatus after the first operation of siphon No. 1, and when the tank is empty, as shown in Fig. 1 of the drawings; the starting bell of siphon No. 1 being at this time completely filled, that of siphon No. 2 one-third filled and that of siphon No. 3 two-thirds filled. When the water rises in the tank in the next and subsequent operations of the apparatus, the compressing bells come into operation.

It being understood that each air compressing bell is adapted to contain a quantity of air sufficient to depress the level of the water in its associated starting bell a distance of one-third of the height of the bell, it follows that each time the water rises in the tank, the water in such starting bell will be displaced to an extent equal to one-third of the quantity of water contained in the bell when the same is completely filled. If, therefore, one of the starting bells be one-third filled, as in the case of the starting bell of siphon No. 2, after the water first rises in the tank, when the water level next rises, the air forced from the compressing bell of said siphon No. 2 will force the water therefrom and give such increased pressure in said starting bell as to break the seal of its associated blow-off trap and start siphon No. 2 into operation. Likewise, in the case of the starting bell of siphon No. 3, which in starting the apparatus was filled two-thirds full of water, when the water rises the second time in the tank, the air forced into said starting bell will displace a quantity of water therefrom equal to one-third of its capacity, leaving it one-third full, and when the water rises a third time in the tank, the air so forced into the said starting bell will displace the water remaining therein, and when the water reaches its maximum level in the tank, the pressure developed in the starting bell will be sufficient to force the seal of the associated blow-off trap and start the main siphon No. 3 into operation. Assuming that either starting bell is full of water, as in the case of the starting bell of siphon No. 1, as shown in the drawing, the water in the tank will rise three times before all of the water will be displaced from said filled starting bell, and the venting of the main siphon associated therewith will take place after the water in the main tank has risen three times, with the effect of forcing all of the water from such starting bell, and sufficient air pressure will then have been developed to break the seal of the blow-off trap and thereby start the associated main siphon in operation. In case of a starting bell which, when the tank has been emptied, is filled only one-third full of water, such water will be displaced and its main siphon will be started when the water rises once in the tank, and likewise, in the case of a starting bell which, when the tank is empty, is two-thirds filled with water, all of the water will be forced therefrom and its main siphon will be started in operation when the water so rises the second time.

It follows from the above that after the three siphons are in operation, in the manner stated, each time the water rises in the tank, that one of the starting bells that is filled with water will have one-third of the water forced therefrom, that one of the starting bells that is two-thirds full will have the level of the water therein depressed correspondingly, and the starting bell that is one-third full will have the water level lowered to the bottom of the bell, and sufficient air pressure will be developed therein to start its associated main siphon into operation. As soon as the seal in either blow-off trap is broken and air permitted to escape through such blow-off trap from its associated siphon, the breaking of the seal in the blow-off trap will not only allow the air to escape from the top of the main siphon, to start the same in operation, but the air will also escape from the top of the associated starting bell through the blow-off trap, thereby permitting the surrounding water to flow into such starting bell through its cup and completely fill the same. When the water in the main tank next rises, one-third of the water will be forced from such filled starting bell and the operation will continue as before; the starting bells of the three siphons operating successively, each time the water rises in the tank, to vent one

of the main siphons and effect the emptying of the tank.

As before stated, the effective depth of the air compressing bell may be changed by opening one of the several air vents N, N′, N², located at different distances below the top of the said bell, so that either air compressing bell may be adapted to force a sufficient quantity of air into its associated starting bell to force all of the water from the latter in two, three, four or more operations of the compressing bell, according to the number of siphons to be operated. The air compressing bells illustrated, when all of the air vents N, N′, N² are closed, will hold sufficient air to displace one-half of the water in a filled starting bell, and when the vent N is open, will contain a quantity of air required to displace one-third of the water in a filled starting bell. If it be desired to cut out of operation one of the three main siphons illustrated, then all of the vents on the air compressing bells of the other two siphons will be closed, whereupon, each time the water rises in the main tank, one-half of the water will be forced from the starting bells of the siphons that are in operation, each of the two siphons will be operated after the water has risen twice in the tank and such two siphons will operate in alternation with each other. One of the vents N′ or N² will be used in case the apparatus is provided with four or five siphons in which case the water will rise four or five times in the tank to effect the operation of either starting bell.

It will be understood that the pipe J′, leading from the top of the compressing bell and discharging at the level of the bottom of the starting bell, is arranged to rise to a point near the top of said starting bell, and then descend, in order that the water may be retained in said starting bell by atmospheric pressure when the tank is empty; it being obvious that the pressure of the atmosphere will act downwardly on the top of the water in the descending leg of said pipe J′, in the same manner as it acts on the top of the water in the exterior part of the cup I, to prevent the water in the starting bell from flowing outwardly through the said pipe J′. Said pipe J′ may be arranged otherwise than as shown, provided it has a rising and descending leg and has its downwardly opening end approximately at the level of the bottom edge of the starting bell or below the surface of the water in the sealing cup.

In Fig. 6, I have shown a construction in means for introducing the proper quantity of water into two of the starting bells, adapted for use in place of the air cocks L and M, hereinbefore described. As shown in said figures, O and P are two small vent pipes, attached to the starting bells and connecting with the upper parts of the interior of the same. Said pipes O and P are of inverted U-form having their lower bends below the levels of the bottom edges of the starting bells, and consisting of longer descending legs and shorter rising legs; the ends of the rising legs being open. The vent pipe O has the open end of its rising leg at a vertical distance from the bottom of the bell, equal to two-thirds of the height of the same. The vent pipe P has its open end at a vertical distance from the bottom of the bell equal to one-third of the height of the same. The vent pipes O and P, arranged as described, operate automatically, when the starting bells are being filled in preparation for operation, to give the desired quantities of water in their associated starting bells. As the water level rises in the tank and enters the starting bells through the cups thereof, air will escape from the tops of the bells through said pipes O and P, until the water level reaches the upper ends of said pipes, when the same will be sealed by water which will then flow into such open ends, the escape of air will be cut off, and no more water will enter the bells. During the usual operation of the apparatus, these vent pipes will remain sealed, and the starting bells will operate in the same manner as is the case with the starting bells of Figs. 1 to 5, when the air cocks L and M thereof are closed.

It will be understood that the air compressing bells, while they may be located elsewhere than beneath the starting bells, must necessarily be located below the level of the said starting bells in order that they may be subject to the greater water head or pressure than that within the starting bells so that the air pressure developed in the starting bells will be sufficient to force the water therefrom.

An apparatus embodying my invention may be variously modified in its details of construction and in the arrangement of its parts, and I do not desire to be limited to the special features of construction illustrated, except so far as the same may be pointed out in the appended claims, as constituting parts of my invention.

I claim as my invention—

1. An apparatus for the purpose set forth comprising a tank, a plurality of trapped siphons, a blow-off trap communicating with the air space of each siphon above the seal thereof, a constantly sealed starting bell for each siphon, the air space of which bell is connected with the blow-off trap of said siphon, and means associated with the starting bell of each siphon operated by the rise of liquid in the tank and acting each time the liquid rises in the tank to deliver to said

starting bell a quantity of air less than that required to give therein a pressure sufficient to break the seal of its associated blow-off trap.

2. An apparatus for the purpose set forth, comprising a tank, a plurality of trapped siphons, a blow-off trap for each siphon connected with the air space of said siphon above its trap, a constantly sealed starting bell for each siphon connected with the blow-off trap thereof, and an air compression bell for each siphon adapted for the discharge of air into its associated starting bell.

3. An apparatus for the purpose set forth, comprising a tank, a plurality of trapped siphons, a blow-off trap for each siphon communicating with the air space of the same above its trap, a starting bell for each siphon, provided with a cup adapted to contain liquid for sealing the bell, said bell being connected with its associated blow-off trap, and an air compressing bell for each siphon adapted for the discharge of air into its associated starting bell.

4. An apparatus for the purpose set forth, comprising a tank, a plurality of trapped siphons, a blow-off trap for each siphon communicating with the air space of the same above its trap, a starting bell for each siphon provided with a cup adapted to contain liquid for sealing the bell, said bell being connected with its associated blow-off trap, and an air compressing bell for each siphon adapted for the discharge of air into its associated starting bell, one or more of said starting bells being provided with a valved vent opening therefrom between its top and bottom.

5. An apparatus for the purpose set forth, comprising a tank, a plurality of trapped siphons, a blow-off trap for each siphon communicating with the air space of the same above its trap, a starting bell for each siphon provided with a cup adapted to contain liquid for sealing the bell, said bell being connected with its associated blow-off trap, and an air compressing bell for each siphon adapted for the discharge of air into its associated starting bell, all but one of said starting bells being provided with valved vents opening from the same between its top and bottom at points spaced vertically to correspond with the number of main siphons in the apparatus.

6. An apparatus for the purpose set forth, comprising a tank, a plurality of trapped siphons, a blow-off trap communicating with the air space of each siphon above its trap, a constantly sealed starting bell connected with the blow-off trap of each siphon, an air compressing bell connected with the starting bell of each siphon, each of said air compressing bells being of such capacity in proportion to that of its associated starting bell that the quantity of air delivered therefrom to the starting bell at each rise of liquid in the tank will be such that the air compression bell will operate a number of times equal to the number of main siphons in action before the amount of air compression in said starting bell will be sufficient to break the seal of its associated blow-off trap.

7. The combination with a trapped siphon, of a blow-off trap, a constantly sealed starting bell connected with said blow-off trap, an air compressing bell, and an air delivery pipe connected with the air compressing bell, said pipe having a rising and a descending leg and having the lower or exit end of its descending leg located below the level of the top of the sealing cup.

8. The combination with a trapped siphon, of a blow-off trap and a constantly sealed starting bell, said trap comprising an upright pipe communicating at its top with the air space of the siphon above its trap, an upright pipe connected at its lower end with the first-named pipe and opening at its upper end to the atmosphere above the level of the liquid in the tank, and a U-shaped pressure-transmitting pipe connected with the lower ends of the two-first mentioned pipes, and with the top of the starting bell.

9. The combination with a trapped siphon, of a blow-off valve, a starting bell connected with the blow-off valve, a cup surrounding the lower margin of the starting bell and an air compressing bell provided with a discharge pipe for delivering air to the starting bell, said air compressing bell being formed by a depending flange on the bottom of said cup.

10. As a means for producing air pressure through the rising and falling of the level of a body of liquid, a bell provided with a passage leading from its top to the space in which air pressure is to be produced, a cup supported beneath the said bell and adapted to contain liquid to seal the bell, and an air compressing bell adapted to discharge air into the first-named bell.

11. As a means for producing air pressure through the rising and falling of the level of a body of liquid, a bell provided with a passage leading from its top to the space in which air pressure is to be produced, a cup supported beneath said bell and adapted to contain liquid to seal the bell, an air compressing bell, and a pipe leading from said air compressing bell and discharging into the first-named bell.

12. As a means for producing air pressure through the rising and falling of the level of a body of liquid, a bell provided with a passage leading from its top to the space in which air pressure is to be produced, a cup supported beneath said bell and adapted to contain liquid to seal the bell, an air com-

pressing bell, and a pipe leading from said air compressing bell and discharging into the first-named bell, said pipe having a rising and a descending leg, and having the discharge end of its descending leg located below the liquid level in said cup.

In testimony, that I, claim the foregoing as my invention I affix my signature in the presence of two witnesses, this 26th day of April, A. D. 1912.

JAMES W. COX.

Witnesses:
EUGENE C. MANN,
CHAS. W. POOLE.