E. S. CHASE.

SIPHON.

APPLICATION FILED MAR. 6, 1913.

1,078,995. **Patented Nov. 18, 1913.**

2 SHEETS—SHEET 1.

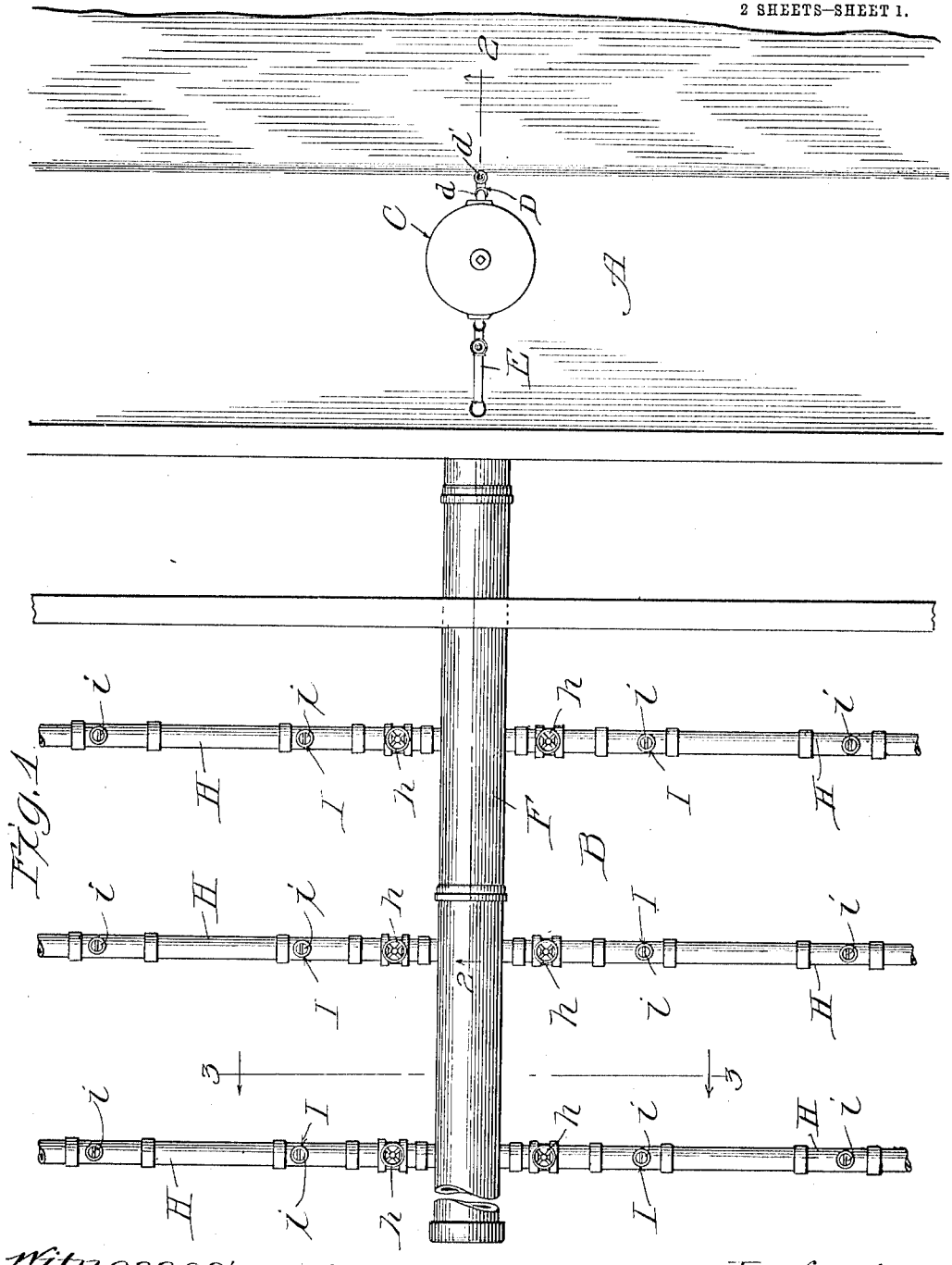


Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

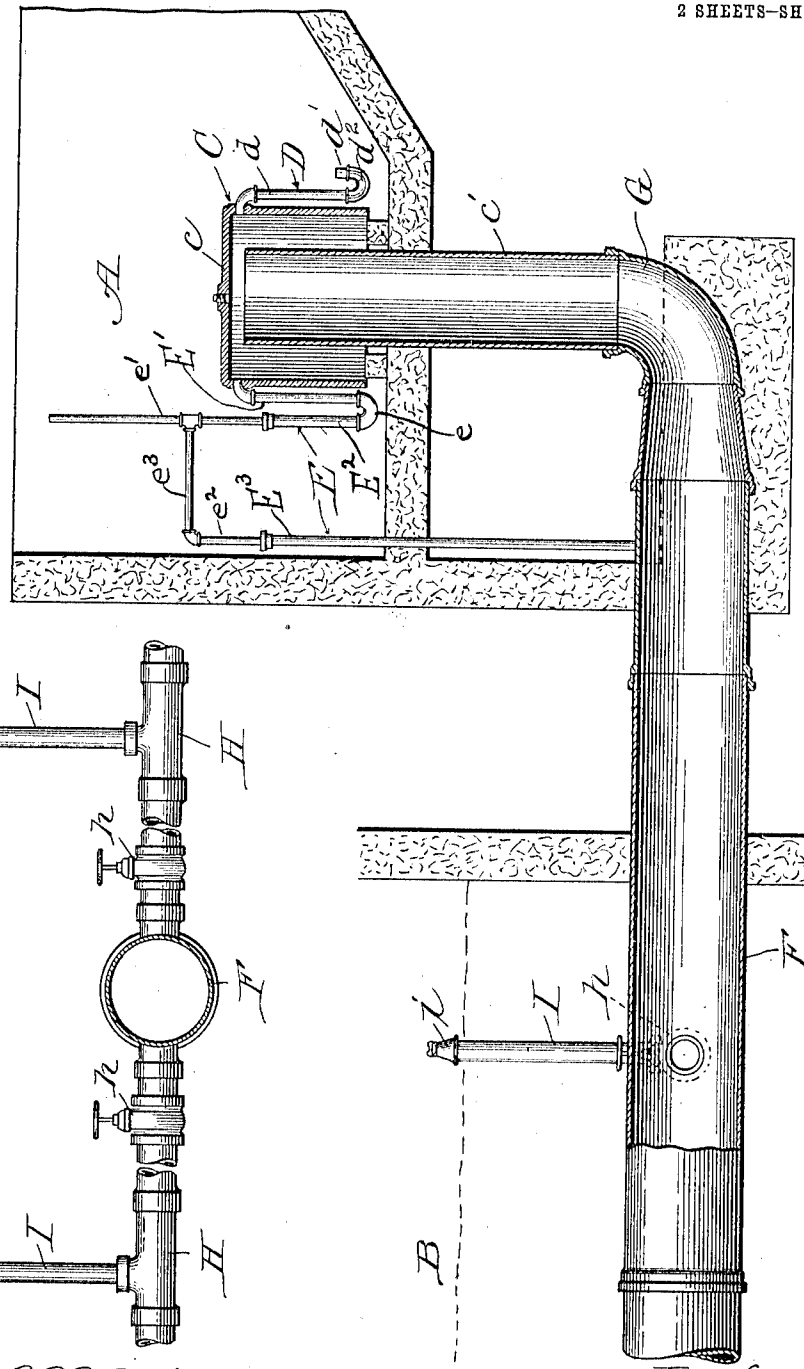


Fig. 3.

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UNITED STATES PATENT OFFICE.

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SIPHON.

1,078,995. Specification of Letters Patent. Patented Nov. 18, 1913.

Application filed March 6, 1913. Serial No. 752,267.

To all whom it may concern:

Be it known that I, EDWARD S. CHASE, a citizen of the United States, and a resident of Reading, in the county of Berks and State of Pennsylvania, have invented certain new and useful Improvements in 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 improvements in apparatus of the kind known as "dosing devices for sprinkling filters" and more particularly to devices of the kind stated which are adapted for use in connection with filtration and sewage purification systems in which the liquid is discharged by intermittently operating siphons upon filter or contact beds through the medium of a plurality of spray nozzles.

The object of this invention is to improve and simplify the construction for systems of this type, and especially to provide features whereby, as compared with the constructions heretofore used, the friction of the liquid within the several pipes is greatly reduced, by the elimination of bends or angles in the discharge pipe leading from the siphons to the sprinklers.

It has been found by experiment that the friction loss which occurs within the discharge pipes due to the bends heretofore present in such discharge pipe tends to reduce the static head of the liquid to a very appreciable extent, thus reducing also the efficiency of the entire system. In prior devices of this kind it has been necessary, in order to offset the effect of this loss by friction, to increase the size of the pipes and fittings, thus greatly increasing the cost of construction. In small installations the effect of the friction loss is very marked, and in such cases the efficiency of an installation is largely lessened by the friction within the pipes due to the particular arrangement thereof heretofore employed.

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

In the drawings—Figure 1 is a plan view of a portion of a filtration or sewage purification system, showing a single discharge siphon located within the main receptacle, a portion of a filter or contact bed separate from the main receptacle, and a discharge pipe line leading thereto from the siphon, provided with branch pipes, risers and nozzles; Fig. 2 is a sectional view on an enlarged scale taken on line 2—2 of Fig. 1; Fig. 3 is a cross-sectional view taken on line 3—3 of Fig. 1.

Referring to the drawings, the liquid to be filtered or purified, as the case may be, flows into the main receptacle A of the system from an exterior source of supply. The drawings illustrate an apparatus for the purification of sewage by the use of a filter bed, and in each apparatus, adjacent to said main receptacle, separated therefrom and located at a level below that of said receptacle, is a filter bed B, consisting of a layer of crushed stone, or similar subtance, (indicated by dotted line in Fig. 2) upon which the liquid is sprayed. The liquid so sprayed passes downwardly into or through the said layer, to effect the removal of the impurities from the liquid in a manner common in sewage treatment systems of this type.

Within the main receptacle A is a discharge siphon C, the same comprising an inverted bell-shaped intake limb c supported upon the concrete floor of the receptacle and having its lower rim at a short distance above such floor, and a vertical discharge limb c', the upper or receiving end of which is located within the intake limb c, adjacent to the top wall thereof, said discharge limb extending downwardly through the floor of the receptacle. Said intake limb c is further provided with a U-shaped vent pipe D comprising a long leg d, communicating with the intake leg at its top and an upwardly opening shorter leg d'. Said vent pipe D is adapted to admit air to the interior of the siphon when the level of the liquid falls sufficiently to uncover the upper part of the bend at d^2 of the vent pipe, thus stopping the action of the siphon. The vent pipe D is preferably of the type shown and fully described in the prior U. S. Letters Patent to Miller, No. 1,037,791, but may be of any other design. Said intake limb c is further provided with an auxiliary or blow-off trap E, adapted to start the siphon in operation to discharge the liquid from the main receptacle when the liquid has reached a predetermined level therein. This auxiliary

or blow-off trap illustrated is of the type shown and described in the prior U. S. Letters Patent to Miller, No. 871,427, and comprises a vertical leg E′ that rises exterior to the intake limb *c* and is connected with the interior thereof adjacent to its top, a similar vertical leg E^2 arranged parallel to the leg E′ and connected at its lower end with the lower end of the leg E′ by a U-fitting *e*. An extension member *e′* extends vertically upward from said leg E^2 and has telescopic engagement therewith. A vertical pipe E^3 extends through the bottom wall of the receptacle and connects with the discharge pipe F, said pipe E^3 being also provided with an extension member e^2. A horizontal pipe e^3 joins the said member e^2 with the member *e′* at a point substantially midway of its height.

The purpose of the form of blow-off trap is to start the siphon in operation when the level of the liquid within the receptacle has reached the desired height, and operates as follows: A quantity of water is confined within the lower portions of the legs E′ and E^2 and acts as a seal to prevent the premature venting of the siphon. As the liquid rises in the receptacle the air pressure within the leg *c* of the siphon is increased and likewise the pressure upon the water within the said legs of the blow-off trap. When the liquid in the receptacle reaches the predetermined level the air pressure will be sufficient to force the water from the legs E′ and E^2, and discharge it through the members *e′*, e^3, e^2 and E^3 into the pipe F. The seal being thus broken, air will be admitted to the siphon through the extension member *e′*, acting to vent the siphon and start the same in operation. The purpose of the extension member is to provide a means of varying the height of liquid in the receptacle at which the siphon will operate. This height will obviously depend upon the position of the horizontal member e^2, since a higher level of the liquid in the receptacle will be required to break the seal in the trap when the height of the extension member is increased. A lowering of the extension member will likewise effect the discharging of the siphon at a lower level of the liquid in the receptacle.

Connected with the lower extremity of the discharge limb *c′* of the siphon, is a discharge pipe F, shown as connected with the discharge limb by an elbow fitting G. Said discharge pipe is, by preference, made of slightly greater diameter than said discharge limb, but it need not necessarily be larger in diameter than said discharge limb. Said pipe extends into the filter bed B below the level of the top of the layer of crushed stone constituting the same. In the preferred arrangement of the pipe F illustrated, it extends centrally of the filter bed, from its margin adjacent to the receptacle to the opposite margin thereof, but it may be otherwise arranged or located relatively to the bed. Extending laterally from said pipe F is a plurality of branch pipes H, also located in the filter bed B. Said branch pipes are usually arranged in pairs, said pairs in such instances being spaced evenly apart throughout the length of the pipe F. Said branch pipes H are considerably less in diameter than the said main pipe F, and may, if desired or found necessary, be severally provided with shut-off valves *h* adjacent to the said pipe F. Extending upwardly from each of said branch pipes is a plurality of upright pipes or risers I, of a diameter somewhat less than that of the branch pipes. The said risers I extend at their upper ends above the level of the layer of crushed stone and are provided at such upper ends with spray nozzles *i* of suitable design. The arrangement of these risers with respect to each other is such that the liquid may be sprayed in a uniform manner over the surface of the bed. Thus the entire area of the filter bed is provided with a plurality of risers disposed at uniform distances apart, according to the area that will be covered by the spray delivered from the nozzles, and arranged in parallel rows, which are equally spaced center to center from each other, each nozzle being thereby adapted to deliver the liquid over an equal area. The distance apart and number of the nozzles and branch pipes will necessarily depend upon the static head of the liquid, or, in other words, the liquid pressure to which the system is subjected determines the area of the filter bed that a single nozzle will sprinkle, and hence the spacing apart of said nozzles.

In order that an apparatus made as described may have the same efficiency as one having its siphon made as shown in the prior Letters Patent to Miller, No. 727,991, under like conditions with respect to the size or capacity of the siphon itself, three factors need to be considered, to wit, the height of the nozzles above the level of the lower end of the discharge limb *c′* of the siphon, the cross-sectional area of the risers, and the number of the risers. As regards the first factor, it is necessary that the height of the nozzles above the pipe F be such that the nozzle openings will lie in a horizontal plane slightly below the level of the floor of the main receptacle A, and will substantially correspond in level with that of the upper or discharge end of the upwardly extending discharge limb of the trap shown in said Miller patent. As regards the two factors last mentioned, the same are interdependent one upon the other, and therefore, may be simultaneously considered. In order to afford the same capacity of discharge as obtains in a like siphon made in accordance

with said Miller Patent, No. 727,991, the combined cross-sectional areas of the riser will need to be not less than the cross-sectional area of the upwardly directed part of the discharge limb of the siphon, or, stated in a different manner, the cross-sectional area of one of the risers multiplied by the number of the risers must be, in general, equal to or be greater than the cross-sectional area of the discharge limb c' of the siphon.

Referring to the construction of the siphon shown in said Miller patent, a deep seal or trap is provided which is formed by means of a U-shaped bend at the lower extremity of the discharge limb, and a vertical return pipe parallel with the discharge limb of the siphon, extending upwardly to substantially the floor level of the main receptacle. At that point the vertical return pipe is bent through an angle of 90° and communicates at that point with a horizontal or downwardly inclined pipe, as the case may be, which is connected with a main pipe similar to the pipe F in my device.

By my novel construction, the U-shaped bend at the lower extremity of the discharge limb of the siphon and the vertical return pipe, which together form the trap or deep seal, are eliminated, and the risers are so arranged as to perform the same function previously performed by the eliminated parts. The dimensions of the discharge pipe and risers will be determined in practice by the conditions existing in any particular apparatus, but in order to obtain an apparatus corresponding in capacity with one of like size, having its siphon made according to said Miller patent, said risers will have their height and combined cross-sectional areas generally equal to the height and cross-sectional area of the pipe forming the vertical discharge pipe of the siphon trap shown in said Miller patent, due allowance being made for the greater discharge capacity obtained by the improved form of the apparatus.

The horizontal pipe F, being connected directly with the discharge limb c' of the siphon, the liquid in my improved apparatus passes through one bend only, namely, the elbow G, while in the prior construction it must pass through a 180° U-shaped bend at the lower end of the discharge limb, a 90° bend at the upper end of the vertical return pipe, and two bends of less angle made necessary by a downwardly inclined pipe connecting the horizontal limb of the vertical return pipe with the pipe corresponding with the pipe F in my improved construction. The purpose of the U-shaped bend and vertical return pipe used in the prior construction referred to, is to form a trap or deep seal, which retained a sufficient head of the liquid in the vertical and parallel limbs to seal the discharge or outlet portion of the siphon, thereby opposing the liquid head in the receptacle, the purpose being to prevent the siphon from being started in operation by the pressure of the liquid in the receptacle, before the same has been filled, and the siphon starting devices brought into action. By reason of the hereinbefore described construction and arrangement of the main pipe F and the risers, it is obvious that they serve the same purpose as the U-shaped deep seal trap of the Miller Patent, No. 727,991, namely, to form a deep seal or trap, having the same function as the said deep seal or trap described in said Miller patent.

The operation of my improved form of apparatus applied in connection with purification plants of the sprinkler type is as follows: Assuming that the receptacle A has just been emptied by the siphon, the liquid continues to flow into the receptacle and fills the same to the predetermined level, when the siphon is vented by means of the automatically-operated blow-off trap E in a manner as described above. The venting of the siphon breaks the seal within the intake limb c and the liquid is forced upwardly therein and through the discharge limb c', and thence through the transmission pipe F and branch pipes H, upwardly into the risers I and is finally discharged through the nozzles i in the form of a spray over the entire surface of the crushed stone in the filter bed. When the level of the liquid in the receptacle A approaches the bottom thereof the upper part of the bend at d^2 of the vent pipe D is uncovered, allowing air to be admitted to the intake limb of the siphon, thus interrupting its action. The liquid again fills the receptacle, there being retained a quantity of air within the intake limb by reason of the fact that the blow-off trap and the vent pipe D are sealed. The air is further prevented from escaping through the discharge limb c' by reason of a quantity of the liquid that remains in the same, the transmission pipe F, the branch pipes H, and the risers I, the pressure of which tends to oppose that of the liquid in the receptacle, and to prevent the siphon from being prematurely set in operation by the pressure of the liquid in the receptacle.

The advantages of my improved apparatus over prior devices of like character lies chiefly in the reduction of the friction of the liquid in the pipes, by the elimination of several bends therein. In sprinkling systems such as described, in which the operation is entirely dependent upon atmospheric and hydrostatic pressure, losses by friction within the pipes act to greatly reduce the efficiency at the nozzles and of the entire system, and such losses are due to the decrease in the liquid head occasioned by the

friction loss. Hence by a material reduction in the friction loss, the area covered by each nozzle may be increased, the number of nozzles required may be decreased accordingly, and the efficiency of the system correspondingly augmented.

A further advantage of my device is the widening of the range of applicability of small sprinkling systems of this type. In the smaller installations in which lesser quantities of water are handled, the liquid pressures or heads under which the liquid is forced through the siphons is proportionally less than in larger systems. The loss of head due to the liquid friction within the pipes is, however, proportionally greater owing to the smaller pipes used. For this reason the use of installations of small sizes has not been practical in many cases. By the use of my improved construction, the small sprinkling systems are rendered equally efficient with the larger systems of the same type.

A material saving in the cost of construction is obtained by the use of my improved device in that smaller pipes and fittings may be used, whereas in the prior construction larger pipes were necessary in order to reduce as much as possible the friction loss. A further saving is obtained by the elimination of a considerable portion of the piping and fittings necessarily used in prior forms of construction.

A sprinkling system constructed in the manner hereinbefore described, affords a distinct advantage over similar systems having a siphon of the form described in the before-mentioned Miller Patent No. 727,991, in cases in which it is desired to increase the depth of the crushed stone in the contact bed by adding an additional layer of the material. Such an operation necessarily involves an increase in the length of the risers. This may be easily accomplished in cases where my improved construction is used. On the other hand, it would be impossible to raise the level of the crushed stone in cases where the prior form of siphon shown in the Miller patent is used, and for the following reason, which may be more clearly understood by the use of figures. Referring to the device of the Miller patent, the elevation of the nozzle orifices may, for convenience, be taken as 100 feet above datum. With this figure as a basis, the system to operate properly would have the elevation of the lower extremity of the vent pipe H indicated as 102.17 feet and the level of the inverted discharge mouth, located at the upper end of the vertical return pipe, as 100.17 feet, or slightly above the level of the nozzle orifices. Now if it were desired to deepen the contact bed, thus making it necessary to raise to the level of the nozzle orifices, to say 101 feet, the said level would now be approximately 10 inches above the level of the inverted discharge mouth. Obviously, the siphon would not be operable under these conditions for the liquid would stand at a higher level in the contact bed than the level of the said inverted discharge mouth.

Now referring to my improved construction, the possibility of such an alteration may be clearly set forth as follows: As before, indicating the elevation of the nozzle orifices by 100 feet and the elevation of the upper part of the bend at d^2 of the vent pipe D, by 102.17 feet, which elevation represents the liquid level at which the siphon is vented and its operation is interrupted. If it were desired in this case to increase the depth of the bed, involving a corresponding elevation of the nozzle orifices to say 101 feet, it would only be necessary to increase the liquid level at which the operation of the siphon is stopped. This would be done by the use of an adjustable vent D, hereinbefore mentioned, and as described in the patent to Miller, No. 1,037,791.

By raising the adjustable portion or invert of the bend at d^2 the level of the same can be made to be at 103.17 feet, or, in other words, the elevation at which the siphon is vented is at the same distance above the elevation of the nozzle orifices as before, so that the operation of the system will not be affected by the increase in the elevation of the said nozzle orifices. This feature adds greatly to the flexibility of the system and permits important and material alterations to be made after the system has been installed. This feature is obviously lacking in a system employing the prior form of siphon, in which such alteration would involve a large amount of labor and expense.

Knowing that the details of construction of my device may be variously modified without departing from the spirit of my invention, I do not wish to be limited to the construction hereinbefore described and shown in the drawings, except so far as set forth in the appended claims.

I claim as my invention—

1. In an apparatus for the purpose stated, the combination with a receptacle and a surface to be sprayed, of a siphon for discharging the contents of said receptacle, a liquid delivery pipe connected with the lower end of the discharge limb of the siphon and forming a continuation thereof, said delivery pipe extending therefrom beneath the surface to be sprayed, and a riser communicating at its lower end with said delivery pipe and provided at its upper end with a spray nozzle, said riser being adapted to form with said discharge limb and the intermediate portion of the delivery pipe, a seal or trap for the siphon.

2. In an apparatus for the purpose stated,

the combination with a receptacle, of a siphon for discharging the contents of said receptacle, a liquid transmission pipe connected with the lower extremity of the discharge limb of the siphon and forming a continuation thereof, and a plurality of risers communicating at their lower ends with said transmission pipe and provided at their upper ends with spray nozzles; said risers being adapted to form with the said discharge limb of the siphon and the transmission pipe, a deep seal or trap for the siphon.

3. In an apparatus for the purpose stated, the combination with a receptacle, of a siphon for discharging the contents of said receptacle, a horizontally arranged transmission pipe connected with the lower end of the discharge limb of the siphon, and forming a continuation thereof, a plurality of risers communicating at their lower ends with said transmission pipe, said risers having an aggregate cross-sectional area not less than that of the discharge limb of the siphon and adapted to form with said discharge limb and the transmission pipe, a deep seal or trap for the siphon.

4. In an apparatus for the purpose stated, the combination with a receptacle and a surface to be sprayed, of a siphon for discharging the contents of said receptacle, a liquid transmission pipe connected with the lower end of the discharge limb of the siphon and extending therefrom beneath the level of the top of the surface to be sprayed, a plurality of risers communicating at their lower ends with said transmission pipe, and spray nozzles upon the upper ends of said risers, said risers constituting with the said discharge limb and the transmission pipe, a deep seal or trap for the siphon.

5. In an apparatus for the purpose stated, the combination with a receptacle and a surface to be sprayed, of a siphon for discharging the contents of said receptacle, a liquid transmission pipe connected with the lower end of the discharge limb of the siphon, and extending therefrom beneath the level of the top of said surface to be sprayed, a plurality of branch pipes extending laterally from said transmission pipe, and risers connected at their lower ends with said branch pipes and provided with spray nozzles at their upper ends, said risers constituting with the said discharge limb of the siphon and the transmission pipe, a deep seal or trap for the siphon.

6. In an apparatus for the purpose stated, the combination with a receptacle, of a siphon adapted to discharge the liquid from the said receptacle and provided with a downwardly extending discharge limb extending through the floor of the receptacle, a horizontal liquid transmission pipe connected with the lower end of said discharge limb of the siphon and forming a continuation thereof, a plurality of branch pipes extending laterally from said transmission pipe, a plurality of risers connected at their lower ends with said branch pipes, said risers being provided at their upper ends with spray nozzles located in the same horizontal plane, the said risers having an aggregate cross-sectional area not less than the cross-sectional area of the discharge limb of the siphon, and the horizontal plane of said nozzles being so related to that of the lower edge of the receiving limb of the siphon, as to form with the discharge limb of the siphon and the liquid transmission pipe, a deep seal or trap for the siphon.

7. In an apparatus for the purpose stated, the combination with a receptacle, and a surface to be sprayed, the level of which is below that of the floor of the receptacle, of a siphon having the lower edge of its intake limb adjacent to the floor of the receptacle and having its discharge limb arranged to extend downwardly through said floor, a horizontally arranged liquid transmission pipe connected with the lower extremity of said discharge limb and extending below the level of the top of said surface to be sprayed, a plurality of branch pipes extending laterally from said liquid transmission pipe, a plurality of risers connected at their lower ends with said branch pipes and provided at their upper ends above the top of the bed, with spray nozzles, located in a horizontal plane slightly below the floor level of the said receptacle, the combined cross-sectional areas of said risers being substantially equal to or greater than that of the discharge limb of the siphon, and said risers constituting, with the said discharge limb of the siphon and the transmission pipe, a seal or trap for the siphon.

In testimony, that I claim the foregoing as my invention I affix my signature in the presence of two witnesses, this 14th day of February A. D. 1913.

EDWARD S. CHASE.

Witnesses:
G. LEONARD KESTNER,
HOWARD S. GERBER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."