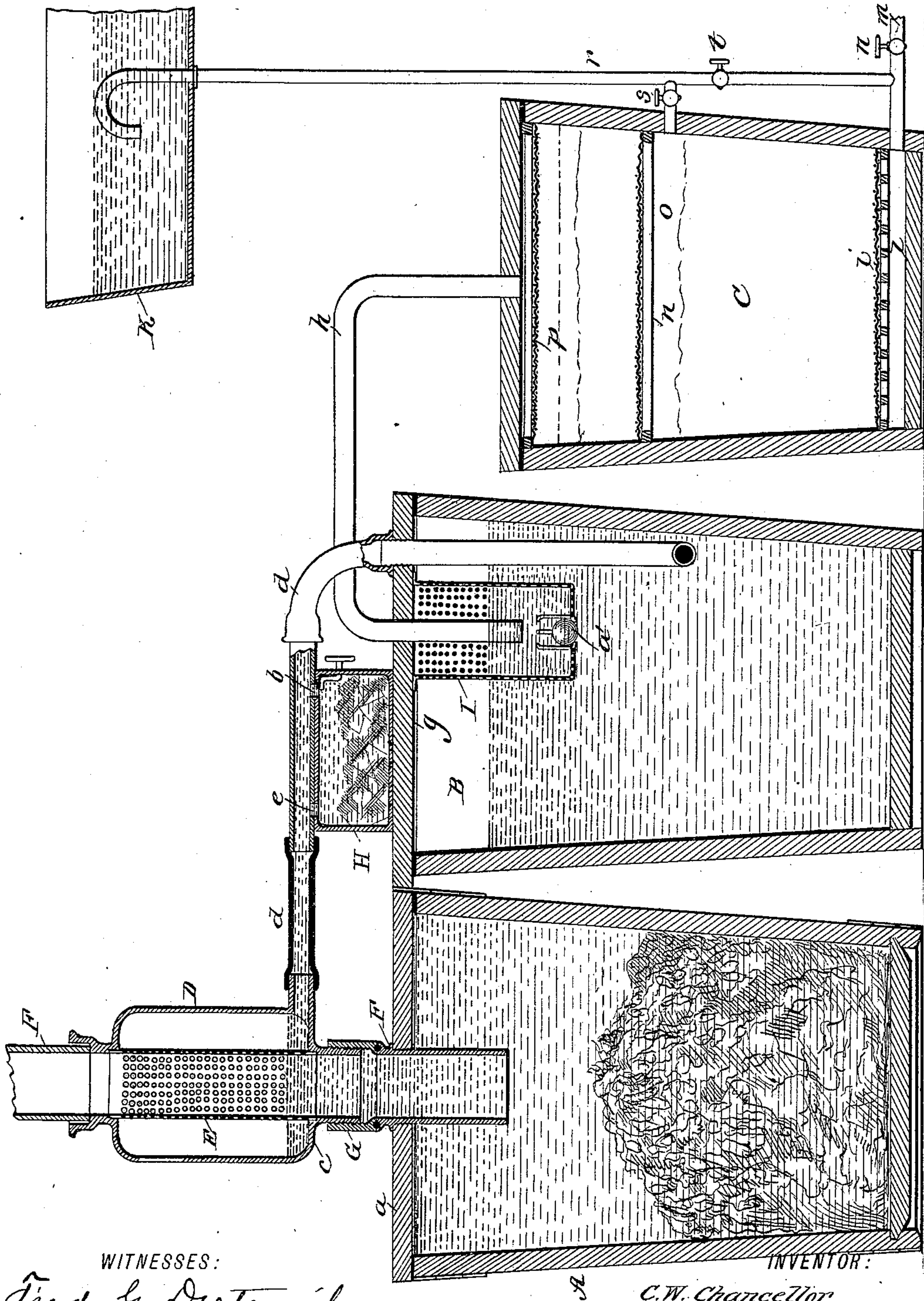


(No Model.)

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APPARATUS FOR TREATING SEWAGE.

No. 448,122.

Patented Mar. 10, 1891.



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APPARATUS FOR TREATING SEWAGE.

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To all whom it may concern:

Be it known that I, CHARLES W. CHANCELLOR, of Baltimore city, in the State of Maryland, have invented a new and useful Improvement in Apparatus for Treating Sewage, of which the following is a specification.

My invention relates to the process or system of treating sewage, as set forth in my previous patent, No. 372,656, dated November 8, 1887. In this patent I covered a process of discharging solid and liquid matters from the soil-pipe under a column or bed of water, separating continuously the solid matters by subsidence from their greater specific gravity in a sealed receptacle, and continuously filtering the supernatant fluids, whereby putrefactive fermentation of the solids is suppressed by exclusion of air, and the formation of deleterious gases avoided.

My present invention comprises certain features of improvement in the mechanical structure of the apparatus for carrying out the process in a more convenient, practical, and effective manner, and also in certain additional steps which I will now proceed to fully describe with reference to the drawing, in which the figure is a vertical section of the apparatus.

A represents the receiving-vessel or receiver; B, the settling or precipitating tank; C, the filter proper; D, the outer cylinder of the first strainer; E, the inner perforated cylinder of the strainer; F F, the soil-pipe connected with the strainer above and below; G, the collar which connects the soil-pipe with the receiver; H, the box or holder for the precipitating reagent; I, the second strainer attached to the precipitating-tank, and K the automatic flush-tank.

The several parts of the apparatus may be constructed of any suitable material, and of any convenient form. In the drawing, the receiver, precipitating-tank, and filter are shown flared at the top, which is believed to be the most convenient shape for discharging their contents. The receiver A is furnished with a movable cover *a*, resting on the smooth rim of the vessel, with an intervening rubber washer in order to form a tight joint. To

keep the cover firmly in place it is fastened to the receiver by bolts or screws or other suitable device.

G is a collar of metal, by which the lower end of the soil-pipe F is attached to the top of the receiver by a screw or other coupling designed to disconnect readily the two when the receiver has become filled with solid matter. The outer cylinder D of the first strainer, made of galvanized iron or other suitable material, is connected with the soil-pipe F F, above and below, forming, as it were, an enlarged section of said pipe. The interior of the cylinder D is provided with a cylinder E of perforated metal or wire-cloth, of the same diameter as the soil-pipe and continuous with it. Through the meshes of this cylinder, which may be from one-tenth to one-twentieth of an inch in diameter and one-fifth to one-tenth of an inch from each other the liquid sewage passes on its way to the precipitating-tank, while the coarser solid matters are held back and sink into the receiver. The bottom of the space between the two cylinders is a solid floor *c*, which leads the strained liquid to the discharge-pipe *d*, which empties into the precipitating-tank on a lower level than the bottom of the second strainer I. Beneath the pipe and connected with it is the box or casing H, provided with an inlet *e*, to admit the water of solution, and an outlet-aperture *b* of small caliber for the outflow of the solution, which is formed with each flush of the discharge-pipe *d*, which is removably connected with the tank B through its head *g*. This box H is designed to be filled with some solid disinfectant and precipitating agent, such as sulphate of iron and alum, and the quantity of solution passing off therefrom is regulated by a valve at *b*.

The precipitating-tank B is, with the exception of the arrangement of their respective covers *a* and *g*, a duplicate of the receiver A, and by changing the tops one may be substituted for the other. The under side of the top *g* is furnished with a strainer I of finer meshes than the strainer E. It is provided with a nicely-adjusted valve *a'* at its bottom, which will be raised by the increased press-

ure of the water should the strainer become choked. The liquid contents of the tank B, after passing the strainer I, are led into the filter C through the connecting-pipe *h*, which also acts as a siphon and keeps the liquid contents of the tank B at a level with the strainer end of pipe *h*.

The filter C consists of a wrought or cast iron vessel fitted near the bottom with a circular grating *i* covered with wire-cloth or supporting a perforated plate, upon which rests the first or bottom layer of filtering material. Several inches above the top of this stratum, and about midway the filter, is a second grating *n*, fitted to the inner side of the cylinder and covered as in the first grating, upon which rests the top layer of the filtering medium. Above this is a perforated plate *p*, which serves to distribute the inflow of water from pipe *h* evenly over the top of the upper stratum of the filter-bed. The drain-pipe *m* leads out the filtered effluent from the space *l* between the bottom of the filter and the lower grating. The space *o* between the top of the first layer of filtering material and the second grating receives the washout-pipe *r*, either from the general water-supply or the automatic flush-tank K, as the case may be, which conveys the reverse current of water for cleansing the upper stratum of the filter-bed. The flush-pipe *r* is also extended to and connects with the drain or waste pipe *m* in such a way as to send when necessary a reverse current through the lower stratum of the filter-bed.

In washing the filter the accumulated impurities are driven back through pipe *h* into tank B, serving to cleanse the strainer I, or they might be led off by an overflow-pipe, which being an unimportant attachment is not shown in the drawings. The first strainer E, it should have been remarked, is scoured, as it were, and cleansed by each flush from the closet through the soil-pipe F, and the more paper used the more thorough will be the cleansing.

The automatic flush-tank K may be placed at any desired height above the filter, and its capacity must vary according to circumstances and the size of the filter. Usually when the automatic flush is relied on, valve *s* remains open and valves *t* and *u* closed; but when the lower stratum of the filter-bed needs cleaning valves *s* and *u* must be closed and valve *t* opened. The flush-tank K is made to act intermittently by a siphon-leg in a well-known manner.

The operation of the apparatus is as follows: All such matters as are generally discharged into the soil-pipes of houses are conveyed into the receptacle, which is removably connected with the soil or drain pipe. The coarser undissolved matters, such as foreign bodies, ordure, and paper not yet dissolved, which the trap of the soil-pipe has allowed to pass, sink rapidly by gravitation to the bottom of the receptacle, while the mat-

ters that are more or less dissolved in water find their way along with the supernatant liquid of the sewage through the meshes of the strainer, and from thence by a connecting-pipe into the precipitating-tank.

The strainer may be arranged either within or without the receptacle. In the present instance it is placed on the outside and surmounts the receptacle. It consists of a perforated section of the lower end of the soil-pipe inclosed within a hollow cylinder into which the connecting-pipe of the precipitating-tank opens. The pressure of each flush from the water-closet serves to scour or clean the inner side of the strainer automatically, and falling upon the surface of the floating matters, which usually rest on a level with the lower end of the perforated section of the soil-pipe, drives them with force into the receptacle.

The precipitating-tank receives the overflow from the receptacle which has passed through the first strainer. This tank is provided with an automatic device for discharging a certain quantity of chemical precipitants into its contents, and it may be provided also with a second strainer of finer meshes, arranged within or without the vessel should a particularly pure effluent be desired. The supernatant liquid in the precipitating-tank, already quite pure, is run off from the top directly onto the filter-bed.

The next step in the process is the filtration of the sewage-water as it runs from the precipitating-tank, should subsequent filtration be required. The length of time during which a filter-bed continues to filter without cleansing, depends upon the amount and nature of the solid impurities held in the liquid. It has been shown that in this instance the liquid to be filtered has been deprived by straining or precipitation of the great bulk of its solid matter, and, therefore, satisfactory and continuous results can be obtained by a very simple method—a filter-bed made up of sand or sawdust, or any other suitable material, as a top layer, supported by a bed of gravel or a perforated plate underlaid by a stratum of any insoluble granular substance that will attack and destroy organic matter in solution, such as spongy iron, coke, animal charcoal, &c. The agent which I find in practice most available for this purpose is a spongy oxide of iron manufactured in Abergwain, South Wales, and known by the commercial designation of "magnetic spongy carbon" or "polarite." This material has been found to act as a permanent oxidizer and gives a remarkably clear and pure effluent, which, though obviously unfit for drinking purposes, may nevertheless be discharged into the street-gutters or into a water-course without danger. It may be remarked, however, that ordinary sawdust possesses great advantages as a top layer for a sewage-filter bed. On account of its absorbent nature and its tendency to pack closely when saturated it produces a remark-

ably pure effluent, and owing to its light and elastic nature it is readily cleaned by flushing under a minimum pressure.

In addition to the combination of parts already described, the apparatus is provided with an accessory flush-tank of simple construction, as hereinbefore described, by means of which the filter-bed is from time to time automatically washed, and its surface freed from deposits that would otherwise choke the filter. In this way large quantities of sewage-water, which is admitted to be the most difficult of all liquids to filter, can be dealt with continuously and by a very small filter without removing any part of the filter-bed or arresting except momentarily the process of filtration. It is only necessary to regulate the supply of water to the flush-tank, so that it will fill in a given number of hours, and at the appointed time, by means of a special arrangement, a volume of water is discharged under the filter-bed or any part of it, and, rising rapidly, serves to agitate the material, while the accumulated impurities are dislodged and forced back into the precipitating-tank or pass off by an overflow-pipe. The frequency and force of the flush needed to do the work are determined by the rapidity with which the deposit forms, and the amount of impurities required to be removed from off the surface of the filter-bed. Each flush cleans the filter-bed and practically starts a new filter. As the excreta sewage from the closet is deposited under water in a fresh state and is kept in a receptacle practically air-tight, the liquid does not lose its dissolved oxygen, nor has the greater part of the organic matter been broken up into soluble, and therefore more hurtful, products. In other words, putrefactive fermentation is arrested and no deleterious gases are formed.

Hitherto it has been found that all appliances and methods for separating the solid from the liquid matters of household sewage, factory wastes, &c., by filtration have proved unavailing, for the reason that in all mechanical filters the impure liquid, especially when of a slimy nature, as in sewage-water, leaves a deposit on the filtering-surface which quickly becomes impervious to fluids, and must remain so until the deposit is removed. As the apparatus herein described provides for the automatic removal of such deposits from the surface of the filtering-bed without manual labor, stoppages, or spare-machines, it follows that by this process rapid, continuous, and economical filtration is obtained.

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

1. In an apparatus for treating sewage, the combination of a closed receptacle for crude sewage, connected with the discharge-pipe from the closet, and a reticulated screen or

strainer arranged in the path of the discharge from the said discharge-pipe into the receptacle, to serve the purpose, first, of straining the sewage as it issues from the receptacle, and, secondly, of being scoured and having its interstices kept open and operative by the dynamic force of the discharge from the soil-pipe, substantially as shown and described.

2. The combination, with a subjacent collecting-receptacle for the solid or more weighty matters, of a tight soil-pipe connection, a strainer composed of a perforated or reticulated pipe-section interposed in the length of or aligned with the soil-pipe, so as to form a continuation of the conduit, and a surrounding casing disposed about the strainer to carry off the supernatant liquid, substantially as shown and described.

3. In an apparatus for treating sewage, the combination, with the sewage pipe or conduit *d*, having openings *e* and *b*, and the precipitating-tank *B*, into which said pipe discharges, of the box *H*, containing the precipitating reagent, the same being arranged alongside the pipe and having an inlet and outlet in one side, which coincide and communicate with the aforesaid openings, as shown and described, whereby a portion of the liquid sewage passing along the pipe is deflected into and traverses the box *H* and then re-enters the pipe, thus supplying the reagent required for precipitation of sewage in the tank *B*, as set forth.

4. The combination, with the tank *B*, of a strainer *I*, arranged in the top of the same and having an outflow-pipe communicating with its interior, and a relief-valve *a'* opening inwardly into the strainer to relieve any arrest of outflow due to stoppage of the meshes of the strainer, substantially as shown and described.

5. In an apparatus for treating sewage, the combination of three hermetically-closed tanks arranged in communication with each other, the first being constructed, substantially as described, to receive the solid matters by subsidence, the second being provided with an automatic feeder for supplying chemical reagents for precipitating or disinfecting, and the third being arranged as a filter, substantially as shown and described.

6. In an apparatus for treating sewage, the combination, with a filter for filtering the effluent, of an automatically-acting intermittent flushing-tank arranged to relieve the filtering material of accumulated obstruction by a forcible flush in direction opposite to the normal flow, substantially as shown and described.

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Witnesses:

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