Aug. 5, 1930. H. GANDILLON 1,772,214

SEWERAGE SYSTEM

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Fig. 1.

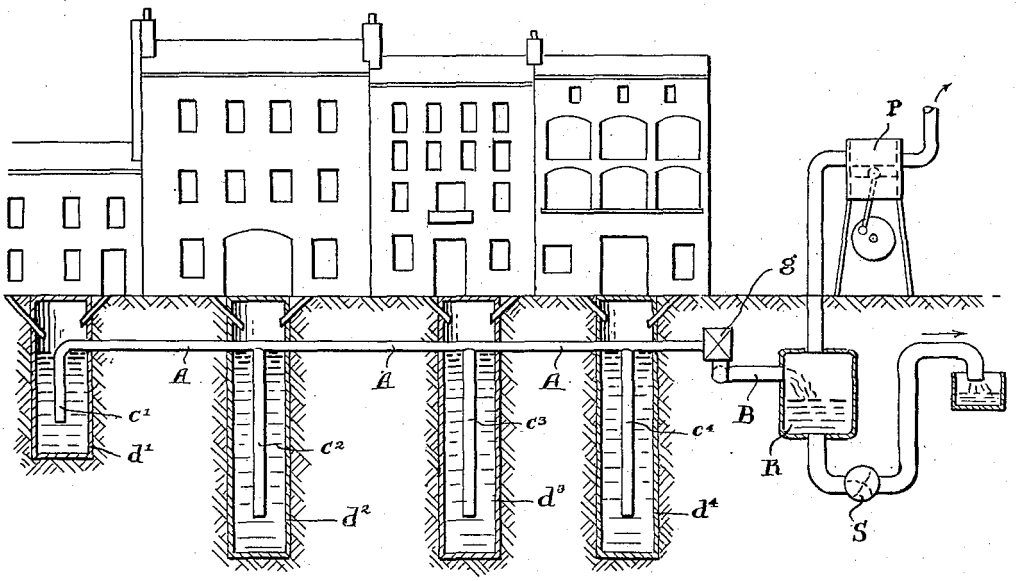

Fig. 2.

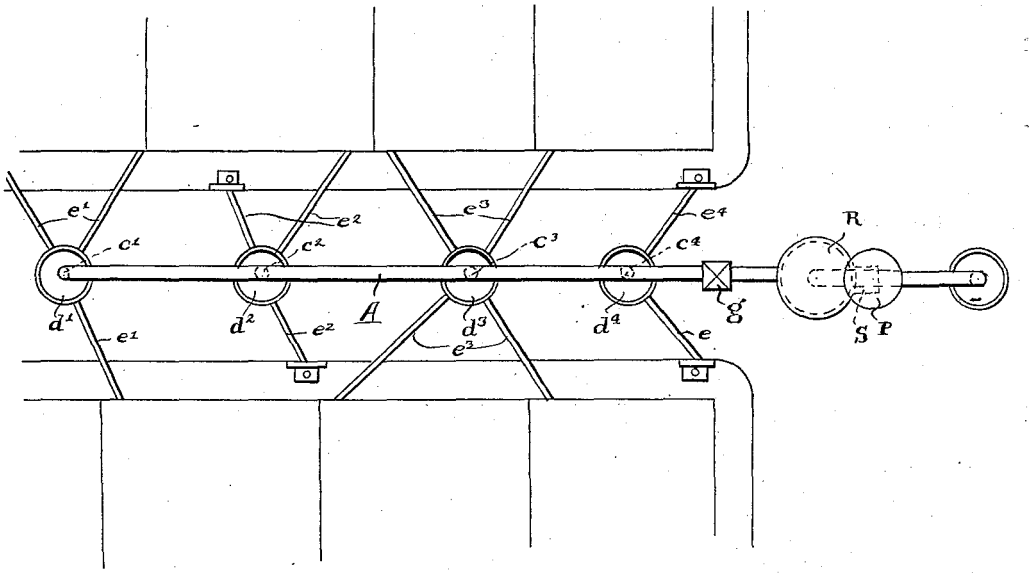

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Fig.4.

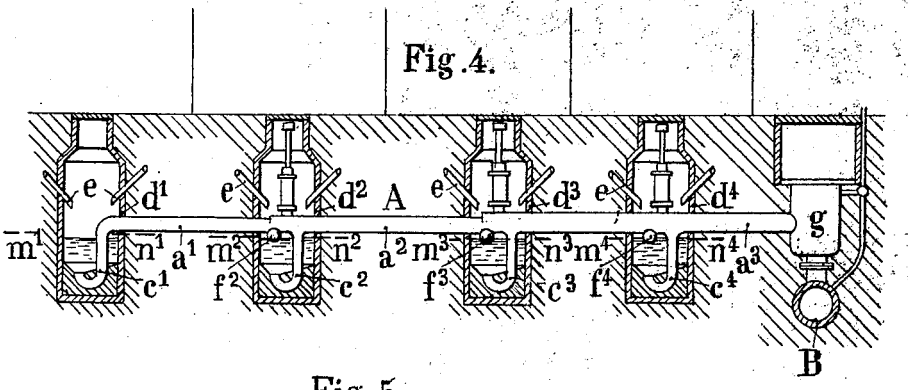


Fig.5.

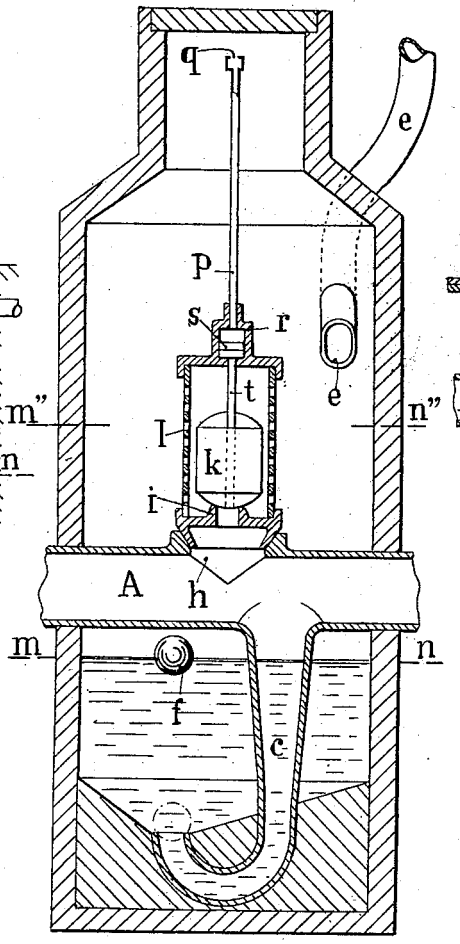


Fig.3.

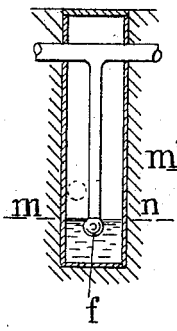
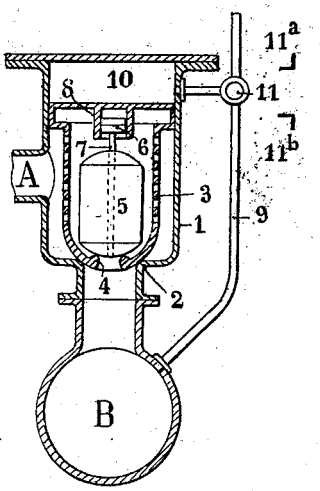


Fig.6.



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UNITED STATES PATENT OFFICE

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SEWERAGE SYSTEM

Application filed January 24, 1928, Serial No. 249,163, and in France January 25, 1927.

The present invention has for its object a process and apparatus adapted to effect the simultaneous removal of flushing water and household sewage in such a manner that the outside collection of the sewage, an operation which is unclean and contrary to hygiene, is avoided and sanitary conditions of towns may be simultaneouly improved.

According to the invention the household sewage collected from buildings by suitable pipes—which may be suitable at the same time for water—is collected at different points by a series of special drains composed of pipes of small section and periodically the mass of water and sewage is removed by a sudden variation of air pressure. There is then produced a movement of the household sewage which effects a scouring of the pipes and assures automatically their cleaning.

It will be understood that, due to these means, flushing with clean water becomes useless, avoiding a considerable expense in the installation and operation. At the same time the manual operations of cleansing of the old drains is no longer necessary, which represents likewise a considerable economy.

An essential characteristic of the new apparatus consists in the construction of the drain pipes.

These pipes are combined with reservoirs placed at suitable distances apart, forming closed spaces of suitable volume into which pour the sewage and water from buildings. The drain pipes are provided with depending pipes which extend into the closed spaces. The depending pipes divide the drains into successive lengths which are preferably of different sections. Due to this construction the flushing water which flows by gravity is obliged to pass through successively the whole of the said closed spaces as it encounters them.

At suitable intervals, determined by the duration of the filling of the closed spaces, these latter are emptied and cleared of their contents by a violent suction of the drain. For this purpose this latter is placed suddenly in communication with part or the whole of the network on the outlet side of the drain in which the vacuum is created and maintained by means of a vacuum pump. By this operation household sewage surrounded by a mass of flushing water contained in the closed spaces is precipitated into the respective lengths of the drain and causes the energetic scouring of the same, due to the solid matter in the household sewage. At the same time the household sewage, submitted to successive pulsations and to an intimate stirring with the flushing water and atmospheric air, advances nearer and nearer to the extremity of the series of pipes. All the heavy bodies which at first have not been able to clear the length of the pipes nevertheless advance at each reduction of pressure, each time getting off the bases of the closed spaces.

The invention is characterized further by the application of an automatic system closing the entrance to the depending pipes so as to prevent the vacuum falling before all the parts of the apparatus are cleared.

The invention presents further various secondary characteristics which will be hereinafter explained in detail.

In order that the invention may be more clearly understood there has been represented in the diagrammatic drawing annexed hereto, given by way of example only, a method of carrying the invention into effect comprising several modifications.

The invention is illustrated in the accompanying drawings in which:

Fig. 1 is a vertical section of a collection of tubes adapted to a group of buildings.

Fig. 2 is a corresponding plan view.

Figs. 3 and 4 show modifications.

Figs. 5 and 6 show detail views.

As seen in the drawing, Fig. 1, the drain pipe A entering a collecting pipe B is divided into separate lengths a^1, a^2, a^3 . . . having depending pipes c^1, c^2, c^3 . . . which extend into the interior of the closed chambers d^1, d^2, d^3. The first depending pipe c^1 is shorter than the others, as represented. Branch pipes e^1, e^2 . . . are adapted to discharge into these chambers, which act as receivers, the household sewage and the flushing water from the buildings, as well as mud and sweepings from the streets. The receivers are filled partly by the water supplied from an overflow of the

receivers above them, and partly by exterior water.

The liquid manure and the household sewage enter the receivers d^1, d^2, d^3, d^4 and as soon as the level of the liquids reaches the conduit A, the slope of which may be directed towards B, the said liquids are discharged by mere gravity into the conduit A and after having passed through the valve g they are discharged in the collector B to the reservoir R whence they are extracted by a water pump S or by a compressed air ejector which delivers them to the purifying basins.

A vacuum pump P attached to the upper part of the reservoir R produces the vacuum in the collector B but this vacuum is not transmitted to the conduit A because the valve g only permits the passage of liquid without letting air pass therethrough.

At a given moment, the sudden opening of the valve g establishes complete communication between the conduit A and the collector B and the vacuum of the collector B extends to the conduit A resulting in the suction of the sewage deposits, which are accumulated at the bottom of the receivers d^1, d^2, d^3, d^4 and also a part of the liquids.

The level of the liquids in the receivers drops to a level so that the difference between this level and that of the conduit A corresponds to the vacuum transmitted to this conduit and the appendices c^2, c^3 remaining plunged. The first receiver d^1 is not as deep as the others d^2, d^3, d^4. Consequently, the receiver d^1 evacuates entirely and the external air penetrates through the appendix c^1 which is no longer plunged in the liquid. A rush of air is then produced which brushes the conduit A from one end to the other whereupon the valve g is closed, which occupies the original operating position without depression by mere gravity in the conduit.

The household sewage and deposits contained in the closed chambers are drawn violently in the drain A, the separate parts of which have dimensions which prevent them being choked. The levels lower in all of the closed chambers up to the time when they are about in the horizontal plane m^1, n^1. At this moment air enters fully through the pipe c^1 and the vacuum is broken.

The arrangement shown in Figs. 1 and 2, which has just been described, is the diagrammatic construction of the principle of the invention. In practice it is advisable to complete the elements which have just been indicated by accessory means adapted to improve the working of the system.

The arrangement shown in Fig. 1 would necessitate the use of very deep receivers, forming wells, which would be an inconvenience. In order to remedy this difficulty each receiver is provided with means for closing automatically the exit of the passages at a moment fixed in advance. Fig. 3 represents an example of carrying this into effect, in which a ball f is arranged in the receiver and is applied to the base of the depending pipe and closes it when the level arrives at m, n. In this case all the receivers are provided with this system of closing except the first, and all can have the same depth.

Fig. 4 shows how such an apparatus may be carried into effect practically. The balls float freely in each of the receivers except the first which does not contain one. The bottoms of the receivers are conical and terminate at the entrance to the depending pipe which, for this purpose, is curved. Preferably this latter widens out in order to facilitate the passage of the materials therethrough.

The operation is the same as previously. In order to clear the apparatus the device at g^1 is closed; a partial vacuum is created in the collecting pipes B^1 and suddenly communication is re-established. By this operation the household sewage and deposits contained in the closed chambers are drawn violently in the drain A; the products of the receiver d^{11} enter into the length a^{11}; those of the receiver d^{12} into the length a^{12} and so on. The volumes of the closed chambers d^{11}, d^{12}, d^{13}, d^{14} are designed lower than the volumes of the respective lengths a^{11}, a^{12}, a^{13}, a^{14} in such a manner that there can be no accumulation of solid matter therein at one point, neither consequently any choking. The levels m^1 n^1, m^2 n^2, m^3 n^3 will be lowered drawing with them the floating balls f^2, f^3 which will finally come into a position to close the upper ends of the depending pipes c^{12}, c^{13}, c^{14}, but the receiver d^{11}, having no obstructing ball, will leave the orifice c^{11} open; then free air enters into the pipe a^{11} drawing the rest of the sewage which may have been stopped in one of the lengths of the said pipe. In order to facilitate the removal of the materials introduced in the closed chambers, the depending pipes have sections which increase in diameter in the direction of the flow, and they are connected by curves with the lower part of the drain pipe. Further the openings by which the household sewage is introduced from the exterior into the closed chambers are of smaller section than that of the exit opening of the depending pipe, so that no wedging action of the solid material is to be feared at the moment of their movement in the pipes.

In this system the sewage, conveniently reduced in dimension, may be ejected by the water closet basins or by any other apparatus limiting the size of the pieces of solid matter introduced into the down pipes.

As a means of safety, and in order to ensure under all circumstances the flow of the liquids, a by-pass having a balanced float is inserted in the drain pipe A^1 between each pair of receivers. For this purpose the drain

pipe A^1 is formed at its upper part with an opening h, Fig. 5, which is closed by a stopper i, and which latter forms a seat for a float k contained within a perforated chamber l. This float is pierced by a tube t open at both ends so that there may be communication between the atmosphere of the drain A^{11} and that of a small cylinder r in which the upper end of the tube t, which carries a piston s, can slide; the diameter of this cylinder is about that of the seat. The cylinder r is surmounted by a tube p which carries at its end a closing diaphragm having a small orifice q. All the parts above the seat h constitute a movable whole, which can be withdrawn from the receiver for cleaning of the screen or for getting at the parts. Further by raising it suddenly, at the moment when the partial vacuum exists in the drain, there is obtained a vigorous cleaning specially localized in the corresponding and lower length of drain pipe.

The working is as follows:

In case there is insufficient flow, or even an obstruction in the passage of a depending pipe between two consecutive periods of emptying the apparatus, the level m, n will be raised to m^2, n^2. The liquids filtered through the perforated vessel l raise the float k and overflow into the drain A.

The system may even operate whilst it is under a partial vacuum. In effect, if at this moment, the ball f being in a position to obstruct the depending tube, there is poured into the receiver a quantity of water greater than its capacity, the float, balanced by the partial vacuum in the cylinder r compensating the suction upon its seating i would be raised when the water had attained the level m'', n'' and would cause it to enter into the drain A.

The opening q is provided in order to assure the ventilation of the various lengths of the drain a^1, a^2, a^3.

Fig. 6 shows in detail the construction of the tap g^{11} shown in Fig. 1, which enables a partial vacuum to be formed in the collecting pipe B^{11}, without interrupting the passage of the liquids from A^{11} to B^{11}.

This apparatus comprises a box 1 having at its base a seat 2 in communication with the collector B. Upon the seat there is applied a hollow movable body 3 which serves to close the passage between A and B. The wall of this body may be perforated in order to form a screen. This body is itself formed with a seat 4 upon which can rest a float 5. This latter is fixed to a piston 6 moving in a corresponding cylinder forming part of the movable body. A tube 7 permits permanent communication of the space below the tap with the closed space of the cylinder 8.

Further a pipe 9 connects the upper closed space 10 of the box 1, forming a cylinder, with the collector B and is furnished with a three way tap 11. The operation is as follows:

Normally the passage through the tap 11 is in the position indicated at 11^a, so that the space 10 is in communication with the atmosphere. The movable block rests upon its seat. The liquids, having filtered through the perforated wall of the chamber 3, raise the float and can pass into the collector B. If a partial vacuum is formed in the collector B nothing is changed. The liquids can continue to pass due to the equilibrium of depression which is produced above and below the float.

In order to produce a pulsation which can assure an advancement of the materials, the tap 11 is turned in order to put the passage therethrough into the position indicated at 11. The space 10 is cut off from the atmosphere and placed in communication with the collector B by means of the pipe 9. At this moment the whole of the movable body 3 is raised to allow the mixture of liquid and sewage to pass. It will be well understood that instead of controlling the system above described by means of the tap 11, other means could be employed. The movable body 3 may be raised and lowered electrically or in any other manner.

From that which precedes it is seen that the normal working is essentially due to gravity because the liquids, after having successively filled the receivers, overflow into the drain pipe A then into the lower part of the drain.

The system of drainage which is the subject of the present invention may serve for other purposes than that of assuring good health. It may thus be applied in certain industries for the transport of more or less fluid or pasty materials, mixtures of solid and liquid matters and the like. For example, in the treatment of beetroots the system can be utilized without much modification.

The arrangements above described are only given by way of example; all the details of execution and carrying into effect, the forms, dimensions of the apparatus, the materials employed, etc., may be varied in all cases without changing the principle of the invention.

What I claim as my invention is:—

1. In a sewerage system, a plurality of receivers, branch pipes for feeding household sewage and refuse into said receivers, a conduit, depending pipes carries by the said conduit and extending into the said receivers, one of said pipes being in constant communication with its receiver, and closing means for the other of said depending pipes.

2. In a sewerage system, a plurality of receivers, branch pipes for feeding household sewage and refuse into said receivers, a con-

duit, depending pipes carried by the said conduit and extending in the said receivers, one of said pipes being in constant communication with its receiver, and a ball valve for closing each of the others of said depending pipes.

3. In a sewerage system, a plurality of receivers, branch pipes for feeding household sewage and refuse into said receivers, a conduit, depending pipes carried by the said conduit and extending in the receivers, said depending pipes successively increasing in cross section.

4. In a sewerage system, a plurality of receivers, branch pipes for feeding household sewage and refuse into said receivers, a conduit communicating with said receivers, means for suddenly creating vacuum in said conduit, a by-pass in each receiver to permit the permanent discharge of excess liquid.

5. In a sewerage system, a plurality of receivers, branch pipes for feeding household sewage and refuse into said receivers, a conduit, communicating with said receivers means for suddenly creating vacuum in said conduit, a by-pass in each receiver to permit the permanent discharge of excess liquid, a float in said by-pass, and means for balancing the float at the time vacuum is created.

6. In a sewerage system, a plurality of receivers, branch pipes for feeding household sewage and refuse into said receivers, a conduit communicating with said receivers, means for suddenly creating vacuum in said conduits, a collector communicating with said conduit, closing means between said conduit and said collector, a movable piston connected to said means, and means for balancing said piston when the pressure in said closing means varies.

7. In a sewerage system, a plurality of receivers, branch pipes for feeding household sewage and refuse into said receivers, a conduit communicating with said receivers, means for suddenly creating vacuum in said conduit, a collector communicating with said conduit, a box at the junction of the conduit and of the collector, a seat in said box, a hollow piston cooperating with said seat and having an orifice at the base thereof, and a float in the piston adapted to uncover said orifice.

8. In a sewerage system, a plurality of receivers, branch pipes for feeding household sewage and refuse into said receivers, a conduit communicating with said receivers, means for suddenly creating vacuum in said conduit, a collector communicating with said conduit, a box at the junction of the conduit and of the collector, a seat in said box, a hollow piston cooperating with said seat and having an orifice at the base thereof, a float in the piston adapted to uncover said orifice, and a relatively small piston rigid with the float for producing equilibrium, during variations of pressure.

The foregoing specification of my "sewerage system" signed by me this 10th day of January, 1928.

HENRI GANDILLON.