To all whom it may concern:

Be it known that I, ADRIEN LE MARQUAND, of Paris, France, have invented certain new and useful Improvements in the Sewerage or Drainage of Houses and Towns or Districts, and Apparatus Connected Therewith, (for which I have received patents in France, No. 170,079, dated April 19, 1887, and in England, No. 6,021, dated April 25, 1887,) of which the following is a specification.

My invention relates to a novel system of sewerage or drainage of houses and towns or districts, and is based on the supposition that all sweepings, dust, kitchen waste, and various other debris more or less hard or solid will be collected and removed frequently by carts or other special appliances, and that rain-water or surface drainage will be separately conveyed away by its own system of pipes or conduits. There thus only remain to be dealt with by my system of sewerage or drainage excreta, household slops, foul waters from factories, and other foul or polluted liquids and matters of a more or less pasty nature capable of becoming more or less dissolved in water—in short, all such matters as are generally discharged into the waste or soil pipes of houses. The main object I have in view is to convey away these matters to such a distance from the town or district that they will no longer be injurious, and to do this automatically and continuously before any fermentation is set up in closed vessels or conduits without contact with the air or with the surrounding earth.

In the accompanying drawings, which form part of this specification, Fig. 1 is a diagram illustrating the general arrangement of the system. Figs. 2 and 2' are sections at right angles to each other of the automatic discharge apparatus. Fig. 3 is a sectional view showing a check-valve. Fig. 4 is a vertical section of one of the collecting-vessels. Figs. 5 and 5' are respectively a sectional elevation and plan illustrating the arrangement of apparatus at the central station. Figs. 6, 6', and 6'' illustrate automatic discharge apparatus similar in most respects to that shown in Figs. 2 and 2'. Fig. 7 is a diagram illustrating the arteries of the district system terminating in collecting-vessels. Figs. 8, 9, 10, and 11 are details illustrating the connection of different sections of the collecting-conduit. Fig. 12 is a vertical section showing the arrangement adopted when the conduit has to pass under an obstacle. Figs. 13, 14, and 15 are details illustrating the connection of a pressure-gage with the conduit, and Fig. 16 is a vertical section showing two automatic collecting-vessels and their operating devices.

I will first give a general description of my system, and then explain the means and apparatus by which I carry it into effect.

The superficial area of a large town is divided into several working districts, such as are indicated in the diagrammatic view, Fig. 1, the extent and boundaries of which are determined by the density of the population, the quantity of water which is each day at the disposition of the inhabitants, the number of houses, and the character of the undulations of the land.

In said Fig. 1, and also in Figs. 5 and 5', N represents the general receivers for the sewage matters, located at the central station. M M are exhaust-chambers at said station, in which a barometrical depression is maintained by suitable exhaust-pumps, (indicated by M'.) These sewage matters are drawn through a pipe, 2, from the receivers N, and carried off by the discharge-conduit P, while the gases 80 are withdrawn from the receivers and pass off by discharge-conduit O. The apparatus at the central works should be perfectly air-tight. The barometrical depression produced in chambers or reservoirs M is communicated throughout the system by means of the barometrical conduit B, leading to the collecting-vessels m m' in each district, C being the pipe or conduit which conveys the contents of said vessels to the general receivers N, being connected therewith at the points 4.

The districts are composed of branches or pipes of short length connected with the collecting-reservoir d and the collecting-vessels m m', as best shown in Fig. 7, the extent of the district being limited only by the capacity of these vessels. The collecting-reservoir d discharges alternately into vessels m m' through pipes 12, the valves of which are automatically opened and closed, as hereinafter described. The barometrical depression is communicated through conduit B, collecting-ves-
sels m and collecting-reservoir d' to the collecting-conduit A and its branches. The waste matters from a building are collected in an automatic discharge apparatus located just outside the building. During the process of filling this apparatus it is cut off from the collecting-conduit A by means of a valve. When the matter in such apparatus reaches a certain level, the valve is automatically opened, and the pressure of the atmosphere acting on its contents discharges the same violently into the collecting-conduit A, by which the matters are conveyed to the collecting-reservoir d'. From the latter the collected matters are discharged alternately into the vessels m and n.

The latter operate on the same principle as the automatic discharge apparatus—that is to say, when the matters in the vessel reach a certain level the valve of the barometrical conduit is automatically closed, the valve closing the part communicating with the atmosphere is opened, and the contents of the vessel are forced to the receivers N through conduit C.

This being the general principle and mode of operation of the system, I will now describe in detail the particular apparatus which it is preferred to employ in carrying the same into effect, beginning with the automatic discharge apparatus shown in Figs. 2, 2a, and 6, 6a, 6b.

The automatic apparatus, which is situated between the main soil or waste pipe D of the house and the collecting conduit or pipe placed under the roadway, is a light box of metal or other material, the shape and dimensions of which can be varied, as required. Its mechanism is such that it can be placed in a very limited space, generally under the ground, as near as possible to the surface thereof, but at a sufficient depth to avoid the effects of frost. A small hole in the yard or garden, into which the soil-pipe passes, is often sufficient to receive this apparatus. It is divided into two closed compartments, a, the lower part only of which is pierced with holes or made of wire or lattice-work of any suitable metal. On one side of this partition in the upper part of the apparatus is the soil-pipe D from the house.

On the other side is a pipe, b, which passes through the body of the apparatus to allow of its junction with the pipe of the collecting-conduit, situated farther on under the roadway.

In the pipe b a vertical sluice or valve, c, of thick glass, is fitted in the interior of the apparatus. Its seat is formed with a hole corresponding to the diameter of the soil-pipe. This sluice or valve, composed of two polished plane surfaces sliding one upon the other, alternately intercepts and opens communication with the collecting conduit. The face of the seat d of the valve is so arranged that the movable member, made of the same material and provided with a catch, cannot leave whether open or closed. To the arm of the lever e of this valve, which is mounted on the pin or axis f, is fitted a metal float, g, of suitable form, provided with a releasing device, h, actuated by another float, i, of smaller dimensions and placed above. The mechanism is enclosed in a metal casing, j, formed with holes and having a metal cover or flaps provided with a latch, a padlock, or any suitable fastening. The two compartments of the apparatus are also each covered with a plate, k, which can be easily opened to permit of cleaning either compartment. This cleaning will only be necessary at very long intervals.

The releasing device is a handle of wood fixed to the float g. It is normally engaged and held by the forked end of a bell crank lever, 6, pivoted at 7 to an arm or bracket, 8. The float i is carried by the horizontal member of the lever 6, which normally rests on a 8 stop, 9. (See Fig. 2.) When the level of the semi-fluid matter reaches the latter rises, turning lever 6 on its pivot and withdrawing the forked end from engagement with pin h. Float g, being thus released, rises with a sudden movement, opening valve c. As the matter flows out pipe b, the float i and lever 6 first resume their normal position, and then as the liquid still farther subdues float g also falls until pin h strikes the lower end of lever 6, turning the latter slightly, and passes under and is caught by the forked end of said lever until once more disengaged by the filling of the vessel.

The cover of the compartment into which the pipe D discharges is provided with a valve, W, capable of opening and shutting, to facilitate the action of the atmospheric pressure within the apparatus when the valve c is opened, so as not to exhaust the siphons of the house pipes. A light spring, 10, returns valve W to its seat when the valve c is closed.

The apparatus, the partitions, the valve, and its seat may be made of any suitable metal or material. All the metal parts may be galvanized and coated with tar to insure preservation.

The working of the apparatus is as follows: The apparatus receives the slops, fecal, and other fermentable matters from the soil or waste pipe of the house. The matters that are more or less dissolved in water pass through the first partition c, all foreign bodies and paper not yet destroyed or insufficiently dissolved, and which the last siphon of the house has allowed to pass, being retained or quickly dissolved in the bottom of the apparatus without obstructing the vertical partition. The sirupy, muddy, and pasty liquid passes through the casing of the mechanism, and their level rising in the apparatus covers the first float. As soon as it is immersed in these matters, the float tends to rise, but is held by the releasing device h, which only acts when the level of the liquid rises to the small float i. At this moment the first float, g, being completely immersed, rises sharply and at the final point of its travel in the apparatus, completely opening the valve c and the communication with the collecting conduit or pipe.
The atmospheric pressure then acts through the valve \( W \) upon the surfaces of the matters and drives them with force float through the partition, and afterward through the open pipe into this conduit, in which, as already stated, a low pressure is constantly maintained. The level immediately falls, compelling the small float \( i \) and the releasing device \( k \), with which it is provided, to resume their normal position. While this level in falling allows the float \( g \) to descend, the valve \( c \) still immersed in the liquid, automatically closes, and the releasing device upon which it then acts by its weight is set ready for the next action. The mechanism thus acts according as the height of the level of the liquid increases or diminishes.

The valve \( c \) during its movement rubs continually against its seat \( d \) and the to-and-fro movement which is imparted to it by the action of the float always keeps the mechanism in a perfect state of cleanliness.

The valve can also be made of two plane surfaces united on one axis and both pierced with a hole at the same distance from this axis, or it may consist of three plane surfaces with a hole communicating with the conduit or pipe. The opening of the valve will then only be produced when the three holes by the play of the float are brought in front of each other. When one of the surfaces turns upon the common axis, so as to cover the hole of the other or of the two others, the proper closing of the valve is obtained. It will be understood that when this valve is shut the pressure of the liquid upon its surface and the atmospheric pressure which acts upon it by reason of the barometrical depression maintained in the collecting conduit or pipe will keep it tight upon its seat, and that the polished surfaces of glass, for example, will not oxidize or deteriorate, although immersed in the liquid, and that placed thus one against the other, they insure a complete and tight closing of the apparatus.

A check-valve, Fig. 3, is placed between the apparatus and the collecting-conduit. It allows not only of completely shutting off the house when from any cause this becomes necessary, but it also automatically prevents in all cases the return of the matters from the conduit to the apparatus, and consequently to the house. The valve \( m \) is formed of a sphere or hemisphere of caoutchouc, which will rise under the action of a slight pressure of the matters or gases drawn by the atmospheric depression or partial vacuum in the collecting-conduit. The seat of the valve on the side indicated by \( r \) slopes downward abruptly, and on the other side, \( r^2 \), is brought to an edge, so that no solid matter can lodge on it. The valve is guided by a rod, \( a \), which moves in a small box, \( s \). It is sufficient to screw up or down another rod, \( p \), upon the first one to prevent the valve acting, and thus form a complete obstruction.

If the quantity of water which is in the house is not sufficient to allow of the evacuation through a general pipe uniting the product of all the waste-pipes, or if the general evacuating-pipe cannot be constructed for some reason, the matters are caused to fall directly from the full-pipe \( D \) into the automatic apparatus, the size of which is then somewhat increased to facilitate, in the absence of the house-siphons, the dissolving of paper, scraps, &c. If, however, a siphonic obstruction by means of the apparatus is considered necessary, it can easily be obtained by arranging that the closing of the valve \( c \) shall never allow the liquids to fall below the prolonged pipe \( D \).

**Collecting conduit or pipe.**—The collecting-conduit \( A \) is placed in galleries, drains, or trenches under the roadway as near as possible to the houses, from which, by means of the automatic discharge apparatus, they receive the matters and liquids. The pipes, which may be of wrought or cast iron, earthenware, or other suitable material, need only be capable of supporting externally a pressure a little higher than that of the atmosphere; but the joints must be strictly tight. The conduit will consist of a number of pipes as long as it is possible to procure them. Its diameter will vary according to the number of houses it has to clear and the quantity of matter to collect. The numerous arteries or branches of the collecting-conduit of a district should proceed in the shortest way toward the two collecting-vessels of this district after having received the matters from the adjacent smaller pipes, but as much as possible without communicating with each other on the way. (See Fig. 7.)

Pipes of different diameter can thus be employed in the arteries of a district, (see \( g, r, s \), Fig. 7) as well as in the various branches of the same artery, (see \( t, u, v \),) according to whether the quantity of materials they have to collect in their course is more or less great. These arrangements will insure throughout the collecting-conduit an almost equal distribution of the barometrical depression, which should be kept up in the vessels of the district; but as the speed of the gases in the pipes is very much greater than that of the liquids, and in order to facilitate the passage of the one over the other, so as to obtain a very regular working of the system, it will be necessary to conform as much as possible to the following rates:

First. When it is desired to effect the junction of a pipe conveying simultaneously the barometrical depression and the sewage matters with another pipe intended for the same purposes, the junction of the one which will deliver its matters to the other should be made upon the upper part of the other by means of a special piece (see Figs. 8, 9, 10) of variable form, with single or double branches, and of increased diameter at the point of junction.

Second. While placing ordinarily the collecting-conduit in the direction of the slope or incline of the district, it will be arranged at different parts in lengths of variable but slight inclination, discharging one into an-
other. (See Fig. 11.) It will be understood
that a pipe following a rapid decline will al-
ways be full at that part which is the lowest,
even with a small quantity of matter in it, and
that it will be useless to attach to this part
any pipe from a house. With the arrange-
ment indicated, while thus facilitating the
equal distribution of the liquids and of the
gases in the conduit, the barometrical de-
pression therein is also equalized as much as
possible. The advantage to be derived from
rapid declines for carrying forward the mat-
ters is no doubt lost; but this apparent loss is
more than compensated for by the acceleration
in the speed of the matters produced by their
being carried forward by the gases, whose pas-
sage is thus favored and whose speed is in
general. Moreover, this arrangement facil-
lates the continual formation in the conduit of
lumps of matter, which, being thrown sharply
forward in a series of jerks, constantly brush
or rub the sides of the pipes, thus insuring their
cleanliness and rendering obstruction or
stoppage more difficult.

Third. The siphon-passage—that is to say,
the parts which have to pass under an obsta-
cle—are provided with a special apparatus,
which is represented in Fig. 12, and is arranged
as follows: A special piece, F, of cast-iron, is
placed on each side, right and left, of the con-
duit at the places where the bend for the pas-
sage of the siphon begins and ends. These
pieces are connected at $x$, $x'$ to two bent pipes,
$y$, $z$, of varying diameters, and which are
placed under the obstacle to be avoided.
Through the lower pipe, $z$, the sewage mat-
ters will pass, while the gases will flow exclu-
sively through the upper one, $y'$, as soon as
the siphon is full. The sewage matters from
the conduit, and which fall into $a'$, will drive
into $b'$ a volume equal to their own weight.
The gases, following the easiest route, will be drawn
in at $a'$, and will re-enter the conduit at $d'$ on
their way to the collecting vessels. By rais-
ing the cover $c'$ an opening will be made for
examining, cleaning, or repairing the appar-
ratus. In the event of the conduit becoming
completely full, and to prevent any matters
entering the pipe $y'$, I provide this pipe on
each side with a small float, $f'$, of metal, move-
able, and of elongated form, so as not to oc-
cupy too much space in breadth. It is guided
by a rod, $r'$, upon which it rests when not in
action. As soon as the level of the sewage
matters reaches the float, it will rise and close
the pipe $y'$ by means of the sphere or hemi-
sphere of india-rubber with which it is pro-
vided at its upper part. As soon as the level of the liquid falls—that is to say, when the
collecting conduit most requires the work to
which the float falls to its position of rest.
In some cases it will be sufficient to make the
two ends of a siphon communicate by a small
pipe placed in the siphon itself or parallel to
it to establish equilibrium in the depression.

Fourth. At intervals in the conduit, as well
as in the greater part of the apparatus, an open-
ing, $G$, will be made in the pipes, in which
will be screwed a small metal tube or pipe, $H$,
Figs. 13, 14, and 15. This tube is constructed
in such a manner that any person can test, by
means, for example, of a gage, $J$, the baro-
metrical depression which exists at that part of
the conduit. This small pipe has a screw-
threaded hole, $l$, closed at its upper part by a
screw-plug, $K$, of the same pitch and provided
with a notch or nick, $L$. The pipe $H$ has be-
sides within it a drilled tube, $M'$, which ter-
minates at $N'$ in the hole $I$, which hole is her-
etically closed by the screw $K$. When it is
wished to ascertain the barometrical depres-
sion at any desired point, with the pipe $H$,
from which it follows that by turning the screw $O$ the screw $K$ will be screwed inward, and
at the same time the gage will be com-
pletely screwed upon the pipe $H$. The neck
$Q$ made in the screw-thread of the instrument
will then communicate with the pipe $M'$ and
with the gage, and the desired indication can
be read upon the dial. It will be evident that
even should the gage not be withdrawn there
be no escape and no loss. If, on the con-
trary, the gage has to be immediately with-
drawn, it is only necessary to unscrew it. The
screw $K$, following all the movements of the key $L$, will rise, first closing the pipe $M'$
and reaching the top of the opening $G$ with the
end of the screw of the gage, which can be withdrawn. The screw $K$ is thus au-
atomatically put in place again and the closing
is hermetic.

Fifth. Finally, to guard against all uncer-
ainties, it will be prudent to unite all the
branches at their meeting-points at the inter-
sections of the drains and, to provide the
with cocks, valves, or sluices to permit of the
sewage matters taking different directions, ac-
cording to circumstances. When the conduit
passes under a road having houses on each
side, it will be understood that a pipe should
be laid on each side and naturally of a diam-
eter smaller than if a single pipe had to re-
ceive the sewage matters from all the houses
in the road. If the roadway is narrow, the
conduit will branch off from each house to the
two pipes, so that by means of cocks or valves
the sewage matters from the houses may be let
into either of these pipes. If the roadway is
broad and this arrangement would necessi-
tate too much work, a connection between
these two pipes should be made only at in-
tervals, or, if the road is not long, at its two
ends only. With a conduit thus constructed
and exclusively in communication with the
discharge apparatus before described, which
under the influence of the atmospheric press-
ure will force through it the sewage matters put into motion by the barometrical depression, and with the rapid passage of the gases above the sewage matters, obstructions and stoppages in the pipes will be impossible and the system will work without interruption.

Automatic collecting vessels, (Fig. 4.)—The arteries of each district terminate separately and directly in a collecting reservoir, $d'$, (see Fig. 7.), which, placed above the two automatic collecting-vessels as $m'$, distributes the sewage matters of the conduit alternately into each of them in a single stream. The capacity of the collecting-reservoir should be calculated to receive the contents of the conduits of the district during the time necessary for the automatic emptying of each of the two collecting-vessels. In this manner the emptying of the sewage matters of the conduits even in the event of one of the vessels being out of action on account of damage or other cause can be assured. Communication between the bottom of this collecting-reservoir and the automatic collecting-vessels is established by a pipe $12$, Figs. 4, 7, and 16, adjoining the check-valves. The collecting-reservoir receives at its upper part a pipe $5$, Fig. 7, which conducts the gases of the collecting-conduit directly into the the barometrical conduit $B$ without passing through the automatic collecting-vessels. The vessels, (see Fig. 4,) which may be of metal, should bear-tight and placed underground at any point of the district as near as possible to the bottom of its inclined and underneath the collecting-reservoir. The dimensions of each of the two vessels will be determined by the area of the district and the quantity of sewage matters to be received and forwarded in the twenty-four hours.

Each vessel is composed of the following parts: an outer shell or casing of metal, which need only be sufficiently strong to support with the sewage matters the atmospheric pressure. A check-valve, $m'$, similar in form to the one before described, is placed at the upper part of the receiver. It allows of the outflow of sewage matters from the collecting-conduit, but it prevents their return, as well as that of gases or of atmospheric pressure. A rod $s'$ passes through a stuffing box and bears upon the rod $13$ of the valve, in order to stop its action during the filling of the vessel. As the vessels automatically fill and empty, so are the two valves of their two foils controlled by a movement which will be hereinafter described. Another check-valve, $j'$, is placed at the lower part of the vessel. It serves exclusively to establish communication between the sewage matters of the vessel and the special sewage-conduit $C$, leading directly to the central works. Its arrangement permits of its allowing these matters to pass, but under all circumstances to prevent their return. Above the vessel, and forming a part of it, is placed a chamber $r'$ of the same metal, in which ter-

minates the barometrical conduit $B$, which never receives sewage matter and communication with which is established on the one hand with the works and on the other with the collecting-reservoir, (see Fig. 7,) and consequently with the collecting-conduit. Atmospheric pressure is exerted in the two vessels through the two openings $s'$ and $l'$. The first opening, $l'$, is closed by a check-valve, $a''$, of metal, which automatically opens inward when the atmospheric pressure acts upon it. The second opening, $s'$, is closed by a sliding valve, $a'$, of metal or other suitable material, attached through an opening arranged in the side of the chamber to a rod, $a'$, which is provided at its upper part with a counter-weight, $a''$. The barometrical conduit can likewise be closed in the interior of the chamber by a similar valve, $a''$, attached directly to the same metal rod. This rod in rising or falling under the action of the float $H'$ actuates the two valves simultaneously. The valve $a'$, however, does not open until the valve $a''$ is closed. The metal float $H'$, of any suitable shape, moves freely up or down the rod $a'$. The automatic operation of the vessel takes place as follows: Let it be supposed that the vessel is empty, the valve $a''$ open and consequently the other valve, $a'$, closed and kept tight on its seat by atmospheric pressure.

The barometrical depression caused by the pumps at the works is transmitted by means of the barometrical conduit and of the valve $a''$ to the interior of the vessel. The weight of the liquids contained in the collecting-reservoir $d''$ causes the valve $m'$ to rise, and the sewage matters are precipitated into the vessel with the gases which have not been drawn through the upper part of the collecting-reservoir into the barometrical conduit $B$. Naturally these gases are then immediately taken up by this conduit and the sewage matters fall to the bottom of the receiver. The level of liquid in rising carries with it the float $H'$, which slides along rod $a'$. When it encounters the tappet $I$, with which the rod is provided at its upper part, it lifts it, carrying with it the two valves $a'$ and $a''$. At this moment the vessel is full of sewage matters, the valve $a''$ is closed, the other valve, $a'$, has just opened. The atmospheric pressure, passing in at $V$, has replaced in the interior the barometrical depression which previously existed there. The atmospheric pressure then acts upon the valve $a''$. The sewage matters no longer pass through the valve $m'$ and are drawn in by the corresponding valve of the other vessel. The suction or draft produced at the works in the general receivers of the sewage matters causes the valve $J$ to rise, and the atmospheric pressure $m''$ acting in the vessel $m'$ upon the liquids which it has just received forces them forward violently and automatically into the special liquid-conduit $C$. The float $H'$, having then fallen with the level of the liquid, meets the
tappet K, fixed to the lower part of the rod x, carries it with it, and before the level can fall below the valve J the valve v' shuts at the same time that the sluice-valve e', on the contrary, opens. The depression of the barometrical conduit is re-established in the vessel, and as soon as the second vessel is full the valve w' again raises the sewage matters again enter the receiver, and the same operation takes place, being in like manner repeated alternately and indefinitely in the two vessels.

The arrangements shown in Fig. 16 permit of obtaining between the two collecting vessels of each district an automatic movement to operate the flow of the sewage matters in one of them at the moment when the emptying of the other commences, and to arrange that the latter, being empty, cannot begin to fill before the first has become full, and vice versa.

The rod x' of each float H' operates valves within the chamber 14, which valves, being similar in construction and operation to those lettered c' and c in Fig. 4, are not shown and need not be further described. The rods x' pass through stuffing-boxes S and are connected to the bell-crank levers U, pivoted at T', and carrying counter-weights U U'. To the levers U are pivoted connecting-rods X, which have slots X' at their farther ends, in which slides one end of a pin or bolt, Y. The valves v b' correspond in construction and function to the valve w in Fig. 4—that is to say, they control the passage of matters from the collecting-reservoir to the vessels m through pipe 12. The rods a' a' are carried by opposite ends of the balance-beam C', which is connected with the pin or bolt Y in slots X'.

The operation is as follows: Vessel m is supposed to be in process of emptying and vessel m' in process of filling. When the float H in the latter rises sufficiently to operate the valves in easing 14, (first closing communication with the barometrical conduit by closing the sluice-valve e, at the same time that the pressure of the balance-beam C', which is connected with the pin or bolt Y in slots X', brings the valve b' in full communication with the atmosphere, as already described in connection with Fig. 4,) the same movement tilts the lever U and counter-weight U', moves rod X' from left to right, and tilts beam C' bringing the rod a' to bear on the top of rod-carrying valve b, thus pressing the latter to its seat and cutting off communication between the collecting-reservoir and vessel m'. By the same movement of beam C', the valve b' is released and is free to rise and admit the passage of matters from the reservoir to the vessel m. When the latter is empty, the descent of rod x' has moved rod X' from right to left, that is, from the pin Y, without affecting the position of beam C'. It is not until vessel m fills that the beam is again tilted to the left, freeing valve b and engaging valve b'. This operation with the necessary intervals will be repeated indefinitely.

Central pumping works, (Figs. 5 and 5')—The barometrical conduit B and the sewage-conduit C put the automatic collecting-vessels m m' in direct connection with the central works. Each of these conduits is composed of pipes of suitable material capable of resisting externally a pressure a little more than that of the atmosphere. Their diameters are calculated according to the cube of the sewage matters and gases to be carried off from the district at the time of day when the delivery will be the greatest. If these conduits communicate directly with the works, their diameter should be the same for the whole of their length. If, on the contrary, they are to distribute their contents or gases into a similar conduit conveying the sewage of another district, the diameters should increase from the point of junction in proportion to the cube to be carried away.

The works should be placed as near as possible to all the collecting-vessels of the different districts of the town, and be joined to these vessels by the shortest road. They are provided with a series of reservoirs, M, in which pumps or pneumatic engines M', of any suitable description, maintain in turn a strong barometrical depression. These reservoirs being put alternately in communication with the barometrical conduit B, transmit the desired depression to the collecting-vessels and throughout the whole of the conduit, and they will produce in the general receivers N the necessary depression, so that the atmospheric pressure acting upon the full collecting-vessels of the district will automatically force forward their contents. The pumps or pneumatic engines M' should be capable of taking up all the gases arising from the system as they are produced, and then forcing them through the gas-conduit O to the place selected for utilizing, creating, or destroying them, or for their preservation.

These gases can be made to undergo a change at the works, such as a cleaning or washing in a series of vessels containing sulphuric acid. They can afterward be employed in the furnaces for heating the boilers, and in this way the conduit for the pumping forward of the gases may be dispensed with.

The liquid-pumps or the suction and force engines may be of any suitable construction, and should also be capable of dealing with all the sewage matters as they arrive in the general receivers N, so as to force them afterward through the conduit P to the place chosen for their utilization, treatment, or purification.

The sewage matters which come from the automatic collecting vessels through the conduit are received at A in the upper part of a series of general receivers placed below the other, and it is from the lower part, S, of these receivers, in the interior of which the atmospheric pressure is caused to act, that the pumps draw the sewage matters to pump them forward.
The conduits for the pumping forward of the sewage matters and gases are constructed of any suitable material. They should be able to resist the maximum internal pressure necessary for carrying the sewage matter and gases to their destination. Their diameters should be calculated by the quantity of sewage matters or gases to be pumped forward in the twenty-four hours.

The pumps and machinery of the works are driven by any suitable motor. For cases of urgency, all the parts of the works are provided with additional or supplementary parts. The apparatus arranged in the works for insuring the regular working of the system throughout its whole extent should be completely and hermetically closed. The works can therefore be placed, if necessary, and without inconvenience, in the midst of or in close proximity to a town or the center of a population, as in the case of water-works.

In some large towns it will be advantageous to replace the barometrical conduit by pumps effecting directly the barometrical depression in the collecting-conduit through the collecting-reservoir and in the collecting-vessels of each district; but it will then be necessary not to pump the gases forward through a special conduit, but to destroy them or utilize them on the spot. In very large towns there should be several works connected together, so as to distribute the power required, and in the smaller towns, where there would only be one district, the two collecting-vessels of this district should be placed in the works.

What I claim, and desire to secure by Letters Patent, is—

1. A system of sewerage or drainage for houses and towns or districts, composed of apparatus which receive the sewage matters from the waste or soil pipes of the houses and discharge them automatically into collecting-conduits, a series of collecting-conduits arranged in arteries and branches throughout the town or district, a pair of collecting-vessels arranged at a suitable point of the town or district, the two vessels of each pair receiving and discharging the sewage matters alternately, a pipe through which the sewage matters are conveyed from the collecting-vessels to pumping-works, another pipe communicating between the upper part of the collecting-vessels and the pumping-works, and pumps or pneumatic engines which maintain a constant barometric depression in the last-named pipe and throughout the system, and also draw the sewage matters from the collecting-vessels, all substantially as set forth.

2. In a system of sewerage or drainage for houses and towns or districts, the combination, in an automatic discharge apparatus that receives the sewage matters from the soil or waste pipe of a house and delivers them to a collecting-conduit, of a valve, \( c \), lever \( e \), float \( g \), releasing device \( h \), and float \( i \), arranged and acting substantially in manner and for the purpose set forth.

3. In a system of sewerage operating by pneumatic power, an automatic discharge apparatus for receiving the waste matters from a house, said apparatus comprising, in combination, a tank or vessel, an outlet-valve controlling the opening into the conduit, the float for operating said valve, the locking and releasing mechanism to permit said float to rise forcibly when the liquid in said vessel reaches a certain level, and an inwardly-opening valve for putting the vessel in communication with the atmosphere when the outlet-valve is opened, substantially as described.

4. In a system of sewerage or drainage for houses and towns or districts, a collecting-conduit forming part of the system, of increased diameter at its outlet end and connected at this end to the upper part of another collecting-conduit, also forming part of the system, substantially as set forth.

5. In a system of sewerage or drainage for houses and towns or districts, the combination, with the sewage collecting or conveying pipe where it has to bend or dip in order to pass under an obstacle, of another bent or dipping pipe connected at its ends to the upper part of the bend of the sewage-pipe, whereby the gases which are traveling with the sewage are provided with a separate pipe for passing under the obstacle, substantially as set forth.

6. The combination, with the pipes \( y \) and \( z \) and the pieces \( F \) \( F \), of the floats \( J \) \( J \), valves \( i \) \( i \), and valve-seats \( e \) \( e \), substantially as and for the purpose set forth.

7. In a system of sewerage or drainage for houses, the combination, with the pumps at the central works for producing a barometrical depression throughout the system, of a collecting-reservoir, a pair of collecting-vessels connected therewith, valves for controlling the communication between said reservoir and said vessels, means for operating said valves, and pipes or conduits connecting said vessels with receivers at the central works, substantially as described.

8. The combination, with the receivers and pumps at central works, of a collecting-vest, a sewage-conduit and a barometric conduit leading from said vessel to said central works, an inlet-pipe leading to said vessel, valves controlling outlets to said barometric conduit and to the atmosphere, respectively, and means, as specified, for closing the first valve and then opening the latter valve when the vessel has filled to a certain level, substantially as described.

9. The combination, with the receiver \( m \) of the collecting-vessel and with the supply-pipe \( A \) and discharge-pipe \( C \) of same, of the chamber \( r \) above said receiver, the valve \( c \), communicating with the barometric-depression conduit \( B \), the valve \( v \), communicating
with the atmosphere, and the float $H'$, whose rod actuates said valves $c''$ and $v'$, substantially as and for the purpose set forth.

10. The combination, with the receivers of the two collecting-vessels and with the float-rods of same, of the balance-beam $C''$, controlling the inlet-valves to said receivers, and of means whereby the fall of the float of the one receiver is transmitted through said beam to the inlet-valve of the other receiver and frees the same, and vice versa, substantially as and for the purpose set forth.

ADRIEN LE MARQUAND.

Witnesses:

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D. P. COWL.