

C. RAWSON, PHILIP OVENDEN, JAMES WYLDE, W. MCCREE & HENRY HILL.
Improvement in Deoderizing and Purifying Sewage.
No. 118,485.

3 Sheets--Sheet 1.

Patented Aug. 29, 1871.

Fig. 1.

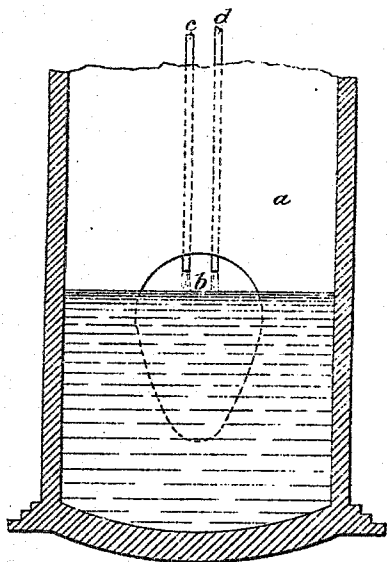


Fig. 2.

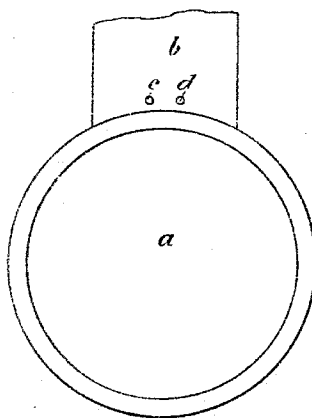


Fig. 6.

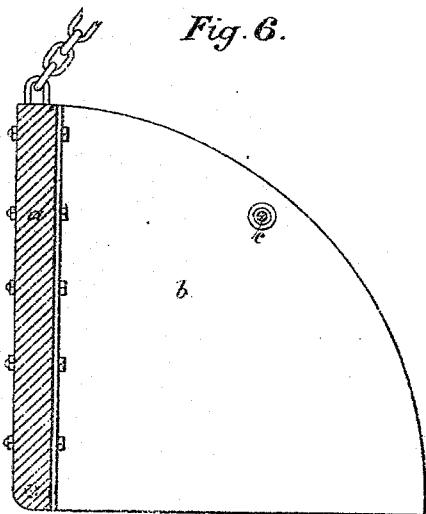
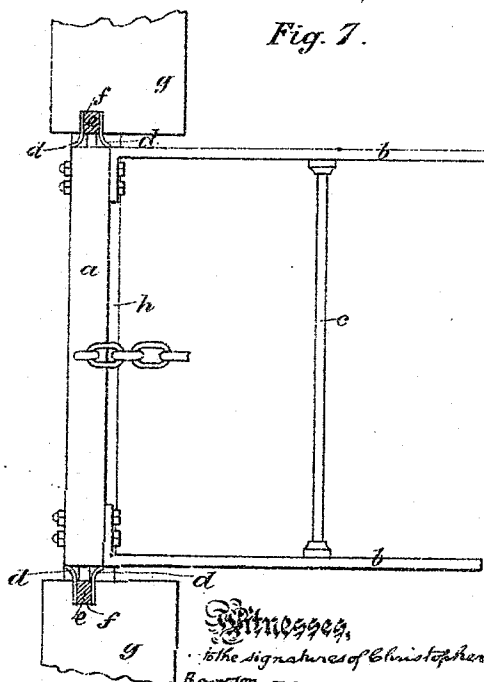


Fig. 7.



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Witnesses,
to the signatures of Christopher
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and John Venn, W. Conduitt, London
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Fig. 3.

Fig. 4.

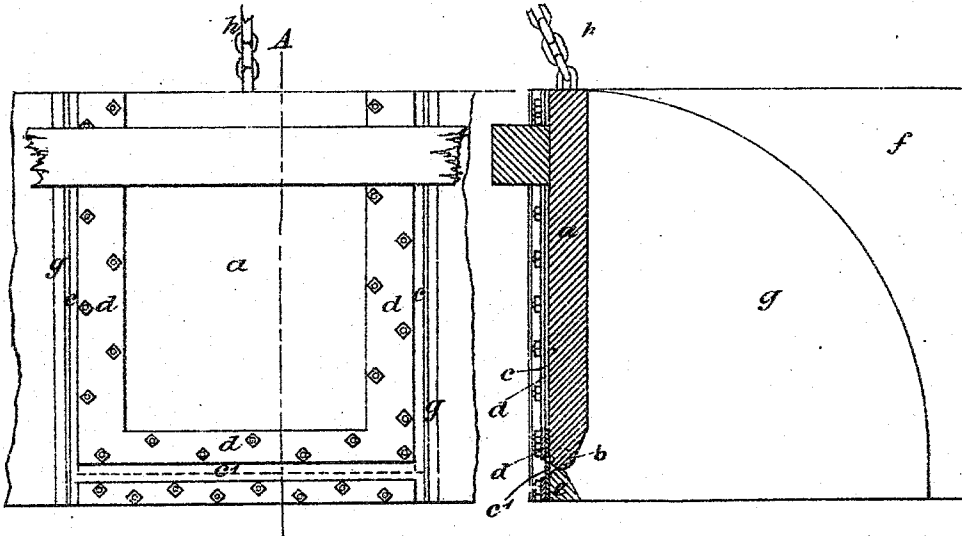
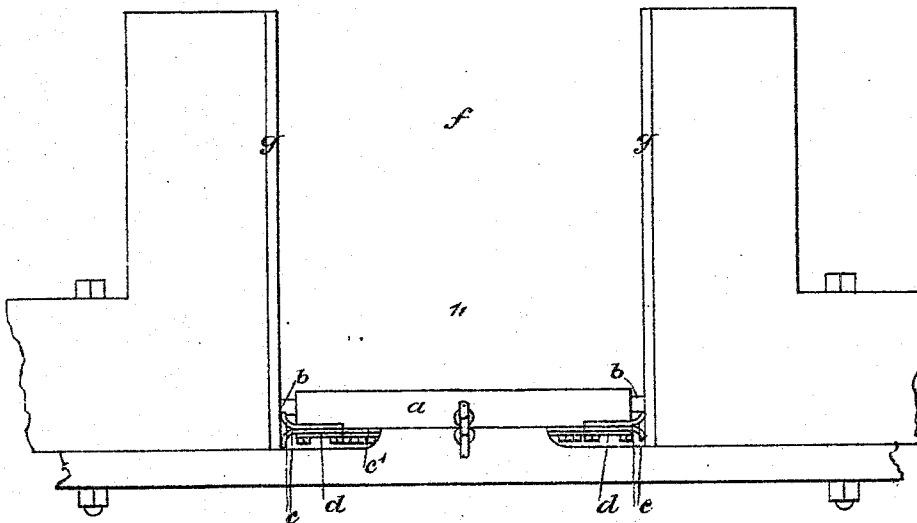


Fig. 5.



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to the signature of Wm. McCree Esq.
to the signature of Henry Hill Esq.
to the signature of Henry Hill Esq.

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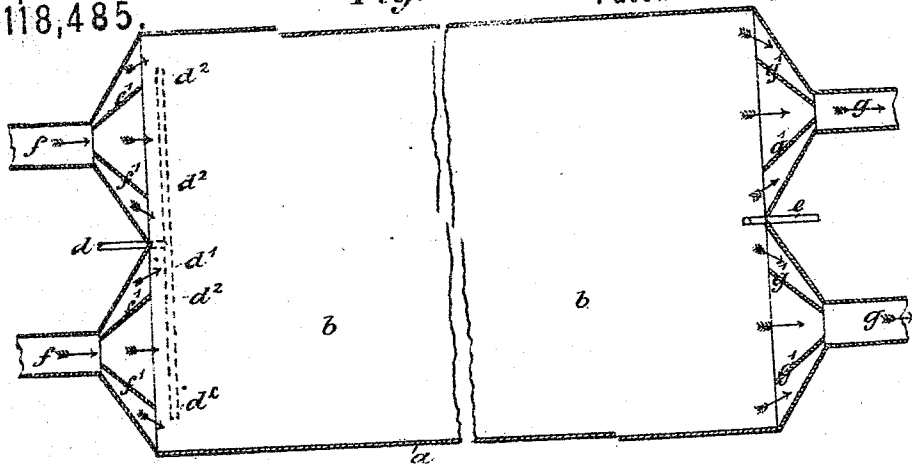


Fig. 10.

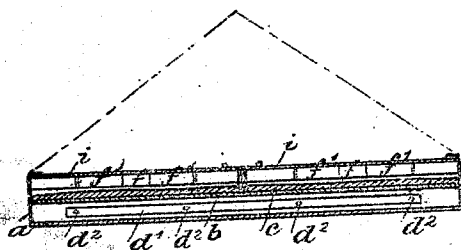
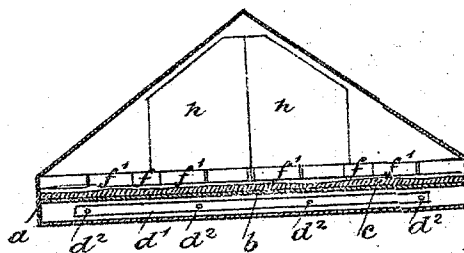


Fig. 9.



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are notary public
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W. Campbell, London
Notary Public
Witness to the Signatures of Philip Ovenden
James Wyld and Henry Hill
Witnesses to the Signatures of Henry Hill
Hall - W. Wainwright, London
W. Wainwright, London

UNITED STATES PATENT OFFICE.

CHRISTOPHER RAWSON, OF LONDON, PHILIP OVENDEN, OF SURREY COUNTY, JAMES WYLDE, OF LEAMINGTON, WILLIAM MCCREE, OF LEYTON, AND HENRY HILL, OF HASTINGS, ENGLAND.

IMPROVEMENT IN DEODORIZING AND PURIFYING SEWAGE, &c.

Specification forming part of Letters Patent No. 118,485, dated August 29, 1871.

To all whom it may concern:

Be it known that we, CHRISTOPHER RAWSON, of No. 1 St. Swithin's Lane, in the city of London, general manager of the Native Guano Company, and PHILIP OVENDEN, of No. 17 Lyndhurst Road, in the county of Surrey, engineer, and JAMES WYLDE, of Leamington, in the county of Warwick, consulting chemist, and WILLIAM MCCREE, of No. 2 Russell Road, Leyton, in the county of Essex, analytical chemist and engineer, and HENRY HILL, of Hastings, in the county of Sussex, analytical chemist, subjects of the Queen of Great Britain, have invented or discovered new and useful improvements in deodorizing and purifying sewage, urine, and refuse matters and liquids, and in making manure therefrom, and in apparatus for those purposes; and we, the said CHRISTOPHER RAWSON, PHILIP OVENDEN, JAMES WYLDE, WILLIAM MCCREE, and HENRY HILL, do hereby declare the nature of the said invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement thereof—that is to say:

Our invention in part relates to a process described in the specification of a United States patent No. 91,373, granted to William Cameron Sillar, Robert George Sillar, and George William Wigner, and dated June 15, 1869, and in the specification of a United States patent No. 108,664, granted to George William Wigner, and dated October 25, 1870, both of which patents have been assigned to and are now being worked by the Native Guano Company, (limited.)

According to that process, alum, blood, clay, manganate of potash or other compounds of manganese, and other substances named in the aforesaid specifications, were to be mixed together and added to the sewage for the purpose of deodorizing and purifying it, and the mixture of sewage and the substances so added thereto was allowed to flow into tanks in which the greater part of the organic and other impurities were precipitated. The mud or sediment thus formed was removed from the tanks and dried for the purpose of making it into manure. When the said mud was partially dry, acid (by preference sulphuric acid) was added to it to prevent loss of ammonia. The process above described is commonly known in England as the "A B C" process.

Our invention consists of an improved mode of using the substances or some of them (niter acid) mentioned in the specifications hereinbefore referred to, in order that such substances may, by the separate use of such of them as have the property of neutralizing acids, act with greater or more beneficial effect than heretofore; in the use of albuminous, albuminoid, and gelatinoid substances in addition to the aforesaid substances in aiding the precipitation of the impurities contained in the sewage, by means of an electric current generated by voltaic, electro-magnetic, or magneto-electric action; of a mode of destroying wholly or partially the offensive gases given off during the acidification or other chemical treatment and drying of the mud hereinbefore referred to; of an improved mode of drying the mud hereinbefore referred to; in purifying the effluent water by aeration; and of improved apparatus for letting off the said effluent water.

In carrying our invention into effect we proceed as follows: We mix, in a suitable pit, tank, or vessel, alum or (by preference, as cheaper and more efficacious) crude sulphate of aluminium, or other soluble compounds of aluminium, such as chloride and acetate of aluminium; blood; albuminous, albuminoid, and gelatinoid substances, such as either gelatine, glue, size, chondrin, isinglass, fish-skins, eggs, or other analogous matter, together with or in substitution for the blood, animal and vegetable charcoal, or any carbonized animal or vegetable substances, and clay with water. We, for the purpose of distinction, call this mixture the "A B C mixture." The said mixture is to be employed for treating ordinary town sewage of an alkaline or neutral nature.

The proportions of the ingredients of the above-described A B C mixture, and their selection, must be varied according to the nature of the sewage to be treated. In practice we find the following proportions give good results with ordinary town sewage. The ingredients contained in 100,000 parts of A B C mixture are: Crude sulphate of aluminium, 3,000 parts by weight; charcoal, 4,000 parts by weight; clay, 10,000 parts by weight; blood, 6 parts by weight; water, 82,994 parts by weight.

The albuminous and albuminoid matters hereinbefore described (or any of them) may be used either in conjunction with or in substitution for

the blood in forming an A B C mixture. When the albuminous and albuminoid substances are used in substitution for the blood either of the following formulas may be used. We digest three parts by weight of such albuminous or albuminoid substances in ten parts of hot water until solution or diffusion in that liquid has taken place. We then add the solution in place of the six parts of blood; or we mix crude sulphate of alumina, 3,000 parts by weight; charcoal, 4,000 parts by weight; clay, 10,000 parts by weight; glue, 1 part by weight; water, 82,999 parts by weight; and we use this latter mixture in substitution for the A B C mixture herein first described. When the albuminous and albuminoid substances are used in conjunction with blood, about one-half the quantity of albuminous and albuminoid substances given in the two formulas last described may be used.

The quantity of mixture to be added to the sewage will be about one volume of the said mixture to one hundred volumes of the sewage; but of course the proportions and constituents will be subject to variation according as the character of the sewage is found to change, the "feed" being regulated as required by any suitable mechanical means. We prefer such an arrangement as will allow of constant inspection of the feed. This A B C mixture is added to and mixed with the sewage, which is then passed or allowed to pass into settling-tanks, where the precipitation of the impurities takes place. These tanks may be of any suitable construction, but we prefer to make them with sloping bottoms and mud-channels, as described in the specification of the United States Letters Patent hereinbefore referred to. The mud deposited is treated in the manner hereinbefore described for the manufacture of manure.

The foregoing description relates to the use of a single pit, tank, or vessel for containing the substances to be used in the A B C mixture for the purification of the sewage. When two pits, tanks, or vessels are used we proceed as follows: We mix in one pit, tank, or vessel the ingredients referred to as constituting the A B C mixture. In the other pit, tank, or vessel we make a mixture, which we designate the "alkaline mixture," consisting of one or more of the alkalies or their carbonates, or of the alkaline earths or their carbonates, mixed with or dissolved in water. The proportions of these ingredients and their selection will vary according to the acidity of the sewage to be treated, the object being to reduce the sewage to at least a neutral state.

We may here state, generally, that the directions given in the specifications of the Letters Patent Nos. 91,373 and 108,664, hereinbefore referred to, respecting the modifications of formulas and the quantity of the purifying substances to be added to the sewage, apply to this invention also.

We add the A B C and the alkaline mixtures separately and simultaneously to the sewage, essentially as represented in Figs. 1 and 2 of the accompanying drawing, which figures respectively represent, in vertical section and plan, the

mixing-pit, in which the said mixtures are added to the sewage. The same letters of reference indicate the same parts in both figures. *a* is the mixing-pit. *b* is the sewer. *c* is the pipe through which the A B C mixture is added, and *d* is the pipe through which the alkaline mixture is added.

In some cases (especially where the sewage is acid) it is expedient to add the alkaline mixture to the sewage in order to render it neutral or alkaline previously to its receiving the A B C mixture; but we do not claim as of our invention the previous addition of the alkaline mixture to the sewage.

After the addition to the sewage of the alkaline and A B C mixtures in either of the two ways herein last described, the said sewage is passed or allowed to pass into settling-tanks for precipitation, as hereinbefore described.

The A B C and alkaline mixtures may, for the sake of economy and portability, be made up in a dry form, and so kept until required for use, at which time the requisite quantity of water may be added.

The precipitation of the impurities contained in the sewage or urine or refuse matters and liquids may be aided by means of an electric current generated by voltaic, electro-magnetic, or magneto-electric action, employing poles or electrodes of carbon, platinum, or other material not prejudicially acted upon by the contents of the sewage or other matters under treatment.

Instead of allowing the treated sewage or urine or refuse matters and liquids to flow continuously through the said tanks, we prefer to allow it or them to remain quiescent in the said tanks for a sufficient time to allow of subsidence, after which we draw or drain off, or otherwise separate the supernatant water from the mud at the bottom of the tanks. It is important to do this without disturbing the mud. For this purpose we use a pen-stock or gate, hinged at its lower side to the sill or to the side walls of the outlet-passage through which the water is drawn off. The sides of the said pen-stock are furnished with double flanges of leather, caoutchouc, vulcanized India rubber, or other suitable material, which work water-tight between quadrantal wing-plates fixed to the sides of the said passage. A toothed quadrant, worked by a worm and shaft, (or any other suitable mechanical appliance,) is affixed to the pen-stock, so that it can be lowered so as to allow the water to flow over its upper edge or be raised into a vertical position. Or the said pen-stock may be raised and lowered by means of a chain. Figs. 3, 4, and 5 of the accompanying drawing represent a pen-stock constructed according to this part of our invention, Fig. 3 being a front elevation of the said pen-stock; Fig. 4 a section, taken on the line A, Fig. 3; and Fig. 5, a plan of the same. The same letters of reference indicate the same parts in Figs. 3, 4, and 5. *a* is the pen-stock, which turns on hinges or pivots at *b*. *c c* are the flexible flanges, which are fixed to the pen-stock by means of a plate or frame, *d*, bolted to the said pen-stock. *e'* is a strip of leather, or caoutchouc, or other flexible material, which is similarly secured to

the pen-stock and the sill *e* of the outlet-passage *f*, so as to prevent water from passing between them. *g g* are the quadrantal wing-plates, between which the pen-stock works. *h* is a chain, by means of which the said pen-stock is raised or lowered, as required.

Instead of the arrangement of flanges and wing-plates described, the wing-plates may be affixed to the sides of the pen-stock and work between double flanges of leather, caoutchouc, or other flexible material affixed to the sides of the outlet-passage. This arrangement is represented in vertical section in Fig. 6, and in plan in Fig. 7, in which figures the same letters of reference indicate the same parts. *a* is the pen-stock, and *b b* are the quadrantal wing-plates bolted thereto. *c* is a strut, which keeps the said plates the requisite distance apart. *d d* are flanges or strips of leather or caoutchouc or other flexible material, which are fixed, by means of bars of wood *e e*, in channels *f f* in the masonry or brick-work *g* of the outlet-passage. *h* (see Fig. 7) is a caoutchouc or other elastic cushion, against which the lower edges of the pen-stock work water-tight.

The effluent water may, where necessary, be further purified, as hereinafter described, before leaving the works. Where the mud resulting from the purification and precipitation above described can be made into a manure, we remove such mud from the tanks, after draining off the supernatant water as hereinbefore described, by pumping, dredging, or other suitable means, and place it in an intermediate tank, where further settlement takes place, the supernatant water being here drawn off as far as possible. We then put the mud in a closed tank or cistern, which communicates by means of a pipe with a pump or a fan or other forcing or exhausting apparatus. In this tank or cistern the sulphuric or hydrochloric or other acid to be used for fixing or retaining the more or less volatile matters or other valuable constituents of the said mud is added thereto, and stirred and incorporated or mixed therewith. As soon as this has been done the pump or fan hereinbefore referred to is set in motion, and the gases given off by the mixture of mud and acid are by this means commingled with chlorine or sulphurous acid in a vaporous or gaseous form. The chlorine or sulphurous-acid gas may be generated by ordinary or well-known means, either in the flue or chimney through which the foul gases pass, or in the tank itself, in which latter case the fan is not required. By this means the offensive gases given off as aforesaid are either wholly or partially decomposed, and the foul smell arising from the mud under treatment is either wholly or partially removed. This part of our invention is also applicable for deodorizing and rendering inoffensive foul gases accompanying sewage or arising from it during its treatment.

When the evolution of gases from the mixture of mud and chemicals has ceased or diminished the said mud is dried. The drying of the said mud (which completes the manufacture of the manure) may be effected in any suitable way, as,

for instance, by spreading the said mud on a suitable surface in the open air or under cover, and, if necessary, completing the drying by means of artificial heat; but we prefer to effect the drying of the said mud by means of apparatus constructed as follows: The said apparatus consists essentially of a drying-chamber furnished with a drying-floor or several drying-floors arranged one above another. The said floor or floors is or are heated from beneath by steam or other suitable heating medium, and hot air is drawn or forced over such floor or floors so that the mud spread thereon, being heated from above and below, is rapidly dried. Figs. 8, 9, 10, and 11 of the accompanying drawing represent a drying-chamber constructed according to this part of our invention. Fig. 8 is a horizontal section of the said drying-chamber. Fig. 9 is a transverse vertical section of the same, showing it with a roof. Fig. 10 is a transverse vertical section of the said chamber, showing the application of flat iron covers thereto; and Fig. 11 is a longitudinal vertical section of the same. The same letters of reference indicate the same parts in the several figures. *a* is the drying-chamber. *b* is the drying-floor on which the mud *c* is spread. Steam is introduced under the said floor through a pipe, *d*, and branch pipe *d'*, which latter is pierced with holes *d² d²*. *e* is a pipe for drawing off the water formed by the condensation of the steam. *f f* are pipes through which the hot air is introduced above the drying-floor, and *g g* are pipes through which the said air passes from the drying-chamber either into the open air or into a chimney-shaft. The course of the air is indicated by the arrows. The said pipes are splayed out, as shown, and are furnished with guide-plates or partitions *f' f' g' g'*, by which means the hot air is equally diffused throughout the chamber. The said air may be drawn or forced through the aforesaid pipes by means of a fan, or a draught may be obtained by leading the pipes *f f g g* into a chimney. *h h* are man-holes, through which the workman enters the drying chamber in order to spread or remove the mud or manure. Flat plates or covers *i i* are hinged to each side of the drying-chamber, Figs. 10 and 11. The said chamber may, in addition to these covers, have a roof, as indicated in dotted lines in Fig. 10.

Several drying-floors, constructed as above described, may be arranged one above another, steam being introduced under each floor and hot air being drawn or forced over each floor. In this case openings (closed by means of suitable doors) are made in the sides of the apparatus (one opening to each floor) to allow of the insertion of the mud and the removal of the dried manure.

In order to decompose any offensive gases given off by the mud while being dried we pass over it chlorine or sulphurous-acid gas, or otherwise bring the said gases into contact.

When sulphurous-acid gas is used in this or the preceding process it may be produced by burning sulphur, or coal containing a large proportion of sulphur, or from other sources. When the apparatus above described is used the sul-

phurous-acid gas may be produced by burning sulphur in the flue through which the hot air is introduced.

For the purification of urine or refuse liquids, or the further purification of the effluent water where circumstances render a high degree of purity desirable, we mix with the said urine or refuse liquids or effluent water sulphate of manganese, or other soluble compound of that metal, converted into oxide by the addition of lime either before, at, or after the addition of such compound, to the urine or refuse liquids or effluent. We take about four grains of the black oxide of manganese and add thereto as much sulphuric acid as will dissolve it, and we add the solution of sulphate of manganese so formed to each gallon of the urine refuse liquids or effluent water decomposing with lime as above described.

We would here observe that where manure is to be made the above-described treatment with sulphate of manganese should not be adopted.

Another mode by which we purify the effluent water consists in aerating it by means of atmospheric air. This may be done in a variety of ways, as, for example, by forcing the air into and through the effluent water by means of force-pumps, delivering the air through finely-perforated pipes into the said effluent water.

Having now described the nature of our invention and the manner in which the same is to be performed, we wish it to be understood that we do not limit ourselves to the precise details hereinbefore described, as the same may be varied without departing from the nature of our invention; but

We claim as our invention—

1. The use of albuminous and albuminoid substances, in addition to the substances named in this specification or in the specifications of United States patents Nos. 91,373 and 108,664, hereinbefore referred to, or in substitution for the blood mentioned in these specifications in the treatment of sewage, urine, and refuse matters and liquids.

2. The improved mode hereinbefore described of using the substances by means of which the precipitation of the impurities contained in sewage, urine, and refuse matters and liquids is effected—that is to say, making two separate mixtures, the one hereinbefore termed the “A B C mixture,” and the other the “alkaline mixture,” essentially as hereinbefore described, and adding both mixtures simultaneously and separately to the sewage, urine, or refuse matters or liquids to be purified, so that the said A B C mixture and the said alkaline mixture shall simultaneously meet and mix in and with the said sewage, urine, or refuse matters or liquids.

3. The method hereinbefore described of aiding the precipitation of the impurities contained in the sewage by means of an electric current generated by voltaic, electro-magnetic, or magneto-electric action.

4. The method hereinbefore described of destroying wholly or partially the offensive gases accompanying the sewage, or given off from it during its treatment, or arising from sewage mud during its treatment—that is to say, mixing such gases with chlorine or sulphurous acid in a gaseous form.

5. The purification of the effluent water by aerating it with atmospheric air, essentially as hereinbefore described.

6. The improved apparatus hereinbefore described, and illustrated in Figs. 3, 4, and 5 of the accompanying drawing, for letting off the effluent water from the surface—that is to say, a hinged pen-stock working between wing-plates and furnished with flexible flanges and fittings, the whole constructed and arranged essentially as described.

7. The modification of the aforesaid apparatus hereinbefore described, and illustrated in Figs. 6 and 7 of the accompanying drawing—that is to say, a hinged pen-stock furnished with wing-plates working between flexible flanges affixed to the sides of the outlet-passage, the whole constructed and arranged essentially as described.

8. The improved method hereinbefore described, and illustrated in Figs. 8, 9, 10, and 11 of the accompanying drawing, of drying sewage-mud—that is to say, by the use of steam heat underneath a drying-floor, and a current of hot air above the mud spread on the said floor, essentially as described.

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Witnesses to the signature of P. OVENDEN:

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