Specification of Fritz Hillé : treating sewage.

A.D. 1872, 15*th* FEBRUARY. N° 484.

SPECIFICATION

OF

FRITZ HILLÉ.

TREATING SEWAGE.

LONDON:
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A.D. 1872, 15*th* *February*. N° 484.

Treating Sewage.

LETTERS PATENT to Fritz Hillé, of Flora Villa, Brentford, in the County of Middlesex, for the Invention of "IMPROVEMENTS IN THE TREATMENT AND UTILIZATION OF SEWAGE, AND THE MANUFACTURE OF MANURE THEREFROM."

Sealed the 23rd April 1872, and dated the 15th February 1872.

PROVISIONAL SPECIFICATION left by the said Fritz Hillé at the Office of the Commissioners of Patents, with his Petition, on the 15th February 1872.

I, FRITZ HILLÉ, of Flora Villa, Brentford, in the County of Middlesex, do hereby declare the nature of the said Invention for "IMPROVEMENTS IN THE TREATMENT AND UTILIZATION OF SEWAGE, AND THE MANUFACTURE OF MANURE THEREFROM," to be as follows:—

This Invention relates to improvements on the Invention for which Letters Patent have been granted to me, dated the 2nd day of December 1870, No. 3167. By these improvements I am able to treat sewage waters more advantageously, and to obtain a manure of greater commercial value.

Hillé's Improvements in Treating and Utilizing Sewage.

There is added to the sewage by preference whilst it is still flowing through the sewer a mixture consisting of 5 cwt. of quicklime, 1 cwt. of chloride of magnesium, and 40 lbs. of gas tar. These materials should be thoroughly ground together and added to the sewage in the proportion of 1 lb. of the mixture to 100 gallons of sewage of the ordinary strength of town sewage. The sewage is then run into depositing tanks, where carbonic acid gas from lime kilns is passed through it, and it lets fall a precipitate. The clear liquor is run from the precipitating tanks on to a filter bed of sand, covered with a layer of the spent charcoal from sugar refineries, together with seaweed or other charcoal. The liquid which has passed through this filter is so pure that it may without objection be admitted into a river or stream; or when convenient the clear liquor from the depositing tanks may be used to irrigate land. The sludge is run from the depositing tanks, and mixed with clean water is again used to precipitate another quantity of sewage.

The sludge resulting from a second deposition is mixed with the charcoal, which is removed from the filtering bed when it has become saturated with ammonia, and dried for use as manure; and I increase its manurial value by adding to it to the extent of from 8 to 10 per cent. the impure salt resulting from saturating the ammoniacal liquor of gas-works with sulphuric acid, and evaporating to dryness. In this manner I simultaneously deodorise sewage waters, and render them innocuous and produce a manure of considerable commercial value.

Sometimes I precipitate the sewage first with a mixture of 5 cwt. of sulphate of alumina and 1 cwt. of chloride of magnesium. I in this case add milk of lime in one of the depositing tanks.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said Fritz Hillé in the Great Seal Patent Office on the 15th August 1872.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, FRITZ HILLÉ, of Flora Villa, Brentford, in the County of Middlesex, send greeting.

Hillé's Improvements in Treating and Utilizing Sewage.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Fifteenth day of February, in the year of our Lord One thousand eight hundred and seventy-two, in the thirty-fifth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Fritz Hillé, Her special license that I, the said Fritz Hillé, my executors, administrators, and assigns, or such others as I, the said Fritz Hillé, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an Invention for "IMPROVEMENTS IN THE TREATMENT AND UTILIZATION OF SEWAGE, AND THE MANUFACTURE OF MANURE THEREFROM," upon the condition (amongst others) that I, the said Fritz Hillé, my executors or administrators, by an instrument in writing under my, or their, or one of their hands and seals, should particularly describe and ascertain the nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that I, the said Fritz Hillé, 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 :—

This Invention has for its object improvements in the treatment and utilization of sewage, and in the manufacture of manure therefrom.

On the Sheet of Drawings hereunto annexed I have shewn a system of depositing tanks and apparatus for treating the sewage of towns arranged according to my Invention.

Figure 1 is a plan view, and Figure 2 a longitudinal section taken on the line A, B, in Figure 1; and Figure 3 is a transverse section taken on the line C, D, in Figure 1.

Z is the inlet sewer which leads the sewage to the mixing chamber. On both sides of this sewer, or at such place near the sewage works which is best fitted for their erection, are impounding reservoirs A, A, constructed to provide storage room for any excess of sewage water during

storms or heavy rainfalls, or at night time. The sewage entering the works, or about some 50 yards before it enters the works, receives part of the disinfecting compound in a liquid form, namely, a solution of chloride of magnesium. The sewage enters into chamber B. Here the sewage receives an addition of milk of lime, and this milk of lime decomposes the chloride of magnesium, producing a bulky precipitate, which quickly subsides and carries down with it all the suspended matters and part of the matters held in solution in the sewage. This precipitate contains all the phosphoric acid and part of the nitrogenous matter of the sewage. The supernatant liquor in the deposit tank is entirely free from smell, and may most advantageously be employed for irrigation purposes, as it still holds many fertilizing ingredients, which if the liquid in the deposit tanks is not used for irrigation will subsequently be completely purified on its passage through the artificial filter provided in the system. In the chamber B there is a revolving agitating wheel, driven continuously in any suitable manner, so that the sewage and disinfectant are here most intimately mixed one with the other. From the mixing chamber B the mixed sewage and disinfectant flows through either one or the other of the channels C, C, into the depositing tanks D, D. These depositing tanks have been peculiarly arranged as follows:—They are divided by transverse partitions into three compartments, so as to impede and obstruct the flow of the sewage, and allow the almost complete settlement of the solid matters held in suspension. The arrows in the Drawing shew the flow of the mixed sewage. In the third compartment of the deposit tanks are provided self-acting floating outlets E, E, through which at a regulated flow the purified sewage is led away through sluice valves to the outlet chamber G, and thence to the artificial downward filters H, H, which are of peculiar construction, acting both as a chemical and a mechanical filtering medium. F, F, are wash-out pipes passing direct from the reservoirs D to the outfall; and F^1, F^1, are irrigation outlets. The filter beds are constructed as ordinary filter beds of waterworks, broken bricks at the bottom, then coarse gravel and fine gravel, then coarse sand and fine sand, and between the top layer of small white stones a layer varying in thickness of the spent charcoal from sugar refineries mixed with seaweed or any other vegetable charcoal. This chemical filter, i.e., the layer of mixed charcoal, absorbs all the impure matters suspended or in solution which are left in the purified sewage after having undergone the chemical precipitation process. Before the purified sewage is allowed to flow on to the filters carbonic acid gas is

forced into it in the outlet chamber at all such sewage works where the lime is burnt on the premises, this carbonic acid gas being a waste product from the lime burning process. The addition of this carbonic acid gas produces an extraordinary purification of the sewage, inasmuch as any excess of lime contained in the purified liquid will at once be precipitated to the bottom as carbonate of lime, thus avoiding the purified water having an alkaline reaction. Where the lime is not burnt on the premises, then for the purpose of effecting the same amount of purity a small quantity of perchloride of iron by preference is added to the purified sewage water. The liquid which has passed through the artificial downward filter is sufficiently pure to be admissible into any river or running stream.

Where the locality permits or where otherwise convenient the clear liquid from the depositing tanks may be used for irrigation purposes, as this clear liquid, after having simply undergone the first half of my process, namely, the precipitation process, still holds sufficient fertilising ingredients to be useful for such a purpose. By preference in such a case I lay out the land as shewn on the sketch, Figure 4, as I find that if the sewage or partly purified water is discharged into the irrigating channels *a*, *a*, *a*, which are about 50 feet apart, the beds B, B, receive the greatest benefit for agricultural purposes from the fertilizing ingredients contained in the liquid so used for irrigation purposes. This manurial water, introduced sideways instead of being applied over all the surface, has a greater and more beneficial effect on the roots of the plants, and allows a more regulated application than under any other system of laying out land for irrigation purposes. At the same time this way of laying out the land necessitates no complicated system of under drainage, and will give the land only sufficient moisture, but not an excess of moisture, as is the case where surface or cubical irrigation is resorted to.

At all sewage works erected according to my system I build the above-described artificial filters, because the sewage water passed through these filters will be found always sufficiently pure for admission into a river, and if land for irrigation be at hand as well, then by my system the purified water may only be applied to the land for irrigation purposes when the season or the crops require it; and in winter time, or at any other time of the year when the ground does not require irrigation, the

purified water from the deposit tanks will flow away from the filters perfectly purified.

Sluices F^1, F^1, are provided from the first outlet chamber to conduct the purified sewage on to the land through proper channels; or the purified sewage from the deposit tanks, after passing through the first outlet chamber G, and then after having passed through the artificial filters, may enter a second outlet chamber, from which it is carried off by self-acting floating outlets, like those shewn at E, E, fitted with valves, by opening or closing which the speed of filtration can be regulated. I is the channel for conveying the filtered sewage water. K designates the sand washing machine used for the cleaning the sand; when the filters are renewed for washing the sand the effluent water may be used. L, L, are lime kilns; M, coal store; N, boiler room; O, engine room; P, the drying room; Q, the sludge pumps; and R, the sludge well where the sludge is collected by means of the sewer in the divisional wall between the depositing tanks. The depositing tanks being inclined towards the sewer, and being fitted with valves respectively, sluices provide an easy method of conveying the sludge accumulated in them to the said sewer. Q is the pumping apparatus connected with the pumping engines for raising the accumulated daily sludge from the sludge well on to the drying floor, which by preference is so constructed as to use the air as drying medium after by straining or the use of hydro-extractors the greatest part of the water contained in the sewage residue has been separated.

Passages not shewn in the Drawing are arranged along the two outer sides of the systems of deposit tanks, so that when any of the three compartments may require cleaning, the sewage, instead of passing into such compartment, may be led into the compartment next to it.

By this arrangement the system of tanks can never be out of working order. These deposit tanks are as above stated cleaned daily, and this construction enables me to use the precipitate produced by the addition of the chemical mixture to the sewage a second time for the same purpose, effecting hereby, in the first place, a most considerable saving of the chemicals required for purifying the sewage; and, secondly, enabling me to produce a precipate much richer in fertilizing ingredients for the manufacture of manure.

The disinfecting compound I prefer to use consists as before described

of a solution of chloride of magnesium in combination with milk of lime or of zinc, or in very hot weather a mixture of lime and tar dissolved in water; or chloride of magnesium dissolved in the proportion of about 15 to 1, that is, 15 parts in weight of water to 1 part in weight of chloride of magnesium. With this solution lime or lime and tar mixed together is also used as above mentioned. It is added in a subsequent tank or in the mixing chamber B. I manufacture the disinfecting compound for use as a dry compound, with addition of spent charcoal, in casks or cakes, the size of which depends on the quantity of sewage I have to deal with or on the effect I intend to produce. The solution of disinfectant is allowed to drop or flow into the sewage, and is thoroughly mixed therewith by means of an agitating wheel. The water employed to dissolve the disinfectant may be the water resulting from the purified sewage. I prefer to use the disinfectant in form of bricks of different size around the inlets to the storing reservoirs at A×, A×. It is also useful in the form of powder for urinals, closets, and such like at railway stations, closets in private houses or public buildings, such as military barracks, hospitals, theatres, hotels, and the like; and a considerable advantage may be obtained by the employment of my disinfectant in the holds of ships for transport of cattle or other living freight. The following is the manner in which it is preferred to manufacture the disinfecting agent:—I use the best chalk lime slacked with sufficient water to produce a kind of paste, and to the slacked lime such other ingredients as chloride of zinc or salts of magnesia, such as chloride of magnesia, may be added as are readily obtained in the locality. This addition either in a dissolved or undissolved state should be made at the highest temperature of the lime, so as to produce the greatest possible efficiency of the disinfectant; if tar or carbolic acid be added it has to be done when the slaked lime is at its greatest heat. The quantity of the disinfectant and purifying compound required for complete, effective, and lasting deodorization of sewage or other impure waters depends upon the quantity as well as the quality of such waters, and averages from half a pound or more of disinfecting compound for every 1,000 lbs. of sewage water to be purified, according to the more or less putrified state of sewage and its organic contents.

To manufacture the sewage precipitate into a marketable manure the sludge resulting from a second precipitation is mixed with the charcoal from the filter beds. This mixed charcoal layer on the filter beds I use

for the purpose of completely purifying the liquid from the deposit tank, inasmuch as the charcoal absorbs the still remaining impurities, and thus becomes much richer as a fertiliser. The spent charcoal, after having been used twice in sugar refineries, is a cheap article, is very porous, and has great absorbing power. When the charcoal has purified the water, then it is mixed with the precipitate from the deposit tanks, and this mixture forms in itself a very good manure; but to increase the contents of ammonia in this manure I add to it to the extent of from 8 to 10 °/₀ of the impure salt resulting from treating the ammoniacal liquor of gas-works with sulphuric acid, and evaporating it to dryness. In this manner I simultaneously defecate sewage waters and render them innocuous, and produce a manure of considerable commercial value.

Having thus described the nature of my said Invention, and the manner of performing the same, I would have it understood that I claim, the method and arrangement of apparatus for the treatment and utilization of sewage, substantially as described.

I also claim the manufacture of artificial manure from sewage, substantially in the manner described.

In witness whereof, I, the said Fritz Hillé, have hereunto set my hand and seal, this Fifteenth day of August, in the year of our Lord One thousand eight hundred and seventy-two.

F. HILLÉ. (L.S.)

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Printers to the Queen's most Excellent Majesty. 1872.

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HILLÉ'S Specification.

(1 SHEET)

FIG. 3.

FIG. 4.

FIG. 2.

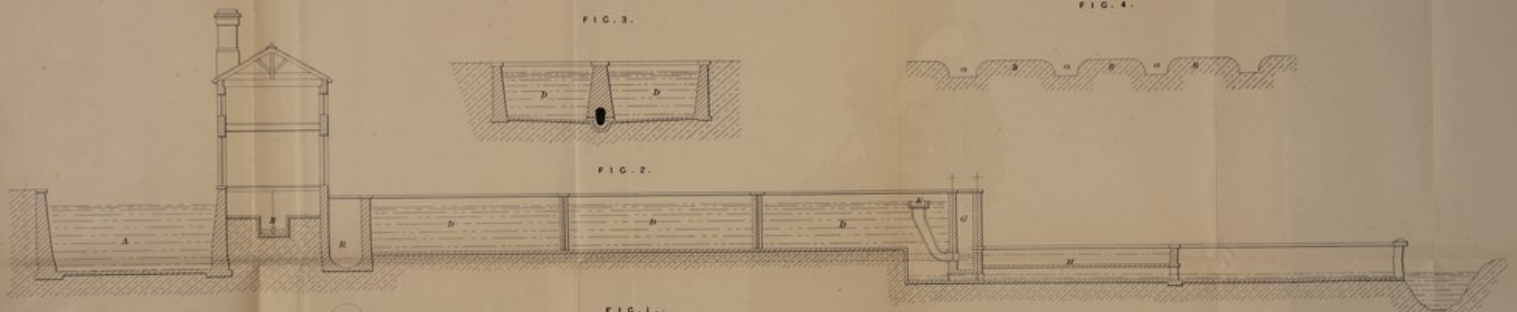
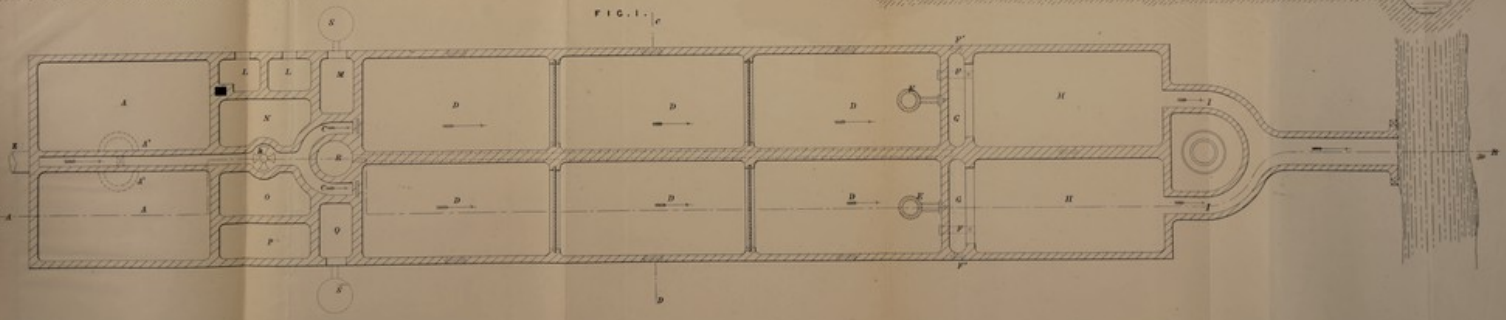


FIG. 1.



The filed drawing is partly colored.

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