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A. D. 1904

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PROVISIONAL SPECIFICATION

"Improvements in and relating to the Treatment of Sewage"

I, Turner Henderson, Gentleman, of Studley Priory, Oxford, do hereby declare the nature of this invention to be as follows:—

The invention relates to the bacterial treatment of sewage and is specially applicable as a means of completing the existing anaerobic or septic tank processes, although it can also be applied to the purification of sewage generally.

The object of the invention is to provide a process for the purification of sewage which shall be more rapid in action than those processes at present known while at the same time less expensive to work.

The invention consists broadly in a process of sewage purification by the action of aerobic bacteria in which the material to be treated is artificially supplied with oxygen in such a manner as to maintain the bacteria in a condition of maximum activity throughout the body of the sewage.

The invention further consists in apparatus adapted to carry into effect the above process comprising one or more vessels or tanks through which the sewage is led and in which it is brought into intimate contact with oxygen in the form of small bubbles at a suitable pressure.

The invention also contemplates combining with the above process a step in which the sewage is treated with a suitable medium for destroying pathogenic germs.

In carrying the invention into effect according to one method, liquid sewage or sewage that has passed through a preliminary process of anaerobic decomposition is diluted, if necessary, and then passed successively through a series of deep, upright tanks, the sewage preferably entering each of the tanks at the top and flowing out at the bottom.

Air containing the oxygen necessary for the due development of the bacteria is led, at a suitable pressure, into the

bottom of each tank and by a spraying or atomising device, such for example, as a series of capillary holes in concentrically arranged nozzles, is broken up into small bubbles, which pass up through the sewage in a uniformly distributed state.

The air and sewage are preferably warmed to the temperature most conducive to aerobic bacterial development.

The volume of air passed through in a given time is adjusted for complete nitrification and depends, inter alia, upon the concentration, character and temperature of the sewage.

The free oxygen generated and then takes the place of the air in be specially generated and then takes the place of the air in the above described process.

In the last tank through which the sewage is passed, it may be treated with electrolysed brine, chlorine or other suitable medium for the destruction of pathogenic germs, thus rendering the complete process extremely hygienic in use.

Among the advantages afforded by the above process may be mentioned the fact that it is continuous and under complete control while the apparatus necessary for carrying it into effect is extremely compact, thus contrasting favourably with the bacterial beds at present in use which necessarily cover a considerable area.

Dated this 15th day of June 1904.

MARKS & CLERK,

18, Southampton Buildings, London, W.C.

13, Temple Street, Birmingham, and

30, Cross Street, Manchester,

Agents.

COMPLETE SPECIFICATION.

"Improvements in and relating to the Treatment of Sewage"

I, Turner Henderson, Gentleman, of Studley Priory Oxford, do hereby declare the nature of this invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement:—

The invention particularly, relates to the bacterial treatment of sewage and is specially applicable as a means of completing the existing anaerobic or septic processes although it

can also be applied to the purification of sewage and to other processes.

The specific object of the invention is to provide a more rapid in action than those bacterial processes at present known while at the same time less expensive to work.

The invention consists broadly, in processes involving a bacterial action, in artificially supplying the material to be treated with large numbers of small bubbles of a suitable medium activity throughout the body of the material.

The invention further consists in apparatus adapted to carry into effect the above process as applied for example to sewage purification and comprising one or more vessels or tanks through which the sewage is led and means for producing small bubbles at a suitable temperature and pressure.

Referring to the accompanying drawings, which form part of the specification:—

Figure 1 shows a sectional elevation of a form of apparatus or device for breaking up the gas into the requisite small bubbles, Figure 2 being a part plan of the upper perforated plate of the same.

The scale on the drawings refers to Figures 1 and 2. In carrying the invention into effect according to one method, as applied to the purification of sewage, liquid or sewage or sewage that has passed through a preliminary process of anaerobic decomposition is passed successively through a series of deep, upright tanks, the sewage preferably entering each of the tanks at the top and flowing out at the bottom as to retard the bubbles.

Air containing the oxygen necessary for the development of the bacteria is led, at a suitable pressure, into the bottom of each tank and by a series of spraying or atomising devices is broken up into very small bubbles which pass through the sewage in a uniformly and densely distributed state.

A suitable form of spraying device is shown full size in Figures 1 and 2 of the accompanying drawings and consists of a cone-like funnel or casing, *a*, of any suitable cross section provided with an air inlet, *b*, at its lower or narrow end. At its upper or larger end three plates, *c*, *d*, *e*, are arranged resting on the projecting lip, *f*. The first plate, *c*, has a number

of tapering holes, *h*, as shown, registering with another set of holes, *i*, in the plate, *d*; these again register with a series of groups, *k*, of small holes arranged, for example, as seen 4405 in Figure 2, the individual holes of each group being of the order of .5 of a millimeter in diameter.

I may form a lug, *m*, on the plate, *d*, projecting through a slot, *n*, in the casing so that by a small angular movement of this disc, the various holes may be thrown out of register and the flow of air stopped.

The air and sewage are preferably warmed to the temperature most conducive to aerobic bacterial development.

The volume of air passed through in a given time is adjusted for complete nitrification and oxidation and depends, inter alia, upon the concentration, character and temperature of the sewage.

Among the advantages afforded by the above process may be mentioned the fact that it is continuous and under complete control while the apparatus necessary for carrying it into effect is extremely compact, thus contrasting favourably with the bacterial beds at present in use which necessarily cover a considerable area.

Moreover the temperature of the sewage may be readily adjusted.

The following explanation may be given of the principle on which the invention is based.

In nature it is found that the maximum development of, say, aerobic bacteria in a given medium takes place invariably at or near to the surface of the medium where an adequate amount of moist oxygen is to be found.

Now, this invention recognises the fact that the supplying of the bacteria of oxidation with such an adequate amount of moist oxygen is the principal factor governing the rate of purification of the sewage. The problem, therefore, is largely a question of sufficient extent of a suitable surface, which is provided according to the present invention by the aggregate area of the surfaces of the numerous individual bubbles, the walls of which provide almost ideal conditions for the development and activity of the bacteria.

It will be obvious that the essence of the invention depends neither upon the particular bacteria nor on the particular gas forming the bubbles, so long as the one is suitable for the other. Such a process can therefore be used as a reducing process with reducing bacteria and further by using bubbles

of a suitable gas, the process can be applied to any substance in which bacteria work in a liquid and require gas for their activity.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed I declare that what I claim is:—

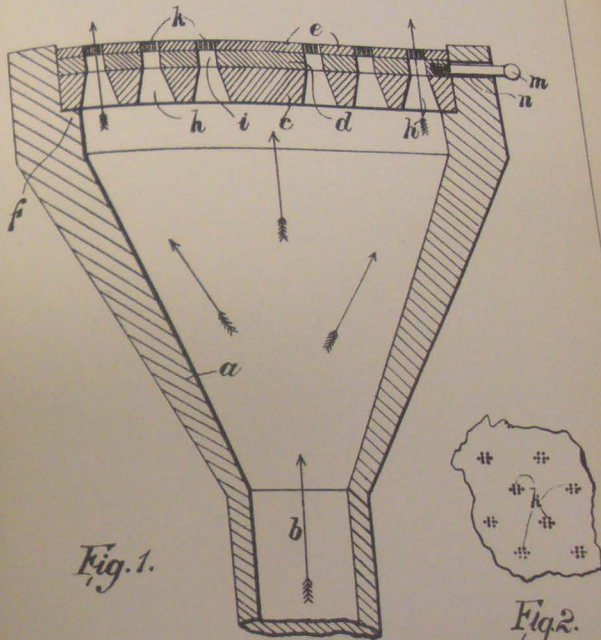
1. In processes of the type indicated involving bacteria, supplying the material to be treated with large numbers of small bubbles of a suitable gas, thereby maintaining the bacteria in a condition of maximum activity throughout the body of the material and accelerating the process substantially as described.
2. A process of sewage purification, consisting in spraying the sewage with large numbers of small bubbles of air or oxygen, substantially as and for the purpose described.
3. In a sewage purification plant, means for distributing large numbers of small bubbles of air or oxygen throughout the body of the sewage, substantially as and for the purpose described.
4. The spraying or atomising device hereinbefore described with reference to the accompanying drawings.

Dated this 15th day of March, 1905.

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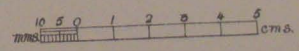
2nd Edition



[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 1.

Fig. 2.



4406