Specification of Henry Young Darracott Scott : treating and deodorizing sewage water.

Contributors

Scott, Henry Young Darracott.

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A.D. 1865, 31st OCTOBER. N° 2808.

SPECIFICATION

OF

HENRY YOUNG DARRACOTT SCOTT.

TREATING AND DEODORIZING SEWAGE WATER.

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A.D. 1865, 31st *October*. N° 2808.

Treating and Deodorizing Sewage Water.

LETTERS PATENT to Henry Young Darracott Scott, of Ealing, in the County of Middlesex, Lieutenant-Colonel in the Royal Engineers, for the Invention of "IMPROVEMENTS IN THE TREATMENT AND DEODORIZATION OF SEWAGE WATER."

Sealed the 24th April 1866, and dated the 31st October 1865.

PROVISIONAL SPECIFICATION left by the said Henry Young Darracott Scott at the Office of the Commissioners of Patents, with his Petition, on the 31st October 1865.

I, HENRY YOUNG DARRACOTT SCOTT, of Ealing, in the County of Middlesex, Lieutenant-Colonel in the Royal Engineers, do hereby declare the nature of the said Invention for "IMPROVEMENTS IN THE TREATMENT AND DEODORIZATION OF SEWAGE WATER," to be as follows:—

The object of this Invention is to provide a method of getting rid in a cheap and efficient manner of the nuisance and danger attendant upon the discharge of fluid sewage matter into our rivers and as a manure over our fields. The methods of deodorization hitherto employed by means of lime or metallic salts have either been imperfect from the inefficiency of the remedy, or have been abandoned on account of their expense. The lime process yields with sewage matter a precipitate and deposit which is harmless when dry, but

in the process of drying smells very offensively, and the liquid sewage which passes off is temporarily deodorized, but after a time it undergoes changes by which fetid gas is again evolved. In great part the offensive smell of sewage is due to sulphuretted hydrogen, and on this account certain soluble metallic salts, particularly perchloride or sulphate of iron, have been recommended as deodorizers, since such salts not only precipitate the phosphoric and carbonic acid of sewage waters, carrying down with the phosphates and carbonates formed the flocculent suspended matter, but lock up in a quite innocuous form the sulphuretted hydrogen they come in contact with. The latter mode of treating the sewage matter is therefore considered far more satisfactory than any other that has been attempted, but its expense is a serious objection to its use.

Now my Invention consists in doing with lime, a comparatively cheap material, that which lime will effect as well as metallic salts, and supplementing its action with the properties which the far more costly metallic salts possess of locking up in a harmless form the noxious sulphuretted hydrogen. It is not sufficient to throw into the sewage water compounds consisting of lime and metallic salts, or to add them simultaneously to the fluid sewage, as has sometimes been proposed, for the lime by precipitating the bases of the metallic salts as oxides temporarily neutralizes their tendency to seize hold of the sulphuretted hydrogen. The lime, therefore, must be allowed first to do its work on the phosphoric acid and carbonic acid present, and to this end I subject the sewage water to the action of the lime in a receptacle which I will designate reservoir No. 1. When the required deposit is obtained I run off the supernatant liquid into reservoir No. 2, and subject it then to the action of sulphate or perchloride of iron, either of which salts will seize upon the sulphur of the soluble sulphurets contained in the liquor. In this manner the effluent sewage may be reduced to a harmless condition, but where it is necessary also to deodorize that portion of the sulphuret of calcium and other sulphurets which remain mechanically mixed up with the lime precipitates and deposit in reservoir No. 1, I proceed as follows:—I have already stated that so far as the effluent liquid is concerned the metallic salt is wasted, and the deodorizing not permanently effectual if the metallic salt and the lime be applied together, since the metallic oxide thrown down by the alkaline earth will not instantaneously combine with the sulphur of soluble sulphuretted compounds, which will be discharged as such into watercourses and be removed from the action of the iron oxide. Nevertheless if time and opportunity be given such combination will take place, and it is only necessary to procure the intimate admixture of hydrated metallic oxides with the deposited sludge of

the lime precipitate to ensure that the sulphurets entangled with it shall gradually give up their sulphur to them. To bring this about the metallic salt (that which I prefer using in order to obtain the hydrated oxide of iron being the sulphate) should be stirred in with the milk of lime before it is added to the sewage water, for if thrown in with it a portion of the metal will be taken up by the phosphoric or carbonic acids of the sewage to form phosphates and carbonates of iron, which are not so readily decomposed again by sulphur compounds as soluble salts of iron, and thus unnecessary expenditure of iron will take place.

The next portion of my Invention consists in the arrangements by which I prefer (though as above appears I do not limit myself to these arrangements) to bring the precipitating and chemical agents into contact with the sewage matter. For this purpose I prefer using these agents combined in a consolidated form, the blocks or pieces being of such shape and size as will permit of their being piled together to form filter beds. While thus serving as a filter the blocks or pieces will under the action of the flowing liquid gradually pass into solution, and the portions dissolved will act as precipitants (I suppose the grosser fecal matters to be caught in depositing tanks and wicker or other separations and rough filters before my treatment begins). In bringing the lime into the form of sufficient firmness for the purpose I make use of 5 to 10 per cent. of sulphate of iron, which salt when intimately mixed with finely divided lime will, the lime being somewhat dead, control its violence of action on its being made into paste with water so far as to enable it to harden, slaking and setting simultaneously, after the manner of a cement. The blocks or pieces so prepared will contain the hydrated oxide of iron necessary to purify the sludge which will be precipitated with it as the water acts upon the lime. The sulphate of lime resulting from the decomposition of the sulphate of iron contained in the sewage water will also tend to prevent the expulsion of ammonia. In making use of the pieces of lime compound thus prepared I vary my arrangements according to the nature of the sewage and its comparative freshness. If comparatively free from flocculent matter I employ the blocks or pieces as flints and clinkers are employed in filtration, but if I fear the choking of the filters I make use of a series of screens or cases of wicker or iron work, which will retain the pieces of lime until they are dissolved, so as to allow of the percolation of a portion only of the sewage matter through them whilst the main portion passes through narrow channels formed by the screens, and these channels are so arranged as to turn the fluid in its passage between them from side to side, and secure an intimate mingling of the dissolved lime with the sewage matter.

Scott's Improvements in the Treatment and Deodorization of Sewage Water.

To remove the sulphuretted hydrogen of the effluent sewage water I prefer using sulphate of iron, because that salt can be procured at a cheap rate and in crystals, which will admit of being used as I have above proposed to use the pieces of lime compound arranged as a filter or in screens, and both in the case of the lime and the iron salt I propose to provide my filters with self-feeding hoppers for maintaining the filter beds in proper condition.

I have now to allude to certain modifications of my processes. In lieu of milk of lime prepared from fat limes which readily slake abroad, I sometimes propose to use dolomitic limes; or again, lime compounds of the nature of cements, which after calcination will not slake to powder, but if ground to a powder and mixed in with the sewage water will act to a certain extent in the same manner, and will give consistency to the sewage deposits. Such compounds usually contain iron oxide which will slowly in the presence of sulphuretted hydrogen form sulphide of iron; they also contain substances useful as manure.

Similar compounds may be sometimes used in pieces in lieu of the artificial lime compounds above described to form filters for the sewage matter.

In forming the artificial pieces of lime compound above described I sometimes mix in 10 or 15 per cent. of sulphate of lime, which will also control its slaking, or 10 or 15 per cent. of chloride of sodium, or 5 to 10 per cent. of perchloride of iron, which will render the pieces more soluble, and themselves act as disinfectants; or I may add 5 to 10 per cent. of carbolic acid in manufacturing the pieces on account of its supposed effect on nitrogenous matter.

Again, in lieu of employing crystals of sulphate of iron for the second part of the disinfecting process I may employ a compound of perchloride of iron or of sulphate of iron and artificial gypsum made into pieces which would be less readily soluble than crystals of sulphate of iron. The beneficial effects of gypsum on certain crops is well ascertained, and when the sewage is to be applied to irrigation the sulphate of lime would not be wasted. In the preparation of such pieces of artificial gypsum and iron salts I merely mix dehydrated sulphate of lime or plaster of Paris with a solution of the iron salt in the right proportion to make a paste on solidification, and they are fit for use. Carbolic acid or chloride of sodium may also be sometimes advantageously mixed with the paste from which the blocks or pieces of this compound are to be formed.

Scott's Improvements in the Treatment and Deodorization of Sewage Water.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said Henry Young Darracott Scott in the Great Seal Patent Office on the 30th April 1866.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, HENRY YOUNG DARRACOTT SCOTT, of Ealing, in the County of Middlesex, Lieutenant-Colonel in the Royal Engineers, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Thirty-first day of October, in the year of our Lord One thousand eight hundred and sixty-five, in the twenty-ninth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Henry Young Darracott Scott, Her special licence that I, the said Henry Young Darracott Scott, my executors, administrators, and assigns, or such others as I, the said Henry Young Darracott Scott, 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 DEODORIZATION OF SEWAGE WATER," upon the condition (amongst others) that I, the said Henry Young Darracott Scott, 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 Henry Young Darracott Scott, do hereby declare the nature of my said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement, reference being had to the Drawing hereunto annexed, and to the letters and figures marked thereon (that is to say):—

The object of this Invention is to provide a method of getting rid in a cheap and efficient manner of the nuisance and danger attendant upon the discharge of fluid sewage matter into our rivers or when used as a manure over our fields. The methods hitherto employed for deodorizing sewage by means of lime or certain soluble metallic salts have either been imperfect from the inefficiency of the remedy, or have been abandoned on account of their expense. The mixture of lime with sewage matter yields a precipitate and deposit which is harmless when dry, but during the process of drying

emits a very offensive smell, and the liquid sewage which passes off is only temporarily deodorised, as after a time it undergoes changes by which fetid gas is again evolved. The offensive smell of sewage is mainly due to the presence of sulphuretted hydrogen, and on this account certain soluble metallic salts of iron, zinc, and manganese, particularly perchloride or sulphate of iron, have been recommended as deodorisers, since such salts not only precipitate the phosphoric and carbonic acid of sewage waters and carry down with the phosphates and carbonates thus formed the flocculent suspended matter, but lock up in an innocuous form the sulphuretted hydrogen they come in contact with. The latter mode of treating the sewage matter is therefore considered far more satisfactory than any other that has been attempted, but its expense is a serious objection to its use.

Now my Invention consists in effecting with lime (which is a comparatively cheap material) that which lime will do as well as metallic salts, and then supplementing its action with the properties which the far more costly metallic salts, such as soluble salts of iron, manganese, zinc, and copper possess of locking up in a harmless form the noxious sulphuretted hydrogen. It is not sufficient to throw into the sewage water compounds consisting of lime and metallic salts or to add them simultaneously to the fluid sewage as has sometimes been proposed, for the lime by precipitating the bases of the metallic salts as oxides temporarily neutralizes their tendency to seize hold of the sulphuretted hydrogen. The lime therefore must be allowed first to do its work on the phosphoric and carbonic acid present, and to this end I subject the sewage water to the action of the lime in a receptacle which I will designate reservoir No. 1; when the required deposit is obtained I run off the supernatant liquid into reservoir No. 2, and then subject it to the action of sulphate or perchloride of iron, which I prefer to the other salts named, and either of which salts will seize upon the sulphur of the soluble sulphurets contained in the liquor. In this manner the effluent sewage may be reduced to a harmless condition, but where it is necessary also to deodorize that portion of the sulphuret of calcium and other sulphurets which remain mechanically mixed up with the lime precipitates and deposit in reservoir No. 1, I proceed as follows:—I have already stated that so far as the effluent liquid is concerned the metallic salt is wasted and the deodorizing process will not be permanently effectual if the metallic salt and the lime be applied together, because the metallic oxide thrown down by the alkaline earth will not instantaneously combine with the sulphur of the soluble sulphuretted compounds; these latter will therefore be discharged unchanged into the water courses, and thus be placed beyond the action of the iron oxide. Nevertheless

if time and opportunity be given the required combination will take place, and it will only be necessary to procure the intimate admixture of the hydrated metallic oxides with the deposited sludge of the lime precipitate in order to ensure that the sulphurets entangled with it shall gradually give up their sulphur to such metallic oxides. To effect this object the metallic salt (that which I prefer to use in order to obtain the hydrated oxide of iron being the sulphate) should be well mixed with the milk of lime before it is added to the sewage water, for if the metallic salts be thrown into the sewage water with the lime without being previously mixed with the latter a portion of the metal will be taken up by the phosphoric or carbonic acids of the sewage to form phosphates and carbonates of iron, which are not so readily decomposed again by sulphur compounds as the hydrated oxide of iron.

The next portion of my Invention relates to a novel mode of applying the precipitating and chemical agents so as to bring them into contact with the sewage matter in a suitable manner. For this purpose I prefer to use these agents combined in a consolidated form, the blocks or pieces being of such shape and size as will permit of their being piled together to form filter beds.

In the accompanying Drawing I have shewn a convenient arrangement of apparatus for effecting the object of my Invention. Fig. 1 is a vertical section representing one of the filtering chambers in which the consolidated blocks of lime compound are placed. *a*, *a*, is a hopper into which the blocks are thrown indiscriminately, and from whence they descend into the filtering chambers *b*, *b*, which may be formed of perforated metal or other suitable material. The lumps of lime compound prepared in the manner already described when placed in the hopper descend into the vertical filtering chambers and are there exposed to the action of the effluent sewage water as it flows through the filters. These filtering chambers are provided with sluices or gates *c*, *c*, from which any sludge or deposit that may accumulate at the bottom of the filtering chamber may be removed by lifting up the sluices or gates *c*, *c*, by means of the rods and handles c^1, c^1. It will now be understood that while serving as a filter the blocks or pieces will, under the action of the flowing liquid, gradually pass into solution, and the portions dissolved will act as precipitants on the sewage water. The grosser fecal matters may be caught in depositing tanks and wicker or other separating apparatus or rough filters before my treatment begins. In bringing the lime into the form of sufficient firmness for the purpose I make use of five to ten per cent. of sulphate of iron, which salt when intimately mixed with finely divided lime will (the lime being somewhat dead) control its violence of action on its being made into

paste with water so far as to enable it to slake, harden, and set simultaneously after the manner of a cement. The blocks or pieces so prepared will contain the hydrated oxide of iron necessary to purify the sludge which will be precipitated with it as the water acts upon the lime. The sulphate of lime resulting from the decomposition of the sulphate of iron will also tend to prevent the expulsion of ammonia from the sewage water. In making use of the pieces of lime compound thus prepared I vary my arrangements according to the nature of the sewage and its comparative freshness. If comparatively free from flocculent matter I employ the blocks or pieces as flints and clinkers are employed in filtration, but if there be reason to fear the choking of the filters I make use of a series of screens or cases of wicker or iron work, which will retain the pieces of lime until they are dissolved so as to allow of the percolation of a portion only of the sewage matter through them, whilst the main portion passes through narrow channels formed by the screens, and these channels are so arranged as to turn the fluid in its passage between them from side to side, and secure an intimate mingling of the dissolved lime with the sewage matter.

This arrangement is shewn in the sectional plan view, Fig. 2, in which *d* is a tank provided with a vertical perforated screen *e*, whereby the grosser fecal matters are arrested and caused to be deposited in the tank *d*. Part of the liquid sewage which passes through the screen *e* will pass straight through the vertical filters *b*, which are constructed in the manner shewn in the enlarged view, Fig. 1, and another part of the sewage will pass in a serpentine line between the filters, and in so doing will become mixed with the other portion which has been acted on by the lime compounds in the filters, so that the whole mass of sewage will be acted upon by the lime compound. The bed or bottom on which the vertical filters *b*, *b*, rest is sloped downwards towards the tank *f* in which the precipitate occasioned by the action of the lime in the filters *b*, *b*, is deposited, and may be cleared out from time to time. A second set of filters *g*, *g*, are placed at the further end of the tank *f*, and are charged with the metallic salt precipitant. The distance between the filters *b* and *g* must depend upon the ordinary condition of the sewage water. To remove the sulphuretted hydrogen of the effluent sewage water I prefer using sulphate of iron, because that salt can be procured at a cheap rate and in the form of crystals, which will admit of the metallic salt being used in the manner above described in reference to the use of the pieces of lime compound, that is, arranged as a filter or in screens, or as both combined, in the case of the lime and the iron salt. The filters

are to be provided with self-feeding hoppers for maintaining the filter beds in proper condition as the lime and iron salt is washed away.

As regards certain modifications of the first portion of my process above described, in lieu of milk of lime prepared from fat limes which readily slake abroad I sometimes propose to use dolomitic limes or a lime compound of the nature of cements, which latter after calcination will not slake to powder; but if ground to a powder and mixed in with the sewage water will act to a certain extent in the same manner, and will give consistency to the sludge deposits. The latter compounds usually contain iron oxide which, in the presence of sulphuretted hydrogen, will slowly form sulphide of iron; they also contain substances useful as manure.

Similar compounds may sometimes be used in pieces in lieu of the artificial lime compounds above described to form filters for the sewage matters.

In forming the artificial pieces of lime compound above described I sometimes mix in ten or fifteen per cent. of sulphate of lime, which will also control the slaking of the quicklime, or ten or fifteen per cent. of chloride of sodium, or five to ten per cent. of perchloride of iron, which will render the pieces more soluble, and will themselves act as disinfectants. Sometimes I add five to ten per cent. of carbolic acid in manufacturing the pieces on account of its disinfecting properties.

Instead of employing crystals of sulphate of iron for the second part of the disinfecting process I sometimes employ a compound of perchloride of iron, or of sulphate of iron and artificial gypsum made into pieces, which would be less readily soluble than crystals of sulphate of iron. The beneficial effects of gypsum as a manure for certain crops is well known, and when the sewage is to be applied to irrigation the sulphate of lime would be found a useful adjunct. In the preparation of such pieces of artificial gypsum and iron salts I merely mix dehydrated sulphate of lime or plaster of Paris with a solution of the iron salt in the right proportion to make a paste on solidification. Carbolic acid or chloride of sodium may also be sometimes advantageously mixed with the paste from which the blocks or pieces of this compound are to be formed.

Having now described my Invention of improvements in the treatment and deodorization of sewage water, and having explained the manner of carrying the same into effect, I claim, as the Invention secured to me by Letters Patent as aforesaid, treating sewage water first with lime, and afterwards with metallic salts, as herein set forth.

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Second, I claim preparing lime compounds in a solid form as herein set forth, for the purpose of applying such compounds for the treatment and deodorization of sewage water.

In witness whereof, I, the said Henry Young Darracott Scott, have hereunto set my hand and seal, the Thirtieth day of April, in the year of our Lord One thousand eight hundred and sixty-six.

HENRY Y. D. SCOTT. (L.S.)

Witness,

FRED. WALKDEN,

66, Chancery Lane.

LONDON:
Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty. 1866.

A.D. 1865, Oct. 31, N° 2808
SCOTT'S Specification

(1 SHEET)

FIG. 1.

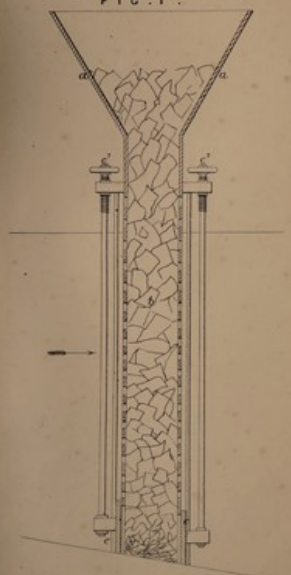
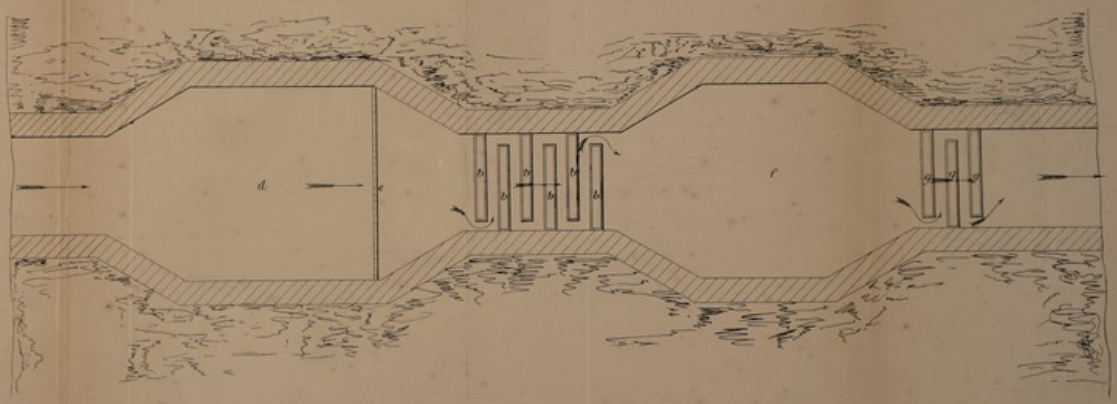


FIG. 2.



The filed drawing is colored.

Drawn on Stone by Maltby & Sons

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Printers to the Queen's most Excellent Majesty. 1866.