

## **Specification of Charles Felton Kirkman : treating sewage.**

### **Contributors**

Kirkman, Charles Felton.

### **Publication/Creation**

London : Great Seal Patent Office, 1871 (London : George E. Eyre and William Spottiswoode)

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A.D. 1870, 6th OCTOBER. N° 2653.

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S P E C I F I C A T I O N

OF

CHARLES FELTON KIRKMAN.

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TREATING SEWAGE.

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LONDON:

PRINTED BY GEORGE E. EYRE AND WILLIAM SPOTTISWOODE,  
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY:

PUBLISHED AT THE GREAT SEAL PATENT OFFICE,  
25, SOUTHAMPTON BUILDINGS, HOLBORN.

1871.







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A.D. 1870, 6th OCTOBER. N° 2653.

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### **Treating Sewage.**

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**LETTERS PATENT** to Charles Felton Kirkman, of High Street, Islington, in the County of Middlesex, Gentleman, for the Invention of "**IMPROVEMENTS IN TREATING SEWAGE, AND IN THE APPARATUS AND MEANS EMPLOYED THEREIN.**"

Sealed the 31st December 1870, and dated the 6th October 1870.

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**PROVISIONAL SPECIFICATION** left by the said Charles Felton Kirkman at the Office of the Commissioners of Patents, with his Petition, on the 6th October 1870.

I, CHARLES FELTON KIRKMAN, of High Street, Islington, in the  
5 County of Middlesex, Gentleman, do hereby declare the nature of the said Invention for "**IMPROVEMENTS IN TREATING SEWAGE, AND IN THE APPARATUS AND MEANS EMPLOYED THEREIN,**" to be as follows :—

This Invention has for its object to separate from the useful fertilising properties contained in sewage those matters such as sand, gravel, which  
10 are useless as manure. The substances thus removed from the sewage are divided into several catagories and are disposed of for other purposes.



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The manurial particles in the sewage are at the same time preserved therein and are subsequently removed by other processes and converted into artificial manure. For this purpose I cause the sewage to pass from the main sewer or branches thereof into machines or apparatus in which the sand, grit, and other heavy matter will be retained and separated 5 from the sewage water which with the flocculent matter will continue flowing uninterruptedly through the apparatus.

The apparatus consists of a series of inclined screens placed one under the other. These screens are of different degrees of fineness, the coarsest being uppermost. At the lower part of each screen an opening is made 10 through the sides of the apparatus through which the solid substances released by each separate screen are conducted through separate channels to any suitable receptacle, leaving the liquid to run away to another apparatus.

The object of this Invention is to separate effectually, rapidly, and 15 economically the detritus of the roads from the flocculent matter of sewage, which is then conveyed to close disinfecting chambers. Carbonic acid gas obtained by the combustion of fuel or by the decomposition of any suitable cheap carbonate (such as carbonate of lime) by means of a cheap acid is supplied to the disinfecting chambers and made to bubble 20 up through the sewage water, whereby they become innocuous. The flocculent matter being deposited the aqueous portion is then to be forced into filters or absorbing beds charged with an earthy mineral such as calcined brick, earth, clay, broken bricks, or unglazed pottery, which will act as a filter and will attract and retain the ammonia and other fer- 25 tilizing salts which are held in solution by the sewage. The liquid sewage is passed through a chamber in which are suspended pairs of zinc and copper plates or gratings which by their voltaic action will set up a stream or continuous current of electricity through the sewage water and will materially aid in freeing it from its manurial properties. The 30 supernatant or pure water will then pass off pure, and will be available for domestic use, for irrigating land, charging fire mains, manufacturing or other purposes. When the calcined earthy matters are sufficiently charged with ammonia and other manurial salts they will be removed from the absorbing beds, and when disintegrated they may be added to 35 the dry sewage refuse deposited by the previous operation, and when mixed in suitable proportions to suit particular soils and crops they may be used as a fertilizing manure.

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**SPECIFICATION** in pursuance of the conditions of the Letters Patent, filed by the said Charles Felton Kirkman in the Great Seal Patent Office on the 6th April 1871.

**TO ALL TO WHOM THESE PRESENTS SHALL COME**, I, CHARLES FELTON KIRKMAN, of High Street, Islington, in the County of Middlesex, Gentleman, send greeting.

**WHEREAS** Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Sixth day of October, in the year of our Lord One thousand eight hundred and seventy, in the thirty-fourth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Charles Felton Kirkman, Her special licence, that I, the said Charles Felton Kirkman, my executors, administrators, and assigns, or such others as I, the said Charles Felton Kirkman, 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 TREATING SEWAGE, AND IN THE APPARATUS AND MEANS EMPLOYED THEREIN**," upon the condition (amongst others) that I, the said Charles Felton Kirkman, 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 Charles Felton Kirkman, 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) :—

My Invention of improvements in treating sewage and in the apparatus employed therein has for its object to separate from the useful fertilizing properties contained in sewage water those solid matters (such as sand and gravel) which are useless as manure. The solid substances when removed from the sewage are divided into several



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categories and are disposed of for other purposes. The manurial particles in the sewage are at the same time preserved therein, and are subsequently removed by other processes and are converted into artificial manure.

In the accompanying Drawing Fig. 1 represents a plan view and 5 Fig. 2 a sectional elevation of an apparatus by which I separate from the useful fertilizing properties contained in sewage those substances such as sand, gravel, sticks, stones, and other solid matters which are useless as manure. Fig. 3 is a vertical section of a close disinfecting chamber, wherein the flocculent matter of sewage is disinfected and 10 precipitated by means of carbonic acid gas; Fig. 4 represents a filtering chamber and absorbing bed by which the ammonia and other manurial salts will be extracted from the water.

In carrying out my Invention the sewage coming from a main sewer or branch of a main sewer is caused to flow down a spout *a* into the appa- 15 ratus shewn at Figures 1 and 2, through which the liquid portion will pass, leaving the sand, grit, and other heavy matters behind on the screens *b, b, b*. This apparatus may be circular, square, octagon, or other shape, and it consists, mainly of a vibrating framework *c, c*, which at its lower end is provided with a sleeve shaft *c<sup>5</sup>*, and is supported on a vertical pin 20 fixed in the cross bar *c<sup>6</sup>*. The frame is kept steady by a centre pin *c<sup>5\*</sup>* above, and in the frame are mounted (in an inclined position) the series of screens *b, b, b*, of different degrees of fineness. These screens are placed one under the other, the coarsest being uppermost, and at the lowermost part of each screen is a mouth, spout, or opening *b<sup>1</sup>*, through 25 which the solid substances retained by each screen are conducted by separate channels to any suitable receptacle as *d, d<sup>1</sup>, d<sup>2</sup>*. In order to shake the solid matters off the screens as they accumulate thereon a horizontal vibrating motion is imparted to the frame *c, c*, by means of a crank pin *c<sup>1</sup>* on the rotating disc *c<sup>2</sup>*, being made to take into the vertical 30 slot of a bar *c<sup>3</sup>*, the lower end of which is inserted in a hole in the upper part of the framing *c*, as shewn best in the detached view Fig. 5. Upon communicating rotary motion to the shaft upon which the pin disc *c<sup>2</sup>* is mounted the slotted bar *c<sup>3</sup>* will be reciprocated in its guides *c<sup>4</sup>*, Fig. 5, and the frame *c* will be vibrated horizontally on its vertical 35 centres *c<sup>5</sup>, c<sup>5\*</sup>*. The liquid matters pass away into a well *e* below, from which they will then be raised by an endless chain of buckets *f, f*, or by a pump, and will be conducted to a close disinfecting chamber *g*, Fig. 3,



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in which, by the application of carbonic acid gas generated in the vessel *h*, the sewage water will be disinfected and become innocuous. Carbonic acid gas is found imprisoned in an exceedingly condensed form in all earthy carbonates, more particularly in carbonate of lime, its immense  
5 volume when liberated from the earthy matters by means of an acid will give a power equal to six hundred pounds on the square inch, and with suitable apparatus will force water one thousand two hundred feet high, therefore, when the sewage has been relieved of all solid matter, such as sand, grit, stones, sticks, &c., it may be advantageously used  
10 in a liquid form as sewage manure, the elastic force of the carbonic acid gas when generated under pressure affording an inexpensive means, by which it can be conveyed from the close disinfecting chamber to surrounding farms, and to lands otherwise beyond the reach of liquid distribution by gravitation. This liquid sewage may also be used for  
15 watering plants and crops when most needed, and the water being impregnated with carbonic acid gas, the vegetative power of the sewage will be increased in an extraordinary degree. When not wanted for vegetation the flocculent matter may be deposited, and the aqueous portion forced into filters or absorbing beds, such as that shewn at  
20 Fig. 4, where it will be freed from its manurial properties, and will then pass off pure, and be available for domestic use, for irrigating lands, or charging fire mains or for manufacturing and other purposes. The close disinfecting chambers (in which considerable pressure is maintained by the elastic force of the carbonic acid gas, and wherein the gas and  
25 sewerage water are mixed) are provided with safety valves and levers for the purpose of allowing the escape of gas when any excess of pressure arises.

The great difficulty in or prejudice against the liquid application of sewage is that farmers are not able to use it as and when they wish,  
30 but are obliged to take it at all times, but by this process when the sewage is not wanted it will be conveyed into filters, shewn at Fig. 4, where the absorbing beds through which the sewage is made to pass in a serpentine direction are charged with an earthy mineral, such as calcined brick, earth, pottery waste, or broken bricks, which will act as filters  
35 and also attract and retain the ammonia and other fertilizing salts which are held in solution by the sewage. When these earthy matters are fully charged with ammonia or other fertilizing salts they may be removed from the filtering chamber and when pulverized they may be used as a



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manure for some crops or lands, or they may be mixed if desired with the flocculent matters which subside in the vessels or chambers *g*, and which may be drawn off at the bottom into the trough *g*<sup>1</sup>. In order to facilitate the removal of the earthy matters from the filters they are contained in cages which may be lifted out bodily, for which purpose they are 5 provided with rings to which tackle may be attached. On its way to the filtering chambers (shewn at Fig. 4), the liquid sewage passes through a chamber *i*, in which are suspended voltaic batteries composed of pairs of zinc and copper plates or gratings. One of these batteries is shewn detached in side elevation at Fig. 6 and end elevation at Fig. 7. 10 Between the pairs of zinc and copper plates are layers of flannel, woollen cloth, or felt, and by the voltaic action set up by this battery a stream or continuous current of electricity is made to pass through the sewage water, and will thereby materially aid in freeing it from its manurial properties. This horizontal pile is considered a perpetual electric machine, and it is 15 very efficient and convenient. The metal plates are square and are set lozenge fashion, the lower points resting between two strips of glass *l*, *l*, fixed on a long board *k*, *k*, and are supported by side rails of baked wood, varnished, as indicated in the end elevation Fig. 7. The side rails are secured to blocks *m*, *m*, at the extremities of the base *k*. Two screws, 20 one at each end, pass through these terminating blocks by which the series may be a little compressed, they serve also as the conducting terminations of the pile, and from these points shocks and all other electrical effects of the pile may be obtained.

Volta's pile as is well known is constructed of thin circular or square 25 plates of zinc and copper about two inches square, and a corresponding number of pieces of common cloth, felt, or flannel of somewhat less dimensions than the plates. The cloth of a voltaic pile is usually kept moistened with salt water or any saline solution. For my purpose the sewage water itself is sufficiently saline to keep up the electric action. 30 For constructing the pile the zinc plates should be carefully cleaned and then a plate of copper should be placed on a convenient insulating base, and upon this a plate of zinc, then upon this a disc of moist cloth, then commence again with another plate of copper upon the cloth, then a plate of zinc, then another piece of moist cloth, and so on in series 35 until we arrive at a terminating plate of zinc, the result is a self-acting electrical machine, powerful in proportion to the extent and number of the series. The water when deprived of its ammonia and other soluble



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salts will then pass off pure, and be available for domestic use, or for irrigating land, watering streets, or charging fire mains, or for manufacturing or other purposes.

The arrangement of the apparatus whereby the objects of my Invention may be effected admits of considerable modification, and must depend not only upon the quantity of sewage matter to be operated upon, but also upon the convenience of the locality and other circumstances; I do not therefore intend to confine myself to the precise details described, as many alterations as to dimensions and arrangement of parts may be made without in any way departing from the principle of the Invention, and I wish it to be understood that I do not claim generally the manufacture of artificial manure from sewage matter; but what I consider to be new and therefore desire to claim as the Invention secured to me by Letters Patent as aforesaid is, the combination of processes or operations and general arrangement of the several apparatus herein set forth, or any mere modification thereof, whereby the useful manurial properties of sewage water may be extracted therefrom without admixture with the sand, gravel, stones, and other solid substances which are not required and are not useful as manure.

20 In witness whereof, I, the said Charles Felton Kirkman, have hereunto set my hand and seal, the Fifth day of April, in the year of our Lord One thousand eight hundred and seventy-one.

C. F. KIRKMAN. (L.S.)

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Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,  
Printers to the Queen's most Excellent Majesty. 1871.







FIG. 1.

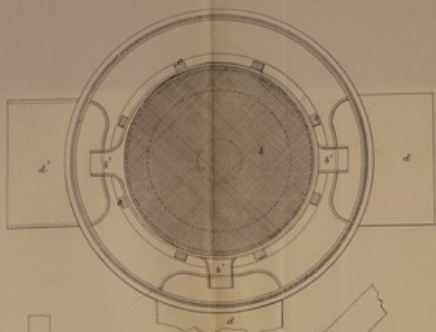


FIG. 2.

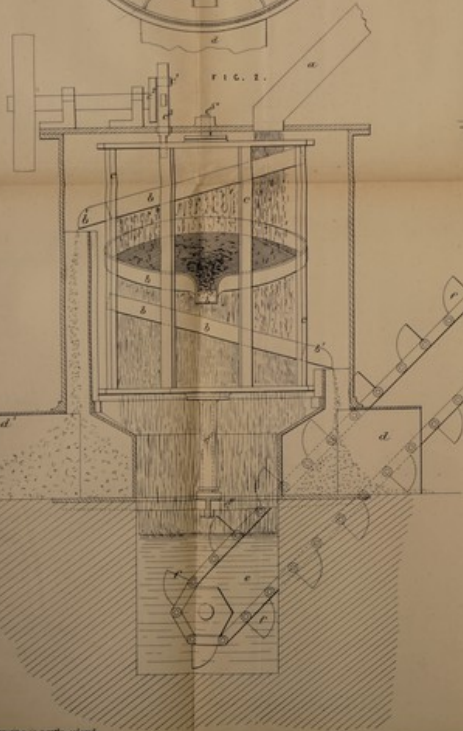


FIG. 3.



FIG. 4.

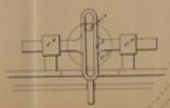


FIG. 5.



FIG. 6.

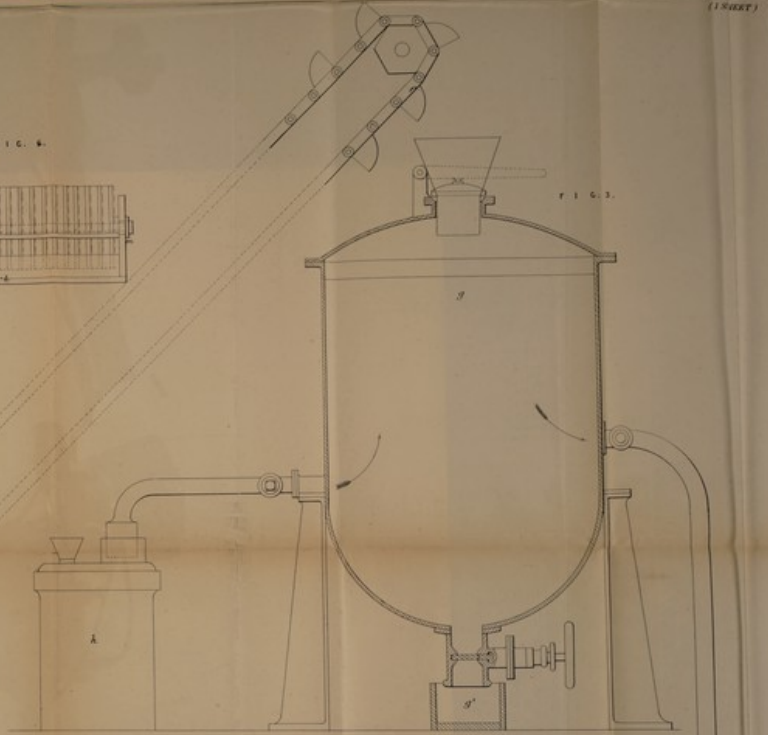


FIG. 7.

