Specification of John Hughes Lloyd : utilizing and deodorizing sewage matters.

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A.D. 1870, 20th JULY. N° 2047.

SPECIFICATION

OF

JOHN HUGHES LLOYD.

UTILIZING AND DEODORIZING SEWAGE MATTERS.

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Utilizing and Deodorizing Sewage Matters.

LETTERS PATENT to John Hughes Lloyd, M.D., of Llangefni, in the County of Anglesey, North Wales, for the Invention of "IMPROVEMENTS IN UTILIZING AND DEODORIZING SEWAGE MATTERS OF DWELLING HOUSES AND OTHER PLACES, AND IN APPARATUS TO BE USED IN CONNEXION WITH THE SAME."

Sealed the 17th January 1871, and dated the 20th July 1870.

PROVISIONAL SPECIFICATION left by the said John Hughes Lloyd at the Office of the Commissioners of Patents, with his Petition, on the 20th July 1870.

I, JOHN HUGHES LLOYD, M.D., of Llangefni, in the County of Anglesey, North Wales, do hereby declare the nature of the said Invention for "IMPROVEMENTS IN UTILIZING AND DEODORIZING SEWAGE MATTERS OF DWELLING HOUSES AND OTHER PLACES, AND IN APPARATUS TO BE USED IN CONNEXION WITH THE SAME," to be as follows:—

This Invention consists in certain improvements upon an Invention for which Letters Patent were granted to me entitled "Improvements

in Utilizing and Deodorizing Sewage Matters of Dwelling Houses and other Places, and in Apparatus to be used in connection with the same," dated the Twenty-sixth day of June 1857, No. 1793. That Invention consisted in applying the waste or refuse of fire-places in houses and other places, either alone or in combination with lime to correct or remedy the nuisance produced by the sewage of houses especially by human excretions, and thereby reduce them to a harmless and inoffensive state, so as to be easily removable with such refuse and so be used as manure or for other purposes. By the waste refuse was meant what is generally called the sifted ashes or breeze, and more or less the whole of the cinders at times to be used either as they usually occur or more or less ground or pounded, and either alone on combined with quicklime in certain proportions and assisted in certain circumstances by small quantities of the chloride of lime of commerce or burnt sulphate of lime or burnt clay.

In the Specification of that Invention I stated that the useful action of the substances above mentioned require changes in the closets, middens, necessaries, and cesspools now in common use. Where water-closets or night chairs or privies are now used it will not be necessary to use water at all according to this plan, the very principle of which is to get rid of all the water contained naturally in the excretions and so prevent the possibility of putrefaction. I proposed to use inside of closets and night chairs, and beneath the seats of privies metallic or other pans of sizes convenient to be introduced and removed therefrom, the pans being generally of a square shape from a cubic foot upwards in dimensions and divided by a curved or other shaped partition in such a position with regard to the circular opening of the seat as effectually to separate the fæces and urine as they fall for enabling them to be acted upon separately.

One form of closet by which I proposed to carry out the principles above described consisted of a metallic or other vessel with a curved partition so dividing the vessel and bisecting the circle of the seat that all urine shall fall in front of the partition and all fæces behind, each to be acted upon by the deodorizing materials. In this case the materials were added each time after the closet had been used by means of a ladle or other convenient instrument.

In another form of closet I placed the pan in a suitable case having a seat and cover, and made the partition in the pan straight, bisecting

the circle of the seat, and rising up to a certain distance, when it was met by a broad flat valve when the closet was not in use and covered the hinder compartment. When the closet had to be used the valve was opened by a handle like that of an ordinary watercloset, or by the weight of the person using the closet acting upon springs in communication with multiplying levers. In either case I made the movement of the valve assist in introducing the deodorizing materials spontaneously in the following manner:—Behind the axis of the valve there was another axis carrying a cylinder with several pockets upon it, and by means of two toothed wheels and a ratchet wheel the cylinder was made to revolve in one direction, and that only during the closure of the valve; behind and above the seat there was a box or feeder filled at proper times with the deodorizing material and placed above the cylinder with which it communicated by an opening, and as the cylinder revolved the deodorizing material fell into the pan or receptacle of the closet, first falling into a chamber or pocket behind the valve, by the motion of which it was well carried forward into the closet.

The object of my present Invention is the same as my former one, namely, to correct or remedy the nuisance produced by human excretions and thereby reduce them to a harmless and inoffensive state, but my present improvements enable this object to be attained with greater economy and efficiency than heretofore.

I employ the waste or refuse of fire-places before described either alone or mixed with other disinfectants as herein-after described, and by preference I adopt the system of having two compartments for the excretions, one for the fæces and the other for the urine, and these compartments are formed either of two separate vessels, or of one vessel having a partition.

I construct a simple and efficient closet by placing in a case or box three rectangular pans or vessels, two clasped together for receiving the excretions and the third for containing the ashes. Above the two for the excretions there is a seat, the circular opening of which is so placed that the fæces can fall into the back compartment and the urine into the front one, and above all there is a cover for covering the seat and ash-pan when the closet is not in use. In most cases I partially fill both compartments with the deodorizing ashes and other matters, and only make small additions as required, but by preference after each entrance of fæces into the back compartment they are covered with ashes or other

matters from the ash-pan by means of a ladle or other instrument, and when required the seat is either raised or removed and the pans taken up or taken out by a door in the front, side, or back for emptying their contents.

Another variety of this closet has the box for the deodorant or deodorants behind and above the closet having a small slit in the lower and front part of the box from which the deodorant can be taken and used with a ladle. In both these forms the seat is hinged to the back or side of the closet so that it may be raised and the powder used without being spilled upon it. In all moveable commodes like these the receptacles are placed in a wooden or other case, and the distance or height of the seat above the receptacles I find is best about six inches in order to allow them to be filled fully and to prevent the partition (when used) from interfering with the person when sat upon.

In another form I fix at the back of the seat a box, and place in bearings near the bottom a shaft carrying a valve and spreader worked one way by a handle and their reverse way by their own gravity. In the front pans of the closets for receiving the urine, and in pans used as independent urinals, I now use for each pan a pipe passing from the inside to the outside, the pipe being fixed at the inside near the bottom, and at the outside a short distance from the top it comes out and its outside end communicates by a pipe with a sewer or any other receptacle. The pan is nearly filled with ashes or other deodorants at times and a great part of the urine passed into it is at once absorbed, but the excess filters upwards through the ashes to the pipes outside, and by so doing becomes divested to a great extent of its salts and organic matters. But when ashes alone are used the overflow is a nearly pure solution of carbonate of ammonia and fit for many manufacturing purposes.

My next improvements relate to my former self-feeding closet before described. I employ a pan with a straight partition as before for forming two compartments, one for the fæces and the other for the urine, and use a valve for covering the back compartment when the closet is not in use, and this valve is worked one way by pressure on the seat and the other way by a weight or springs. The valve causes the fæces and other matters to be pushed back out of the closet. This action may also be performed by an archimedean screw or by the principle of concussion herein-after described. I place at the back of the seat a supply box or reservoir for containing the dry ashes or other deodorizing matter

there being near the bottom a semi-cylindrical valve or flap which can be opened and closed by hand when moved to be replenished, but instead of making the feeding cylinder with pockets I now make it plain, and place above and in front of it an adjustable slotted spring plate to be elevated or lowered as required for regulating the supply of ashes to the closet, the slots enabling the plate to yield readily and allow the passage of ashes or cinders larger than usual. I prefer that none of the cinders shall be larger that about one half inch. The valve has flaps at the sides and one where it meets the partition, and there are bands of india-rubber, cloth, or other suitable material to keep the valve tight when being closed and opened, in which latter position it is inclined about 60°.

Instead of making the pan portable as before, I now in many cases make it stationary and open at the back, and in the top of the front compartment I place sometimes an archimedean screw, on the shaft of which there is a chain wheel connected by a chain with a chain wheel on the shaft of the feeding cylinder, the wheels and chain being by preference outside the pan or case. In bearings at the bottom of the valve I place a shaft carrying a rake or hoe and fix at one end of the shaft an arm and roller which can be acted upon by a stationary cam at one side of the pan. At the back of the valve there is a pocket open at the top and bottom, and another smaller pocket open at the top but closed at the bottom by a small valve guarded by an india-rubber spring, and the dry ashes fall into these pockets when the feeding cylinder is turned forwards, the board or plate forming the bottom of the pockets being inclined about 40° when the valve is closed. The valve is worked by multiplying levers and rods in connection with the seat, and the cylinder is turned by means of one ratchet and two spur wheels in a forward direction only when the valve is being brought forward for closing and these parts are placed outside the pan or case. In the back compartment there is always a layer of ashes or deodorizing materials raised to the level of the inclined line of the backward movement of the rake, and there is also a layer or ashes in the front compartment which is renewed by the valves just described throwing fresh matter into it and removing a portion each time, and is made sometimes to pass it forwards for the purpose described. When the closet is not in use the valve is close to the partition and the back compartment is covered but when the seat is depressed the multiplying levers turn back the valve to uncover the back compartment for the reception of fæces, the

front compartment being always sufficiently open for the reception of the urine. When pressure is taken off the seat the weight or spring brings forward the valve and the feeding cylinder delivers a quantity of ashes to the pockets behind the valve, from the larger of which the ashes are thrown on the fæces, and from the smaller delivered through the opening of the small valve to the urine compartment; and as the feeding cylinder turns an archimedean screw (when used) is turned to push the surplus ashes from the front compartmeut to the back one. When the closet is next used and the valve turned back the rake or hoe pushes the covered fæces out of the compartment to a pipe or receptacle, and when the valve is brought forward the rake or hoe is lifted up to prevent any backward action by means of a cam fixed to the side of the pan. When required a series of rakes may be used to push the covered fæces any distance desired.

Another mode of removing the fæces from one part of the house to another, or from the front to the back, is by having an air-tight tube in connection with the closet passing through the space between the joists which support the flooring. An endless band of india-rubber, leather, or other suitable material travels through the tube and conveys the fæces and deodorants to any placed required. To prevent dust rising I cause the valve to work close to the sides of the pan and to shut up accurately in front.

In another arrangement of self-feeding closets I employ a weight or spring in front for opening the valve, and a handle jointed to a rod connected by a cord to the valve for closing it, and the rod of the handle being sometimes jointed, so that when the valve is closed the handle is bent over the hole in the seat to prevent the valve being open when not in use. Or I connect the cover of the seat to a lever attached to the valve, so that when the cover is removed the valve will be lowered, and when the cover is put on the valve will be closed by the assistance of a weight or spring. The supply boxes or reservoirs for containing the deodorizing ashes or materials may be made of any required size and shape, and provided, when required, with screws for assisting the descent or passage of the ashes to the delivering cylinder. Or one large box is hoisted to the upper part of the house and its contents let down by pipes to the different closets.

In another form of closet I dispense with the expensive mechanism employed for distributing the deodorant on the fæces by the weight of

the person using the closet acting upon springs in communication with multiplying levers, as also the cylinder and wheels in the handle closet, as follows:—To a straight rod horizontally passing through the bottom of the box containing the deodorant I affix a lever having a jointed handle so formed that it shall lay upon this seat of the closet when not in use. When the closet is required to be used the person using it will first have to lift up and remove this bent handle which will cause a movement or oscillation of the horizontal rod, thereby causing the ashes or other deodorants to fall from the inclined planes on which they were resting on to the fæces, which movement takes place each time the handle is moved. In some cases I employ an archimedean screw for removing the fæces covered with ashes sideways or in any other direction from the closet, the screw being worked by a chain from the shaft carrying the wheels which actuate the levers and shafts for working the mechanism before described.

My next improvement relates to the ordinary petty, and consists in having an archimedean screw to work one way only running along the whole depth of the petty underneath the seat so that the ashes from the cinders which are thrown on to a screen shall fall down on to the screw, which, being moved forward by a handle or other suitable means, shall carry onwards the ashes and mix same with the fæces as required, and carry the whole forward to a close receptacle on the other side of the petty, the screw being so enclosed as to form an air-tight valve by means of india-rubber.

My next improvement has reference to a midden and ash-pit combined. The ashes and cinders are placed in a box hinged to the framework, through an opening in which the box is tilted when full; the cinders fall on a screen (fixed by india-rubber fastenings to the opposite side of the framework, to which the aforesaid box is fixed, but not reaching quite across the midden) and roll down to nearly the bottom. When the screened cinders are required to be spread over the fæces a handle attached to a lever, having fastened to it a chain or cord passing over pulleys under the seat, and attached to the said screen at the opposite end to which it is hinged, is pulled, when the india-rubber fastenings yielding allow it to move a little, when it is suddenly let go again, and the shock or vibration causes the ashes to fall as desired and are projected forward on the fæces and urine in their proper compartments. The said box to receive the cinders is so hinged to the framework as to

leave a space or opening underneath it through which refuse not fit for deodorizing purposes may be thrown, and so not mix with the ashes or manure. I depend still mainly upon the breeze or ashes for use as deodorants, kept quite dry, and sifted or screened through meshes of about half an inch in diameter or less; or the whole of the ashes may be used when the quantity is small and no substitute at hand.

To produce more instant deodorization of fæcal smell or in cases of contagion or larvæ of insects and animalculi I prepare the ashes by a slight admixture with one or both of the following deodorants:—First, sulphurous acid, which I use strong and in small quantities mixed with the ashes and other matters; secondly, the more or less bituminous shales of the coal formation, and the rock oils separated from them, or coal itself in various states of purity, artificially or by natural process. The shale itself I use reduced to a rough powder when heated or slightly roasted, and it is useful to sprinkle powdered sulphur or brimstone upon it hot, which in burning produces sulphurous acid, which unites in small quantities with the carbon and bitumen of the shale, making it more powerfully deodorant. The ordinary ashes I also sometimes treat with small quantities of sulphur when some of the lumps are hot, or a few hot lumps are added to the cold mass and sulphur sprinkled thereon, and the whole well mixed together, which renders them more powerfully and instantly deodorant. The oils distilled or otherwise separated from the shales or coal itself are also powerful deodorants particularly when in combination with sulphurous acid gas, which dissolves in them in large quantities. Or the compounds may be prepared by shaking up a solution of sulphurous acid gas in water with the oils, which absorbs the acid from the water in large quantities. These compounds are particularly adapted for the front compartments where filtration is going on, as they give off powerful deodorant vapours to neutralize those of the urine and of the fæces in the back compartment.

The following combinations are very useful in the filtering chamber of the new front compartment or in other places for filtration. Superphosphate of alumina and sulphate of magnesia, pure or impure, but in a fused and ground state, sulphite of soda and phosphate of soda ground and mixed into a paste with thick shale oil or paraffine. The result produced by the gradual solution of the substance by the urine being the complete deodorization of that liquid and the detention of nearly all its

valuable fertilizing matters in the solid or semi-solid state in the front compartment.

When a number of closets are employed on the same or different floors I employ the hoisting gear mentioned in my former Specification to raise the ashes, whether treated with the aforesaid chemical compounds or not, to a suitable box or reservoir at the upper part of the house which communicates by pipes or tubes with each of the closets, and so keeps the box or boxes supplied with the ashes or deodorants.

The pans containing the fæces and ashes or the deodorants in the front compartments or in the urinals may be taken away and used at once as manure; or they may be covered by any suitable cover and placed in an oven or heated room to dry. When treated in the latter manner and reduced to powder the fæces and other matters may be placed in bags or any other suitable receptacle and carried to any place required, it being then quite or nearly free from any offensive smell.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said John Hughes Lloyd in the Great Seal Patent Office on the 19th January 1871.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, JOHN HUGHES LLOYD, M.D., of Llangefni, in the County of Anglesey, North Wales, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Twentieth day of July, 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 John Hughes Lloyd, Her special license that I, the said John Hughes Lloyd, my executors, administrators, and assigns, or such others as I, the said John Hughes Lloyd, 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 UTILIZING AND DEODORIZING SEWAGE MATTERS OF DWELLING HOUSES AND OTHER PLACES, AND IN APPARATUS TO BE USED IN CONNEXION WITH THE SAME," upon the condition, amongst others, that I,

the said John Hughes Lloyd, 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 John Hughes Lloyd, 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 thereof, reference being had to the accompanying eight Sheets of Drawings, and to the letters of reference marked thereon (that is to say) :—

This Invention consists in certain improvements upon an Invention for which Letters Patent were granted to me entitled "improvements in utilizing and deodorizing sewage matters of dwelling houses and other places, and in apparatus to be used in connection with the same, dated the Twenty-sixth day of June One thousand eight hundred and fifty-seven, No. 1793.

That Invention consisted in applying the waste or refuse of fire-places in houses and other places, either alone or in combination with lime, to correct or remedy the nuisance produced by the sewage of houses, especially by human excretions, and thereby reduce them to a harmless and inoffensive state so as to be easily removable with such refuse, and so be used as manure or for other purposes. By the waste refuse was meant what is generally called the sifted ashes or breeze, and more or less or the whole of the cinders at times to be used either as they usually occur or more or less ground or pounded, and either alone or combined with quicklime in certain proportions, and assisted in certain circumstances by small quantities of the chloride of lime of commerce, or burnt sulphate of lime or burnt clay.

In the Specification of that Invention I stated that the useful action of the substances above mentioned required changes in the closets, middens, necessaries, and cesspools now in common use. Where water-closets or night chairs or privies are now used it will not be necessary to use water at all according to this plan the very principle of which is to get rid of all the water contained naturally in the excretions, and so prevent the possibility of putrefaction. I proposed to use inside of

closets and night chairs and beneath the seats of privies metallic or other pans of sizes convenient to be produced and removed therefrom, the pans being generally of a square shape, from a cubic foot upwards in dimensions, and divided by a curved or other shaped partition in such a position with regard to the circular opening of the seat as effectually to separate the faeces and urine as they fall for enabling them to be acted upon separately.

One form of closet by which I proposed to carry out the principles above described consisted of a metallic or other vessel with a curved partition so dividing the vessel and bisecting the circle of the seat that all urine shall in falling fall in front of the partition, and all faeces behind, each to be acted upon by the deodorizing materials. In this case the materials were added each time after the closet had been used by means of a ladle or other convenient instrument.

In another form of closet I placed the pan in a suitable case having a seat and cover, and made the partition in the pan straight, bisecting the circle of the seat and rising up to a certain distance where it was met by a broad flat valve when the closet was not in use, and covered the hinder compartment. When the closet had to be used the valve was opened and shut by a handle like that of an ordinary watercloset or by the weight of the person using the closet acting upon springs in communication with multiplying levers. In either case I made the movement of the valve assist in introducing the deodorizing materials spontaneously in the following manner:—Behind the axis of the valve there was another axis carrying a cylinder with several pockets upon it, and by means of two toothed wheels and a ratchet wheel the cylinder was made to revolve in one direction, and that only during the closure of the valve. Behind and above the seat there was a box or feeder filled at proper times with the deodorizing material and placed above the cylinder with which it communicated by an opening, and as the cylinder revolved the deodorizing material fell into the pan or receptacle of the closet, first falling into a chamber or pocket behind the valve, by the motion of which it was well carried forward into the closet.

The object of my present Invention is the same as my former one, namely, to correct or remedy the nuisance produced by human excretions in commodes, closets, petties, middens, or at the ends of sewers, or at

certain parts in their course, and thereby reduce them to a harmless and inoffensive state, but my present improvements enable this object to be attained with greater economy and efficiency than heretofore.

I employ the waste or refuse of fire-places before described either alone or mixed with other disinfectants as herein-after described, and by preference I adopt the system of having for each commode, closet, or petty two copartments of improved forms for the excretions, one for the faeces and the other for the urine, and these compartments are formed either of two separate vessels or of one vessel having a partition with many new arrangements in connection with it.

I construct a simple and efficient closet or commode by placing in a case or box three rectangular pans or vessels, two clasped together for receiving the excretions, and the third for containing the ashes or other deodorizing matters.

Fig. 1, Sheet 1, of the accompanying Sheets of Drawings is a transverse section, and Fig. 2 a plan of this arrangement. *a*, representing the box or case; *b*, the pan for the faeces; *c*, the pan for the urine; and *d*, the pan for the ashes or other matters. Above the two pans *b*, *c*, for the excretions there is a seat *e*, the circular opening *f* of which is so placed that the faeces can fall into the back compartment, and the urine into the front one, and above all there is a cover *g* for covering the seat and ash pan *d*, when the closet is not in use. In most cases I partially fill both compartments with the deodorizing ashes or other matters, and only make small additions as required, but by preference after each entrance of faeces into the back compartment they are covered with ashes or other matters from the ash pan by means of a ladle or other instrument, and when required the seat is either raised or removed, and the pans taken up or taken out by a door in the front side or back for emptying their contents.

Another variety of this closet has the box for the deodorant or deodorants behind and above the closet having a small slit in the lower and front part of the box, from which the deodorant can be taken and used with a ladle. In both these forms the seat is hinged to the back or side of the closet so that it may be raised and the powder used without being spilled upon it. In all moveable commodes of this description the receptacles are placed in a wooden or other case, and the best distance or height of the seat above the receptacles I find to

be about 6 inches, in order to allow them to be filled fully and to prevent the partition (when used) from interfering with the person when sat upon.

In another form I fix at the back of the seat a box, and place in bearings near the bottom a shaft carrying a valve and spreader worked one way by a handle, and the reverse way by their own gravity. In the front pans of the closets for receiving the urine and in pans used as independent urinals I now use for each pan a pipe marked *h*, Fig. 1, passing from the inside to the outside, the pipe being fixed at the inside near the bottom, and at the outside a short distance from the top it comes out, and its outside end communicates by a pipe with a sewer or any other receptacle. The ash pan is nearly filled with ashes or other deodorants, and a great part of the urine passed into it is at once absorbed, but the excess filters upwards through the ashes to the pipes outside, and by so doing becomes divested to a great extent of its salts and organic matters, but when desired the filtration up and down may be frequently repeated to take up matter. When ashes alone are used the overflow is a nearly pure solution of carbonate of ammonia and fit for many manufacturing purposes, or it may be absorbed as afterwards described.

My next improvements shewn in the sections and plans, Figs. 3 and 4, Sheet 2, 5 and 6, Sheet 3, and 7 and 8, Sheet 4, relate to self-feeding closets in which I employ a pan *k* with a straight partition *l* for forming two compartments, one for the faeces and the other for the urine, and use a valve *m* for covering the back compartment when the closet is not in use and this valve is worked one way by a handle *n*, Figs. 3, 4, 7, and 8, or by pressure on the seat *o*, Figs. 5 and 6, and the other way by springs, or by a weight *p*, when required, there being at the bottom of the valve a knuckle-jointed rake *q*, Figs. 3 and 5, to scrape the ashes off the urine compartment, ment at the bottom of a pocket *r* underneath the valve another knuckle-jointed rake or hoe *s*, Fig. 3, for causing the faeces, and other matters to be pushed back outside, or they may be removed by an archimedean screw. I place at the back of the seat of each closet a supply box or reservoir *t* for containing the dry ashes or other deodorizing matter, there being in one arrangement a valve or flap *u*, Figs. 3 and 5, near the bottom, which can be closed by hand when moved to be replenished. Instead of making the feeding cylinder with pockets, as in my former Patent, I now make it plain, as shewn at *v*, Figs. 3, 4,

and 5, and place above and in front of it an adjustable slotted spring plate *w*, Figs. 3 and 5, to be elevated or lowered, as required for regulating the supply of ashes to the closet, the slots enabling the plate to yield readily and allow the passage of ashes or cinders larger than usual, but at the same time I prefer that none of the cinders shall be larger than about half an inch. I now make the valve with flaps at the sides and in some cases form a flap where it meets the partition *l*, but in other cases I cause the front of the valve to pass over the partition, as shewn in Figs. 3 and 5, and where required there are bands of india-rubber cloth, or other suitable material to keep the valves tight when being closed and opened, in which latter position they are inclined about 60°.

Instead of making the pan always portable, as before, I now in many cases make it stationary and open at the back as in Fig. 3, or at the side as in Figs. 5 and 6, and in the top of the front compartment I sometimes place an archimedean screw, on the shaft of which there is a chain wheel connected by a chain with a chain wheel on the shaft of the feeding cylinder, the wheels and chain being by preference outside the pan or case, but I prefer the mode of shifting the ashes concentrated with urine by the rake *q*, Figs. 3 and 5.

In another arrangement in bearings at the bottom of the valve I place a shaft carrying a rake or hoe, and fix at one end of the shaft an arm and roller which can be acted upon by a stationary cam at one side of the pan. The pocket *r* at the back of the valve is open at the top and bottom, and the dry ashes fall into this pocket when the feeding cylinder is turned forwards, the board or plate forming the bottom of the pocket being inclined about 40° when the valve is closed. The valve *m*, Figs. 5 and 6, is closed by the weight *p* and opened by multiplying levers *x* and rods *y* in connection with the seat *o*, and the cylinder *v* is turned by means of one ratchet wheel a^1, and two spur wheels b^1 in the forward direction only when the valve is being brought forward for closing, and these parts are placed outside the pan or case. In the back compartment there is always a layer of ashes or deodorizing materials raised to the inclined surface of the backward movement of the rake when one is used as shewn in Fig. 3, and there is also a layer of ashes in the front compartment, which is renewed by the upward movement of the valve throwing fresh matter into it, and a portion is removed by the rake at each backward movement of the valve. For removing the covered faeces

I also use an archimedean screw c^1, Figs. 5 and 6, leading through an open side to a pipe or receptacle, the screw being worked by a chain and chain wheels from the shaft of the ratchet wheel a^1. When the closet is not in use the valve extends over the partition, and the back compartment is covered, but when the seat is depressed the multiplying levers turn back the valve to uncover the back compartment for the reception of faeces, the front compartment being always sufficiently open for the reception of the urine. When pressure is taken off the seat the weight or spring brings forward the valve, and the feeding cylinder delivers a quantity of ashes to the pocket behind the valve, from which the ashes are thrown on the faeces, and into the urine compartment. When the closet is next used, and the valve turned back, the rake q pushes the ashes from the front compartment into the back one, and the archimedean screw pushes the covered faeces out of the back compartment to a pipe or receptacle, and when the valve is brought forward the rake q gives way by means of the knuckle joints to prevent any backward action, and where rakes are used instead of the screw for removing the covered faeces their knuckle joints give way in the same manner. When required a series of rakes may be used to push the covered faeces any distance desired, and dust is prevented from rising by causing the valve to work close to the sides of the pan by means of the flanges and india-rubber sheets before mentioned.

In the arrangement of self-feeding closet, shewn in Figs. 3 and 4, I employ springs, or the weight p in front for opening the valve, and the handle n jointed to the rod e^1 connected by the cord f^1 to the lever g^1 for closing it, and the rod of the handle is sometimes jointed, so that when the valve is closed the handle is bent over the hole in the seat to prevent the valve being open when not in use, as seen in Fig. 4; or I connect the cover of the seat to a lever attached to the valve, so that when the cover is removed the valve will be lowered, and when the cover is put on the valve will be closed by the assistance of a weight or spring. In the closet shewn in Figs. 7 and 8 the valve m fits close to the partition l, and the pocket for the ashes is above the valve. Above the front compartment there is a grid or railing to allow the ashes to pass, and to the shaft of the valve is connected a lever h^1 attached by a cord j^1 to the rods connected with the handle n. The supply boxes or reservoirs for containing the deodorizing ashes or materials may be made of any required size and shape, and provided when required with screws

for assisting the descent or passage of the ashes to the delivering cylinder; or one large box is hoisted to the upper part of the house, and its contents let down by pipes to the different closets. In the handle closet, shewn in Figs. 7 and 8, I dispense with the cylinder and wheels employed for distributing the deodorant on the faeces, and employ the following arrangement:—To a shaft k^1 passing horizontally through the bottom of the box l^1 containing the deodorant I affix the lever h^1 connected by the cord j^{11} and rod e^1 to the jointed handle n, which is so formed that it shall lay upon the seat of the closet when not in use, there being in the box inclined planes p^1, q^1, and to the shaft k^1 are fixed small levers or wires v^1 connected by cords s^1 to india-rubber bands t^1. When the closet is required to be used the person using it will first have to lift up and remove this bent handle, which will cause a movement of the horizontal shaft and oscillation of the small levers or wires, thereby causing the ashes or other deodorants to fall from the inclined planes on which they were resting on to the faeces, which movement takes place each time the handle is moved, so as to close the valve. I not only employ an archimedean screw for removing the faeces covered with ashes sideways from the closet, but also in any other direction, the screw being worked by a chain from the shaft carrying the wheels which actuate levers and shafts for working the mechanism before described.

My next improvement relates to an ordinary petty and midden or ash-pit, shewn in the transverse section Fig. 9, Sheet 6, and consists in having an archimedean screw v^1 to work one way only, running along the whole depth of the petty underneath the seat, so that the ashes from the cinders which are thrown on to a screen w^1 shall fall down on one end of the screw, which being moved forward by a handle x^1 working a catch for turning a ratchet wheel y^1 or other suitable means shall carry onward the ashes and mix the same with the faeces as required, and carry the whole forward or sideways to a close receptacle on the other side of the petty, the screw being so enclosed as to form an air-tight valve by means of india-rubber, and when all urinous smell is to be removed another screw works in the front compartment jointed mechanically with the one just described.

My next improvement has reference to another petty and ash-pit combined, shewn in Fig. 10, Sheet 5, and Fig. 11, Sheet 6, and partly described in my first Specification. The ashes and cinders are placed in

a box a^2 hinged to the framework b^2 through an opening c^2, in which the box is tilted when full. The ashes and cinders fall on an inclined screen d^2 suspended by chains e^2, and held by india-rubber springs f^2 to the wall g^2, but not reaching quite across the midden, and the large cinders and clinkers roll down the inclined screen to the compartment h^2, Fig. 11, from which they are removed through an opening. To cause the fine ashes on the screen to be spread over the faeces I employ a handle i^2 attached to a lever j^2, having fastened to it a chain or cord k^2 passing over pulleys l^2, and attached to the screen at the part m^2, so that when the handle i^2 is pulled the india-rubber springs f^2 are stretched and the screen moved back from the wall g^2, and when the handle is suddenly let go the shock or vibration arising from the screen striking the wall g^2 causes the ashes to fall down the inclined plane n^2 and be projected forward on the faeces in the compartment o^2 and the urine in the compartment p^2, there being a flap q^2 to prevent dust from rising, or I employ the moveable seat for working the screen. The box a^1 which receives the cinders is hinged to the framework, so as to leave a space or opening underneath it, through which refuse not fit for deodorizing purposes may be thrown, and so not mix with the ashes or manure.

In Fig. 12, Sheet 6, I shew a combination of two petties with ash-pits or middens having my improved moveable screens, the cinders being passed through openings closed by ordinary doors r^2, the petty s^2 being similar to that shewn in Fig. 10, and the petty t^2 to that shewn in Fig. 1, Sheet 1.

Fig. 13, Sheet 7, is a transverse section, Fig. 14 a back view, and Fig. 15 a plan representing the application of my improved closets and ash-pits to a house. On the upper floor there is a closet, in which covered urine and faeces are removed by rakes, shewn in Fig. 3, to a pipe u^2 descending to a receptacle, and above the room there is a box v^2 containing the ashes. In the next floor below there is a closet in which an archimedean screw is employed for removing the covered faecal matters to the pipe u^2. In the yard there is a combined petty and ash-pit, the ashes being passed through the hole w^2, or in any other required manner, and for purifying bed room messes, dirty or soapy water, or other liquids there is a box x^2 with two or more compartments containing ashes or filtering media, and the clean water passes off through the pipe y^2. I depend still mainly upon the breeze or ashes

for use as deodorants, kept quite dry and sifted or screened through meshes of about half an inch diameter, or less, or the whole of the ashes may be used when the quantity is small and no substitute at hand.

To produce more instant deodorization of faecal smell, or in cases of contagion or larvæ of insects, germs, and animalculi, I prepare the ashes by a slight admixture with one or both the following deodorants :— First, sulphurous acid, which I use strong and in small quantities mixed with the ashes and other matters ; secondly, the more or less bituminous shales of the coal formation and the rock oils separated from them, or coal itself in various states of purity, artificially or by natural process. The shale itself I use reduced to a rough powder when heated or slightly roasted, and it is useful to sprinkle powdered sulphur or brimstone upon it, which in burning produces sulphurous acid gas or dioxide of sulphur, which unites in small quantities with the carbon and bitumen of the shale, making it more powerfully deodorant. The ordinary ashes I also sometimes treat with small quantities of sulphur when some of the lumps are hot or a few hot lumps are added to the cold mass and sulphur sprinkled thereon, and the whole well mixed together, which renders them more powerfully and instantly deodorant. The oils, distilled or otherwise separated from the shales or coal itself, are also powerful deodorants, particularly when in combination with sulphurous acid gas or dioxide of sulphur, which dissolves in them in large quantities ; or the compounds may be prepared by shaking up a solution of sulphurous acid gas in water with the oils, which absorbs the acid from the water in large quantities. These compounds are particularly adapted for the front compartments, where filtration is going on, as they give off deodorant vapours to neutralize those of the urine and of the faeces in the back compartment. The following combinations are very useful in the filtering chamber of the new front compartment or in other places :— Supersulphate of alumina and sulphate of magnesia, pure or impure, but in a fused and ground state, sulphite of soda or silicate of soda, and sometimes phosphate of soda, ground and mixed into a paste with thick shale oil or paraffin oil. The result produced by the gradual solution of the substance by the urine being the complete deodorization of that liquid and the detention of nearly all its valuable fertilizing matters in the solid or semi-solid state in the front compartment of the closet, and, if necessary, a second or third filtering compartment is used ; and I also

still sometimes use quicklime in the back compartments to assist in solidifying and fossilizing the excreta.

When a number of closets are employed on the same or different floors I employ the hoisting gear mentioned in my former Specification to raise the ashes, whether treated with the aforesaid chemical compounds or not, to a suitable box or reservoir at the upper part of the house, which communicate by pipes or tubes with each of the closets, and so keeps the box or boxes supplied with the ashes or deodorants for a long period. The pans containing the faeces and ashes or the deodorants in the front compartments or in the urinals may be taken away and used at once as manure, or they may be covered by any suitable cover, and placed in any heated room to dry. When treated in the latter manner and reduced to powder, it may be placed in bags or any other suitable receptacles, and carried to any place required; it being then quite free or nearly from any offensive smell.

I desire it to be understood that in my various improved closets, commodes, petties, and ash-pits I vary and transpose the several mechanisms according to the requirements, and also use the ashes alone or combined with the deodorants before mentioned, as circumstances may demand. And I now mention some modification of some of the details.

For preventing dust rising from closets with flaps where concussion is used I place in the side of each flap a slide running forwards above the dust, and moved one way by the concussion movement and the other way by india-rubber or other springs; or the slide may be worked by pressure on the seat, or there may be a continuation of the upper part of the sifting or concussion parts long enough to come forwards so far as to reach to the anterior border of the hole of the seat when not in use, the levers being sufficiently multiplying to clear it away behind when self-acting. In the closets with the broad valve flaps this object is effected by making the flap overlap the front compartment and close it, so that its anterior margin shall reach below and before the front edge of the seat hole. For avoiding the bad results of liquids thrown improperly or casually into dry closets, those acting with flaps and slides, when self-acting, are sufficiently protected if there are waste pipes from the front compartment, the liquids when in excess finding their way to sewers, but in closets with handles or those acting by archimedean screws without being protected by flaps or self-acting slides openings

must be made in the sides of the closets above the level occupied by the excreta, through which the excess of liquids will fall to a false bottom below, and from that to a waste pipe to the sewers.

The following are modifications of some of the various parts of my Invention:—

In the front compartments of the closets I cause the filtration to be not only upwards but also downwards or sideways in addition, and use a chamber for chemicals. I also, when required, pass an archimedean screw on the moistened ashes or deodorants in a contrary direction to the flow of the urine to the waste pipe, or to the receptacle of solids and faeces. I also, when desired, form slots in the edge of the front compartment, through which wires or rakes attached to the flaps or slide valves will scrape back the moistened material in the front compartment, which was renewed by the flap slides or archimedean screw. In some cases I place a pan for faeces, enclosed in a larger pan, containing my improved deodorants and filtering arrangement for urine with waste pipe. To prevent regurgitation of gases or fluids from the receptacles containing the excreta I use flaps and inclines, and in screw closets I employ conical india-rubber valves attached to the end of the casing of the screw, the valves closing by elasticity when not in use, but opening by the action of the screw which forces the excreta to the general receptacle. In screw dry closets, to secure the complete mixture or nearly so of the excreta, paper and other matters with the deodorant powder, so that on their removal they may not be easily recognisable by their appearance no more than by their smell. I arm the end of the archimedean screw with projecting wires or spikes working into and between others fixed inside the metallic casing of the end of the screw and before the point of attachment of the conical india-rubber valve, by which means when the teeth or spikes are turned they will break up the solid excreta, paper, and other matters, and mix them sufficiently with the deodorant to disguise them. In the flap closet the same object is obtained by making the teeth of the rake attached to the flap for pushing the excreta backwards to work between fixed teeth attached to the inclined plane or channel through which the covered excreta passes to the general reservoir. As to the materials to be employed I adhere to those before mentioned, the dry ashes of the fires being the chief foundation when obtainable and of proper chemical constitution, and assisted by or supplemented when required by the different substances

already mentioned, in various proportions and forms of combination, and the whole assisted or worked by the various mechanical contrivances and principles before mentioned, so as best to suit the various exigencies, localities, and necessities of different towns, villages, houses, or populations.

The next part of my Invention relates to sewers, and consists in improved arrangements for purifying and filtering the sewage.

Fig. 16, Sheet 8, is a plan of parts of some sewers to which my improvements are applied; and Figs. 17 and 18, sections of parts of the same. The sewage passes through the branch and main sewers to a number of filtering compartments, there being a flood gate or moveable weir for allowing the excess to escape in case of floods. At one end of the compartments there is a depôt for purified ashes or other deodorants, and at the other end a depôt for the reception of the ashes charged with the deodorized faecal matters, the ashes being supplied to the compartments by the archimedean screw a^3, Figs. 17 and 18, and removed to a receiving depôt by the screw b^3, both screws being worked by turbines, water wheels, or other hydraulic machinery, or by a gas engine. These arrangements are intended to work silently and without smell or nuisance, and also to occupy small space, mostly underground. I propose to have one or more of these in the course of long sewers to lessen the mass of filth, and to prevent a long and large surface for evaporation, and to relieve many other evils. I quicken the passage of semi-solid matters where the incline is small by using archimedean screws joined together at corners or different levels by universal joints, and worked by preference by hydraulic machinery or gas engines to prevent smoke; or I use a number of flaps or valves like the one used in one description of the dry closets, to which a rake is attached to push back the dry sewage, the motions being at times regulated by a cam. A number of these flaps I join together at such distances apart as to work or pass the sewage from one to the other, the whole being moved by a wire rope or rods connecting each together, and worked in one direction only by mechanical contrivances put in motion by gas engines or hydraulic machinery. The substance extracted from the sewage is intended to be rendered more or less dry by pressure in filters, or by the addition of solidifying matters to suit the use to be made of it, and means and distance of transit.

Lloyd's Improvements in Utilizing and Deodorizing Sewage Matters.

To prevent the infiltration of sewage from the sewers to the surrounding earth and subsoil I propose to make them watertight by carefully cementing or caulking the masonry or by lining them with sheet metal.

And, lastly, to remedy the evils generally associated with small branch sewers from houses I propose to use screws in them moved either by mechanism similar to that used in the closets, or by doors, or worked occasionally by hand.

And these improvements in sewers and deodorizing and utilizing the sewage I mean rather as temporary means to relieve the present pressing evils until a more perfect system is generally adopted, such as the universal use of closets, commodes, petties, and ash-pits in which the faecal and offensive matters are first deodorized and afterwards removed in a dry or nearly dry state.

I also propose to deodorize and purify the vapours in large sewers by placing in them lamps burning my new deodorizing compound of paraffin oil and sulphur, or by the slow combustion in them of sulphur itself, or the exposure of the said compound in open vessels in the sewers or ventilating shafts.

In witness whereof, I, the said John Hughes Lloyd, have hereunto set my hand and seal, this Seventeenth day of January, in the year of our Lord One thousand eight hundred and seventy-one.

J. H. LLOYD, M.D. (L.S.)

Witness to signature,
JNO. E. GRIFFITHS.

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FIG. 1.

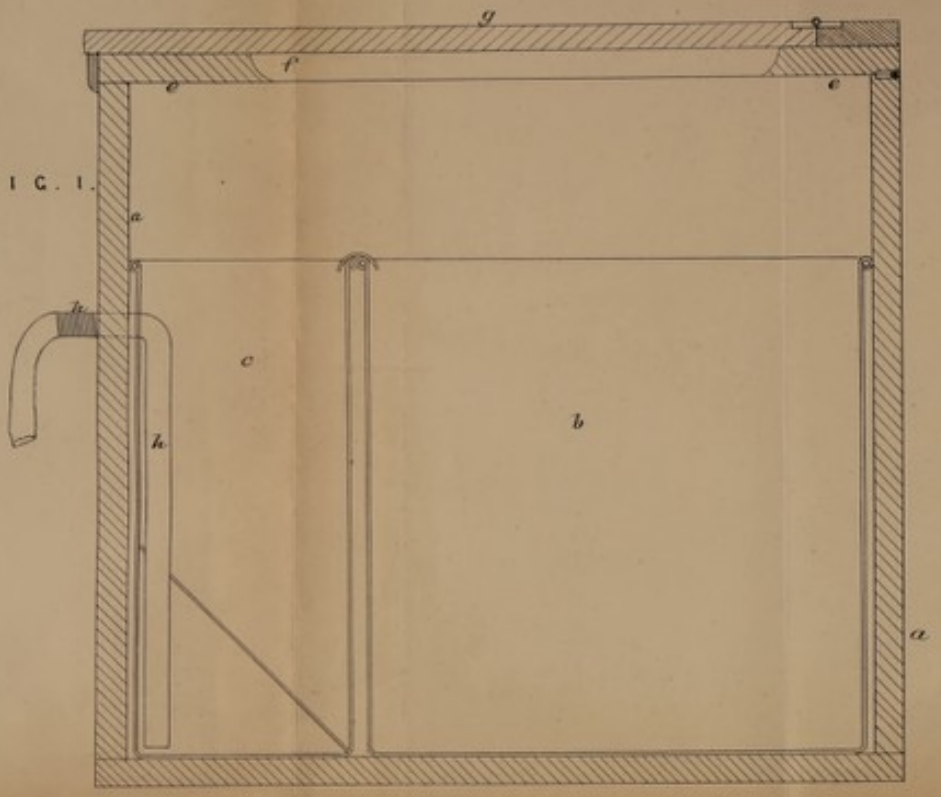

FIG. 2.

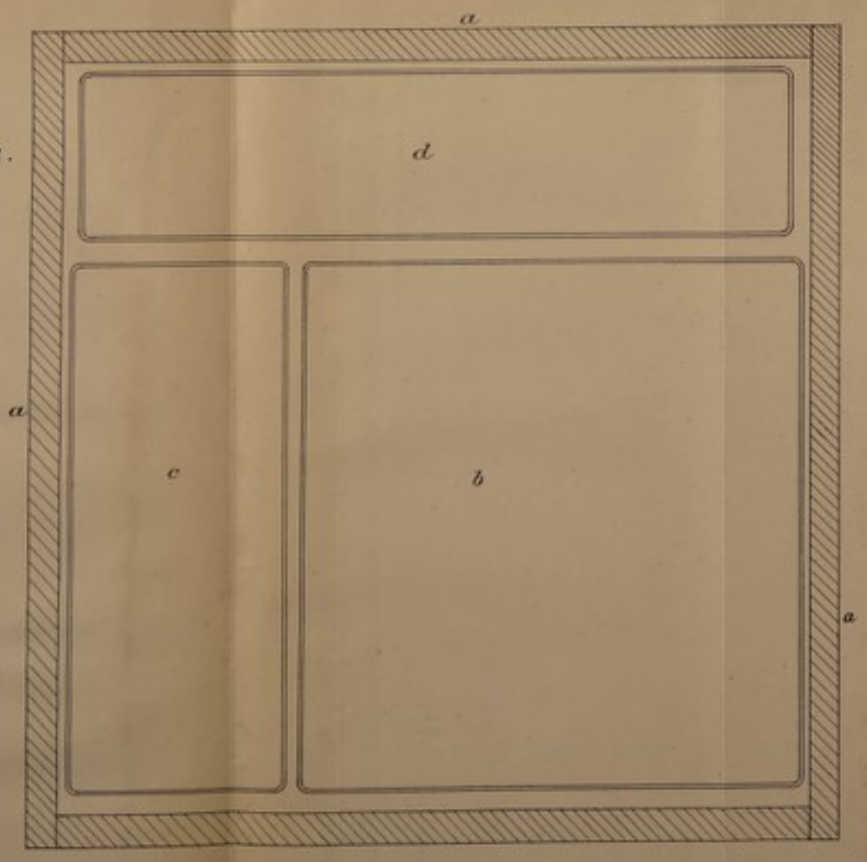

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FIG. 3.

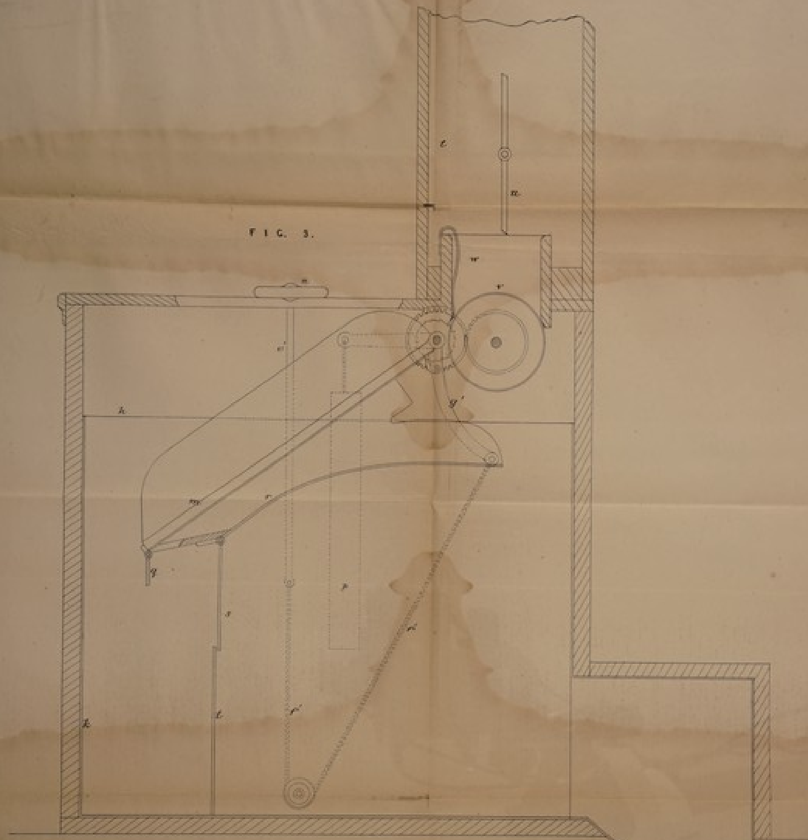

FIG. 4.

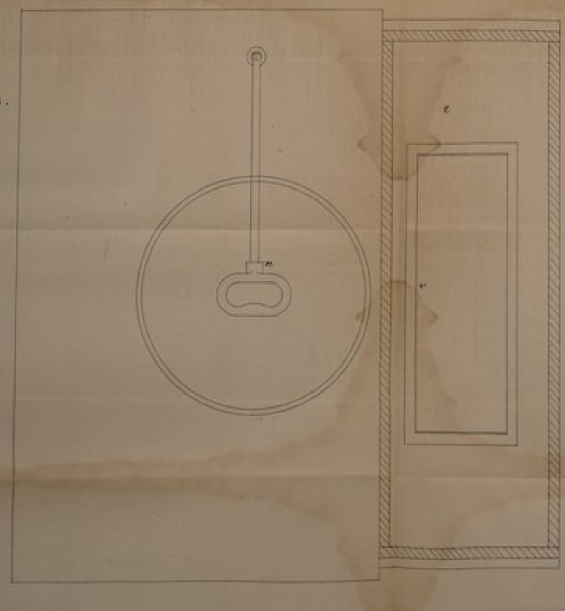

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FIG. 5.

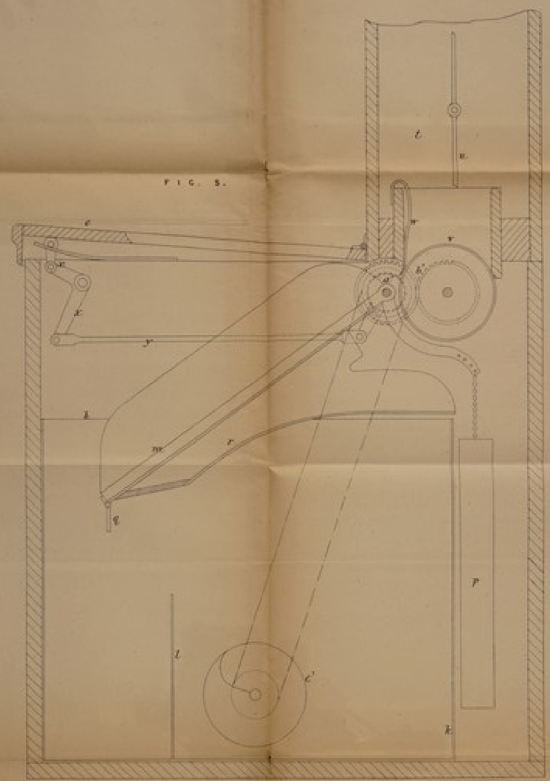

FIG. 6.

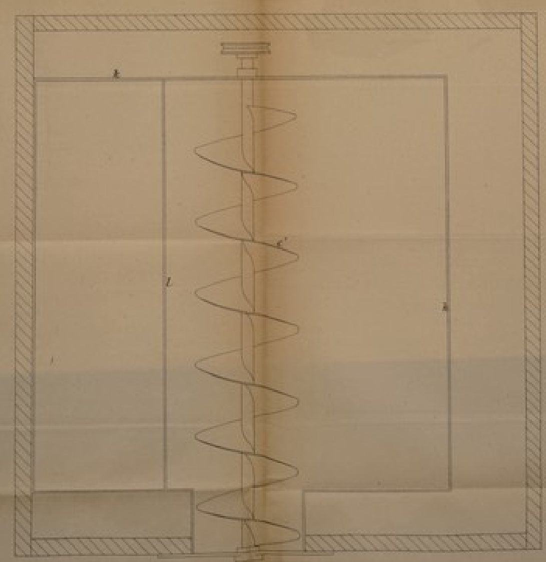

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FIG. 7.

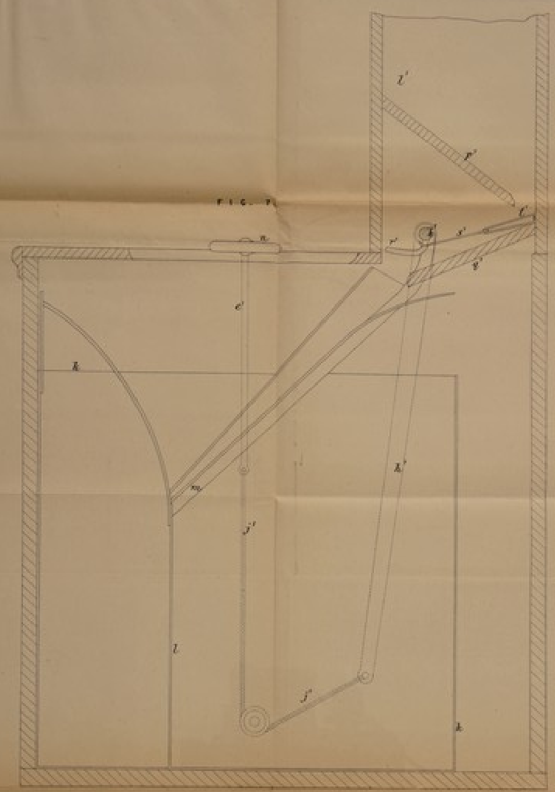

FIG. 8.

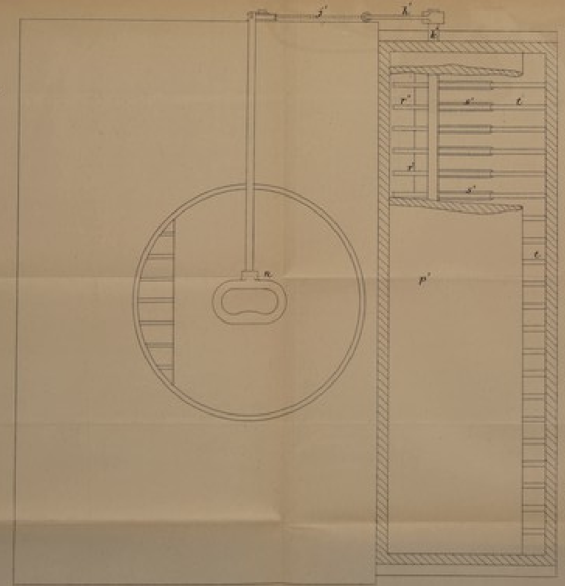

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FIG. 9.

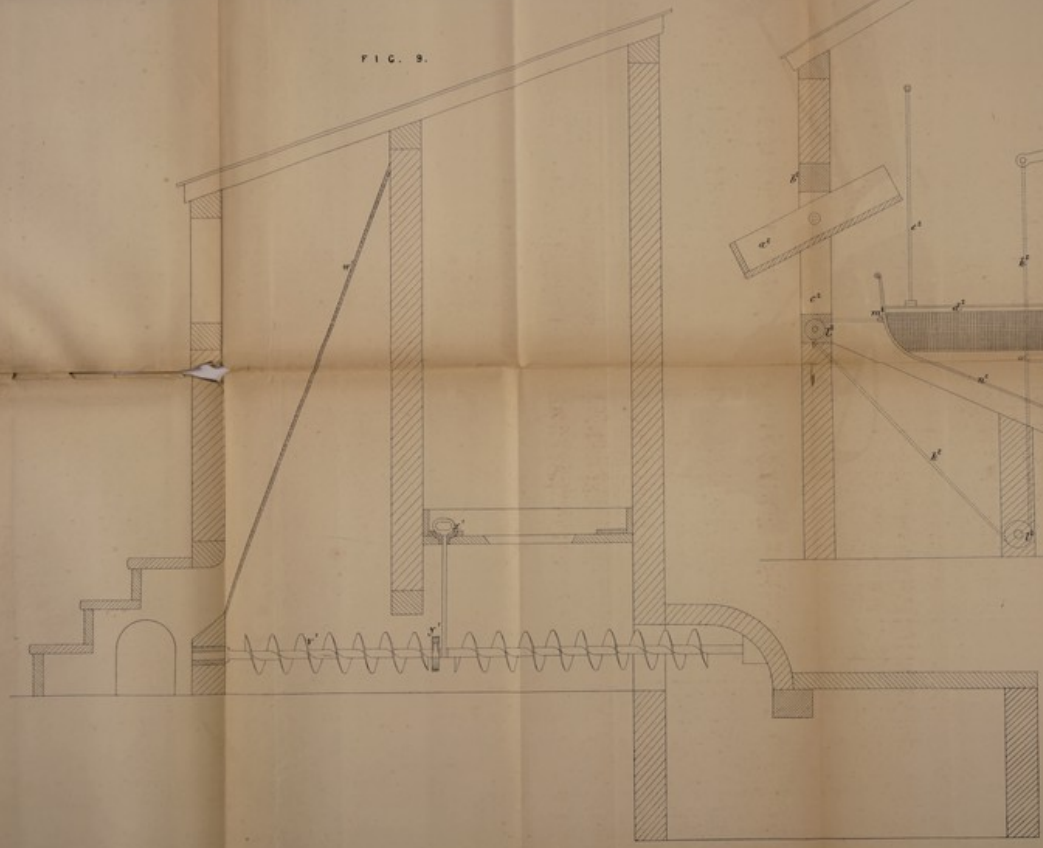

FIG. 10.

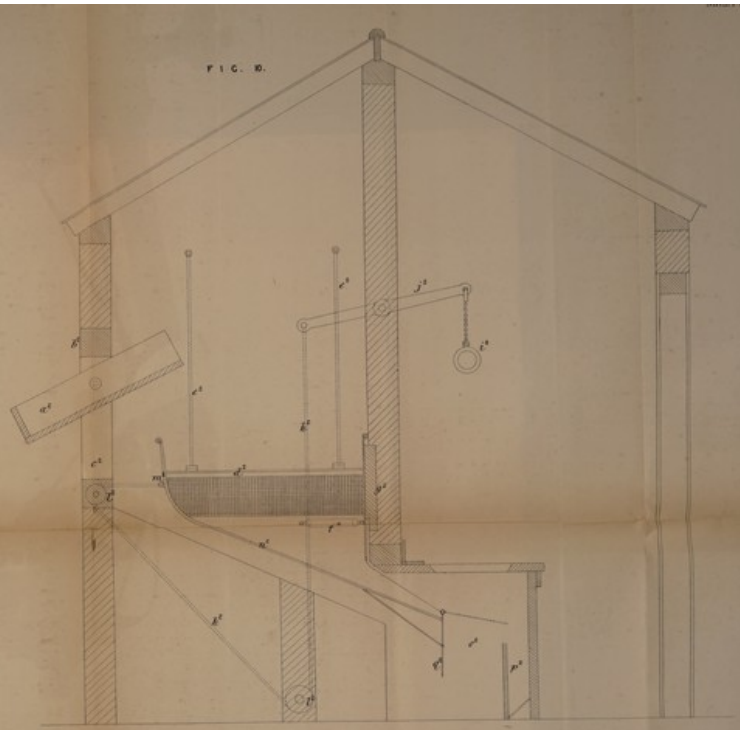

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FIG. 11.

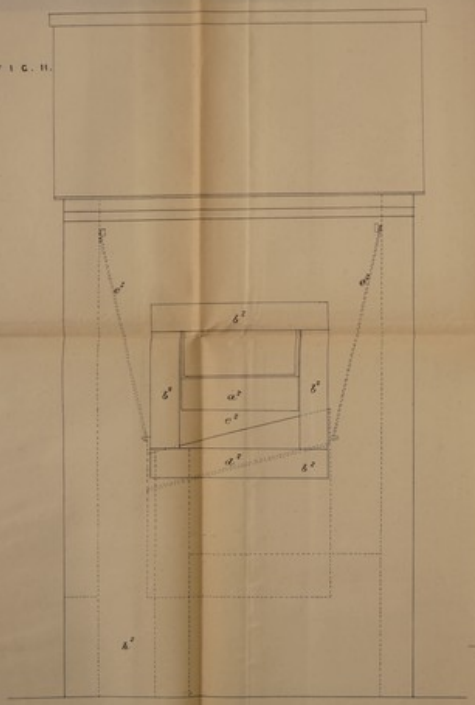
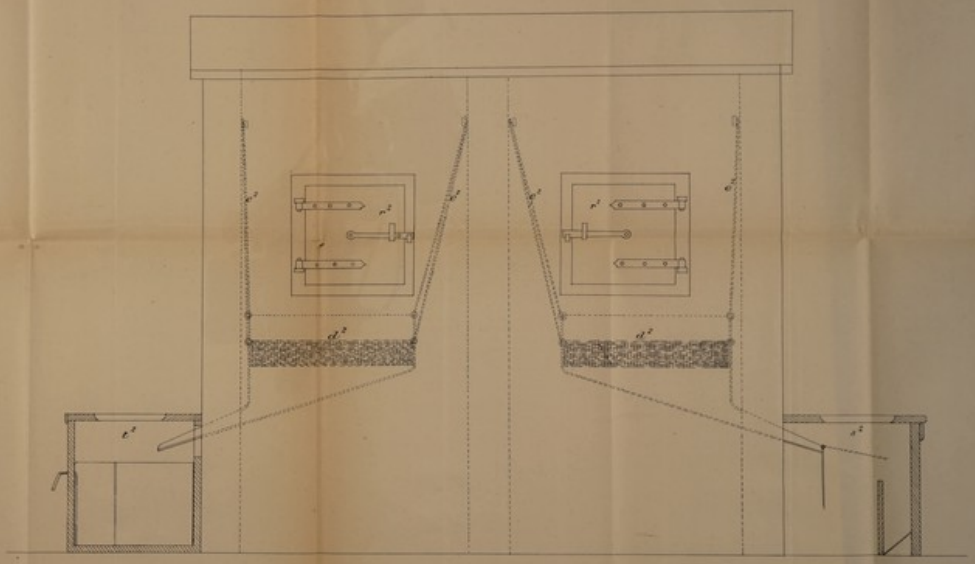


FIG. 12.



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(9 SHEETS)
SHEET 2.

FIG. 13.

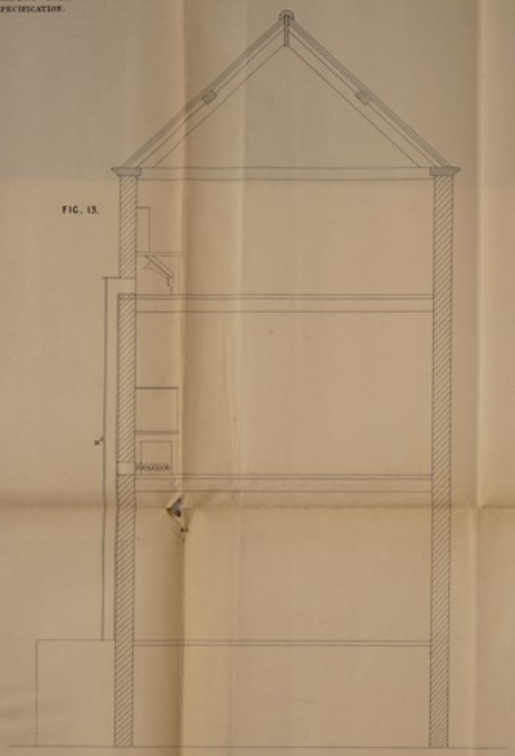


FIG. 14.

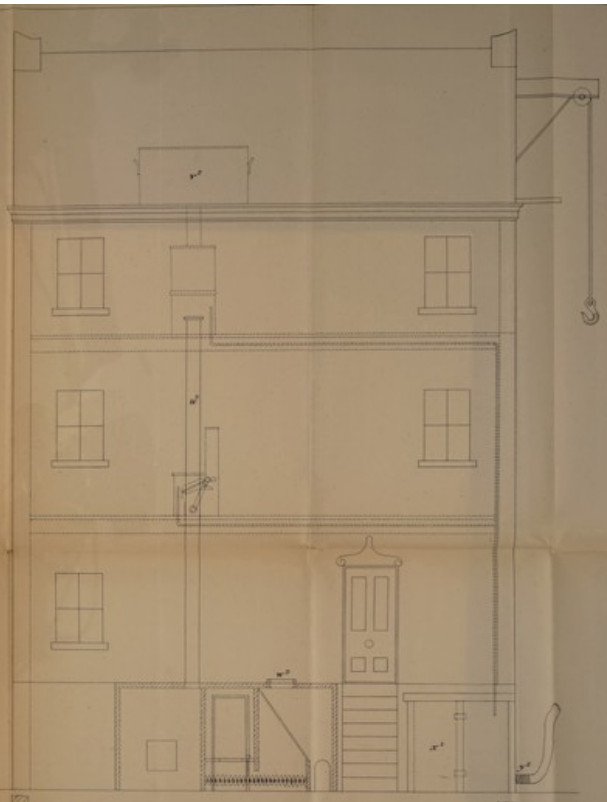
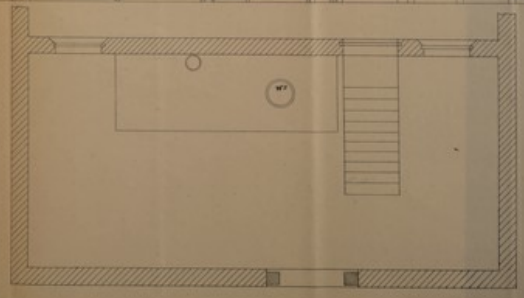


FIG. 15.



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(6 SHEETS.)
SHEET 3.

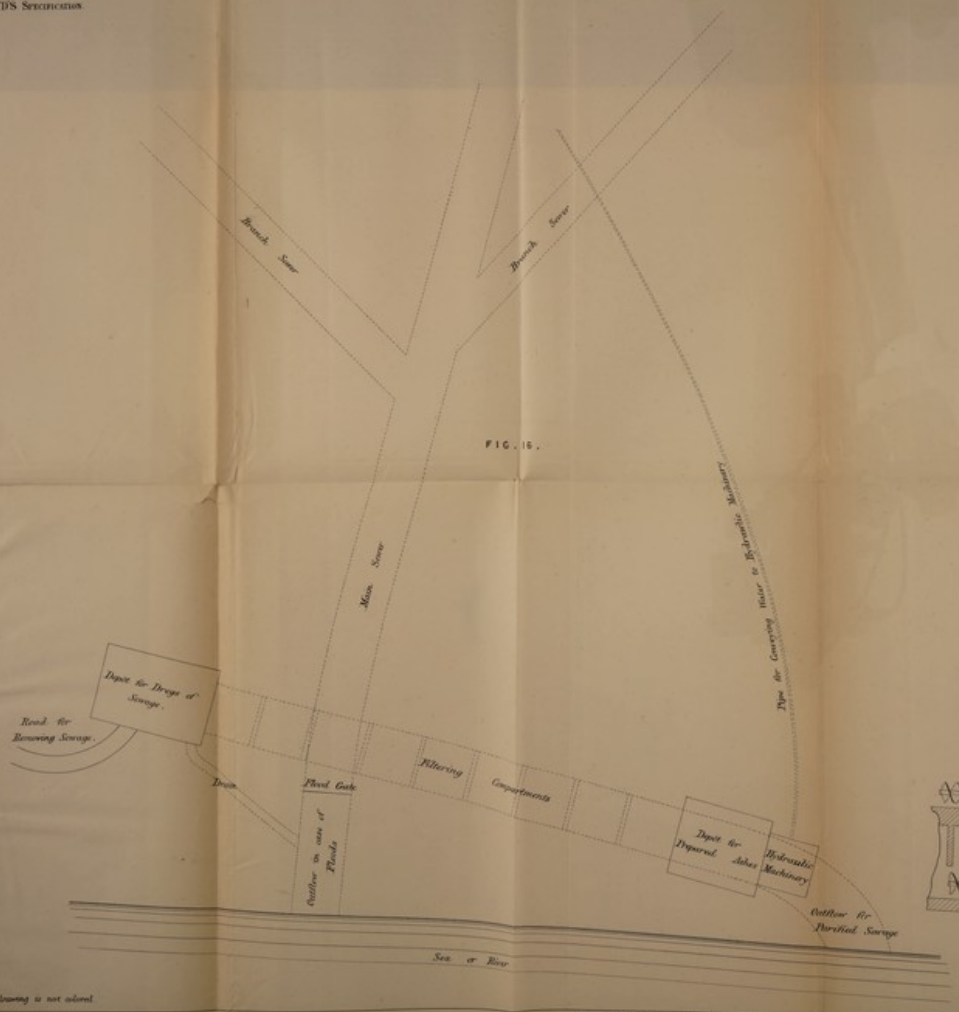

FIG. 16.

FIG. 17.

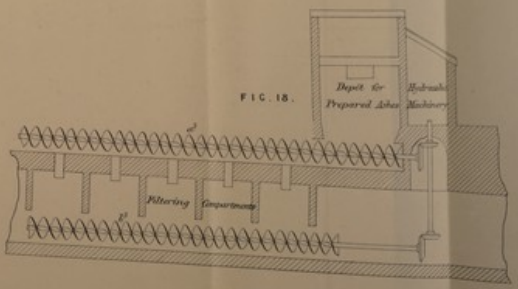

FIG. 18.

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