

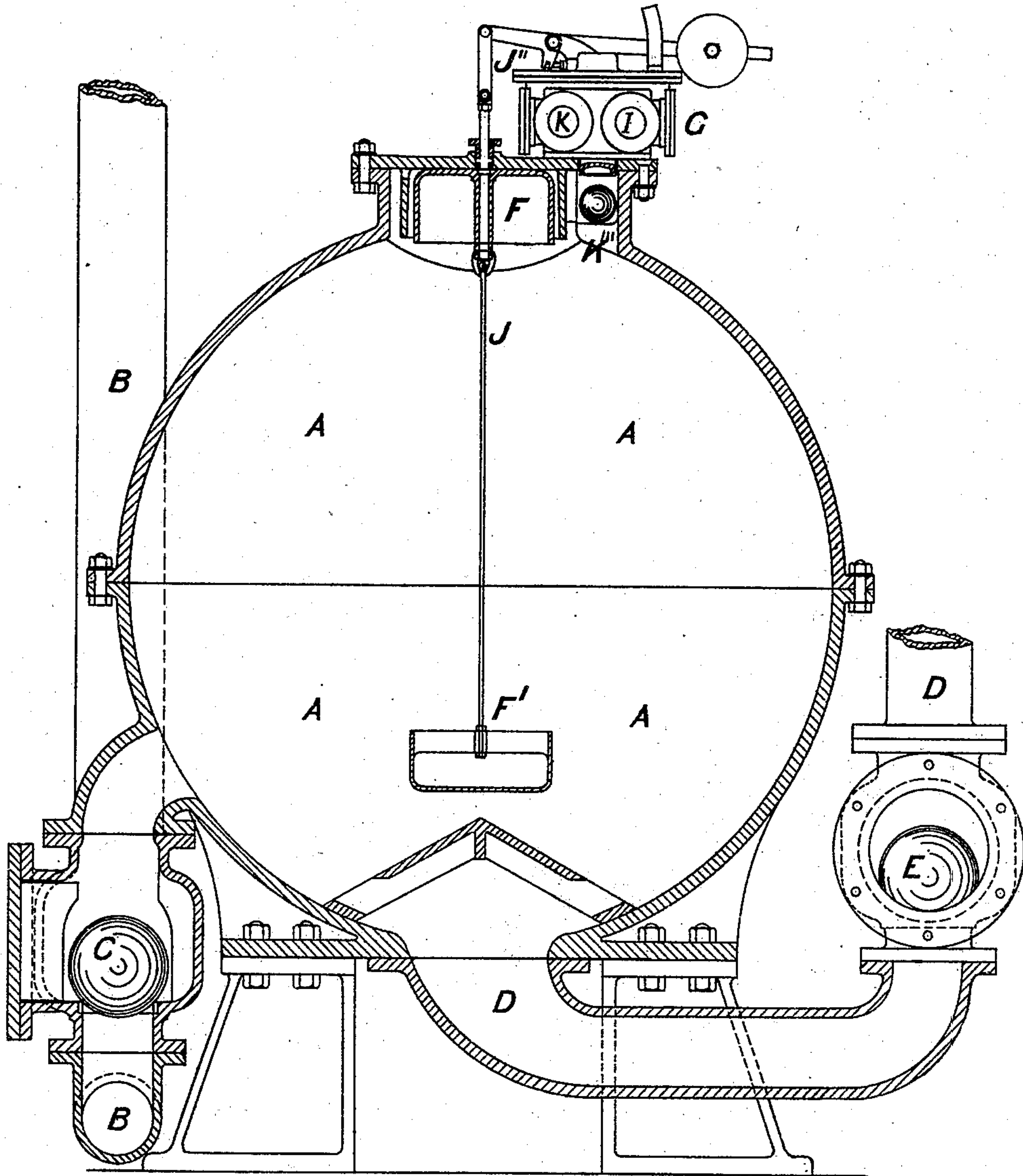
I. SHONE.

Method of and Apparatus for Removing Sewage.

No. 235,910.

Patented Dec. 28, 1880.

FIG 1



WITNESSES,  
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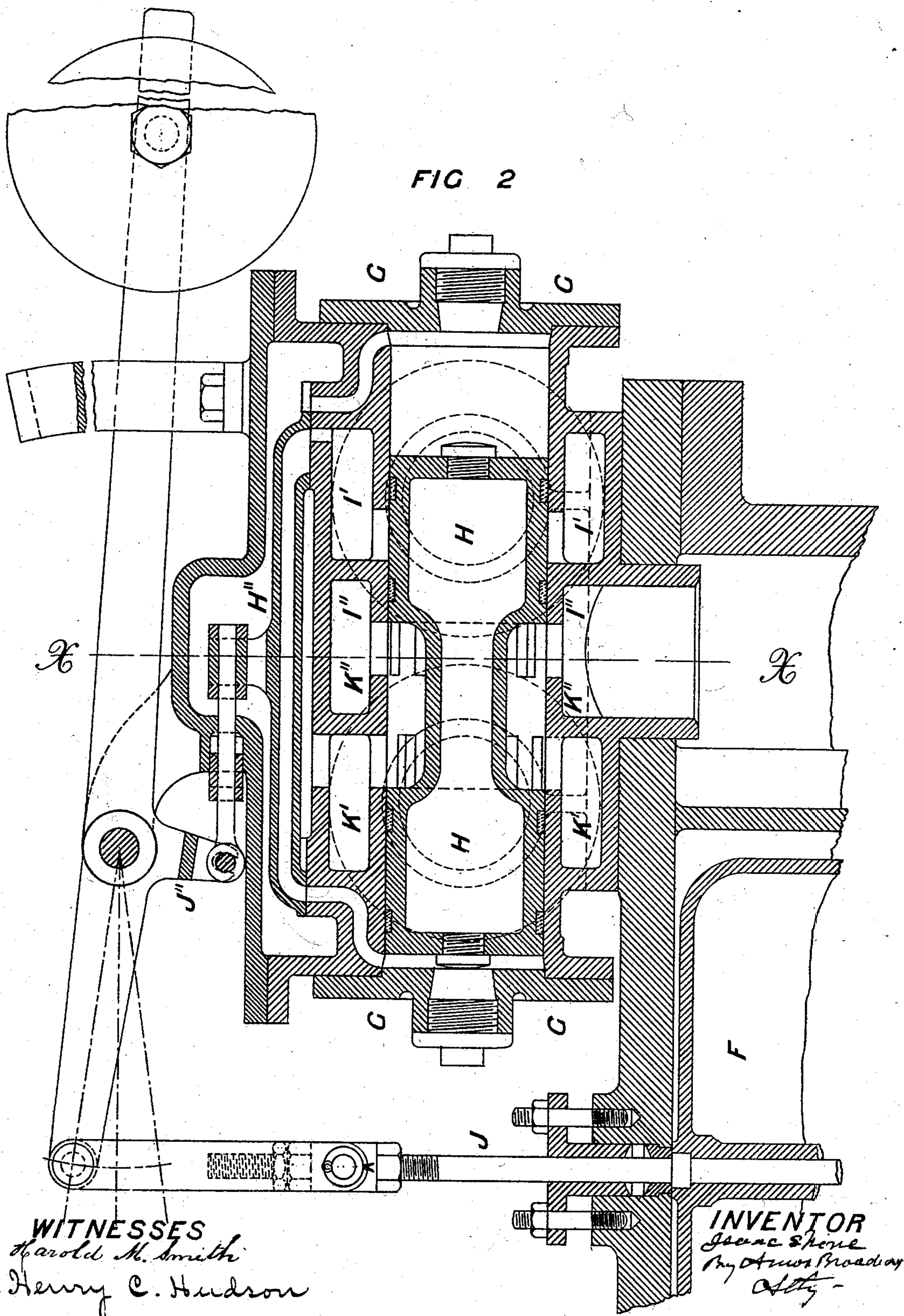
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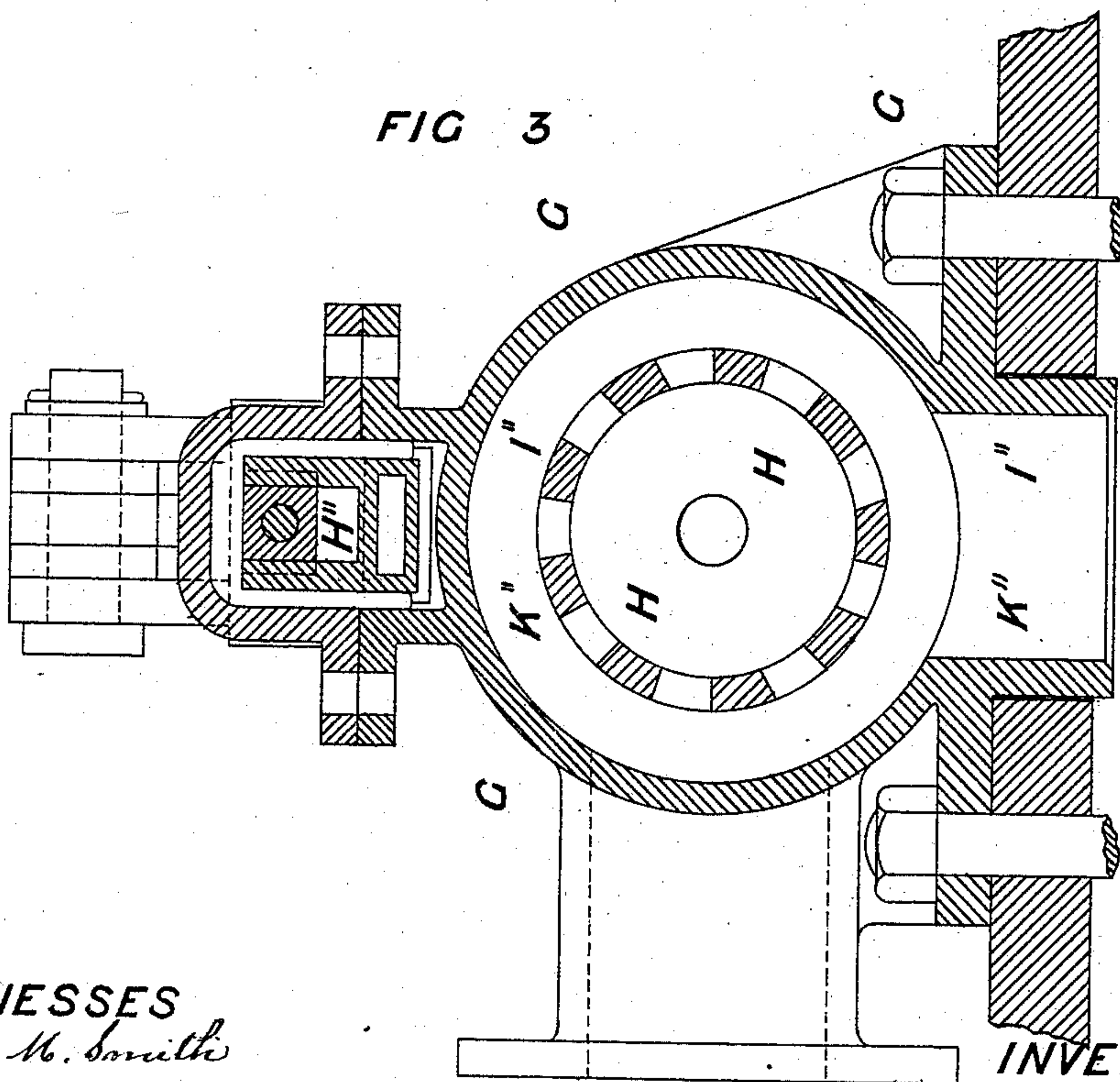


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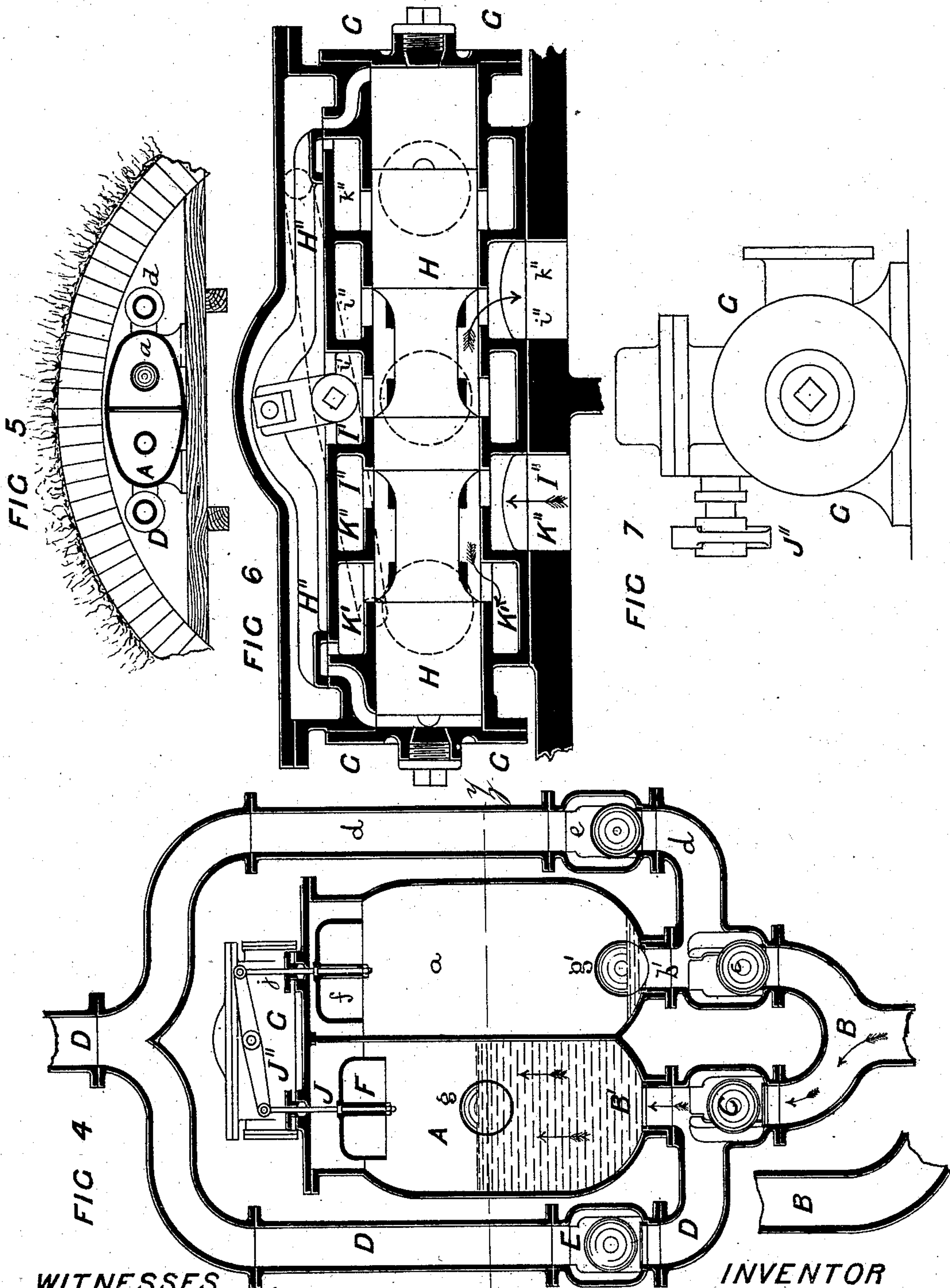
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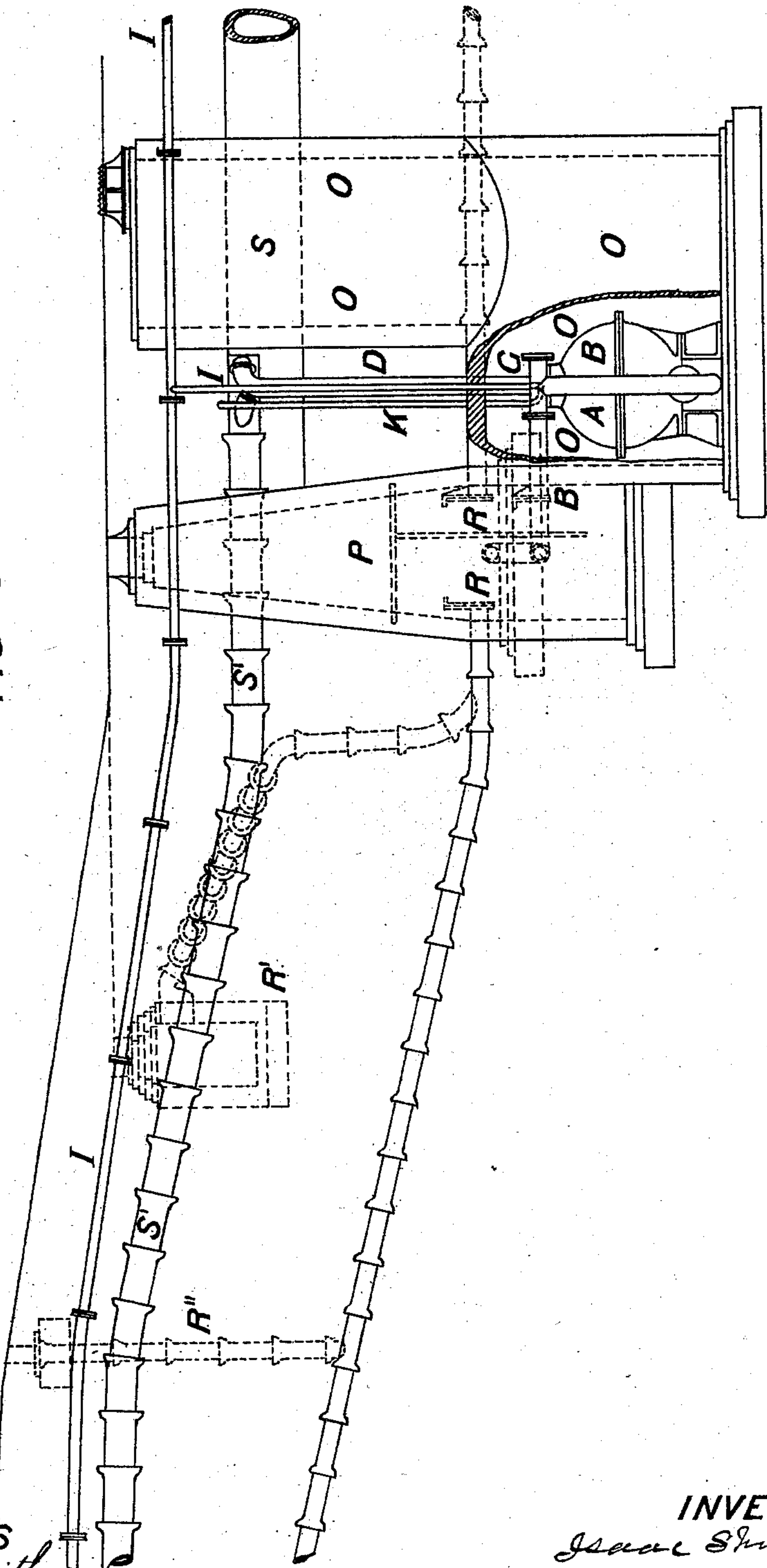
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FIG 8



WITNESSES

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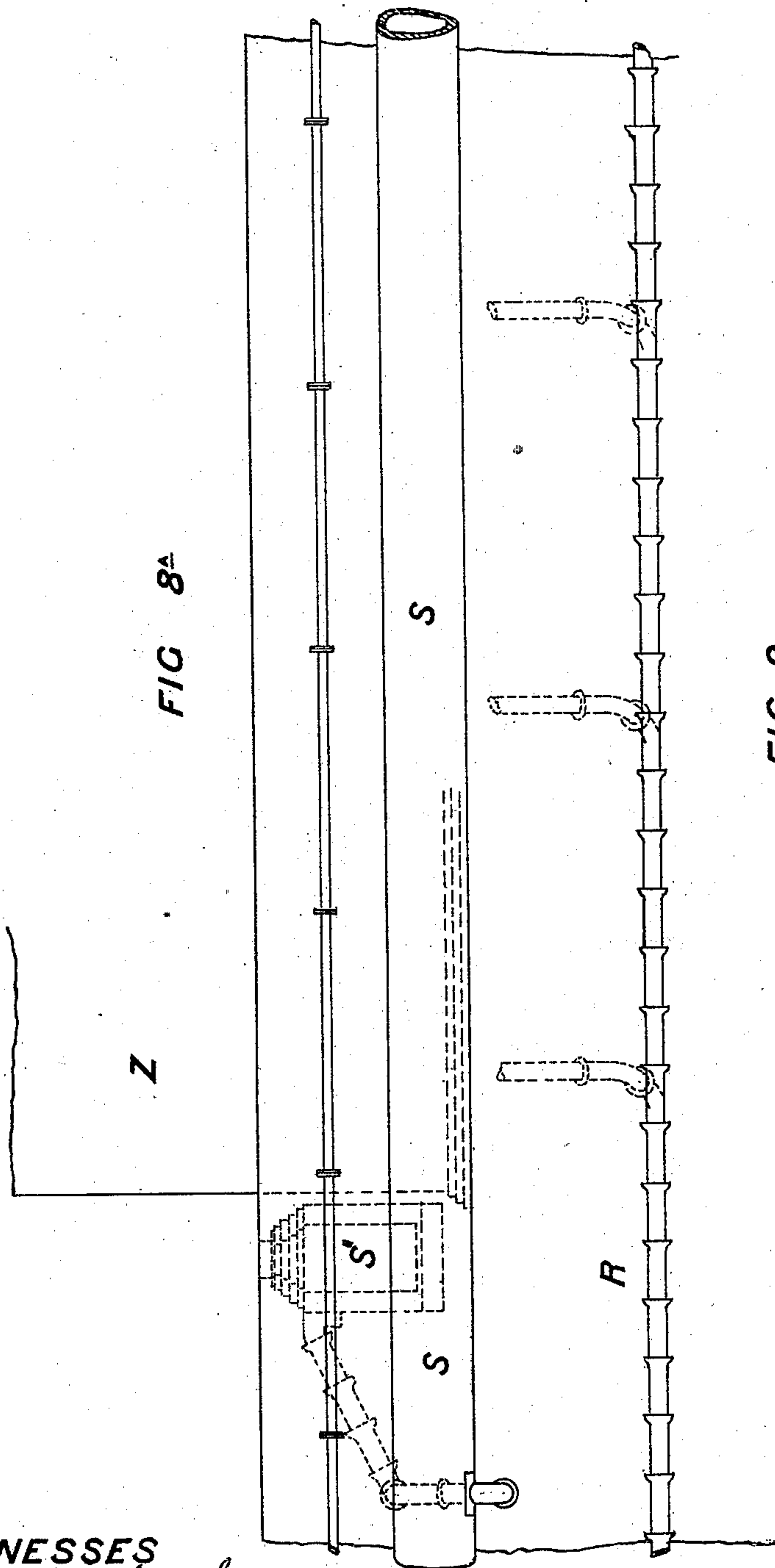
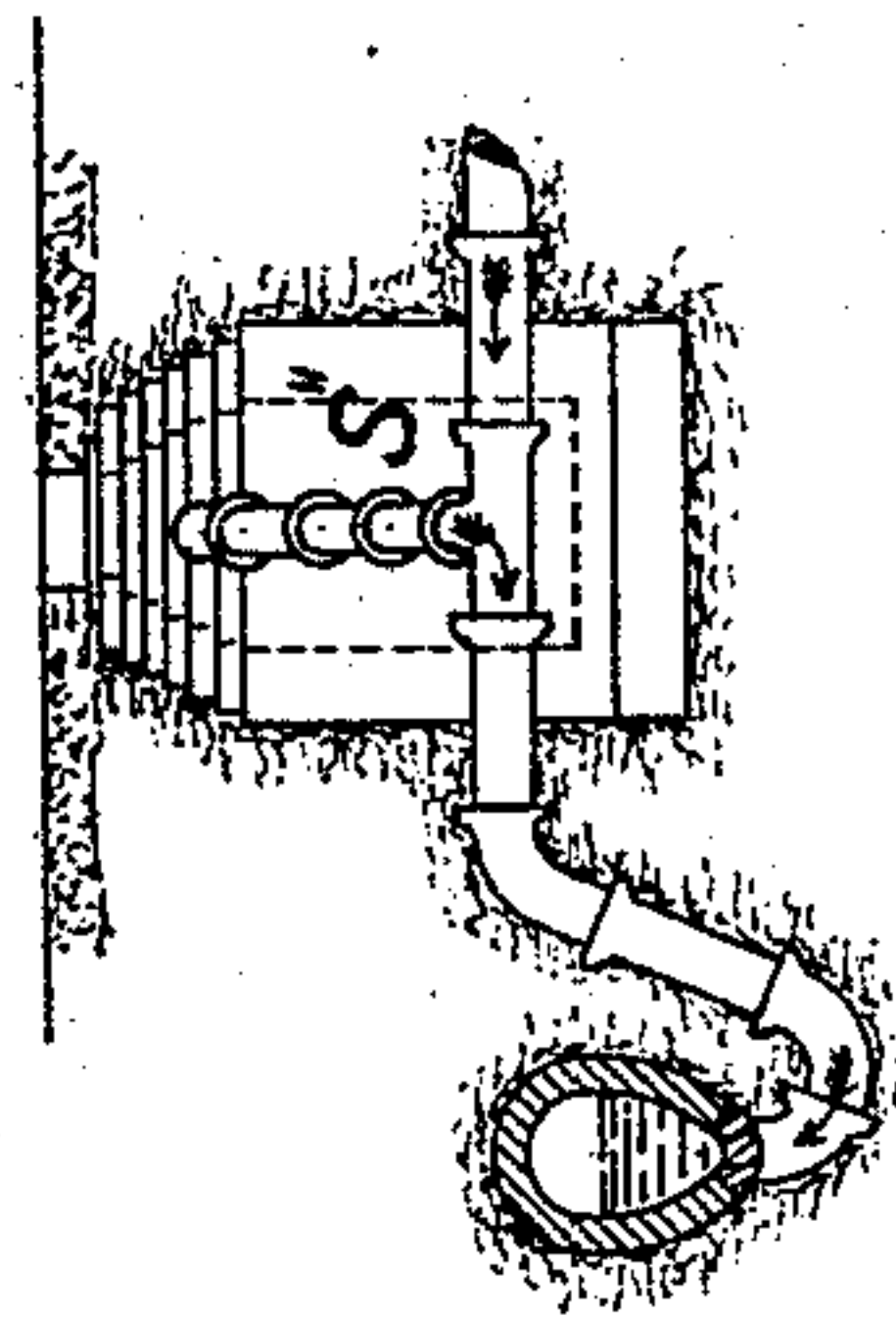


FIG 9



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**No. 235,910.**

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# UNITED STATES PATENT OFFICE.

ISAAC SHONE, OF WREXHAM, COUNTY OF DENBIGH, NORTH WALES.

## METHOD OF AND APPARATUS FOR REMOVING SEWAGE.

SPECIFICATION forming part of Letters Patent No. 235,910, dated December 28, 1880.

Application filed August 15, 1879. Patented in England September 5, 1878.

To all whom it may concern:

Be it known that I, ISAAC SHONE, of Wrexham, in the county of Denbigh, in that part of the United Kingdom of Great Britain and Ireland called North Wales, have invented a new and useful Process for Removing Sewage, and apparatus to be employed therefor, of which the following is a description in such full, clear, and exact terms as to enable any one skilled in the arts or science to which it appertains to make and use the same, reference being had to the accompanying drawings, making part of this specification, by which there is illustrated certain machinery used in the practice of my invention, and in which—

Figure 1 is a sectional elevation of a pneumatic ejector, referred to hereinafter. Fig. 2 is an enlarged sectional elevation of the valve-gear of Fig. 1. Fig. 3 is a sectional elevation at X, Fig. 2. Fig. 4 is a sectional elevation of a double-acting pneumatic ejector, referred to hereinafter. Fig. 5 is a sectional plan of Fig. 4 through Z. Fig. 6 is an enlarged sectional elevation of valve-gear of Fig. 4. Fig. 7 is an outside end view of Fig. 6. Fig. 8 is a sectional elevation of a sewerage-station according to my invention, arranged to illustrate my improved process for removing sewage. Fig. 8<sup>A</sup> is a continuation of Fig. 8. Fig. 9 is a section illustrative of street-gully in connection with my improved system. Fig. 10 is a plan illustrative of my improved system or process of removing sewage as applied to blocks of houses.

My invention consists of an improved method or process of collecting and removing sewage, and is applicable to the removal of all fluids and other matter from water-closets, privies and their conduits, sinks, subsoil, house, and other drains generally; also applicable to the removal and service of sewage from farms through and over lands, and to the removal of refuse matters and liquids generally from chemical and other works, and for irrigation purposes; and has for its object (among others) the surmounting of physical difficulties attendant upon the flat or undulating configurations of towns, villages, districts, or farms required to be dealt with, and the irregular lines, inclinations, or levels of conduits, caused in many cases by the subsidence of some light and wet soils, and by prompt removal to ren-

der practically impossible those accumulations of solid matter which the gravitating systems of sewerage, *per se*, (however perfect,) have hitherto too frequently promoted.

This invention relates to a system in which compressed air is employed as a motive power for ejecting sewage, and to apparatus employed therefor, and the system may be thus divided: first, the collection of sewage or other refuse matter or liquid into closed receptacles or reservoirs or conduits; secondly, of the use of compressed air or gas as an ejector or propelling agent; thirdly, of various details and arrangement of parts of apparatus for carrying out the process or system of sewerage according to this invention into operation.

By the method of expulsion used under the process being the subject of this invention the hydrostatic head or pressure for propelling purposes is only limited by the power of the air-compressing engine employed, which may be driven by steam, water, or other power, and it is well known that compressed air can be produced and transmitted to long distances in large or small volumes very economically.

The process or system according to this invention can be applied independently and also easily and advantageously to existing sewerage systems—for instance, as an addition to an old town, where the existing sewers could not be carried to some remote, low, or flat parts, the sewage from these parts could be ejected therefrom into the existing old sewers, and thereby aid in discharging more speedily than is now the case the sewage and other liquid which too often lodges on the invert of the conduits of the gravitating systems. It could also be applied to existing drainage or irrigation works.

I now proceed to illustrate and set forth how the process or system according to my invention may be practically applied, and to describe a form and arrangement of apparatus suitable for being employed for carrying my invention into practice, reference being had to the accompanying drawings, illustrative thereof, which are marked with letters and figures of reference corresponding with those in the following explanation, like letters and figures being used to denote the same or corresponding parts throughout the various views.

On reference it will be seen that a series of receptacles or reservoirs, A, are used, which re-



ceptacles are so placed that the sewage or other matter or fluid to be ejected will, by its natural head, gravitate into and fill such reservoirs A.

5 Referring to Fig. 1, which is a sectional elevation of the ejecting-receptacle A, it will be seen that the receptacle A is constructed with a siphon-trapped inlet-pipe, B, provided at or near its junction with the receptacle A with a  
10 non-return valve, C. The receptacle A is provided with an outlet-pipe, D, provided at or near its junction with the receptacle A with a non-return valve, E. The receptacle A is connected, through the valve G, to a pipe, I, being  
15 a compressed-air main from an air-compressing engine or from a receiver. The valve G is also connected to an exhaust-pipe, K. The valve G is of the piston type, and is automatically worked, as hereinafter described, and  
20 acts as an inlet-valve for compressed air to the receptacle A, or as an outlet-valve for compressed air from the receptacle A.

On reference to Fig. 2, it will be seen that the valve G is of piston type, the piston H of  
25 which is worked automatically by the slide-valve H'', which is operated automatically by the float-rod J; the lever J'', the bell-float F, and the cup F'. Compressed air is admitted to the receptacle A through the passages I' I''  
30 of the valve G, and exhausted from the receptacle A through the passages K' K'' of the valve G. The arrangement of bell and cup float will be understood upon reference to Fig. 1. The receptacle A is also provided  
35 with a float ball valve, K''', for the purpose of preventing the liquid from the receptacle A passing up into the valve G.

In operation, sewage or other matter or fluid flows or gravitates through the pipe B and  
40 valve C and fills the receptacle A. When the receptacle A is full the bell-float F rises, and by means of the rod J and the lever J'' brings the slide-valve H'' into position for moving the piston H into such a position as to admit com-  
45 pressed air from the pipe I, through the passages I' I'', into the receptacle A. The compressed air then expels the sewage or other matter or fluid from the receptacle A, through the discharge-pipe D and valve E, to the re-  
50 quired destination. As the liquid descends and is emptied out of the receptacle A it leaves the cup-float F' full, which descends, and thus, by means of the rod J, the lever J'', and the  
55 slide-valve H'', the position of the piston H is reversed, and the receptacle A is open to the exhaust through the passages K' K'' and the pipe K.

Referring to Fig. 4, which is a sectional elevation of a double-acting apparatus of like  
60 construction, (only modified in shape to Fig. 1,) it will be seen that the receptacle is divided by a diaphragm into two parts, A a. B is the inlet-pipe, which may be fed by gravitation through connection with a trapped uptake-  
65 pipe, or by connection to the discharge-pipe of an ejector below. C c are the inlet-valves. The inlet and outlet of receptacles A a are through

the branch B' b', common to both the inlets and outlets, as will be seen upon reference. D  
d are the outlet or discharge pipes. E e are  
70 the outlet or discharge valves. The pipes D d develop into a rising main common to both. The air supply and exhaust valve G is of duplex construction to that illustrated at Fig. 2,  
75 and will be understood upon reference to Fig. 6. The slide-valve H'' is worked by the lever J'', by means of the two float-rods J j and the two bell-floats F f. The cup-float F', used in the apparatus, Fig. 1, is dispensed with in the  
80 double-acting apparatus. In the double-acting apparatus two float-valves, g g', are used, the use of which is hereinafter described.

In operation the sewage or other matter or fluid is forced or gravitates through the pipe B  
85 and valve C into the receptacle A. When the receptacle A is full the cup-float F rises, and, through the medium of the rod J, the lever J'', and the duplex valve H'', (see Fig. 6,) brings the piston H, Fig. 6, into such a position that  
90 compressed air passes through the passages I' I'' into the receptacle A, and expels the contents of the receptacle A through the pipe D. While the receptacle A is emptying, receptacle  
95 a is filling, and when full rises, its float f opening the receptacle A to the exhaust through the passages K' K'', and the receptacle a to the compressed-air inlet through the  
100 passages i' i''. The float-valves g g' are provided to prevent one compartment filling before the other has completed its emptying operation, and to prevent the escape or waste of  
compressed air through the discharge-pipes D d.

In carrying out the process for removing sewage according to my system into operation,  
105 a series of receptacles or reservoirs, A, may be placed in stations such as that illustrated at Figs. 8 and 8<sup>a</sup>. It will be seen that the receptacle A is placed within a man-hole, O. P  
110 is a man-hole and collecting-reservoir, which is fed by the tributary drains R. These tributary drains may flow from the blocks of houses Z, Fig. 8<sup>a</sup>, or from the gullies R' R'', or from  
115 any other position. The receptacle A is fed with sewage or other matter or fluid through the pipe B, and ejects such sewage or other matter or fluid through the pipe D into the  
sealed gravitating sewer S, or into the sealed rising sewer S', under pressure.

Fig. 9 illustrates connection of street-gullies  
120 S'' with the gravitating-sewer S. I is the compressed-air main, communicating by a branch pipe to the valve G of the receptacle A. K is the exhaust-pipe from the receptacle A, which may open into the sealed gravitating  
125 sewer S, from whence the exhaust-air is led to a furnace for purification; or the exhaust-air may be allowed to escape into the man-holes or elsewhere to render it harmless.

Fig. 10 illustrates an ideal plan of a flat dis-  
130 trict drained and sewered by one receptacle and ejector, A. The lines (marked V) to the house-blocks 1, 2, 3, 7, 8, and 9 show the street-waters delivered into branch sewers V' at man-



hole V'', and thence to the ejecting-receptacle A. The lines (marked W) to blocks of houses 13 to 24 show street, rain, and storm waters completely separated from the sewage proper, and delivered to a special ejector, A A, discharged by a special sewer, W', to any requisite distance or outfall.

It will be seen upon studying the drawings that each receptacle or reservoir A is constructed, by preference, with a siphon or trapped inlet-pipe, B, provided at or near its junction with the receptacle A with a non-return valve or valves, C, and with a compressed-air inlet and outlet valve, G, and the following may be taken as an example of the carrying out of the system of sewerage by the application of such ejector-receptacles A applied to a town. The town should be divided into districts, according to the natural inclinations of the surface. The sewage and slops, including storm-waters and subsoil-waters, if any, of each district are carried by means of gravitating pipes of such sizes and inclinations as to give the self-cleansing velocities to the liquid required by sanitarians. These gravitating pipes, which should be ventilated in the most approved manner, would be made to converge in each district to a pneumatic liquid-ejector receptacle, such as A, placed at such a depth as to allow the liquid to flow into it and fill it. When full the liquid is to be ejected from the receptacle A through the pipe D by means of compressed air of the required pressure, supplied through the valve G by a pipe communicating from an air-compressing engine or air-reservoir. The sewage or other matter or liquid will be forced through the outlet-pipe D into a sewer leading to the outfall. This sewer can be sealed throughout its entire length, and in this case the moment the sewage or other matter or liquid has passed the outlet-valve E by being forced out of the ejector-receptacle A it would be cut off from any connection with the outside atmosphere until it had reached its final destination, being prevented from returning to the ejector A by the non-return valve or valves of the pipe D.

It has been my chief object in perfecting the process or system the subject of this invention to provide for the rapid transmission of the sewage or other refuse matter or liquid away from the town, village, or district to its prescribed destination, and to do this without altering in any material degree the application of water to the carriage of sewage so largely adopted.

The principle involved under my invention may be said to be the application, substantially in the manner described, of pneumatic pressure obtained by the compression of natural fresh atmospheric air as a motor for emptying sewage receptacles or reservoirs, and thus propelling sewage or other matter or liquid to a natural outfall or other desired destination under pressure, or into a main gravitating sewer or drain, which latter may be ventilated by the exhaust-air from the recep-

tacle or reservoir; but no claim is made to the application of the natural pressure of atmospheric air applied by the vacuum system or the system known as the "Leirnur" system.

In the working of the process or system the subject of my invention, the sewage or other refuse matter or liquid may be driven through pipes of a comparatively small diameter, insuring a perfect scour, and allowing little or no chamber or space for the generation of foul and noxious gases; or, in other words, the sewage may be driven through sealed pipes of a comparatively small diameter so rapidly as to practically prevent the generation of foul or noxious gases therein, and also to prevent any gases that may be generated from passing into the streets or houses.

Having now described and ascertained the nature, object, and purposes of my invention, and shown the process, system, mode, or manner in or under which the same is or may be used or carried out into practical effect, I would remark, in conclusion, that although my invention is for a new and useful process for removing sewage, it will also be evident that the apparatus can be used for forcing fluids generally; but I would have it known that I am perfectly aware that compressed air has been used for forcing liquids generally, and among others patents have been granted to John M. Brooke, of Lexington, Virginia, No. 139,538, dated June 3, 1873, and William E. Prall, of Washington, No. 146,357, dated January 13, 1874; also to William Porter Maddison, (British patent,) No. 1,798, A. D. 1872; but no patents have been obtained, so far as I can ascertain, for the direct application of compressed air as a propelling agent for sewerage systems.

I disclaim all other apparatus for forcing liquid by compressed air now in use.

What I claim as my invention is as follows:

1. The method or process of collecting and removing sewage so as to avoid the exposure, nuisance, and cost of handling and transporting it, consisting of conducting the sewage from the gutters and sewers through gravitating conducts into a receiver, then expelling it therefrom by means of pneumatic pressure applied in said receiver, substantially as herein described.

2. In combination with a sewer, a tight receiving-chamber, A, provided with self-acting floats F and F', connected to the self-acting gearing, to regulate the admission and expulsion of the sewage from the receiver, substantially in the manner described.

3. The valve G, interposed between the air compressor and the receiver A, and provided with a lever, J'', a connecting-rod, and float F, combined with the receiver A, by which the action of the valve is controlled automatically.

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