No. 780,943. PATENTED JAN. 24, 1905.

J. E. DOUGLAS.

STEAM PUMP.

APPLICATION FILED MAR. 23, 1904.

3 SHEETS—SHEET 1.

Fig. 1.

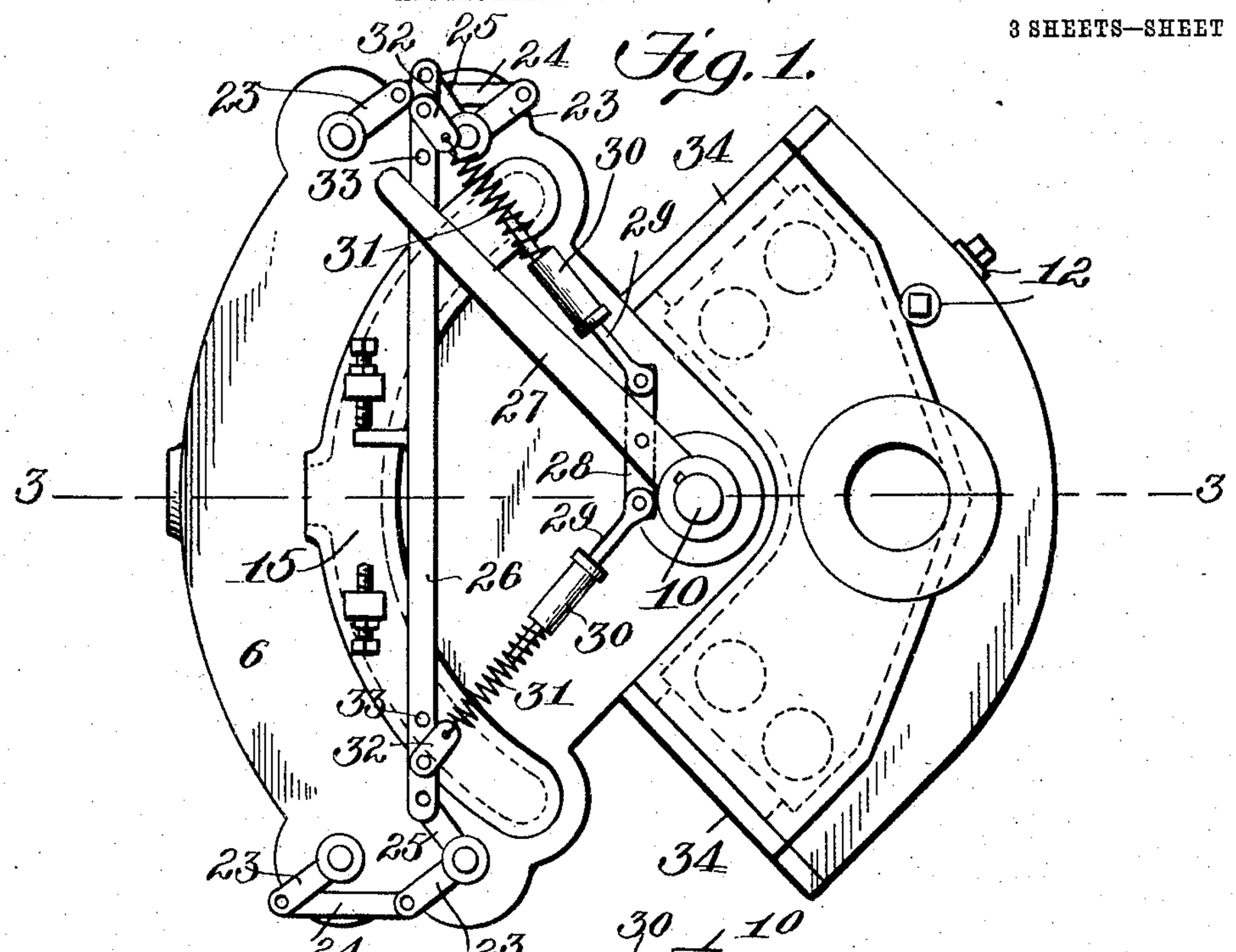

Fig. 2.

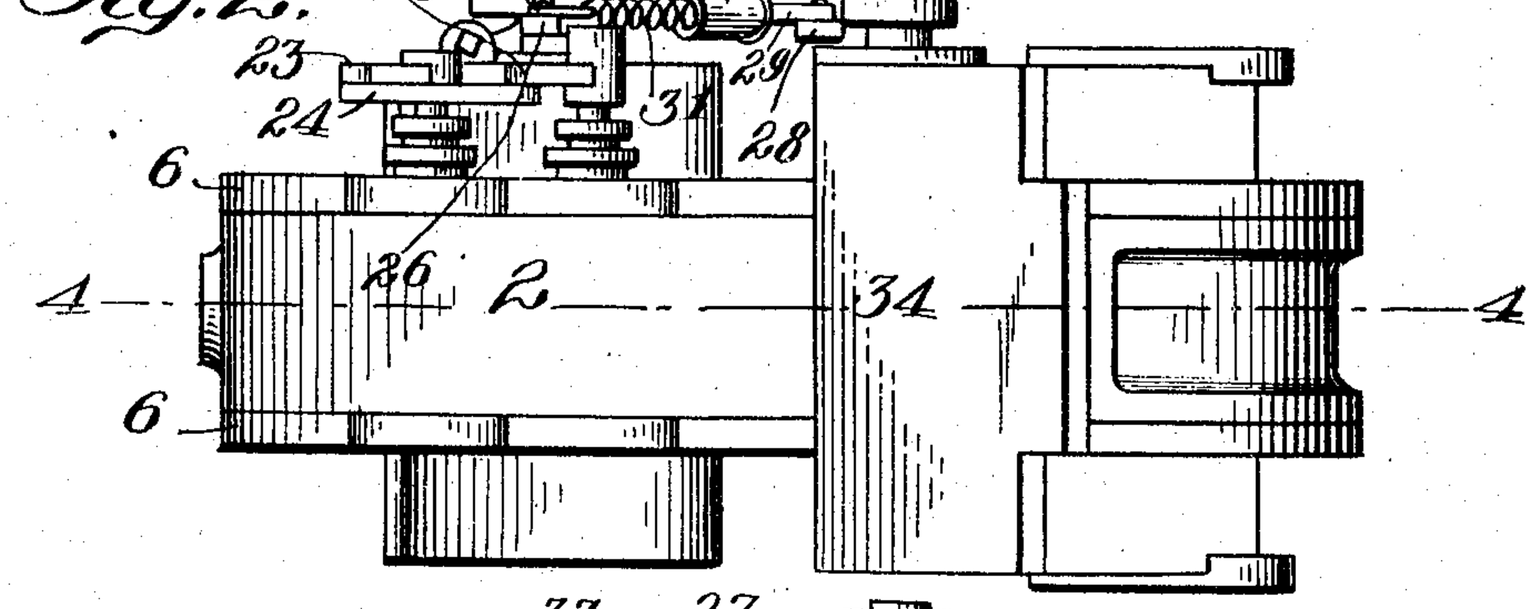

Fig. 3.

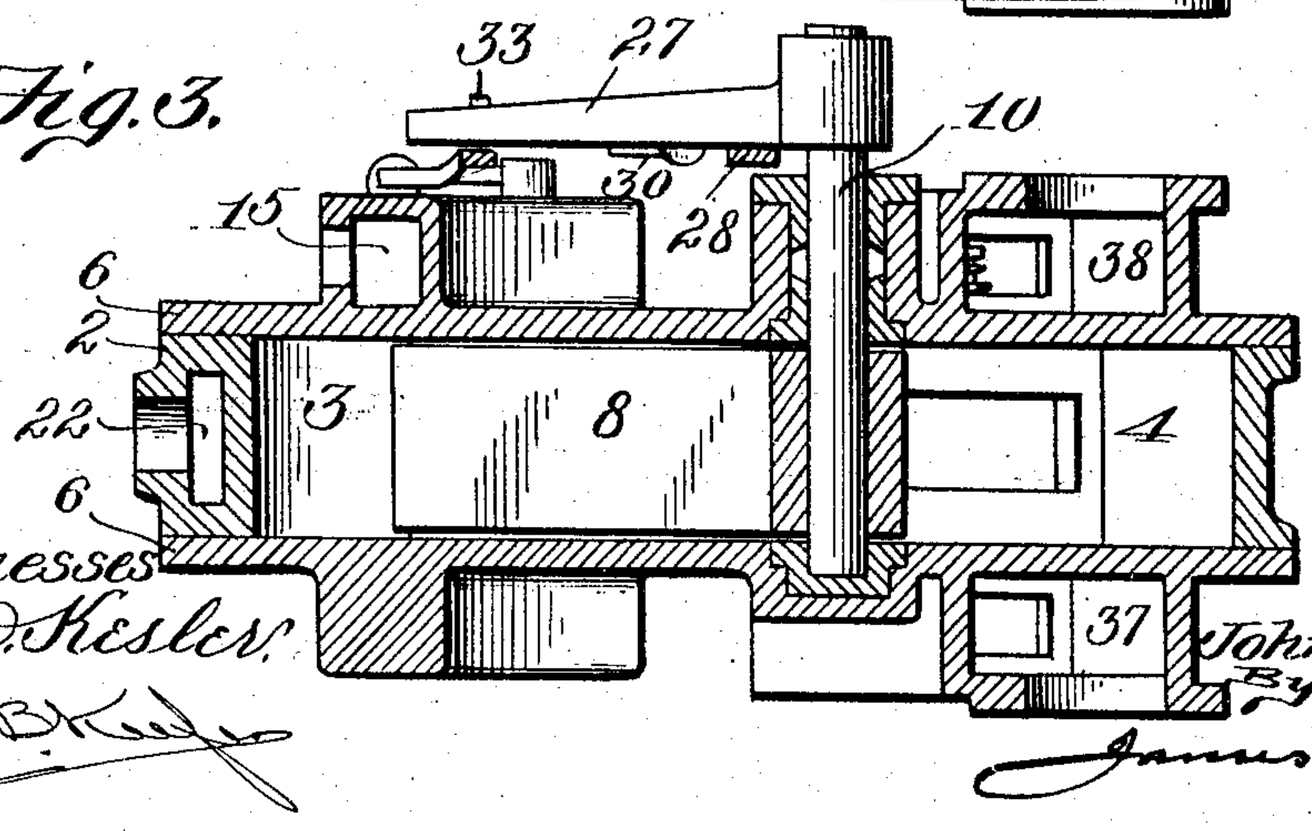

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PHOTO-LITHOGRAPHED BY SACKETT & WILHELMS LITHO. & PTG. CO. NEW YORK.

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3 SHEETS—SHEET 2.

Fig. 4.

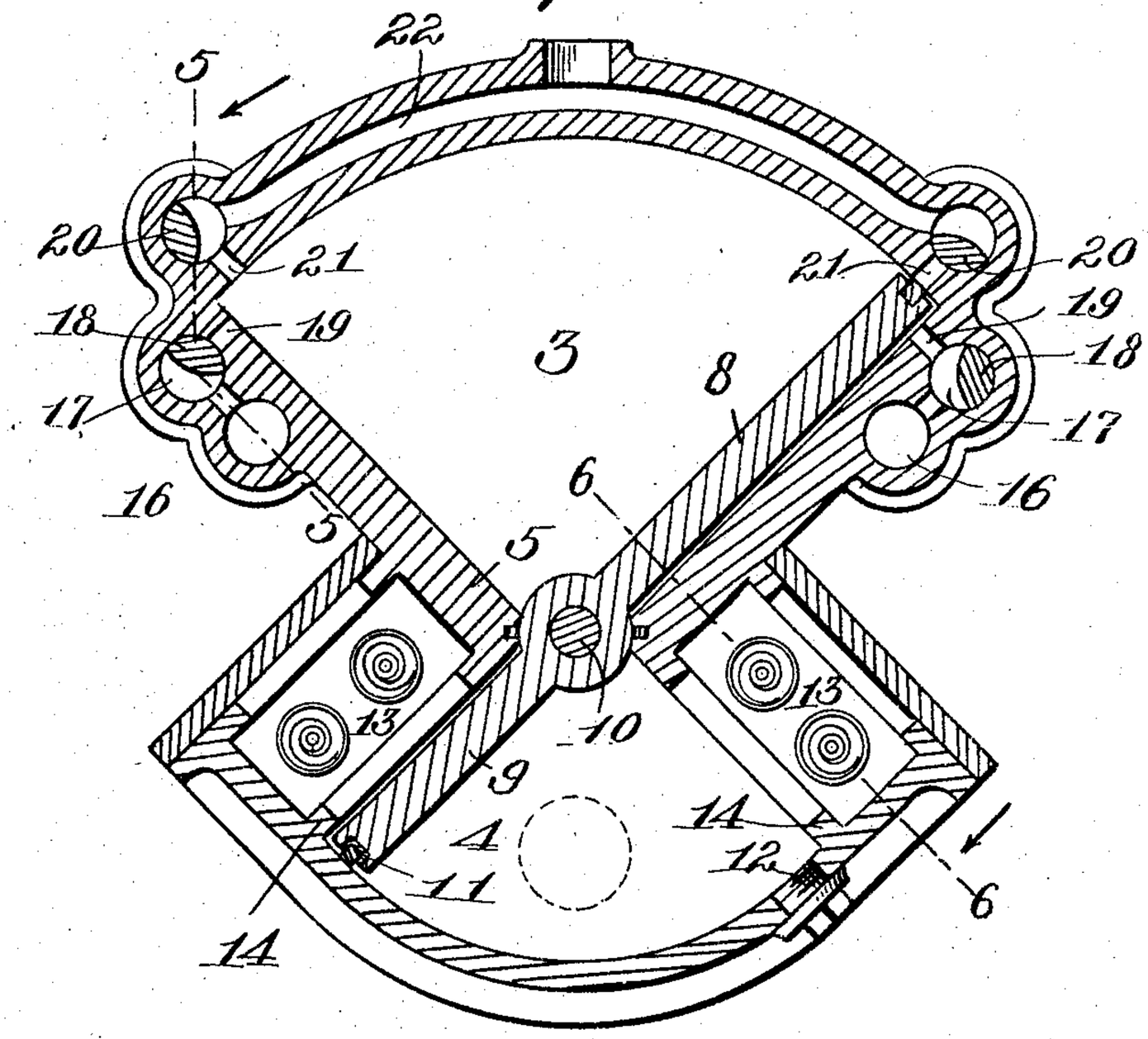


Fig. 5.

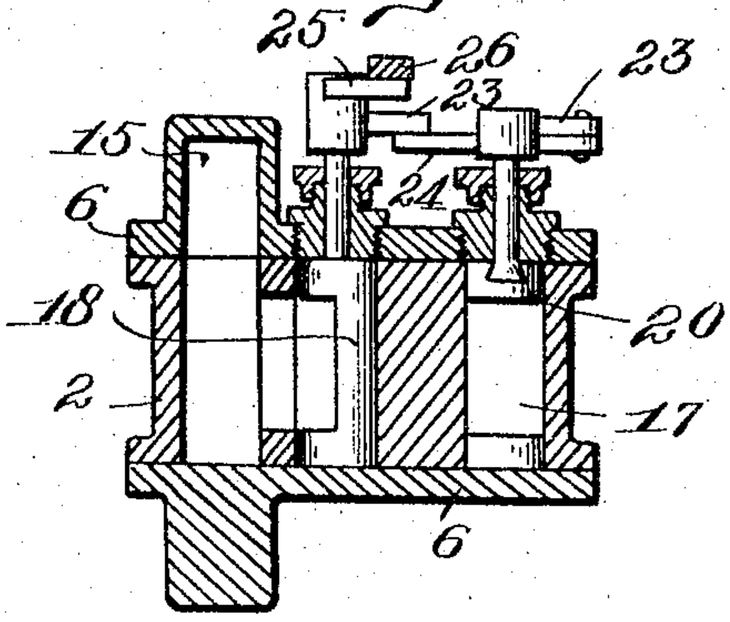
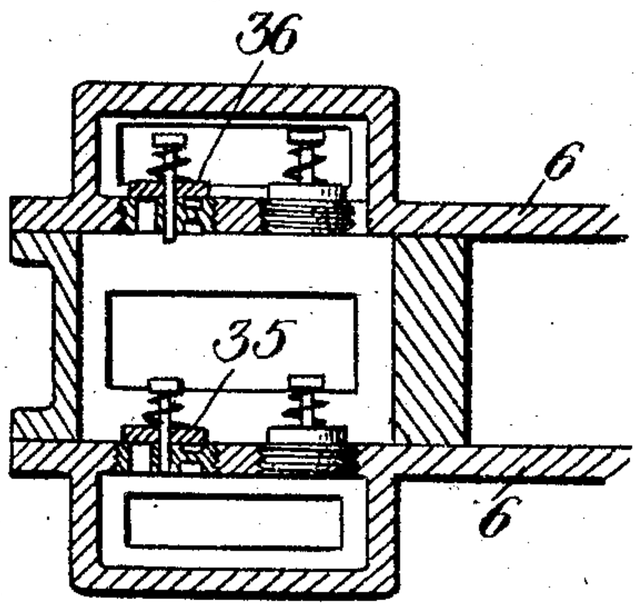


Fig. 6.



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3 SHEETS—SHEET 3.

Fig. 7.

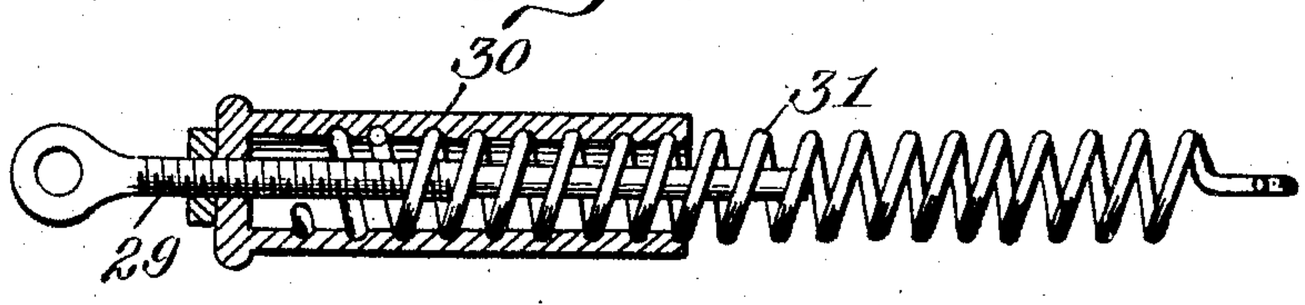


Fig. 8.

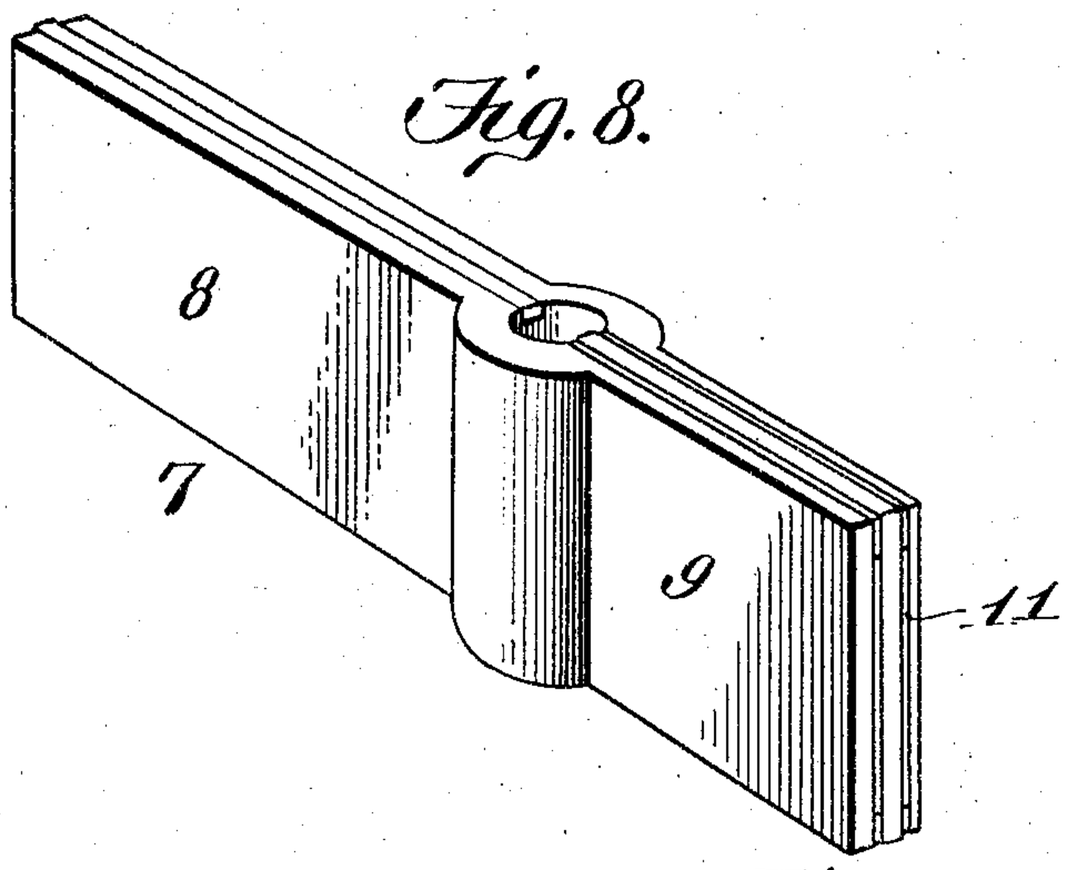


Fig. 9.

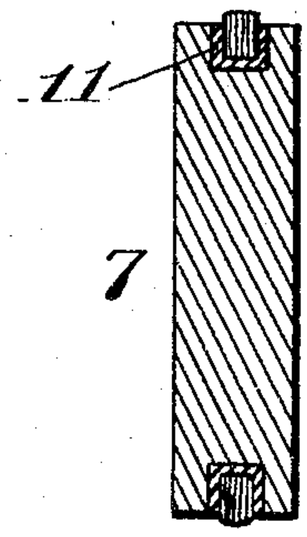
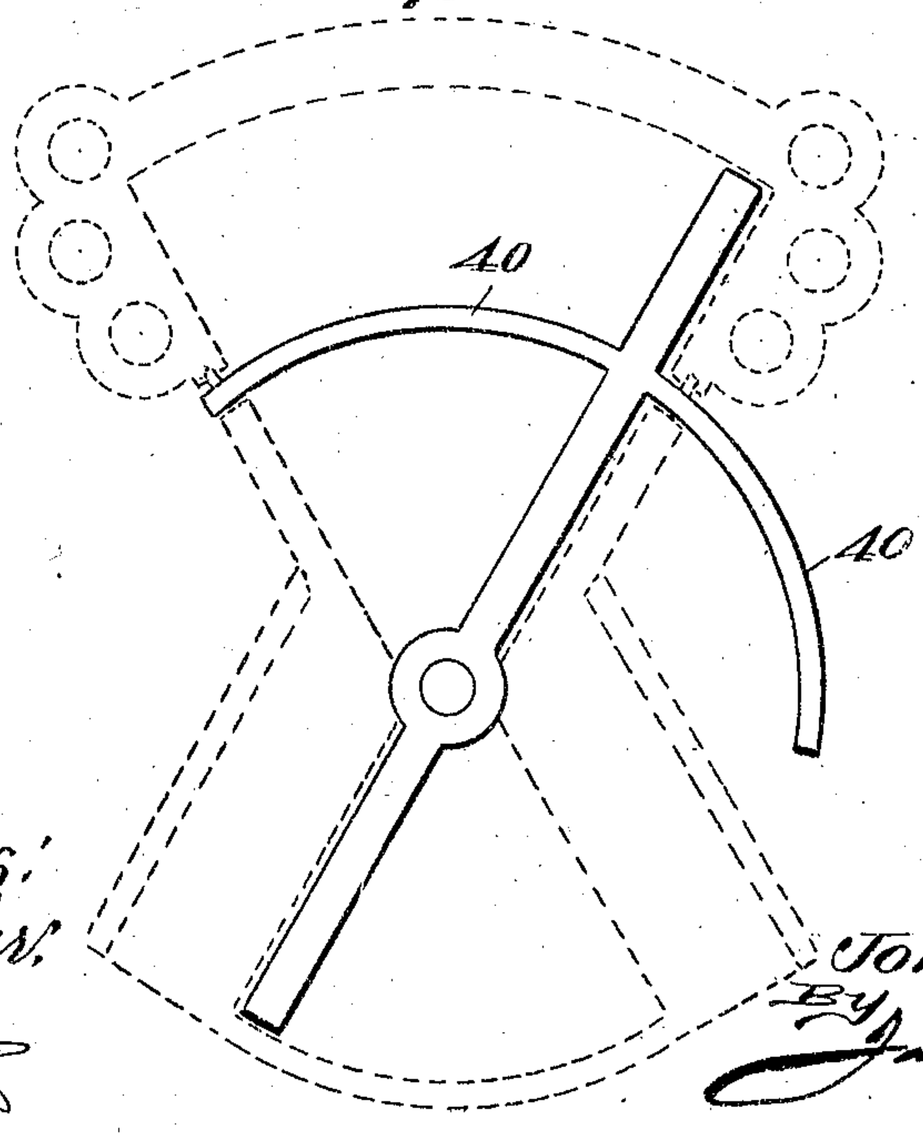


Fig. 10.



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No. 780,943. Patented January 24, 1905.

UNITED STATES PATENT OFFICE.

JOHN E. DOUGLAS, OF BIRMINGHAM, ALABAMA, ASSIGNOR OF ONE-HALF TO AUGUSTUS J. CAMP, OF BIRMINGHAM, ALABAMA.

STEAM-PUMP.

SPECIFICATION forming part of Letters Patent No. 780,943, dated January 24, 1905.

Application filed March 23, 1904. Serial No. 199,621.

To all whom it may concern:

Be it known that I, JOHN E. DOUGLAS, a citizen of the United States, residing at Birmingham, in the county of Jefferson and State of Alabama, have invented new and useful Improvements in Steam-Pumps, of which the following is a specification.

This invention relates to steam-pumps, the object of the invention being to provide a simple and effective device of this character which is compact and strong and capable of elevating large quantities of water.

While I have termed the invention a "steam-pump," this has been done simply for convenience, for motive fluids other than steam may be utilized for actuating the pump. In like manner, I do not restrict myself to the use of the invention for lifting water, for the pump may be used for lifting oil, and in the particular embodiment of the invention which I have selected for illustration in the accompanying drawings, forming a part of this specification, an advantage follows this particular use, as the steam employed to actuate the pump serves to heat the oil and maintain the latter in a fluid condition, which is an important consideration.

The improved pump illustrated by said drawings includes an oscillatory member having branches at opposite sides of its center of motion, one of which branches is fluid-operated and the other of which constitutes a pump member. In the present instance that branch of said oscillatory member which constitutes the pumping element thereof is not as long as the fluid-operated piston part, whereby I am enabled to secure the advantage of leverage which cannot be obtained in pumps of the ordinary kind. It is to be understood that I do not limit myself to the showing made by the following description of said drawings, for the organization hereinafter disclosed may be materially varied within the scope of my claims succeeding such description.

In the accompanying drawings, Figure 1 is a plan view of a pump including my invention. Fig. 2 is a side elevation. Fig. 3 is a longitudinal sectional elevation, the section being taken in the line 3 3 of Fig. 1. Fig. 4 is a sectional elevation in the line 4 4 of Fig. 2. Fig. 5 is a sectional elevation taken in the line 5 5 of Fig. 4. Fig. 6 is a similar view, the section being taken in the line 6 6 of Fig. 4. Fig. 7 is a detail sectional view of one of the yieldable connections constituting part of the valve gearing or rigging. Fig. 8 is a detail view of the duplex piston. Fig. 9 is a transverse sectional elevation of the same, and Fig. 10 is an elevation of a modification.

Like characters refer to like parts in all the figures of the drawings.

In the description of the figures I have described Fig. 1 as a plan view, as ordinarily the pump therein illustrated will be supported flatwise upon a suitable foundation, but it may stand in any other desired way as may be convenient or desirable to meet particular conditions. Such pump is represented as including in its construction a shell, as 2, which may be in the form of a casting or made in any other suitable way. The shell 2 is shown as having two openings 3 and 4, respectively, of approximately segmental form, the two openings being connected by a neck 5, the walls of which are concentric with the axis of motion of a piston element hereinafter described. The opening 3 in the present instance is of greater radius than that of the openings 4, for a purpose that will hereinafter be obvious. The shell therefore presents approximately the form of two merging quadrants, and to its opposite faces are fastened in some suitable manner the plates 6 of substantially similar contour, screws being a simple means to unite the parts. When the plates are attached to the shell, the structure thus assembled constitutes a casing for the piston element, to which reference has been made, and which casing, as will be apparent, contains two chambers, one of which is composed of the space 3 and the plates 6, while the other one consists of the space 4 and the two plates. For convenience of description I will hereinafter denote one chamber by the numeral 3 and the other by the numeral 4, the chamber 3 constituting a steam-chamber, while the

chamber 4 constitutes a water-chamber, although it will be evident from my initial statements that these chambers may respectively receive other motive fluids or other liquids. The piston element to which reference has been made is denoted in a general way by 7. It consists of an elongated blade mounted for oscillation between its ends. The longer arm or branch of the duplex piston or blade 7 is denoted by 8, while the shorter is denoted by 9. In the present instance the longer branch constitutes a steam-piston, while the shorter branch serves as a pump-piston, although I do not limit myself to the differential lengths of the two piston members. Preferably, however, the fluid-operated piston member 8 is longer than the supplemental piston member or pump member 9, so that the former when actuated can transmit to the latter a considerable leverage, governed, of course, by the variation in length of the two parts. The hub of the piston element fits within the neck 5, joining the two chambers 3 and 4, and is fixed to the rock-shaft 10. The outer edge of the steam-piston 8 traverses the arcuate portion of the chamber 3, while the corresponding portion of the pump-piston 9 traverses the arcuate surface of the chamber 4, the side edges of the piston being contiguous to the inner faces of the plates 6 on the oscillation of the piston element. The walls of the neck 5 are channeled to receive suitable packing in order to prevent the passage of steam from the steam-chamber to the pump-chamber. The side edges of the pump piston member 8 are channeled to receive packings, while the pump piston member 9 is also channeled, but does not directly receive the packing, the packing being introduced into trough-shaped carriers, as 11, removably inserted into the side channels of said pump piston member 9. The casing, or rather the shell 2 thereof, has a perforation or hand-hole 12 opening from the outside thereof into the pump-chamber 4, by which access may be had to the pump piston member 9 to remove the trough-shaped packing-carriers 11 when occasion requires the same—such, for example, as when such packing becomes worn. When the carriers are repacked, they can be applied in place to the pump piston member 9 through said perforation or hole 12.

Steam is alternately introduced into the steam-chamber 3 from opposite sides thereof in order to oscillate the steam-piston 8 and apply a corresponding motion to the pump-piston 9.

The casing composed of the shell 2 and face-plates 6 has other water-chambers in addition to the water-chamber 4, each of which I will denote by 13 and which are formed by slotting the pump portion of the shell at opposite sides of the main water-chamber 4. It will therefore be evident that the main water-chamber 4 is separated from the auxiliary water-chambers 13 by walls, as 14, in which ports are made to put the auxiliary water-chambers into communication with the main or intermediate water-chamber.

I form upon the outer face of one or both of the face-plates 6 a curved passage 15. These curved passages produce strengthening-ribs upon the exterior of the respective plates. I will describe in detail one of them. Between the ends of the passage 15 is an inlet, into which a supply-pipe for steam or other motive fluid is tapped. The ends of the passage open into the cylindrical chambers 16 in the shell 2, which chambers are connected by suitable ports with valve-chambers, as 17, the valves of said chambers being designated by 18 and being of the rocking type. The valve-chambers communicate by ports 19 with the steam-chamber 3, at opposite sides thereof, and the steam is alternately directed into said chamber through said ports 19, thereby to oscillate the piston element, the steam of course being directed against the member 8 of said piston. The exhaust-controlling valves are practically the same construction as the supply-controlling valves and are denoted by 20, their cylindrical chambers being connected by ports 21 with the steam-chamber 3 at opposite sides of the piston member 8. The ports 21 do not open into the steam-chamber directly at the inclined walls thereof, by reason of which a certain amount of steam will be retained between the piston and the supply-controlling valve mechanisms on the opposite strokes thereof, which steam acts as a cushion. The chambers of the exhaust-controlling valves 20 open into the common exhaust-passage 22, formed in the shell 2, and which is intersected between its ends by a delivery-outlet into which a pipe can be tapped or otherwise held in place.

The rock-shaft 10 extends through the casing, while the same applies to the stem of the several supply and exhaust controlling valves, said stems being provided with crank-arms, (each denoted by 23, and respectively connected by links 24.) The stems of the supply-valves are provided with other crank-arms, as 25, extending at right angles, or substantially so, to the other crank-arms and to which the connecting-rod 26 is pivotally or otherwise suitably joined.

To the shaft 10 I key or otherwise suitably fasten the actuator 27, shown as a rod, and at a point in the vicinity of the shaft I pivot to said rod the equalizing-lever 28, the arms of which are of equal or practically equal length. To the opposite ends of the equalizing-lever I have shown as pivoted the screw-threaded stems 29, which diverge toward the shaft 10 and upon which the sleeves 30 are screwed. In other words, the sleeves are adjustably connected to the stems, this being for the purpose of regulating the tension of springs hereinafter described, and they are held in their adjusted position by means of jam-nuts.

Each sleeve is counterbored to receive the inner terminal portion of a spring 31, shown as of the coiled form. The inner ends of the springs are rigidly united to the sleeves, while the outer ends thereof are connected to the short links 32, pivotally connected in turn to the connecting-rod 26, near the opposite ends of the latter. The said connecting-rod between the two links is provided with projections or studs, as 33, in the path of the swinging or oscillatory arm or rod 27, which, it will be remembered, moves with the piston element 7.

I have not described in detail the construction of the valves 18 and 20, for they are of a familiar type, and the same statement applies to their operation. In fact, valves of a radically-different form and mode of operation may be substituted therefor and I can accomplish all the objects of my invention.

When the piston element 7 is at either end of its stroke, a spring 31 will be in line with a crank-arm 25, connected with the supply-controlling valve, and it will be assumed that the piston member 8 is at what is shown in Fig. 4 as the right end of its stroke. Therefore the spring 31 at the right will be in line with the corresponding crank-arm 25. At this stage the supply-valve 18 on the right is wide open, while the corresponding exhaust-valve 20 is closed, the reverse relation being the case at the opposite side. Therefore when steam is admitted into the supply-passage 15 it will traverse the supply-valve chamber and enter the steam-chamber 3 at the right thereof in order to operate the steam-piston and swing it toward the left in Fig. 4. During the movement of the piston the spring 31 on the right is applying its force to the spindle of the corresponding supply-valve on the right through the intermediate crank-shaft 25, the said spring of course during the motion of the rod or arm 27 with the duplex piston being stretched. Owing to the presence of the equalizing-lever 28, which is pivotally carried by the rod or arm 27 for movement relatively thereto, the spring on the left at this time is not stretched. When the free portion of the rod or arm 26 strikes the projection 33 on the left, at which point the piston has completed one stroke, the rod 26 will be thrust toward the left, thereby imparting an initial closing movement to the supply-valve 18 through the intermediate crank-arm 25 at the right, and hence swinging said crank-arm from off the dead-center. The instant that the crank-arm passes the dead-center the spring 31 becomes effective for imparting an accelerated closing motion to the supply-valve 18 on the right to instantly shut off the supply of live steam to the corresponding side of the steam-chamber. As the supply-valve 18 on the right closes the corresponding exhaust-valve, through its connections with said supply-valve, will be simultaneously opened. During the movement of the piston, and hence the rod 27, toward the left the supply-valve 18 on the left is closed and the corresponding exhaust-valve 20 is open, so that the exhaust can be expelled from the chamber 3 by the moving piston through the port 21 by way of the exhaust-valve chamber to the exhaust-passage 22, from which it passes through the outlet hereinbefore described and by way of suitable piping to the atmosphere. When the piston has practically completed its stroke toward the left, the rod or arm 27, operative therewith, as previously set forth, strikes the projection 33, so that through the rod 26 the supply-valve 18 on the left is opened and the corresponding exhaust-valve, through the intermediate connections with said coöperating supply-valve, is closed, at which stage the return stroke of the piston takes place. The action of the four valves takes place in unison, being brought about by the rod 26 under the power of the spring on the right.

In the description of the operation of the pump just set forth I have described certain of the parts as being on the "right" and others as being on the "left," reference in this connection being had particularly to Fig. 4 of the drawings. In Fig. 1 those parts at the right will be at the upper side of the figure, while those at the left will be at the under side of the figure.

I have hereinbefore described a main water-chamber 4 and auxiliary water-chambers 13 at opposite sides of the same, the water being drawn by the pump alternately into such auxiliary water-chambers and into the intermediate main chamber, from which latter it is forced by the pump-piston 9. The face-plates 6 cover these several chambers, while manholes covered by removable plates, as 34, open into the auxiliary chambers, so that access may be had to the water-controlling valves, hereinafter described. Into each auxiliary chamber 13 ports open, said ports being furnished with valves, the inlet-valves in each case being denoted by 35, while the outlet-valves are designated by 36, the inlet-valves of course being inwardly opening, while the reverse applies with respect to the outlet-valves. Each plate 6 has formed thereon an enlargement or swell to provide for interior passages, as 37 and 38, the passage 37 being the supply one, while the other passage constitutes an exhaust-passage. Suction and delivery pipes are fitted to the face-plates and communicate with the water-supply or suction and exhaust or delivery passages, respectively.

In Fig. 4 I have described the steam-piston 8 as moving toward the left from the right, and in this case the pump-piston will move from the left toward the right. As the pump-piston moves in such direction it sucks water into the auxiliary chamber 13 at the left, the inlet-valves 35 of course being

opened by the suction and the water passing into the intermediate or main chamber 4. The water of course enters the auxiliary chamber 13 through the supply-passage 37 and will fill the chamber 13 at the left and the main chamber 4 when the pump-piston has completed its stroke toward the right. The instant that the pump-piston swings toward the left under the action of the steam or power operated piston 8 the water is expelled thereby from the chamber 4 through the chamber 13 at the left, the supply or inlet valves 35 being closed as soon as the piston commences its stroke, and such water is forced into the exhaust-passage 38 by way of the outlet-valves 36 into the exhaust-pipe or, as it would be in some cases, a supply-pipe. The same action follows with respect to the pump-piston on its stroke toward the right. The steam and pump pistons are therefore double-acting, doing work on each stroke.

In some cases I need not utilize the entire area of the steam-piston, as will now appear from a description of the modification shown in Fig. 10. In this modification I intend to concentrate the energy of the steam or equivalent motive agent at the outer end of the steam-piston or at a point beyond which the latter balances with the pump-piston. Referring to said Fig. 10, it will be seen that the piston is provided with segmental wings 40 of substantially duplicate construction, which upon the oscillation of the piston are adapted to play in apertures in the casing, packing being interposed between the wings and casing to prevent the escape of steam from the steam-chamber. The arcs of the segmental wings are struck, of course, from the axis of motion of the duplex piston. The wings 40 therefore serve to divide the steam-chamber into two compartments, into one only of which the steam is directed—that is to say, the steam is directed into the outer compartment—by virtue of which the concentration of the steam at the place most desired is secured.

The ports in the steam end of the pump, it will be seen, are relatively of considerable size, so that any foreign matter that may be drawn into the pump-chamber will cause no injury and will have no effect upon the working capacity of the pump.

By reason of the device hereinbefore described I provide for an increased effective area in the steam end or chamber of the pump as compared with high-pressure pumps with which I am familiar. I may also apply leverage to any extent and in pumping water can use a small orifice for discharge when high-water pressure is desired and a large orifice where volume is desired.

The pump is simple in construction and I am enabled to dispense with such parts as sliding stuffing-boxes and other like accessories which are generally present in pumps of the ordinary kind.

Having thus described the invention, what I claim is—

1. In a pump of the class described, an oscillatory piston element having a plurality of parts, and a casing for the same having two chambers in one of which one of the piston parts is adapted to move and in the other of which the other piston part is adapted to move, means for controlling the supply of a motive agent to and the exhaust of such agent from, one of said chambers, and means for controlling the supply of liquid to and the delivery of such liquid from the other chamber.

2. In a pump of the class described, an oscillatory piston element having a plurality of parts, and a casing therefor having substantially segmental chambers to receive for motion the respective parts of the piston.

3. In a pump of the class described, an oscillatory piston element having a plurality of parts and a casing therefor having substantially segmental chambers in which the respective parts of the piston are arranged for motion, and a connecting-neck to receive the hub of the piston.

4. In a pump of the class described, an oscillatory piston element having a plurality of parts and a casing therefor having substantially segmental chambers in which the respective parts of the piston are arranged for motion, and a connecting-neck to receive the hub of the piston, said neck being channeled to receive packing.

5. In a pump of the class described, an oscillatory piston element having two piston parts, one of which constitutes a prolongation of the other, and one of said piston parts being of greater length than the other and being fluid-operated, and the other constituting a pump-piston.

6. In a pump of the class described, a casing having steam and water chambers and a piston element having a plurality of parts movable respectively in said steam and water chambers, a discharge-passage, the ends of which are connected with the steam-chamber at opposite sides of the piston part therein, exhaust-valves for controlling the exhaust from the steam-chamber, a steam-supply passage communicating with the steam-chamber at opposite sides of the steam-piston part, supply-controlling valves, and means operable with the piston for simultaneously actuating the valves.

7. In a pump of the class described, a casing having a steam-chamber and a water-chamber of approximately segmental form, and an oscillatory piston element supported for oscillation at the junction of the chambers and having a plurality of parts adapted to move in the respective chambers, a discharge-passage the ends of which are connected with the steam-chamber at opposite sides of the piston part therein, a pair of exhaust-valves at the ends of said discharge-chamber, ports

leading from the chambers of the exhaust-valve into the steam-chamber between the inclined faces of the latter, a steam-supply passage communicating with the steam-chamber at opposite sides of the steam-piston part, supply-valves for controlling the supply, and means operable with the piston for simultaneously actuating the valves.

8. In a pump of the class described, a casing having a steam-chamber and a main water-chamber, auxiliary water-chambers at opposite sides of and communicating with the main water-chamber, inlet and outlet passages connecting the auxiliary water-chambers, valves for controlling the flow of liquid into and from the auxiliary water-chambers, a piston element having a plurality of parts movable respectively in the steam-chamber and main water-chamber, and means for controlling the supply of steam to and the exhaust of steam from the steam-chamber.

9. In a pump of the class described, an oscillatory piston element having a plurality of parts and a casing therefor having substantially segmental chambers in which the respective parts of the piston are arranged for motion, means for dividing one of the chambers into a plurality of compartments, and means for admitting an operating fluid into one of the compartments where it can act against one portion of the piston element.

10. In a pump of the class described, an oscillatory piston element having a plurality of parts and a casing therefor having substantially segmental chambers in which the respective parts of the piston are arranged for motion, one section of the piston having lateral wings and the casing being pocketed to receive said wings.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JOHN E. DOUGLAS.

Witnesses:
T. B. ALFORD,
W. G. SCHUSTER.