Feb. 17, 1925. 1,527,018

W. J. SMITH

AUTOMATIC PUMP

Filed May 20, 1924

Fig. 1.

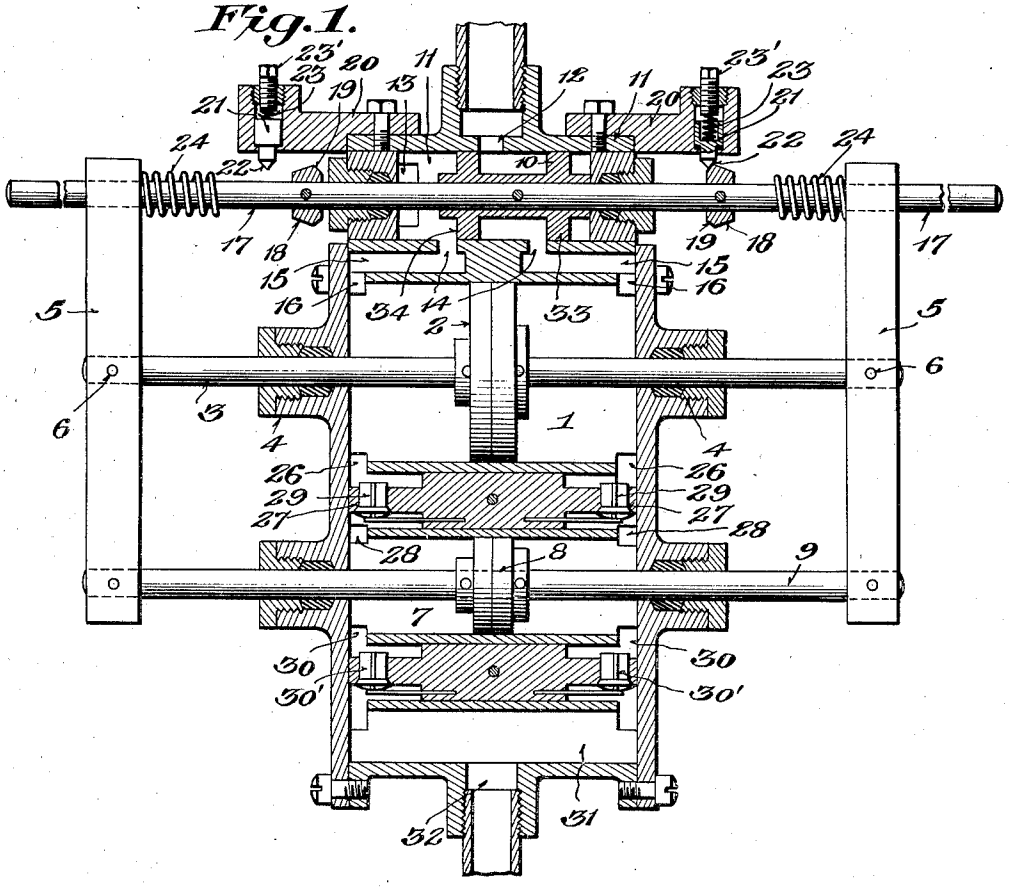


Fig. 2.

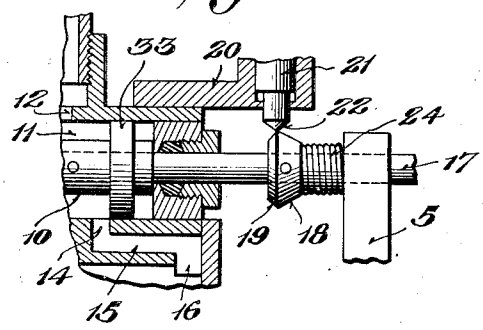
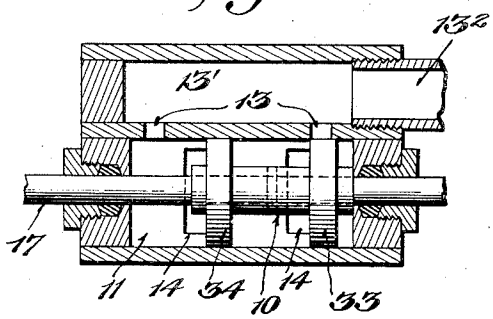


Fig. 3.



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UNITED STATES PATENT OFFICE.

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AUTOMATIC PUMP.

Application filed May 20, 1924. Serial No. 714,620.

To all whom it may concern:

Be it known that I, WILLIAM J. SMITH, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Automatic Pumps, of which the following is a specification.

This invention relates to automatic pumps.

The object of the invention is to provide an automatic pump in the operation of which a quantity of water admitted at a low pressure shall raise a portion of the water to a higher pressure.

The invention in its simplest form consists of two or more cylinders and pistons, means for admitting and discharging water alternately to and from the sides of the pistons, and means whereby the combined force exerted by the pistons is utilized to raise the pressure of water on one side of one or more pistons.

In the drawing I have shown in Figure 1 a central vertical sectional view of a pump constructed in accordance with the invention.

Figure 2 is a fragmentary view, partly in section, particularly showing the positions of the parts when the pistons have moved to their extreme left positions, the right detent has been raised from the collar on the valve stem, and the valve is about to be shifted by the action of the compressed spring on the valve rod.

Figure 3 is a central horizontal sectional view of the valve and valve casing.

In this drawing 1 represents a cylinder and 2 represents a piston, which has attached to it a piston rod 3 extending from the faces of the piston, the respective ends of the rod extending through stuffing boxes 4 in the ends of the cylinder. The ends of the piston rod 3 are each rigidly attached to a yoke 5, as by pins 6. Arranged adjacent to, preferably below, the cylinder 1 is a second cylinder 7 having a piston 8 and a piston rod 9 of a construction and disposition similar to those of the piston 1. The ends of the piston rods 9 are also rigidly attached to the yokes 5.

The diameter of the cylinder 1 may with advantage be greater to any desired extent than that of the cylinder 7, in order that the power, obtained by imposing the force of water under pressure upon the pistons of both the cylinders, and utilizing the power so obtained to raise the pressure of the water on one end of the cylinder 7, may be as great as may be required. Obviously, the relative sizes of the cylinders may be changed at will, in order to obtain, within certain limits, any power desired.

Located adjacent to the cylinder 1, for instance, above it as herein shown is a slide valve 10 having disk heads 33, 34 spaced apart, by means of which water is alternately admitted to and discharged from the respective ends of the cylinder 1 and, is admitted, through valves located between the cylinders, alternately to the respective ends of the cylinder 7.

The valve is located in a casing 11, having an inlet port 12 connected to a source of water supply, for instance, to a water main of a city, which is usually under ten to twelve pounds pressure to the square inch. The casing has in it two outlet openings 13, through which, as will be hereinafter described, water, after being utilized to operate the piston of the cylinder 1, is discharged into a chamber $13'$ and thence through a discharge opening 13^2 from the pump. The valve casing is provided with ports 14, 14, which communicate through passages 15, 15 with ports 16, 16 located near the respective ends of the cylinder 1.

Extending from each side of the valve 10 is a valve stem 17 the ends of which each project through and freely slide in an opening in one of the yokes 5. The valve rod has secured to it, at points between the valve casing and the yokes, the collars 18, whose faces are gradually inclined upward from their outer to their inner portions, the inclines 18 terminating at their junctures with the abruptly inclined inner portions 19 of the faces. Extending from each side of the valve casing is a bracket 20 having therein a socket receiving a detent 21 having a conical end 22 and yieldingly held in position by a spring 23. The body of the detent is hollow to receive the spring, and bearing on the spring is an adjusting screw $23'$ by which the tension of the spring may be governed. The spring-held detents are

so disposed as to be in the paths of movements of the collars 18, and to contact with the inclined surfaces of the collars as the valve stem reciprocates.

Each end of the valve stem has on it a spring 24 interposed between collars 13 and the inner faces of the yokes 5, the springs being alternately put under compression in the reciprocation of the pistons of the cylinders by contact with the collars.

Each end of the cylinder 1 communicates through ports 26 and passages 27 with ports 28 located one near each end of the cylinder 7. In each passage 27 is a check valve 29 so formed and disposed as to permit passage of water from the cylinder 1 to the cylinder 7, and automatically to check flow of water in the opposite direction.

The cylinder 7 is connected at each end by passages 30 with a chamber 31 which has an outlet opening 32 through which water put under pressure by the operation of the pump may be discharged and from which it may be conducted to a place of use.

Each passage 30 is provided with a check valve 30' of such construction that water is allowed to pass freely from the cylinder 7 to the chamber 31, while the flow of water from the chamber to the cylinder is prevented.

In the operation of the pump, assuming that the parts thereof are in the positions shown in the drawing, and that water remaining from a previous operation is contained in the left end of the cylinder 7, water under pressure admitted through the inlet port of the valve casing passes between the valve heads 33 and 34, through the port 14, the passage 15, and the port 16 to the right end of the piston 1, and also, through the described communication to the right end of the cylinder 7. When the valve is in the position shown a communication through the left port 16, passage 15 and port 14, between the left end of the cylinder 1 and the valve casing is established between the left end of the cylinder 1 and the outlet opening 13^2, but passage of water from the left end of the cylinder 7, through the cylinder 1, to the valve casing is prevented by the check valve located in the passage connecting the left end of the cylinders. Therefore, as the pressure of the admitted water is imposed upon the piston 2 and the latter is moved thereby comparatively little resistance is offered by the water in the left end of the cylinder. By reason of the communication between the cylinders, the pressure of the water is also imposed upon the right face of the piston of the cylinder 7. The piston rods of the two cylinders being connected by the yoke 5, as described, the force exerted upon the water in the left end of the cylinder 7 is equal, less loss by friction of the moving parts to the force exerted by the admitted water on both pistons.

Passage of water from the end of cylinder 7 at which water to operate the piston 8 is being admitted to the chamber 31 is prevented, because at once on the beginning of the strokes of the pistons water under pressure is forced into the chamber 31. As the pressure of the water thus forced into the chamber is much greater than that of the water by which the pistons are operated, the valve 30' at the end mentioned is moved to close the passage 30 and is held in that position until the end of the strokes of the pistons.

In the reciprocation of the pistons the springs 24 on the valve stem are alternately compressed between the yokes and the collars on the rod, and as the pistons approach the limit of their stroke in either direction the tension of the spring compressed is sufficient to shift the valve stem against the retaining action of the detent which is in engagement with one of the collars having inclined faces on the rod. In the positions of the ports shown in Figure 1 water admitted to the right ends of the cylinders has moved the pistons to the left about half their strokes. When the pistons reach the left positions the right spring, having been compressed, acts to shift the valve stem and valve to the left to admit water from the source of supply to the left ends of the cylinders, and to establish a discharge conduit for the water contained in the right end of the cylinder 1. The pressure maintained on the detents by their springs is such compared with the force exerted by the springs on the valve stem when compressed that such force is sufficient to cause the valve stem to move and raise the detents by the action of abrupt inclines on the collars of the stem, and then to shift the valve. As one collar is released from its detent the opposite collar moves to receive the corresponding detent, by which it is to be yieldingly held, on its gradually inclined face and by contact with which the detent is raised without offering material resistance to the movement of the valve stem. The movement of the end of a detent over the abrupt inner inclined face of a collar, when this is reached, under the impulse of the spring by which the detent is held, serves to complete the throw of the valve. Contact of a detent with this abruptly inclined face maintains the valve in the position to which it has been moved, as described, against displacement until a valve-operating spring has been put under sufficient tension, by the movements of the pistons, to shift the valve stem.

From the foregoing description it will be clear that when water under pressure is supplied to the valve the pistons of the

cylinders will be caused to reciprocate continuously, and that at each stroke of the pistons water previously introduced to move the piston of one of the pistons in one direction will, on the movements of the pistons in the opposite direction, be put under a pressure corresponding to the force which the water so supplied exerts upon both pistons. The pump is capable of many advantageous uses. For instance, it furnishes inexpensive means for raising the water to the upper parts of a building where the available supply is under too low pressure to serve the purpose.

While I have herein specifically described a pump in which two cylinders and pistons are employed, it will be clear from an understanding of the invention that any number of cylinders may be used, and that the power obtained as described may be concentrated upon one or more of the pistons for the described or for similar purposes. Also, two or more pumps may be coupled, each successive pump receiving the discharge from a preceding one, and thereby they may be compounded.

I claim:

1. An automatic pump comprising a plurality of cylinders and pistons, means for admitting and discharging water alternately to and from the sides of the pistons, and means whereby the force exerted by the pistons is utilized to raise the pressure of water on one side of one of the pistons.

2. An automatic pump comprising a plurality of cylinders and pistons, the pistons being connected, means for admitting and discharging water alternately to and from the sides of the pistons, and means whereby the force exerted by the pistons is utilized to raise the pressure of water on one side of one of the pistons.

3. An automatic pump comprising a plurality of cylinders and pistons, means for admitting and discharging water alternately to and from the sides of the pistons, and means whereby the force exerted by the pistons is utilized to raise the pressure of water alternately on opposite sides of one of the pistons.

4. An automatic pump comprising a plurality of cylinders and pistons, the pistons being connected, means for admitting and discharging water to and from the sides of the pistons alternately, and means whereby the force exerted by the pistons is utilized to raise the pressure of water alternately on opposite sides of one of the pistons.

5. An automatic pump comprising a plurality of cylinders and pistons, a valve operated by the pistons for admitting water alternately to and from opposite sides of the pistons, and means whereby the combined force exerted by the pistons is utilized to raise the pressure of water on one side of one of the pistons.

6. An automatic pump comprising a plurality of cylinders and pistons, a valve operated by the pistons for admitting water alternately to and from the sides of the pistons, and means whereby the combined force exerted by the pistons is utilized to raise the pressure of water alternately on the opposite sides of one of the pistons.

7. An automatic pump comprising a plurality of cylinders and pistons, a valve for admitting water alternately to and from the opposite sides of the pistons, means for operating the valve in the reciprocation of the pistons including compressible springs and detents by which the springs are controlled, and means whereby the combined force exerted by the pistons is utilized to raise the water alternately on opposite sides of one of the pistons.

8. An automatic pump comprising a plurality of cylinders and pistons, a slide valve having ports connected with the ends of the cylinders and a discharge port, a connection between the pistons and the valve whereby as the pistons reciprocate the valve is operated to admit and discharge water alternately to the opposite sides of the pistons, and means whereby water is discharged alternately from the ends of one cylinder and water is confined alternately in the ends of the other cylinder and raised in pressure by the combined force exerted by both pistons.

9. An automatic pump comprising a plurality of cylinders and pistons, the pistons being connected, a slide valve by which water is admitted alternately to the opposite ends of the cylinders provided with springs contacted with and compressed by the connection between the pistons, and yieldingly held detents controlling the springs, whereby when the tension of the springs overcomes the detents the valve is operated.

In testimony whereof I affix my signature.

WILLIAM J. SMITH.