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PUMP.  
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991,469.

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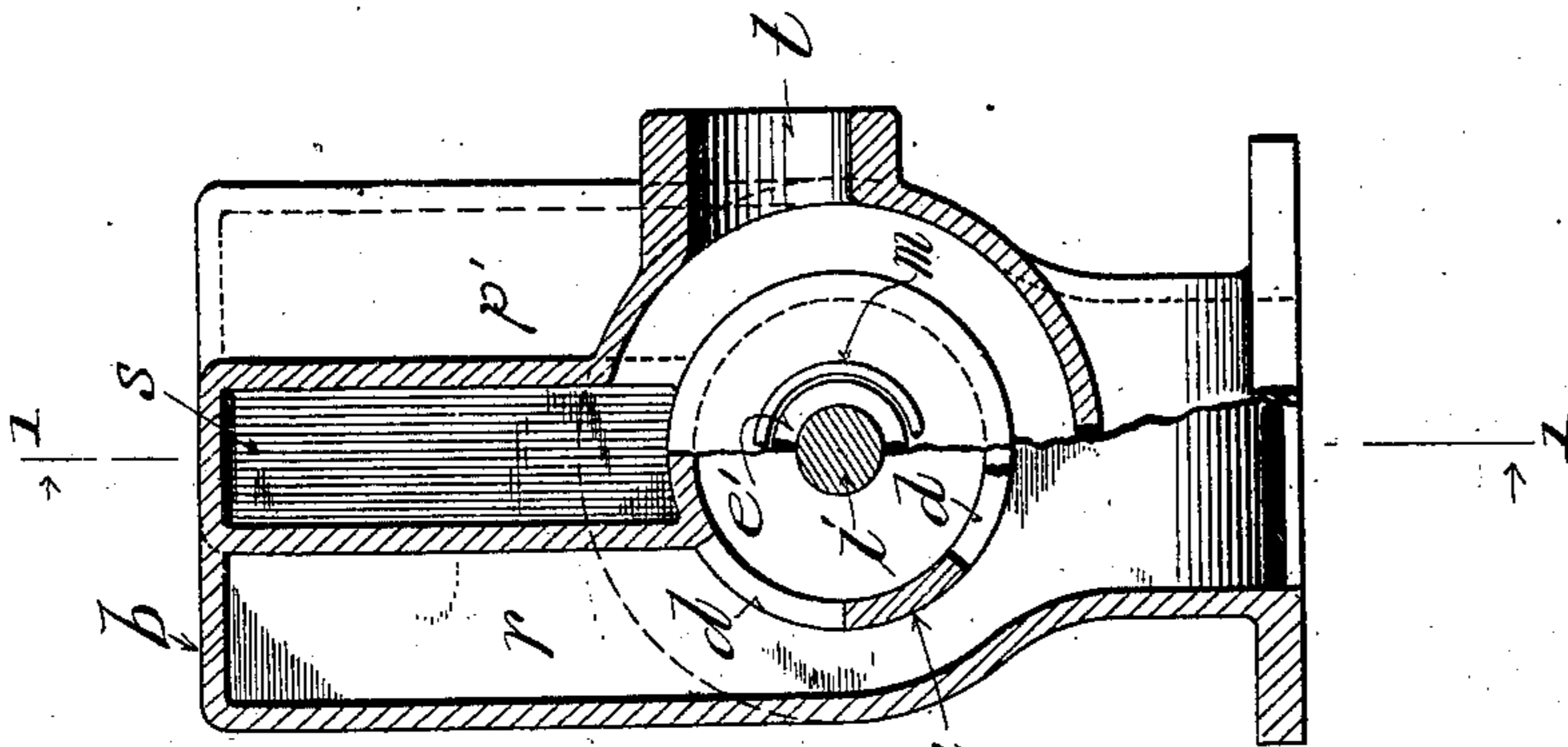


Fig. 2.

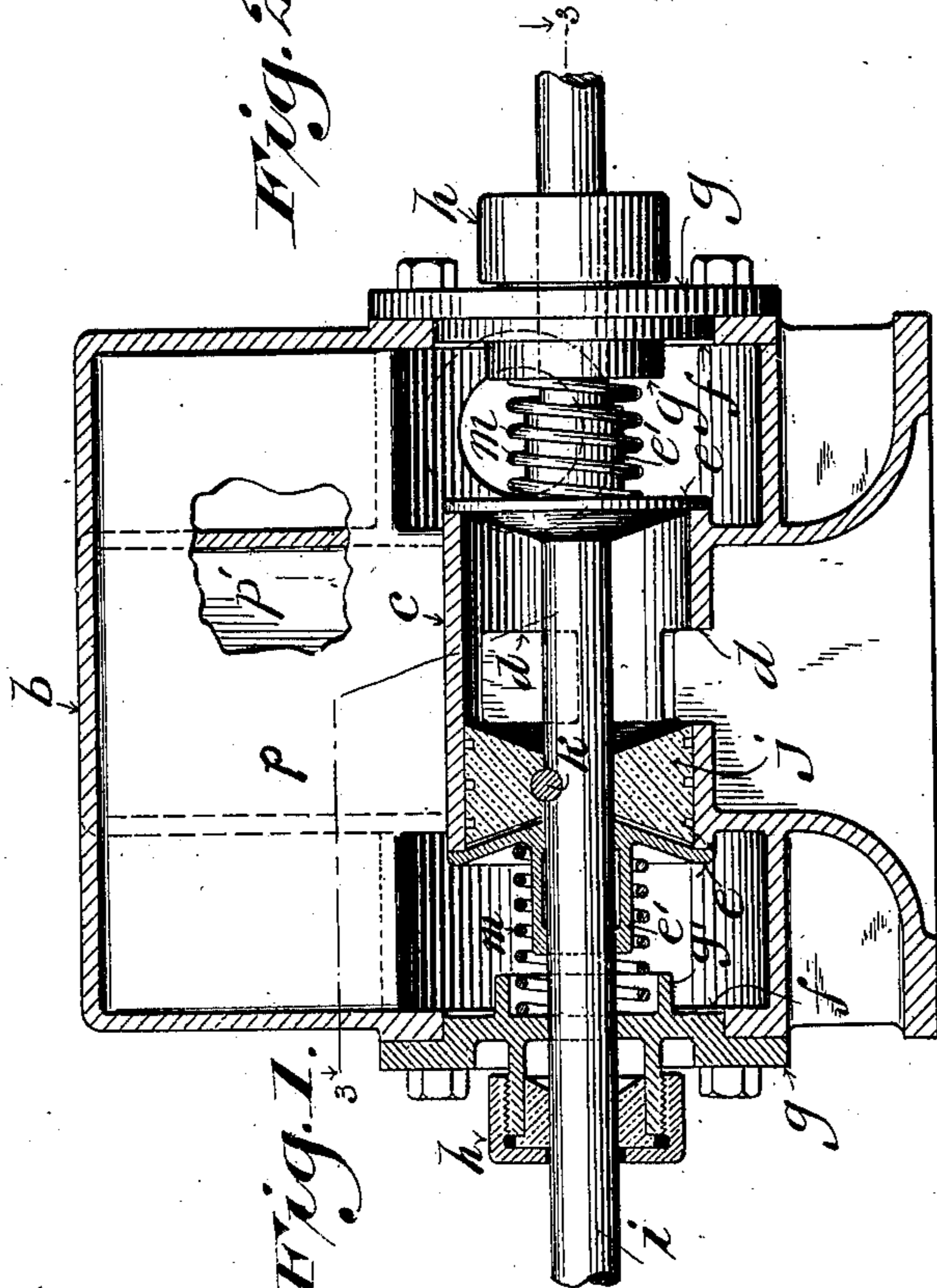


Fig. 1.

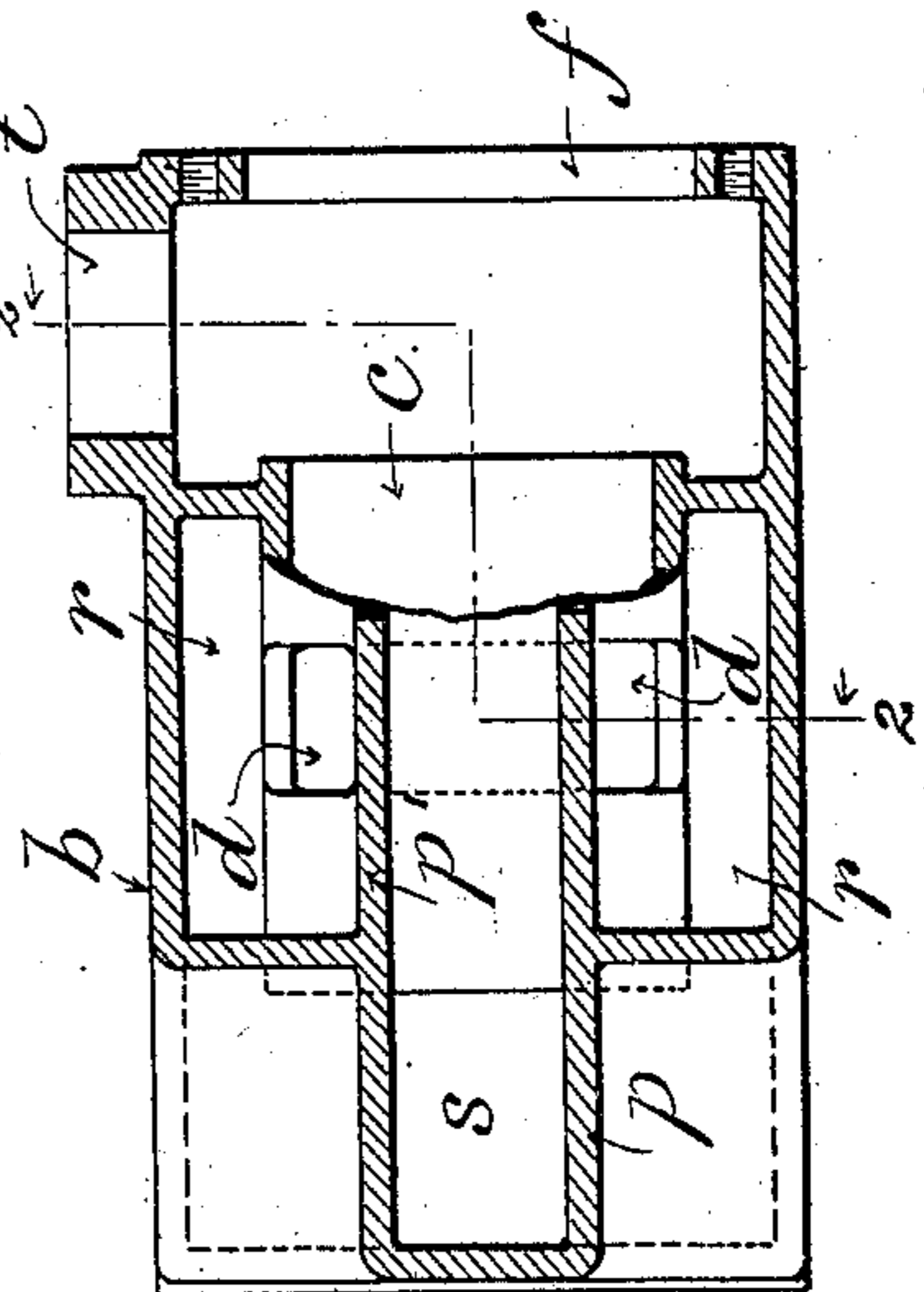


Fig. 3.

Witnesses:  
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# UNITED STATES PATENT OFFICE.

JOHN ASTROM, OF FORT WAYNE, INDIANA.

## PUMP.

991,469.

Specification of Letters Patent.

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*To all whom it may concern:*

Be it known that I, JOHN ASTROM, a citizen of the United States, and resident of Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Pumps; and I do hereby declare that the following is a full, clear, and exact description thereof.

My invention has for its object to provide simple, economical piston-pumps each having the least possible number of parts so assembled as to permit of its being operated at a much higher speed than is possible with an ordinary pump, whereby provision is had for reduction of its size for a predetermined capacity, and said invention consists in what is herein particularly described with reference to the accompanying drawings and pointed out in claims as constituting a piston-pump devoid of suction-valves and having discharge-valves of a free area approximately equal to the area of the pump-cylinder, the fluid to be pumped being in direct contact with said cylinder under the least possible resistance to flow.

Figure 1 of the drawings represents a longitudinal central section of my improved pump, and is indicated by line 1—1 in the next in ascending numerical order of the several views; Fig. 2, a transverse sectional view of the pump indicated by lines 2—2 in the next in ascending numerical order of said views, and Fig. 3, a horizontal section of said pump indicated by lines 3—3 in Fig. 1.

Referring by letter to the drawings, *b* indicates a pump-chamber containing a pump-cylinder *c* with which it is preferably integral, the wall of the cylinder being centrally provided with open ports *d* at suitable intervals of its circumference. The pump-cylinder is headless and its ends constitute seats for valves *e*, and opposite the ends of said cylinder the pump-chamber *b* is provided with openings *f* covered by heads *g* bolted to said chamber. These heads are provided with exterior stuffing-boxes *h* of ordinary construction for the packing for a continuous piston-rod *i* that extends through the pump-chamber and cylinder, the pump-piston *j* being fastened by a key *k* on said rod. This piston has concave, preferably conical, end surfaces and being carried on the rod *i* it does not tend to wear the pump-cylinder. The valves *e* have convex faces that match the end surfaces of the piston *j*,

and thus the clearance between said piston and valves may be reduced in any desirable degree. The valves are provided with hubs *e'* loose on the piston-rod *i*, and said valves are held against their seats by springs *m* interposed between the same and the heads *g* under tension. The springs surround the hubs of the valves and are themselves surrounded by annular flanges *g'* of the afore-said heads.

By means of vertical partition walls *p, p'*, the pump-chamber is divided into a pair of suction-compartments *r* and a discharge-compartment *s*, these compartments being outside of and completely surrounding the pump-cylinder. The wall of the cylinder projects into the suction-compartments and these compartments are united and open below said cylinder. The discharge-compartment is intermediate of the suction-compartments above the cylinder, and incloses the ends of said cylinder, its outlet being an opening *t* in the pump-casing.

In practice, reciprocating motion is imparted to the rod *i* and the piston *j* therewith, by any suitable means, and when said piston moves from the extreme of its stroke in one direction, a vacuum or partial vacuum is formed between it and the adjacent valve until clearance of the cylinder-ports *d* begins, at which time the fluid in the suction-compartments *r* of the pump-chamber *b* has free access to the cylinder *c* back of said piston and rapidly fills the space owing to the difference of pressure in said cylinder and said suction-compartments, the gravity of said fluid or both of these causes. As the piston proceeds on its stroke, fluid ahead of same is trapped in the cylinder and during the remainder of said stroke this trapped fluid is positively displaced and forced out of said cylinder, the opposing valve being unseated against spring-resistance to permit escape of said fluid into the discharge-chamber *s* having the outlet *t* aforesaid. The operation above described takes place when the piston is on stroke in either direction, and hence the pump is double-acting. The vacuum or suction produced in the pump-cylinder for a time on each stroke of the piston is a resistance denoting an apparent loss of work, but this resistance decreases with the absolute pressure in the suction-chambers, and therefore if the pump is used in connection with a condensing apparatus or other source of continuous fluid supply of

very low absolute pressure the loss aforesaid practically disappears. The aforesaid loss is also greatly or totally eliminated by the inertia of the fluid entering the cylinder and creating an additional pressure on the piston and valve ahead of same, which pressure, furthermore increased by the speed and concave shape of said piston, causes said valve to unseat before the fluid is trapped by said piston, whereby the efficiency of the pump is enhanced. In other words, the work apparently lost by suction pressure is partially or wholly restored by the inertia of the fluid, which assimilates same in the way of velocity.

I claim:

1. A double-acting piston-pump devoid of suction-valves and comprising a chamber partitioned to form a pair of suction-compartments having a common inlet and a discharge-compartment between the suction-compartments, a horizontal cylinder open in its wall to the suction-compartments of the chamber and having its ends within the discharge-compartment of the same, spring-loaded valves normally closing the ends of the cylinder, and a piston reciprocative

within said cylinder to alternately open and close the same with respect to each suction-compartment; the aforesaid valves being alternately unseated incidental to the movement of the piston.

2. A double-acting piston-pump devoid of suction-valves and comprising a chamber divided into a pair of suction-compartments having a common inlet and a discharge-compartment between the suction-compartments, a horizontal cylinder partly within said suction-compartments with which it communicates and which has its ends in said discharge-compartment, a piston reciprocative in the cylinder to alternately close and open the same to the aforesaid suction-compartments, and spring-loaded valves normally closing said ends of said cylinder.

In testimony that I claim the foregoing I have hereunto set my hand at Fort Wayne in the county of Allen and State of Indiana in the presence of two witnesses.

JOHN ASTROM.

Witnesses:

SAML. L. MORRIS,  
JOHN JELLEFF.