

JOHN S. BARDEN.
Water Meter or Motor.

No. 125,114.

Patented April 2, 1872.

Fig. 1.

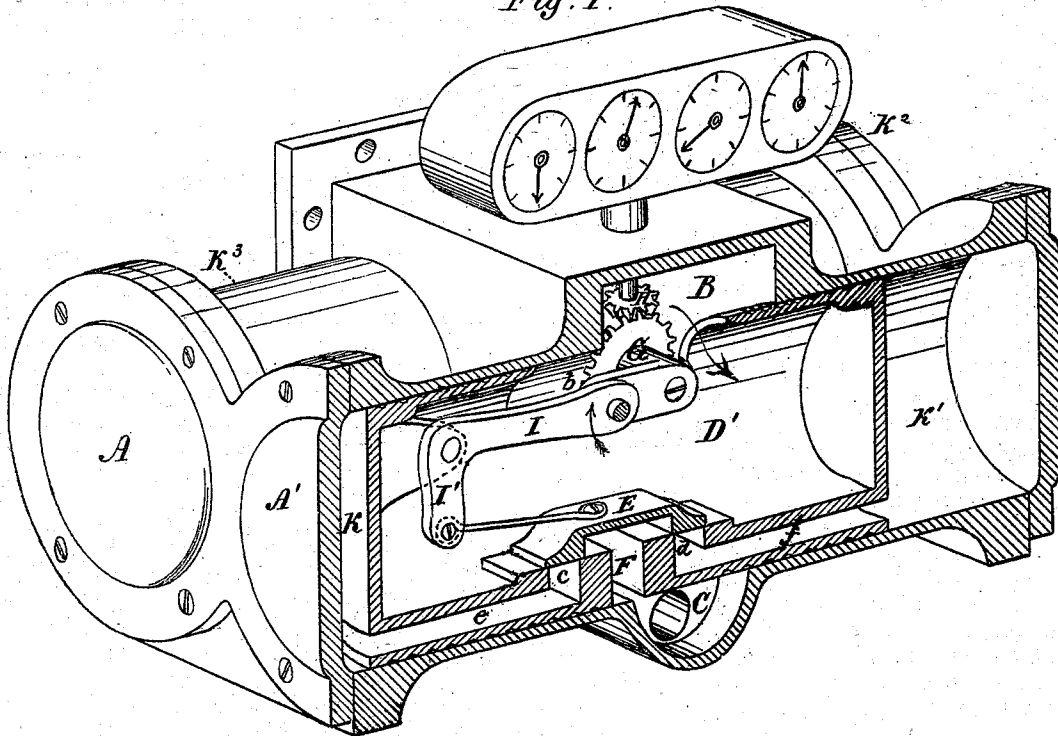
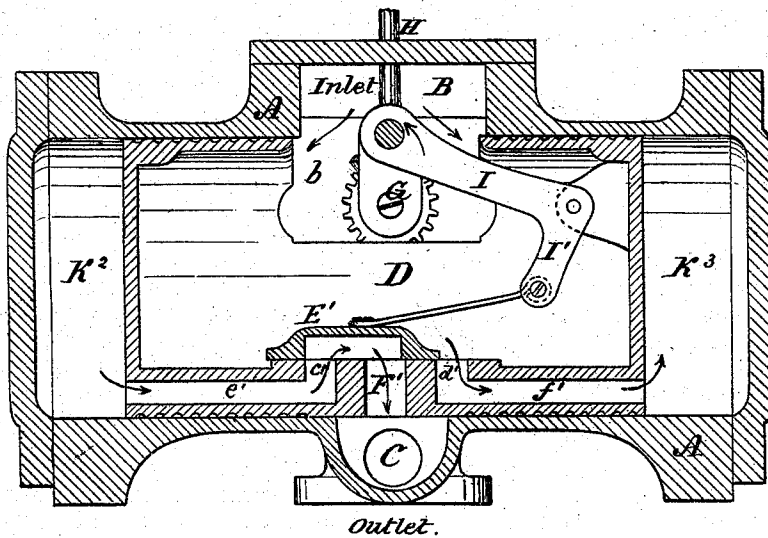


Fig. 2.



Witnesses:

Phil. F. Harmon
Geo. F. Stenz

Inventor:

John S. Barden
By Wm. Wood
Attorney

UNITED STATES PATENT OFFICE.

JOHN S. BARDEN, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR OF ONE-HALF
HIS RIGHT TO ALBERT F. ALLEN, OF SAME PLACE.

IMPROVEMENT IN LIQUID-METERS.

Specification forming part of Letters Patent No. 125,114, dated April 2, 1872.

To all whom it may concern:

Be it known that I, JOHN S. BARDEN, of the city and county of Providence and State of Rhode Island, have invented a certain new and useful Hydraulic Meter or Motor.

My invention relates to that general class of apparatus in which a continuous or intermittent rotary movement is derived from the reciprocating action of one or more pistons operated within a cylinder or cylinders by hydraulic pressure. My invention consists, first, in a novel hollow piston, provided with an induction-port, which is never closed, and an eduction port or ports with conducting-passages, which are guarded or controlled in a novel manner by an interior valve, which not only moves with the piston, but which is moved or operated automatically by the piston, with an action practically independent and peculiar to itself; secondly, in combining the said novel piston with its internal valve-gear with a cylinder, which is provided with an induction-port and an eduction-port, and in so arranging the piston within the cylinder that the induction-ports of both will be always coincident, and also so that the eduction-ports of the piston and their conducting-passages will, by the movement of the piston and the valve, be brought alternately into communicative relation with the interior of the piston and the interior of the cylinder, and also with the interior of the cylinder and its eduction-port; thirdly, jointly, in combining two or more such cylinders and providing each with a piston of the character referred to, in arranging therefor an inlet and an outlet practically common to all of the cylinders and their pistons, and also in operatively connecting each and all of the pistons to a crank-shaft or its equivalent, so that, while each piston will be independently acted upon by the water in its passage under pressure through its respective cylinder, they will all work together in unison upon the crank-shaft, and thereby communicate the movement or power requisite for operating any suitable registering apparatus, or for any other purpose desired. My invention further consists in certain minor points, more fully hereafter in detail described; and I do hereby declare that the following specification, taken in connection with the drawing furnished and forming a part of the same, is a clear, true,

and exact description of a hydraulic meter or motor involving the separate and combined features of my invention.

Referring to the drawing, Figure 1 represents, in perspective, one of my meters or motors with one cylinder in central longitudinal vertical section. Fig. 2 represents the opposite cylinder in central longitudinal vertical section.

In both figures the internal parts occupy their proper relative positions.

A and A' denote the cylinders. They are of equal size, and are placed side by side. B and C denote, respectively, the induction and eduction ports, which are common to both cylinders. D and D' denote the pistons, which are fitted to the cylinders A and A', respectively. They are of peculiar and novel construction. They are both hollow and cylindrical, closed at both ends, and provided with an open eduction-port, *b*, on the upper side, as shown in the drawing. This port is always coincident with the induction-port B in the cylinder. As so far described they possess no special novelty, as somewhat similar pistons have before been employed in the same general connection. My piston differs from all others known to me in being provided, first, with eduction-ports *c* and *d*, located at a central point, and adjacent to communicating ducts *e* and *f* in the shell of the piston, which extend from the eduction-ports toward and to each end; secondly, in a valve, E, which guards and controls the eduction-ports and their communicating ducts. In this instance the valve is exhibited as a simple slide-valve with a central cavity in its lower side. Many of the well-known kinds of valve may be adapted thereto. A register-valve is particularly well adapted to this purpose, and, although a rotary valve may be used with approximate results, it is believed that the simple slide or register valve will prove of the greatest practical utility. Between the two eduction-ports *c* and *d* is an eduction-passage, F, which is always more or less coincident with the main eduction-port C of the cylinders. This passage F extends downward from the face of the valve-seat inside the piston to the main eduction-port. By the reciprocating movement of the slide-valve and the piston the main eduction-port C and the passage F are alternately brought into communicative connection with

the eduction passages or ducts *e* and *f*. *G* denotes a crank-shaft. It is mounted in bearings at right angles to the longitudinal line of the cylinder and their pistons, and is located in the main induction-ports *B* and *b* of the cylinders and pistons. From this shaft power is communicated. In this instance a pair of beveled gears are represented as employed for giving motion to the registering apparatus through the vertical shaft *H*.

Each piston is operatively connected to the crank-shaft by means of a crank and a connecting-rod or pitman, *I*, which is pivoted at one end to the interior of the piston, near one of its heads. In this instance the connecting-rods *I* are represented as rectangular two-armed levers, with the arms extending at nearly right angles to each other from the pivot. The long arm is connected with the crank; the short arm *I'* is connected by a valve-rod with the slide-valve *E*. Each crank is set or pitched on a line peculiar to itself, so that there can be no delay in passing centers. In each cylinder the variable spaces *K* between the exterior of the piston-heads and the interior of the cylinder-heads constitute in this instance the measuring-chambers, into and from which the water flows when under sufficient pressure to move the piston.

Having thus described the several portions of my apparatus in detail, I will now proceed to describe its operation. In Fig. 1 the interior of cylinder *A'* is shown. It will be observed that the piston is represented as if it had completed its movement toward the left hand, and that the crank is on a dead-center. The valve *E* is shown to be guarding both eduction-ports, and the main eduction-passage *C* and the piston-passage *F* are coincident with each other, but not with either of the ducts *e* or *f*. The measuring-chamber *K* will be readily understood as having discharged its contents, while the chamber *K*¹ is filled and ready to discharge. In Fig. 2 the interior of cylinder *A* is shown with precisely the position of its interior parts which they will occupy with relation to the corresponding parts of cylinder *A'*, as shown in Fig. 1, and before described.

Instead of being on a center, the crank in this cylinder is on a vertical line and ready to move to the left (as shown in the figure) in the direction of the arrow. In this view the several parts of the apparatus are designated either by the same precise letter as before used, or with the same letters and a numeral, 1, 2, or 3, affixed thereto.

It will be observed the valve *E'*, in cylinder *A*, is so set with relation to the eduction-ports of the piston that the port *d'* is wide open, leaving free passage by the way of its duct *f'* into the measuring-chamber *K*³. So long as this valve is open at all the piston must be moved toward chamber *K*² at the opposite end of the cylinder. As the piston so moves the water in chamber *K*² is forced or allowed to flow therefrom, by way of duct *e'*, through the port *c'*, under the valve *E'*, down through the pas-

sage *F'*, to the main outlet *C*. As the piston continues to move to the left, the valve *E'* closes both ports *c'* and *d'*, and, continuing onward, reopens the port *c'* to the interior of the piston, and places the duct *f'* of the measuring-chamber *K*³ in communication with the passage *F'*, and thence to the main outlet, as before described.

Assuming that a meter was in operation, and that its several parts occupied the positions shown in both figures, its action would be consecutively as follows: In Fig. 1 the chamber *K* may be considered as practically empty, although filled with such water as must always be held therein when in use. The chamber *K*¹ is full of water, the crank being on a dead-center, and, both ports being fully closed by the valve, no further movement of the piston *D'* is possible, so far as relates to its own resources for moving power. On the opposite side, in cylinder *A*, the chamber *K*² is being emptied by way of duct *e'* and port *c'*, while at the same time the chamber *K*³ is being filled by water passing from the piston through port *d'* and duct *f'*; by this filling of chamber *K*³ the piston is forced toward chamber *K*², and by its action on the crank-shaft carries the crank of piston *D'* past its center, which, in turn, carries the valve *E* toward the right hand, opens the port *c*, and allows water from the interior of the piston to flow through duct *e* into the chamber *K*, and thereby force the piston in the opposite direction toward chamber *K*¹, which, by the movement of the piston, is emptied by the way of the duct *f*, port *d*, passage *F*, to the general outlet, and these consecutive movements of the piston will continue in alternate action so long as any discharge or escape of water occurs. It will be seen on reference to Fig. 1 that there is a period of time in which the valves *E* not only guard the eduction-ports *c* and *d*, and prevent water from passing from the piston, but they prevent water from passing from the already-filled measuring-chamber *K*¹. If the piston and valves be practically water-tight it will be impossible for any water to escape from the cylinder *A* or its piston to delivery.

It is to be remembered that Fig. 2 represents the cylinder *A*, with its piston and valve in their precise positions, relatively considered, with Fig. 1. If water be drawn at all from the meter when in this position it must of course be discharged from the chamber *K*², and, as the pressure from the interior of the piston through port *d'* into chamber *K*³ will cause the piston to advance into chamber *K*² as rapidly as the displacement of water will permit, the said displacement must be duly registered, which renders it practically impossible for any quantity of water, however small, to be drawn from the meter without a proper and accurate indication thereof. It is impossible to so place the valves, pistons, and outlets, when arranged as described, so that a direct or sinuous passage will be open for water to escape without producing a movement

of both pistons proportionate to the volume of water escaping. My improvement is based generally on the prompt action of the interior valves, and in their capacity for being so connected to the pistons that they not only are moved with and by them in the same direction at the same rate of speed, but also at a higher rate of speed, not only while moving in the same direction, but in a directly opposite direction, and also in the peculiarly rapid action of the valves when the pistons are changing direction or while the cranks are passing centers, for at such times, although the pistons move but slowly, the valves are moving rapidly.

I am aware that it is not new to couple pistons together by a crank-shaft to secure unity of action, for such have been employed for many years in a great variety of steam and hydraulic motors; and, also, that water meters and motors have heretofore been constructed in which single, double, and hollow pistons have been employed; that hollow or double pistons, operating within separate cylinders, have served as valves each for the other; that in some cases such hollow pistons, operating in separate cylinders, have been linked or coupled together by a crank-shaft; that double pistons have been so constructed and arranged as to intermittently operate valves which were located in their cylinders for controlling the induction to and eduction therefrom; but I am not aware that before my invention a hollow piston was ever known to exist which was provided with an interior valve which moved with it and at the same time was automatically independently operated by it.

To prevent dirt or other extraneous matter from entering the cylinders any of the well-known strainers or traps may be employed.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. A hollow piston provided with an induction-port which is never closed, an eduction port or ports, and a valve for guarding or controlling the same, which is attached to, moves with, and is automatically operated in a manner peculiar to itself by the movement of the piston, substantially as and for the purposes specified.

2. The combination of a hollow piston, provided with an induction and with an eduction port or ports and an internal valve, substantially as described, with a cylinder provided with an induction and an eduction port, the piston being so constructed and arranged within the cylinder that its induction-port will always be coincident with the induction-port of the cylinder, and the interior valve being so arranged that, by its peculiar movement and the movement of its piston, it will alternately communicatively connect, by the way of a suitable duct or ducts, the interior of the piston with the interior of the cylinder, and the interior of the cylinder in a similar manner with its eduction-port, substantially as and for the purposes specified.

3. The combination of two or more of my novel pistons, operatively connected by a crank-shaft or its equivalent, with two or more cylinders provided with an inlet and an outlet practically common to all the cylinders and pistons, and arranged to operate substantially as and for the purposes specified.

4. The combination with the piston and cylinder, substantially as herein described, of the crank-shaft, two-armed lever, valve, and connecting-rod, as and for the purposes specified.

JOHN S. BARDEN.

Witnesses:

JOHN C. PURKIS,
HENRY MARTIN.