2 Sheets—Sheet 1

L. H. NASH.

Rotary Water-Meter.

No. 211,769 Patented Jan. 28, 1879.

Fig. 1.

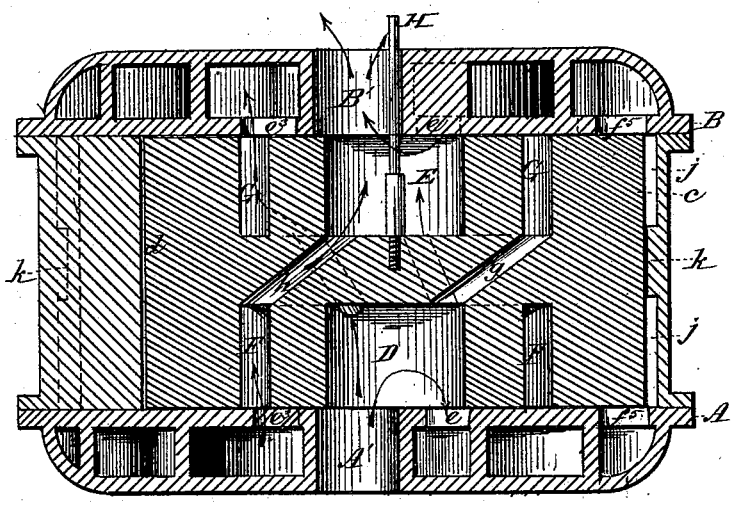
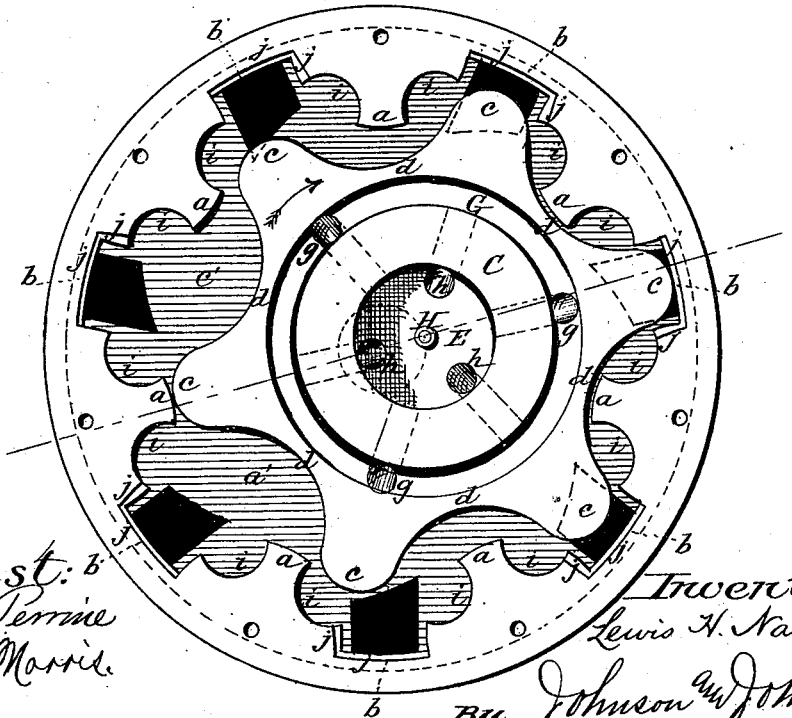


Fig. 2.



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2 Sheets—Sheet 2.

L. H. NASH.

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No. 211,769. Patented Jan. 28, 1879.

Fig. 3.

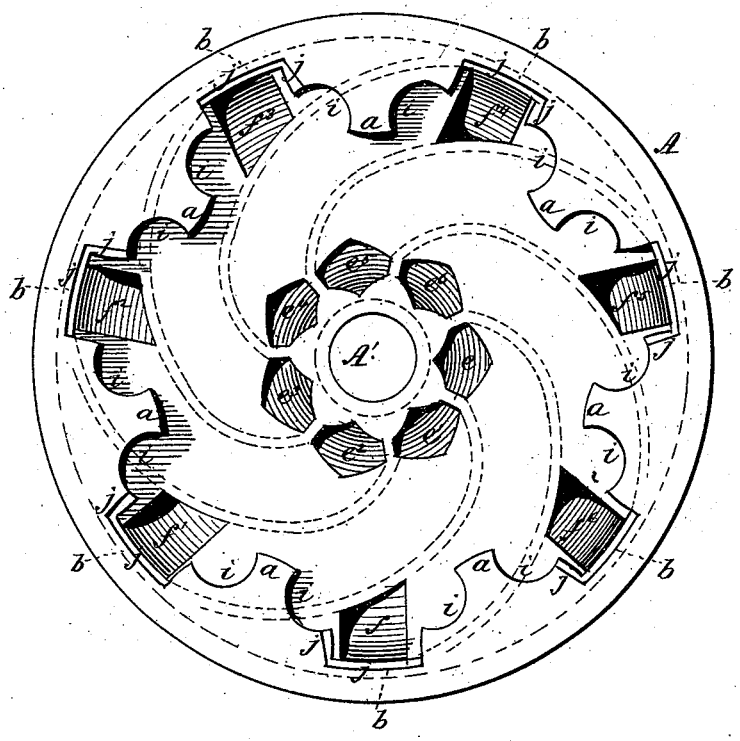
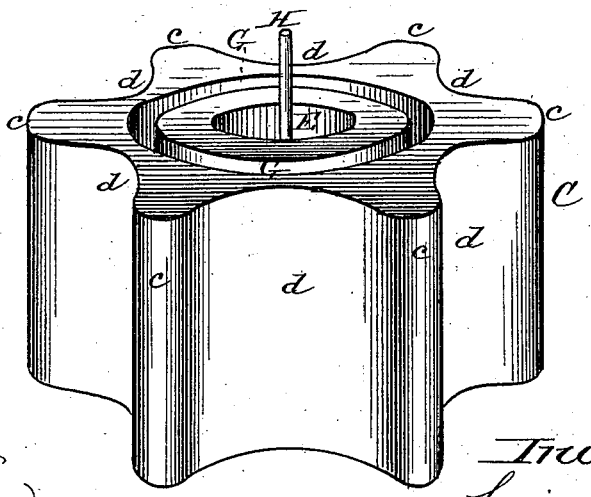


Fig. 4.



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UNITED STATES PATENT OFFICE.

LEWIS H. NASH, OF BROOKLYN, ASSIGNOR TO NATIONAL METER COMPANY, OF NEW YORK, N. Y.

IMPROVEMENT IN ROTARY WATER-METERS.

Specification forming part of Letters Patent No. **211,769**, dated January 28, 1879; application filed November 8, 1878.

To all whom it may concern:

Be it known that I, LEWIS H. NASH, late of South Norwalk, Connecticut, but now of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Water-Meters, of which the following is a specification:

In a patent bearing date January 21, 1879, No. 211, 582, I have described and shown a piston of a water-meter adapted to have an eccentric or side rocking movement within and upon continually-changing lines across the center of the cylinder-chamber, to effect the division of said chamber at two or more continually-changing points on its sides into receiving and discharging spaces, which communicate with the inlet and the outlet, the said piston having also a revolving motion around its own center, to allow of the continuous passage of the water within said chamber from the receiving to the discharging spaces thereof. In this connection the piston is adapted for co-operation by means of a valve formed integral therewith, and through which the inflow and outflow takes place at opposite ends of the piston.

My present improvements embrace a construction and adaptation of a double-end valve and piston, and water-passages in the opposite cylinder-heads, by which I obtain both an inlet and an outlet port on each side of the piston, whereby a greater capacity of the valve is obtained, and at the same time maintain the balance of the pressure of the water on each side of the piston, and avoid friction and wearing. The walls of the cylinder are formed in such manner as to allow free passage of the water between the receiving-spaces of the cylinder on one side of the piston, and also free passage of water between the discharging-spaces on the other side, of the piston, so as to cause the pressure of the water in the communicating spaces to be uniform throughout, and to prevent the retarding of the piston by avoiding choking of the water in the passages and spaces, which would be liable to cause such retardation. This construction is also such as to allow sediment and foreign substances to pass through the cylinder-chamber without interfering with the working of the piston. These are some of the advantages which my present improvements accomplish.

Referring to the drawings, Figure 1 represents a section taken through the inlet and outlet ends and the valved piston and cylinder of a water-meter embracing my invention; Fig. 2, a plan view of the meter with one of the heads removed, and showing the valved piston in the relation it occupies in dividing the cylinder-chamber into receiving and discharging spaces; Fig. 3, an inside plan view of one of the cylinder-heads, showing the inlet-valve ports and the outlet-ports therein; and Fig. 4, the valved piston, of peculiar construction of double-end ports.

The piston is constructed with a double-end valve formed therein, and adapted for co-operation with a cylinder-chamber having water-passages formed in its opposite inlet and outlet heads, so that in whatever position the piston may be the valve-space at one end of the piston will always communicate with the inlet-passage, and the valve-space at the other end of the piston will always communicate with the outlet-passage, of the cylinder-chamber during the continually-changing points of division of said chamber made by the movements of the piston.

The interior wall of the cylinder-chamber is formed by alternate projections *a* and recesses *b*, extending from the inner side of the inlet-head A to the inner side of the outlet-head B, while the piston has circumferential alternate projections *c* and recesses *d* of a relative shape, adapted to pass into the recesses *b* at one side of the cylinder, and over the projections *a* at the opposite sides thereof, as the piston is caused to rock sidewise across the center of the cylinder, to form continually-changing lines of bearing or contact at two or more points, to divide the said chamber into receiving and discharging spaces *a' c'*, Fig. 2, which continually change their volume, and into and from which the water has an unobstructed flow and a positive displacement without loss of pressure in said flow. Current with the rocking motion of the piston across the center of the cylinder-chamber, to effect

its division at two or more points, the piston has also a motion around its own center, to effect the measurement of the water passing into and from the cylinder-spaces, and both these movements of the piston are effected by the relative shape of the piston and cylinder and the direct action of the water upon the piston.

As the principle involved in this construction and operation is fully set forth in my said patent, a more detailed description thereof is deemed unnecessary in the presentation of the special improvements claimed herein.

The arrangement of the ports in both heads of the cylinder is alike, and it is by this means, in connection with a double-end valved piston, that the capacity of the valve is doubled. Each cylinder-head forms a shell with a series of ports therein, and a central opening having perpetual communication with spaces in the opposite ends of the piston-valve, and which central openings form the inlet-port A′ and the outlet-port B′ of the meter. Concentric with and near these central ports are ports $e\ e^1\ e^2\ e^3\ e^4\ e^5\ e^6$, corresponding in number with the cylinder-recesses *b*, and which communicate by curved passages with circumferential ports $f\ f^1\ f^2\ f^3\ f^4\ f^5\ f^6$, opening at said wall-recesses, as shown in Fig. 3. These curved passages stand in reverse positions in the heads—that is, they curve one way in the inlet-head and in the opposite direction in the outlet-head, so as to direct the water into the chamber on opposite sides of the piston, and in the same direction with its revolving motion, so that both heads have corresponding ports, in which some of one set, *e*, &c., communicate with central valve-spaces in the piston during its movements, and the other set, *f*, opening directly into the cylinder-chamber. Between and joining these heads the piston works in its side rocking and rotary movements, so as to constantly change its communication with the ports $e\ e^1\ e^2$, &c., but not with the inlet and outlet ports of said heads.

The valve in the piston C is of peculiar construction, and consists of an annular central space, D and E, in each end, of equal depth and area, and an annular space, F and G, surrounding each central space, and of equal depth and area. These annular spaces communicate with each other by means of interior diagonal passages crossing in opposite directions. The annular central space D at the inlet end of the piston communicates with the annular surrounding space G at the outlet end of the piston by the diagonal passages *g g g*, while the annular central space E at the outlet end of the piston communicates with the annular space F at the inlet end of the piston, by the diagonal passages *h h h*, as shown in Fig. 1.

In the head A the inner ports, $e\ e^1\ e^2$, &c., communicate through the curved passages with the outer ports, $f\ f^1\ f^2$, &c., and the cylinder-spaces *b* between the wall projections, while the inner corresponding ports, $e\ e^1\ e^2$, &c., of the head B communicate, by similar but oppositely-curved passages and outer ports, $f\ f^1\ f^2$, &c., with the cylinder-spaces, thereby forming a double-end valve, or a valve having a double capacity in connection with the cylinder-head ports.

The inlet-port A′ always communicates with its corresponding central valve-space, D, and this space always opens some of the inner ports, $e\ e^1\ e^2$, &c., of the head A, which allows the water to flow to the left of the piston through the outer ports, while the outlet-port B′ always communicates with its corresponding central valve-space E, and this space always opens communication with some of the inner ports, $e\ e^1\ e^2$, &c., of the head B, which allows the water to flow out through the outer ports, $f\ f^1\ f^2$, &c., to the right of the piston. At the same time the central valve-space D of the inlet-head opens communication through some of the inner ports of the outlet-head B, through the annular space G, causing the water to flow with the same side of the piston as already has free inlet through the lower piston-space, as just described, while the annular space F at the inlet end of the piston communicates with the central valve-space E at the outlet. By this construction the water entering at A′ is divided, part flowing through the ports $e\ e^1\ e^2$, &c., of the head A, and out through the ports $f\ f^1\ f^2$, &c., into the cylinder-chamber, and part passing through the diagonal passages *g g g* to the annular space G, and thence through the ports $e\ e^1\ e^2$, &c., and $f\ f^1\ f^2$, &c., of the head B into the cylinder-chamber. In like manner the water escapes through the ports $f\ f^1\ f^2$, &c., and $e\ e^1\ e^2$, &c., into the annular space F, and thence through the diagonal passages *h h h* into the central valve-space E to the outlet-port. In a similar manner the water escapes, through the ports $f\ f^1\ f^2$, &c., and $e\ e^1\ e^2$, &c., of the head B, into the valve-space E to the outlet.

The object of this construction is to give a greater capacity to the valve, and at the same time balance the pressure of the water on each side of the piston, and avoid both friction and wearing, because E and F are outlet-spaces communicating with each other, while D and G are inlet-spaces and communicate with each other.

The piston has a shifting connection with the dial mechanism by means of a central stem, H, as in my said patent, to accommodate the side rocking movement across the center of the cylinder-chamber.

To obtain a uniform action of the water upon the piston, and prevent the choking of the passages and spaces of the cylinder, deep recesses *i* are formed on the opposite sides of the cylinder-wall projections *a*, to allow free passage between the receiving-spaces of the cylinder on one side of the piston, and free passage of water between the discharging-spaces on the other side of the piston, and thereby cause the pressure of the water in the

communicating spaces to be uniform throughout. In connection with these recesses *i* on the sides of the projections, communicating spaces *j* are formed in the walls of the recesses *b* by means of belt projections *k*, Fig. 1, which extend over that side of the projections *b* toward which the piston turns, so as to form bearings for the piston projections *c*, and leave a free passage for the water to follow behind the points *c* of the piston, and thus prevent the retardation of the movements of the piston while a bearing-point, *c*, is leaving a cylinder-recess, and at the same time allow sediment and foreign substances to pass through the meter without interfering with the proper working of the piston.

Under this new construction of valve, piston, and cylinder-ports I obtain a perfect inlet and outlet valve at each end of the piston, and, in connection with both the inlet and outlet cylinder-ports, giving a uniform action to the piston, and effecting an accurate measurement without loss of pressure in the flow. The water passing into the cylinder-chamber has an inflow and an outflow at each side of the piston as it revolves, and thereby avoids any undue lateral pressure of the water upon the piston. This construction is specially adapted for a valve forming part of the piston, and necessarily controlled by its movements, so as to effect its proper co-operation with the cylinder-head inlet and outlet ports.

I do not confine myself to the specific shape of the piston and the cylinder bearing-points and recesses, as these may be varied and produce the same results; nor do I confine myself to the specific construction of the double-end valve herein described, as the arrangement of the ports and passages may be changed without changing the results or operation.

From the foregoing description it is evident that the valve is complete in itself on each end of the piston, so that either end would form the valve to the exclusion of the other, because the inlet and outlet ports of each end of the piston are independent of each other, with the outlet passing through the piston; and in applying my invention to motors one valve would have sufficient capacity, but for meters the double-ended valved piston is desirable.

I claim—

1. The combination, with the cylinder having the series of inner ports, *e* to e^6, the outer ports, *f* to f^6, and a central inlet-port in its head communicating with the cylinder-chamber, of a valve formed within the piston, having inlet and outlet ports at one and the same end, adapted to have a perpetual communication with the central inlet head-port, and a shifting communication with the inner head-ports by the eccentric or side rocking and rotary motions of said piston within and across the center of the cylinder-chamber, in close contact with its heads, for the purpose stated.

2. The valve-ports in the cylinder-heads, and their communicating curved passages, arranged in reverse positions to each other, and combined with the valve of the piston, substantially as described, whereby to cause the inflow of the water to be directed upon opposite sides of a piston having a side rocking motion across the center of the cylinder, and a revolving motion around its own center, to divide said chamber into receiving and discharging spaces.

3. The piston of a water-meter having a valve formed therein, consisting of the central and annular surrounding spaces at each end, and the communicating diagonal passages, in combination with the inlet and outlet cylinder-ports, and the valve-ports in the cylinder-heads, arranged for operation with a continuous flow of water into and from said cylinder-chamber, and into and from said piston-valve.

4. The belt projections *k*, arranged upon the walls of the cylinder-recesses *b*, and between the projections *a*, in combination with the piston bearing-points *c*, adapted for operation with said belt-bearings, to form wall-spaces *j*, to allow the water to follow behind the piston-points, to obtain the advantage stated.

5. The combination, with the cylinder projections *a*, having recesses *i*, of the belt projections *k* in the wall-recesses *b*, whereby to form wall-spaces behind the bearing-points *c* of the piston, and a free passage between the receiving and discharging spaces of the cylinder-chamber, to obtain the advantages stated.

6. The combination, in a water-meter, of a piston adapted to have an eccentric or side rocking and rotary motion within and across the center of the cylinder-chamber, in close contact with its heads, and a valve having both an inlet and an outlet port at each end, with cylinder-heads having inlet and outlet ports communicating with the ports of the valves, whereby the valve at each end operates independent of the other, to maintain a perpetual circulation from inlet to outlet with the ports of both cylinder-heads, and in which there is both an inflow and an outflow into and from each cylinder-head.

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

LEWIS H. NASH.

Witnesses:

F. STUART KING,

S. E. SPEAR.