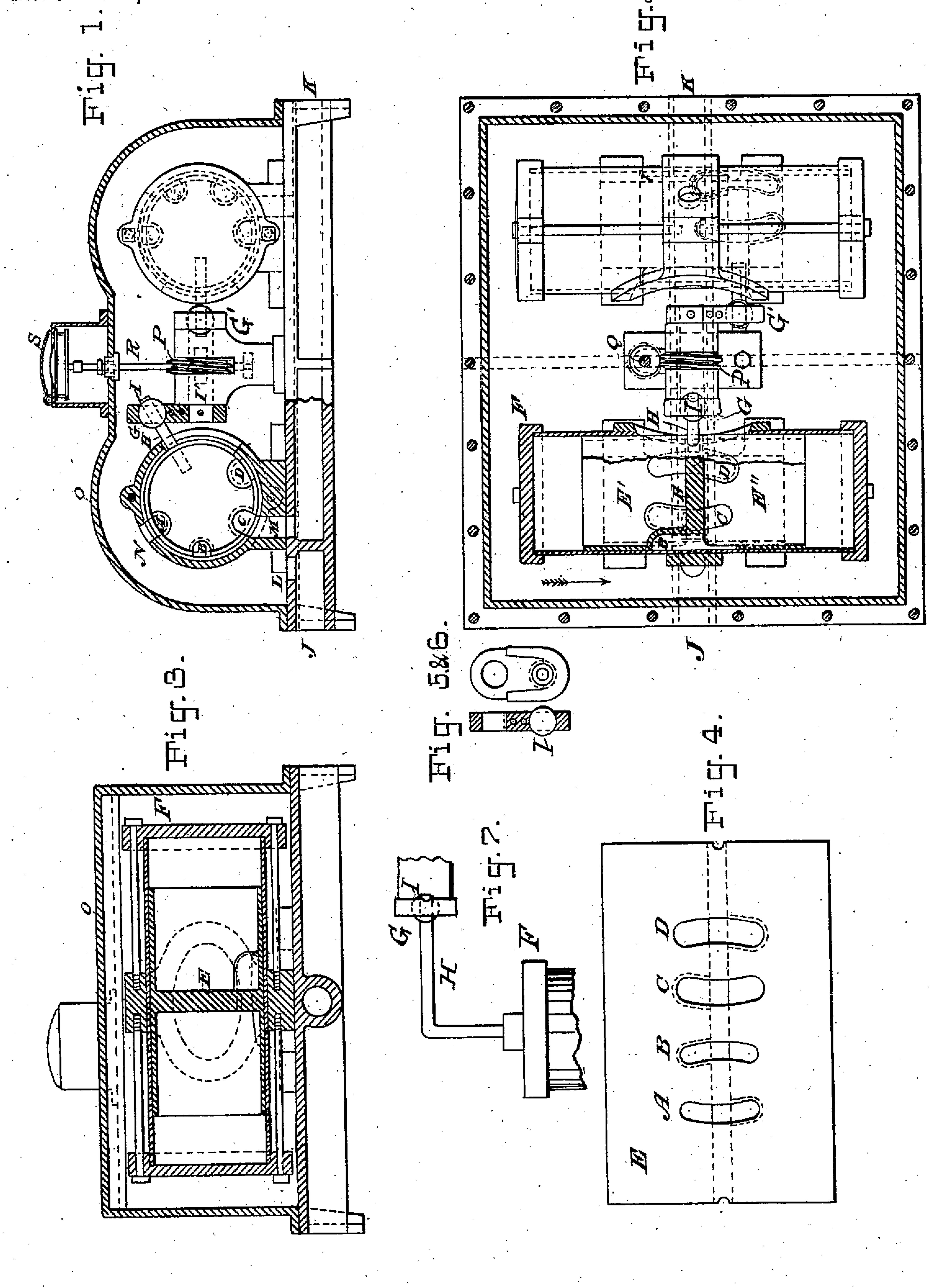
(No Model.)

A. P. EMERY.

PISTON FOR WATER METERS, &c.

No. 256,554. Patented Apr. 18, 1882.



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PISTON FOR WATER-METERS, &c.

SPECIFICATION forming part of Letters Patent No. 256,554, dated April 18, 1882.

Application filed April 21, 1881. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR P. EMERY, of the city of Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Pistons for Water-Meters, Pumps, Air-Compressors, and other Analogous Machines; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the drawings accompanying and forming part of this specification.

Water-meters, pumps, air-compressors, and analogous machines of the class to which my improvements relate have heretofore been so constructed that the ports of the piston-cylinder and its piston have been opened and closed by slide-valves. It was also in such prior machines found necessary to pack the piston with some material at one or more points on its exterior surface. By my invention I am enabled to do away with all slide-valves and slide-valve gear, also to dispense with packing material on the piston-surface.

This invention consists in so constructing a double piston, with induction and eduction ports for each end, that the piston will, when slightly rotated within the cylinder, have one of such ports opened to either the induction or eduction port of the piston-cylinder, as the case may be, and the other closed alternately at each end of said piston—that is to say, when the piston is slightly rotated in one direction the induction-port of one end of the piston is opened and its eduction-port is closed, while the induction-port of the other end is closed and its eduction-port opened, and when the piston is slightly rotated in the other direction the induction-port of the first end mentioned is then closed and its eduction-port opened, while the eduction-port of the other end is then closed and its induction-port opened, and so that such ports shall remain open and closed, respectively as stated, at each end alternately while such piston is taking and discharging water during its longitudinal movement back and forth within said cylinder; further, in so arranging the ports on the piston that such piston will commence to take water and to discharge the same at each end alternately during a portion of its longitudinal movement in its cylinder, and just after such piston has been slightly rotated therein, for the purpose of opening and closing its induction and eduction ports at each end, respectively, through or along channels made in the periphery of the piston and leading into the ports of such piston; further, in the combination, with such a piston and piston-cylinder, of a ball-and-socket joint, the ball being connected to the piston or its rod by means of a spindle, and its socket being contained within the arm of a crank, for the purpose of giving the piston within said cylinder two motions alternately—namely, one which shall slightly rotate the piston first in one direction at one end of its longitudinal movement and in the opposite direction at the other end of its longitudinal movement, and thus open the induction-port in one end of the piston to the induction-passage of the cylinder and close it in the other end alternately, and at same time close the eduction-port in one end of the piston to the eduction-passage of the cylinder and open it in the other alternately, and to give between these two changes the longitudinal movement of the piston through the piston-cylinder, so that while one side of the piston is filling the other side will be discharging on each stroke of the piston.

In the drawings my improvements are represented as embodied in a water-meter.

Figure 1 is an end view of the meter, showing on one side my improved piston and its ports in vertical cross-section. Fig. 2 is a plan view of same, showing said piston and the piston-cylinder on one side partly in longitudinal cross-section and on the other side in full plan view. Fig. 3 is a longitudinal vertical section of the piston and the meter, taken in the line *x x* of Fig. 2. Fig. 4 is a view of the piston and its ports developed in a horizontal plane. Figs. 5 and 6 are detail views of the ball-and-socket joint and crank carrying the same, and Fig. 7 is the ball-and socket joint mechanism located at a different point on the piston.

A B C D are four ports in a double-chamber piston, E, such piston being open at both ends, E′ E″. F is an exterior cylinder to this piston, and in which such piston has a longitudinal movement. This piston E is connected to

the crank-arm G by a ball-and-socket joint, as follows: H is a spindle, rigidly connected at one end to the side of the piston E through an opening in the side of the piston-cylinder, and containing at the other end a ball, I, which is inserted in a socket in the end of the crank-arm G. The rotation of this crank-arm on its axis I′ will cause the piston to move longitudinally back and forth in the piston-cylinder, also will cause it at the termination of each of the longitudinal movements to slightly rotate, first in one direction at the termination of one of its longitudinal movements or strokes, and in the other direction at the termination of the other of its longitudinal movements or stroke. This rotating of the piston by the ball-and-socket joint, first in one direction and then in the other direction, will cause the piston to both take and discharge water at each stroke of such piston by changing the ports thereof in manner as hereinafter more particularly specified.

J is the induction-pipe of the meter. K is its eduction-pipe.

L is the passage from the induction-pipe to the interior of the meter.

M is the passage or eduction-port from the piston-cylinder into the eduction-pipe. In the top of the piston-cylinder F is the passage or induction-port N to the piston.

O is the exterior casing of the meter.

P is an endless worm placed on the axle I′ of the crank, and gearing with the toothed wheel Q, so as to operate by means of the vertical spindle R a hand on a dial, S, &c., placed in a dome on top of the meter-case in the usual way, in order to register the movements of the pistons within their cylinders.

I will now describe the operation of my improved piston in the taking and discharging of water during each stroke.

I will suppose the piston of the cylinder (shown partly in section in Fig. 2) to be moving in the direction of the arrow. Water is consequently being drawn through the inducting passage or port N of the piston-cylinder and through the port A of the piston now open to the port N, as seen in Fig. 1, into the end E′, induction-port B of end E″ being closed to port N, as seen in Fig. 1, eduction-port D in end E′ being closed to eduction-port M, and eduction-port C in end E″ being open thereto, as seen in Fig. 1. Water is consequently being discharged from end E″ through eduction-passage K. At the end of such stroke of the piston the movement of the crank downward, bringing the ball-joint down to and over its center, tends to rotate the piston slightly, thus removing the induction-port A of the piston from the induction-port N of the cylinder and bringing into coincidence with it the induction-port B of the side E″ of the piston. This same rotation carries the eduction-port C of the side E′ of the piston away from the eduction-passage M of the cylinder and brings into coincidence with said passage the eduction-port D of the side E′ of the piston, so that on the return-stroke of the piston it will draw water on the side E″ and discharge it on the side E′. Just before the stroke in the direction of the arrow is again made the crank, moving up to and over its center, again changes the ports by rotating the piston slightly in the other direction and so as to bring the ports in the position as shown in Figs. 1 and 2, and thus enable the piston to draw water at its end E′ and discharge that taken in at the end E″ on its previous stroke.

Grooved channels or passages are made along the exterior periphery of the piston leading into the respective ports of the piston, so that when the piston is at either end of the piston-cylinder and as it approaches the center water may be readily taken into and discharged at the respective ends. These grooved passages are shown in Fig. 4. Those leading to the induction-ports are marked in dotted lines on the openings A B and those leading to the eduction-ports are marked in dotted lines on the openings C D. The remaining portions, or the ports proper, are elongated openings. Both the channels and openings are required to be curved slightly to conform to the slight twist movement given to the piston-cylinder by the ball-and-socket-joint mechanism between each passage of the crank on its center, and the consequent shifting of the ports.

In order to get the crank over its center in the application shown of my new piston and piston-port-shifting mechanism, I propose to employ a duplicate of the parts above described, connected through the crank-axis I′, as seen on the right-hand side in Figs. 1 and 2, the crank-arms G G′ being set at a quarter of a circle from each other. This duplicate piston and piston-cylinder are also connected with the eduction-passage K, as shown in the drawings.

When the piston is connected simply as a pump a piston-rod passing through a gland in the end of the piston-cylinder may have connected therewith a balance-wheel, which will enable the crank to pass easily its centers.

The spindle of the ball-and-socket joint may be connected to a piston which passes through a gland in the head of the piston-cylinder, instead of being attached to the cylindrical part of the piston at the opening made through the side wall of the piston-cylinder, and it will operate in the same manner as above described, if so attached. Such attachment in the meter would bring the two cranks and the ball-joint-operating mechanism out in advance of the cylinder-head, as shown in Fig. 7.

I claim—

1. The combination of a piston with its cylinder, such piston containing induction and eduction ports for each end, arranged therein so that it will, when slightly rotated within said cylinder, have at one end an induction-port opened and an eduction-port closed and at the other end an eduction-port opened and

an induction-port closed alternately, so that the piston will both take and discharge water at each of its strokes, substantially as described.

2. The piston provided with channels or passages, in combination with the induction and eduction ports of the piston-cylinder, substantially as described.

3. The combination of the piston and piston-cylinder with a ball-and-socket joint, the ball being connected to the piston by means of a spindle, and the socket being contained in a crank, substantially as described.

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