No. 881,222. PATENTED MAR. 10, 1908.

F. BREITENSTEIN.

WATER MOTOR.

APPLICATION FILED JUNE 7, 1907.

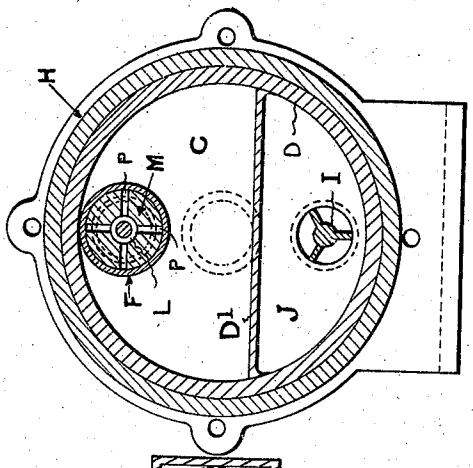


FIG. 2.

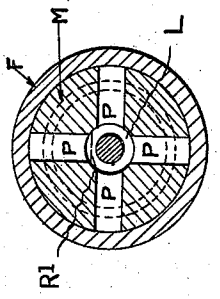


FIG. 5.

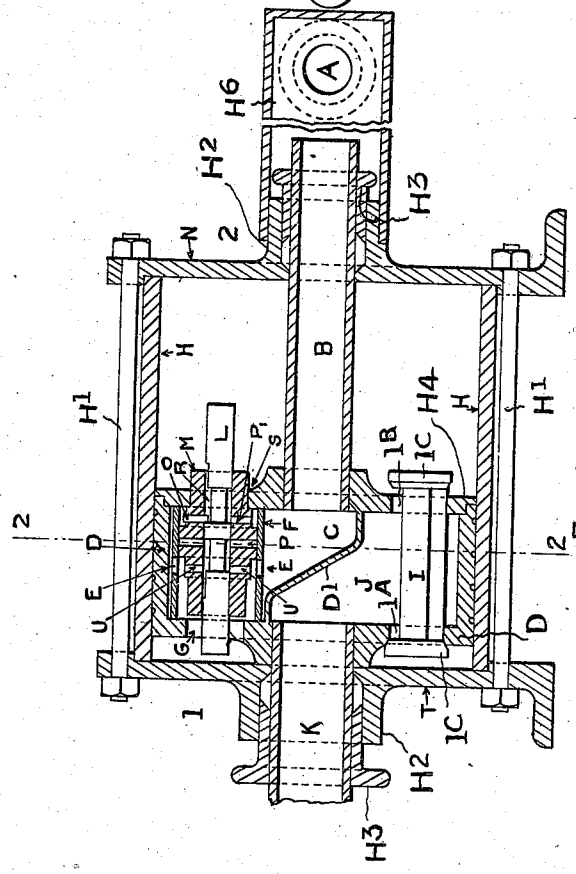


FIG. 1.

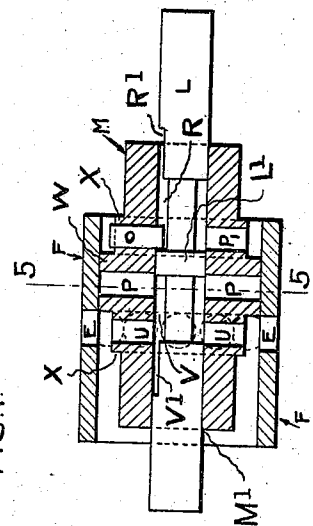


FIG. 4.

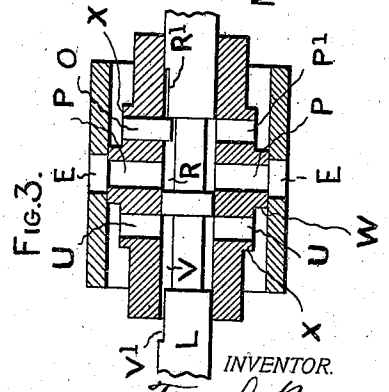


FIG. 3.

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WATER-MOTOR.

No. 881,222. Specification of Letters Patent. Patented March 10, 1908.

Application filed June 7, 1907. Serial No. 377,777.

To all whom it may concern:

Be it known that I, FRANK BREITENSTEIN, a citizen of the United States of America, residing at the city and county of Denver and State of Colorado, have invented a new and useful Water-Motor, of which the following is a specification.

My invention relates to improvements in water motors, and the objects of my invention are: First, to provide a water motor in which the piston is automatically reversed at the ends of its reciprocal strokes. Second, to provide a positively operating valve mechanism for water or other motive fluid motors. And third, to provide a simple, durable, and practical water-motor.

I attain these objects by the mechanism illustrated in the accompanying drawings, in which,

Figure 1, represents a longitudinal central section through a water motor embodying my invention. Fig. 2, is a cross-section of Fig. 1 on line 2—2. Fig. 3, is an enlarged longitudinal central section of the compound valve mechanism of my water motor. Fig. 4, is a similar view showing the parts in another position. And Fig. 5, is a cross section of Fig. 4 on line 5—5.

Similar letters of reference refer to similar parts throughout the several views.

Referring to the drawings, the letter H designates the cylinder, and N and T the cylinder heads of my water motor. These cylinder heads are secured to the cylinder by means of bolts H^1, which are preferably arranged to extend along the cylinder through both cylinder heads and thus clamp the heads and cylinder together. Both cylinder heads are provided with stuffing boxes H^2 and glands H^3. Within the cylinder a hollow piston head D is reciprocally fitted, which preferably consists of a hollow disk body portion, and a removable head end H^4, which is secured to the hollow disk body portion by any suitable means, preferably by cap screws. This hollow piston is divided into two independent chamber portions C and J, which are separated from each other by an oblique partition D^1. The chamber C is the fluid inlet chamber and the chamber J is the fluid exhaust chamber.

The piston D is provided with two tubular piston-rods B and K, which are threaded or otherwise secured to apertures formed axially in the opposite ends of the piston. These piston rods are adapted to admit the water or other motive fluid to the piston, from which it is discharged into the cylinder, and also to exhaust the water or other motive fluid from the cylinder through the piston, as will be hereinafter fully described, and I preferably make them of different diameters, the exhaust piston rod K being of greater diameter than the fluid inlet piston rod B. The fluid inlet piston rod B enters the fluid inlet chamber C of the piston, and the fluid exhaust piston rod K is connected to the exhaust chamber J. The piston-rod B extends through the stuffing box and gland of the cylinder head N into a tubular fluid inlet chamber H^6, which is threaded or otherwise secured to the outside of the hub of the stuffing box H^2 of the cylinder head N. This tubular inlet chamber is made large enough to inclose the piston rod B, and it is preferably closed by an end head portion and a fluid inlet aperture A, is preferably formed in its side. The piston rod K extends through the stuffing box H^2 of the cylinder head T, a sufficient distance for the length of its stroke, but only a fragment of its length is shown. Its outer end, however, is adapted to be connected to a waste pipe or tube which I do not illustrate. In the fluid inlet chamber I secure a bushing F between the head ends of the piston, arranging it in axial alinement with the axis of the piston. This bushing is provided at the center of its length with a circumferential row of fluid port holes E, which extend through its shell into its interior, and through the opposite head ends of the piston in axial alinement with this bushing I form ports G and S, which are smaller in diameter than the inner diameter of the bushing, and which form fluid outlet ports from the interior of the bushing through the opposite heads of the piston to the opposite ends of the cylinder. The interior of this bushing forms a valve seat for a valve M, which I call the main valve. This main valve consists of a round stem of any suitable metal or material of about the length of the thickness of the piston, the opposite ends of which fit slidably in the fluid ports G and S. The stem is formed at the center of its length with an enlargement W, which forms the body portion of the valve, and which fits closely but reciprocally in the bushing, and is provided with a circular row of ports P, which extend radially through to an axial valve port M^1, which extends through it. A stepped por-

tion X, of less diameter than the enlargement W, is formed on each side of the said enlargement, and these portions have radial ports U and P^1 respectively, which also open into the valve chamber M^1. These steps X form shoulders which limit the throw of the valve M, as will hereinafter more fully appear. This main valve is consequently reciprocally mounted in the bushing valve seat and in the fluid inlet ports G and S, through either one or the other of which one of its ends always extends, as it reciprocally operates to admit the operating fluid to the opposite ends of the cylinder, as will be fully explained hereinafter. Within the axial valve port M^1, which extends through the valve M from end to end, is located a valve L, which I term an auxiliary valve. This auxiliary valve comprises a round stem which is reciprocally mounted in the axial port of the main valve, and is made somewhat longer than the thickness of the piston in order that it will always project through the ports G and S, and beyond the opposite sides of the piston far enough to strike the cylinder heads on the opposite strokes of the piston, as will be explained hereinafter. This auxiliary valve has two circumferential recess ports R and V, formed in it at each side of a collar portion L^1 at the center of its length. The collar portion L^1 is of the same diameter as the body of this auxiliary valve and fits the axial port of the main valve; consequently it forms a separating partition between these two ports.

The ports V and R are each provided with an extension portion R^1 and V^1, which are formed by cutting away or flattening the periphery of the valve adjoining the ports, and for a sufficient distance beyond the ports, to bring the outer extremities of the said extensions beyond the ends of the valve M, alternately, as the valve L is moved by contact with the cylinder heads, and these extensions form passages for the escape of the exhaust pressure on either side of the enlargement W of the valve M.

The three circumferential rows of ports U, P, and P^1 which extend radially through the valve M, register with the ports R and V of the auxiliary valve, and these ports U, P and P^1 are positioned at a distance apart equal to the thickness of the central partition portion L^1, of the auxiliary valve. This valve is moved alternately back and forth in the valve M, by contact with the ends of the cylinder, and its movement in each direction is limited by a pin O, which extends through the valve M into the circumferential recess R between the collar L^1 and the opposite end of the recess. By contact with the cylinder head N the valve L is moved until it contacts with the pin O, and its movement is thereby imparted to the valve M, which is then moved with the valve L until its ports P register with the ports E of the bushing, as shown in Fig. 3, when the pressure passes through ports E, P, and P^1 to the end of the bushing F, between the enlargement W, and the end of the piston, and throws the valve M to the position shown in Fig. 4, or to the diametrically opposite position, according to the position of the piston with respect to the ends of the cylinder.

The main and auxiliary valve mechanism is adapted to admit the water or other motive fluid from the piston rod B to the opposite ends of the cylinder, and I employ an independent valve mechanism for exhausting the water or other motive fluid from the opposite ends of the cylinder. This valve I place in the exhaust chamber J of the piston, and it consists of a three-way winged stem-shaped valve I, which is reciprocally mounted in ports 1^A and 1^B, formed through the opposite head ends of the piston parallel with the axis of the piston, the valve stem being made long enough to extend across the thickness of the piston and through and beyond these ports a distance sufficient to allow the ends of this valve to strike the opposite cylinder heads of the cylinder at the opposite strokes of said piston. The opposite ends of this valve stem are provided with heads 1^c, which are secured to them in any suitable manner. The outside entrances to the ports 1^A and 1^B are divergingly tapered to form seats and the inside edges of the heads 1^c of the valve 1, are beveled to fit the bevel of the seats.

The operation is as follows: Assuming the ports to stand as shown in Fig. 1, the water or other fluid pressure enters the tubular inlet pipe, from a source of supply through a suitable pipe or hose which I do not illustrate, but which is adapted to be connected to the inlet aperture of this tube, and flows through the piston-rod B, into inlet chamber C of the piston from which it flows through the port E of the valve seat bushing, and through the port G into the end 1 of the cylinder, and this entering fluid pressure forces the valve I to move to close its adjacent port 1^A and to open its port 1^B, thus allowing the fluid to escape from end 2 of cylinder, into chamber J, and through the piston K to waste, and allows the piston to be moved to the opposite end 2 of the cylinder where the auxiliary valve L strikes the cylinder head N, and is moved in the axial port of the main valve M, toward the end 1 of cylinder until it strikes the stop pin O, when the main valve M is moved far enough in the same direction to close the bushing valve seat's port E and also the port G of the piston into which its adjacent end moves, but at the same time not enough to open the port S, which is still closed by the opposite end of the valve M, but enough to cause the port P to register with the port E

and cause the motive fluid to flow through ports P and P^1 in main valve M by means of port R into right hand end of the bushing valve seat which forces the main valve M to the extreme left hand end of its movement, and at the time of the left hand movement of the main valve M any exhaust pressure in the left hand end of the valve M escapes through the port U and the extension port V^1 of the port V to the atmosphere at the left hand end or end 1 of the cylinder, and this completed movement of the main valve M by the fluid pressure opens the ports E and S, and allows the motive fluid to flow from the chamber C through the ports E of the bushing valve seat through port S to the end 2 of the cylinder, and moves the exhaust valve 1 to close its port 1^B and open its port 1^A and allow the water or other fluid pressure to exhaust from end 1 of the cylinder into piston's chamber J and through piston K to the atmosphere.

When the piston D reaches the end 1 of the cylinder, the auxiliary valve L strikes the cylinder head T and is shifted to the right far enough for its pin O to move the main valve to close ports E and S and still hold port G closed, and also far enough to allow ports P and U to be opened to register with valve seat port E by means of port V in the left end of the bushing valve seat F thereby forcing the valve M to extreme right in the valve seat F, while at the same time exhaust pressure from the right end of the valve seat F escapes by extension port R^1 to end 2 of cylinder and then to atmosphere through exhaust valve L and its ports and piston-rod K, and at the same time the motive fluid is again admitted to port E and G to end 1 of cylinder and the operation is again repeated.

My invention is simple and makes a positively operating differential movement valve mechanism that is free from springs and reliable in its action.

Having described my invention what I claim as new and desire to secure by Letters Patent, is:

1. In a water motor, the combination with the cylinder and the piston provided with independent fluid inlets and exhaust chambers and oppositely extending piston rods, of the fluid outlet ports in the opposite sides of said piston's fluid chamber, the fixed bushing in alinement with said ports and provided with inlet ports, and the differential movement valve arranged in said bushing and ports and comprising the main and auxiliary valves, said auxiliary valve being arranged to contact with the opposite ends of said cylinder at the opposite strokes of said piston.

2. In a water motor, the combination with the cylinder and the hollow piston provided with oppositely extending hollow fluid inlet and exhaust piston rods, and containing independent fluid inlet and exhaust chambers of the outlet ports in the sides of said fluid inlet chamber, the fixed bushing valve seat in said chamber, the main valve in said bushing, the auxiliary valve in said main valve, and coöperatively arranged with said main valve to admit motive fluid to the opposite sides of said piston, and the exhaust valve and its ports in said piston's exhaust chamber.

3. In a water motor, the combination with the cylinder, of a hollow piston provided with a fluid inlet chamber and an independent fluid exhaust chamber, and provided with a hollow fluid inlet piston rod at one end, connected to said piston's fluid inlet chamber, and a hollow fluid exhaust piston rod at the opposite end of said piston connected to said piston's fluid exhaust chamber, ports through the opposite sides of the exhaust chamber of said piston, a valve stem extending through said piston and beyond it at each end far enough to engage the opposite ends of said cylinder, and provided with a valve at its opposite ends adapted to control the oppositely arranged ports of said piston's fluid exhaust chamber, of ports through the opposite sides of the said piston's fluid inlet chamber, a fixed bushing valve seat in said chamber registering with said ports, a main valve seated in said bushing valve seat and said inlet chamber ports, an axial port in said main valve, an auxiliary valve in said axial port of said main valve adapted to engage the opposite ends of said cylinder at the opposite strokes of said piston, and a series of ports in said bushing valve seat and said main and auxiliary valves coöperatively arranged to admit a suitable motive fluid to the opposite ends of said cylinder in alternate order.

4. In a water motor, the combination of the cylinder, the hollow piston reciprocally mounted on said cylinder and provided with an independent fluid inlet and an exhaust chamber, a fluid inlet piston-rod connected to said piston's fluid inlet chamber and extending through said cylinder from one side of said piston, and a hollow piston rod connected to said exhaust chamber and extending through said cylinder from the opposite side of said piston, a port through the opposite sides of said piston in said exhaust chamber, and a slide valve arranged to control said ports, and to admit the exhaust fluid from opposite sides of said piston in alternate order to said exhaust chamber, with a pair of ports positioned in the opposite sides of said piston in its fluid inlet chamber, a fixed bushing valve seat positioned in said chamber in alinement with said ports and of larger diameter than said ports, a main valve comprising a central body portion fitting slidably said bushing valve seat, and having opposite end portions fitting slidably in said ports, an axial port through said main valve, an auxil-

iary valve slidably mounted in said port and extending beyond said valve and said piston on opposite sides of it far enough to engage the opposite ends of said cylinder on the alternate strokes of said piston, and adapted to be moved by said engagement with said cylinder a predetermined distance, fluid inlet ports through the central portion of said bushing valve seat to said main valve and to said fluid inlet chamber, inlet ports in the opposite sides of said piston, circumferential ports in said auxiliary valve at each side of its central portion, and extension ports extending from said circumferential ports along the length of the opposite end portions of said valve, a predetermined distance, sufficient to register beyond the sides of said piston in the opposite end strokes of said auxiliary valve, a plurality of radial ports in the center of the body portion of said main valve arranged to register with the circumferential ports of said auxiliary valve, and two groups of radial ports through the end portions of said main valve on opposite sides of said main valve's central radial ports, arranged to register in alternate order with said auxiliary valve's ports and opening into said bushing valve seat and a stop pin in said main valve extending into one of said auxiliary valve's ports and adapted to permit the reciprocal movements of said auxiliary valve to coöperatively operate and move said main valve to alternately admit fluid pressure to opposite ends of said piston and cylinder in alternate order.

5. In a water motor, the combination with the cylinder and the piston provided with a water inlet piston rod and chamber and an independent water exhaust chamber and piston rod, with the fixed sleeve in said inlet chamber, provided with inlet ports, the ports in the opposite sides of said chamber in alinement with said sleeve, the main valve slidably mounted in said sleeve, the auxiliary valve reciprocally mounted in said main valve and arranged to strike the ends of said cylinder at the opposite ends of said piston's reciprocal strokes, and the operative ports in said main and auxiliary valves.

6. In a water motor, the combination with the cylinder, the piston, and the water inlet and exhaust piston rods, of a fixed bushing in said piston, provided with inlet ports, water outlet ports in the opposite sides of said piston in alinement with said bushing, and a differential movement valve mechanism operatively mounted in said bushing and ports.

7. In a fluid controlled motor, the combination with the cylinder, the piston, the fluid inlet piston rod, and the valve controlled exhaust piston rod, of a fixed bushing in said piston, provided with fluid inlet ports, water outlet ports in the opposite sides of said piston, and a differential movement valve in said bushing comprising a main valve reciprocally mounted in said bushing and said water outlet ports, and an auxiliary valve reciprocating within said main valve and arranged and adapted to strike the opposite ends of said cylinder at the ends of the reciprocal strokes of said piston, a stop pin in said main valve and a shoulder on said auxiliary valve arranged to engage said pin and move said main valve a predetermined distance, and a group of ports in said main and auxiliary valves coöperating with the inlet ports of said bushing arranged and adapted to admit fluid pressure to move said main valve the remainder of its operative movement.

8. In a fluid controlled motor, the combination with the cylinder, the piston, the fluid inlet and exhaust piston rods, the fluid inlet chamber, the bushing, the outlet ports in said fluid inlet chamber, and the main auxiliary valves coöperatively arranged in said bushing, of a fluid exhaust chamber in said piston independent of and separated from said fluid inlet chamber by a partition, fluid inlet ports in the opposite sides of said piston leading into said exhaust chamber, a valve stem reciprocally mounted in and extending beyond said ports, and a valve on the opposite ends of said valve stem arranged to strike the opposite ends of said cylinder at the ends of said piston's reciprocal strokes, and arranged to seat in the entrance of said ports in alternate order.

9. In a water motor, the combination with the cylinder, the piston provided with the water inlet and exhaust chambers, and the water inlet and exhaust piston rods, of the fixed bushing and the water ports in said bushing and said piston, the main and auxiliary water inlet valves operatively arranged in said piston's inlet chamber, within said bushing and ports, said auxiliary valve being provided with ports arranged to communicate with the opposite sides of said piston, and being arranged to strike the opposite ends of said cylinder at the end of its reciprocal strokes, and moved through its operative stroke, a set of ports in said main valve coöperating with the ports in said bushing, and means connected with said auxiliary valve for moving said main valve to open and close said bushing and piston's inlet chamber's ports.

10. In a water motor, the combination with the cylinder and the piston, provided with an independent water inlet chamber and an exhaust chamber separated by a partition, and the water inlet and exhaust piston rods connected to their respective chambers, of the main and auxiliary valves and ports operatively mounted in said pston's inlet chamber, and arranged to admit water from the opposite sides of said piston into the op-

posite ends of said cylinder, said auxiliary piston being arranged to engage the opposite ends of said piston at the ends of its reciprocal strokes, a port in the opposite sides of said piston into said piston's exhaust chamber, and a reciprocal valve stem provided with a valve at each end arranged to fit the outside entrances to said ports and adapted to engage the opposite ends of said cylinder at the ends of its reciprocal strokes.

In testimony whereof I affix my signature in presence of two witnesses.

FRANK BREITENSTEIN.

Witnesses:

G. SARGENT ELLIOTT,

ADELLA M. FOWLE.