(No Model.) 2 Sheets—Sheet 1.

D. P. WEIR.

WATER MOTOR.

No. 338,572. Patented Mar. 23, 1886.

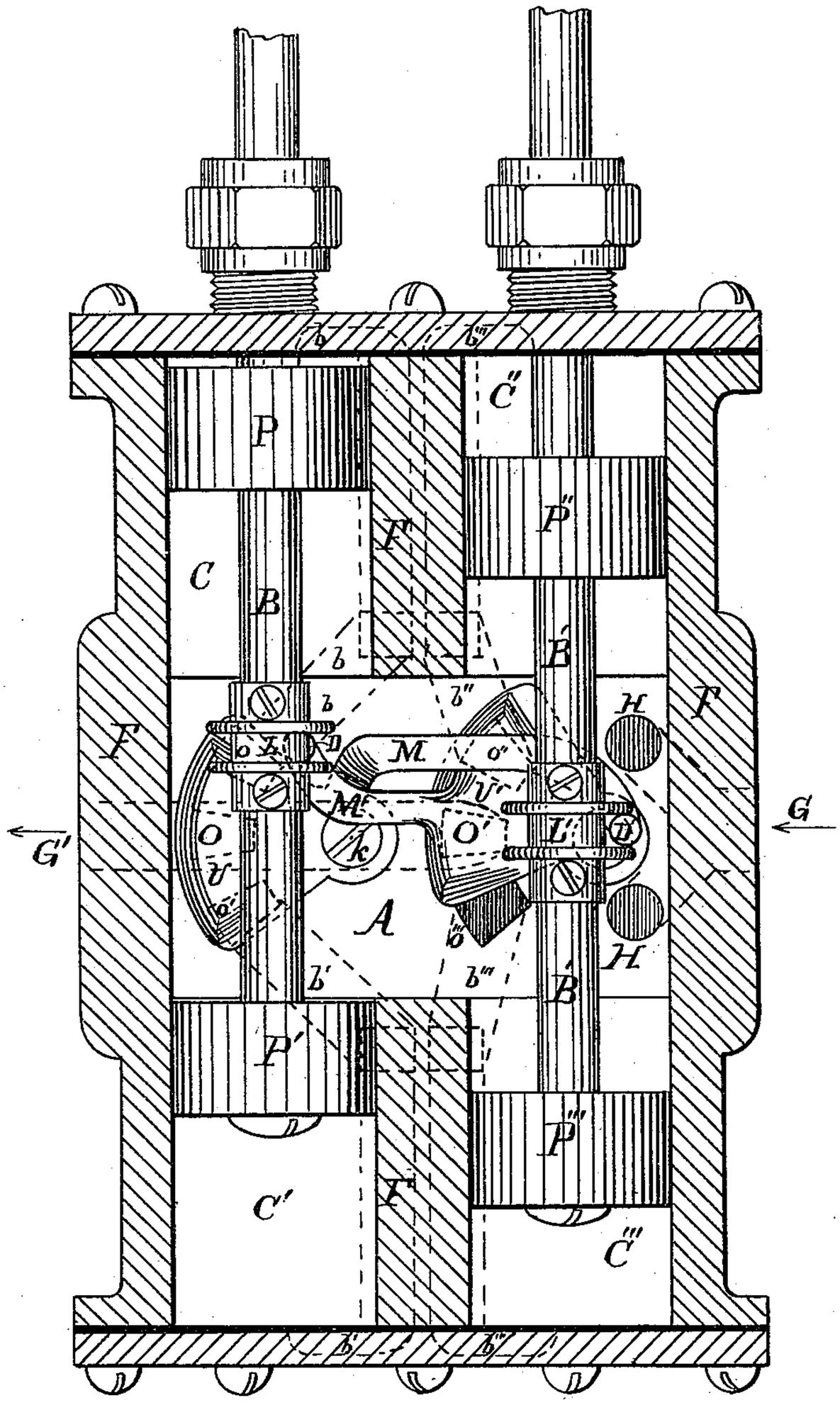

Fig 1.

Witnesses.

Charles Sewall

Nath'l J Haldeman

Inventor.

David P Weir

(No Model.) 2 Sheets—Sheet 2.

D. P. WEIR.

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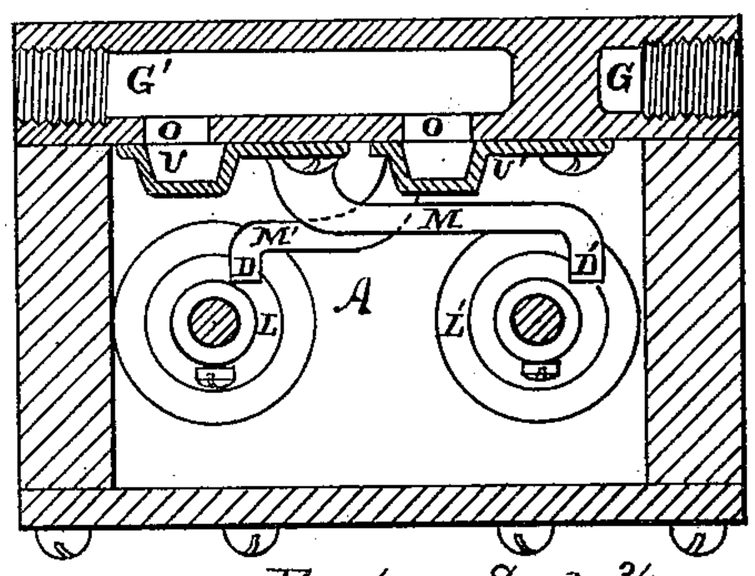

Fig 4. Scale 3/4.

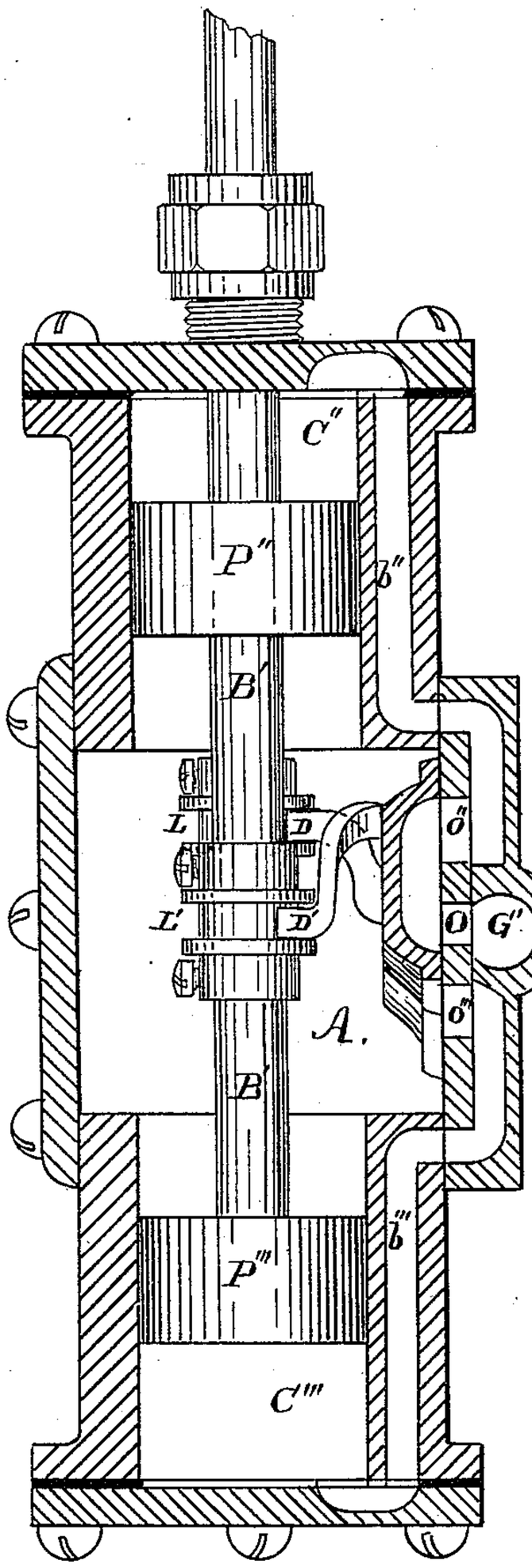

Fig 2.

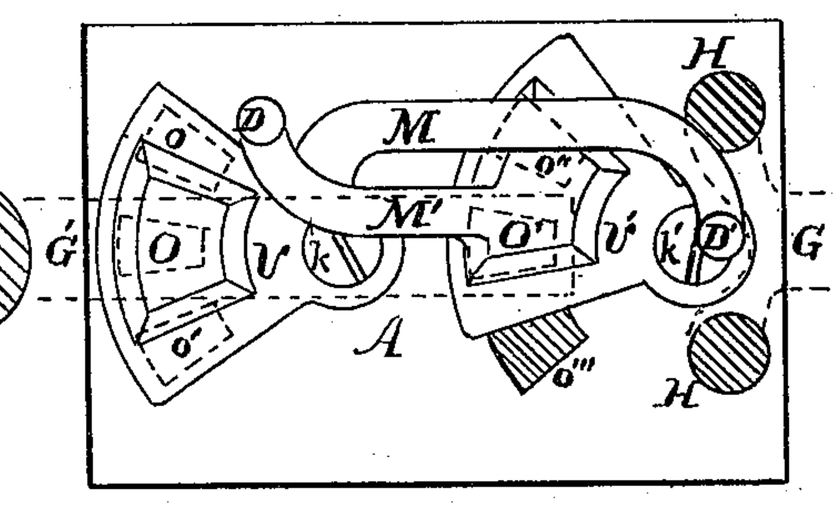

Fig 3.

WITNESSES
Charles Sewall
Nath'l J Holden

Daniel P. Weir
INVENTOR

By Attorney

UNITED STATES PATENT OFFICE.

DANIEL P. WEIR, OF SALEM, MASSACHUSETTS.

WATER-MOTOR.

SPECIFICATION forming part of Letters Patent No. 338,572, dated March 23, 1886.

Application filed December 23, 1885. Serial No. 186,572. (No model.)

To all whom it may concern:

Be it known that I, DANIEL P. WEIR, of Salem, in the county of Essex and State of Massachusetts, have invented a new and useful Improvement in Water-Motors, of which the following, taken in connection with the accompanying drawings, is a specification.

My invention relates to motors operated by the force of water acting upon pistons to produce a reciprocal motion which is converted into a rotary motion by means of the ordinary quarter crank-shafts with connecting-rods in the usual manner; but my invention especially pertains to the valves and the mode of operating them.

The advantages claimed for my invention are simplicity of construction, slight friction, and direct water ducts or passages from the valves to the cylinders, and constitutes an important improvement for the purpose of water-motors over a similar system of cylinders, pistons, and valves now employed in my water-meter, for which a patent (No. 234,898) was granted to me November 30, 1880.

In the drawings, Figure 1 is a longitudinal section of the machine, showing the operation of the pistons and valves. Fig. 2 is a longitudinal section in the opposite direction, showing the water-passages from the inlet-chamber to the cylinders and thence to outlet. Fig. 3 is a view of the valves, the same as in Fig. 1, the piston-rods being removed to show more distinctly the positions of the crossed arms which move the valves. Fig. 4 is a horizontal section through the center of the machine, drawn to a scale of three-quarters the size of the other figures, and shows the relative positions in the valve-chamber of the valves, arms, and piston-rods.

The machine consists of an outside casing, F, inclosing a central inlet or valve chamber, A, in which are the two valves V and V′, and from which extend two pairs of cylinders, C C′ and C″ C‴, one end of each of which communicates directly with the chamber A and the other end of each communicates with the same chamber by passages, hereinafter described. Moving in the pair of cylinders on the left are the pistons P and P′, connected by the piston-rod B, and on the right are pistons P″ P‴, connected by the rod B′. Both rods are made to extend outward through the casing at one end and to operate an ordinary quarter crank shaft by means of connecting-rods. The crank-shafts and connecting-rods are not shown on the drawings, the piston-rods being represented as broken a short distance beyond the casing. The back of the valve-chamber is cast with certain ducts or passages. On the right is shown the principal inlet, G, conveying the water under pressure into the valve-chamber through the apertures H H. From the valve-chamber the ports O O′ allow the water to pass out into the principal outlet G′, which is a duct in the back of the valve-chamber in line with the inlet-duct G, but separated from it by a solid partition in the casting. The outlet-ports O O′ are in the form and positions shown by the dotted lines in Figs. 1 and 3, and are of sufficient size to allow the free passage of water. They are made in the form of sectors of circles, or nearly so, the sector being about one-twelfth of the circle of which it might form a part. On both sides of each of these outlet-ports and of the same size and shape, and being very nearly equal sectors of the same circle, and separated from the outlet-ports by other equal sectors of the same circle, are what may be called the "cylinder-ports" *o o′* and *o″ o‴*, being openings in the back of the valve-chamber through which the fluid may pass to the passages *b b′* and *b″ b‴*, which extend from the cylinder-ports through the castings to the extreme ends of the cylinders, as shown by the dotted lines, each port being thus connected by a distinct passage to the space at the outer end of the cylinder nearest to it. The valves which open and close these ports are each shell-shaped oscillating valves covering an area of about five-twelfths of the circle of which the ports are sectors. They vibrate on what would be the centers of the circles, (represented by the screws *k k′*,) and are moved by the arms M M′, operated by the grooved collars L L′ and pins D D′. Both valves oscillate in the same direction from their centers. The valve V′ for the right-hand ports is moved by the left-hand piston-rod, and the valve V for the left-hand ports is moved by the right-hand piston-rod. The arm by which the valve V is moved is attached near the pivotal center, and is operated as a lever of the first power, having the pivot or center for a fulcrum, while the valve V′, hav-

ing its arm M′ attached near the circumference, is a lever of the second power, the fulcrum being at the opposite end. This arrangement gives the reverse action of the valves necessary to the proper working of the pistons without the crossing of the water-ducts leading to the outer ends of the cylinders. A portion of each valve is raised, making a box or shell, with the under side open, having a flat flange working water-tight. These valves shut at all times the direct passage of water from the valve-chamber to the outlet-ports O O′, but permit as they vibrate the alternate flow from the valve-chamber through the cylinder-ports *o o′* and *o″ o‴* to the ducts *b b′* and *b″ b‴*, and through them to the cylinders; thence, after acting upon the pistons, returning by the same ducts and through the valve-shell, which would then be in position to receive the flow, the fluid passes through the middle ports, O O′, to the outlet G′.

In operation the position of the pistons is such, being attached to the quarter-crank shaft, that when one is at its "dead-point" the other is moving with most power and motion. Fig. 1 shows the pistons in such a position. The left-hand pair of pistons is at the highest point and its crank at dead-point. The right-hand pair is then at the middle of its stroke. The left valve, V, being operated by its arm M from the right piston-rod, B′, by means of the pin D′, working in the grooved collar L′, is in a position half-way between the opening of the cylinder-port *o* to the inlet or valve chamber and the closing of cylinder-port *o′*, both ports being for an instant shut off from both outlet and inlet. While the pistons P P′ are thus nearly at rest the valve V is being rapidly changed by the quick motion of the other piston-rod, B′. The piston-rod B being at its highest point, the valve V′ is also raised by the arm M′, pin D, and collar L, and the cylinder-port *o‴* is full open to the inlet-chamber, the water passing through passage *b‴* to the bottom of cylinder C‴ and forcing upward the piston P‴. The cylinder-port *o″* is at the same moment covered by the valve-shell of valve V′, giving the fullest outlet from the cylinder C″ above through the passage *b″*, port *o″*, and outlet-port O′ to the common outlet G′. It will be noticed that the water in the valve-chamber A has practically no effect upon the sides of the pistons facing toward said chamber, because it acts on all equally. In illustrating this I will refer more particularly to Fig. 2, and consider the same as represented in a vertical position. If, now, the water is of such pressure as to exert a force of one hundred pounds on the pistons, it will exert precisely the same force on the top of piston P‴ and the under side of piston P″, and the force exerted on these faces of the pistons will thus be equal, and so far as these faces of the pistons are concerned the water will exert no moving force on them, for they will be perfectly counterbalanced; but the water also presses with a force of one hundred pounds on the under side of the piston P‴, and as the opposite cylinder, C″, is exhausting there is no pressure on the upper side of the piston P″; consequently the full force of the one hundred pounds pressure is exerted to force the piston P‴ upward until it reaches the end of its stroke, when its valve is changed and the pressure is reversed from cylinder C‴ to cylinder C″. The reciprocal action of the pistons thus operate upon each other, giving a continuous discharge from the outlet G′, and the force of the water under pressure acting upon the pistons is transmitted to the crank-shaft, giving an even and constant rotary motion.

What I claim as new is—

1. A water-motor consisting of the two pairs of cylinders C C′ and C″ C‴ and the pistons P P′ and P″ P‴, in combination with the two sector-shaped valves V and V′ and the crossed arms M M′, each arm being rigidly attached to one valve and extending toward the valve carrying the other arm and connected with a piston, substantially as described.

2. In a water-motor, the two chambered or boxed sector-shaped valves V V′, combined with the crossed arms M M′, and suitable connections with the reciprocating piston-rods, whereby said valves are caused to oscillate upon the centers of the circles of which they are the sectors and in the same direction from those centers, as described.

3. In a water-motor, the two like oscillating sector-shaped valves V V′, in combination with the sector-shaped ports O O′ and *o o′ o″ o‴*, and the crossed arms M M′, each arm being rigidly attached to one valve and extending toward the valve carrying the other arm and connected with a piston-rod, substantially as described.

4. In a water-motor, the two like-oscillating sector-shaped valves V V′, in combination with the crossed arms M M′, each arm being rigidly attached to one valve and extending toward the valve carrying the other arm, pins D D′ and grooved collars L L′, piston-rods B B′, and pistons P P′ P″ P‴, all constructed and arranged substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 12th day of December, A. D. 1885.

DANIEL P. WEIR.

Witnesses:
JOHN A. BASSETT,
CHAS. C. RHOADES.