2 Sheets—Sheet 1.

J. S. WILLIAMS.

Water-Motors.

No. 200,679. Patented Feb. 26, 1878.

Fig. 1.

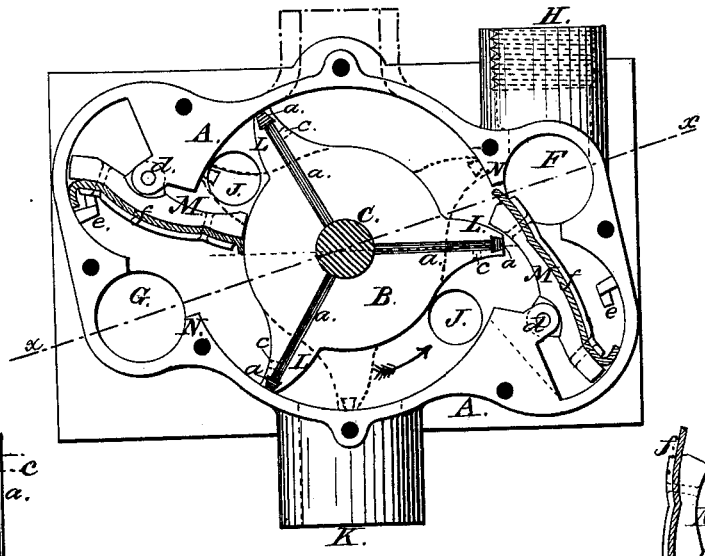


Fig. 5.

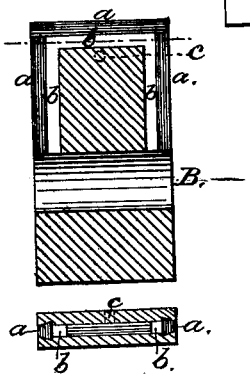


Fig. 6.

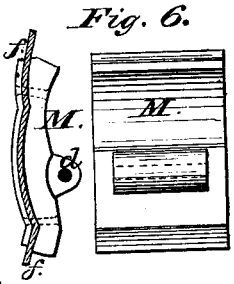
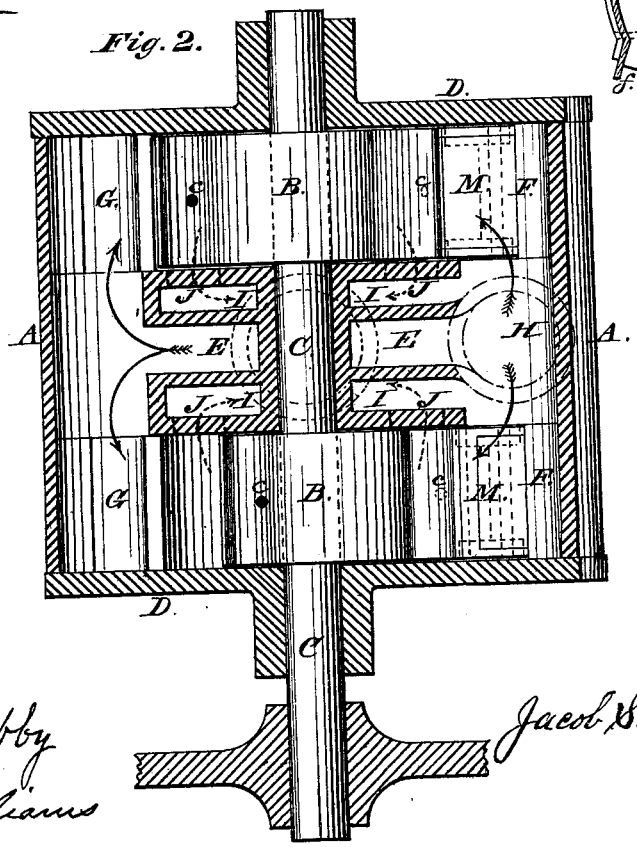


Fig. 2.



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2 Sheets—Sheet 2.

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Water-Motors.

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Fig. 3.

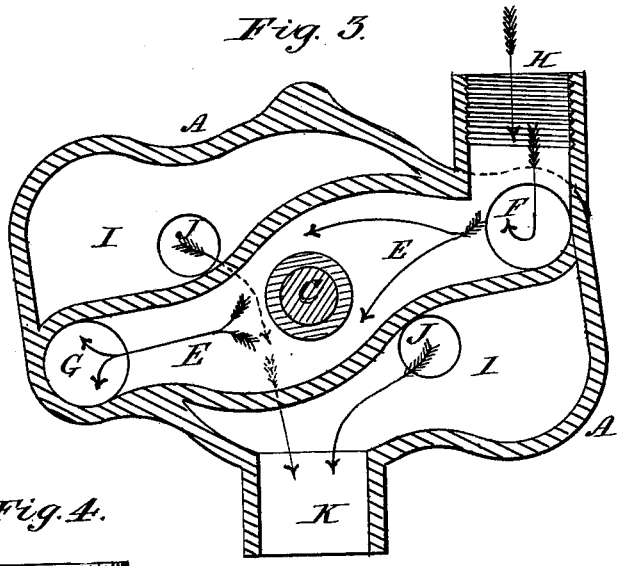


Fig. 4.

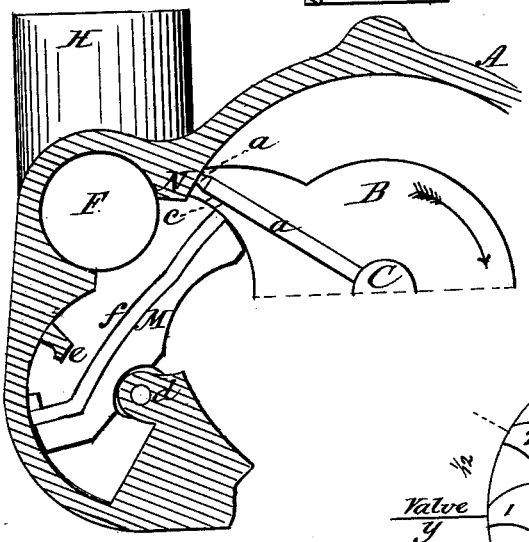
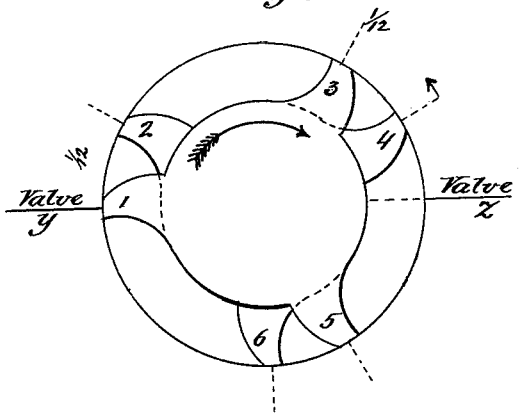


Fig. 7.



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UNITED STATES PATENT OFFICE.

JACOB S. WILLIAMS, OF ST. LOUIS, MISSOURI.

IMPROVEMENT IN WATER-MOTORS.

Specification forming part of Letters Patent No. **200,679**, dated February 26, 1878; application filed August 14, 1877.

To all whom it may concern:

Be it known that I, JACOB S. WILLIAMS, of St. Louis, in the county of St. Louis and State of Missouri, have invented certain new and useful Improvements in Water-Motors; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

My improved water-motor is designed with special object to apply the pressure of the water continuously and uniformly on both sides of separate wheels upon the same shaft in separate chambers, and to obtain a constant and equal pressure on all parts, rendering the motor more reliable and easily operated with comparatively little water, and of a cheap construction, not liable to get out of order.

The interior of the case or shell is of peculiar construction, being divided to form a central water-way between the wheels and on both sides of the shaft, and communicating with opposite side distributers opening at opposite sides of the case into the separate chambers of the wheels, the exhaust-ports from which enter a space partially or wholly surrounding or adjoining the central water-way, by which construction each wheel-chamber fills and discharges twice in each revolution of the wheels.

An important matter of my invention is the arrangement of the abutments of one wheel in advance of those of the other wheel, and in such relation to pivoted overbalanced valves, the admission and the outlet ports, that equal to three chambers are working full always, making available at all times about three-quarters of the whole power of the motor.

Overbalanced valves are pivoted at the opposite sides of each wheel, and exactly opposite in the separate chambers, so as to operate in proper relation with the wheels and with projections of the inlet-ports or water-distributers. Suitable stops are combined with these valves to limit their inward movement and reduce the friction and pressure of their inner ends upon the wheels.

The wheels are provided with dovetailed packing having underlying water-channels and jet-openings, through which water-pressure is admitted to make a tight and a slack packing as the wheels revolve. The releasing of the pressure upon the packing during a portion of the revolution of the wheels is of special advantage in making the wheels run easier.

The valves and the abutments of the wheels are arranged in such relation to the wall-projections of the inlet-ports or distributers as to cause the packing of the abutments to pass upon the walls of the wheel-chambers before the valves shall have passed the jet-openings in the wheel-abutments to force out the packing, and thus save the latter from being projected too soon and being cut by the edge of the inlet-port or distributer.

The water passes to the wheels right and left from distributers or ports at the point of induction; and from said induction-point it passes across on both sides of the shaft to the other side of the case into other distributers or ports, and thence right and left upon the opposite sides of the wheels, and it is this construction that gives the constant and equal pressure on the separate wheels carried by the same shaft in separate chambers.

In the drawings, Figure 1 represents an under-side view of my improved water-motor with the cover removed; Fig. 2, a section in line with the opposite double inlet-ports or distributers at the line *x x* of Fig. 1; Fig. 3, a section taken through the induction and eduction pipes and the water-way connecting the two sets of inlet-ports or distributers; Fig. 4, an enlarged detail, showing the relative positions of one of the valves, the wheel-abutment, and the wall-projection of one of the inlet-ports or distributers with respect to the water-jet for applying pressure to the packing; Fig. 5, a section of one of the wheels, showing the dovetail packing and its underlying water-chambers; Fig. 6, a detail view of one of the valves, and Fig. 7 a diagram showing the manner of arranging the abutments of one of the wheels in advance of the other.

The shell or case A has two separate chambers arranged at opposite sides of the shell, and within which are wheels B B, arranged up-

on and revolving the shaft C, which passes through the center and the side covers D D of the case. Two water-ways are arranged across the center of the case parallel with the wheel-chambers and crossing the shaft, and one of them, E, forms the water-way which communicates with opposite side ports or water-distributers F and G, and with the induction-pipe H, while the inlet-ports or distributers F G also open into the opposite sides of the wheel-chambers, in a manner to direct the water right and left upon the opposite sides of both wheels with the same force and pressure.

The exhaust-water way I partially or entirely surrounds the water-way E, and connects with the ports or openings J J at opposite points in the inner walls of the wheel-chambers, and with the eduction-pipe K at the side of the case opposite to that at which the water enters. This construction gives four ports, F F G G, for the admission and distribution of the water, arranged in line with each other at opposite sides of the case, one on each side of each wheel, and joining the chamber thereof outside of the circle described by the wheel-abutments, and four ports, J, for the discharge of the water from the wheel-chambers.

The acting portions of the wheels are formed by three equally-spaced abutments, L, which revolve within the side chambers, and are provided with recesses on three of their sides to receive leather or other packing, *a*, to securely pack the outer sides of the abutments against the circular walls of the wheel-chambers, and their ends against the straight walls of said chambers.

The dovetail form of the recesses shown in Figs. 1 and 5 is to give holds for the packing, and allow a certain amount of play therein, for a purpose to be presently stated.

The packing *a* extends from the shaft C outward on one end of the wheel B, over the outer side of the abutment L, and back to the shaft on the opposite end of said wheel. A channel, *b*, Fig. 5, is formed behind the packing *a* for the water-jet, which is admitted by a small aperture, *c*, in the acting side of each abutment L, and by which jet the packing is set out on all sides by the water-pressure in the wheel-chambers.

At opposite sides of each wheel, and at opposite points in the separate chambers, are arranged in side extensions of the wheel-chambers overbalanced valves M, pivoted near one end, at *d*, to the case, so that their inner ends may extend into the wheel-chambers in a manner to be successively acted upon and turned by the action of the wheel-abutments L as they revolve. Stops *e*, Figs. 1 and 4, are arranged upon the inner walls of the case, against which the outer ends of the valves act to limit the inward movement of their acting ends, and thus prevent their pressure and consequent friction upon the sides of the wheels, to give them an easier movement. The acting ends of these valves are arranged to receive the pressure of the water from the distributers F G, and to direct such pressure upon the abutments, and keep the valves in contact with the wheels and abutments.

A packing, *f*, is riveted to the outer sides of the valves M in a manner to pack their acting ends with the wheel and their sides and outer ends with the case, and for this purpose the packing *f* is of greater area than the valves, to allow the edges to be turned over to close the joints by the pressure of the water, as shown in Figs. 1, 4, and 6.

In Fig. 4 the valve M is shown in the position as having just passed the jet-opening *c*, through which the water passes into the channel *b* under the dovetail packing *a*, so that the pressure of the water from the inlet-port or distributer at that point will be applied under the packing, and press it outward against the inclosing-walls of the wheel-chamber.

The relative positions of the points N of the water-distributers F G, the acting ends of the valves, and the abutments, are such that the abutments L will have passed the point N before the valves pass the water-jet openings *c*; otherwise the packing would be protruded by the water-pressure, and cut as it passes said projection. As soon as the next succeeding abutment touches said projection N the pressure of the water-jet will be removed or shut off from the packing of the preceding abutment, and the pressure and friction thereof will be relieved, and it will remain functionless in its seat until again brought into action as before.

It will be seen that as the wheel revolves to the right the valves M act upon the sides of the abutments in which the jet-openings *c* are formed, as shown in Fig. 4; and, in order to prevent any concussion in the action of the valves, this side of each abutment is made with a gradual bend to the bottom or surface of the wheel.

In Fig. 7 I have shown a diagram illustrating the arrangement of the abutments of one of the wheels one-twelfth of the circumference in advance of the abutments of the other wheel in their respective chambers. In the diagram the valves are represented in their respective positions, *y* and *z*, and the abutments of one wheel are designated by the numerals 1, 3, and 5, and those of the other wheel by 2, 4, and 6.

Now, supposing the abutment 1 to be at valve *y*, the abutment 4 will be one-twelfth from the valve *z*, and they will pass the valves at one-twelfth the circumference apart in the following order: abutment 1, valve *y*, abutment 4, valve *z*, abutment 3, valve *z*, abutment 6, valve *y*, abutment 5, valve *y*, abutment 2, valve *z*, abutment 1, valve *z*, &c.

Unless the abutments are placed one-twelfth apart, they would pass the valves irregularly, or in pairs, causing a material loss of power and steadiness; but the arrangement I have adopted gives three wheel-chambers working full and an available pressure on nearly three-

quarters of the abutments all the time, which I consider a great advantage gained by my plan.

The operation of the motor is as follows: Water, being admitted through the inlet-pipe H, passes through the port-distributers F F to the wheels on the right and left, and through the central water-way E on both sides of the shaft C to the distributers G G, and thence to the right and left to the opposite sides of the wheels, as shown in Fig. 2.

As soon as one of the valves M reaches the top of one of the abutments L the latter passes to the point N, and cuts off the supply from the preceding chamber, and the abutment next in advance passes the exhaust-port J, and allows the water to escape into the central exhaust-passage I, partially or entirely surrounding the water-way E, and out through the eduction-pipe.

In practice the inlet-pipe H will be arranged on the center of the case, as shown in dotted lines in Fig. 1, so as to make it more uniform, and the water will be supplied to all parts of the motor more uniformly.

Covers D are secured to each side of the case to give access to the interior of the wheels and valves for repairs.

The motor may be made of any size and materials, and it can also be used as a steam or gas motor.

The course of the water is indicated by the full arrows for the inlet and by the dotted arrows for the outlet.

I claim—

1. In a motor, two wheels arranged upon the same shaft, their chambers being open at opposite sides, in combination with valves, water-inlet ports or distributers, and a central communicating water-way therefor, whereby the water is directed upon the wheels right and left at their opposite sides.

2. The combination of the revolving wheels B B on the same shaft and the pivoted valves M with a case and the inlet-ports or water-distributers F and G, arranged for operation substantially as herein set forth.

3. In a motor, the interior cross water-way E, the exhaust-passage I, and the double sets of inlet-ports or water-distributers F G and exhaust-ports J J, in combination with the wheels and their co-operating valves, substantially as herein set forth.

4. In a motor having wheels with abutments, the dovetail packing *a* and underlying channels *b* in the abutments and wheel, as described, in combination with the jet-openings *c* in the acting sides of said abutments, substantially as and for the purpose herein set forth.

5. The distributer-projections N of the case, the valves M, and the wheel-abutments L, so arranged in relation to each other and the jet-openings *c* that, as the wheels revolve, the outside packing of the abutments will pass the said projections N before the valves have passed said jet-openings, whereby the packing is prevented from being projected in advance of its passing said projections.

6. The combination, with the pivoted valves M and the wheel-abutments L, constructed for operation substantially as described, of the stops *e*, whereby the inward movements of the valves are arrested and their pressure and friction upon the wheels reduced.

7. In a motor having wheels in separate chambers upon the same shaft, and in which said chambers communicate on both sides of the wheels, the abutments of the wheel in one chamber arranged one-twelfth of the wheel-circumference in advance of the wheel-abutments in the other chamber, whereby equal to three chambers are always working full with a greatly-increased available power.

8. The motor herein described, consisting of a case with separate interior water-ways, with double sets of ports communicating respectively therewith, wheels with abutments arranged in separate chambers upon the same shaft, and the pivoted valves opposite each other in said chambers, all constructed and operating as herein set forth.

In testimony that I claim the foregoing I have affixed my signature in the presence of two witnesses.

JACOB S. WILLIAMS.

Witnesses:
M. C. LIBBY,
JNO. R. WILLIAMS.