

(No Model.)

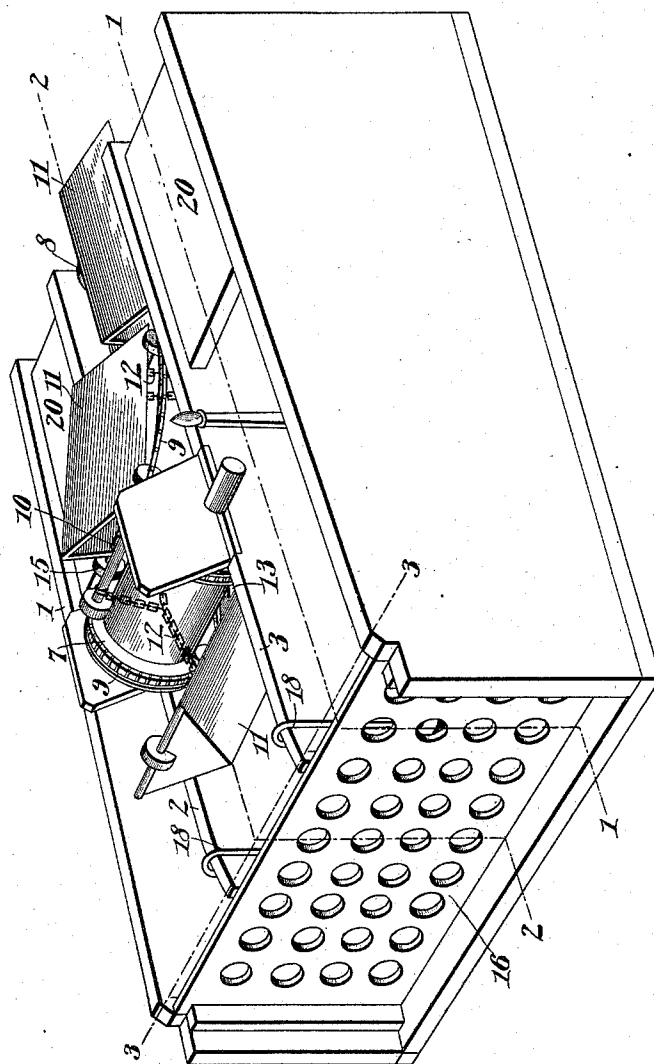
3 Sheets—Sheet 1.

W. H. WOODWARD.
MECHANISM FOR UTILIZING WATER POWER.

No. 579,209.

Patented Mar. 23, 1897.

Fig. 1.



Witnesses;

J. M. Withers
E. J. Myers

Inventor,

Wm H. Woodward,

By Joseph L. Atkins
Attorney

W. H. WOODWARD.

MECHANISM FOR UTILIZING WATER POWER.

No. 579,209.

Patented Mar. 23, 1897.

Fig. 2.

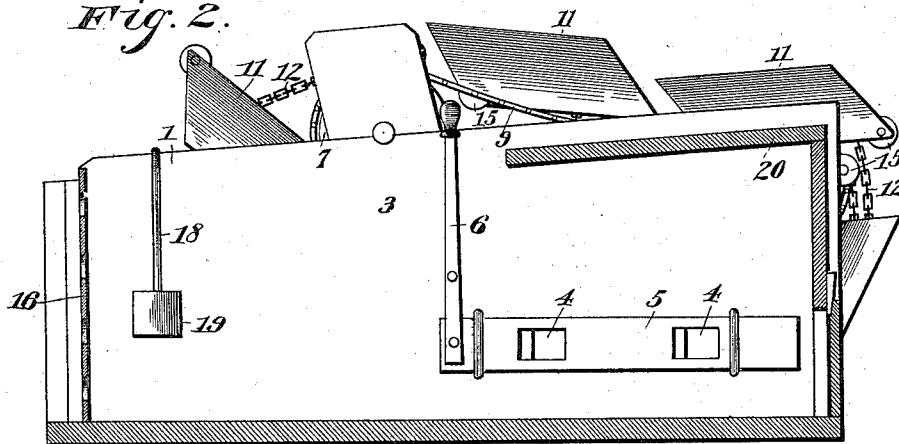


Fig. 3.

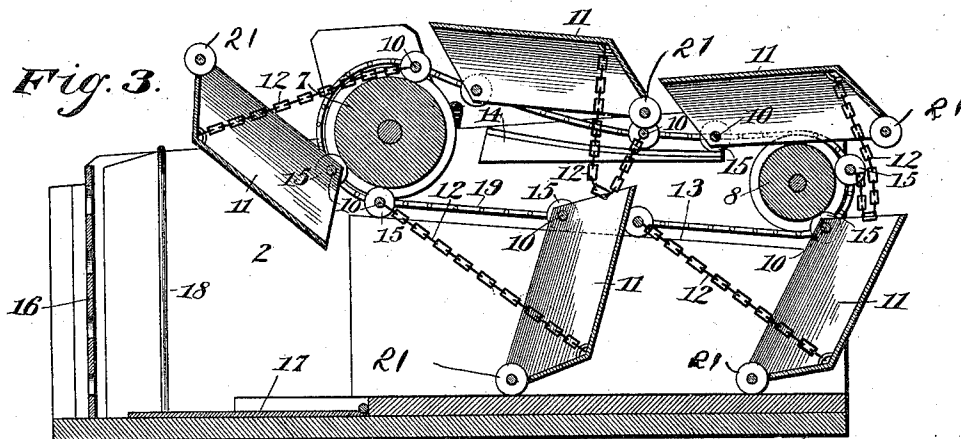


Fig. 5.

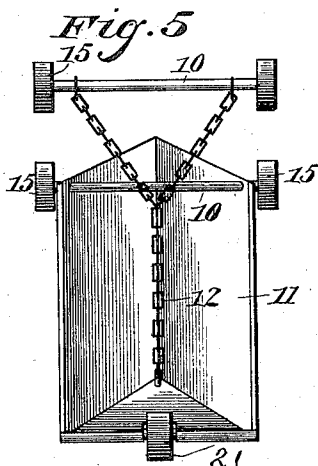
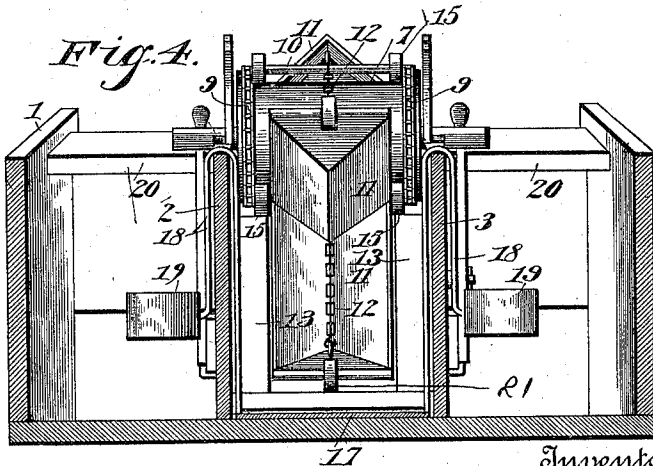


Fig. 4.



Witnesses;

J. M. Withrow.
G. T. Myers

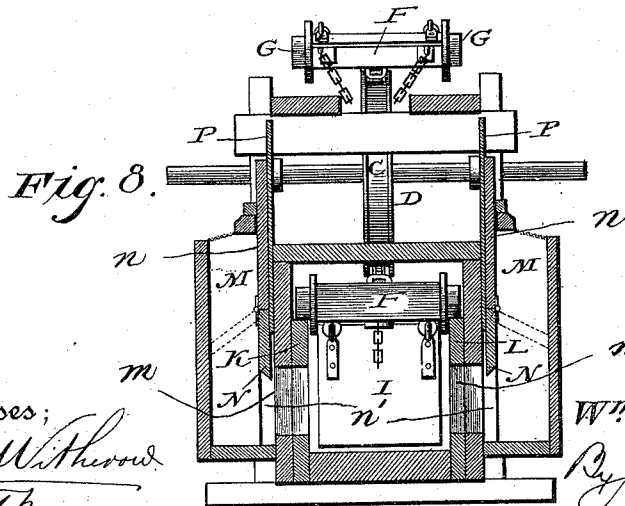
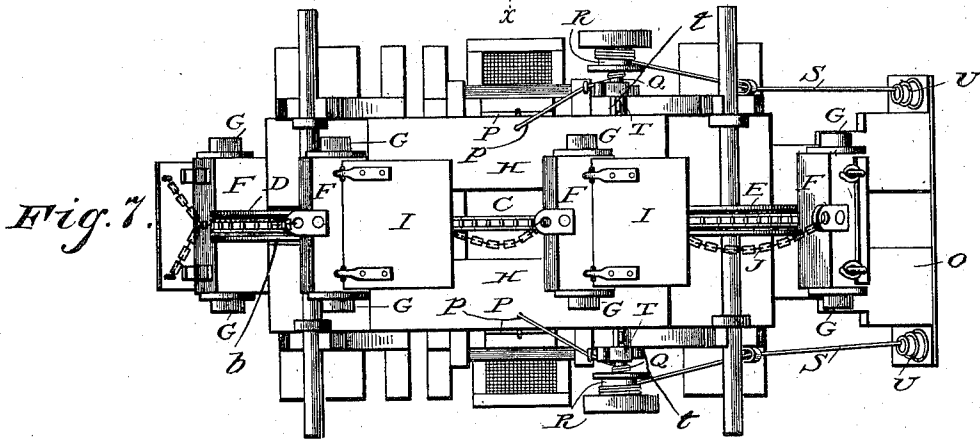
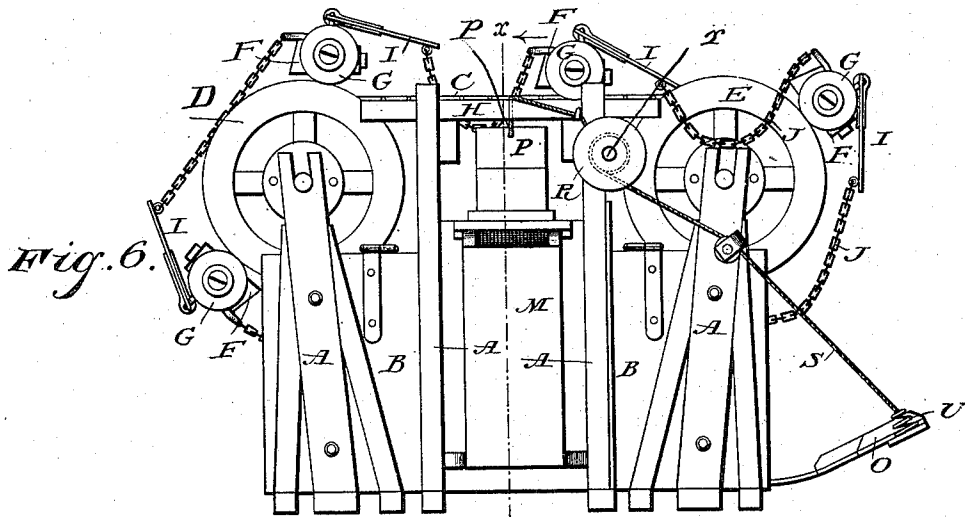
Inventor,
Wm. H. Woodward,

R. J. Smith & Co.
Attorneys

W. H. WOODWARD.
MECHANISM FOR UTILIZING WATER POWER.

No. 579,209.

Patented Mar. 23, 1897.



Witnesses;
J. M. Whitcomb
G. T. Myers

Inventor,
Wm. H. Woodward
By Joseph H. Kline
Attorneys

UNITED STATES PATENT OFFICE.

WILLIAM HENDERSON WOODWARD, OF CEDAR GROVE, TENNESSEE.

MECHANISM FOR UTILIZING WATER-POWER.

SPECIFICATION forming part of Letters Patent No. 579,209, dated March 23, 1897.

Application filed November 29, 1893. Serial No. 492,386. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM HENDERSON WOODWARD, of Cedar Grove, county of Carroll, State of Tennessee, have invented certain new and useful Mechanism for Utilizing Water-Power, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to hydraulic motors, and has for its object to provide an improved motor operated by the flow of a running current of water and provided with novel means for regulating the speed of the motor.

To these ends my invention consists in the features and in the construction, arrangement, or combination of parts hereinafter described, and pointed out particularly in the claims following the description, reference being had to the accompanying drawings, forming a part of this specification, wherein—

Figure 1 is a perspective view of my improved motor. Fig. 2 is a longitudinal vertical section on the line 1 1 of Fig. 1. Fig. 3 is a similar section on the line 2 2 of Fig. 1. Fig. 4 is a transverse vertical section on the line 3 3 of Fig. 1, and Fig. 5 is a detail view of one of the paddles or buckets and its supporting shaft and chain. Fig. 6 is a side elevation of a modified form of my improved motor. Fig. 7 is a plan view thereof, and Fig. 8 is a vertical sectional view on the line *xx* of Fig. 6.

Referring to the drawings, the numeral 1 indicates the frame or casing of my improved motor, which is divided into three chambers by the vertical longitudinal partitions 2 and 3. The central channel constitutes a race in which the operative mechanism of the motor is arranged. The two side chambers communicate with the central chamber or race by means of ports 4 4, formed in the partitions 2 and 3, which are controlled by sliding gates 5 5, actuated by hand-levers 6 6, pivoted intermediate their ends to the partitions 2 and 3 and at their lower ends pivoted to the sliding gates. Journaled in bearings on the partitions 2 and 3 are rollers 7 and 8, around which is carried an endless belt consisting of two endless chains united at suitable and uniform intervals by shafts 10. Upon each of the shafts 10 is pivotally supported a paddle or bucket 11, said paddles being arranged to re-

ceive the impact of the water and drive the endless belt by which they are carried, thereby rotating the rollers 7 and 8, from either or both of which the power may be converted or transmitted in any well-known or preferred manner. The paddles are held in their operative positions by chains 12, each attached at one end to the free end of the paddles and at its other end attached to the supporting-shaft 10 of the next succeeding paddle. In order to prevent the sagging of the endless belt between the rollers, I provide tracks 13 and 14, arranged one above the other and attached to the partitions 2 and 3, the upper track 14 being arranged above the race between the rollers 7 and 8 and the lower track 13 arranged underneath said rollers within the race on the sides of the latter, and on the opposite ends of the shafts 10 are journaled antifriction-rollers 15, which travel on the tracks 13 and 14 and support the belt and the buckets carried thereby. Antifriction-rollers 21 may also be journaled on the free ends of the paddles 11, as shown, and are adapted to travel on the bottom of the frame or casing 1 and reduce the friction.

The forward ends of the race and the two side chambers are covered by a screen 16, fitted in the frame or casing 1, which intercepts and prevents the entrance of drift and debris into the said chambers, which would otherwise clog up the machine. The two side chambers are closed at their rear ends by right-angular partitions 20, which prevent the passage of the water through said chambers save through the ports 4 4. The passage of the water through the race is controlled by a governor comprising a tilting gate 17, pivoted at its rear end to the bottom of the frame or casing 1 and extending entirely across the race between the partitions 2 and 3. To the opposite edges of the gate 17 are attached the lower ends of two approximately V-shaped rods or arms 18, which pass over and straddle the partitions 2 and 3 and extend down into the two side chambers and at their free ends are provided with floats 19.

The operation of my improved motor is as follows: The frame or casing 1 is anchored or otherwise suitably secured in the current or channel of running water with its forward end disposed toward the direction in which the

current flows. The water flows freely through the central chamber or race, and by its impact against the paddles or buckets 11 actuates the endless chain and imparts rotary motion to the rollers 7 and 8, which latter, by any suitable gearing or transforming mechanism, transmits the power to the point desired.

If it be desired to utilize the whole force of the head or current of water, the levers 6 are oscillated to cause the slides 5 to uncover the ports 4, upon which the water will flow from the side chambers into the central chamber or race and by its impact with the paddles adds its weight or dynamic power to that of the water flowing through the race. It will be manifest that by moving the gates 5 in the proper direction the size of the ports 4 may be altered and the quantity or volume of water admitted from the side chambers to the race thus be regulated, whereby the speed or power of the motor may be adjusted to the work to be performed. Should the volume of the current of running water be suddenly increased, the strain upon the operative parts of the motor is obviated by the gate 17, which is raised by the floats 19 as the latter are elevated by the increased height of the water in the side chambers, and the area of the inlet end of the race is thus reduced.

In Figs. 6, 7, and 8 I have shown a modified form of my device, which is especially designed for use in small streams where it is desirable or necessary to utilize, with as little waste as possible, the force generated by the rapid flow of water within a limited space. Referring to said figures of drawings, the letter A indicates a frame rectangular in cross-section and of any suitable construction and inclosing a trunk B, open at its opposite ends and constituting a race through which the water runs and propels the paddles. In the upper opposite ends of the frame A are journaled grooved rollers D and E, which slightly project through slots *b*, formed in the ends of the top of the trunk B. Passing about the grooved rollers D and E is an endless belt C, which preferably consists of a single-stranded chain, and to said chain are securely attached at uniform distances apart cross-bars F, which are provided at their opposite ends with antifriction-rollers G, that are adapted to travel on tracks K and L, formed on or attached to the inner sides of the trunk B, and on tracks H, arranged on the top of the frame A between the rollers D and E, the tracks H being of sufficient width to support the free ends of the paddles hereinafter described. Paddles I are pivoted to each of the cross-bars F, and the vibratory movement of said paddles is limited by chains J, which are each attached at one end to one of the paddles and at its other end is attached to the next succeeding cross-bar. The limited space which this form of motor is designed to occupy renders impractical the employment of the side chambers hereinbefore described, and I therefore provide vertical chambers M M, which are arranged on

each side of the trunk B and are open at their tops and at their lower portions communicate with the race or interior of the trunk by means of apertures *m*, formed in the sides of the latter. The size of said apertures is controlled by check-valves N, which are hinged at their upper ends to slides *n*, and said slides are made vertically movable in grooves *n'*, formed in the sides of the chambers M. By adjusting the slides up and down in said groove the size of the apertures *n'* may be altered as circumstances may require. Should any back pressure of the water occur in the race, the check-valves will be automatically opened outward and upward and will close the chambers M against such back pressure. Between the sides of the trunk B and the slide *n* are arranged vertically-movable sliding gates P, which are adapted to be raised and lowered to open and close to any desired extent the apertures *m* independently of the check-valve N, and thus regulate the flow of water from the chambers M to the race. A tilting gate O is hinged to the lower edge of the outlet end of the trunk B, and to the upper ends of said gate are attached flexible connections S, the other ends of said connections being wound upon drums R, fixed on the opposite ends of a shaft *r*, journaled in the frame A. Drums Q are also fixed on the shaft *r*, and about the same are wound flexible connections *p*, which at their other ends are connected to the upper ends of the sliding gates P. The connections *p* are wound about the drums in a direction opposite to that in which the connections S are wound, whereby when the shaft *r* is turned in one direction (which may be done by hand in any convenient manner) the tilting gate O will be raised and the sliding gates P at the same time be lowered, thus checking the flow of water through the motor and establishing a proper equilibrium between the currents in the race and through the vertical side chambers. It will be evident that by turning the shaft *r* in the opposite direction the gate O will be lowered and the gates P raised. Instead of attaching the ends of the flexible connections S directly to the tilting gate O, I attach them to coiled springs U, fixed on said gate, whereby said gate is permitted to yield should it be struck by the paddles or debris carried by the current. The gates are held in their adjusted positions by pawls T, which engage ratchet-wheels *t*, fixed on the shaft *r* or by any other suitable and well-known means. The operation of this part of my invention is as follows: The frame A is anchored by any suitable means in the stream and a bulkhead is preferably erected across the channel, extending from a point on each side of the frame between the side chambers M and the outlet end of the trunk B to any desired distance to each side of the frame. The water flowing through the race will propel the paddles therethrough, aided by the force of the currents passing through

the side chambers into the race. The paddles will successively enter, pass through, and leave the race, carrying the endless belt with them, and both said belt and paddles are carried continuously around the rollers D and E, imparting a continuous rotation to the latter and driving the machinery which may be connected to the shafts of said rollers in any manner desired. By providing the tracks H and K and L and causing the antifriction-rollers carried by the cross-bars F to travel on said tracks the endless belts are prevented from sagging and the movement of the belts and paddles is facilitated. Moreover, by making the tracks H sufficiently wide the free ends of the paddles are supported thereon in passing from the roller E to the roller D. Should the force of the current become too great, the shaft *r* is turned in the proper direction to close the gates O and P sufficiently to permit only the proper volume of water to pass through the race and the side chambers, and the motor may be brought to a complete state of rest by entirely closing said gates.

It will be readily understood from the foregoing description that my improved motor is adapted to operate equally as well in swift currents of water where an equalization of the force is desirable as in small streams where the economical consumption of water is the end in view.

Having described my invention, what I claim is—

1. The combination with a frame or casing having a central race and chambers disposed on each side of the race, of an endless belt carrying paddles arranged to travel through said race, a hinged gate arranged in the inlet end of the race, and floats disposed within said chambers and connected to the said gate, whereby, when the volume of the water is increased the gate will be automatically raised to reduce the area of the inlet end of the race, substantially as described.

2. The combination with a frame or casing having a central race and an endless belt carrying paddles arranged to travel through said

race, of chambers disposed on each side of the race and provided with inlets open to the current and having ports communicating with the race, and valves controlling said ports for regulating the passage of the water from said chambers to the race, substantially as described.

3. The combination with a frame or casing having a central race provided at its inlet end with a gate and an endless belt carrying paddles arranged to travel through said race, of chambers disposed on each side of the race and provided with inlets open to the current and having ports communicating with the race, valves for controlling said ports, and means operated by the rise and fall of water in the chambers on the sides of the race to open and close the gate controlling the inlet end of the race, substantially as described.

4. The combination with the frame or casing 1 divided by longitudinal partitions 2 and 3 into a central race and two side chambers, each of said partitions being provided with ports 4 4 for establishing communication between the said race and chambers, sliding gates 5, 5, operating to open and close said ports, levers 6 for actuating said gates, and an endless belt carrying paddles 11, arranged to travel through said race, substantially as described.

5. The combination with a frame or casing 1 divided by partitions 2 and 3 into a central race, and two side chambers, the race being open at its opposite ends and the side chambers being closed at their rear ends, a screen 16 arranged across the forward open ends of the race and the side chambers, valved ports establishing communication between the race, and said side chambers, and an endless belt carrying paddles arranged to travel through said race, substantially as described.

In testimony of all which I have hereunto subscribed my name.

WILLIAM HENDERSON WOODWARD.

Witnesses:

A. M. LEE,

G. W. HUMBLE.