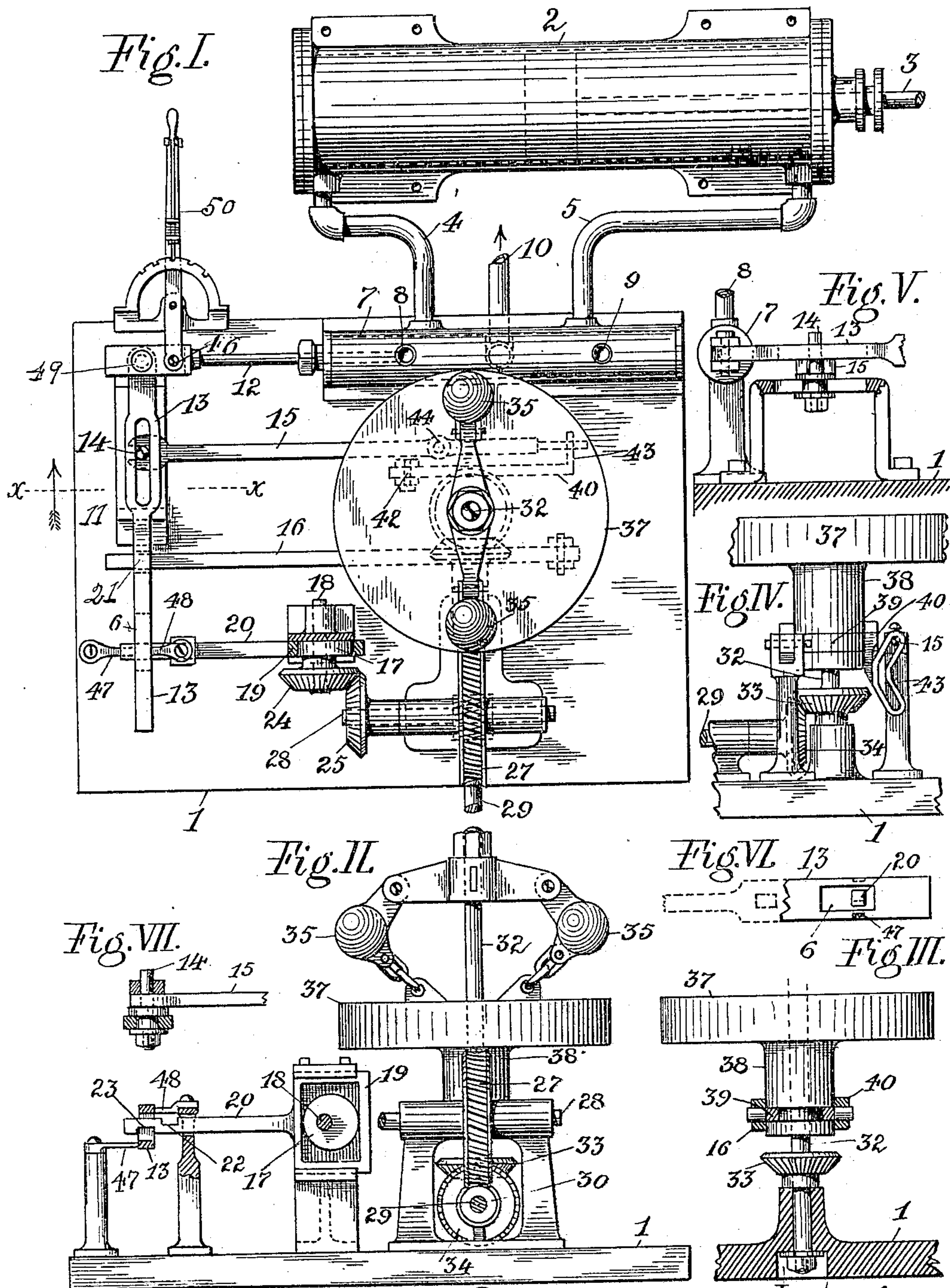


No. 819,629.

PATENTED MAY 1, 1906.

G. H. BAILEY.  
REGULATOR FOR WATER WHEELS.  
APPLICATION FILED JULY 31, 1905.



Witnesses.

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Fig. VIII. 43  
15 45

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# UNITED STATES PATENT OFFICE.

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## REGULATOR FOR WATER-WHEELS.

No. 819,629.

Specification of Letters Patent.

Patented May 1, 1906.

Application filed July 31, 1905. Serial No. 272,017.

*To all whom it may concern:*

Be it known that I, GEORGE H. BAILEY, a citizen of the United States of America, residing at San Francisco, county of San Francisco, and State of California, have invented certain new and useful Improvements in Regulators for Water-Wheels; and I hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification.

This invention relates to apparatus for regulating the speed and power of water-wheels and to that class of such regulators wherein there is employed a fluid-cylinder and piston to move and control the gates, valves, or nozzles that supply water to the wheels and to certain improvements to move and control the distributing-valves of the cylinder and piston by centrifugal apparatus, as hereinafter fully described, and illustrated by drawings, that form a part of this specification.

My improvements consist in centrifugal apparatus and devices connecting with and controlling the action of the distributing-valve of a piston that regulates the water-supply to a water-wheel, locks this valve when it is in a neutral or non-acting position, and produces in emergency a quicker and more extended motion of this valve, and consequently of the piston and water-supply devices to which the latter is connected.

The objects of my invention are to avoid chasing or vibratory effect of the centrifugal apparatus when a water-wheel is operating normally or with the intended load and water-supply, and to provide for emergent changes, as when the whole or a principal part of the resistance or load is suddenly added or thrown off.

To these ends I construct and apply devices, as shown in the drawings.

Figure I is a plan view of my improved devices, including a fluid-cylinder and piston that operates the water-supply gates or valves of a water-wheel. Fig. II is a partial side view of the same devices. Fig. III is a detail of Figs. I and II, showing a part of the centrifugal apparatus and manner of connecting thereto. Fig. IV is also a detail of Figs. I and II, showing connections to and the manner of driving the centrifugal apparatus. Fig. V is a detail of Fig. I, showing the construction of the movable fulcrum of the lever that operates the distributing-valve of the actuating-piston that controls

the water-supply; Fig. VI, an enlarged detail of the end of the lever that operates the distributing-valve; and Fig. VII, an enlarged detail of the movable fulcrum for the lever that operates the distributing-valve of the actuating-piston for the water-supply gate or valves, taken on the line *xx* in Fig. I. Fig. VIII is an enlarged end view of a device to control the movable fulcrum of the valve-operating lever.

In water-regulating devices controlled by centrifugal apparatus it is desirable to lock or fasten the parts when not in action and the water applied on a wheel is nearly constant. It is also desirable that the range and degree of adjustment made in the water-supply for wheels be adapted for ordinary variations of load—such as occur in generating electric current, for example—and likewise adapted for emergencies, such as suddenly throwing on or off the whole load. These purposes I attain by the devices now to be described by the aid of the drawings.

1 is a sole-plate on which the several parts are mounted, and 2 an actuating-cylinder, connecting by the piston-rod 3 to the water-supply devices, which may be a gate, valve, or movable nozzle, according to the character of the water-wheel employed.

The cylinder 2 can be set in any desired position or at any angle, connection being made to the ends thereof by the pipes 4 and 5, that lead from a common distributing-valve in the chamber 7, to which water, oil, or glycerin under pressure is supplied through the inlet-passages 8 and 9, which after acting escapes through the waste-pipe 10.

The actuating-cylinder 2 and its distributing-valve in the chamber 7 being of the ordinary construction and well understood and not forming a part of my invention do not require detail description.

The distributing-valve in the chamber 7 is operated by a rod 12 in the usual manner and is connected to a lever 13, that has an adjustable fulcrum 14, moved outward and inward by a lever 15, that slides a fulcrum-pin 14 in a slot 11 in the lever 13, operating as hereinafter explained.

The lever 13 is given a vibratory movement on the pin 14 by means of a cam 17 on the shaft 18 and a yoke 19, with an extension-bar 20, that has notches 22 and 23 to engage the lever 13, as shown in Fig. II. This lever has also a vertical adjustment, as hereinafter explained.



The shaft 18 is driven by bevel-wheels 24 25 and a tangent wheel 27 on a shaft 28, that is in turn driven by a screw-pinion 30 on the shaft 29, which latter is connected to and  
5 driven from machinery connected to the water-wheel to be regulated. This shaft drives at corresponding rate the vertical shaft 32 of the centrifugal apparatus by means of the bevel-wheels 33 34.

10 The centrifugal apparatus consists of the usual centrifugal weights 35, linked to a gravity-weight that slides upward and downward on the shaft 32 as the velocity and centrifugal strain of the weights 35 may determine.  
15

The gravity-weight 37 has a downward-extending sleeve 38, grooved to receive a loose collar 39, to which collar is attached the lever 16 and indirectly the lever 15, the latter  
20 by means of an interposed lever 40, fulcrumed at 42 and shown in plan by dotted lines in Fig. I also in end view in Figs. IV and VIII.

On the end of the short lever 40 is an obliquely-slotted extension or cam 43, that when moved a considerable way upward or downward moves laterally the inner end of the lever 15, thereby sliding the fulcrum 14 of the lever 13 outward or inward accordingly. This slotted or cam extension 43 of the lever 40 (shown enlarged in Fig. VIII) consists of three sections, top and bottom parts correspondingly oblique, and a central portion at 45, that is straight, for purposes  
30 hereinafter described.

Besides the devices explained for moving the fulcrum-pin others of a different construction, such as links, can be employed. I have shown one that clearly explains the desired motions of the parts.  
40

When the regulating devices are not acting upon the valve-rod 12 or when there is a normal resistance to the water-wheel and a nearly uniform quantity of water being consumed, the lever 13 is engaged and held in a fixed position by the stops 47 and 48, as shown in Fig. II, the actuating bar or extension 20 then sliding fully through a slot 6 in the bar 13, as shown in Figs. I and VI. At  
50 the same time the lever 15 is in the position shown in Figs. I and VII and the fulcrum 14 is in the center of the slot 11 and middle of its stroke. If then the speed of the water-wheel and of the centrifugal apparatus is increased, the weights 35 and 37 rise, raising the lever 16, that passes through the lever 13 at 21, raising the latter clear of the stop 47, as shown in Fig. II. This permits the notch 23 in the reciprocating bar 20 to engage the lever 13, setting it and the rod 12 in motion, thus reciprocally moving and operating the distributing-valve in the chamber 7, supplying water or other fluid to the outer end of the cylinder 2, pushing outward the rod 3  
60 and shutting off a portion of the supply-wa-

ter from the wheel. If, however, the speed of the water-wheel is not sufficiently arrested while the end of the lever 15 has passed over the straight portion 45 of the slotted member 43 and the fulcrum 14 is in a central position, 70 the weight 37 and lever 40 continue to rise until the oblique portion at the bottom of the member 43, acting on the lever 15, shifts the fulcrum 14 backward, increasing the range of this lever and of the rod 12 accordingly, admitting a full force of the impelling fluid to the cylinder 2. This quickens and extends the movement of the piston-rod 3 and water-controlling apparatus connected thereto.

In the reverse operation the several motions are alike, but inverse. To admit fluid to the opposite end of the cylinder 2, the levers 40 and 16 are depressed by the centrifugal apparatus, the lever 13 is disengaged from the stop 48 and is engaged by the notch 22 in the bar 20, setting the lever 13 and the rod 12 in reciprocation in its outward position, admitting water intermittently to the inner end of the cylinder 2, thus retracting the rod 3, admitting more water to the wheel. In this case the slotted end 43 of the lever 40 moves the fulcrum 14 outwardly the same as before to increase the range of the rod 12 and supply of fluid to the inner end cylinder 2. In this manner it will be seen that when  
90 no action of the cylinder 2 is required its distributing-valve is locked by reason of the stops 47 48, that hold the lever 13 still in its central position.

When only slight changes for regulation occur, as in regular duty, the fulcrum 14 is not moved; but in cases of emergency the range and amount of fluid admitted to the cylinder 2 is increased by an automatic movement of the fulcrum 14 in the manner before explained. In any case when the water-supply is to be controlled by hand and independent of the regulating devices described the pin 49 in the end of the lever 13 is removed and a hand-lever 50 is attached by a pin 46  
100 and employed to move the rod 12, as shown in Fig. I.

Having thus described the nature and objects of my invention, what I claim as novel, and desire to secure by Letters Patent, is—  
115

1. In water-wheel-regulating apparatus, an actuating-fluid cylinder and piston to control the water-supply to the wheel, centrifugal devices to regulate the admission of fluid under pressure to this cylinder and automatic means to detach the centrifugal apparatus and lock the distributing-valve of the actuating-cylinder when out of action, in the manner substantially as described.  
120

2. In water-wheel-regulating apparatus, an actuating-fluid cylinder and piston to control the water-supply to the wheel, centrifugal apparatus to regulate the admission of fluid to the actuating-cylinder, piston and automatic devices to augment or diminish the  
125 30



stroke of the distributing-valve for the main cylinder accordingly as the rapidity and range of the actuating-piston and change of the water-supply is required and means to  
5 automatically lock and hold the distributing-valve after its adjustment, substantially as specified.

3. In water-wheel-regulating apparatus, an actuating-cylinder and piston connected  
10 to and controlling the water-supply, a distributing-valve for the actuating-cylinder and piston having a reciprocating motion produced by a lever, a cam to move the lever and means to lock the latter when out of ac-  
15 tion, substantially as specified.

4. In water-wheel-regulating apparatus, an actuating-cylinder and piston to adjust

the water-supply, a distributing-valve for this cylinder and piston moved by a cam-  
actuated lever, centrifugal apparatus to en- 20  
gage and disengage this lever and means to shift fulcrum of the same to increase and decrease the range of the distributing-valve and devices to automatically lock said valve  
when the required quantity of fluid is ad- 25  
mitted to the sides of the actuating-piston, substantially as specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GEORGE H. BAILEY.

Witnesses:

OLIVER DIBBLE,  
ELMER WICKES.