No. 652,389. Patented June 26, 1900.

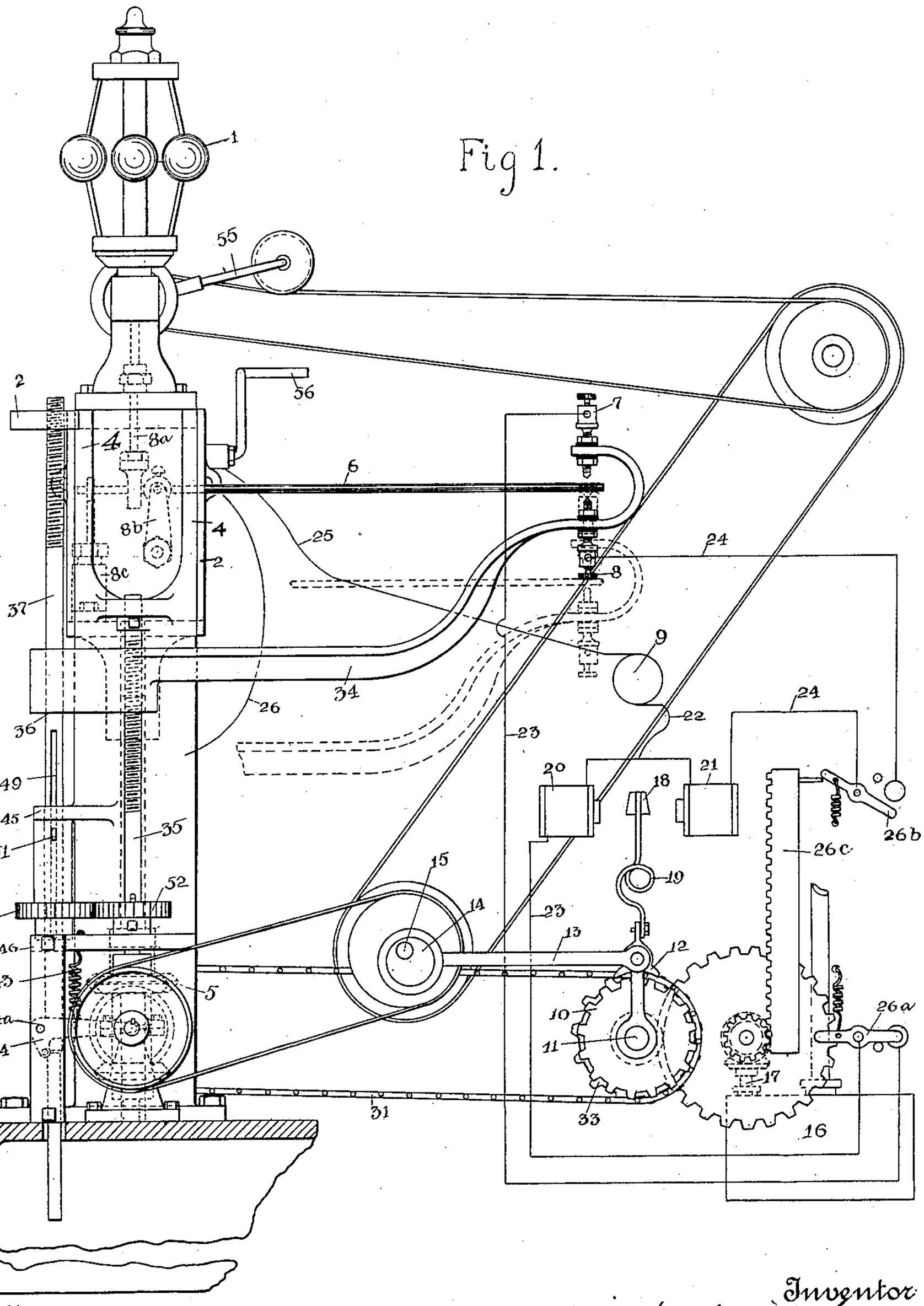
W. W. HANDY.

WATER WHEEL GOVERNOR.

(Application filed Mar. 9, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig 1.



Witnesses
Charles A. Williams
M. R. Jones.

Inventor
William Wonder Handy
by
Stuart & Stuart
Attorneys

No. 652,389. Patented June 26, 1900.

W. W. HANDY.

WATER WHEEL GOVERNOR.

(Application filed Mar. 9, 1899.)

(No Model.) 2 Sheets—Sheet 2.

Fig 3.

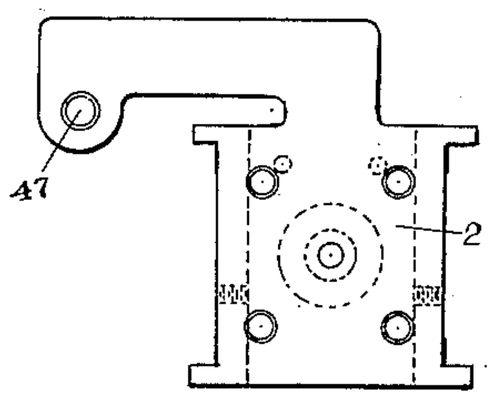


Fig 2.

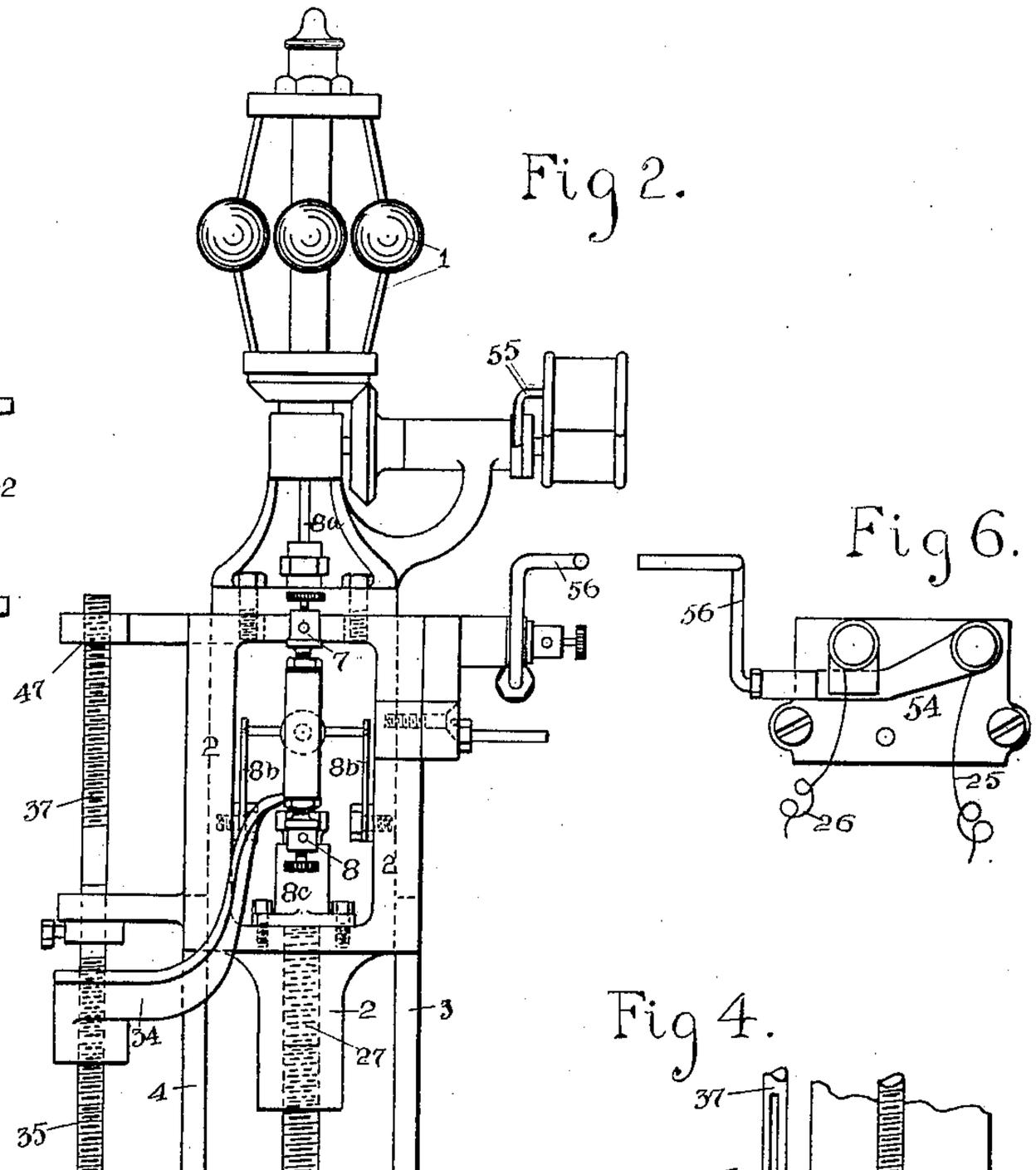


Fig 6.

Fig 5.

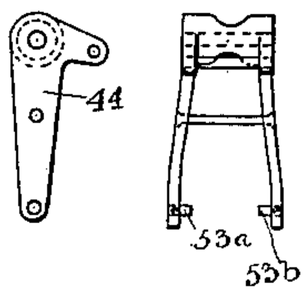
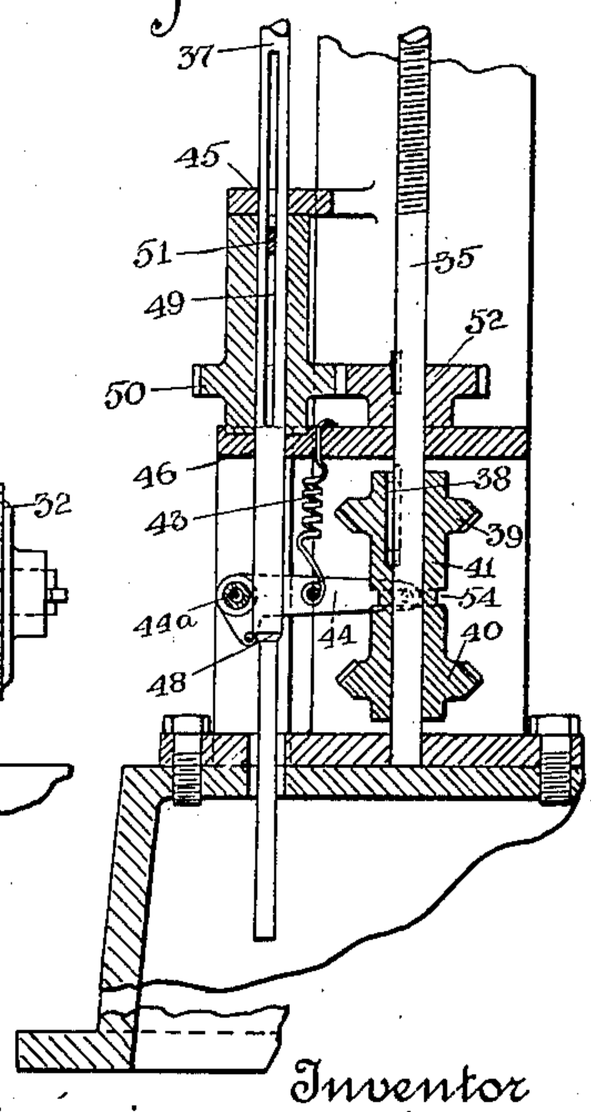


Fig 4.



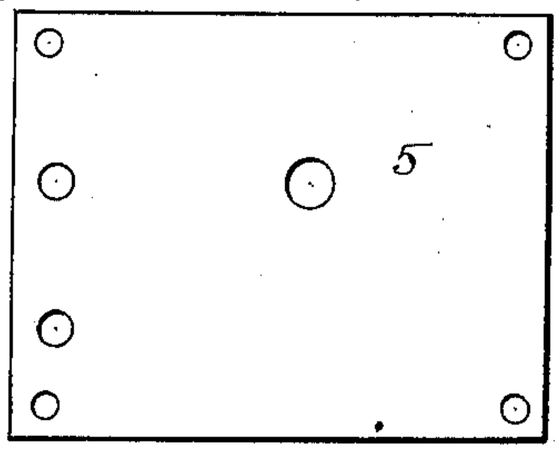


Fig 7

Witnesses
Charles A. Wilkinson
M. R. Jones

Inventor
William Wirt Handy
by
Stewart & Stewart
Attorneys

UNITED STATES PATENT OFFICE.

WILLIAM WINDER HANDY, OF BALTIMORE, MARYLAND.

WATER-WHEEL GOVERNOR.

SPECIFICATION forming part of Letters Patent No. 652,389, dated June 26, 1900.

Application filed March 9, 1899. Serial No. 708,427. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM WINDER HANDY, a citizen of the United States of America, and a resident of the city of Baltimore, in the State of Maryland, have invented certain new and useful Improvements in Water-Wheel Governors, of which the following is a specification.

The object of my invention is to provide a governor for water-wheels or other types of prime movers which will rapidly operate the gates or valves for supplying power to the prime mover and yet prevent excessive movement of said gates or valves, thereby preventing overgoverning.

My invention consists in a centrifugal governor actuating a lever which is normally held in a state of balance between a pair of electrical contacts which are connected to a gate or valve operating device and a source of electricity and in a relay device controlling both the motion of the lever and the electrical contacts in such a manner as to break contact between said lever and contacts during the period in which the gate-operating device is in motion and return the lever and contacts to their normal position with respect to each other. The structural details by means of which the above results are accomplished are fully explained in the following specification, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation of the governor with a diagrammatic view of the electrical connections and gate-operating device. Fig. 2 is a side elevation taken at right angles to that shown in Fig. 1. Fig. 3 is a plan view of the slide on which the centrifugal governor is mounted. Fig. 4 is a vertical section of the relay mechanism; Fig. 5, views of the relay-shifting lever. Fig. 6 is a side elevation of a safety-switch. Fig. 7 is a lower plan view of the governor-frame.

Referring to Figs. 1, 2, and 3, 1 is a centrifugal governor, which is mounted on the slide 2, said slide being designed to move vertically in guides 3 and 4, which form a part of the supporting-frame 5.

6 is a lever operated by the governor 1, said lever being normally held by the governor in a state of balance between two contacts 7 and 8. The lever 6 is operated by the stem 8^a of the governor and supported in adjustable bearings 8^b, as shown. 8^c is a dash-pot containing a piston connected to the rear end of the lever to prevent any undue vibration.

9 is a dynamo or other source of electricity, and 10 a ratchet-wheel mounted on the shaft 11 and operated by the double pawl 12, which receives motion by means of the connecting-rod 13 and eccentric 14, mounted on the shaft 15, which is driven in any suitable manner from a water-wheel 16.

17 is the gate-stem of the water-wheel.

The governor 1 is driven from the shaft 15 by a system of belts—such, for example, as that shown in Fig. 1.

18 is an armature connected to the pawl 12 by means of the spring 19, said armature being adapted to oscillate between the poles of two magnets 20 and 21, which are connected by the wires 22, 23, 24, 25, and 26 with the governor-frame 5, contact-points 7 and 8, and dynamo 9.

26^a and 26^b are limit-switches in series with the wires 23 and 24, said switches being opened by the rack 26^a in such a manner as to prevent the gate-stem of the water-wheel being moved past its limits.

The slide 2 has a threaded hole 27 in its bottom which receives the threaded end of a shaft 28, said shaft receiving motion from the shaft 11 through the pair of bevel-gears 29 and 30, chain 31, and sprocket-wheels 32 and 33. The contacts 7 and 8 are mounted on the supporting-arm 34, which is adapted to receive vertical motion from the threaded shaft 35. The rear end of the arm 34 is provided with a bearing 36, through which passes the shaft 37, the bearing 36 being provided as a means for steadying the arm 34 as it is moved up or down on the threaded shaft 35.

Mounted on the shaft 35 by means of a feather-key 38 (see Fig. 4) are a pair of bevel-gears 39 and 40, which are rigidly connected together by the sleeve 41, said gears being normally held in the position shown and out of contact with a constantly-revolving gear 42 by means of spring 43, which operates a double bell-crank lever 44, pivoted at 44^a. The shaft 37 is mounted in the bearings 45 and 46, forming a part of the frame 5. The upper end of the shaft 37 is screw-threaded and enters a threaded hole 47 in the slide 2,

as shown in Figs. 1, 2, and 3, the lower end being turned down to a small diameter for part of its length and the two parts of the shaft of different diameters connected by means of the inclined surface 48. 49 is a slot cut in the shaft 37, and 50 a gear mounted on said shaft, which transmits motion to the shaft by means of the pin 51, extending through the slot 49.

Keyed to the shaft 35 is a gear 52, which meshes with the gear 50 on shaft 37, said gears being provided with an equal number of teeth, so that each revolution of shaft 35 causes shaft 37 to turn one revolution also. As the upper end of the shaft 37 is screw-threaded, it will move up or down in the bearings 45 and 46 as it is revolved, depending on the direction of rotation, the pin 51 sliding in the slot 49 and permitting free vertical movement of the shaft.

From the construction it is also evident that any motion of the slide 2 will cause the shaft 37 to move with it. In other words, the shaft 37 receives vertical movement from two sources—namely, the slide 2, which is operated by the screw-threaded shaft 28, and from the shaft 35, which receives its motion intermittently from the constantly-revolving gear 42. The long arm of the double bell-crank lever 44 is provided with inwardly-projecting pins 53^a and 53^b, which engage a peripheral groove 54 in the sleeve 41, the short arm of the lever normally resting midway on the inclined surface 48 of the shaft 37, as shown. When the shaft 37 is moved endwise, due to an up or down movement of the slide 2, the short arm of the lever is moved, said lever turning on its axis 44^a and throwing one of the gears 39 or 40 into contact with the constantly-revolving gear 42. If the shaft 37 moves down, the short arm of lever 44 is raised against the tension of the spring 43 and gear 39 thrown into contact with gear 42, which causes the shaft 35 to turn, thereby moving the arm 34 and the shaft 37 by means of the gears 50 and 52 to screw up farther into the slide 2, until said shaft returns to its normal position, with the short arm of lever 44 midway on the inclined surface 48 and gear 39 out of contact with gear 42. If the shaft 37 moves up, the short arm of the lever 44 is drawn down by the tension of the spring 43 and gear 40 thrown into contact with gear 42, thereby turning shafts 35 and 37 in the opposite directions and lowering 37 to its normal position with the short arm of lever 44 resting midway on the inclined surface 48 and gear 40 out of contact with gear 42.

The speeds of the various parts of the governor are so proportioned that the vertical movement of the slide 2 is more rapid than the vertical movement of the contact-arm 34. Also the thread on the shaft 35 should be of the same pitch as the thread on shaft 37, due to the fact that for each vertical movement of the centrifugal governor and lever 6 the contact-arm should move through exactly the same distance. Suppose the slide 2 moves down to the position shown by the dotted lines in Fig. 1. The shaft 37 moves it, but in so doing gear 39 is thrown into contact with gear 42 and the two shafts 35 and 37 revolved, shaft 35 lowering the contact-arm 34 until gear 39 is thrown out of contact with gear 42. Since each revolution of shaft 35 means a revolution of 37, and since the two shafts have threads of equal pitch, and since shaft 37 must return through exactly the same distance as it and the slide 2 have moved before gear 39 is disengaged, it follows that the contact-arm 34 will also move through the same distance as shaft 37, and consequently through the same distance as the slide 2.

Referring to Figs. 1, 2, and 6, 54 is a safety-switch in circuit with wires 25 and 26, said switch being opened in case of accident to the belt driving the governor by the arm 55 of the governor falling on the switch-arm 56, thereby breaking the circuit supplying current to the magnets 20 and 21, liberating the pawl 12, and stopping any further movement of the gate-shaft 17.

In operating the governor works as follows: Assume that the water-wheel is running at its normal speed and that the load is decreased. The governor 1 will force the end of lever 6 up on contact 7 and a current will flow from the dynamo 9 through safety-switch 54, lever 6, contact 7, switch 26^a, and magnet 20 to the other terminal of the dynamo. Magnet 20 operates pawl 12 through the aperture 18 and moves the gate-stem 17 in such a direction as to admit less water to the wheel, thereby decreasing its speed. During this operation the shaft 28 has been revolving, moving the slide 2 in a downward direction, and the governor 1 and lever 6, being mounted thereon, have moved with it. This has decreased the pressure exerted by the lever on the contact 7 and caused contact to be broken between 7 and 6 before sufficient time has elapsed for the speed to return to normal and cause the governor of its own accord to break the connection between 6 and 7. In this way the operation of the governor is checked and overgoverning thereby prevented. At the instant that the slide 2 started to move down gear 39 was thrown into contact with gear 42, thereby revolving shafts 35 and 37 and moving the contact 7 down through the same distance as the lever 6, but at a slower rate of speed, as has been previously explained in this specification. This is necessary, because if the contact 7 moved at the same rate as the lever 6 the connection would not be broken until the speed had returned to normal and the governor of its own accord broken the contact, which in turn would make the checking of the governor impossible. This speed of movement of the contacts 7 and 8 is so regulated by means of the gearing 39, 40, and 42 and threaded shafts 35 and 37 that by the time the speed

has returned to normal the bell-crank lever 44 is in its normal position with respect to shaft 37 and contacts 7 and 8, and hence stationary. In case the load increased, the speed will first decrease and the governor 1 cause the lever 6 to make contact with contact-point 8, thereby causing a current to flow from dynamo 9 through safety-switch 54, switch 26^b, and magnet 21, thereby moving the gate-stem 17 in the opposite direction and increasing the flow of water to the wheel. Before the speed has returned to normal the stand 2 and lever 6 have been moved up by shaft 28 and contact broken between the lever and point 8, stopping an excessive movement of the gate-stem in a direction to admit more water to the water-wheel. At the instant that the slide 2 started to move up gear 40 was thrown into contact with gear 42, revolving shafts 35 and 37 and moving contact 8 up through the same distance as the lever 6, so that when the speed has reached normal and the lever is again balanced it will rest midway between the contacts 7 and 8.

I do not desire to claim as new the form of gate or valve operating mechanism described in this application, said mechanism consisting of a pair of magnets, a reciprocating pawl, and a ratchet-wheel, as any other suitable device may be employed to accomplish the same result; but

What I claim, and desire to secure by Letters Patent, is—

1. The combination with a centrifugal governor, a source of electricity and electrical contacts, a gate or valve mechanism connected with said contacts, and a lever operated by the said governor and normally held in a state of balance between the electrical contacts, of means for automatically moving the lever away from the contacts after the circuit through the same has been established, and means for automatically moving the contacts in the same direction through the same distance as the lever, so that when the lever returns to its normal position, the contacts and said lever will be in the same relative position with respect to each other.

2. The combination with a centrifugal governor, a source of electricity and electrical contacts, a gate or valve mechanism connected with said contacts, and a lever operated by said governor and normally held in a state of balance between the electrical contacts, of a relay device consisting of a sliding block supporting the governor, means for moving said block and means for moving the contacts, substantially as and for the purpose set forth.

3. The combination with a centrifugal governor, a source of electricity and electrical contacts, a gate, or valve, mechanism connected with said contacts, and a lever operated by said governor and normally held in a state of balance between said contacts, of a relay device, consisting of a sliding block supporting the governor, a screw-threaded shaft for moving the block and lever, and independent means for moving the contacts to follow the block through the same distance, substantially as set forth.

4. The combination of a centrifugal governor, a source of electricity and electrical contacts, a gate, or valve, operating mechanism connected with said contacts, and a lever operated by said governor between said contacts, of a relay device, consisting of a sliding block supporting a governor, and a movable arm to carry the contacts, means for moving the block, a pair of screw-threaded shafts connected by gears, and means for operating the shafts in such a manner as to move the contacts through the same distance as the block, substantially as set forth.

5. The combination of a centrifugal governor, a source of electricity and electrical contacts, a gate, or valve, operating mechanism connected with said contacts, and a lever operated by said governor and normally held in a state of balance between said contacts, of means for moving the said lever, a screw-threaded shaft for operating said contacts, a pair of gears mounted on said shaft, and means for revolving the gears in opposite directions in such a manner, as to move the contacts through the same distance as the lever, substantially as set forth.

6. In a water-wheel governor, the combination with a centrifugal governor, a source of electricity and electrical contacts, a gate, or valve, operating mechanism connected with said contacts, and a contact-lever connected to and operated by said governor, said lever being vibratable between said contacts, and a sliding carriage on which the governor and lever are mounted, of means for operating the carriage actuated by the gate-moving mechanism, a contact-carrier supporting the contacts and independently mounted, so as to permit motion parallel to that of the governor-carriage, and means, controlled by the governor-carriage, for moving the contact-carrier to follow the motion of the governor-carriage, substantially as set forth.

Signed by me at the city of Baltimore, in the State of Maryland, this 25th day of February, 1899.

WILLIAM WINDER HANDY.

Witnesses:
CHARLES H. MILLIKIN,
E. W. CADY.