No. 671,465. Patented Apr. 9, 1901.

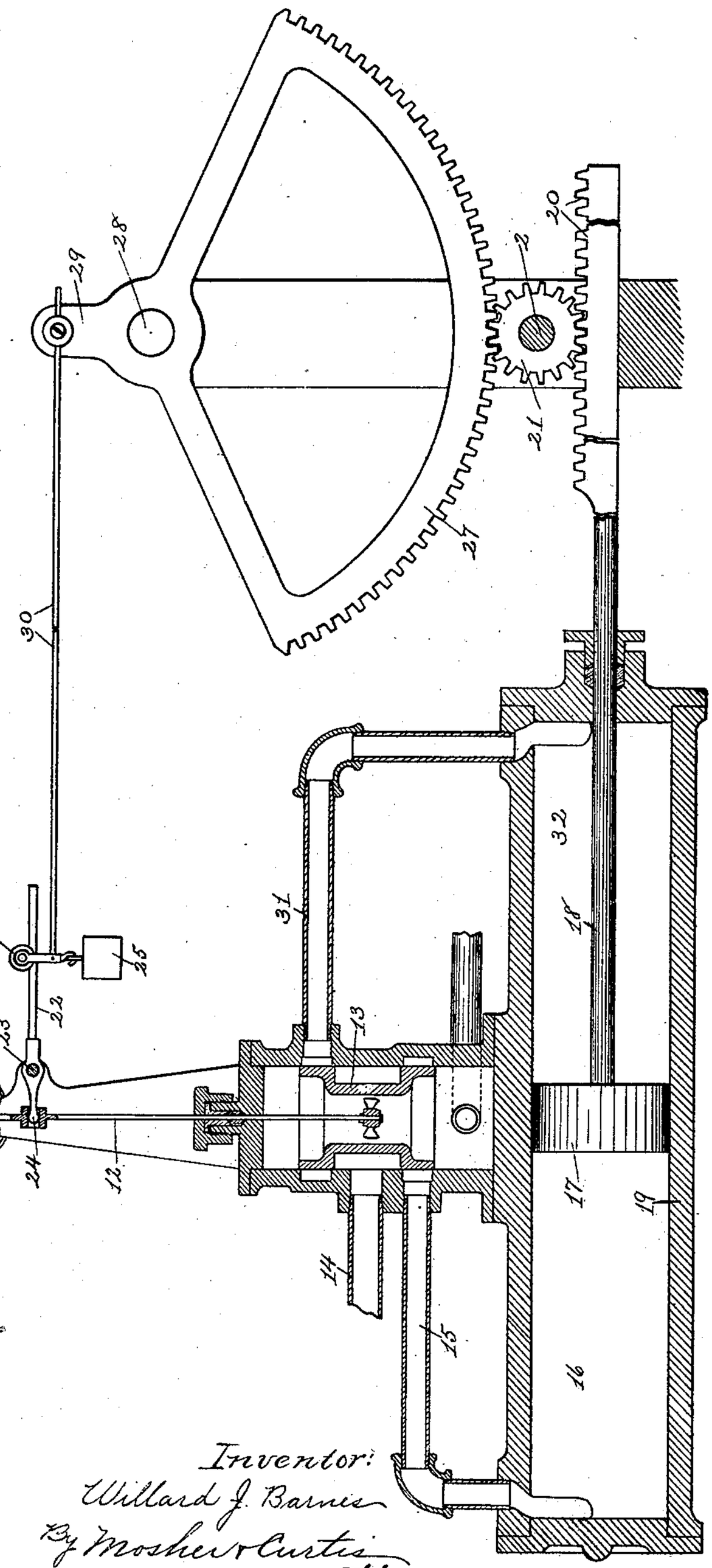
W. J. BARNES.

SPEED REGULATOR.

(Application filed Sept. 24, 1900.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.



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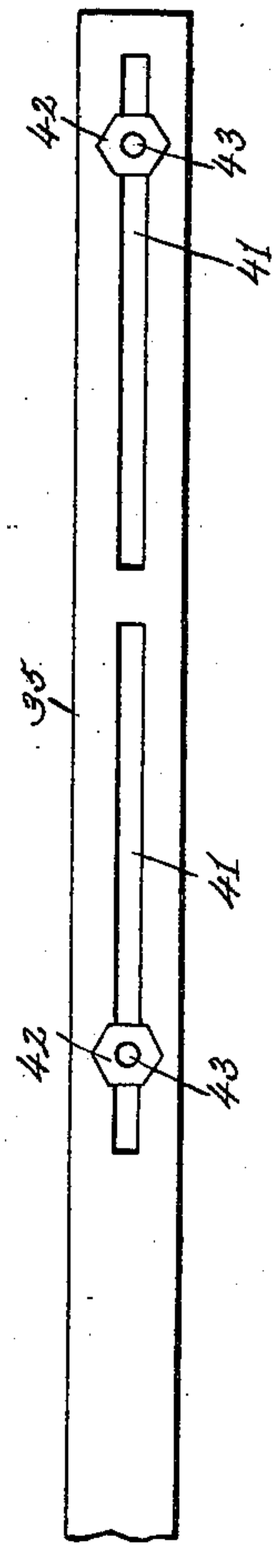

Fig. 3.

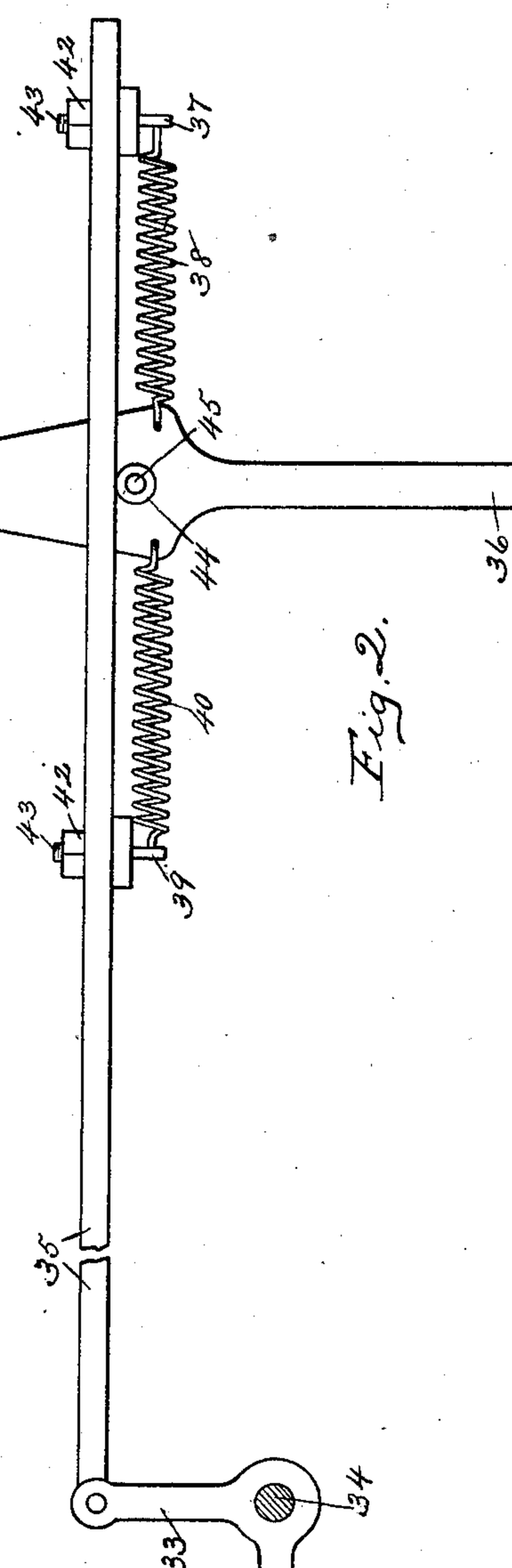

Fig. 2.

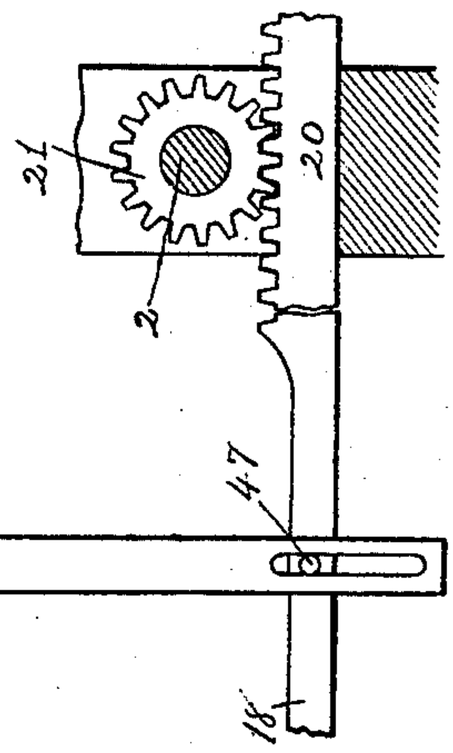

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Fig. 5.

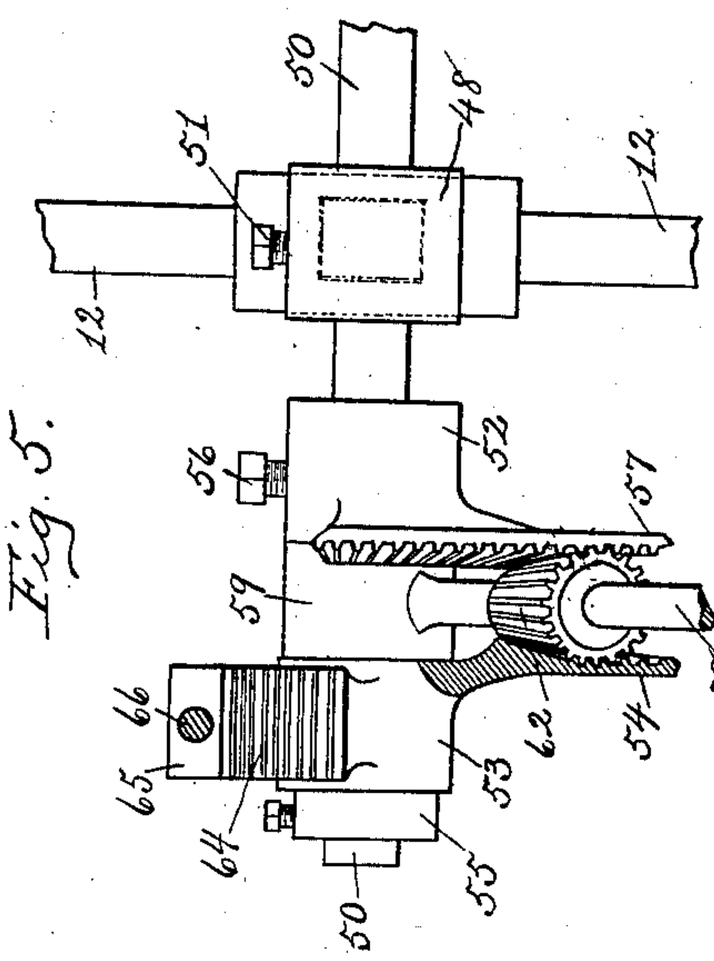
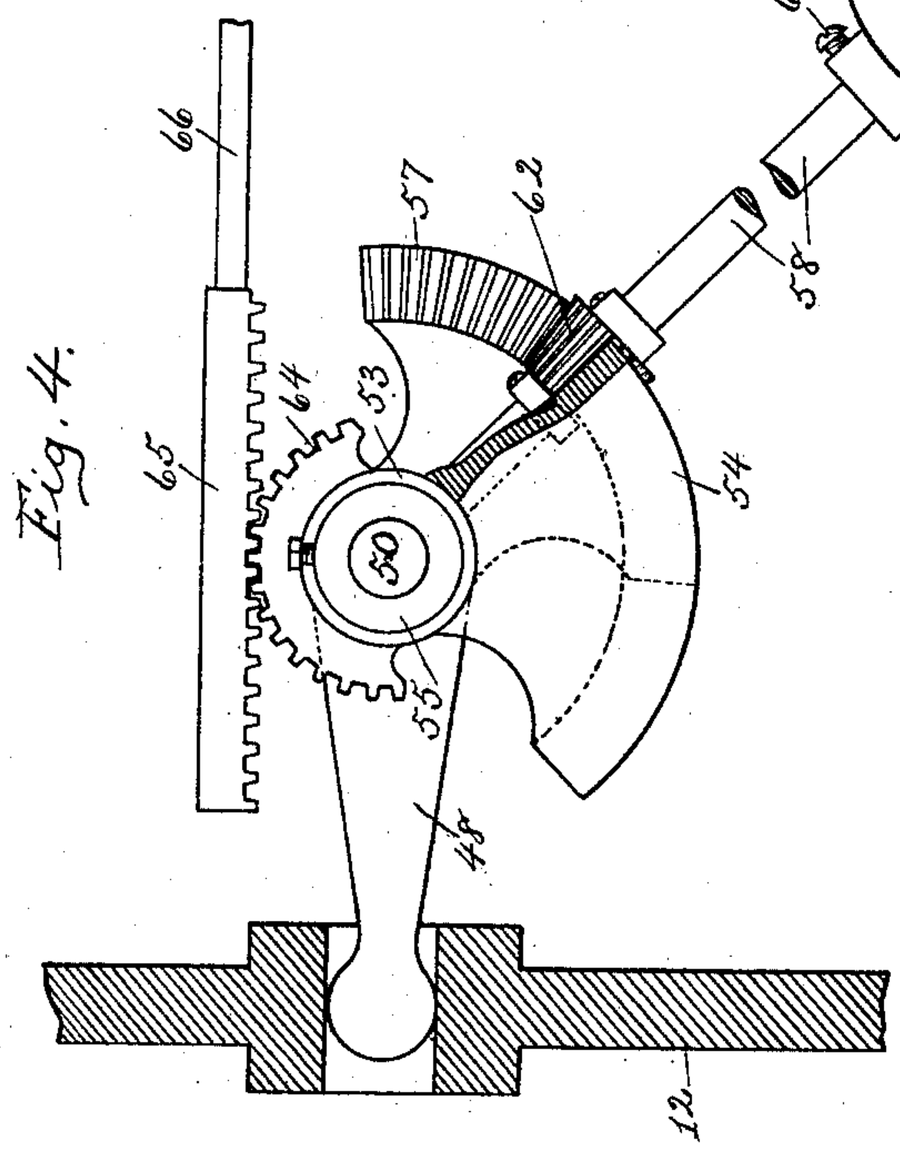


Fig. 4.



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Inventor:
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Attys.

UNITED STATES PATENT OFFICE.

WILLARD J. BARNES, OF MECHANICSVILLE, NEW YORK.

SPEED-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 671,465, dated April 9, 1901.

Application filed September 24, 1900. Serial No. 30,886. (No model.)

To all whom it may concern:

Be it known that I, WILLARD J. BARNES, a citizen of the United States, residing at Mechanicsville, county of Saratoga, and State of New York, have invented certain new and useful Improvements in Speed-Regulators, of which the following is a specification.

The invention relates to such improvements; and it consists of the novel construction and combination of parts hereinafter described and subsequently claimed.

Reference may be had to the accompanying drawings, and the reference characters marked thereon, which form a part of this specification.

Similar characters refer to similar parts in the several figures.

In speed-regulators for water-wheels and the like of the relay type, in which a centrifugal governor controls the movements of powerful mechanism for operating the main gates when changes of speed occur, due to fluctuations in power or variations in load, and the governor has brought into action the mechanism for opening or closing the gates, it is obvious that the movement of the gates will continue until the speed of the machinery has returned to the normal.

Great or frequent fluctuations in the load tend to cause too great a movement of the gates before the speed of the machinery returns to the normal, which causes "racing" or "hunting" and consequent excessive fluctuations in speed. Various means of preventing this racing have been devised which act with varying degrees of certainty and success.

The object of my invention is to provide a simple and easily-operated mechanism adapted to materially reduce or wholly eliminate such fluctuations in speed.

I make use of a well-known means for directly operating the gate, consisting of a piston and cylinder adapted to be operated by fluid under pressure and a valve for admitting pressure to the opposite sides of the piston, respectively, to open or close the gate and connect this valve with the slide-sleeve of a centrifugal governor. Heretofore this valve has been connected with the gate or the gate-controlling mechanism in such a way that the movements of the gate-controller would close the valve without affecting the movements of the centrifugal governor, other means being employed to neutralize the function of the governor until the machinery and governor had come to their normal speed. In my improved regulator I connect the gate-controller or gate with the link or stem which connects the valve with the slide-sleeve of the governor in such a manner that I am able not only to close the valve by the movements of the gate-controller, but to synchronously and with certainty restore the governor to its normal position, so that the governor-weights will revolve approximately in their normal plane.

Referring to the drawings, Figure 1 is a central vertical longitudinal section, partly in elevation, showing my improved regulator in engagement with a gate-shaft, the gate not being shown. Fig. 2 is a side elevation showing a modified form of connection between the valve-stem and the gate-controller. Fig. 3 is a top plan view of a portion of such connection. Fig. 4 is a side elevation of a modified form of such connection. Fig. 5 is a front elevation of the parts shown in Fig. 4.

The centrifugal governor 1, which may be of any known type, is connected with the machinery, driven by a water-wheel or the like, (not shown,) operated by a main gate (not shown) secured to a shaft 2. A revoluble movement is communicated to the centrifugal weights 3, supported by springs 4, the ends of which are secured to sleeves 5 and 6, by means of the belt 7, connecting the moving machinery (not shown) with the bevel-gear 8, which meshes with the bevel-gear 9, secured to the lower sleeve 6, which causes the sleeves to rotate upon their upright support 10. The upper sleeve 5 is free to slide on its support and is connected with the upper end of valve-stem 12, so as to communicate vertical longitudinal movements to such stem. The lower end of the stem is connected with the valve 13.

The position of the parts shown in Fig. 1 is the normal or midway position which they occupy when the machinery is running at the preferred normal speed. Should the machinery run too fast, the centrifugal force exerted upon the weights 3 causes them to fly outward from each other and draw the slide-sleeve 5 downward, thereby forcing the valve-stem downward to admit fluid-pressure through inlet-pipe 14, by the valve, through

pipe 15 into the cylinder-chamber 16, and thereby force the piston 17 and piston-rod 18 along the cylinder 19 toward the right hand, causing the rack 20 on the end of the piston-rod to engage the gear 21 on the gate-shaft 2, rotating the same in a direction to partially close the main gate, and thus tend to check the speed of the machinery. As a means for preventing the gate from being closed too far I provide a lever 22, fulcrumed upon the stationary frame at 23, having one end 24 engageable with the valve-stem. The other end of the lever is provided with a weight 25, suspended from the lever by means of a grooved trolley 26, adapted to be moved back and forth on the arm of the lever. When the various parts are in their normal position, the weight 25 counterbalances the centrifugal weights 3, permitting the arms of the lever to rest in a horizontal position. When the increased speed of the governor causes the valve-stem to move downwardly to open the valve, as just explained, it forces the weighted arm of the lever upward. The weight is connected with the gate-controller, comprising a piston and cylinder operated by fluid-pressure, in such a manner that the movement of such controller due to the opening of the valve, as before explained, draws the weight toward the elevated end of the lever until it reaches a point where the leverage is sufficient to enable the weight or counterbalance to depress the elevated end of the lever, thereby closing the valve and at the same time forcing the slide-sleeve 5 of the governor upwardly to its normal position and drawing the centrifugal weights inwardly to their normal position. As a means for moving the weight along the arm of the lever I provide a toothed sector 27, pivoted upon a stationary support, as stud 28, so adjusted as to engage the gear 21, fixed on the gate-shaft and be given oscillatory movements thereby. The sector is provided with an upwardly-projecting arm 29, upon the end of which is pivoted the link 30, which connects this arm with the weight, whereby the movement of the gate-controller toward the right, as seen in Fig. 1, imparts to the weight a similar movement toward the end of the lever-arm which supports it. The movement of the gate-controller and the weight continues until the weight overbalances the force of the governor-weights to close the valve and at the same time restore the governor to its normal position, as before described. It is obvious that the closing of the valve 13 stops the supply of fluid under pressure to the cylinder 19, which arrests the movement of the gate-controller and the gate-shaft. Should the speed of the machinery be reduced for any reason, then the centrifugal force of the governor-weights, being reduced, will be overbalanced by the counterbalance or weight 25, which will drop and force the valve-stem upward to open the valve, which admits fluid under pressure by the upper end of the valve through the pipe 31 to the chamber 32 of the cylinder, which forces the piston toward the left, thereby operating the gate-shaft to partially open the gate, the weight-supporting arm of the lever 22 having been depressed from the horizontal position. The sector 27 is oscillated so as to cause the link 30 to push the weight up the incline toward the fulcrum of the lever until the equilibrium is restored between the counterbalance and the force of the centrifugal weights, thereby causing the lever to resume its horizontal position, forcing the valve-stem upward to again close the valve and at the same time restore the governor to its normal position.

In Fig. 2 I have shown a modified form of valve-actuating lever and counterbalance, together with means for operating the same, in which the lever is in the form of a bell-crank 33, fulcrumed upon the stationary pivot 34, the upper arm of the lever being pivoted on one end of the link 35, the other end of the link being slotted and provided with two supports adjustably secured in said slot. The lever 36, fulcrumed at 46 and connected at 47 with the piston-rod 18, so as to move with the same, is connected with the support 37 by a coil-spring 38 and with the support 39 by a coil-spring 40. The reciprocatory movement of the piston-rod of the gate-controller will impart to the link 35 a corresponding movement, thereby actuating the bell-crank lever to move the valve-stem longitudinally in the same manner that the lever shown in Fig. 1 is moved by the weight. The supports 37 and 39 can be moved along the slideway-slot 41 in link 35 by loosening the nut 42 on the screw-threaded stem 43 until the springs are given the proper tension to effect the desired movement of the valve-stem. The link 35 may rest upon and be supported by a roller 44, rotary on the pivot 45, projecting from the supporting-lever 36.

In Figs. 4 and 5 I have shown a modified form of weight or counterbalance for operating the lever 48, which actuates the valve-stem, consisting of a shaft 50, supported in suitable bearings and provided with a rock-lever arm 48, which is fixed thereon, as by means of the set-screw 51, also with a pair of sleeves 52 and 53, each provided with a bevel-gear sector, the sleeve 53, having the sector 54, being loose upon the shaft and held thereon by the collar 55. The sleeve 52 is fixed upon the shaft, as by set-screw 56, and is provided with the sector 57, the two sectors being oppositely disposed to each other. The arm 58 projects from the sleeve 59, loose upon said shaft between the sector-supporting sleeves, its projecting end being provided with a weight 60, movable upon said arm and adapted to be secured in an adjusted position thereon by means of the set-screw 61. The weighted arm is provided intermediately of its ends with the bevel-gear 62, adapted to engage with the oppositely-disposed sectors. The loose sleeve 53 is also provided with a toothed segment 64, adapted to engage with

the rack 65 on the end of link 66, which connects it with the piston of the gate-controller or mechanism operated by it. When the governor and machinery are running at normal speed, the parts preferably occupy the midway position, (shown in Fig. 4,) in which the weighted arm is inclined at an angle of about forty-five degrees. Should the speed of the machinery be increased beyond the normal, the valve-stem will be moved downwardly, as before explained, overbalancing the normal force of the weighted arm. As the stem moves downwardly it depresses the rock-lever arm 48, which elevates the geared sector 57, rolling the beveled pinion up the other sector 54, and thereby lifting the weighted arm slightly, because the sector loose on the shaft is prevented from yielding to the force of the weighted arm by the rack 65, which is connected with the mechanism operated by the piston of the gate-controller. Furthermore, the opened valve has set the piston of the gate-controller in motion and in that direction which will move the rack to the left, as seen in Fig. 4, and elevate the sector 54, rolling the beveled pinion up sector 57 until the weighted arm pressing down upon the sector 57, fixed to the shaft, has acquired sufficient power to overbalance the governor-weights and elevate rock-lever arm 48 sufficiently to close the valve and restore the governor to its normal position. While the rock-lever arm is being elevated, the sector 57 is correspondingly depressed, the loose beveled pinion rolling down the sector 54, the latter sector being held up by the rack 65. When the speed of the machinery falls below normal, the movements of these parts are reversed.

My invention is applicable to any form of speed-regulator employing a centrifugal governor, and any known mechanism may be substituted for that shown as a means for causing such governor to influence the movements of the main gate or valve.

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

1. In a speed-regulator for water-wheels and the like, the combination with a gate-controller adapted to be operated by fluid-pressure; and a centrifugal governor; of a valve for controlling such fluid-pressure; connections between the centrifugal governor and valve for operating the valve; connections between the gate-controller and valve-operating mechanism adapted to close the valve and at the same time to force the governor-weights into an abnormal position relatively to the rotary speed of the governor, substantially as described.

2. In a speed-regulator, for water-wheels and the like, the combination with a gate-controller adapted to be operated by fluid-pressure; and a centrifugal governor; of a valve for admitting fluid-pressure to operate the gate-controller; valve-operating mechanism connecting the governor and valve; connections between the gate-operating mechanism and the valve-operating mechanism adapted to close the valve and restore the governor to its normal position synchronously with the movements of the gate and before the rotary speed of the governor becomes normal, substantially as described.

3. In a speed-regulator, for water-wheels and the like, the combination with a gate-controller adapted to be operated by fluid-pressure; a centrifugal governor; and a valve for admitting fluid-pressure to operate the gate-controller; of a stem connecting such valve and the slide-sleeve of the governor; a lever fulcrumed upon a stationary support and operatively connected with such stem; and a yielding lever-operating connection between the gate-controller and such lever whereby the movements of the controller acting upon such lever will gradually close the valve and restore the governor to its normal position, before its rotary speed becomes normal, substantially as described.

4. In a speed-regulator, for water-wheels and the like, the combination with a gate-controller adapted to be operated by fluid-pressure; a centrifugal governor; and a valve for admitting fluid-pressure to operate the gate-controller; of a stem connecting such valve with the slide-sleeve of the governor; a lever fulcrumed upon a stationary support and operatively connected with such stem; a counterbalance acting through such lever and stem upon the slide-sleeve of the governor to balance the normal force of the governor-weights and movable independently of such lever and stem; operating connections between such balance and the gate-controller for changing the relative positions of the balance and lever and restoring the governor to its normal position, while its rotary speed remains abnormal, substantially as described.

5. In a speed-regulator, for water-wheels and the like, the combination with a gate-controller adapted to be operated by fluid-pressure; a centrifugal governor; and a valve for admitting fluid-pressure to operate the gate-controller; of a stem connecting such valve and slide-sleeve of the governor; a rock-shaft rotatively supported in stationary bearings; a rock-lever fixed upon such shaft and operatively engageable with such stem; a pair of bevel-gear sectors, one loose and the other fixed upon such shaft and disposed thereon oppositely to each other; operative connections between the loose sector and the gate-controller whereby the movements of the controller impart to the loose sector an oscillatory movement on the shaft; and an arm weighted at one end and loosely supported at the other end on the rock-shaft and provided intermediately of its ends with a loose beveled pinion located between and engageable with both the oppositely-disposed sectors, substantially as described.

6. In a speed-regulator, the combination with mechanism for operating a gate or the like controlling the fluid-supply to a prime

mover; of a centrifugal governor; operating connections between the governor and gate-operating mechanism; and connections between the gate-operating mechanism and governor whereby the governor is forced by the movement of the gate-operating mechanism into an abnormal position relatively to its rotary speed, substantially as described.

7. In a speed-regulator, the combination with a centrifugal governor, and mechanism for operating a gate or the like controlling the fluid-supply to a prime mover; of operating connections between the governor and gate-operating mechanism, movable in one direction by the governor; and means for forcing such connections in a direction opposed to the normal action of the governor, thereby forcing the governor into its normal position and at the same time stopping the action of the gate-operating mechanism before the rotary speed of the governor becomes normal, substantially as described.

8. In a speed-regulator, the combination with a gate-controller; a centrifugal governor; and governor-actuated mechanism for inducing action and inaction of said controller; of connections between the gate-controller and the governor adapted to force the governor-weights into their normal plane of rotation, independently of their angular velocity, synchronously with the movements of the gate-controller, and thereby actuate the mechanism for inducing inaction of said controller.

9. In a speed-regulator, the combination with a gate-controller; a centrifugal governor; and governor-actuated mechanism for inducing action and inaction of said controller; of connections between the gate-controller and the governor adapted to force the governor-weights into a plane of rotation abnormal to that corresponding with their angular velocity, synchronously with the movements of the gate-controller, whereby said governor is caused to induce, independently of its angular velocity, inaction of said controller.

In testimony whereof I have hereunto set my hand this 14th day of September, 1900.

WILLARD J. BARNES.

Witnesses:

FRANK C. CURTIS,

E. M. O'REILLY.