E. WRIGHT.

Governors for Water-Wheels

No. 169,073. Patented Oct. 19, 1875.

Fig. 1.

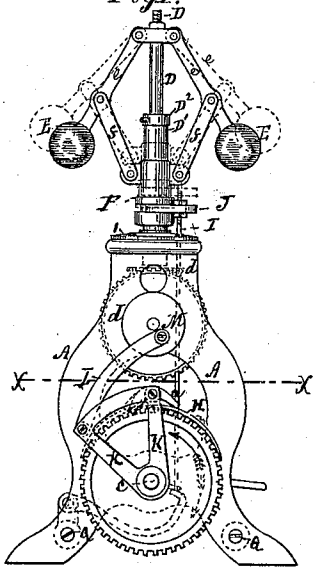


Fig. 5.

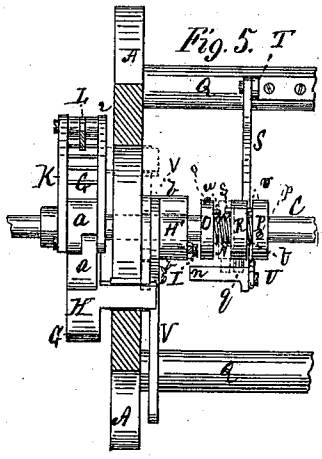


Fig. 2.

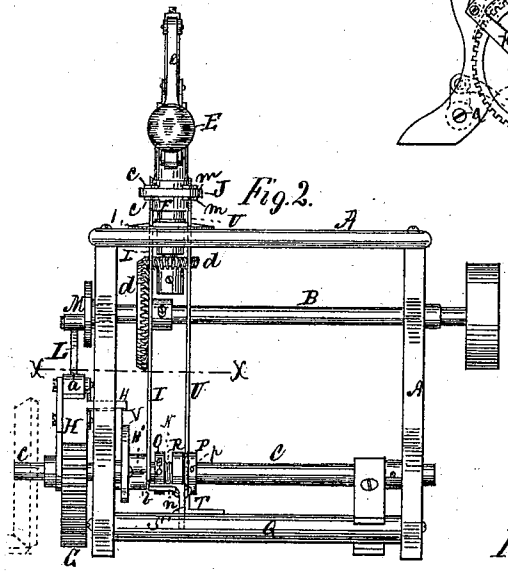


Fig. 4.

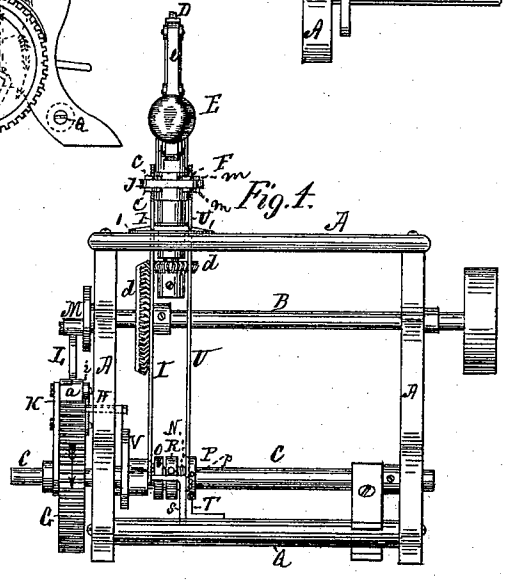
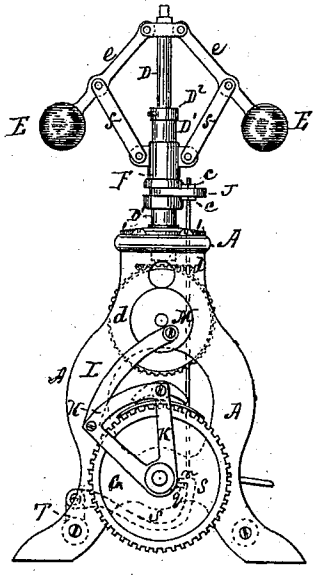


Fig. 3.



Witnesses.

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EDWARD WRIGHT, OF WORCESTER, MASSACHUSETTS.

IMPROVEMENT IN GOVERNORS FOR WATER-WHEELS.

Specification forming part of Letters Patent No. **169,073**, dated October 19, 1875; application filed May 18, 1875.

To all whom it may concern:

Be it known that I, EDWARD WRIGHT, of Worcester, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Water-Wheel Governors; 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 pertains to make and use the same, reference being had to the accompanying drawing, and to the letters of reference marked thereon, which form a part of this specification, in which—

Figure 1 represents an end elevation of a governor, having my improvement applied thereto; and Fig. 2, a side elevation of the same, both views showing the position of the various parts of the apparatus when running too slow. Fig. 3 also represents an end elevation, but showing the position of the various parts of the apparatus when running at the required velocity. Fig. 4 represents the same elevation as is represented in Fig. 2, but shows the position of the various parts of the apparatus when running too fast. Fig. 5 represents a horizontal section, on a larger scale, of a portion of the machine as taken through the line *x x* of Fig. 2, one end being broken off.

My invention relates more especially to the improved water-wheel governor patented to me November 17, 1874, No. 156,867.

In practice, I have found it desirable to place the shield of the ratchet-gear that controls the movement of the water-gate under the direct and sole control of the governor, so that the very moment the speed of the latter should exceed or fall short of the required velocity to be imparted to the machinery being driven, the remedy may be applied with the least practicable delay; otherwise great damage may ensue. To provide such a device is the object of my improvement.

My invention for this purpose consists in connecting the ratchet-shield with, and in operating it directly through, the slide-sleeve of the governor, so that under all circumstances, while being automatically operated, the movements of the two shall relatively correspond with each other, and synchronously, whereby the very moment the speed of the machinery shall exceed or fall short of the required velocity the action of the governor because thereof will cause the shield to uncover the ratchet and expose it to the action of the pawl, and thereby open or close the gate, as the case may be, as regulated by the action of the governor.

In the drawing the improvement is shown in connection with the governor patented to me, as before stated, on the 17th of November, 1874; hence it is not deemed necessary to give more than a general description of any part of that machine other than those devices with which the improvement is more immediately connected and combined.

A represents the supporting-frame; B, the driving-shaft, operated by belt or otherwise from the mill-shaft machinery or water-wheel, the speed of either of which is to be governed. The main shaft C of the governor is connected, when in use, to the gate or gate-shaft of the water-wheel by suitable gearing, indicated by dotted lines in Fig. 2, and so that the rotation of said shaft C shall increase or diminish the flow of water to the wheel, according to the direction of rotation, and thus increase or diminish the speed of the motor, as the case may be. In the present instance, the rotation of the shaft C and its ratchet-wheel G, in the direction indicated by the arrow, drawn in full lines in Fig. 1, will open the gate to increase the flow; and when reversed, as indicated by a dotted arrow in the same figure, and by the full arrow in Fig. 4, will diminish the flow.

The governor-spindle D is operated from the driving-shaft B, through the instrumentality of bevel-gears *d d*, one being mounted on the lower end of spindle D, and the other on driving-shaft B. Spindle D is provided with, and carries in the usual manner, at its upper end, the governor, or centrifugal balls or weights E E, they being supported at the lower ends of the hinged arms *e e*, and which again are connected with the slide-collar F by links *f f*, so that said slide-collar F shall move up and down on the spindle-shaft D or its bearing-sleeve D^1, as the speed varies, by the action of the balls E in the ordinary manner. Ratchet-wheel G receives motion from the oscillating pawls *a a*, and imparts it to main

shaft C, according to the direction in which it itself is turned. Between the pawls *a a* and the face of ratchet-gear G is arranged the ratchet-shield H, and which is made of such length that, when arranged in a central position with respect to the pawls, it will prevent either from engaging with the teeth. Shield H is supported from a hub or sleeve, H′, loosely mounted on main shaft C, just inside of supporting-frame A. Sleeve H′ is provided with lugs or arms *b b′*, to either one of which is pivoted the lower end of a rod, I, the upper end of which extends upward to slide F, and is adjustably connected therewith by being made to pass through a forked plate, J, the forks of which are made to loosely embrace slide F, they taking into a circumferential groove cut in the outer periphery of said slide, as shown. The forks of said plate J thus applied to slide F allow the latter to turn freely, while the former remain stationary, so far as rotary motion is concerned.

Rod I, previous to passing through an opening in plate J, is made to pass through the upper cross-beam of the frame, and through the supporting-plate 1 of the stationary sleeve D^1, which forms the bearing of governor-spindle D, a collar, D^2, secured to the latter, supporting it in place on the upper end of the former. Being now loosely connected at its lower end to one of the lugs—say, *b* of sleeve H′—and its upper end passed through one of the two openings formed for the purpose in forked plate J, rod I is then adjustably secured by nuts *c c*, screwed onto its end, the one above and the other below said forked plate J, as shown.

This application of rod I to plate J serves to confine its forked ends within the groove of slide F, and yet leaves it free to slide up and down with the latter on spindle D, or, as shown in the drawing, on the bearing-sleeve D′ of the latter. Slide F and ratchet-shield H being thus connected directly together through the sliding rod I, it will be apparent that the slightest movement of the slide will be imparted to the shield.

By securing the upper end of rod I to forked plate J by means of the nuts *c c*, the length of the connecting-rod I can be readily adjusted, so as to graduate or adapt the governor to any degree of speed at which it may be desired to run the water-wheel or machinery. The rod I can also be attached to sleeve H′, and to forked plate J, on either side of shaft C′, sleeve H′ being provided with two lugs, *b b′*, for that purpose, and forked plate J being capable of being applied to the corresponding side of spindle D, suitable openings for that purpose being also made through the upper cross-piece of the frame, and through the supporting-plate 1 of the stationary bearing-piece D′ of the governor-spindle D. This is of great convenience, and much facilitates the setting up of the governors, as it permits of gearing to the gate-shaft in any position above or below shaft C, and also allows shaft B and regulator-spindle D to be run in either direction, as most convenient.

Pawls *a a*, which operate ratchet-wheel G, are mounted on a pivotal stud, common to both, fixed in the corner of a sector or sectoral arm or lever, K, the hub of which works on the shaft C as a center, said sector K being oscillated, to give movement to the pawls, by a connecting-rod, L, the lower end of which works on a stud secured to the other corner of the sector, while its upper end is attached to, and actuated by, a crank, M, on the end of driving-shaft B.

Each revolution of the shaft moves the sector and pawls once back and forth over the face of the gear G.

The studs on which rod L and pawls *a a* are pivoted are connected together at their rear ends by a back rim, *i*, the ratchet, pawls, and rods all working in the same plane between the sector and back rim.

N indicates a screw-threaded sleeve, arranged on the shaft C, and secured in position by a set-screw, *o*, through its head O. P indicates a nut screwed onto the end of the sleeve N, and is provided with a set-screw, *p*, by which it can be firmly retained at any adjusted position. R indicates a traverse-nut, arranged to turn on the screw-sleeve N, and is provided with a radial projection or pin, *q*. The nut R is provided with lugs *s t* at either side. Head O and nut P are also provided with a lug each, and are marked *u* and *v*, respectively. They are also so arranged as to engage, respectively, with the lugs *s* and *t*—that is to say, *u* with *s* and *v* with *t*.

The devices described thus far are the same as those described and shown in my patent before referred to.

To the machine as thus constructed I now apply a lever, S, pivoted at one end to a standard, T, mounted on, and secured to, one of the lower cross-rails Q, and connected at its other end, by a loose joint, to the lower end of another connecting-rod, U, the upper end of which, like rod I, is made to pass through an opening in the upper cross-rail of the frame, and through supporting-plate 1 of sleeve D′, and also through a slot or opening in forked plate J, to which it is then adjustably connected by screw-nuts *m m*, in the same manner as rod I by the nuts *c c*.

On the side of the end of lever S, to which the lower end of rod U is connected, is formed a horizontally-projecting arm, *n*, of a length nearly sufficient to extend to the outer end of sleeve H′, as shown in Fig. 5. The length of lever S, on the outer end of which arm *n* is formed, is such as to bring the latter within striking distance of the radial pin *q* of the traverse-nut R, so that said pin shall engage or be made to abut against said arm, upon its upper or lower side, according to the direction in which nut R is made to revolve.

Arm *n*, lever S, and rod U, as thus combined with the slide-collar F of the governor, connecting-rod I, and shield H, and with th

traverse-nut R of the main shaft C, operate as follows: When the speed is too low the governor apparatus assumes the position shown in Figs. 2 and 5, and also in full lines in Fig. 1. This exposes ratchet-wheel G to the action of one of the pawls *a*, causing it to turn in the direction of the arrow, (shown in full lines,) and carrying shaft C in the same direction. Shaft C carries with it the traverse-nut R until its pin *q* is brought in contact with arm *n* on its lower side, which holds it by overcoming the friction on the screw N until, as the shaft revolves, nut R is moved along the screw sufficiently far for its lug *t* to engage with the lug *v* on nut P. This then causes nut R to revolve with shaft C, and in so doing, through pin *q*, to lift up arm *n* of lever S, and with it rod U and forked plate J, the latter carrying with it slide F and rod I, thereby moving shield H to a central position beneath the pawls, as shown in Fig. 3, thus relieving ratchet G from further action of the pawl, where it will remain until the speed of the machinery has again fallen below or been raised above the regulated rate of speed, when, if too slow, the same action will be again repeated; but if too fast, the reverse operation will ensue, shield H being thrown over to the other side of gear G, exposing the latter to the action of the other pawl, so as to cause it to turn in the opposite direction to that indicated by the black arrow in Fig. 1, or as indicated by the arrow in Fig. 4. This causes main shaft C to rotate in the same direction, carrying with it traverse-nut R, withdrawing its pin *q* from beneath arm *n*, and around with it, until pin *q* is again made to engage with arm *n*, but on its upper side, where, its friction being overcome, as before, it will remain until, having moved along the screw-sleeve N, its lug *s* becomes engaged with the lug *u* of screw-head O, which, being secured to shaft C, turns with the latter, carrying with it nut R and its pin *q*, causing the latter to depress arm *n* of lever S, and thereby, through its rod U, drag down slide F, which, through rod I acting on sleeve H′, forces up shield H to a central position between the pawls *a a* and gear G—*i. e.*, to its normal regulated position. This movement of the ratchet or gear G and shaft C, through a gear-wheel mounted on the outer end of the latter, and indicated by dotted lines in Fig. 2, imparts motion through suitable connections to the water-gate, or shaft of the water-gate, thereby opening and closing it, to increase or diminish the flow of water to the wheel, as the case may be, according to the direction in which shaft C is turned.

When turned in the direction indicated by the arrow shown in full lines in Fig. 1, it acts upon the gate so as to increase the flow of water, and consequently to increase the speed of the machinery, and vice versa.

In altering plate J and rods I and U to the other side of main shaft C, lever S and its pivotal stud T must also be changed to the lower cross-beam Q on the opposite side of the one to which, as represented in the drawings, it is now attached.

V represents a pivoted forked lever for operating shield H by hand, as occasion may serve.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination of the ratchet-wheel G, shaft C, screw-sleeve H and its head *o*, traverse-nut R and its radial pin *q*, nut P, and their respective stops *s*, *t*, *u*, and *v*, with arm *n* of lever S, rod U, and slide-collar F of the governor, as and for the purpose substantially as set forth.

2. The combination of rod U, lever S, and its arm *n*, with screw N and its head O, traverse-nut R and its radial pin *q*, nut P, and their respective stops *s*, *t*, *u*, and *v*, main shaft C, and ratchet-gear G, sleeve H′, ratchet-shield H, rod I, forked plate J, and slide-collar F of the governor, the whole being arranged, constructed, and operated in the manner and for the purposes substantially as set forth.

In testimony that I claim the foregoing as my own invention I affix my signature in presence of two witnesses.

EDWARD WRIGHT.

Witnesses:

ABIEL E. WILSON,

DANIEL DAVIS, Jr.