(No Model.)

A. B. MORSE.

SPEED REGULATOR.

No. 449,688. Patented Apr. 7, 1891.

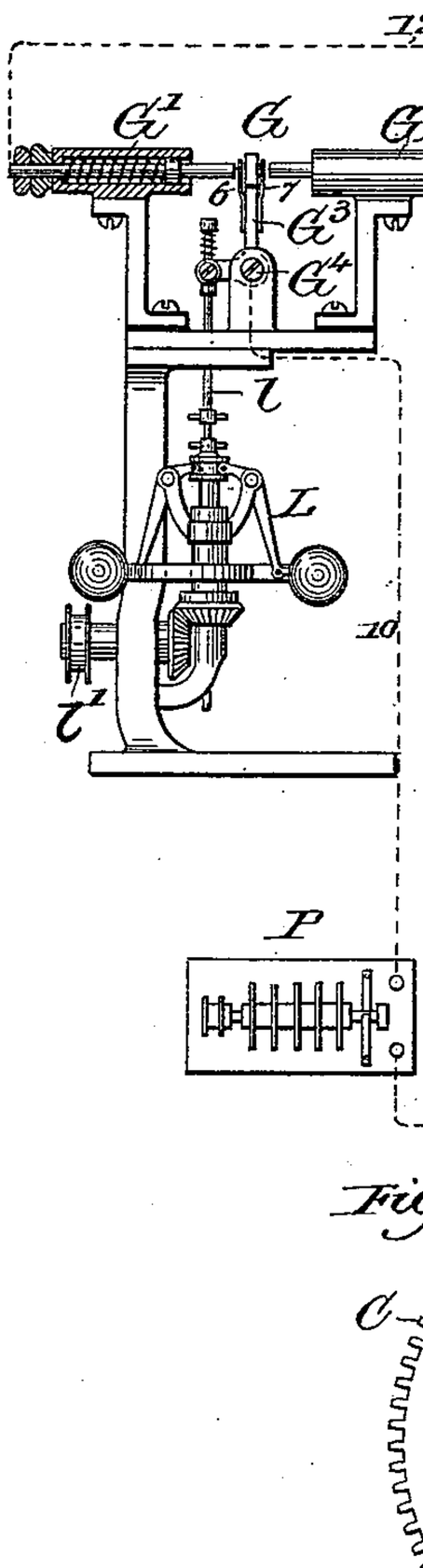

Fig: 1.

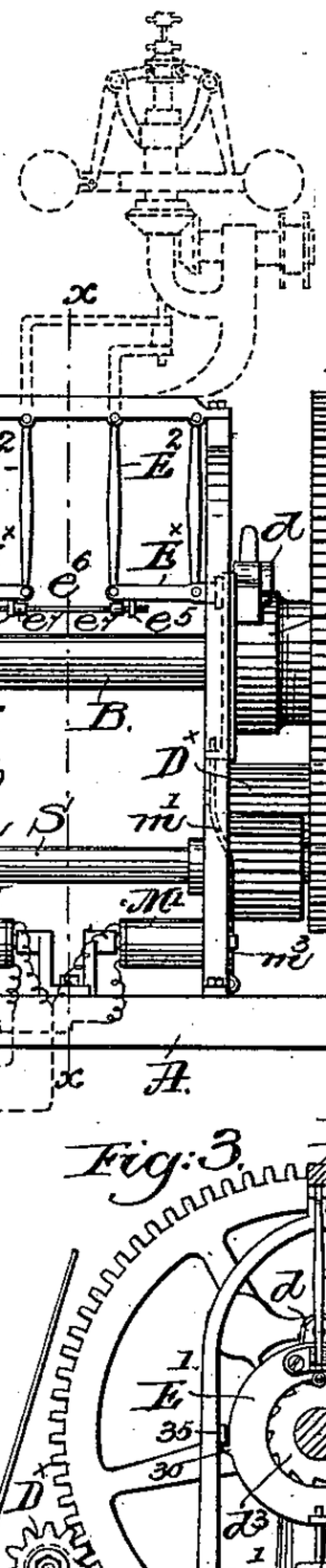

Fig: 2.

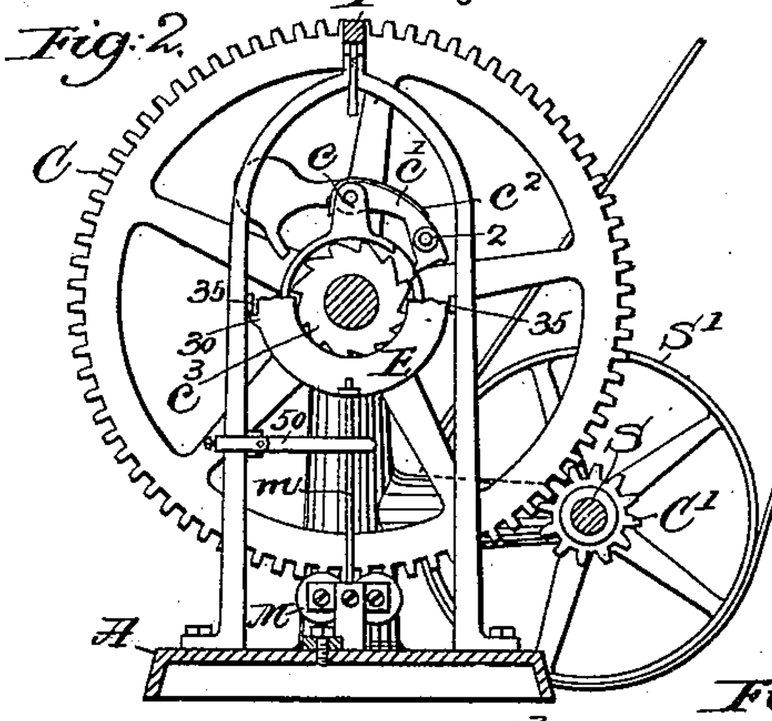

Fig: 3.

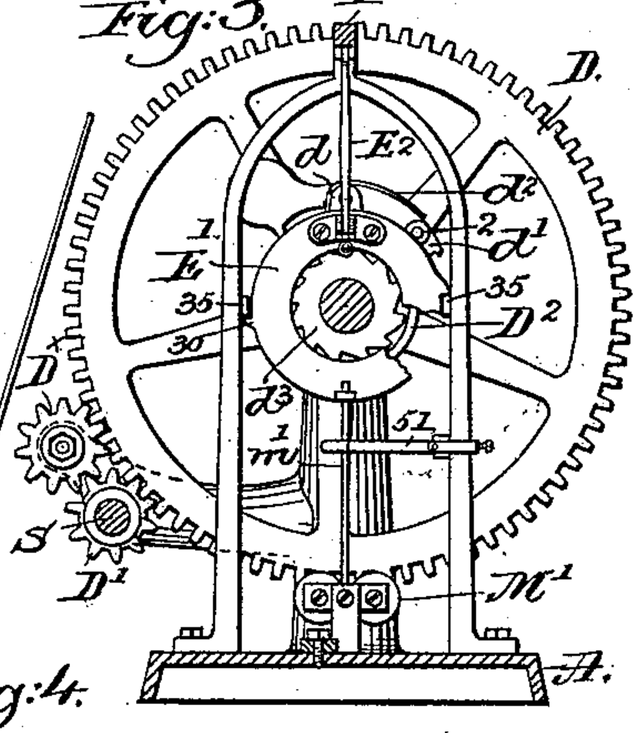

Fig: 4.

Fig: 6.

Fig: 5.

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UNITED STATES PATENT OFFICE.

ALFRED B. MORSE, OF EASTON, MASSACHUSETTS.

SPEED-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 449,688, dated April 7, 1891.

Application filed November 28, 1890. Serial No. 372,786. (No model.)

To all whom it may concern:

Be it known that I, ALFRED B. MORSE, of Easton, county of Bristol, State of Massachusetts, have invented an Improvement in Speed-Regulators, of which the following description, in connection with the accompanying drawings, is a specification, like letters and figures on the drawings representing like parts.

This invention has for its object the production of an efficient and sensitive regulator device which is applicable to various classes of machinery, I having herein illustrated my invention as adapted to be used in connection with a water-wheel.

In accordance with this invention the shaft which controls the position, in this instance, of the gate for regulating the supply of water has fast upon it two ratchet-wheels, the teeth of which point in opposite directions, to be acted upon by one or the other of two pawls carried by two gear-wheels loosely mounted on the said shaft and kept in rotation continuously in opposite directions. According as one or the other of the oppositely-moving pawls is in engagement with the ratchet-wheel will the shaft controlling the gate be rotated in one or the other direction to increase or decrease the water-supply. To control the position of the pawls with relation to their ratchet-wheels, I preferably employ two cam-faced rings, each of which when in one position supports its pawl out of engagement with its ratchet-wheel, and when in its other position permits the pawl to engage its ratchet-wheel and turn the shaft. The position of these rings is preferably controlled by electro-magnets, the circuits through which are under the control of a circuit changer or director moved by a governor of usual form belted or driven from the shafting operated by the water-wheel. According as the current of electricity is caused to flow through one or the other electro-magnet will the pawl controlled by that magnet be thrown into or out of engagement with its ratchet-wheel.

One part of my invention therefore consists in the shaft, the wheels loose thereon, combined with a governor and intermediate mechanism actuated thereby to cause one or the other of said wheels to be engaged with and to rotate the said shaft, substantially as will be described.

Other features of my invention will be hereinafter described, and pointed out in the claims at the end of this specification.

Figure 1 is a front elevation of a regulating device embodying this invention; Figs. 2 and 3, vertical sections on the dotted line $x\,x$, Fig. 1, looking to the left and right, respectively. Fig. 4 shows one of the cam-rings by itself, and Figs. 5 and 6 sectional details to be referred to.

Referring to the drawings, the base A has suitable supports A′, having journaled therein the shaft B, rotation of which controls the position of the gate (not shown) which regulates the supply of water to the water-wheel. (Not shown.) Two gear-wheels C D are mounted loosely upon the shaft B, and are driven by pinions C′ D′ upon the counter-shaft S, journaled in suitable brackets forming a part of the supports A′, the said counter-shaft having a pulley S′, driven by a belt shown only in Fig. 2. An intermediate pinion $D^{\times}$, also supported by one of the said brackets, is interposed between the pinion D′ and the gear-wheel D, so that a continuous movement in opposite directions may be transmitted to the said gear-wheels C D. The hollow hubs C^2 D^2 of the continuously-moving gear-wheels C D are provided with ears c d, between which are pivoted the pawls c' d', facing in the direction of motion, and acted upon by suitable springs c^2 d^2 to engage the teeth on the ratchet-wheels c^3 d^3, fast on the shaft B within the hollow hubs C^2 D^2. Each pawl c' d' is provided upon its inner face with a pin or stud 2, adapted to be acted upon, as will be described, by the cam-faced rings E E′, encircling the shaft B and provided with the studs or arms $E^{\times}$, to which are jointed parallel links E^2, also jointed at their opposite ends to the rigid frame F, so that the said rings may be moved horizontally toward and from their respective pawls. The rings E E′ at their lower edges are provided with ears to receive the armature levers or rods m m', carrying the armatures m^2 m^3 of the electro-magnets M M′. The inner faces of the rings E E′ are formed to present

a series of cam projections or surfaces *e*, running tangentially from the inner edges of the peripheries. (See Fig. 4.) The magnets M M′ are placed in electric circuit with a circuit-controller G, placed at any convenient point, and herein shown as comprising two spring-controlled pins G′ G², between the ends of which is the oscillating bell-crank lever or arm G³, pivoted at G⁴ and having the contact-pens 6 7 to co-operate with the said spring-controlled pins G′ G², the position of the said arm G³ being controlled by the spindle *l* of a governor L, the pulley *l′* of which is belted to a shaft the speed which it is desired to regulate.

Referring to Fig. 1, the wire 10 leads from one pole of the electric generator P to the oscillating arm G³ of the circuit-controller G, and from the contact-pin G′ thereof a wire 12 leads to and through the contact-pens 15 16, to be described, and thence to the magnet M. A wire 13 leads from the other pin G² to and through the contact-pens 17 18, to be described, and thence to the magnet M′. A common wire 14 leads from the magnets M M′ to the cut-out O, and thence to the other pole of the generator P. The normal positions of the various parts—that is, when the shafting is running at the proper speed—are as shown in the drawings, the oscillating arm G³ being between and out of contact with the pins G′ G², and both pawls *c′ d′* on the oppositely-revolving wheels C D being held out of engagement with their ratchet-wheels *c*³ *d*³ by their pins 2 riding around on the peripheries of the rings E E′, the shaft B therefore remaining stationary. Now if the speed of the shafting is increased the balls of the governor L will lift and depress the spindle *l*, causing the arm G³ to be moved to the left to close the circuit through the pin G′ and magnet M, attracting the armature *m*² of said magnet and moving the ring E to the right away from the moving pawl *c′*, permitting the said pawl to spring into engagement with its ratchet-wheel *c*³ to thus turn the shaft B in the direction in which the pawl and wheel C are moving, as herein shown, turn shaft *b* and close the gate slightly and decrease the speed; but it might be to turn the said shaft and move a belt-shipper or equivalent device. As soon as the speed shall have been reduced again to normal the arm G³ will be returned to its central position, breaking the circuit through the pin G′ and magnet M and permitting the spring 50 to throw the ring E to the left into the path of movement of the pin 2 on the moving pawl *c′*, when said pin will engage one of the cam projections *e* on the inner face of the said ring and will be moved up the incline out of engagement with the teeth of its ratchet-wheel, the said ring being further moved to the left, so that the pin 2 will follow around on the smooth periphery of the ring, as shown in Fig. 5. In precisely the same manner if the speed drops below the normal the governor-balls will drop, raising the spindle *l* to close the circuit through the arm G³, pin G², and magnet M′, attracting its armature *m*³ to move the ring E′ away from and out of engagement with the pawl *d′*, permitting the said pawl to spring into engagement with its ratchet-wheel *d*³ to thus turn the shaft B in the opposite direction to open the gate and increase the speed. When the speed has risen to normal, the circuit will be broken by the arm G³ returning to its central position, and the armature-lever *m′*, acted upon by the spring 51, will move the ring E′ to the right to throw the pawl *d′* up out of engagement with its ratchet-wheel.

The inclined cam projections *e* on the rings E E′ are provided with slots or grooves 3, in which travel the heads or flanges 4 on the pins or studs 2, so that it will be impossible to draw the ring away out of engagement until the pawl has been moved fully up and out of engagement with its ratchet-wheel, and the said rings E E′ are provided with diametrically-opposite ears or projections 30, which act against the stops 35 on the frame F to keep the said rings from turning when acted upon by the pins of the rotating pawls. The pawls *c′ d′* are made to perfectly balance in any position, so that a slight force only is required to move them into and out of engagement with their ratchet-wheels. If when the water-supply is low and with the gate wide open the speed is still too slow, the regulating device in trying to raise the gate still more would be liable to break some of the parts, and to obviate this I have placed upon the shaft B a collar *w*, threaded to receive the hub *w′*, having an arm *w*², extending upwardly through a guide-slot in the arm or bracket *w*³, secured to one of the supports A′, so that as the shaft B is revolved in one or the other direction the hub *w′* and its arm *w*² will be moved to the right or left. The bracket *w*³ has secured to it, as shown, the two pairs of insulated pens 15 16 and 17 18, previously referred to, the pens of each pair being normally in contact with each other, as shown. The outside pen of each pair is provided with a threaded stud 19, so adjusted with relation to the arm *w*² that when the shaft has been rotated a sufficient number of times in either direction to fully open or close the gate, the arm *w*² will strike against one or the other of the studs 19 and separate the pens of that pair to break the circuit and throw the pawl operated by that circuit out of engagement with its ratchet-wheel, to thus prevent the same from turning the shaft B too far. The other set of pens and the other magnet in each case remain in circuit, so as to be in readiness to check the speed if it should suddenly start in the opposite direction.

To obviate any possibility of both rings E E′ being out of engagement with their pawls at the same time, and thus permit both pawls to engage their ratchet-wheels and try to turn

the shaft B in opposite directions at once, I have provided the arms $E^{\times}$ on said rings with downwardly-projecting ears e^5, having holes through which passes the rod e^6, having threaded thereon the nuts e^7, so adjusted that it will be impossible to move one of the rings away from its pawl without pushing the other ring into engagement with its pawl, if not already in engagement.

While I prefer to employ electricity as a means to operate the rings E E′, still I may, if desired, operate the device directly from the governor, as shown in dotted lines, Fig. 1, wherein the governor is supported directly over the regulating device, its spindle *l* moving vertically between the extended arms E^2 to operate them in one or the other direction to throw the rings into or out of engagement with their pawls.

It is obvious that the wheels C D may be operated by belts instead of gears, as shown.

The whole apparatus may be cut out by simply moving the switch or cut-out O to break the circuit.

While I have herein shown and described my invention as applied to a water-wheel, yet I do not desire to limit this invention thereto, as it is applicable to many other machines as well, and by the use of only one-half of the apparatus, as the wheel C, pawl *c′*, and ring E, a very efficient stop-motion and regulator for winding and other machines may be produced.

I do not desire to limit this invention to the particular construction of the various parts, as the same may be varied without departing from the scope of this invention, nor to any particular form of governor.

I desire it to be understood that should the pawls referred to be connected to and made movable with the shaft B and moved by a laterally-movable ring, similar to the ring E, to engage the wheels C D to thus turn the shaft B such will be considered as within the scope of this invention.

It is obvious that in lieu of the thread cut upon the collar *w*, as shown, I may employ a cam-groove adapted to move an arm or other circuit-breaking device.

I claim—

1. The shaft B, the wheels C D, loose thereon, combined with a governor, a circuit-controller operated thereby, and electro-magnets and intermediate mechanism actuated thereby to cause one or the other of said wheels to be engaged with and to rotate the said shaft and to be disengaged therefrom, to operate substantially as described.

2. The combination, with the shaft B and a ratchet-wheel fast thereon, of a continuously-rotating wheel loosely mounted on said shaft, a pawl carried by said wheel to co-operate with said ratchet-wheel, and the ring E, to operate substantially as described.

3. The combination, with the shaft B and a ratchet-wheel fast thereon, of a rotating wheel C, pawl *c′*, carried thereby, the ring E, magnet M, and circuit-controller G, all to operate substantially as described.

4. The combination, with the shaft B and a ratchet-wheel fast thereon, of a rotating wheel C, pawl *c′*, the ring E, having an arm $E^{\times}$, and the links E^2, supporting the said ring, and mechanism to operate said ring, substantially as described.

5. The shaft B, having the ratchet-wheels c^3 d^3 fast thereon, combined with the oppositely-moving wheels C D on said shaft, pawls carried by said wheels, and the rings E E′ and mechanism to operate them, substantially as described.

6. The shaft B and the ratchet-wheels c^3 d^3 fast thereon, combined with the oppositely-moving wheels C D on said shaft, pawls *c′ d′*, the rings E E′, having ears 30, and the rod e^6, to operate substantially as described.

7. The shaft B and the ratchet-wheels c^3 d^3 fast thereon, combined with the wheels C D, pawls *c′ d′*, rings E E′, and the spindle *l* and governor L, to operate substantially as described.

8. The combination, with a governor and its spindle *l*, of the arm G^3, provided with pens 6 7, and the spring-controlled pins G′ G^2, to operate substantially as described.

9. The shaft B, a ratchet-wheel fast thereon, a rotating wheel loosely mounted on said shaft, and a pawl carried thereby, combined with the hub *w′*, threaded to move longitudinally on said shaft B, the ring E, and mechanism intermediate the said hub and ring to throw said pawl into and out of engagement with said ratchet-wheel, substantially as described.

10. The combination, with the shaft B and a ratchet-wheel fast thereon, of a rotating wheel loosely mounted on said shaft, a pawl carried by said wheel to co-operate with said ratchet-wheel, and the ring E, having the projections *e*, provided with grooves 3, to operate substantially as described.

11. In a speed-regulator, the combination of the following instrumentalities, viz: a shaft, a governor, and mechanism controlled thereby to turn said shaft in one or the other direction, an arm movable by and with relation to said shaft, and electrically-actuated means controlled by said arm to prevent said mechanism from turning said shaft more than a predetermined number of revolutions in either direction, substantially as described.

12. In a speed-regulator, the combination of the following instrumentalities, viz: a shaft B, the wheels C D loose thereon, a governor, and electrically-actuated mechanism controlled thereby to cause one or the other of said wheels to be engaged with said shaft, combined with an arm, as w^2, movable by and with relation to said shaft to prevent said wheels from turning said shaft more than a predetermined number of revolutions in either direction, substantially as described.

13. The shaft B and ratchet-wheels fast thereon, the rotating wheels C D, pawls *c' d'*, carried thereby, the rings E E', and the magnets M M' to control the position of the same, combined with the pens 15, 16, 17, and 18, and an arm between said pens and movable by said shaft B, to operate substantially as described.

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

ALFRED B. MORSE.

Witnesses:
JAS. H. CHURCHILL,
FREDERICK L. EMERY.