(No Model.) 2 Sheets—Sheet 1.

M. A. REPLOGLE.

ELECTRICAL GOVERNOR.

No. 604,544. Patented May 24, 1898.

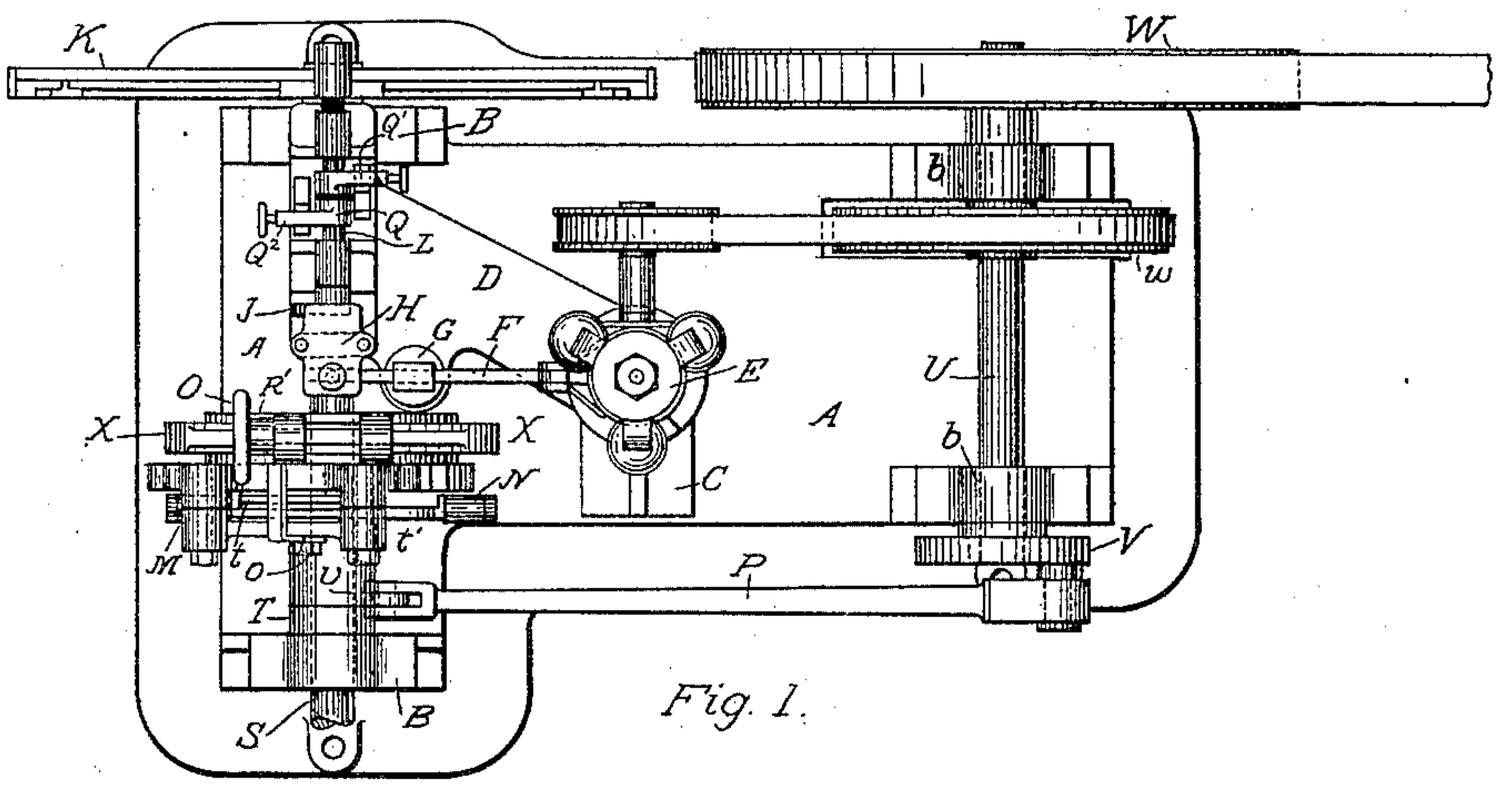

Fig. 1.

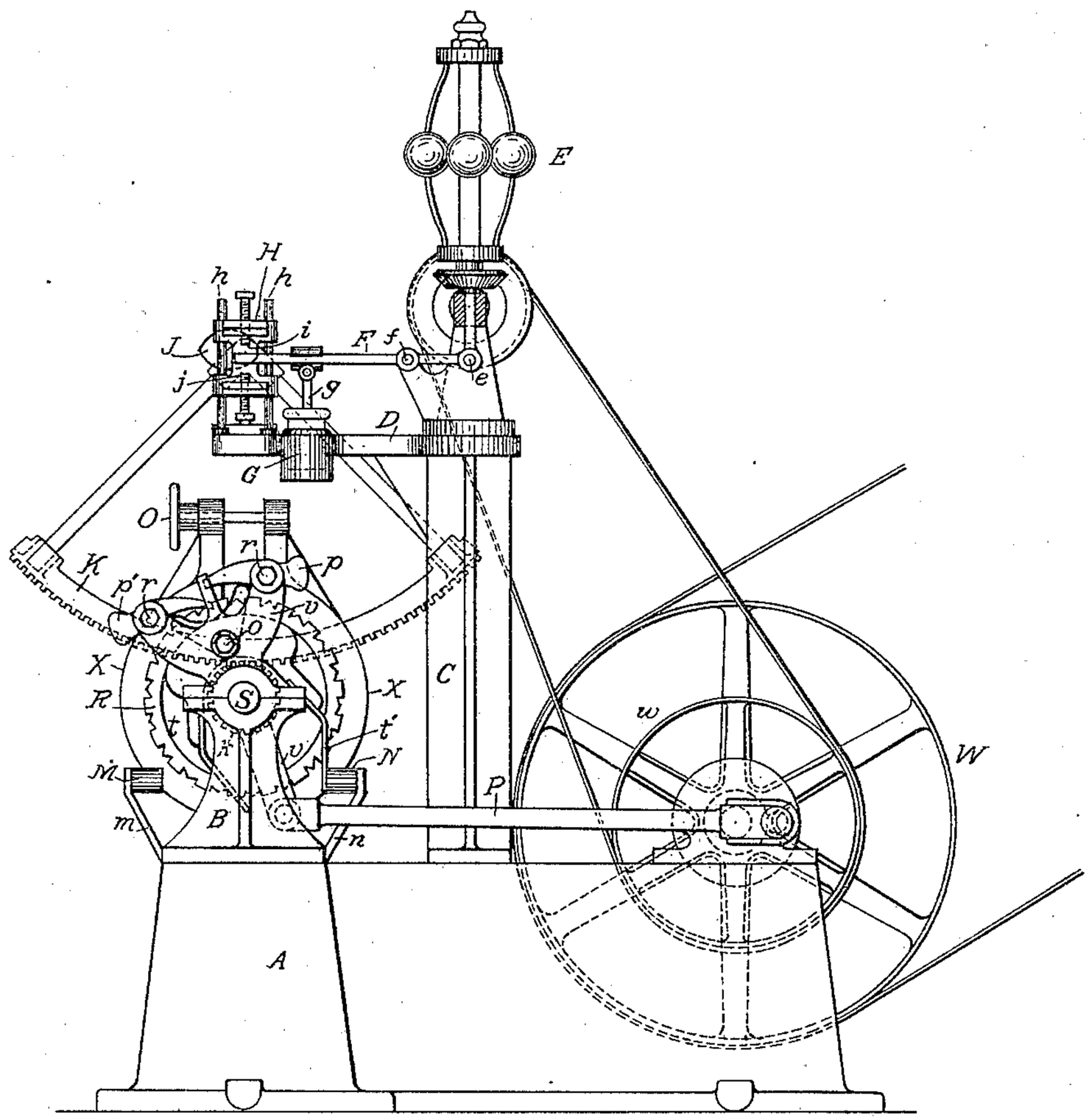

Fig. 2.

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(No Model.) 2 Sheets—Sheet 2.

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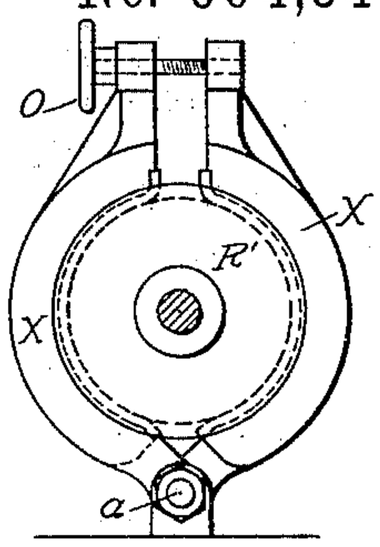

Fig. 5.

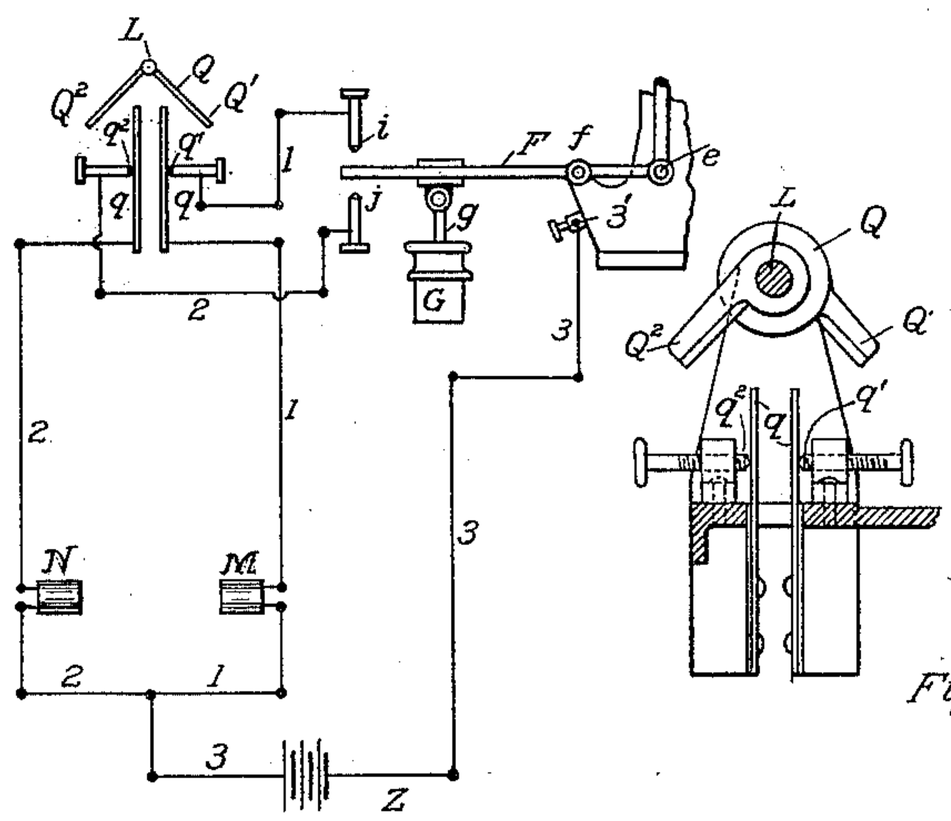

Fig. 7.

Fig. 6.

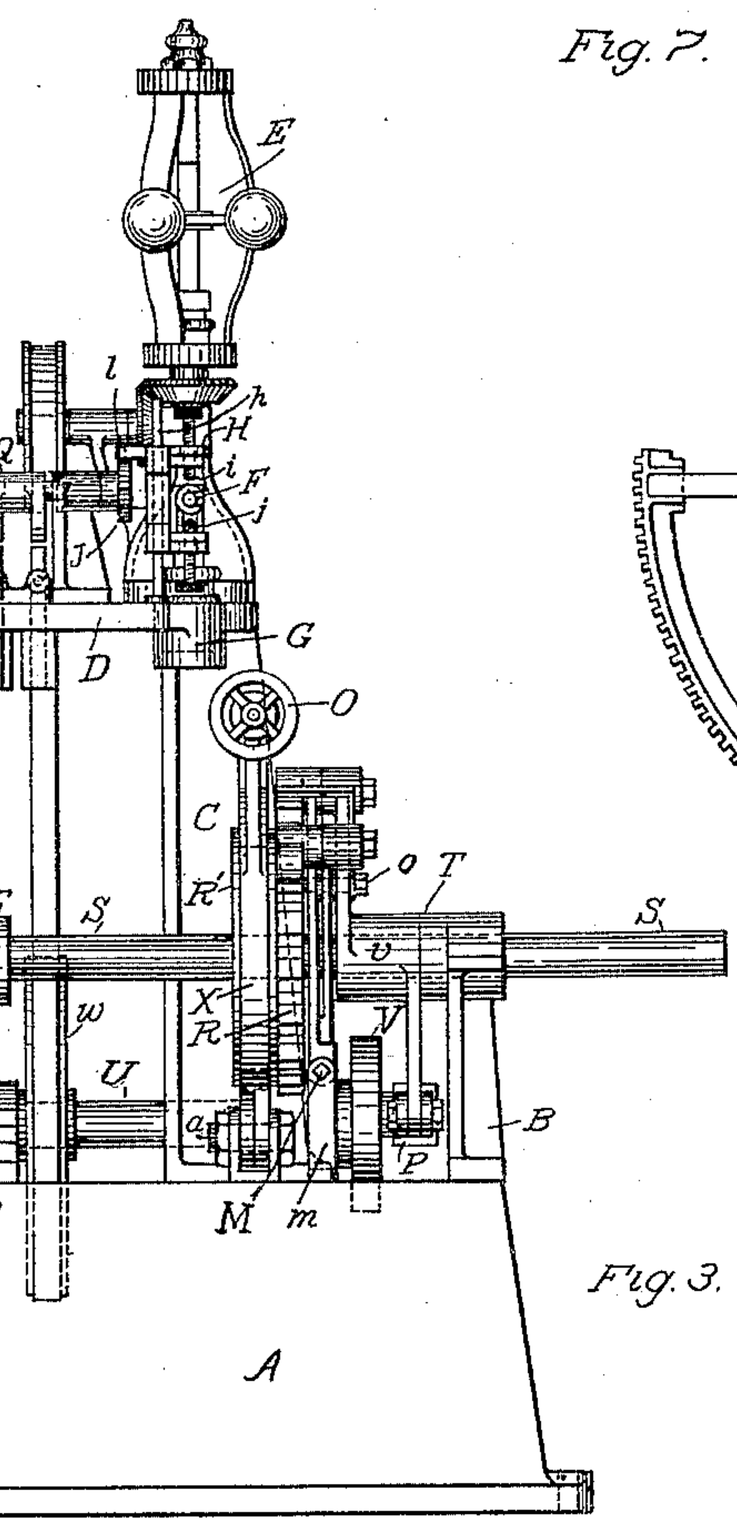

Fig. 3.

Fig. 4.

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MARK A. REPLOGLE, OF AKRON, OHIO.

ELECTRICAL GOVERNOR.

SPECIFICATION forming part of Letters Patent No. 604,544, dated May 24, 1898.

Application filed February 19, 1897. Serial No. 624,271. (No model.)

To all whom it may concern:

Be it known that I, MARK A. REPLOGLE, a citizen of the United States, residing at Akron, in the county of Summit and State of Ohio, have invented certain new and useful Improvements in Electrical Governors; and I declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

This invention relates to that class of governors in which electromagnets and electrical circuits are used to set into and out of operation mechanisms for increasing and decreasing the supply of power or motive force in the machinery to be governed.

The objects of this invention are to provide a cut-out for the purpose of preventing the governor from acting to excess or overdoing and to provide a relay for automatically changing the positions of the electrical contact-points for the purpose of preventing the phenomenon known as "racing" in governors; and is particularly designed as an improved form of the device for which United States Letters Patent were granted to me June 7, 1892, No. 476,311, and also August 4, 1896, No. 565,032.

To this end the invention is comprised in the arrangement, construction, and combination of the several elements herein described, and illustrated in the accompanying drawings, in which—

Figure 1 is a top view of one of my improved electrical governors complete. Fig. 2 is a side elevation of the same. Fig. 3 is an end elevation of the same. Fig. 4 is a diagrammatic view of the sliding bracket, quadrant, cam, and gear which are used to shift the position of the electrical contact-points used in my device. Fig. 5. is a detail view of the brake and brake-wheel used to steady the motor-controlling shaft. Fig. 6 is a detail view of the electrical cut-out which is used to stop the action of the governor, a cross-section on line *x y* of Fig. 3. Fig. 7 is a typical view or diagram showing an electric battery, the magnets, contact-points, contact-lever, cut-outs, and my method of wiring the machine.

Similar letters and figures of reference refer to similar parts throughout the several views.

In the drawings, A designates the frame or base-plate on which my machine is built. B B are journal-stands bolted thereto, to which the main or motor-controlling shaft S is journaled.

C designates a pillar or pedestal on which is mounted the common speed-governor E and from which extends the arm D, supporting a small dash-pot G and vertical sliding rods *h h*, on which is mounted a sliding bracket H, carrying the contact-points *i* and *j*. The dash-pot G is integrally cast with the arm D and is fitted with a plunger *g*, which is pivotally attached to the oscillating rod or lever F, which is adapted to be raised or lowered by the action of the centrifugal governor-balls of the governor E. The quadrant K is keyed to the shaft L, which it is designed to turn, it being toothed and geared to the pinion *k* on the end of the shaft S, and the cam J is so disposed on the end of the shaft L that the projection *l* rests on the sliding surface of the cam, so that turning one way will lift the bracket H, with its contact-points, upward, and turning in the opposite direction will let the sliding bracket slide downward by its own weight.

M and N designate horizontal electromagnets fixed to the supports *m* and *n* in such position that the armature-levers *t* and *t'* will, the one and then the other, be swung into contact with their respective magnets as the arm *v* is vibrated by the pitman P, which is attached by means of a crank to the shaft of the belt-wheel W. The arm *v* carries two pawls *p* and *p'*, which it vibrates in an arc over the double ratchet-wheel R, the vibrated arm *v* being centered or journaled on the shaft S, while the ratchet-wheel R is securely keyed to the said shaft. The shaft S is prevented from sliding lengthwise in its journals by means of the collars T T. To the shaft S is also keyed a brake-wheel R', with which the brake-jaws X X, which are pivoted to the base A at *a*, engage. The brake is adjustable by means of the hand-screw O and

is designed to steady or hold the shaft S in the positions to which it is set by the pawls *p p'* and ratchet-wheel R aforesaid, the force of the said pawls being sufficient to overcome the resistance of the brake.

When the gate of the motor is fully closed, the shaft S should be revolved until the quadrant-sector K is turned to one end of its course, as that shown by full lines in Fig. 4, and when it is fully open the said quadrant by means of the revolution of the shaft S should be turned to the opposite end of its course, as that shown by the open lines in said Fig. 4, and likewise the cam J should be so adjusted on its shaft L that the bracket H is dropped to the lower part of its course in the one position of the quadrant aforesaid and shifted to the upper end of its course when the said quadrant takes the other position, as aforesaid. The armature-levers are pivoted to a pin *o* in the arm *v* and are weighted, so that the armature of each lever has a tendency to hang in such position that its armature will be swung against the corresponding magnet, which is at the outer end of its course. The pawls *p* and *p'* are respectively pivoted to the upwardly-extending lugs of the arm *v* by means of the pins or bolts *r r*, so that the pawls are in the same vertical plane with the ratchet-wheel R, which they are adapted to actuate. The upper ends of each of the armature-levers extend to and are adapted to engage with the under sides of the pawls *p* and *p'*, so as to normally hold them out of engagement with the ratchet-wheel R, and the pawls are counterbalanced, so as to make them readily or easily lifted out of engagement when in engagement and easily held or prevented from coming into engagement with the said ratchet-wheel R.

To the shaft U, which is journaled to the opposite end of the base A by means of the journals *b b*, the belt-wheels W and *w* are keyed, the belt-wheel W being adapted to be belted to the main or jack shaft of the machinery to be governed or regulated and drives the whole machine, and the belt-wheel *w* is used for driving the speed-governor E. The shaft U is also provided with a crank or crank-wheel V, which drives the pitman P, designed to oscillate the arm *v*.

In Fig. 7, Z designates a battery or other source of electric current which is used to charge the magnets M or N, according as the lever F touches the contact-point *i* or *j*. When the end of the lever F touches *i*, the circuit is completed through the wires 1 and 3 and the stand and the lever F of the governor E. On the other hand, if the end of the lever F touches *j* the circuit is completed through the wires 2 and 3 and the stand and lever F of the governor E, the wire 3 being secured to the stand of the governor at 3'. The wires 1 and 2 are each passed through the circuit-breaker, (shown in Fig. 6,) and they are respectively attached to the adjustable screws *q'* and *q*², which have their ends pressed against the flexible strips *q* and *q*, by means of which the respective circuits through 1 and 2 are adapted to be broken. These strips are arranged immediately under the shaft L and under the member Q, which is secured thereon in such position that its arms Q' and Q² are each adapted to engage with the upper ends of the flexible strips *q* and *q* as the quadrant K is turned to fully-open or fully-closed positions.

The operation of the machine may now be explained. The gate of the motor is suitably connected to the shaft S, so that it may be opened when the shaft is turned in one direction and closed when the shaft S is turned in the opposite direction. The belt-wheel W is then belted to a suitable shaft of the machinery to be governed and kept in continual motion at a fairly-rapid speed. The governor E is also belted to the belt-wheel *w* with such sized belt-wheels as will speed the governor, so that at normal speed the governor will maintain the lever F in a substantially horizontal position. The quadrant should also be adjusted so that it is in medium position (shown in all the figures except Fig. 4) when the machine is at normal speed and the plant doing its normal amount of work. The cam J should also maintain the bracket H at about the middle of its course during the conditions just described. The machine being thus installed and adjusted, if there is a variation below the required speed the governor E will press at the pivot *e* and tilt upward the farther end of the lever F, which is fulcrumed at *f*, until it touches the point *i*, thus completing the electrical circuit through the wires 1 and 3, charging the magnet M. The magnet M being thus charged, when the armature-lever *t* is next swung against it the said lever will be held with its armature against the magnet, while the arm *v*, holding the pawl *p*, pivoted at *r*, will be swung in such direction that it will drop the pawl *p* into engagement with the ratchet-wheel R and turn the shaft S so as to open the power-supply, and in so doing it shifts the quadrant, turning the cam J and lifting the bracket H, carrying the contact-points *i* and *j* upward, where the point *i* will not be touched again by the lever F unless an additional drop in speed occurs; but of course the adjustment must not be such that the operation of the cam would raise the bracket H until the point *j* touches the end of the lever F. In other words, the adjustment should be such that at one operation of the pawl the cam should lift or drop the contact-points which are carried by the bracket H to such position that the end of the lever F is disposed midway between them. The purpose of this is evident, for if the change which caused the variation in speed is a permanent or a relatively permanent addition to the work to be done the governor will have shifted the power-supply open to the position required to do that work and will have adjusted itself into the posi-

tion best adapted to maintain normal speed under the new condition. If, however, the cause of slowing speed is something sudden and temporary, when the governor has shifted the motor-gate so as to turn on a greater supply of power it is evident that after shifting the contact-points, if the cause is removed which slows the speed in that position of the gate, the speed of the machinery will rise above normal, which will cause the end of the lever F to come in contact with the point *j*, thus completing the electric circuit through the wires 2 and 3 and charging the magnet N, which, similar to the magnet M, controls the pawl *p'*, which turns off the power-supply immediately after it has been turned on. Also in case the cause which dropped the speed continues and in addition thereto still more load of work is thrown on the plant the governor will continue to open the gate wider and shift the bracket H higher until, if required, the motor-gate is fully open and the bracket H is shifted to the upper end of its course. In this latter position it will be seen the arm Q', attached to the shaft L, will press the flexible strip *q* away from the contact-point *q'* in the circuit-breaker, (shown in Fig. 8,) thus breaking the circuit which charges the magnet M, which will prevent the machine from straining or breaking the connections which control the gate. Of course it is plain, under the latter conditions, that the full capacity of the power having been thrown on the machinery to be governed may after that drop below normal speed as much as may be, even to stopping, yet if the load is removed again and the machinery speeds up until it comes to normal speed the moment it speeds slightly above normal the governor will again take it in hand and turn off power-supply, and if the load continues to be removed, so that the speed tends to increase at each operation of the governor, the bracket H, with its contact-points, will be lowered so as to keep normal speed at any position in which the change to lighter work may cease, and if the change to lighter work does not cease until all or nearly all the power is turned off the governor will have been changed step by step from a governor of speed in the heaviest work to a governor of speed in the lightest work to be done by the plant, with but very little variation of speed in making the change. In the latter case, when the power has been turned off until the quadrant K is shifted to the opposite end of its course and the bracket H is dropped to the lower end of its course, the arm Q^2, attached to the shaft L, will press its corresponding flexible strip *q* away from its contact-point q^2, thus breaking the circuit passing through the wires 2 and 3, so that the magnet N will no longer be charged and the governor will turn the gate no farther in that direction. The adjustment may be such that when the latter condition exists the gate is fully closed, or it may be so adjusted that so little power is turned on that there is no danger of the machinery speeding too high when running empty.

The movable contact-points attached to the bracket H and sliding on the rods or guide-posts *h h* must be insulated each from each and also from the arm D of the pedestal C in the operation of the machine. This may be done by any suitable method. The dash-pot G during the operation of the machine should also be filled with a liquid through which a plunger *g* may move by a light pressure, but will not be moved by slight sudden jerks. This arrangement, it is evident, will prevent the lever F from making contacts with *i* and *j* by the trembling motion of the machine or at any time when not caused by the pressure induced by variation in speed.

Having thus described my invention, I do not claim as new all of the features herein set forth, and I do not confine myself to the exact constructions and arrangements set forth, as it is evident that many details may be modified and varied without departing from the general spirit of my invention.

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

1. In combination with an electrical governor having a pair of electromagnets, a pair of insulated electrical contact-points by means of which electrical circuits may be completed through the said magnets, the said insulating contact-points being separately adjustable and jointly movable substantially as described and for the purpose set forth.

2. In a governor the main or motor-controlling shaft having a pinion keyed thereto engaging with the toothed partial circumference of a sector or quadrant, the said sector or quadrant operating a cam adapted to change the basis of governing, to correspond with the different loads of work thrown on or off the machinery or plant to be governed substantially as specified.

3. The herein-described governing apparatus consisting of a main or motor-controlling device built upon a base plate or frame, having a pedestal erected thereon and the said pedestal surmounted with a common centrifugal governor and also provided with a horizontal arm supporting guide-posts or sliding rods, the said sliding rods being provided with a sliding bracket carrying electrical contact-points with the end of a tilting lever disposed between them, the said tilting lever being fulcrumed intermediate of the common speed-governor and the contact-points aforesaid, and being adapted to be operated by the action of the centrifugal balls of the governor, for the purpose of setting into and out of operation the main or motor-controlling device and means by which the main or motor-controlling device may change the location of the contact-points aforesaid substantially as specified and for the purposes set forth.

4. In an organized governing apparatus, the combination of a motor-controlling device

adapted to be set into and out of operation by means of electromagnets and electrical circuits adapted to charge the said magnets, with a common speed-governor operating a tilting lever adapted to make the required electrical connections and means whereby the motor-controlling device may shift the points, through which the electrical connections are thus made for the purpose of adapting the apparatus to light or heavy work substantially as specified.

5. In a governing apparatus having a main or motor-controlling shaft, a pair of sliding rods or guide-posts disposed over and above said motor-controlling shaft, the said rods having a bracket sliding thereon, a projection of the said bracket engaging with the curved surface of a cam attached to a shaft and the said shaft also provided with a sector or quadrant geared to a revolving pinion on the said motor-controlling shaft so as to move the sliding bracket upward when the motor-controlling shaft is turned in one direction and to allow it to drop downward when the motor-controlling shaft is turned in the opposite direction substantially as specified and for the purposes set forth.

6. In an organized governing apparatus consisting of a motor or gate controlling device, the said motor or gate controlling device being composed of a main shaft S to which is keyed a double ratchet-wheel R by means of which, the said shaft is adapted to be turned, the oscillating arm *v* carrying oppositely-disposed pawls adapted to engage with the said ratchet-wheel, the said arm adapted to be continuously vibrated by means of a pitman P and crank V driven by a belt-wheel W for the purpose of operating the motor-controlling shaft; in combination with a common speed-governor E adapted to operate a tilting lever F for the purpose of setting into or out of operation one or the other of the pawls aforesaid and means for shifting the field for operation of the said tilting lever to correspond with the load or degree of work imposed upon the plant or machinery to be governed substantially as specified.

7. In a governing apparatus of the kind described, a motor-controlling shaft having a pinion keyed thereto and the said pinion geared to a sector or quadrant adapted to turn a shaft parallel and over the motor-controlling shaft, which last-mentioned shaft is provided with a cam adapted to raise and lower a bracket sliding on vertical rods and carrying electrical contact-points, adapted to make connections setting into and out of operation mechanisms for turning the motor-shaft aforesaid all arranged for joint operation in the manner specified and for the purposes set forth.

8. In an organized governing apparatus of the kind described, a pair of electrical circuits and corresponding electromagnets for the purpose of setting into and out of operation mechanisms for turning on or off the supply of power, the herein-described cut-out consisting of flexible strips connected with the wires of the said electrical circuits, so that the said circuits are completed through the said strips and the said strips adapted to be pressed out of contact so as to break the circuits aforesaid, in combination with a pair of arms disposed on a revolving shaft and placed over such strips in such relation, that if the said shaft is revolved in one way one of said circuits will be broken by one of the arms pressing its corresponding flexible strip out of contact, and if the shaft be revolved the other way the other of said arms will press out of contact its corresponding flexible strip for the purpose of cutting out the action of the governor substantially as specified.

In testimony whereof I affix my signature in presence of two witnesses.

MARK A. REPLOGLE.

Witnesses:

D. L. MARVIN,

C. S. HOVEY.