(No Model.) 2 Sheets—Sheet 1.

M. A. REPLOGLE.

ELECTRICAL GOVERNOR.

No. 476,311. Patented June 7, 1892.

Fig. 1.

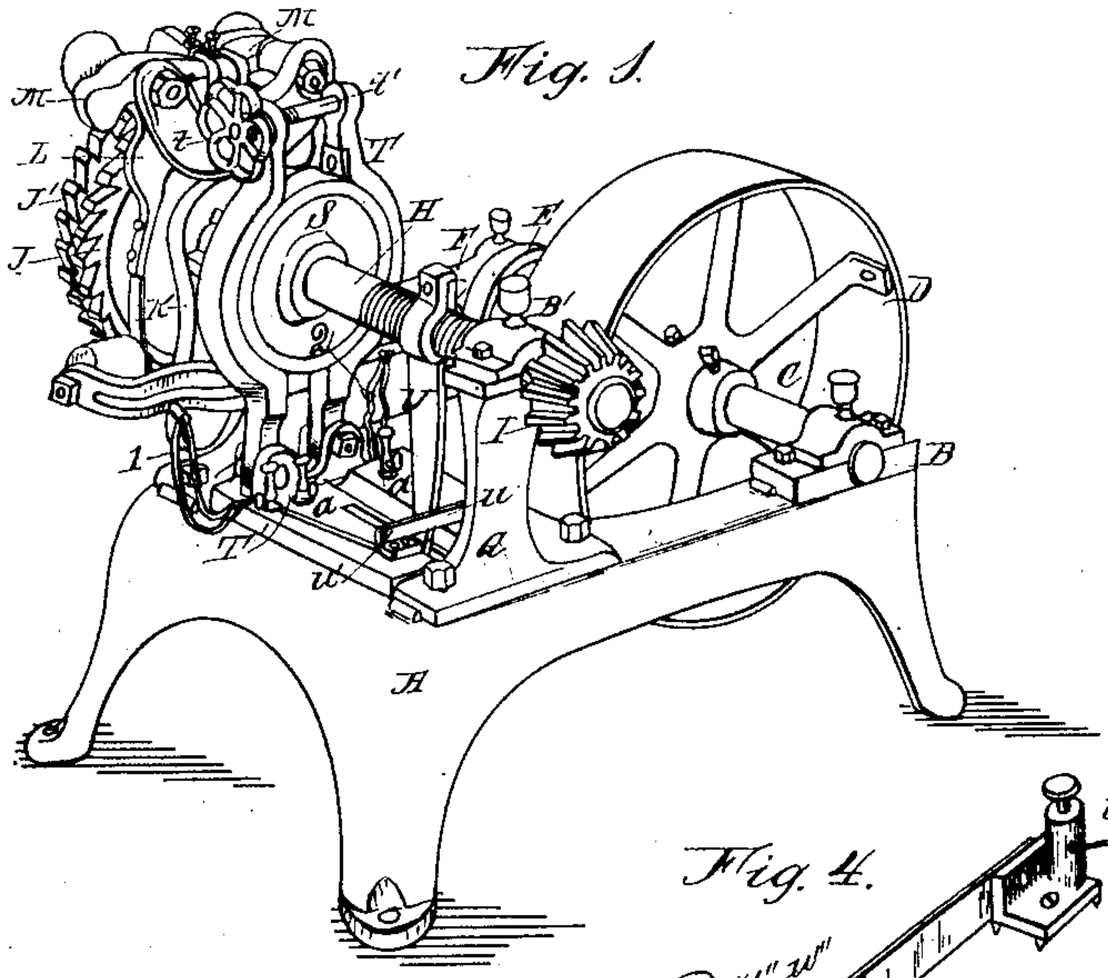


Fig. 3.

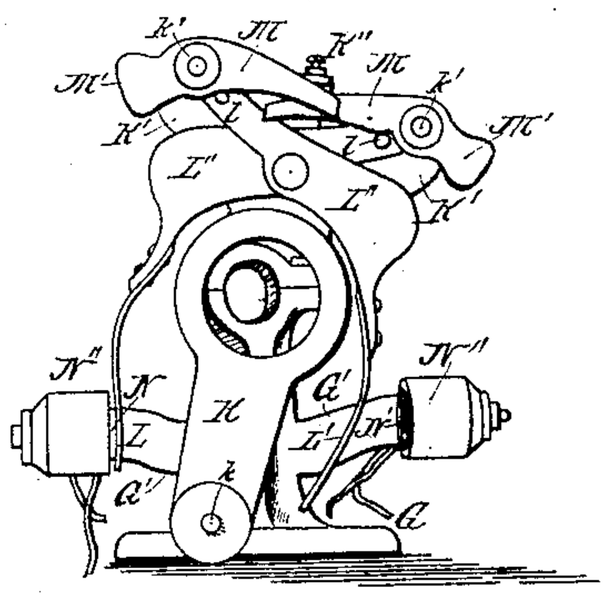


Fig. 2.

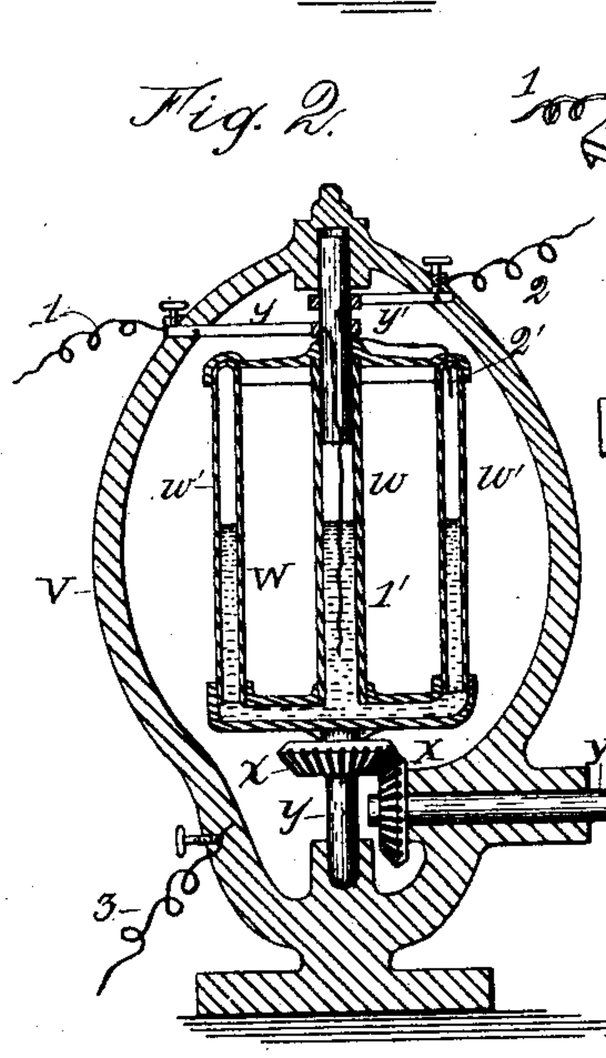


Fig. 4.

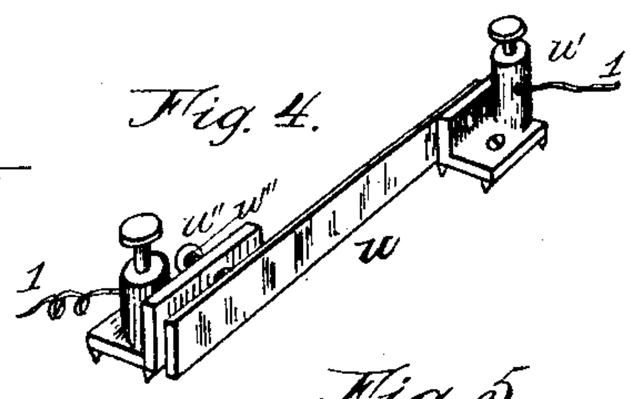


Fig. 5.

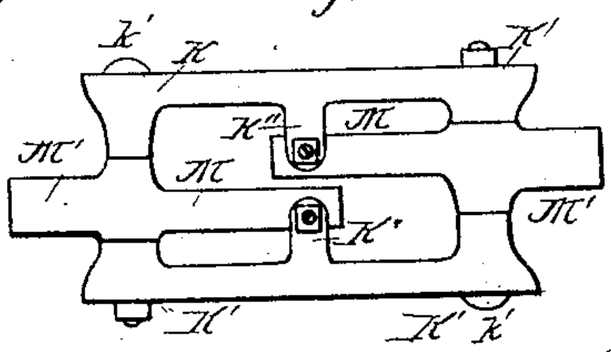


Fig. 6.

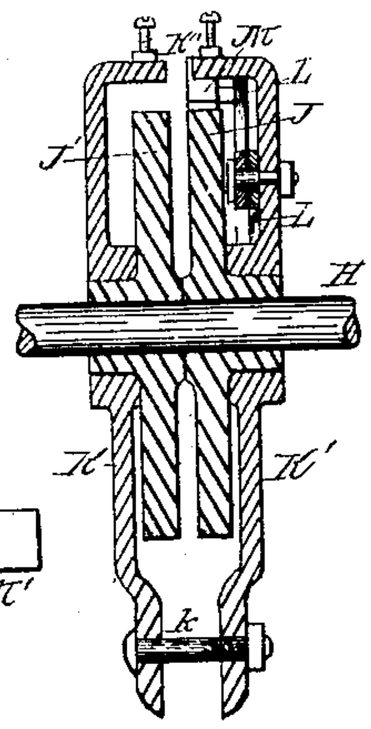
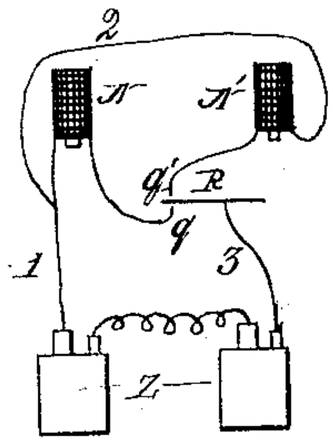
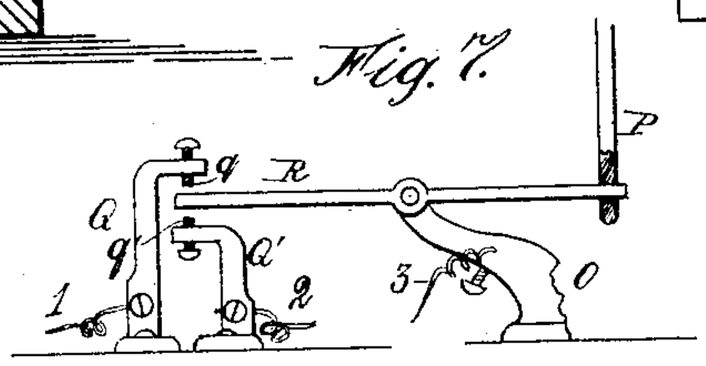


Fig. 7.

Fig. 8.





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(No Model.) 2 Sheets—Sheet 2.

M. A. REPLOGLE.

ELECTRICAL GOVERNOR.

No. 476,311. Patented June 7, 1892.

Fig. 9.

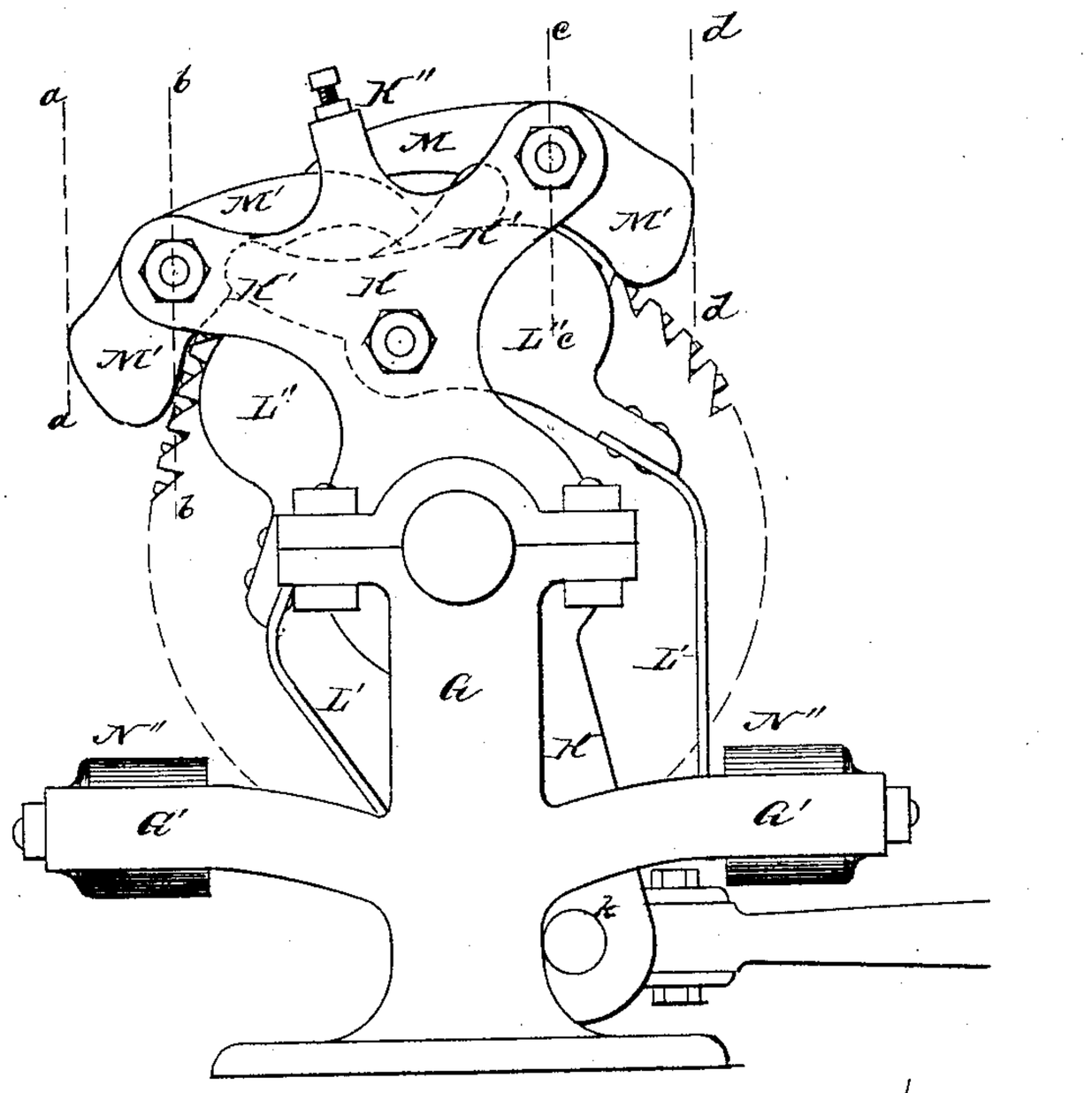
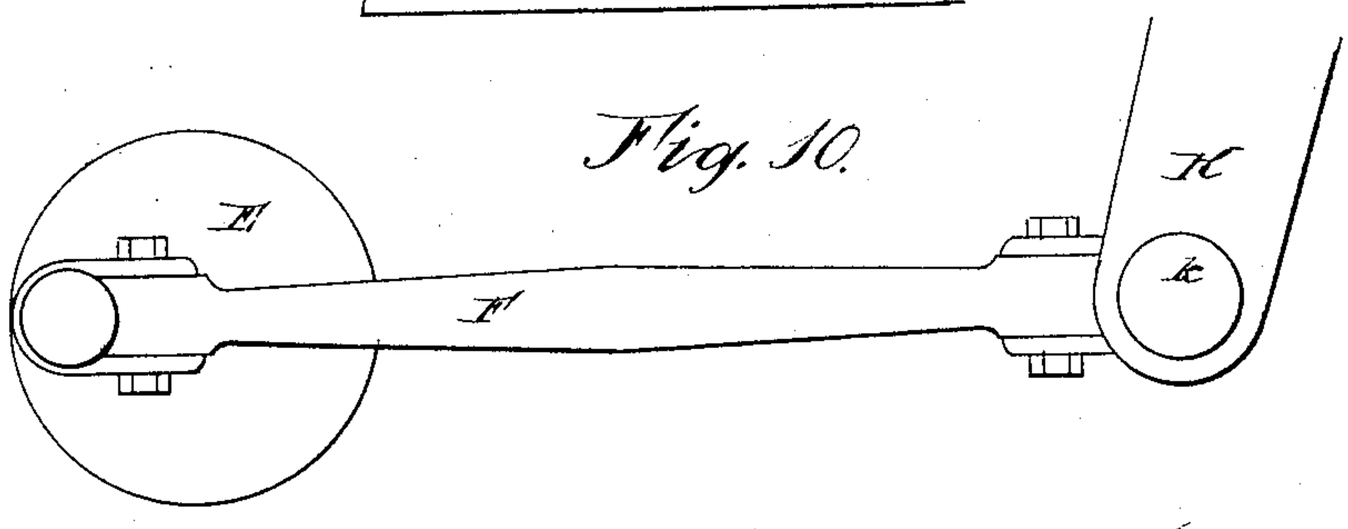


Fig. 10.



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UNITED STATES PATENT OFFICE.

MARK A. REPLOGLE, OF MATTAWANA, PENNSYLVANIA.

ELECTRICAL GOVERNOR.

SPECIFICATION forming part of Letters Patent No. 476,311, dated June 7, 1892.

Application filed December 12, 1890. Serial No. 374,443. (No model.)

To all whom it may concern:

Be it known that I, MARK A. REPLOGLE, a citizen of the United States, residing at Mattawana, in the county of Mifflin and State of Pennsylvania, have invented certain new and useful Improvements in Electrical Governors; and I do hereby 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.

The object of this invention is to improve the construction of electrical governors, so as to render them more symmetrical and workmanlike in appearance and more sensitive and efficient in service than hitherto.

The invention consists in the construction, combination, and arrangement of parts, as hereinafter fully set forth and claimed.

In the accompanying drawings, forming a part of this specification, Figure 1 is a view in perspective of the main portion of a machine embodying my invention. Fig. 2 is a central vertical section of a mercurial governor adapted to operate in connection with the machine shown in Fig. 1. Fig. 3 is a side elevation of the ratchet-operating mechanism of my machine. Fig. 4 is a perspective view of a circuit-breaker applied to the machine. Fig. 5 is a plan view of the oscillating arms and connected pawls. Fig. 6 is a central vertical section of the same. Fig. 7 is a fragmentary view of mechanism to connect a common ball-governor with the machine, and Fig. 8 is a typical view of an electrical battery and the mode of connecting the same with the machine. In Sheet 2, Fig. 9 is an elevation showing the parts illustrated from the opposite side; and Fig. 10 shows the connection of the crank-wheel and the lower end of the oscillating arms.

Similar letters and figures of reference indicate corresponding parts.

Referring to the drawings, A is the bed or frame of the machine, made in a neat and substantial style of cast-iron. One end of the bed is bifurcated, and on the two members thereof are mounted boxes B to receive the shaft C, carrying a belt-wheel D. One end of the shaft is provided with a crank-wheel E, to the wrist of which is connected a pitman F, the other end of which connects with the wrist *k* of oscillating arms K K′, hereinafter to be more particularly described.

Opposite the boxes B B, at the other end of the frame, are standards G G, with boxes B′ B′ at the upper ends to receive the shaft H, on one end of which is a pinion I to engage with the power-supply mechanism of the motor to be regulated. At the other extremity of this shaft are keyed ratchet-wheels J J′, adapted to move in opposite directions. On the outwardly-extended hubs of these ratchet-wheels are loosely mounted the oscillating arms K K′, above referred to. These arms, as will be seen, are made from the same pattern, and are connected at the bottom by the wrist-bolt *k* and at the diverging upper portions by bolts *k′ k′*, on which are pivoted the pawls M M, adapted to actuate oppositely the ratchet-wheels above described. Lugs K″ K″, provided with a set-screw, serve for an adjustable stop for these pawls. To one of these arms K′, below the pawls, is pivoted a pair of armature-levers L L′, the lower extremities of which are adapted to engage with electro-magnets N N′, mounted on arms G′ G′, attached to or forming a part of the standard G.

An improvement in the construction of the pawls consists in providing them with counter-weights M′ M′, whereby they are nearly balanced on the pins *k′ k′*, the weight of the inner ends being of course sufficient to permit prompt engagement with the ratchet-wheels. It will be noticed that these pawls are of peculiar construction, in that the counter-weight, instead of being in line with the point of the pawl and pivot, is mostly below such line, the whole body of the pawl thus conforming to a considerable degree to the curvatures of the ratchet-wheels. The object of this is to produce a differential effect in the gravital action of the pawl as between its initial and final movement. This point is clearly illustrated in Fig. 9, in which the pawl at the left may be supposed to represent the initial position and the one at the right the final position. In the former, as will be clear by considering the relative amount of weight between the lines *a a* and *b b* in one case and the lines *c c* and *d d* in the other, there is less weight counteracting the weight of the opposite end of the pawl than in the latter. Now

in practice this is what is desirable instead of the contrary action. In the final position the armature-lever L′ is at a distance from the magnets, unless it shall have been previously caught by the magnets on the reverse stroke. Consequently the whole weight of the armature-lever and the counter-weight L″ is brought to bear against the under side of the pawl to liberate it from the ratchet-wheel. In the initial position the armature-lever is carried by the oscillation of the arm K to the position shown. Now if the magnet is charged the armature engages, and there is relatively more weight in the pawl to cause its prompt engagement with the ratchet-wheel. In short, by this construction of the pawls I am able to operate my governor with a much weaker current than would be possible with a spring-controlled pawl, or even a pawl having a counter-weight in line with its pivot and point. To counteract the extra weight of the inner ends of the pawls, the armature-levers are increased in weight at L″ L″, so that as soon as released from the electro-magnets the arms swing free therefrom. At the upper end they are provided with lateral lugs or studs *l l*, which engaging with the pawls lift them out of contact with the ratchet-wheels when the armature-levers are disengaged.

In Fig. 7 is shown so much of a common ball-governor as is sufficient to illustrate the operation of the machine. P is the stem of such a governor, adapted to move up or down, according to the velocity of the governor, in the usual way. O is a portion of the governor standard or base. To this is pivoted a lever R, one end of which engages with the stem P and the other passes between the electrical points *q q′*. These parts communicate electrically with the machine and a suitable battery by means of wires 1 2 3. (See Fig. 8.)

In Fig. 8 is represented the electrical connection of the battery Z with the governor and the machine. Wire 1 connects the battery with the point *q* and the electro-magnet N. Wire 2 in the same manner connects the battery with the point *q′* and the magnet N′. A return-wire 3 connects the battery with the lever R.

The operation of the machine will now be readily understood. Continuous motion is imparted to the pulley D by a belt connecting with any other continuously-running pulley. This causes continuous oscillation of the arms K K′. When the motion is normal, the armature-levers hang inwardly at the lower end, and thus hold up the pawls from engagement with the ratchet-wheels. When the speed of the motor increases, the governor-stem P is depressed or elevated, according to its construction, carrying the lever R into contact with the point *q*. A circuit is thus made through the wires 1, 1, and 3 and the electro-magnet N. At the succeeding contact of the armature L it is held, thus permitting the pawl supported by it (the one at the right in Fig. 3) to drop into engagement with the ratchet-wheel J′, whereby the shaft H is turned to shut off the supply of power to the motor. When the motion is too slow, contact is made with the point *q′*, and thence in the same manner through the other electro-magnet, and the movement of the shaft is reversed, thus increasing the supply of power. The maximum movement of the shaft H is determined by means of an automatic circuit-breaker. A portion of the shaft H is screw-threaded, and on this is mounted a nut U, having a depending arm adapted to engage with a spring *u*, attached to a binding-post *u′* at one end and the other adapted to engage with the end of a screw *u‴* in the binding-post *u″*. Normally the current to one of the electro-magnets passes through the spring-conductor *u*, but on the shaft being turned past a certain limit the arm U throws the spring out of contact and breaks the circuit. The nut is made double to admit of ready adjustment to any desired point on the shaft.

In practice the electro-magnet which I use in this governor is that described in my application for Letters Patent of even date herewith and serially numbered 374,442. The device, briefly described, consists of a single electro-magnet N N′, surrounded by a cup N″, the effect of which is to intensify the power of the magnet, on the same principle that the bending of a magnet in the form of a horseshoe increases its power, and also to gather up the magnetism otherwise dissipated in the air from the outside of the coil. The device is not only a more powerful magnet than those in common use, so that a weaker current is sufficient to operate the governor, but its form is such as to make it specially convenient in this place. Where the common double electro-magnet is used, great care must be taken to so bend the armature-levers L L′ as to secure contact with the poles of each. In this, however, only a single pole is brought into contact with the armature, (the cup receding somewhat from the end of the magnet,) so that it is a very easy matter to secure proper contact of the armature-levers.

In Fig. 2 is shown a mercurial governor adapted to control the action of the machine. V is a suitable standard, within which is mounted a vertical shaft Y, to which motion is imparted by the horizontal shaft Y′ and its pulley through the medium of bevel-gearing X X. On the vertical shaft is mounted a tripodal vessel W to hold mercury. The middle member *w* should have the same capacity as the other two, with which it communicates at the bottom through the hollow transverse member *w″*. The vertical members should be made of glass, so that the position of the mercury and wires inside may be seen, as well as for perfect insulation. The central tube is provided with an iron wire 1′, the lower end of which extends to near the bottom of the tube and the upper end of which is brought to the surface of the vertical shaft and has contact with a brush or collector *y*, insulated

from the standard V. To this brush is connected a wire 1, which corresponds with the wire so designated in Fig. 8. Another wire 2 connects in the same manner with a brush or collector y', taking the current from contact with a wire 2', entering one of the lateral tubes. The lower end of this wire should terminate near the top of the tube. At some suitable point a third wire connects with the standard and is numbered 3 to correspond with the return-wire in Fig. 8.

The action of the governor will now be understood. When it is still, the mercury stands at a level, as shown. At a certain rate of speed contact is maintained with the wire in the middle tube. When the governor attains a high rate of speed, the mercury is thrown out of the middle tube and ascends the side ones until contact with the central wire is broken and re-established with the lateral one. This wire so connects with the machine as to cause it to operate to slacken the speed, whereupon the equilibrium is restored. The central wire and its connections have the opposite effect. The construction is such as to render the governor extremely sensitive, since the element displaced by the centrifugal action is a fluid, and there is practically no friction.

To hold the motor at any desired point or to retard the movement of the shaft H, it is provided with a brake consisting of a wheel S and a pair of friction-arms T T, pivoted at the lower end to a block T' and at the upper end provided with a clamping-nut t and screw t'.

It is to be understood that the electrical apparatus is insulated from the bed and other parts of the machine, the binding-posts being mounted on wooden blocks a a, attached to the frame.

I have not shown the battery or governor in connection with the main machine, since they may be set anywhere and transmit the electrical current by wires of any length.

Thus constructed the machine presents a neat and substantial appearance and is of such a character as to perform efficiently, even with a weak current, the work required of it. It is not pretended that the principle upon which the machine operates is new; but in its construction I have introduced certain improvements calculated to make it a more practical and symmetrical machine than those in common use. For example, I have set the electro-magnets lower than the shaft H and placed the armature-levers below the pawls, thus making the arrangement very compact and practically concealing the armatures from view from the other side of the machine. The particular features which I regard as novel and my own are pointed out in the claims.

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

1. In an electrical governor, the combination, with means, substantially as described, for establishing and breaking an electric circuit according to certain rates of speed, of a pair of electro-magnets separately communicating with such means at high and low speed, respectively, a pair of armature-levers pivoted to an arm continuously oscillating between said electro-magnets, a pair of pawls having depending counter-weights, substantially as described, pivoted to said arm above the levers, lugs or studs on the levers to hold the points of the pawls up, and oppositely-arranged ratchet-wheels secured to a shaft, adapted to control the power-supply of the motor.

2. In an electrical governor, the combination, with a continuously-oscillating arm, of a pair of pawls adapted to engage with ratchet-wheels, oppositely-arranged ratchet-wheels secured to the motor-controlling shaft, said pawls having depending counter-weights, as described, a pair of armature-levers adapted to hold said pawls normally out of contact with the ratchets by gravity, and a pair of electro-magnets provided with inclosing cups, substantially as described, and alternately charged with magnetism when the speed is higher or lower than normal, respectively.

3. In an electrical governor, the combination, with the arm K and electro-magnets N N', of the armature-levers L L', having enlarged portions L'' L'' and lateral studs or lugs l l, pawls M M, having depending counter-weights M' M', and the stops K'', whereby the parts are held in normal position.

4. In an electrical governor, the combination, with a suitable standard electrically connected with an electrical supply-circuit, of a revoluble tubular vessel to contain mercury, having a vertical central tube and one or more vertical outer tubes with which the central one communicates, an electrical connection with the mercury in the central tube at speed lower than normal, and an electrical connection with the mercury in the outer tube or tubes at a speed above normal, said connections being separate and independent and insulated from the standard, substantially as and for the purpose set forth.

5. In an electrical governor, the combination of an electrically-connected standard, a tripodal mercury-retaining vessel revoluble in a horizontal plane therein, an insulated electrical connection with the mercury in the middle tube at lower speed than normal, an independent electrical connection with the mercury in the outer tube only at speed above normal, insulated collectors separately connecting with said electric media at the outer extremities, and separate electrical connections with said collectors, substantially as described.

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

MARK A. REPLOGLE.

Witnesses:
HERMAN D. WALTERS,
J. H. BARBER.