(No Model.)

M. S. CONLY.

GOVERNOR FOR DYNAMOS.

No. 459,811. Patented Sept. 22, 1891.

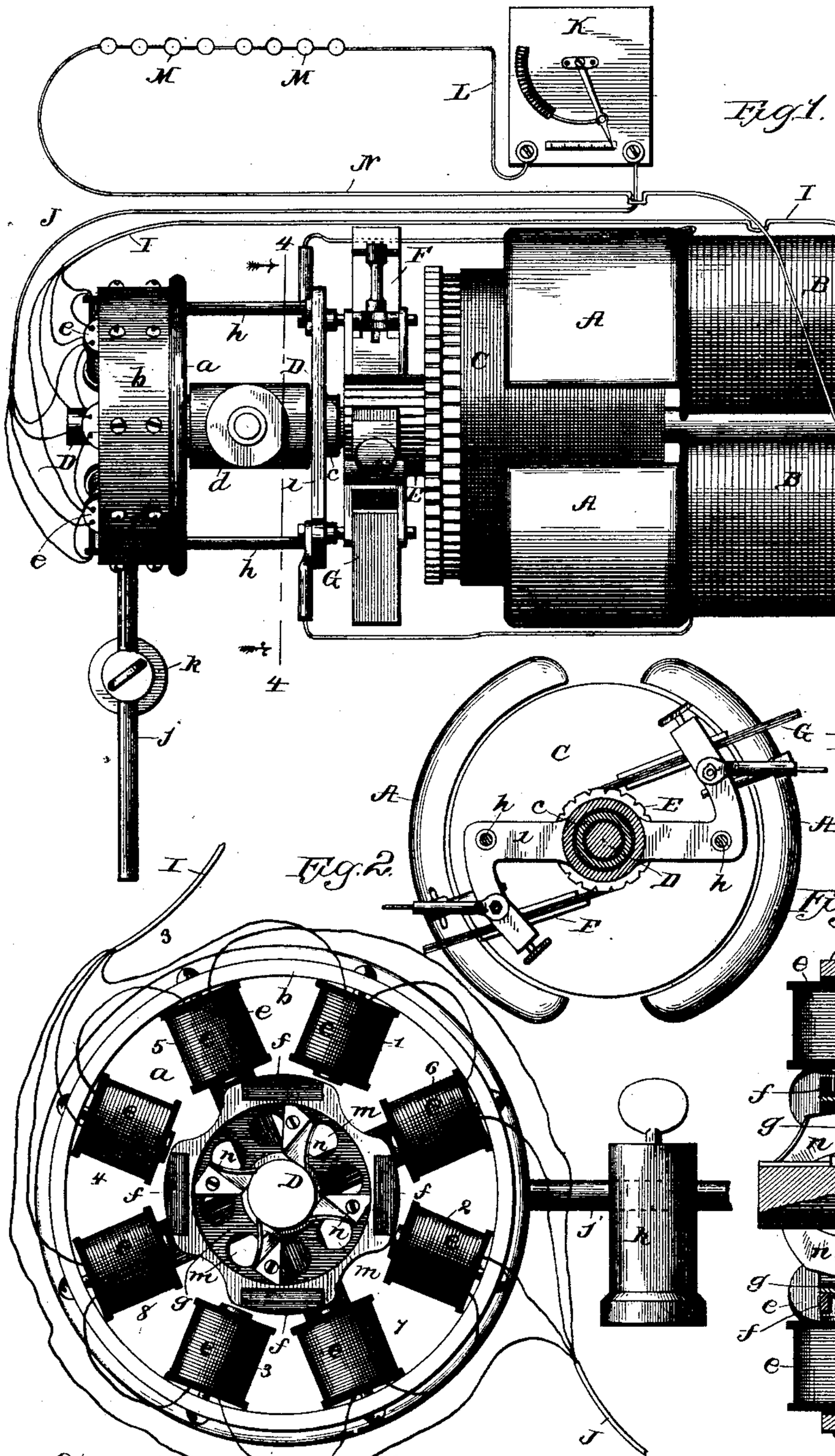

Fig. 1.

Fig. 4.

Fig. 2.

Fig. 3.

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UNITED STATES PATENT OFFICE.

MAHLON S. CONLY, OF CHICAGO, ILLINOIS, ASSIGNOR OF TWO-THIRDS TO EDWIN O. ABBOTT AND FREDERICK H. KILBOURN, OF SAME PLACE.

GOVERNOR FOR DYNAMOS.

SPECIFICATION forming part of Letters Patent No. 459,811, dated September 22, 1891.

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To all whom it may concern:

Be it known that I, MAHLON S. CONLY, a citizen of the United States, residing in the city of Chicago, and in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Governors for Dynamos, of which the following is a specification.

This invention relates to improvements in governors for dynamos automatically operated through the influence of the current of electricity generated thereby to govern and change the voltage or electro-motive force with each change in the resistance of the circuit or variation of armature speed.

Practice has demonstrated the desirability and, in fact, the necessity of governing the voltage or electro-motive force of the electric current produced by the machine according to the work to be performed by such current, less voltage being required for operating, say, a ten-light arc circuit than a twenty-light circuit, and vice versa, and it is the purpose of this class of regulators or governors to reduce the voltage of the current in proportion to the reduction of the work or to increase the voltage with an increase of the work, so that when once the current is adjusted for operating a circuit of a given resistance any change in the resistance, either in increase or decrease thereof, or any change in the speed of the armature resulting in a change in the amprage of the current will be met by a corresponding change in the voltage or electro-motive force of the current through the instrumentality of the regulator or governor, thereby automatically adjusting the amprage and voltage of the current to the new condition. The devices heretofore employed for this purpose, so far as I am aware, have been very complicated and expensive, more or less uncertain in their operation, easy to get out of order, cumbersome, limited in their range of action, and requiring a more thorough knowledge of mechanics and electricity than is ordinarily possessed by dynamo engineers to maintain them in practical operative condition.

The prime object of this invention is to provide a simple, effectual, and economical apparatus for accomplishing the desired end at minimum expense of electro-motive energy. The novel construction and operation are readily comprehended and easy to maintain in perfect working condition.

Another object is to have the governor readily adjustable to all possible variations in the initial current and so sensitive as to be instantly operated by any change in the amprage of the current due to variations of resistance in the circuit or speed of the armature, immediately operating to change the voltage or electro-motive force of the current produced by the machine in proportion to the variation of the resistance in the line, whereby a uniform current is secured and all danger of burning out the armature or any of the apparatus in the circuit is avoided.

These objects are attained by the devices illustrated in the accompanying drawings, in which—

Figure 1 represents a top plan view of a dynamo with a governor applied thereto embodying my invention, showing the line-circuit operated by the dynamo in diagram; Fig. 2, an enlarged face view of the governor; Fig. 3, a section on the line 3 3 of Fig. 2; and Fig. 4, a transverse vertical section on the line 4 4 of Fig. 1, looking in the direction indicated by the arrows.

This invention is based upon the well-known principle that the electro-motive force of the current produced by the dynamo is greatest when the brushes engage the commutator at opposite sides thereof at certain points on the circumference with relation to the field-magnets, and is reduced as the brushes are moved circumferentially about the commutator until the neutral point is reached, to which end the brushes are usually movably supported and are formerly operated manually whenever it is desired to change the electro-motive force of the current; but several forms of automatic governors have heretofore been invented for shifting the brushes with variations of resistance in the line-circuit, so as to change the electro-motive force of the current produced by the dynamo.

I may here state that my invention is applicable to any form or construction of dynamo, being herein shown in connection with a Spurry machine for convenience of illus-

tration; but to adapt it for use in connection with other machines only minor structural changes are necessary, such as may be supplied by any one skilled in the art to which my invention appertains.

Referring now more particularly to the accompanying drawings, in which like letters refer to the same parts in all the figures, A indicates the field-magnets; B, the spools or coils wound about the cores thereof; C, the armature; D, the armature-shaft; E, the commutator, and F G the brushes of the form of dynamo illustrated in the drawings, connected and operating in the usual manner.

The line-circuit operated by the dynamo may be traced by beginning at the binding-post H with the wire I, through the governor, to be described farther on, and wire J back to an ammeter K of any suitable form, and thence by wire L through the arc lights M or any other form of apparatus included in the circuit, returning by wire N to the binding-post O of the dynamo, the two binding-posts H O being connected with the terminals of the spools or coils B in the usual manner. It will thus be seen that both the governor and the ammeter are included in the line-circuit.

The governor comprises a disk or wheel *a*, provided with a lateral iron or other suitable metallic flange *b*, and mounted, if desired, upon an extension of the armature-shaft D, but preferably upon an extension of the bushing *c*, which lines the bearing *d*, in which the armature-shaft is journaled, so that the disk or wheel will not be affected by the rotation of the armature-shaft.

To the metallic flange *b* of the wheel is secured a series of electro-magnets *e*, eight of these being illustrated in the drawings, with their cores or poles extending inwardly and radially from the flange, which constitutes a common heel-piece or connector for all, and all terminating at substantially equal distances from the axis of the armature-shaft, about which they are circumferentially arranged by their attachment to the flange. The coils of these electro-magnets are all included in the line-circuit in such a manner that any two of the electro-magnets will constitute an ordinary electro-magnet with two poles. In other words, say the magnets 1, 2, 3, and 4 have north poles, while the magnets 5, 6, 7, and 8 have south poles, the north and south poles alternating with each other, so that each magnet will operate with the magnets on each side thereof to attract an armature whenever the current is flowing through the coils, and as all the coils are connected in and, in fact, form a part of the line-circuit all of the current generated by the machine necessarily passes through the coils and energizes the electro-magnets.

In large machines where heavy currents are generated a shunt may be used and only a part of the current taken. The armatures for these coils preferably consist of segmental iron pieces *f*, laminated and provided with air-spaces for cooling them and eliminating Foucault currents and mounted upon and carried by a wheel *g*, keyed upon the armature-shaft and working within the flange *b*, this wheel carrying the armatures in rapid succession past the electro-magnets, thus subjecting each armature in rapid succession to the attraction of each pair of magnets. It will of course be understood that the wheel *g* revolves with the armature-shaft, while the wheel *a*, supporting and carrying the electro-magnets *e*, remains normally stationary, although loosely journaled and free to rotate upon the bushing *c*, as before described. When, however, the current is flowing through the line and the electro-magnets are energized, their attraction for the rapidly-revolving armatures *f* induces a partial rotation of the wheel *a*, by which the electro-magnets are carried, differing in degree with the strength or amprage of the current through the magnets, which increases and decreases their attractive force for the armatures. This movement of the wheel *a* is taken advantage of to operate the brushes of the dynamo by connecting the side wheel, preferably by means of rod *h*, with the yoke *i*, carrying the brushes and also loosely journaled upon the bushing *c*, so that as the governor-wheel is caused to rotate in the manner before described the rotation thereof will be imparted to the yoke, and consequently to the brushes, moving the latter toward the neutral point of the commutator, thereby immediately reducing the voltage or electro-motive force of the current produced by the dynamo.

In order to have the governor readily adjustable for governing currents of any desirable initial voltage or electro-motive force, which of course depends upon the work to be performed by the current, the governor-wheel *a* is provided with a radially-extending arm J, to which is attached an adjustable weight K, or any equivalent device for resisting or opposing the rotation of the governor-wheel under the influence of the attraction of the electro-magnets carried thereby for their armatures, as before described. Thus the weight or equivalent devices will be moved out upon the arm or otherwise adjusted until the combined gravity and leverage thereof is sufficient to overcome, or rather balance, the attractive force of the electro-magnets, which holds the weight suspended substantially in a horizontal plane through the axis of the wheel, at which time the brushes of the dynamo will be adjusted with relation to the commutator to produce the maximum desired electro-motive force, and as long as the resistance in the line-circuit remains the same—that is, if none of the lights or apparatus are cut out or short-circuited and no others added and the speed of the armature is not changed—the electro-motive force or voltage of the current generated by the dynamo will remain substantially the same and the weight will be maintained in the radial position, which is

assumed under the initial electro-motive force of the current; but immediately the resistance in the line-circuit is changed by extinguishing, cutting out, or short-circuiting one or more of the lights or increasing the number, if it be an arc-light circuit, although the electro-motive force of the current will remain the same, if the speed of the armature be maintained, the quantity or amprage of the current will be changed, causing a corresponding increase or decrease in the attraction of the electro-magnets *e* of the governor sufficient to cause a partial rotation of the governor-wheel either against or by the quantity of the weight upon the governor-wheel, and consequently, through the medium of the connection between the governor-wheel and the brushes, will impart to the latter a corresponding movement and change the radial position upon the commutator toward or away from the neutral point, thus almost instantly varying the electro-motive force or voltage of the current produced by the machine in proportion to the change of resistance in the line-circuit, for it will be understood that the more the resistance is varied from the initial the more the amprage of the current and the attraction of the electro-magnets of the governor will be increased or diminished, causing a correspondingly greater movement of the governor-wheel and the brushes connected therewith. In other words, any change in the volume of the current is instantaneously or simultaneously compensated for by a change of electro-motive force or voltage. For instance, as long as the resistance in the line remains reduced from the initial point the governor-wheel will remain out of its normal position at the point to which it was moved by the change in the resistance, and obviously any further reduction of the resistance will cause a further and corresponding change in the position of the governor-wheel, and consequently of the brushes, toward the neutral point; but when the resistance or armature speed is restored to normal the counter-weight immediately restores all the parts to their previous position.

Although the armatures *f* of the electro-magnets of the governor do not make contact with the poles of the electro-magnets, but pass freely by in close proximity thereto, it may be found desirable in practice to provide means for preventing the heating of the armature-wheel, which should be as light as possible, and this may be conveniently done by perforating the web thereof, as shown at M in Fig. 2, and attaching to the same wings or fans *n*, which, under the rapid action of the wheel, direct a current of air against the wheel and through the perforation therein.

A governor constructed in accordance with my invention contains numerous advantages, chief among which is the simplicity of its construction and certainty of operation, as well as its adaptability for use in connection with any dynamo and for governing any desired initial current, the counterpoise or balance of the weighted governor rendering it especially sensitive to all changes in the current governed thereby. Besides this, the construction of the governor is extremely simple, cheap, and durable, it is easy to comprehend, even by one of limited electrical or mechanical knowledge, and the parts are of such character that there is little or no liability of their getting out of order.

In conclusion I may add that different arrangements of the elements described may be effected without departing from the spirit of my invention. For instance, the magnets may be revolved and their armature be normally stationary, which is a reversal of the present arrangement, or the magnets may radiate outwardly instead of inwardly from the rim or heel-piece of the governor-wheel, and the armature work upon the outside instead of inside the series of magnets—an obvious modification which would produce exactly the same results.

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

1. The combination, with a dynamo and the armature-shaft and brushes thereof, of a governor comprising a wheel connected with said brushes, but loosely journaled upon the armature-shaft and carrying a circumferential series of electro-magnets included in the line-circuit of the dynamo, and a revolving armature mounted upon and carried by the armature-shaft, said armature working within and being common to all of the magnets of said series, substantially as and for the purpose described.

2. The combination, with a dynamo and the armature-shaft and brushes thereof, of a governor comprising a wheel connected with said brushes, but loosely journaled upon the axis of the armature-shaft and provided with a metallic rim or flange, a circumferential series of electro-magnets included in the line-circuit of the dynamo and secured to said flange and for which the flange constitues a common heel-piece, and a revolving armature mounted upon and rotated by the armature-shaft, said armature working within and being common to all the magnets of said series, substantially as described.

3. The combination, with the dynamo and the armature-shaft and brushes thereof, of a governor comprising a wheel connected with said brushes, but loosely journaled upon the axis of the armature-shaft and provided with a metallic rim or flange, a circumferential series of electro-magnets included in the line-circuit of the dynamo and secured to said flange and for which the flange constitutes a common heel-piece, said magnet having alternate polarities, and a revolving armature mounted upon and rotated by the armature-shaft, said armature working within and being common to all of the magnets of said series, substantially as described.

4. The combination, with a dynamo and the armature-shaft and brushes thereof, of a governor comprising a wheel connected with said brushes, but loosely journaled upon the axis of the armature-shaft and carrying a circumferential series of electro-magnets included in the line-circuit of the dynamo, a counterpoise for said wheel, and a revolving armature mounted upon and rotated by the armature-shaft, said armature working within and being common to all of the magnets of said series, substantially as described.

5. The combination, with a dynamo and the armature-shaft and brushes thereof, of a governor comprising a wheel connected with said brushes, but loosely journaled upon the axis of the armature-shaft and carrying a circumferential series of electro-magnets included in the line-circuit of the dynamo, an adjustable counterpoise for said wheel, and a revolving armature mounted upon and rotated by the armature-shaft, said armature working within and being common to all the magnets of said series, substantially at described.

6. The combination, with a dynamo and the armature-shaft and brushes thereof, of a governor comprising a wheel connected with said brushes, but loosely journaled upon the axis of the armature-shaft and carrying a circumferential series of electro-magnets included in the line-circuit of the dynamo, a radial arm on said wheel, an adjustable weight on said arm, and a revolving armature mounted upon and rotated by the armature-shaft, said armature working within and being common to all the magnets of said series, substantially as described.

7. The combination, with a dynamo and the armature-shaft, brushes, and brush-yoke thereof, of a governor comprising a wheel loosely journaled upon the axis of the armature-shaft and carrying a circumferential series of electro-magnets included in the line-circuit of the dynamo, rods connecting said wheel with the brush-yoke, a radial arm on said wheel, an adjustable weight on said arm, and a revolving armature mounted upon and rotated by the armature-shaft, said armature working within and being common to all the magnets of said series, substantially as described.

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