(No Model.)

S. E. NUTTING.

SPEED REGULATOR FOR DYNAMOS.

No. 436,901. Patented Sept. 23, 1890.

Fig. 1.

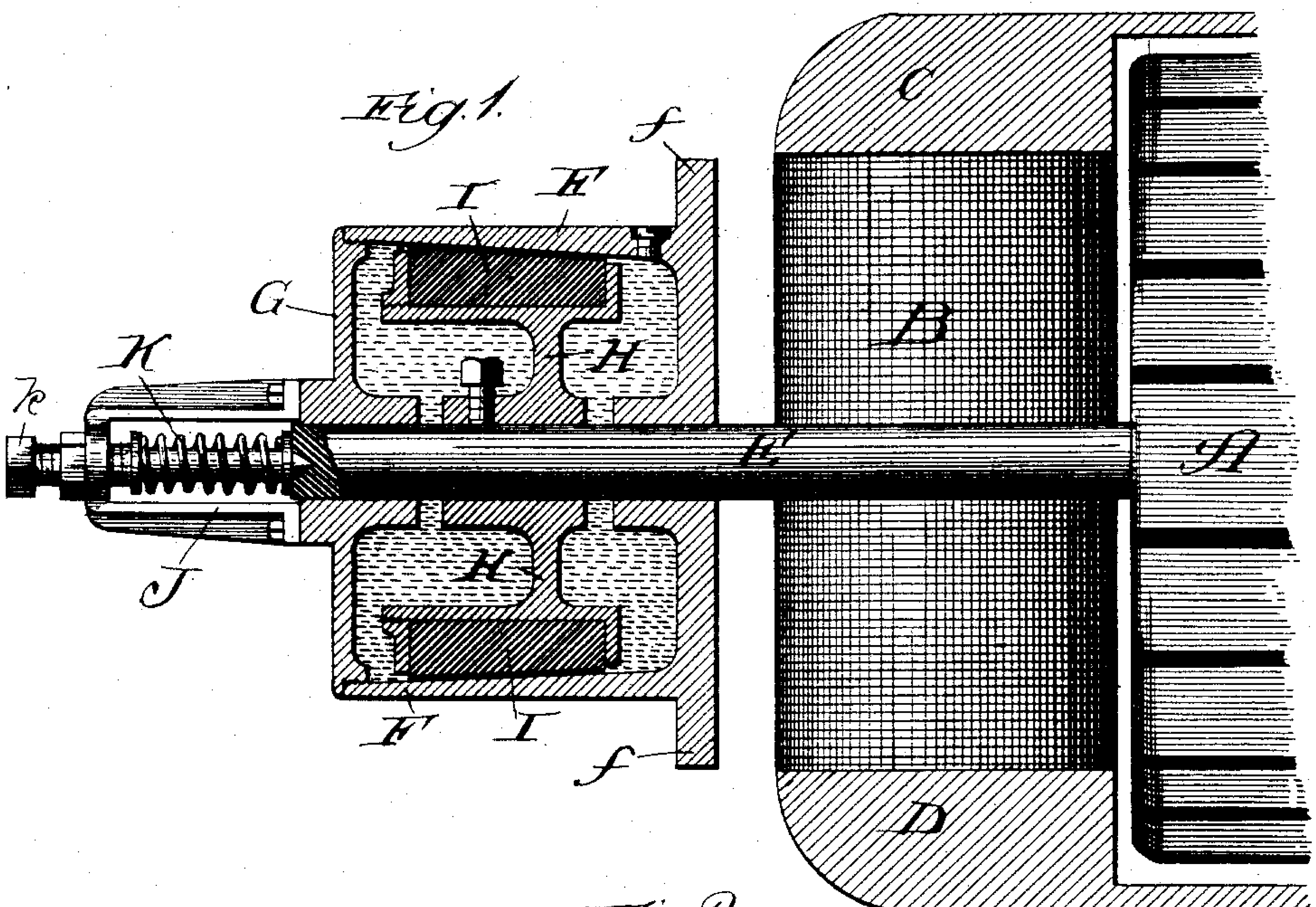
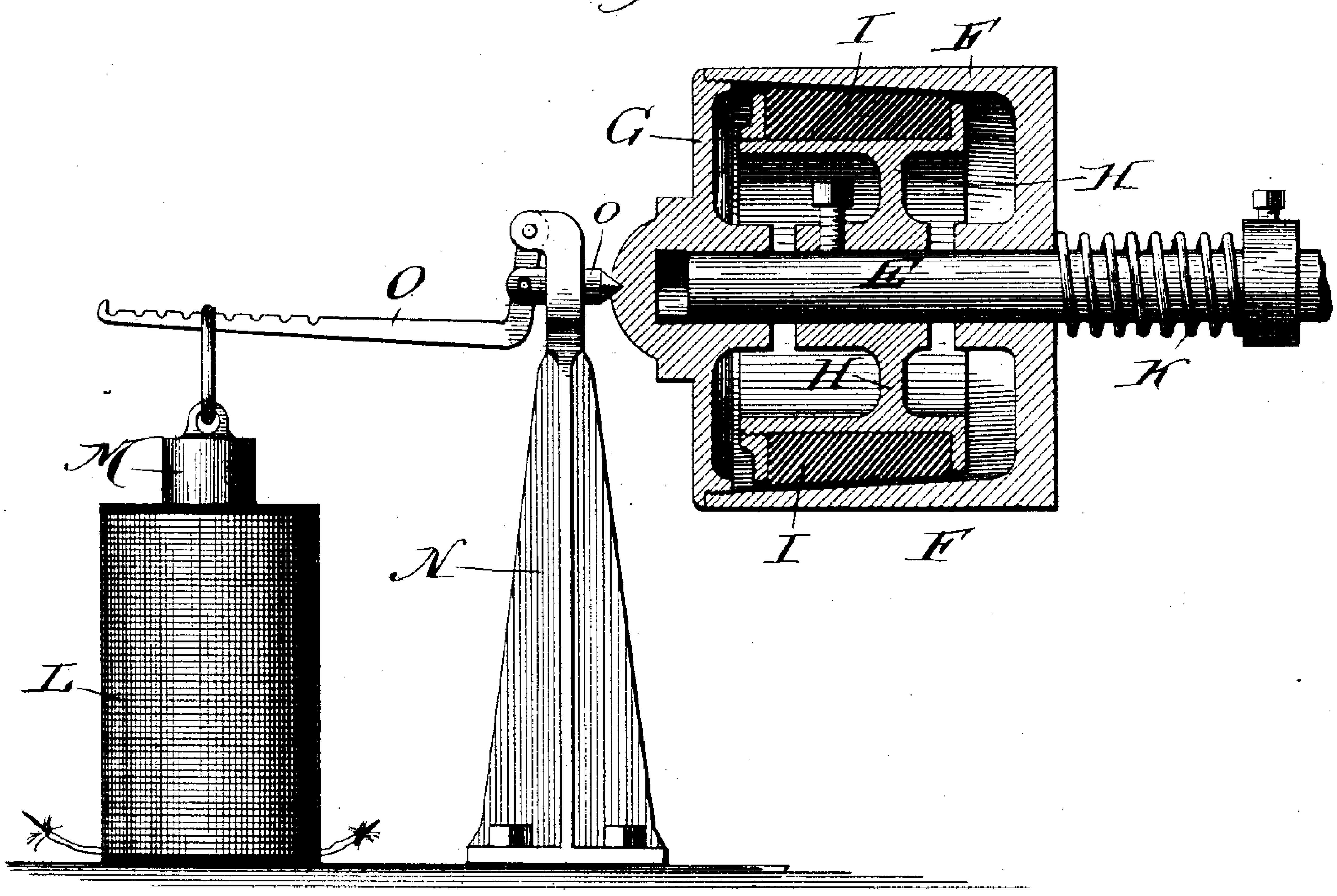


Fig. 2.



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SPEED-REGULATOR FOR DYNAMOS.

SPECIFICATION forming part of Letters Patent No. 436,901, dated September 23, 1890.

Application filed December 30, 1889. Serial No. 335,373. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL E. NUTTING, a citizen of the United States, residing at Chicago, Illinois, have invented a certain new and useful Speed-Regulator for the Armatures of Dynamo-Electric Machines, of which the following is a specification.

The object of my invention is to regulate the speed of armatures in dynamo-electric machines to constantly correspond to changes in the resistance of the circuit, so that the strength of the current will remain invariable whether the resistance be great or slight; and my invention consists in the features hereinafter described and claimed.

In the drawings, Figure 1 is a longitudinal vertical section taken through a dynamo-electric machine with my invention applied to the same, and Fig. 2 is a longitudinal vertical section of the operative parts entering into my invention as applied in a modified form.

It is well known that the strength of the current increases or diminishes with the speed of the armature where the resistance of the circuit remains the same, and that where the resistance varies the strength of the current remains the same if the speed of the armature be correspondingly varied. If, therefore, the speed of the armature can be made to vary to correspond to variations in the resistance of the circuit the strength of the current generated will be unaffected and remain constant. While various devices have been made to increase or diminish the strength of the current according to the resistance to be overcome, yet it has never been attempted, so far as I am aware, to do this by modifying the speed of the armature as the resistance changed independently of the speed of the engine or power by which the armature is rotated. I propose, however, to vary the speed of the armature to correspond to variations in the resistance of the circuit independently of the speed of the engine or motive power actuating the armature. I have found by actual experiments and work that I can do this in a great variety of ways, involving the same principle or mode of operation, so that I can cause the armature to rotate at great speed or slowly, according to the amount of resistance in the circuit, without changing the speed of the engine, and so that the strength of the current will remain constant and uniform, whether one or many lights, if applied to an electric-light circuit, be in operation. This change in the speed of the armature results automatically, increasing as the resistance increases and diminishing as the resistance diminishes. Thus when my speed-regulator is applied to a circuit supplying electric lights the speed of the armature automatically increases, as lamps are brought into the circuit or lighted, so as to increase the resistance, and decreases as they are cut out or extinguished, so as to decrease the resistance. I have chosen to show in the drawings two very diverse means of operating my invention to illustrate the wide range within which its principle or mode of operation is applicable.

In making my speed-regulator for the armature of dynamo-electric machines I take any ordinary dynamo-electric machine in which the armature revolves through a magnetic field whose magnetic strength increases or diminishes according to the strength of the current. I will not therefore stop to describe the construction of such machine in detail; but will simply say that in Fig. 1 of the drawings A represents the armature; B, one of the field-coils; C, one of the poles; D, the other; and E, the shaft, to which power is applied for the rotation of the armature. On the end of the shaft, which extends beyond the machine a convenient distance, I arrange a pulley F, adapted to receive the belt from the engine. This pulley, however, is mounted loosely on the shaft, so as to be rotatable independently therefrom. It is made hollow, as shown in the drawings, and preferably with the end next to the machine provided with a flange *f* to increase the mass of magnetic material capable of being operated on by the magnetic field. The other end of the pulley is preferably provided with an end or cap G capable of being screwed or tightly fitted in place. Within the hollow pulley is arranged a hub H, connected to the shaft by a screw-bolt or otherwise, so that the hub and shaft will rotate together. The outer edge of this hub is composed of some material adapted to present a smooth frictional surface. The hollow of the pulley diminishes in size or diameter toward one end and the exterior of the hub tapers at a corresponding angle. On the end of the cap G is arranged, preferably, a bracket J, in which is located a spring K of a size and tension desired, and preferably made adjustable in tension by means of the set-screw *k*. This spring is intended to afford a mechanical means for opposing the attraction of the magnetism and to retract the pulley-shell when sufficiently released from such attraction. The bracket is connected with the end of the hollow pulley and the spring exerts its tension upon the end of the shaft, tending to move the pulley away from the magnetic field. The magnetism of the magnetic field, being exerted on the other end of the pulley-shell, tends to move the pulley toward the magnetic field and against the tension of the spring. When the power from the engine is applied to the pulley, causing it to rotate at a speed determined by the speed of the engine, the hub arranged within it, together with the shaft and armature, will be caused also to rotate and at the same speed if the frictional contact between the hub and the pulley-shell be sufficiently great. It is preferred that in the commencement of the operation this will be the case, and the strength of the spring may be so adjusted as to move the pulley-shell to that point where its inclined interior surface shall bear against the inclined frictional surface of the hub enough to cause them to rotate together. When the machine is set in operation after being so adjusted, the speed of the armature and the speed of the engine rotating the pulley will correspond with each other unless something intervenes to prevent. The magnetism of the magnetic field, however, is constantly exerted on the end of the pulley-shell, tending to draw it toward the machine. As this magnetism increases with any increase of the current resulting from a decrease of resistance in the circuit, the pulley-shell will be drawn toward the machine, and to that extent loosen the frictional contact between its interior surface and the frictional surface of the hub. This will cause a "slipping," so to speak, to occur between the pulley-shell and the hub, and thus diminish the speed of the armature. If the resistance of the circuit be increased, however, as by bringing one or more lights into the circuit, when my invention is applied to the dynamo of an electric-light circuit the diminished strength of the current will decrease the strength of the magnetism and allow the spring to move the pulley-shell in the other direction and against the attraction of the magnetic field. This increases the frictional contact between the pulley-shell and the hub and increases the speed of the hub and the armature to correspond to the variation that has been produced in the resistance of the circuit. In this way the pulley-shell will be drawn toward the machine by magnetism whenever the resistance in the circuit is decreased and will be drawn away by mechanism whenever the resistance is increased.

In this way a constant and practically imperceptible movement of the pulley-shell toward and from the magnetic field will be produced corresponding to every variation in the resistance of the circuit, and as it moves in the one direction or the other the speed of the armature will be increased or diminished. To prevent wear of the parts and to secure greater ease and nicety of movement, I prefer to fill the pulley-shell with oil, as shown in Fig. 1. I have found in actual work that the parts respond so completely and delicately to every change of resistance in the circuit that the changing speed of the armature produces and maintains a current of constant and uniform strength, whether one light or many lights be in a circuit.

In Fig. 2 I have shown a modification in the application of the same principle and mode of operation. I have located the spring between the machine and the pulley-shell, and have arranged an independent coil L beyond the outer end of the pulley-shell. This coil is connected with the circuit, so that its magnetism constantly and invariably increases and diminishes with any decrease or increase of the resistance of the circuit affecting the strength of the current. It is provided with a movable core M, which its magnetism constantly tends to bring to a central position. On a bracket N is pivotally mounted a lever O, with a pin *o* bearing against the end of the pulley-shell. As the magnetism of the auxiliary coil increases it draws the core farther down and moves the pulley-shell against the tension of the spring, while as it decreases the tension of the spring moves the pulley in the opposite direction. In this way the pulley-shell is constantly moved in the one direction or the other, as the resistance of the circuit increases or decreases, causing its frictional contact with the hub to increase or decrease correspondingly. The speed of the armature is regulated or varied, therefore, to correspond to the resistance in the circuit, as in the application of my invention shown in Fig. 1.

What I regard as new, and desire to secure by Letters Patent, is—

1. In an armature speed-regulator, the combination of an electro-magnet, a hub rotatable with the armature and provided with a frictional surface, a pulley rotatable independently of the armature and provided with a frictional surface, such frictional surfaces bearing against each other in a chamber filled with a lubricant, and being brought to different degrees of frictional contact to vary the speed of the rotation of the hub according to variations in the resistance, substantially as described.

2. In an armature speed-regulator, the com-

bination of an armature adapted to be rotated, an electro-magnet, a shaft adapted to be rotated to rotate the armature, a hub fixedly mounted on such shaft and provided with a smooth friction-surface inclined toward the end, a pulley surrounding the hub inclined on its interior surface to correspond with the inclination on the hub and adapted to be rotated at a speed uninfluenced by variations in the resistance of the circuit, substantially as described.

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