(No Model.)

T. H. MACDONALD.

SPEED REGULATOR FOR MOTORS.

No. 587,265. Patented July 27, 1897.

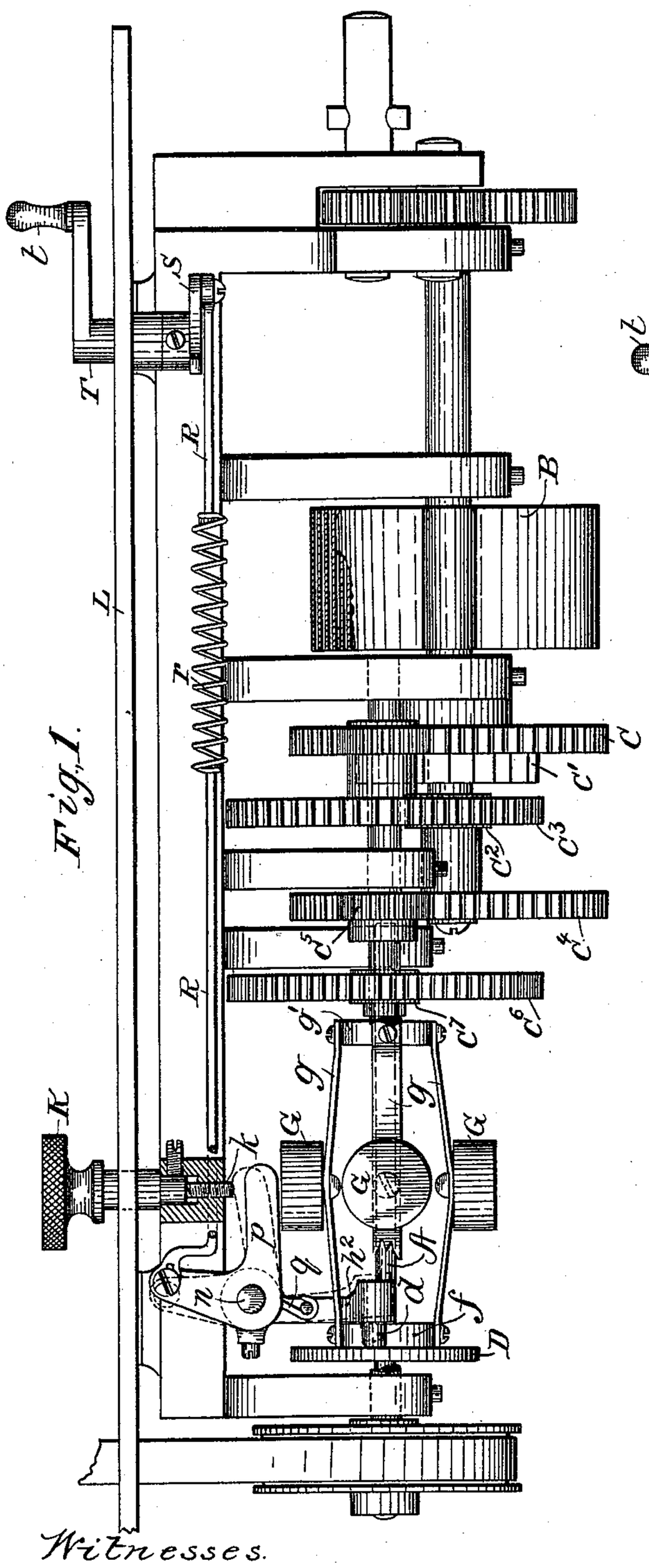

Fig. 1.

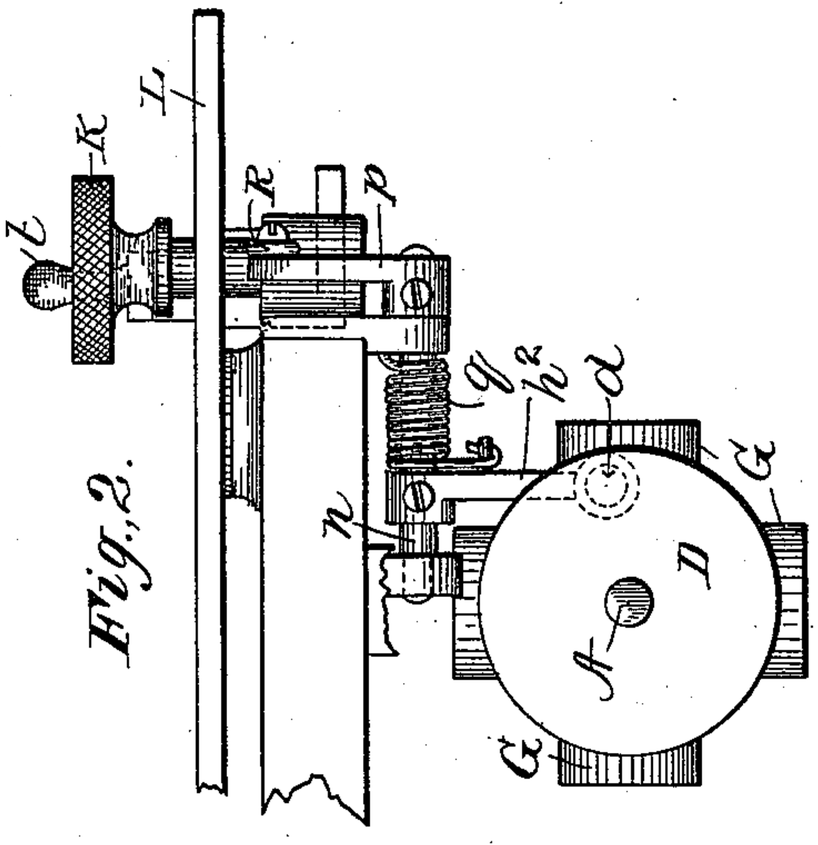

Fig. 2.

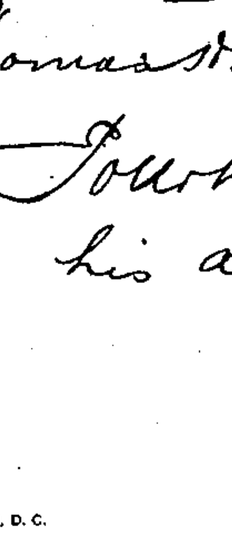

Fig. 3.

Witnesses.
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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

THOMAS H. MACDONALD, OF BRIDGEPORT, CONNECTICUT, ASSIGNOR TO THE AMERICAN GRAPHOPHONE COMPANY, OF WEST VIRGINIA.

SPEED-REGULATOR FOR MOTORS.

SPECIFICATION forming part of Letters Patent No. 587,265, dated July 27, 1897.

Application filed November 2, 1895. Serial No. 567,728. (No model.)

To all whom it may concern:

Be it known that I, THOMAS H. MACDONALD, of Bridgeport, Connecticut, have invented new and useful Improvements in Speed-Regulators for Motors, which are fully set forth in the following specification.

This invention has reference particularly to spring-motors, though applicable to other motors, the object thereof being to secure uniformity of operation with facility for adjustment within the desired limits. The invention was designed more particularly for graphophones to meet the imperative necessity of uniform running speed in recording and reproducing, but is, of course, applicable to motors employed for other purposes. As is well known, in the use of graphophones the slightest deviation from a uniform speed in running causes alteration of the pitch or key of the sounds, which in musical records is a grave defect. Consequently it is necessary to provide the motors for such machines with speed-controlling devices which perform their functions with great exactness.

Prior to this invention attempts to apply spring-motors to driving graphophones have not produced satisfactory results, mainly for lack of governing devices which would release the stored power of the spring with uniformity during the entire period of the expansion of the spring, which operates with constantly-diminishing force.

Spring-motors are usually controlled by governors operating on the principle of an escapement, but such governors lack the precision and certainty desired. According to the present invention the speed of the driving-shaft of the motor is regulated and controlled by a friction device, the pressure which gives rise to the friction being furnished by the spring itself. It is found, after extensive practical use, that, by the means herein described, the expanding force of a coiled spring can be successfully applied to driving graphophones with the uniformity necessary for the uses to which those instruments are put.

The principle of the invention may be carried out in various forms of devices, and I will herein describe a form that has given good results in practice. The driving-shaft (or it may be another convenient shaft geared thereto) is provided with a device, such as a disk, connected to rotate with the shaft, but capable of assuming different positions lengthwise thereof. This device has mechanical connections with said shaft whereby its position lengthwise thereof is automatically varied by the motion of the shaft. These connections are perfectly flexible supports carrying centrifugal balls, as in the common governor. Coöperating with this disk is a friction device, such as a stud or pin, preferably of leather, or having an acting face covered with leather or similar material. This device is relatively stationary and its function is to act as a break against the revolving disk. When the motor is started, the movement of the centrifugal balls brings the disk in contact with the leather pin or stud with a pressure that is proportional to the force of the motor, thus maintaining a uniform speed by exerting a constant check upon the force driving the shaft.

In all governing mechanism of various sorts which act, when excess of speed is developed, by cutting off the power or (which is equivalent) by disconnecting momentarily the driven mechanism from the prime motor, thus bringing it down to the normal, there is always a fall to a certain degree below the normal speed before the governor can act to restore the connection, and thus, while average uniformity of speed is maintained there is usually a rhythmical variation which is objectionable when the instrument is used for reproductions.

In the mechanism constructed in accordance with this invention the power of the spring is constantly exerted on the shaft and the speed of the latter kept down to the normal by a constantly-acting friction device, the friction varying in direct ratio with the power of the spring.

The relatively stationary member of the friction device is adjustable to vary the normal rate of speed, the construction permitting about the same amount of pressure to be developed against the shaft at low as at high speeds. This adjustable member may be carried by a screw in a threaded socket. The adjustable stud or pressure device also

serves as a stopping device, being connected with a button or other convenient switch, so that it can be thrown against the disk with pressure sufficient to arrest the shaft. In such case a spring is provided to return it to the point to which it has been adjusted for speed, this adjustment not being disturbed by the use of the device for stopping the motor.

In the accompanying drawings, Figure 1 illustrates in front elevation a spring-motor for graphophones constructed in accordance with my invention. Fig. 2 is an end view of the governing mechanism, and Fig. 3 is a detail in plan.

L represents the bed-plate of a graphophone by which the motor is supported.

B represents a mainspring, and C C^7 represent a train of gears by which motion is communicated to the driving-pulley and to the shaft A, upon which the centrifugal governor is mounted. The centrifugal balls G are carried by springs *g*, attached at one end to the sleeve F, loosely mounted on shaft A, and at the other to the collar *g'*, fixed to said shaft. To sleeve F is attached a disk D, which constitutes one member of the frictional regulating device, and adjacent to this disk is the relatively stationary member, shown as a stud *d*, preferably of leather or other comparatively soft material. It will be obvious that as the shaft A rotates the balls G will by centrifugal force move outward from the shaft, bending springs *g* and pressing disk D against stud *d* with a force proportional to the speed of rotation. When the motor is started, the disk D moves to the right until its face makes contact with the stud, and these surfaces are in contact during the whole time the motor is running. The degree of pressure depends on the torque of shaft A and the resistance of the driven mechanism, and if there be any irregularity in either the result will be apparent not in a variation of the speed of the motor, but in a variation of the pressure between the members of the frictional regulator which are in constant contact.

As shown, the friction pin or stud *d* is carried by an arm h^2, attached to a rock-shaft *n*. Rock-shaft *n* also carries a bell-crank lever *p*, one arm of which extends under the lower end of the adjusting-screw *k*, provided with the adjusting-button K. A spiral spring *q* is provided, tending to throw the arm *p* against screw *k*, as indicated in dotted lines in Fig. 2, thus fixing the position of stud *d* with respect to disk D. It will be seen that this position could be varied by turning button K.

The mechanism has a further function as a starting and stopping device. For this purpose a link R is attached at one end to the vertical arm of bell-crank lever *p* and at the other to a crank-arm S on a shaft T, which is also provided with a switch arm or handle *t*. Link R is made extensible by forming a portion thereof as a stiff helical spring *r*. When handle *t* is turned to the position indicated in Figs. 1 and 3, lever *p* is turned, causing stud *d* to bear with the pressure of the strong spring *r* against the disk D, thus arresting the motion by a brake action. The motor-shaft is shown in Fig. 1 as being thus arrested. When the position of handle *t* is reversed, spring *q* returns lever *p* to its normal position against screw *k*. Thus the stopping and starting of the motor can be effected without changing the speed adjustment.

From the foregoing description and the illustrations given of practical embodiments of my invention it will be evident that other modifications in the forms and dispensations of the parts may be made, these matters of detail being in some degree controlled by the construction of the motor to which the improved regulator is applied.

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

1. In a spring-motor, the combination with the main driving-spring thereof, of a friction speed-regulator comprising a relatively stationary member, means for adjusting the position thereof, a relatively movable member, connections whereby the spring presses the two members of the regulator together, and means for pressing the two members forcibly together to stop the motor without changing the adjustment for speed, substantially as described.

2. A speed-governor for motors, comprising in combination a shaft driven by the motor, a disk rotating with said shaft but movable lengthwise thereof, centrifugal devices for moving the disk lengthwise of the shaft, a relatively stationary friction device with which said disk engages, means for adjusting the position of said device to determine the rate of speed of the motor, and independent means for moving said device into engagement with said disk with force sufficient to arrest the motor, substantially as described.

3. A speed-governor for motors, comprising in combination a shaft driven by the motor, a disk rotating with said shaft, centrifugal devices for varying the position of said disk lengthwise of said shaft according to the speed of the latter, a lever controlling a friction device for engaging said disk, an adjusting-screw, a spring normally keeping said lever in contact with said screw, and means for overcoming said spring and forcibly pressing said friction device against said disk, without disturbing the position of said adjusting-screw, substantially as described.

4. In a frictional speed-regulator for motors, the combination with one of the motor-shafts of a disk rotating therewith, connections for displacing the disk longitudinally of said shaft by the motion of the latter, said disk constituting one member of the frictional regulator, a friction device or stud constituting the other member, adjusting mechanism for regulating the normal position of said stud relative to said disk thereby determining the speed of the motor, and means independent of

said adjusting mechanism, for pressing said stud forcibly against said disk, thereby stopping the motor, substantially as described.

5. The combination with the shaft, the disk constituting one member of a frictional speed-regulator, said disk being connected with said shaft as specified, a stud forming the other member of said regulator, a holder therefor, a two-arm lever connected with said holder, an adjusting device acting on one arm of said lever but disconnected therefrom, and a switch arm or handle connected with the other arm of said lever, whereby said stud may be forcibly pressed against said disk to stop the motor without disturbing the said adjusting device, substantially as described.

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

THOMAS H. MACDONALD.

Witnesses:
CLEMENT MARCH,
G. L. HUBBELL.