(No Model.) 2 Sheets—Sheet 1.

J. P. B. FISKE.

STARTING OR STOPPING DEVICE FOR ELECTRIC MOTORS.

No. 543,523. Patented July 30, 1895.

Fig. 1.

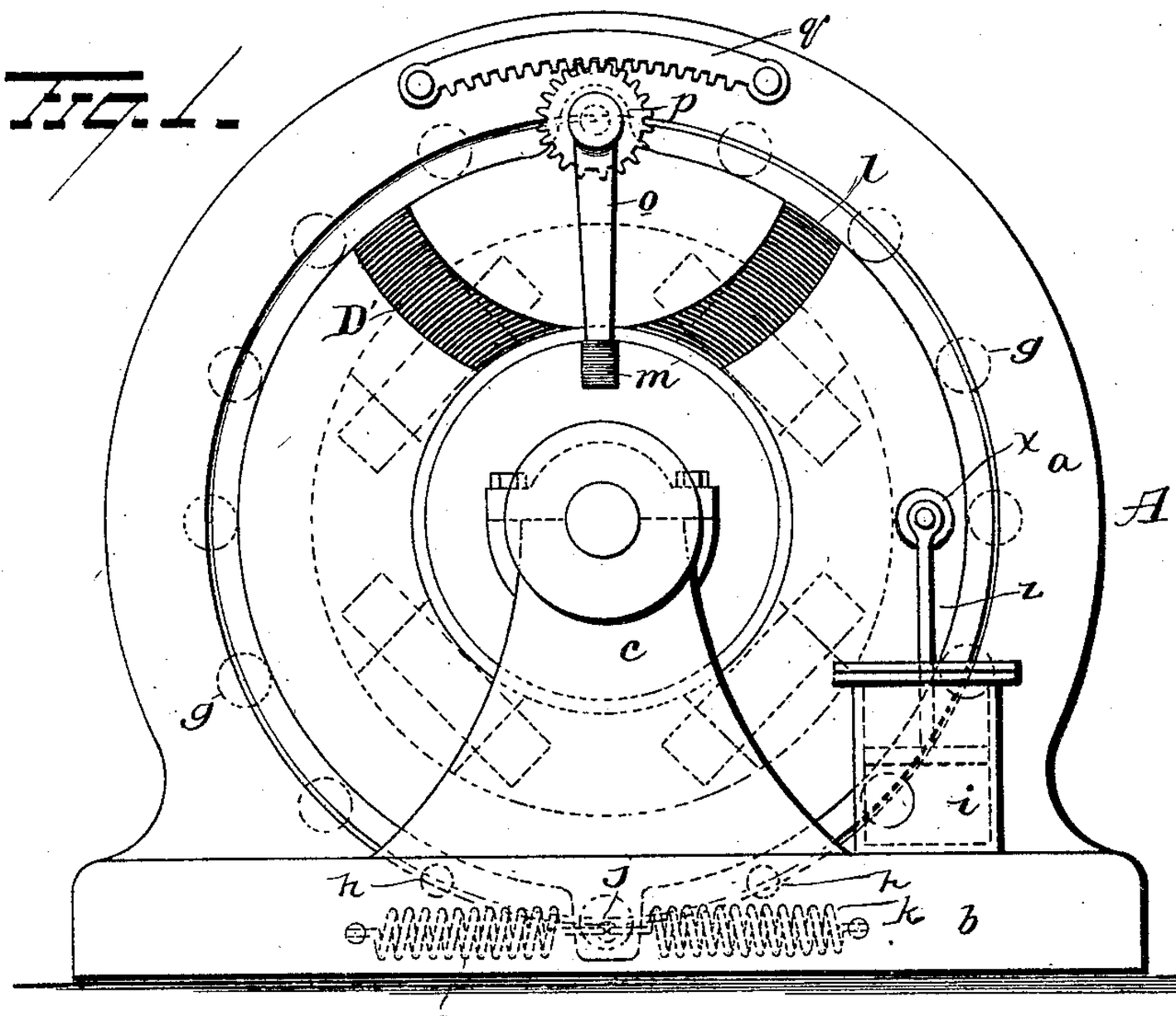
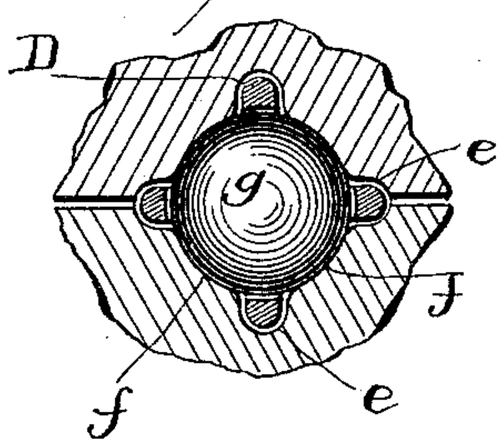


Fig. 3.



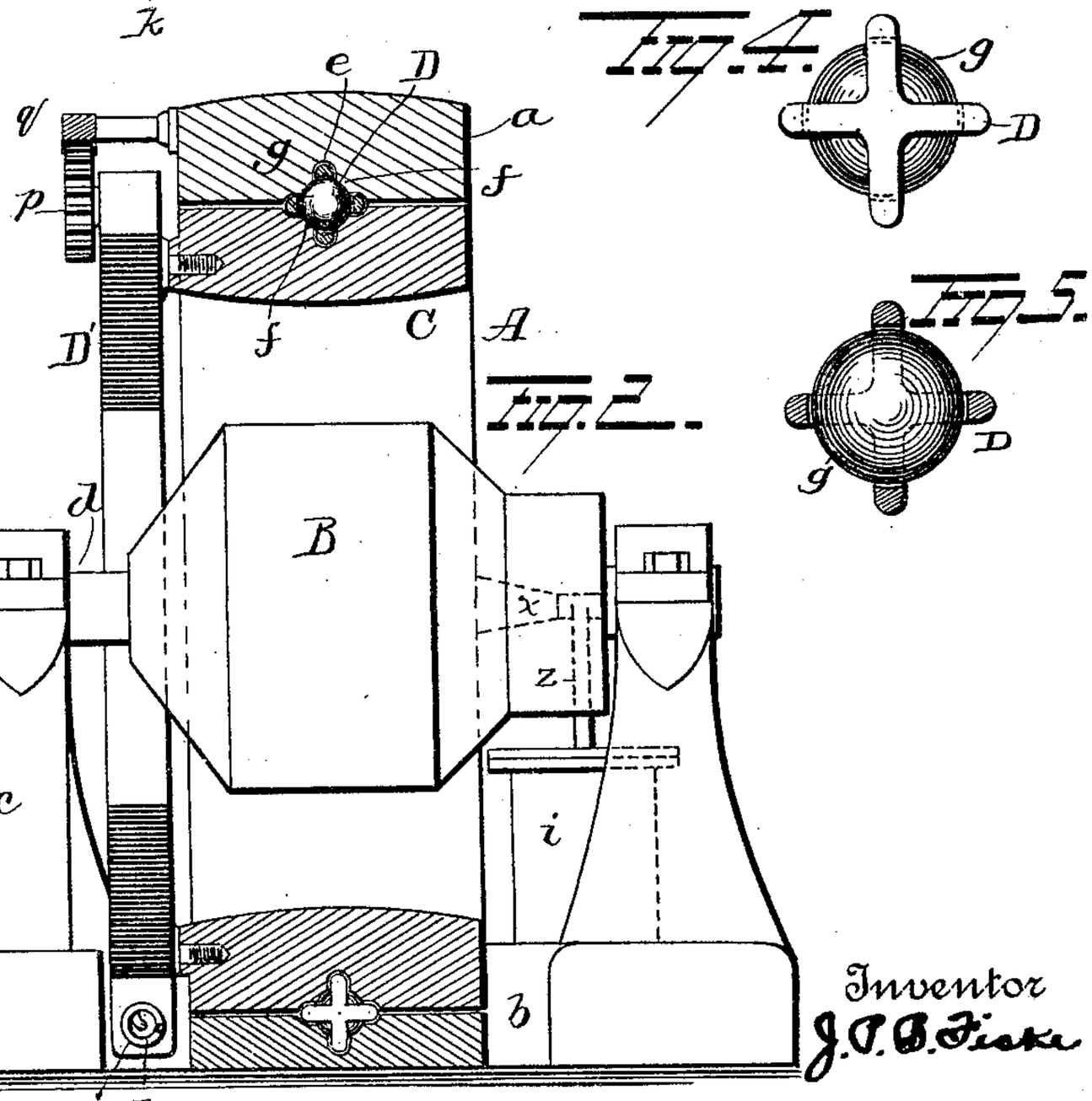


Fig. 4.

Fig. 5.

Witnesses
C. J. Nottingham
G. F. Dodwing

Inventor
J. P. B. Fiske
By H. A. Seymour
Attorney

(No Model.) 2 Sheets—Sheet 2.

J. P. B. FISKE.

STARTING OR STOPPING DEVICE FOR ELECTRIC MOTORS.

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FIG. 6.

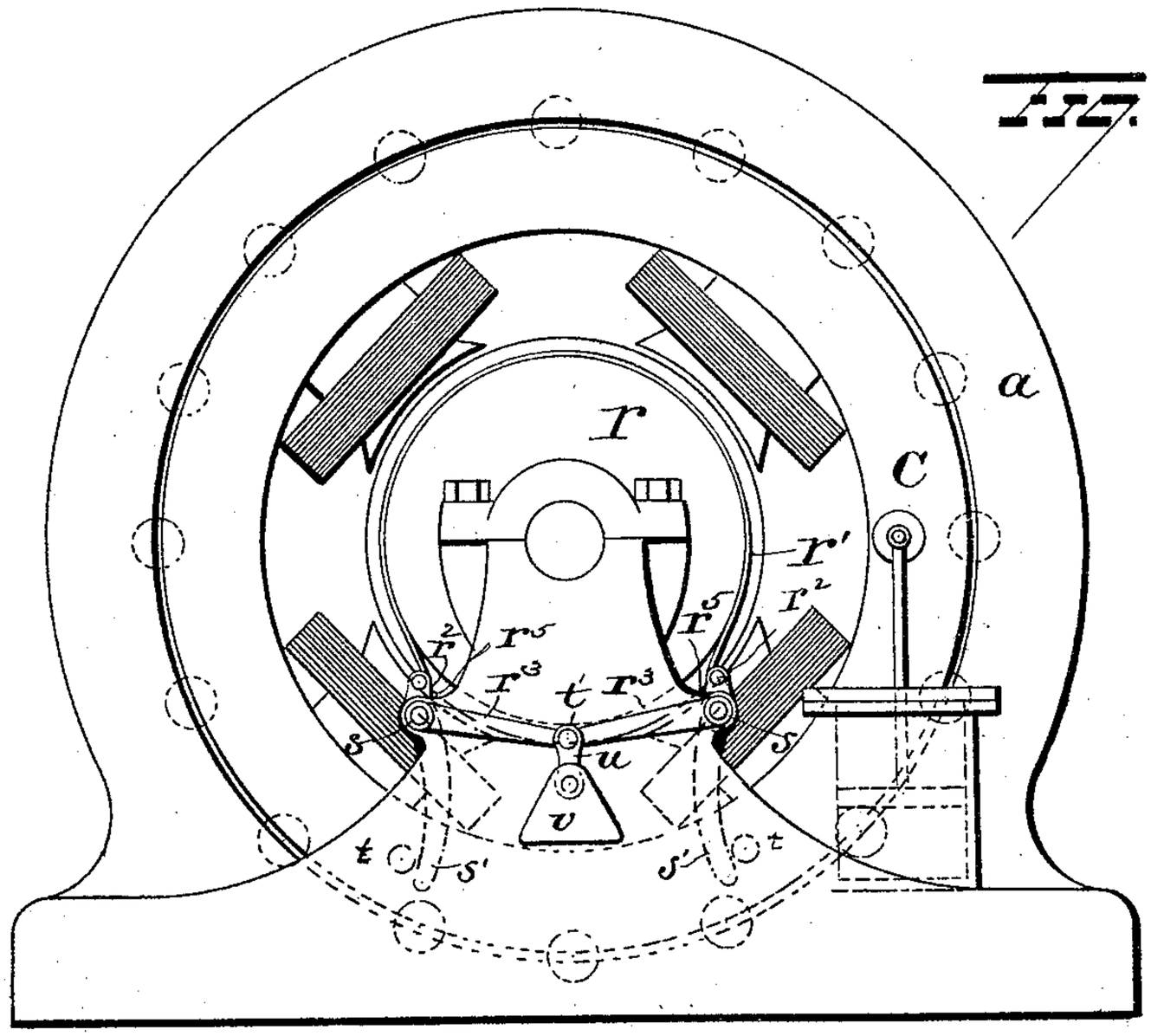
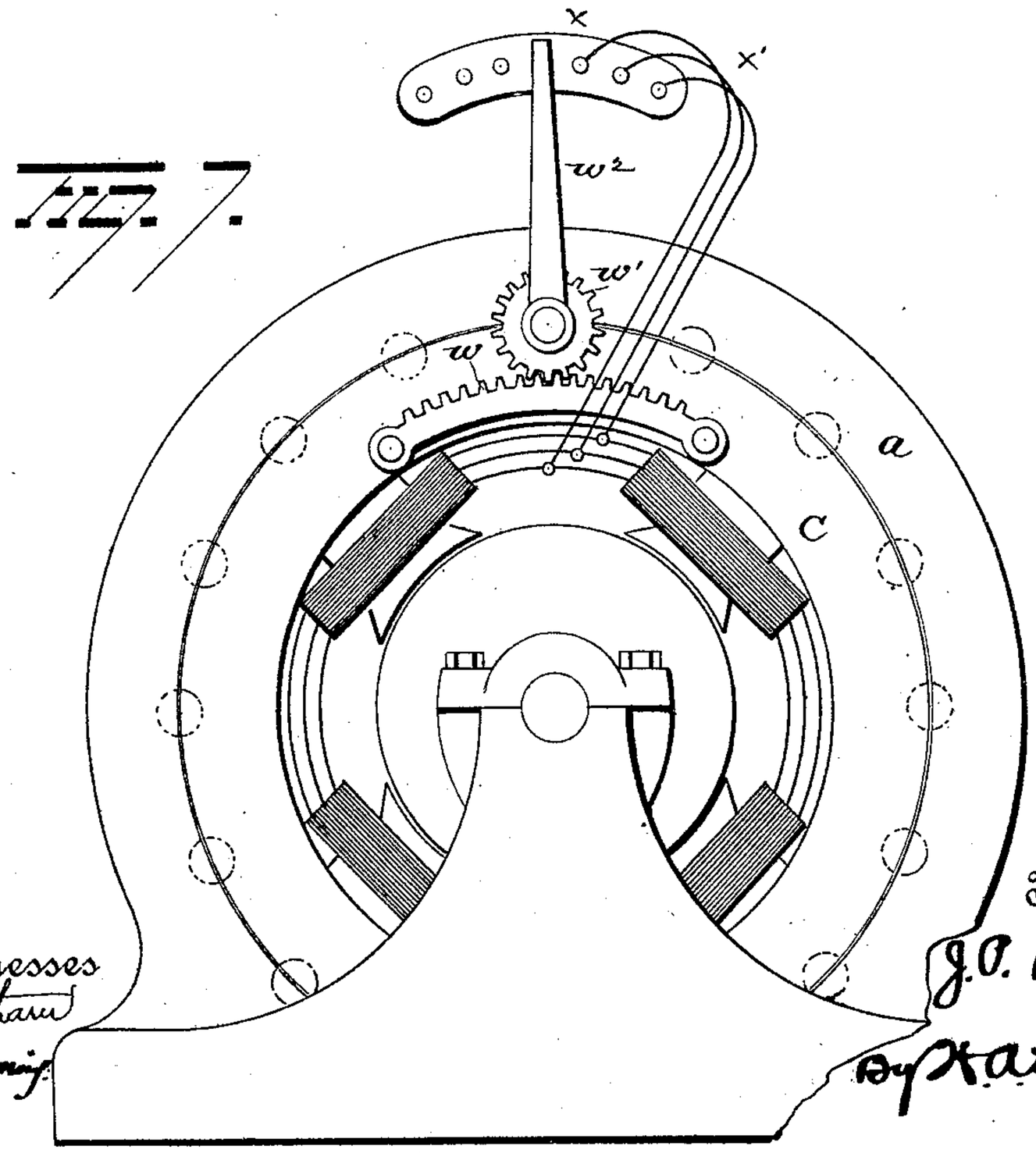


FIG. 7.



Witnesses
E. A. Nottingham
G. F. Dobering

Inventor
J. P. B. Fiske
By H. A. Seymour
Attorney

UNITED STATES PATENT OFFICE.

JONATHAN P. B. FISKE, OF ALLIANCE, OHIO.

STARTING OR STOPPING DEVICE FOR ELECTRIC MOTORS.

SPECIFICATION forming part of Letters Patent No. 543,523, dated July 30, 1895.

Application filed November 14, 1894. Serial No. 528,784. (No model.)

To all whom it may concern:

Be it known that I, JONATHAN P. B. FISKE, a resident of Alliance, in the county of Stark and State of Ohio, have invented certain new and useful Improvements in Starting or Stopping Devices for Electric Motors; 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.

My invention relates to an improvement in starting and stopping devices for electric motors.

Heretofore the usual method of operating stationary motors has been to connect the armature with a rheostat of some kind, the entire resistance of which at the moment of starting the motor will be in the armature, this resistance being cut out gradually as the motor is started. The operation of such starting-rheostat is usually accomplished by an attendant, who is required to turn out the resistance slowly as the motor attains speed. Before the resistance can be turned out the attendant must be careful to connect the motor with the main line by means of a double-pole switch. The double-pole switch and rheostat are usually located on the wall of the room or a switchboard. It is necessary that the operator be careful to close the double-pole switch before he manipulates the rheostat and to exercise caution when cutting out the resistance in order to avoid the burning out of the armature. It is sometimes desirable and indeed necessary that the rheostat be operated more or less automatically, according to the following conditions, viz:

First. When the current is cut off at the central station. Under these conditions the motor slows down and comes to rest, and should the current be again turned on before the attendant turns the rheostat into circuit the current will rush into the motor without anything to check it and burn out the machine. It is, therefore, desirable to have an automatically-operated rheostat, by which the resistance will be switched into circuit when the current is cut off at the central station. This is accomplished by various devices now on the market.

Second. When it is necessary to start or stop the motor from a distance, as in elevator work, or when the motor is located in an inaccessible place, it is necessary that the rheostat shall be automatic both in starting and in stopping the motor, and to accomplish this end various devices now on the market have been employed, such devices being operated by heavy solenoids or by worm and ratchet gearing, which in turn operates the arm of the rheostat.

It is the object of my present invention to obviate the defects, inconvenience, complicacy, and inaccuracy of apparatus for regulating the starting and stopping of electric motors as heretofore constructed and to so construct an apparatus that the motor and starting and stopping devices shall be combined and self-contained and the whole apparatus self-operating, the only duty of the attendant being to close the double-pole switch when he wishes to start the motor and open it when he wishes to stop the motor.

A further object is to produce simple and efficient means whereby to utilize the torque of the motor for the operation of controlling devices when the motor is started or stopped.

A further object is to so construct a combined motor and resistance device that the torque of the machine will act to automatically and gradually switch the resistance out of or into circuit when the current is turned on or off in starting or stopping the motor.

A further object is to so construct an electric motor that the torsional action thereof can be utilized to operate a rheostat and a brake or either a rheostat or a brake.

With these objects in view the invention consists in the combination, with an electric machine constructed and adapted to have a limited torsional action, of devices for controlling the starting and stopping of the machine, connected with said machine in such manner as to be automatically operated by the torque thereof.

The invention also consists in the combination, with an electric machine the field-magnets of which are so constructed and arranged as to have a limited torsional action, of devices for controlling the starting and stopping of the machine and means intermediate of said devices and the torsional field-magnets whereby the torque of the latter will operate to automatically actuate the devices

for controlling the starting and stopping of the machine.

The invention also consists in the combination, with an electric motor having field-magnets constructed and adapted to have a limited torsional movement, of a rheostat and devices intermediate of the rheostat and said torsional field-magnets whereby the torque of the motor will serve to operate said rheostat.

The invention also consists in the combination, with an electric motor having field-magnets constructed and adapted to have a torsional action, of a rheostat and a brake and devices intermediate of said torsional field-magnets and said rheostat and brake whereby the torque of the motor will automatically operate said rheostat and brake; and the invention also consists in certain novel features of construction and combinations and arrangements of parts, as hereinafter set forth, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a view of an electric motor embodying my improvements. Fig. 2 is a sectional view of the same. Figs. 3, 4, and 5 are detail views. Fig. 6 is a view illustrating the brake devices. Fig. 7 is a view showing the application of my improvements to a constant-current motor.

A represents an electric motor comprising in its structure an annular fixed frame *a*, having a base *b* and standards *c*, in which latter the shaft *d* of the armature B is mounted. Within the fixed annular frame a movable field-magnet frame C is located and provided with pole-pieces arranged in any preferred manner. The frames *a* and C are arranged in such proximity to each other that a number of lines of force will pass from the principal field-magnet frame C to the fixed frame *a*, thus constituting the latter, in effect, a fixed portion of the field-magnets. The inner face of the frame *a* and the outer face of the field-magnet frame C are recessed, as at *e e*, so as to receive a cage D and produce a series of bearings *f* (two on each frame) for a series of antifriction-balls *g*, located within said cage. From this construction and arrangement of parts it will be seen that when the current enters the motor and the armature begins to rotate in one direction the torque of the movable field-magnets will cause the latter to turn in the opposite direction. In other words, a mutual torque between the field and the armature would cause the latter to rotate in one direction and the former in the reverse direction; but for my present purpose the movement of the field-magnets or field-magnet frame C will be limited by suitable stops *h*, and in order to check the speed and cushion the movement of the movable frame C a dash-pot *i* will be provided and the piston of said dash-pot connected with said movable field-magnet frame by stud *x* and link *z*. The field-magnet frame C will also be provided with a lug *j*, to which springs *k* are connected, said springs extending in opposite directions from said lug and connected to the fixed frame or the base thereof, the springs *k* tending to maintain the movable frame C in its normal position, with the lug *j* midway between the stops *h*, when the motor is not in operation and to return said movable frame to its normal position after the current shall have been shut off from the motor.

A rheostat or resistance-coil D is secured to the movable frame (or said coil may be secured to the fixed frame if desired) and is preferably composed of a coiled ribbon of German silver or other resistance material having mica or other suitable non-conducting material interposed between its convolutions. One face of the coil is milled to produce a path *l* (preferably made in the arc of a circle) for the accommodation of a contact-shoe *m*, which is carried by a lever *o*, pivoted at its upper end to the upper portion of the movable frame C. The lever *o* also carries a pinion *p*, which is concentric with the pivot of said lever and adapted to mesh with a rack-bar *q*, secured to the fixed frame *a*. If desired, the lever *o* and pinion *p* may be mounted on the fixed frame and the rack-bar secured to the movable frame.

It is not absolutely essential that the resistance-coil be secured to any part of the motor, as it may be secured to the wall of the room and the contact-shoe connected in a suitable manner by rods, &c., with the movable frame C.

The moment the current is made to enter the motor it passes directly into the shunt field-coils. It also passes through the resistance-coil, and thence through the armature and out. The armature has a tendency to rotate to the right or left, depending upon the direction in which the switch is thrown in starting the motor, and at the same time the movable field-magnet frame commences to rotate or move slowly in the opposite direction, the rapidity of this movement of the frame C being governed by the dash-pot, as above explained. As the frame C moves, the engagement of the teeth of the pinion *p* with the rack-bar *q* causes said pinion to turn and the lever *o* to move in the arc of a circle, carrying the contact-shoe *m* over the face of the resistance-coil, and thus gradually cut out the resistance from the armature-circuit, the armature thereby accelerating its speed. When the contact-shoe reaches the end of the resistance the armature will be receiving the full line potential, and will thereby soon attain its full speed. The moment the current is cut off from the motor the retractive springs *k* will cause the movable field-magnet frame and contact-shoe to return to their normal positions.

It will be seen that all that is necessary in operating a motor provided with my improvements is to turn the current on or off, when the motor will gradually speed up or slow down and come to rest.

It is often desirable to provide the motor with a brake to assist in controlling the stopping of the armature, especially in cases in

which the motor is used for elevating heavy weights. In Fig. 6 I have illustrated such a brake constructed and adapted to be actuated by the torque of the field-magnets. A brake-disk r is secured to the armature-shaft in any suitable manner, and on the periphery of this disk a brake or friction band r' is placed. The respective ends of the brake-band r' are connected with the short arms r^2 of levers r^3, which latter are pivotal at r^5 to the stationary frame of the motor or to a standard projecting therefrom. In pivotally connecting the levers r^3 to the standards of the main frame I prefer to employ rock-shafts s, to each of which a depending crank-arm s' is secured and adapted to be engaged by rollers t, carried by the movable field-magnet frame C. The long arms of the levers r^3 are connected together, as at t', and at their point of juncture a link u is connected, to the lower end of which a weight v is secured. From this construction and arrangement of parts it will be seen that when the motor is at rest the weight v will operate to tighten the band on the brake-disk, but that when the motor starts the torque of the movable field-magnet frame will cause the latter to turn, as above explained, and the rollers carried by said movable frame to engage the crank-arms s' and turn the rock-shafts s, thus raising the weight v and loosening the bands on the brake-disks. When the current is shut off from the motor, the movable field-magnet frame C will be returned to its normal position by the weight v, which will also tighten the brake-band by rotating rock-shaft r^2, and thus stop the armature.

The principal use of my improvements will be with constant-potential motors. In the case of constant-current motors it is necessary to vary the strength of the magnetic field by cutting out more or less turns of field-magnet wire, which I propose to accomplish by the torque of the movable field-magnet frame, as shown in Fig. 7. In this construction a rack-bar w is secured to the movable field-magnet frame and transmits motion (as said frame moves) to a pinion w', to which latter a contact-arm w^2 is secured, said arm being adapted to pass over a series of contacts x, and the contacts are connected with the various turns or convolutions of the field-magnet coils by suitable wires or connections x'.

My improvements are very simple in construction, sure of operation, compact, and effectual in all respects in the performance of their functions.

It is evident that various changes might be made in the details of construction of my invention without departing from the spirit thereof or limiting its scope, and hence I do not wish to limit myself to the precise details herein set forth; but,

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

1. The combination with a fixed motor frame, of a movable field magnet frame, a rheostat, a contact shoe, and connections between said shoe and frames, whereby the torque of the movable field magnet frame will automatically operate said shoe and cause it to pass over the contacts of the rheostat, substantially as set forth.

2. The combination with a fixed motor frame, and a movable field magnet frame within the fixed frame, of antifriction devices between said frames, a resistance device, a contact shoe adapted to pass over the contacts of said resistance coil, a contact lever carrying said shoe and pivoted to one of said frames, a rack bar secured to the other frame, and a pinion adapted to move with said contact lever and concentric with the pivot thereof, said pinion being adapted to mesh with said rack bar, whereby the torque of the movable field magnet frame will cause motion to be transmitted to said contact shoe, substantially as set forth.

3. The combination with a fixed frame of a motor, and a movable frame within the fixed frame, recesses in said frames for the reception of balls located between the frames, devices for controlling the starting and stopping of the motor, and connections between said devices and the movable frame, substantially as set forth.

4. The combination with a fixed motor frame, of a movable field magnet frame bearing such relation to the fixed frame as to permit the passage of lines of force to the latter, antifriction bearings between said frames, devices for controlling the starting and stopping of the motor, and connections between the movable frame and said devices, substantially as set forth.

5. The combination with a fixed motor frame, of a movable field magnet frame located within the fixed frame, stops to limit the movement of said movable field magnet frame, springs connected with the movable frame and adapted to maintain it in a normal position when the motor is not running, devices for controlling the starting and stopping of the motor, and connections between the movable field magnet frame and said devices, substantially as set forth.

6. The combination with a fixed frame of a motor, and a movable field magnet frame within the fixed frame, means for limiting the movement of said movable frame, a device for controlling and cushioning the movement of said movable frame, devices for controlling the starting and stopping of the motor, and connections between the movable field magnet frame and said devices, substantially as set forth.

7. The combination with a fixed motor-frame having a recessed inner face, and a movable field magnet frame within the fixed frame and having a recess in its periphery, of a cage within said recess, balls within said cage bearing on the respective frames, devices for controlling the starting and stopping of the motor, and connections between

said devices and the movable field magnet frame, substantially as set forth.

8. The combination with an electric machine having a revoluble member and a member capable of oscillating, of a brake wheel carried by the revoluble member, a brake band or shoe cooperating with said brake wheel, a rock shaft connected with said brake band or shoe, a projection on the oscillatory member of the machine and an arm connected with the rock shaft and adapted to be engaged by said projection, whereby to automatically release the brake band or shoe, substantially as set forth.

9. The combination with an electric motor having a rotary member and an oscillatory member, a brake wheel on the rotary member and a brake band or shoe cooperating with said brake wheel, of a rock shaft connected with said brake band, connections intermediate of said rock shaft and the oscillatory member of the motor, and a cushioning device connected with said shaft, substantially as set forth.

10. The combination with an electric motor having a rotary member and an oscillatory member, a brake wheel on the rotary member and a brake band or shoe cooperating with said brake wheel, of a rock shaft connected with said brake band, a projection on said oscillatory member of the motor and an arm connected with the rock shaft and adapted to be moved by said projection, whereby to release the brake, substantially as set forth.

11. The combination with an electric motor having a rotary member and an oscillatory member, a brake wheel carried by said rotary member and a brake band or shoe on said brake wheel, of a rock shaft connected with said brake band or shoe, a projection on the oscillatory member, an arm connected to the rock shaft and adapted to be operated by said projection to release the brake, and a weighted lever connected with said rock shaft, substantially as set forth.

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

JONATHAN P. B. FISKE.

Witnesses:

WILLIS H. RAMSEY,

E. WOOLGAR.