

(No Model.)

2 Sheets—Sheet 1.

J. H. PALMER.  
ELECTRIC MOTOR.

No. 467,048.

Patented Jan. 12, 1892.

Fig. 1.

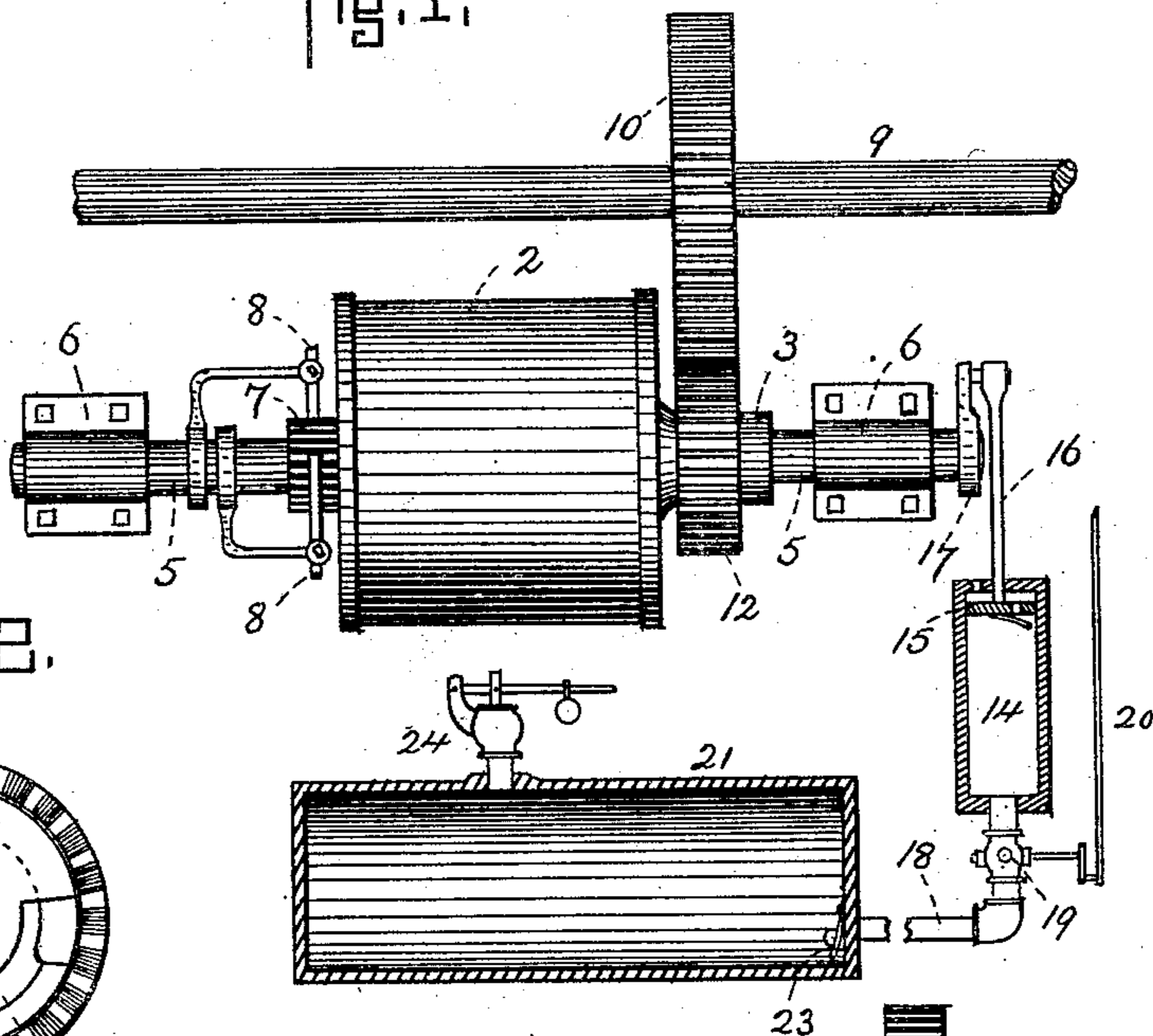


Fig. 2.

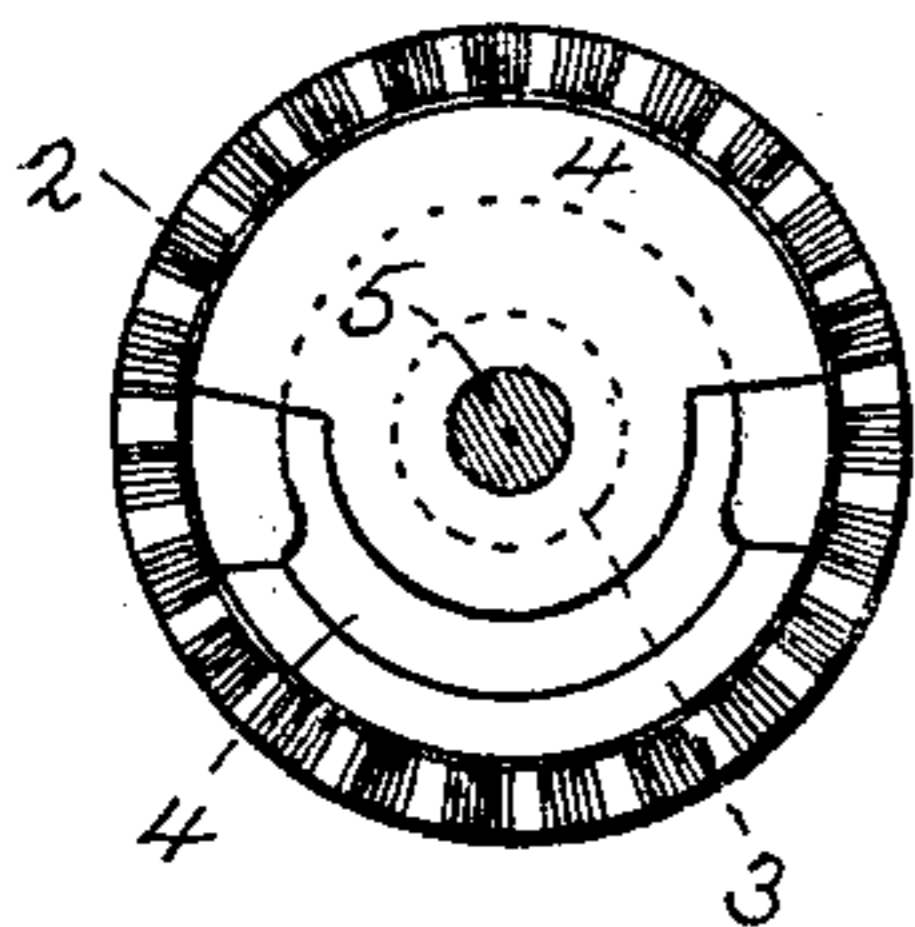
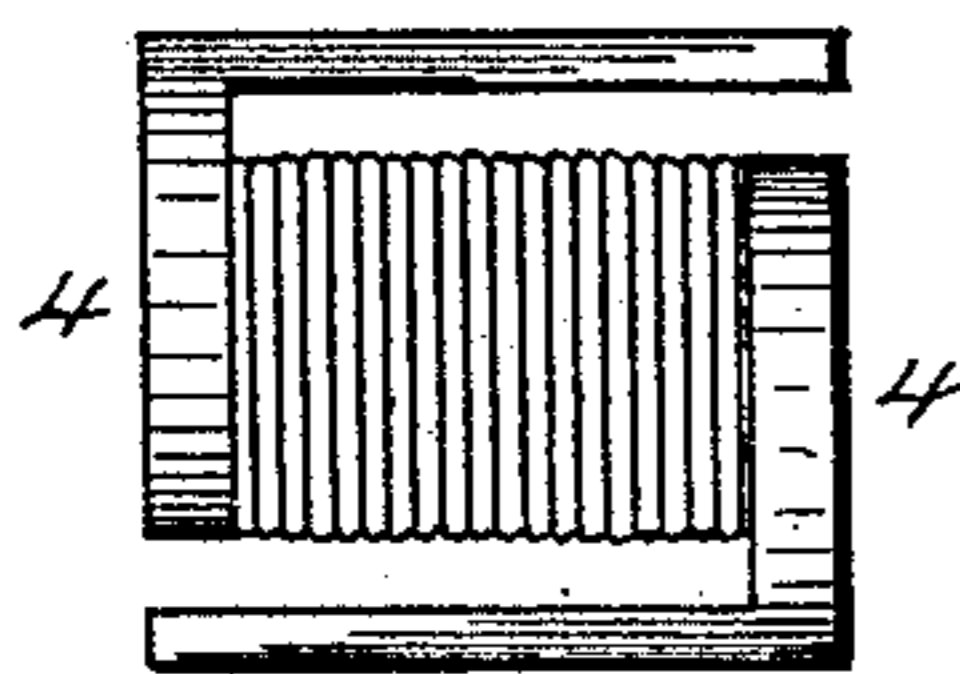


Fig. 3.



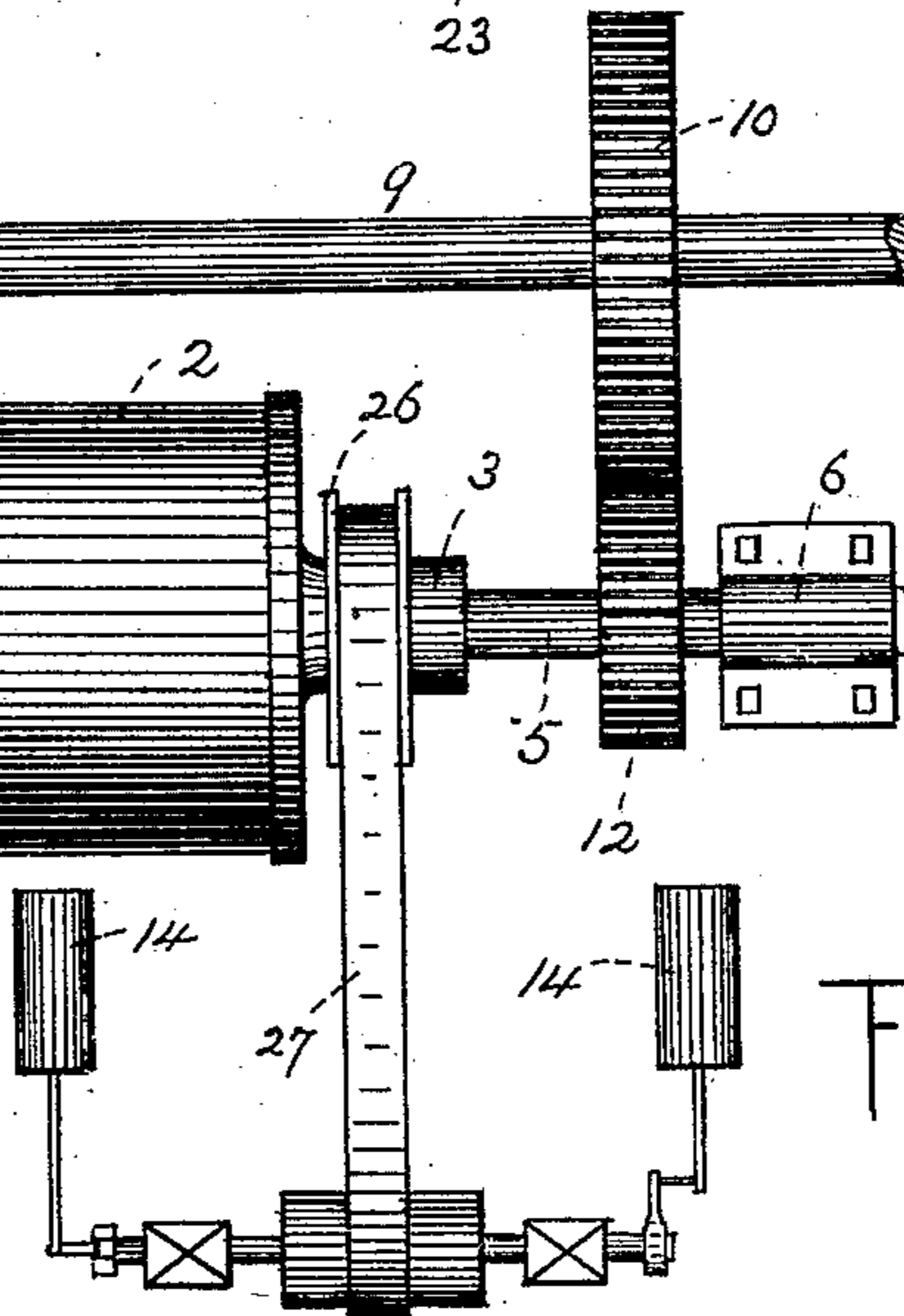
Witnesses.

*Francis C. Stanwood*  
*John A. Dougherty*

Inventor.

*John H. Palmer.*  
*by H. C. Lodge Atty.*

Fig. 4.



(No Model.)

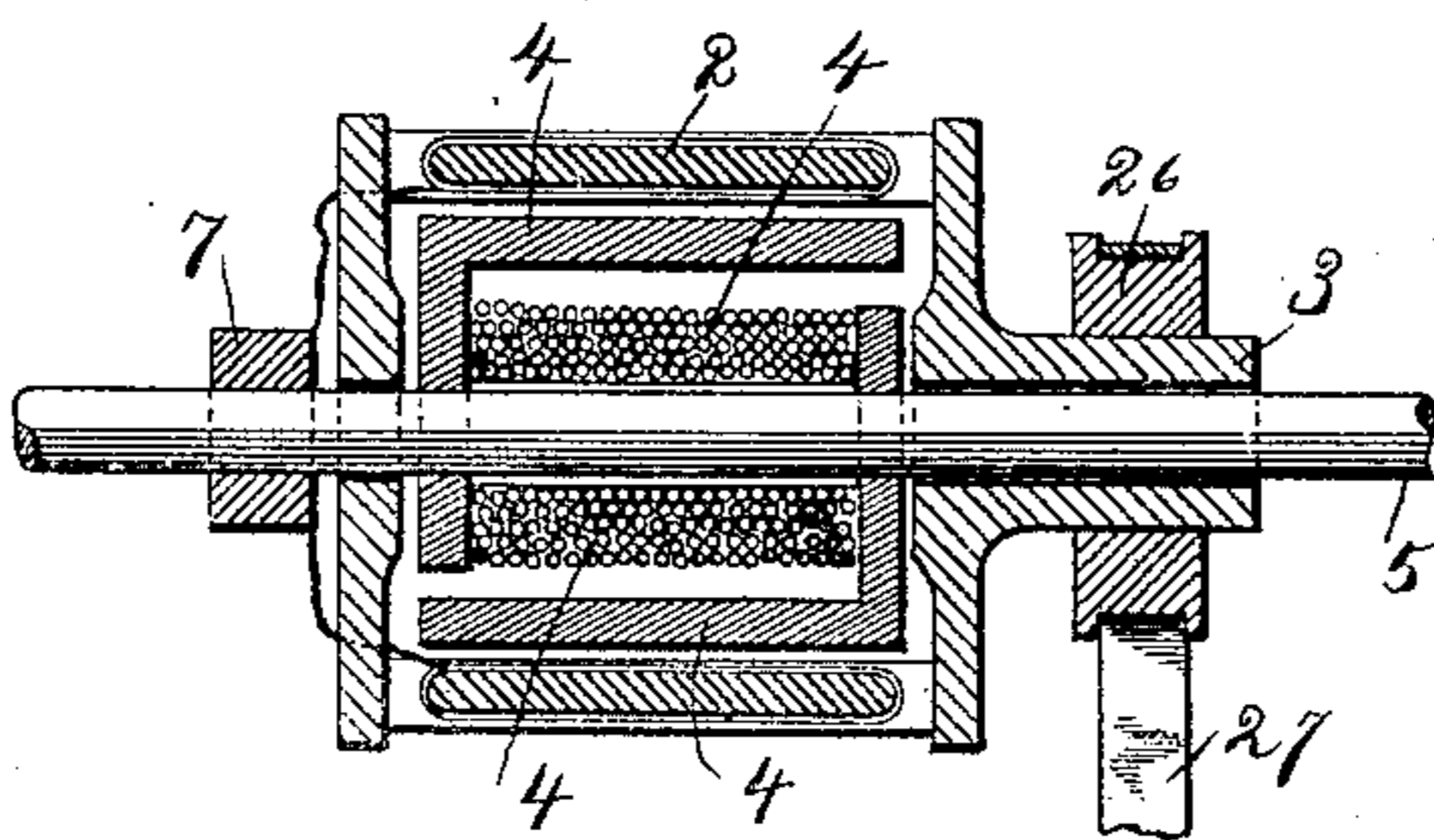
2 Sheets—Sheet 2.

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*Fig. 5.*



*Witnesses:*  
*A. V. Cushman,*  
*Robert Garrett,*

*Inventor:*  
*John H. Palmer*  
*H. E. Lodge Atty*  
*by Henry Palmer*  
*Assoc. Atty.*

# UNITED STATES PATENT OFFICE.

JOHN H. PALMER, OF BOSTON, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO  
RICHARD SMITH, OF SHERBROOKE, CANADA.

## ELECTRIC MOTOR.

SPECIFICATION forming part of Letters Patent No. 467,048, dated January 12, 1892.

Application filed March 23, 1891. Serial No. 386,056. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN H. PALMER, a subject of the Queen of Great Britain, residing at present in Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in 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, reference being had to the accompanying drawings, and to figures of reference marked thereon, which form a part of this specification.

This invention relates to improvements in electric motors in which the armature and field-magnets are both free to revolve in opposite directions, it being understood that their rotations are differential—that is, as one increases the other decreases.

My invention is embodied in mechanism by which the retardation of or stopping the revolution of one part is readily accomplished by the operator of the motor. Briefly stated, this mechanism consists in an air or fluid compressor connected with one of the revolving parts of the motor, either the armature or field-magnets, the action and operation of which will be more fully hereinafter described.

The drawings represent, in Figure 1, a plan of an electric motor of the class above described containing my improvements. Fig. 2 is an end view of the armature and field-magnets. Fig. 3 is a view longitudinally of the field-magnets in side elevation. Fig. 4 is a modified form of construction. Fig. 5 is a detail sectional view which shows independently-rotating field-magnets and armature.

In Fig. 1 the air-reservoir is shown in sectional elevation.

This invention relates to that class of electric motors fully described in an application of mine now on file and serially numbered 361,979. In this invention the essential feature consisted in the construction of a motor in which both the armature and field-magnets not only revolved oppositely, but their speed or rotary movement was reversely differential. In the present instance my improvements relate to the application of a motor of this class to an

electric street-car; and they consist in mechanism by which that part of the motor (either the armature or the field-magnets, as circumstances dictate) which is connected with the axle of a car can be controlled—that is, retarded or stopped—in order to regulate the speed of the car.

The accompanying drawings illustrate an electric motor of the before-mentioned class, in which the armature is shown at 2, its shaft at 3, while the field-magnets 4 4 (see Fig. 2) are affixed upon the shaft 5, mounted in the bearings 6 6. A commutator is represented at 7 and the brushes at 8 8. To connect this motor with the axle of a street-car, I have shown said axle at 9 as furnished with a gear 10, while a pinion 12 (see Fig. 1) is secured to the sleeve-shaft 3 of the armature. The field-magnets 4 are fixed to the shaft 5, as before stated, while the armature 2 and its sleeve-shaft 3 are loosely mounted on the said shaft 5, as more clearly indicated in Fig. 5, thereby leaving the said armature and field-magnets free to revolve in opposite directions. Thus it will be seen that as the speed of the car-axle, as likewise that of the armature-shaft to which it is geared, varies or the rotations cease entirely, according to the movements of the car, so does the speed or rotations of the field-magnets, but differentially so. Hence by varying the resistance or work done by the shaft 5, carrying the field-magnets and thereby controlling the movement of said shaft, I can easily regulate the rotations of the shaft 3 and thereby the speed of the car. Thus if a strong resistance is opposed to the field-shaft and its motion retarded conversely the speed of the armature-shaft is increased, it being understood that the strength of the current remains constant, or approximately so; but if this resistance is removed the speed of the field-magnet shaft increases, while that of the armature-shaft decreases, owing to the resistance occasioned by the load or car, which latter is retarded in its movement or may be entirely stopped. In any event, change in speed either of the armature-shaft or field-shaft to accelerate or retard, one is always in motion, and hence in the best and most efficient condition to receive an increase in the

amount of current to be passed through it. To create this resistance at the will of the operator of the motor, I have arranged a compressor in the shape of a stationary cylinder 5 14, which contains a reciprocating plunger 15, the rod 16 from which is connected with and operated by a face-plate or wrist-pin 17, mounted upon the shaft 5 of the field-magnets. From the end of this cylinder is led a 10 pipe 18, in which is located a vent-valve 19, operated by a lever-rod 20. The latter is under the control of the operator of the motor. Co-operating with the air-compressor and connected therewith by the pipe 18 is an 15 air-reservoir 21, provided with a check-valve 23 and safety-valve 24.

The operation of the above parts is as follows, assuming that the car and motor are at rest with the air-reservoir empty: Upon ad- 20 mission of an energizing-current that part of the motor without any load—in the present instance the field-magnets and shaft—immediately commence to rotate and soon assume their maximum rate of speed, the valve 19 25 being open, and no resistance by the compressor and its plunger is then offered. This movement operates the compressor connected therewith, while, the vent-valve now being closed, the air-reservoir soon attains a pres- 30 sure. As the latter increases the rotations of the field-shaft are retarded until the maximum normal pressure is attained equal to a resistance which corresponds with a maximum load—viz., the car and its burden for the 35 steepest gradient. At this period the field-magnet is approaching its minimum rate of movement. To start the car, the vent-valve is to be closed, and this entirely or partially, according as a sudden or easy start is desired. 40 As resistance to the rotation of the field-magnets is created retardation occurs, as before premised, while movement of the armature-shaft is commenced and increased correspondingly to the retardation of the field-shaft. 45 Should the vent-valve be shut at once, the rapid movement of the compressor-piston raises the pressure in the compressor until it is equal to the maximum pressure in the reservoir and equals the whole load of the car. 50 A corresponding increase in speed of the armature-shaft ensues and the car is at once put in motion. Conversely with the car at full speed the field-magnets are at low speed, being under the retarding effect of the air- 55 reservoir. To check the car the vent-valve 19 is opened, the check-valve 23 at once closes, and the shaft 5 is free to rapidly increase its

rotation, while the armature-shaft 3 is correspondingly reduced in speed.

In Fig. 4 I have shown a modified form of 60 construction—that is, in lieu of having the car-axle united with the shaft 3 of the armature it may be connected with the shaft 5 of the field-magnets. To this end I secure the pinion 12 upon the shaft 5 and a pulley 26 65 upon the shaft 3, said pulley, with a belt 27, serving to operate a counter-shaft, which causes a pair of air-compressors to reciprocate, said compressors communicating with a res- 70 ervoir or reservoirs as before mentioned.

I have described this mechanism as designed for the use of air; but fluid, as glycerine or oil, may be employed to create resistance with equally good results, the only es- 75 sential being that such fluid as escapes by way of the vent-valve should be returned to the system or else fresh liquid be supplied.

What I claim is—

1. The combination, with an electric motor having its armature and field-magnets free 80 to revolve in opposite directions, of means for retarding or stopping the revolution of one part of said motor, consisting of a gas or fluid compressor, operated substantially as shown, and for purposes set forth. 85

2. In an electric motor, the combination, with a car-axle, an armature freely revolving in one direction, field-magnets freely revolving in a reverse direction, and an air or fluid compressor actuated by one of the moving 90 parts, of power-transmitting mechanism between the other moving part and the car-axle, and a vent-valve controlled by the operator to vary the resistance of the compressor, substantially as specified. 95

3. In an electric motor, a car-axle, an armature-shaft, its armature, the field-magnet shaft and the field-magnets thereupon, said armature and field-magnets being free to re- 100 volve oppositely, but at differentially-varying rates of speed, and the mechanism which connects the car-axle with one of the moving parts of said motor, combined with an air-compressor connected with the other of said 105 moving parts of the motor, the air-reservoir, its check and safety valves, and the vent-valve, with its operating-lever, substantially as explained.

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

JOHN H. PALMER.

Witnesses:

H. E. LODGE,

FRANCIS C. STANWOOD.