No. 707,839. Patented Aug. 26, 1902.

E. R. GILL.

ELEVATOR.

(Application filed Dec. 16, 1899.)

(No Model.) 2 Sheets—Sheet 1.

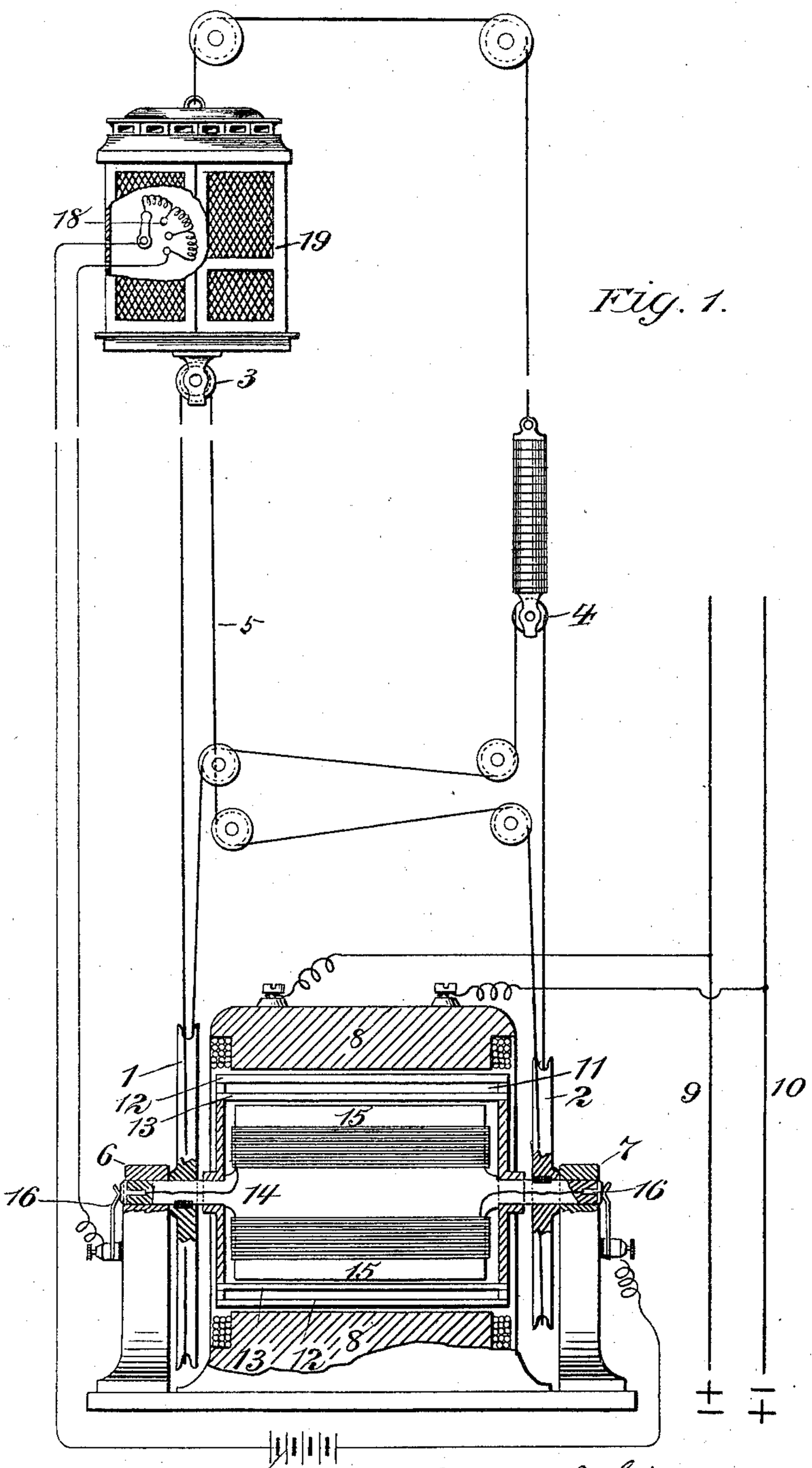

Fig. 1.

Witnesses
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Edwin R. Gill Inventor
By his Attorney H. Mackay

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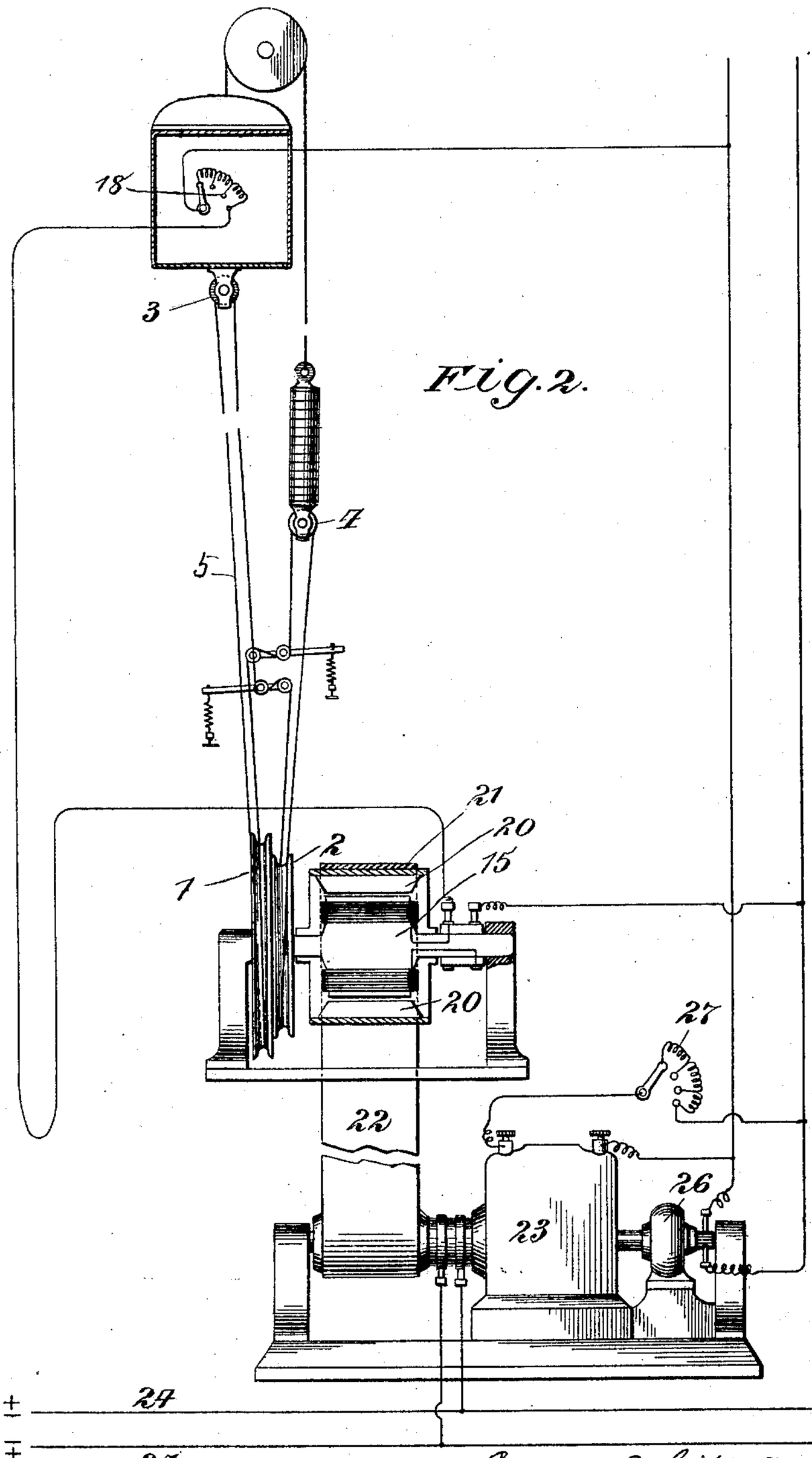

Fig. 2.

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UNITED STATES PATENT OFFICE.

EDWIN R. GILL, OF NEW YORK, N. Y., ASSIGNOR TO INVENTION DEVELOPING COMPANY, A CORPORATION OF NEW JERSEY.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 707,839, dated August 26, 1902.

Application filed December 16, 1899. Serial No. 740,524. (No model.)

To all whom it may concern:

Be it known that I, EDWIN R. GILL, a citizen of the United States, residing in the city, county, and State of New York, have invented a certain new and useful Improvement in Elevators, of which the following is a specification.

My present invention relates to apparatus for the operation and control of elevators by electricity, and more particularly by means of single-phase alternating-current motors.

It is well known that a high degree of efficiency is attained wherever synchronous alternating-current motors operate in synchronism with their generators. Moreover, the employment of this type of motor in circuits tending to produce a detrimental lag in the generating-armature is very advantageous, since by sufficiently exciting the field-magnets of the motor it may be made to produce a phase-lead which counteracts the aforesaid lagging tendency.

It has not hitherto been found practicable to apply motors of the above-named class to elevators, because in elevator practice the maximum effort is required at starting, whereas motors of the type named only attain a working torque when running in synchronism or very near it.

In its broadest aspect my improved elevator apparatus may be operated by any form of motor and involves certain elements of construction, hereinafter described and claimed, apart from alternating-current motors.

It is one of the main objects of my present invention to provide means whereby a motor of the class aforenamed may be made available for the running of elevators under existing conditions of use, thus making available the high working efficiency for which these motors are remarkable.

A preferred specific form of my present invention involves means for causing a descending car to so react upon its driving-motor as to restore energy to the line. Where a number of cars are run by a single motor, this will cause those descending to virtually aid in the lifting of the ascending cars.

My invention is illustrated in two of its many possible embodiments in the accompanying drawings, wherein—

Figure 1 is a diagrammatic view of an elevator system embodying my invention, certain rotating parts being shown in section; and Fig. 2 is a diagram of another embodiment thereof.

Broadly considered, my invention comprises an elevator-car, constantly-moving motive means adapted to counteract the gravitative tendency thereof, and means for regulating the degree of effort exerted by the motive means, so as to overpower or moderate this gravitative tendency without substantial change in the speed of the motive means. This usually takes the form of means comprising variable electromagnetic transmission means.

My present invention in its preferred form involves a driving-motor always revolving in one direction, a differential pulley driven thereby, an endless driving-cable in two bights driven, respectively, by the two parts of the differential pulley and passing over two sheaves, one of which is on the elevator-car and the other of which is adapted to move in relation to said car in the same way as the usual counterweight. That part of the motor which constantly revolves in one direction tends, when energized as hereinafter described, to drag after it a second part, which acts directly upon the hoisting or lowering sheaves and their cables. When this drag is sufficiently strong, it causes these sheaves to overcome the counterbalance condition one way or the other of the elevator and its counterweight, and the elevator will rise or descend, as the case may be. When weakened, this drag becomes merely sufficient to hold the cage still, and when still weaker the counterbalance effect of cage and counterweight becomes active to reverse direction of the cage movement.

In the drawings the above-named elements are shown in both figures. The two parts of the differential pulley are shown at 1 and 2, the two sheaves at 3 and 4, and the driving cable, rope, or belt at 5.

The general operation of these parts is as follows: Assuming the pulleys 1 and 2 to be

rotating downward on the side toward the observer in Fig. 2, it will be evident that the cable 5 will travel downward in front of pulley 1, thence upward to sheave 3, down to smaller pulley 2, and over sheave 4, whence it returns to pulley 1. Since the bight embracing pulley 1 moves faster than that embracing pulley 2, sheave 4 will be made to descend while sheave 3 and the car ascend. In Fig. 1 the opposite tendency will be produced. It is evident that to operate this system either pulley 3 or pulley 4 must tend by superior weight in its favor to descend.

In Fig. 1 the counterweight to which pulley 4 is attached always overbalances the weight of the car plus its load, and the differential pulley is therefore arranged to pull the car itself down against the tendency of the counterweight.

In Fig. 2 the sheave 4 may or may not be attached to a counterweight; but in any event the weight of the car is always sufficient to counterbalance that of the pulley 4 and its support, and the pulleys 1 and 2 are so arranged as to pull down upon sheave 4 to raise the car. The differences of arrangement and of motor and generator construction as exhibited in the two figures of accompanying drawings are intended to exemplify the variety of forms my invention is capable of assuming. It is not to be understood that these are all of the forms covered by my claims nor that the particular grouping of modified structures shown in either figure is essential to my present invention.

In Fig 1 I have shown the two parts 1 and 2 of the differential pulley separated and the motive means placed between them. The bearings common to pulley and motive means are placed outside and are shown at 6 and 7. The motive means consists of an exterior multipolar field-magnet 8, in circuit with a source of alternating current 9 10, which while illustrated as a single-phase circuit may be of any number of phases without departing from my invention. Within the field-magnet 8 turns an intermediate member 11, comprising two sets of conductor-bars 12 and 13, arranged to form two armatures of the well-known mouse-mill type. The field-magnet 8 acts by induction upon the outer mouse-mill bars 12 in a well-known way, producing a self-starting motor or not, according to whether a compound magnetic field is or is not produced by the specific form of windings used. In either case before load is applied the double intermediate member or cylinder can be started and made to rotate upon the inner shaft 14 at a speed corresponding to synchronism between phases of impressed and counter electromotive forces. The inner shaft 14 carries immovably fixed upon it an electromagnetic member, preferably composed of a multipolar field-magnet 15, the windings of which are brought out to convenient terminals, as 16, upon the shaft 14 for receiving an electric current. The pulleys 1 and 2 are made to turn together with the shaft 14. Supposing the intermediate member 12 13 to be rotating at a high rate of speed and circuit to be closed through any generator, as 17 and the magnets 15, it is evident that a strong magnetic field will be caused by currents induced in the inner bars 13, causing the magnets 15 to be attracted to follow the intermediate member. By varying the strength of the current through the magnets 15 this tendency may be made greater or less at will. In Fig. 1 I have shown a variable rheostat 18 on the car 19 as one example of means adapted to this purpose.

The operation of this form of elevator apparatus is as follows: Assume the car to be at rest at the top of its shaft and the intermediate motor member 12 13 to be rotating constantly, the circuit of the magnets 15 being open, so that no appreciable effort is exerted. Now when it is desired to descend, the circuit is closed through the magnets 15 at 18 in the car. Magnetic poles will at once be set up in the inner surface of the intermediate member, due to currents set up in the bars 13 by relative movement between said bars and the fields of force of the magnets 15. Consequently there will be a tendency in the magnets 15 to follow the rotation of the intermediate member 12 13. By gradually decreasing the resistance at 18 or by otherwise increasing the strength of the magnets 15 this rotative tendency may be brought slowly and without shock to a point where it will cause rotation of the pulleys 1 and 2 and will pull the car down against the counterweight 4. Of course the same mode of operation can be applied to raising the car by pulling down upon the counterweight, and this arrangement is illustrated in Fig. 2. Supposing it to be desired to stop at any floor, the strength of the magnets 15 has only to be regulated by a rheostat 18 or otherwise to make their rotative tendency just sufficient to counterbalance the superior effort of the counterweight. Since the rotative tendency or torque at the shaft 14 is greatly magnified by the differential-pulley system shown, and the constant resistances of any elevator system bears a considerable ratio to said torque, it is evident that the gravitative effort in favor of motion can be varied through a considerable range in practice without the car moving. Thus the getting on or off of passengers may take place without sufficiently disturbing the equilibrium to start the car in either direction. At the bottom of the shaft it is merely sufficient to maintain the rotative effort at the magnets 15 at such a point as to prevent upward movement of the car. In the form shown in Fig. 2 the same general mode of operation is adopted, but some differences in construction are apparent. In this figure the two parts 1 and 2 of the differential pulley are placed together at one end of the driving-shaft. The magnets 15 on the driving-shaft

are surrounded by inwardly-projecting armatures 20 within a pulley 21, driven by a belt 22, the belt being driven by an appropriate motor. I prefer to employ in this connection, as well as in others, a separately-excited single-phase alternating-current motor 23, whose armature receives current from the line 24 25 and whose field-magnet is preferably excited by a small direct-current generator 26, driven by said main motor 23. By means of the rheostat 27 or equivalent means the field-magnet strength of the motor 23 may be varied, and the motor may thereby be made to more or less counteract the lagging tendencies of the main circuit. I prefer to place the magnets 15 and their controlling means 18 in a branch from the circuit from generator 26. By this means when the magnets 15 are being driven backward against the attraction of armatures 20 their reaction tends to strengthen the motor field-magnets at 23, and thus reinforce the main circuit by favorably affecting the main generator-armature reactions.

It is one of the beneficial features of my present invention that the constant rotation of the motive means makes it possible to utilize the inertia of the moving parts to start the elevator, and thus relieve the driving-motor of the excessive effort so detrimental to all electric motors on starting. For this purpose the pulley 21 in Fig. 2 may be made very heavy, or other fly-wheel arrangements may be adopted.

In my claims the term "motive means" is applied to any source of actual power—such, for instance, as a steam-engine or electric motor. The term "driving mechanism" covers any form of apparatus which when set in motion by the motive means acts operatively upon the elevator-car. In the drawings this comprises the differential pulleys and cable.

It is to be understood that the details of construction herein shown and described are intended merely to exemplify principles of my invention and that I do not limit myself to said details.

What I claim is—

1. In an elevator, a car, driving mechanism therefor, rotary magnetizable poles adapted to turn therewith, a magnetizing-circuit for said poles, means on the car for varying the current in said circuit, a closed rotatable circuit close to said magnetizable poles and means for imparting rotary movement to said closed circuit.

2. In an elevator, a car balanced so as to tend by gravity to move in one direction, driving mechanism therefor, constantly-moving motive means adapted to operate through said driving mechanism to counteract said gravitative tendency and means for regulating the power of said motive means from zero to a maximum sufficient to move said car against said gravitative tendency without substantially changing the speed of said mechanism.

3. In an elevator, a car, driving mechanism therefor, rotary magnetizable poles adapted to turn therewith, a magnetizing-circuit for said poles, a closed rotatable circuit close to said magnetizable poles, an electric motor for driving said closed circuit continuously, a generator operated by said motor and supplying current to said magnetizing-circuit and means for controlling said magnetizing-current.

4. In an elevator, a car, driving mechanism therefor, rotary magnetizable poles adapted to turn therewith, a magnetizing-circuit for said poles, a closed rotatable circuit close to said magnetizable poles, an alternating-current motor for driving said closed circuit continuously, a generator operated by said motor and supplying current to motor field-magnets and to said magnetizing-circuit, and means for controlling said magnetizing-current.

5. In an elevator, a car, driving mechanism therefor, constantly-rotating motive means, an inducing and an induced electromagnetic transmission member, one of said members being operatively connected to said driving mechanism and the other to said motive means, and means for operatively varying the electromagnetic reaction between said transmission members.

EDWIN R. GILL.

Witnesses:
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