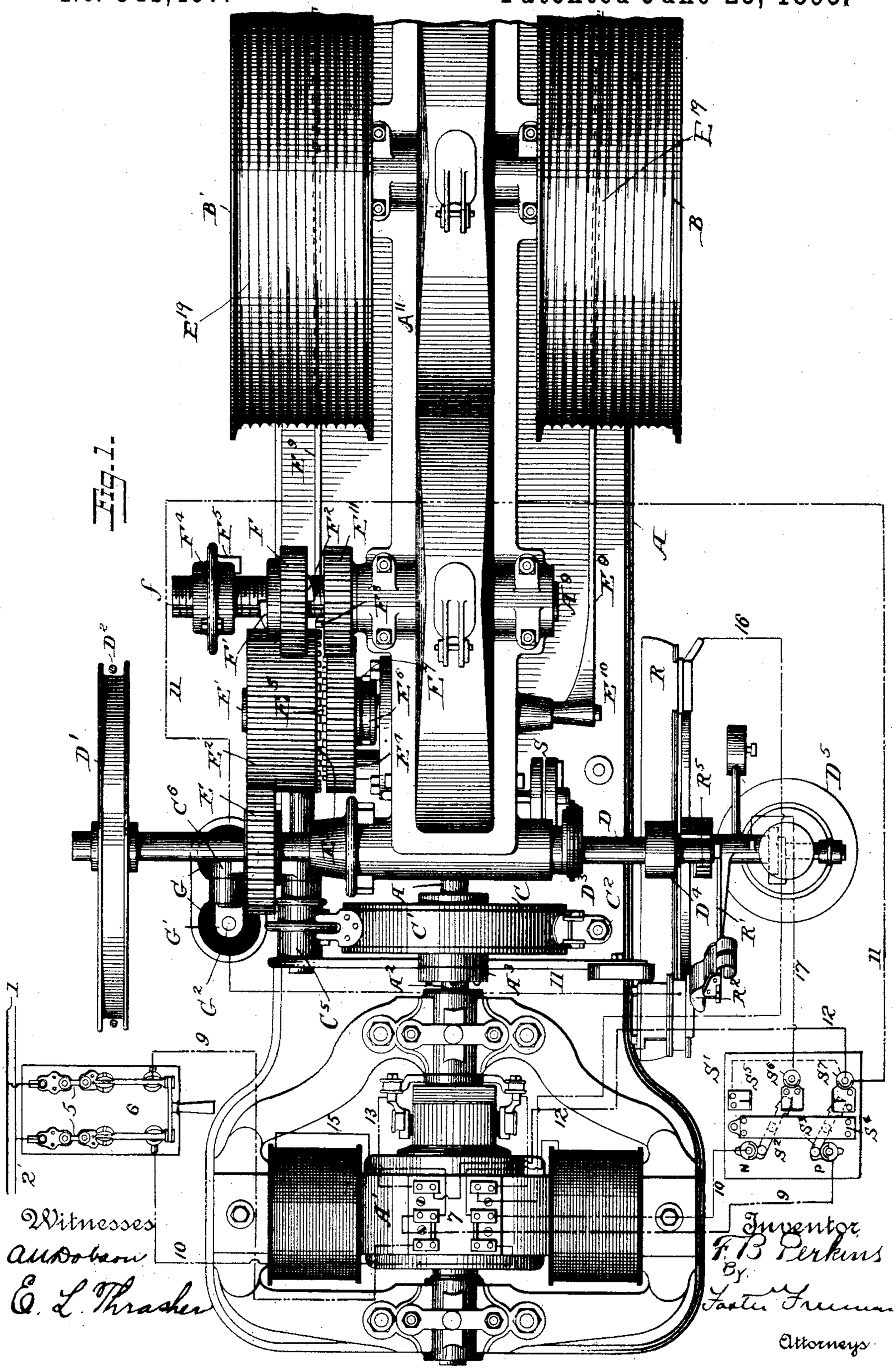
(No Model.) 4 Sheets—Sheet 1.

F. B. PERKINS.

ELECTRIC ELEVATOR APPARATUS.

No. 541,497. Patented June 25, 1895.

Fig. 1.



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(No Model.) 4 Sheets—Sheet 2.

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ELECTRIC ELEVATOR APPARATUS.

No. 541,497. Patented June 25, 1895.

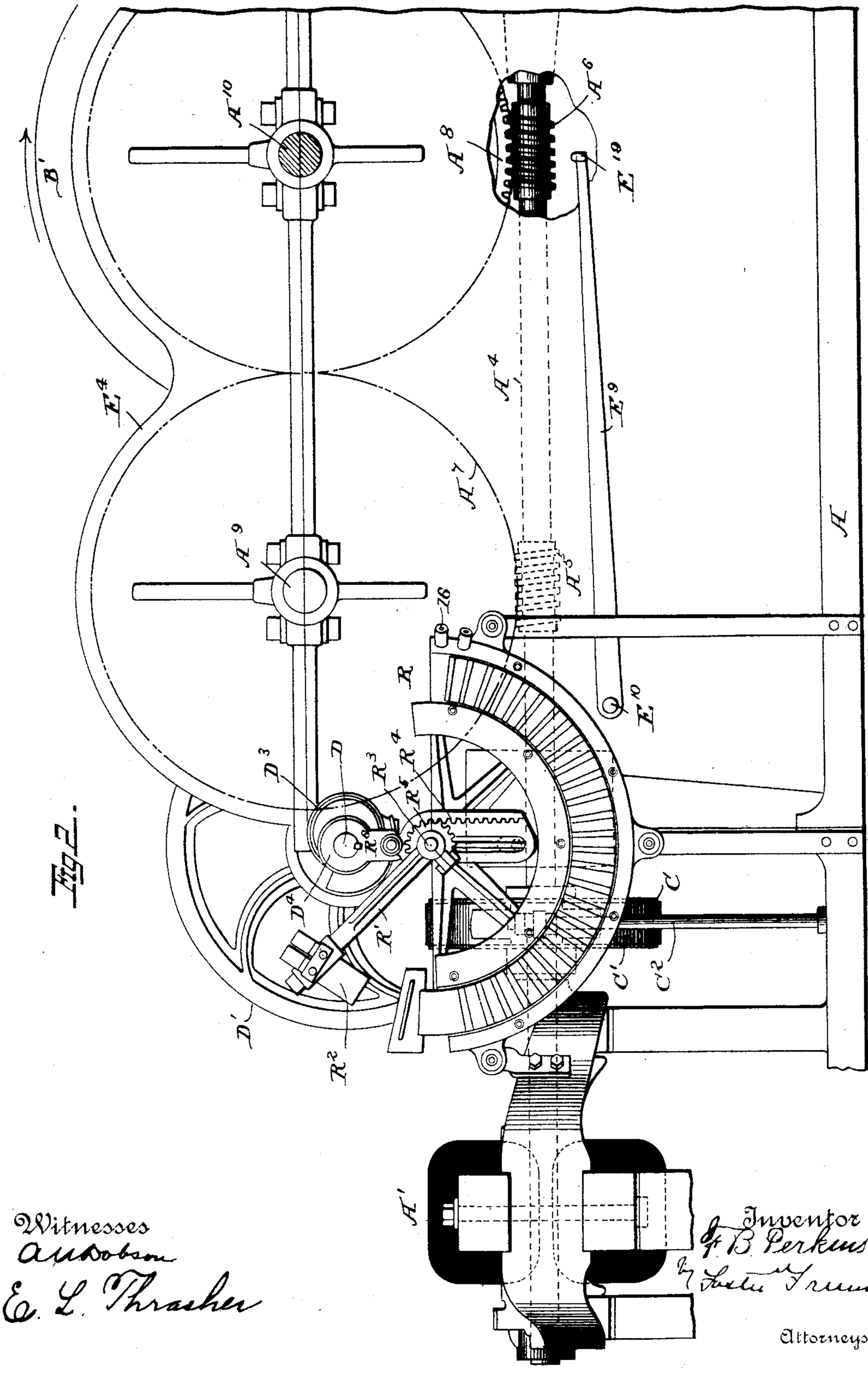

Fig 2.

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ELECTRIC ELEVATOR APPARATUS.

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Fig. 3.

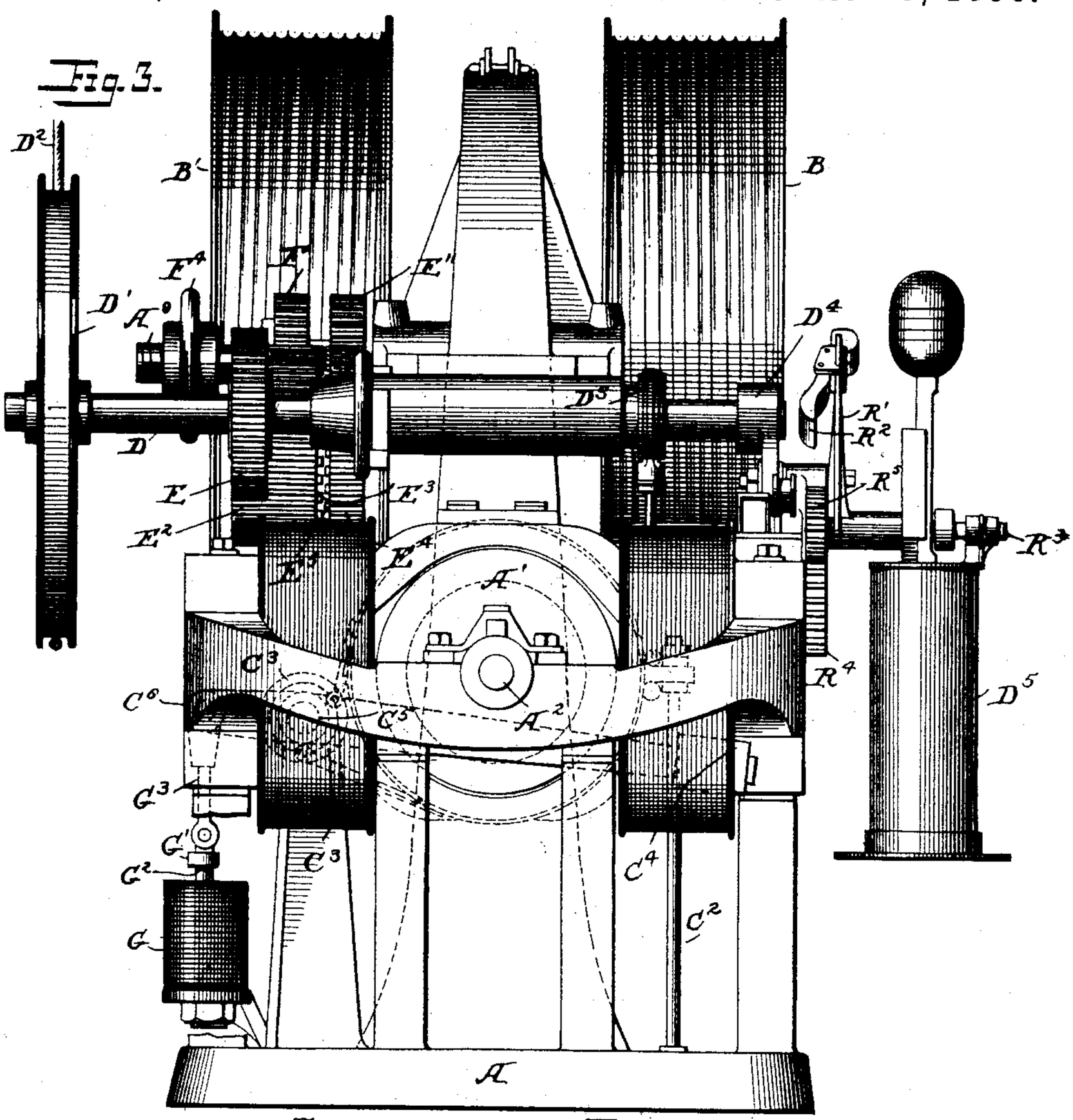
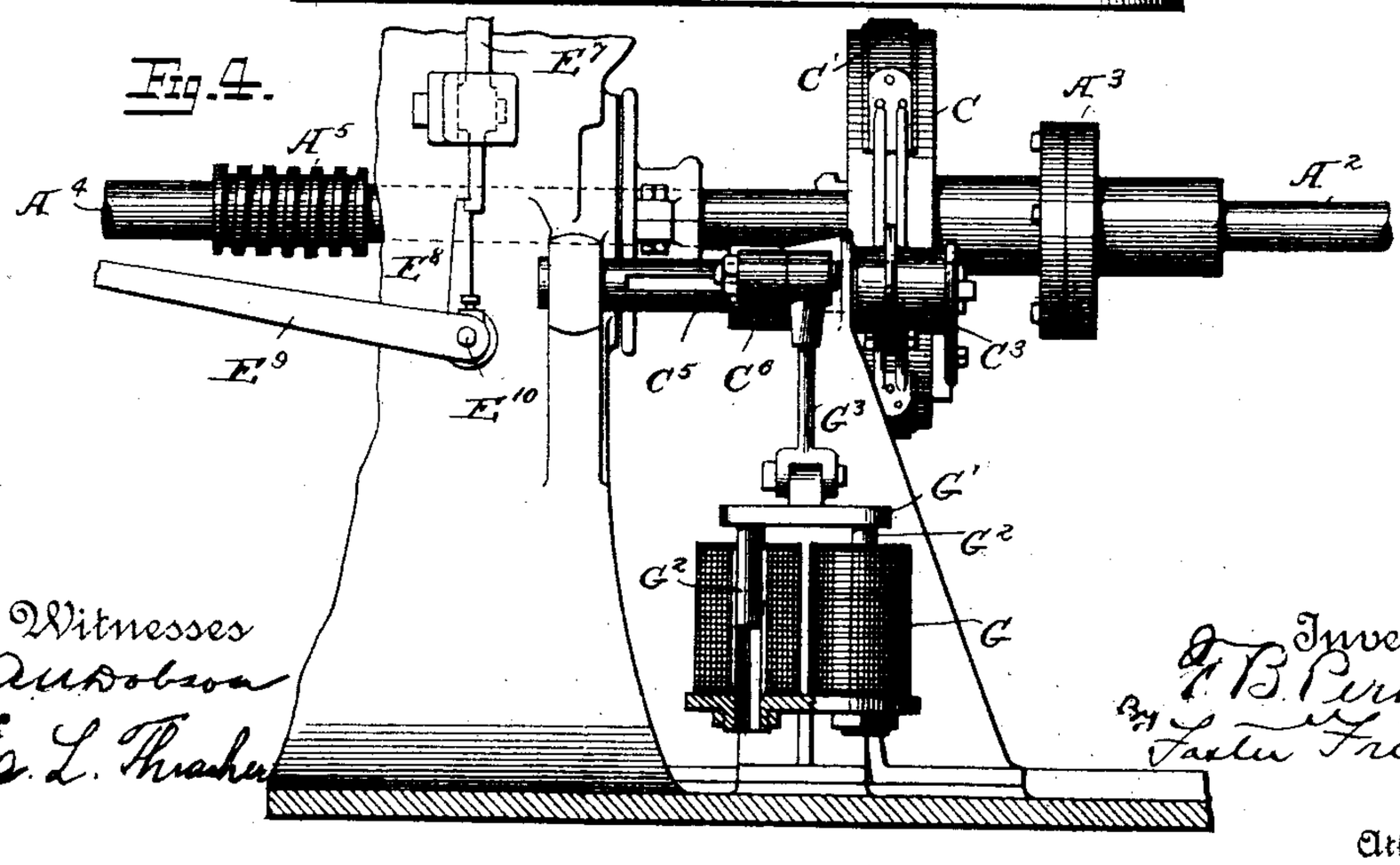


Fig. 4.



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(No Model.) 4 Sheets—Sheet 4.

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ELECTRIC ELEVATOR APPARATUS.

No. 541,497. Patented June 25, 1895.

Fig. 5.

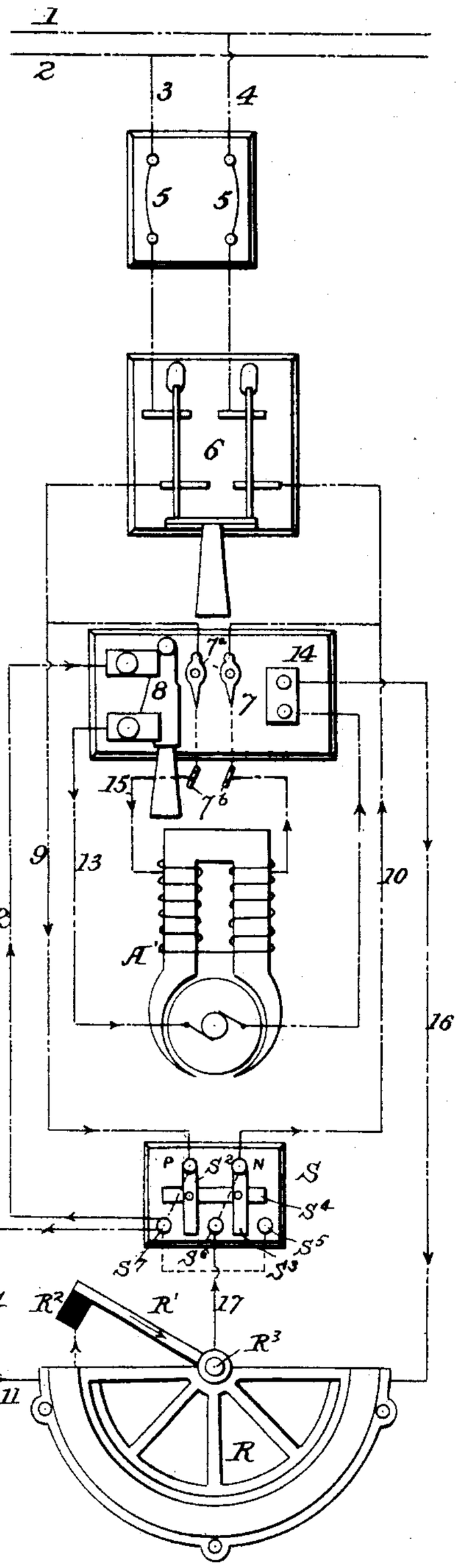
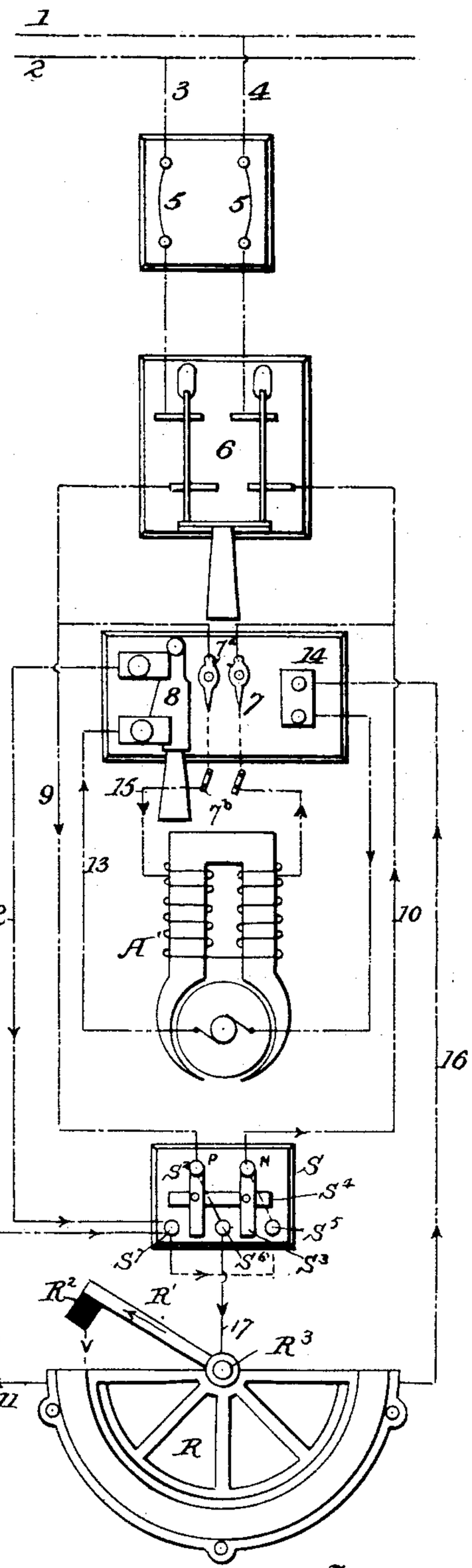


Fig. 6.



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UNITED STATES PATENT OFFICE.

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ELECTRIC-ELEVATOR APPARATUS.

SPECIFICATION forming part of Letters Patent No. 541,497, dated June 25, 1895.

Application filed December 15, 1892. Serial No. 455,278. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS B. PERKINS, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Electric-Elevator Apparatus, of which the following is a specification.

My invention relates to safety devices for electric elevators, and it has for its object to provide means whereby electric elevators may be more safely and certainly operated, and especially to provide means whereby the elevators may be automatically stopped whenever through derangement of the apparatus or circuit or for other reason it is necessary or desirable to stop the mechanism in order to prevent accidents, or injury to the parts or otherwise.

To these ends my invention consists in the various features of construction and arrangement of parts, having the mode of operation substantially as hereinafter more particularly pointed out.

Referring to the accompanying drawings, Figure 1 is a plan view of an electric-elevator mechanism having my invention applied thereto. Fig. 2 is a side view partly in section, some parts being omitted for the sake of clearness. Fig. 3 is an end view. Fig. 4 is an enlarged side view of part of the mechanism relating more especially to the brake device, and Figs. 5 and 6 are respectively diagrammatic arrangements showing the method of wiring or connecting the electric circuits.

While many features of my invention may be applied to electric elevators of different constructions and arrangements, in order that the principles of my invention may be understood, I have shown them applied to one particular and well known form of apparatus using the same as a means of illustrating my invention without intending to limit it in any way, as it is evident to those skilled in the art that the principles of the invention may be embodied in many and various forms and arrangements of devices without departing from the spirit thereof, depending very largely upon the particular work to be done and the apparatus to be operated and controlled.

Referring to the mechanical part of the elevating apparatus which may be briefly referred to, it is sufficient to say that upon a suitable base A, is mounted an electric motor A′, which may be of any suitable and desired construction, and the armature shaft A^2, thereof is connected preferably by an insulating coupling A^3, with a shaft A^4, which in the present instance is provided with two worms A^5, A^6, gearing respectively with two worm wheels A^7, A^8, which in turn gear together and are mounted upon the shafts A^9, A^{10}, suitably supported on the framing A. It will be seen that the worm shaft is practically a prolongation of the armature shaft of the motor, and that the whole is supported upon a single base plate in suitable bearings, the worm wheels being preferably covered with a case A^{11}, to prevent accidents, and protect the worm gearing. Suitably mounted on the shaft A^{10}, are the winding drums B, B′, around which are wound and unwound the ropes of the elevator and counter-weight therefor, or other arrangements of ropes according to the particular class or style of elevator employed.

Connected with the elevating mechanism is some suitable brake apparatus, and I have shown it in the present instance as comprising a wheel C, mounted on the shaft A^4, and having a strap C′, connected at its center or formed in two portions which are adjustably connected to a standard C^2, on one side of the wheel, while the other ends of the brake strap are connected to a rocking bearing or lever C^3, to which is attached an adjustable weight C^4, so arranged as to normally put the brake on, the rocking bearing or lever C^3, being mounted on a stud or shaft C^5, and to this rocking bearing is attached an arm C^6, by means of which the weighted arm may be raised and the strap loosened to relieve the brake, and this I accomplish automatically by electrical means in a manner hereinafter more particularly pointed out. Also mounted in suitable bearings in the frame is a shaft D, operating as the shipper shaft for starting, stopping and reversing the motor, and this is provided with a shipping wheel D′, around which passes the ordinary hand rope D^2, of the elevator or other elevator operating device, and connected to this shaft is a device D^3, for operating the brake and reversing switch S,

and also the device D^4, for controlling the rheostat R, in the circuit of the motor. Further this shaft is provided with means to control its operation to prevent the elevator boy from cutting out the resistance of the rheostat too quickly in starting the motor, and this in the present instance consists of a dash pot arrangement D^5, the details of which need not be specifically set forth, as they form no part of my present invention, it being sufficient to say that the device is so arranged that when the shaft D, is operated to close the circuit, the motion of the rheostat is controlled and regulated so that the resistance shall not be cut out too quickly, regardless of the motion of the shaft, while when the shaft is operated to stop the motor, the shaft may be moved at any proper rate of speed, regardless of the controlling device and the construction illustrated is substantially that shown in Patent No. 509,363, granted to Clark, which I have found to be a desirable construction, although any other arrangement of dash-pot may be used.

In order that the motor will be automatically stopped under certain conditions, I have shown safety devices which will operate to shift the shaft D to cut out the circuit of the motor and apply the brake, thereby stopping the mechanism and while various safety devices may be used, I have shown herein, among others, an appliance to stop the motor when for instance either of the ropes on the drums becomes slack. In order to accomplish this I attach to the shaft D, a pinion E, which is fixed thereon, and mounted on a suitable stud E′, is a loose pinion E^2, having one portion E^3, of a clutch on one of its sides, and also mounted loosely on the stud E′, is another pinion E^4 forming the other portion E^5, of the clutch. To this pinion is connected a collar E^6, into which takes an arm E^7 (Fig. 4) which in turn is operated by the short arm E^8, of the lever E^9, which is pivoted to the frame of the machine at E^{10}, and extends underneath the drum B, preferably having cross arms E^{19}, extending under the drums, as shown in dotted lines, Fig. 1, there being two levers E^9, one for each drum connected to the same shaft E^{10}. Mounted on an extension of the shaft A^9, is a fixed pinion E^{11}, gearing with the pinion E^4, and from this construction it will be seen that if for instance the rope on one of the drums becomes slack, and depresses one of the levers E^9, the pinion E^4, will be moved through the arm E^7 and collar E^6, to bring the clutch portions E^3, E^5 in engagement, and this will cause the pinion E^2, to rotate and through the medium of pinion E move the shaft D, in the proper direction to cut out the circuit and automatically stop the motor.

In order to automatically cut out the circuit and stop the motor when the car has reached the limit of its upward or downward motion, I form the extension of the shaft A^9, as a screw shaft, and mount thereon a loose pinion F, which has a screw threaded bearing, so that it will travel back and forth on the screw shaft, and each side of this pinion is provided with a projection or lug F′, or F^2, while the pinion E^{11}, is also provided with a similar lug F^3, and an adjustable stop piece F^4 is provided with another lug F^5. This stop piece can be adjusted on the screw shaft and secured by means of a key or other device fitting the slot *f*. It will be seen that with this construction when the motor is operating to move the elevator up or down as the case may be, the pinion F, travels on the screw-threaded portion of the shaft, the teeth of the pinion engaging with the wide pinion E^2, but not rotating the same. When, however, the elevator reaches its extreme uppermost or lowermost position, one or the other of the lugs F′, F^2, engages with a corresponding lug F^3, or F^5, and the pinion F, is caused to rotate in one or the other directions, and this rotates the pinion E^2, which meshes with the pinion E, on the shaft D, and moves said shaft to cut out the electric circuit and automatically stop the elevator. It will be seen that this device can be accurately adjusted, so that the elevator can travel to a greater or less distance upward or downward, but that when it reaches its extreme position, it will be immediately stopped automatically by cutting out the electric circuit.

So far I have described more particularly the mechanical parts of the device shown, and I will now describe the electric appliances which are operated by the automatic safety devices, and which control the operation of the motor and brake device.

The break switch S, may be of any ordinary construction, but is shown in a convenient form displayed at S′, in which it will be seen that it comprises the posts N, P, on one side to which are connected the switch arms S^2, S^3, they being connected by an insulating plate S^4, which is operated by an eccentric or cam D^3, on the shaft D, so as to move the contact arms to the contacts S^5, S^6, S^7, the contacts S^5 and S^7, being connected as is usual in forming a reversing switch, while when the shaft is in its normal position, the arms are held between and away from all of the contacts and moved up or down as the case may be to cause the motor to operate in one or the other direction. Other circuit breaking and reversing devices may be used in place of this shown accomplishing substantially the same results.

The rheostat R, may be of any suitable construction, but I have shown it in the well known form of a semi-circle, the switch arm R′, carrying the contact brush R^2, being mounted on a shaft or bearing R^3, and operated from the shaft D, by suitable intervening mechanism, there being shown a curved rack R^4 taking in a pinion R^5, on the shaft of the arm R′, this rack being pivoted to a projecting arm R^6, keyed on the end of the shaft D, and so arranged that in whatever direction the shaft D is turned, the arm R′, will be caused to sweep over the surface of the rheostat from one end to the other, its action in the present

instance being controlled and regulated in one direction by the dash pot D^5 as before intimated. It will thus be seen that whenever the shaft D is turned to close the circuit of the switch S, the rheostat is brought into the circuit, and the resistance gradually cut out of the circuit, and whenever the switch S is opened, the arm R of the rheostat is brought to the position shown in Fig. 2. This rheostat is connected in the circuit in the manner indicated, and more clearly pointed out hereinafter in connection with the description of the diagrams.

As before stated, the brake device which is shown as comprising the band C′, encircling the wheel C, is normally under the stress of the weighted lever C^4, so that the brake is set and the mechanism held stationary. In order that the brake may be released to allow the mechanism to operate at the proper time, I provide electro magnetic devices connected in the circuit of the motor, which when the circuit is in proper order will operate to release the brake device, and which when for any reason the circuit is not in order will allow the weighted lever to automatically apply the brake and stop the mechanism and hold it stationary.

While many and various ways of applying the electro magnetic devices may be adapted to accomplish this result, I have shown in the present instance a magnet G, which is secured to the frame of the machine, and which has an armature G′, in this instance provided with cores G^2, entering the solenoids of the magnets G, and this armature is connected, as by a link G^3, to the arm C^6, on the shaft C^5, carrying the rocking bearing or lever C^3, to which the brake strap is connected. With this arrangement it will be seen that when the coils of the electro magnet G, are properly energized, the armature will be attracted and the shaft C^5, oscillated to lift the weighted lever and release the brake, and the electric motor can operate to propel the elevating device, but when for any cause the current passing through the magnet G, is weakened or interrupted, the brake will be automatically applied to instantly stop the elevating mechanism.

In order to better understand the arrangement of the wiring or circuits of the machine and the operation of the electrical devices, I have shown in Figs. 5 and 6, a diagrammatic arrangement in which 1 and 2 are the main leading wires of any suitable distributing system or source of supply from which the branch wires 3, 4, are taken to supply energy to the elevating mechanism. Interposed in these branch wires are the usual safety fuses 5, and there is preferably a double terminal cut-out or knife switch 6, controlling both branches of the circuit, and there is preferably arranged a motor board 7, also having a knife switch 8, controlling the circuit of the motor and other appliances usual in such cases.

Referring to Fig. 5, it is assumed that the switches 6 and 8 are closed, and that the switch arms S^2, S^3, are moved to the left, as indicated by the dotted lines, the switch arms being connected to the terminals on the switch 6, by the conductors 9 and 10 respectively, and the brush R^2 of the rheostat is turned so that it contacts with the adjacent end of the rheostat R, as indicated by the dotted line. The magnet G, is connected by a conductor 11, to the end of the rheostat, and to the contacts S^7 and S^5, on the switch S. The contact S^7, is also connected by a conductor 12, with a switch 8 on the motor board, and from this switch is a conductor 13, leading to the armature of the motor A′, and to the contact plate 14 on the motor board, while this contact plate is connected by a conductor 16, to the end of the rheostat R, and the shaft R^3, of the rheostat is connected to contact S^6, on the switch S by a conductor 17. The field-magnet coils in the present instance are shown in shunt relation to the armature coils, being connected by the conductor 15, to the conductors 9 and 10, respectively, through the motor board, the conductors 15, being shown as being connected to the binding-posts 7^a, on the motor-board 7, and by connectors 7^b, which are represented just below the motor-board 7. The passage of the current under these conditions will be readily understood and is indicated by the arrows, and it will be seen that as soon as the shaft D, is moved by the hand rope or otherwise, and the rheostat arm makes contact with the rheostat, the circuit is closed through the motor, including the resistance of the rheostat R, while the circuit through the brake magnet G, is complete from the contact S^7, through the coils of the magnet G, brush R^2, arm R′ and conductor 17, contact arm S^3, and out by the wire 10. Thus at the instant of closing the circuit, there is the maximum resistance of the rheostat in the motor circuit, and practically a circuit of no resistance for the brake magnet, so that the greater portion of the energy of the current will be utilized in operating the brake mechanism to release the same, and as the shaft is turned further and the rheostat brush sweeps over the rheostat, gradually cutting out the resistance from the motor circuit and including the resistance in the brake magnet circuit, it will finally result that the brake magnet circuit will include the resistance of the rheostat, while the motor circuit will be practically free from said resistance. Under these conditions I find that sufficient current will flow through the brake magnet to maintain the brake in its released condition and nearly all of the energy of the current will be used in operating the motor.

If now for any reason the strength of the current falls below a minimum of safety, or the circuit is interrupted, the brake magnet immediately releases its armature and the brake is applied, stopping the motor. Further if any derangement occurs to the mechanical part of the elevator mechanism, the

automatic devices above described will operate to turn the shaft D and cut out the circuit of the motor and allow the brake to be applied, and when the elevator reaches its extreme position up or down, the automatic devices heretofore described will also operate to cut out the circuit, stop the motor and apply the brake.

When for instance the reversing switch S, is moved to the position shown in Fig. 6, the circuits will be substantially the same, and it will be seen that on the first movement of the switch and rheostat arm R′, the current will flow through the conductor 17, rheostat arm R′, brush R^2, the conductor 11, brake magnet G, contact S^7, and through the connection to contact S^5, and out through the return wire 10, while the resistance of the rheostat will be included in the motor circuit, and as before, as this resistance is gradually cut out of the motor circuit, it is included in the brake magnet circuit, and the arrangements and mode of operation are the same as before, except that the motor will operate in the reverse direction.

It will thus be seen that in all instances on closing the circuit to start the motor in either direction, the greater portion of the current will flow directly through the brake magnet and energize that to release the brake and permit the motor to operate, and as the current is admitted to the motor by gradually cutting out the resistance of the rheostat, this resistance is gradually included in the circuit of the brake magnet, so that the current may be utilized to the best advantage, and under all conditions any substantial weakening or interruption of the current, or any derangement of the mechanical devices, will operate to immediately apply the brake and stop the elevator mechanism, so that the proper repairs or adjustment may be made. It will further be noticed that the movements of the rheostat arm are controlled by the dash pot or other equivalent mechanism, so that the resistance shall not be cut out of the motor circuit too rapidly, notwithstanding the too rapid movement of the shipper shaft and wheel, but that in stopping the motor, the rheostat arm may be moved at any desired rate of speed to quickly cut out the circuit and apply the brake.

What I claim is—

1. The combination with the motor, rheostat and switch controlling the circuits of the motor, of a brake magnet included in the circuit, the arrangement being such that as the circuit is closed to start the motor a greater portion of the current shall flow through the brake magnet to operate the same, substantially as described.

2. The combination with the motor, rheostat and switch controlling the circuit of the motor, of a brake magnet connected to the switch and rheostat, and arranged so that as the circuit is closed to start the motor, the rheostat shall be included in the circuit of the motor and a greater portion of the current shall pass through the brake magnet, and as the resistance of the rheostat is cut out of the motor circuit, it shall be included in the brake magnet circuit, substantially as described.

3. The combination with the motor, rheostat, and switch controlling the motor, of a brake magnet circuit interposed between the switch and the rheostat in shunt relation to the motor circuit, the brake magnet circuit being connected to one end of the rheostat, and the motor circuit being connected to the other end of the rheostat, substantially as described.

4. The combination with the motor, rheostat, and switch controlling the motor, of a brake magnet circuit connected to the switch and rheostat, a motor circuit connected to the switch and rheostat in shunt relation to the brake magnet circuit, and means for controlling the movement of the rheostat brush, so that at starting the motor the rheostat shall be included in the motor circuit, and as it is cut out of the motor circuit it shall be included in the brake magnet circuit, substantially as described.

5. The combination with the motor, rheostat and reversing switch controlling the circuits of the motor, of a brake magnet circuit interposed between the reversing switch and rheostat, and a dash pot connected to the rheostat brush for controlling its movements in cutting out the resistance of the rheostat in the motor circuit, substantially as described.

6. The combination with an electric motor, a reversing switch and rheostat controlling the circuit of the motor, of a brake magnet included in a shunt circuit between the reversing switch and motor, substantially as described.

7. In an electric elevator apparatus, the combination with the motor, the brake mechanism therefor, a magnet in the circuit of the motor and controlling said brake mechanism, means for controlling the circuit of the motor and magnet from the elevator, and automatic mechanism for operating said controlling means on derangement of the mechanical devices, substantially as described.

8. In an electric elevator apparatus, the combination with the motor, the brake, and the magnet in the circuit of the motor and controlling the brake, of means controlling the circuit of the motor and brake, and automatic devices controlling said means arranged to cut out the circuit and stop the motor as the elevator reaches its upper or lowermost position, substantially as described.

9. In an electric elevator apparatus, the combination with the motor, the brake and electro-magnet controlling the brake, of a shaft controlling the circuit of the motor and brake arranged to be operated from the elevator, a shaft carrying a traveling pinion, and connections between the shaft and the circuit controlling shaft, whereby the circuit

will be cut out and the motor stopped as the elevator reaches its extreme position up or down, substantially as described.

10. In an electric elevator apparatus, the combination with the motor, the brake and a shaft controlling the circuit of the motor arranged to be operated from the elevator cage, of a rotating screw shaft, a pinion traveling thereon, clutch devices secured to said shaft, and connecting mechanism between said pinion and the circuit controlling shaft, whereby the shaft is operated to stop the motor, substantially as described.

11. In an electric elevator apparatus, the combination with the motor, the brake device, an electro magnet controlling the brake, of a shaft controlling the circuit of the motor and brake, a rotating shaft connected to the elevating drums, a traveling pinion on said shaft, clutch mechanism also mounted on said shaft, a pinion provided with a clutch device driven by said shaft, connections between said traveling pinion and clutch device with the circuit controlling shaft and safety appliances arranged beneath the drums to operate the clutch, whereby when the rope becomes slack or the elevator reaches its upper or lowermost position, the circuit controlling shaft will be automatically operated to cut out the circuit of the motor, substantially as described.

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

FRANCIS B. PERKINS.

Witnesses:
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