(No Model.) 2 Sheets—Sheet 1.

S. D. FIELD.

APPARATUS FOR CONTROLLING MOTORS.

No. 566,070. Patented Aug. 18, 1896.

Fig. 1.

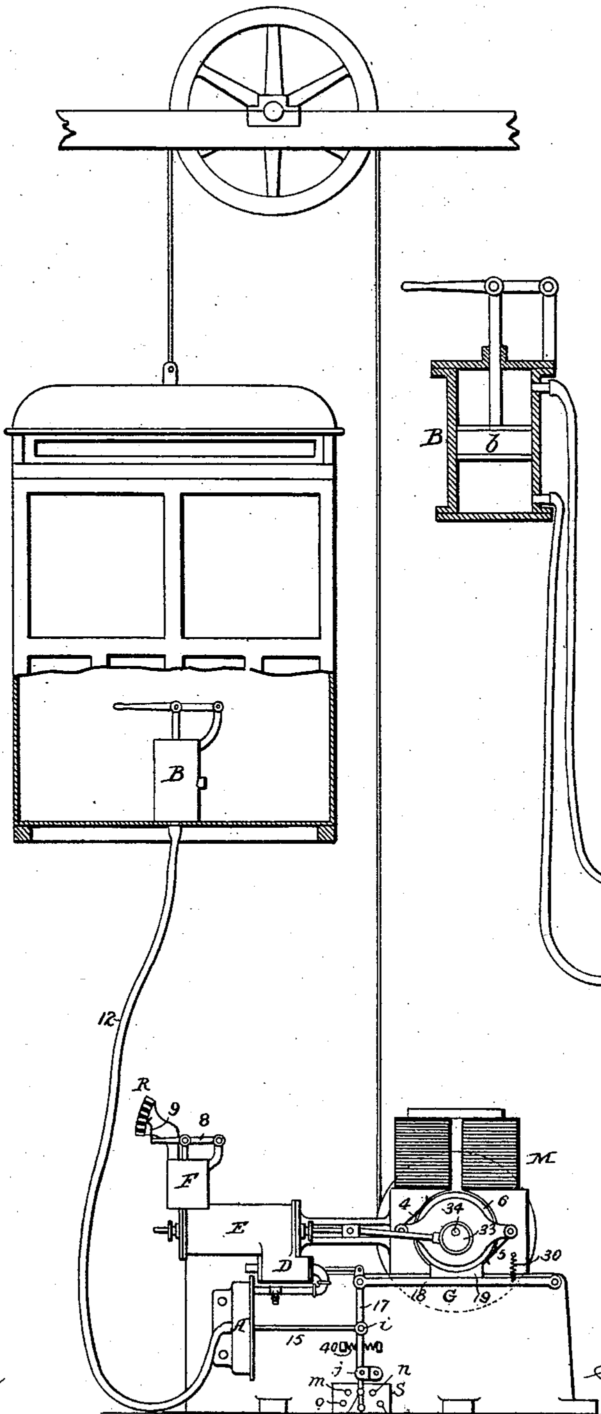
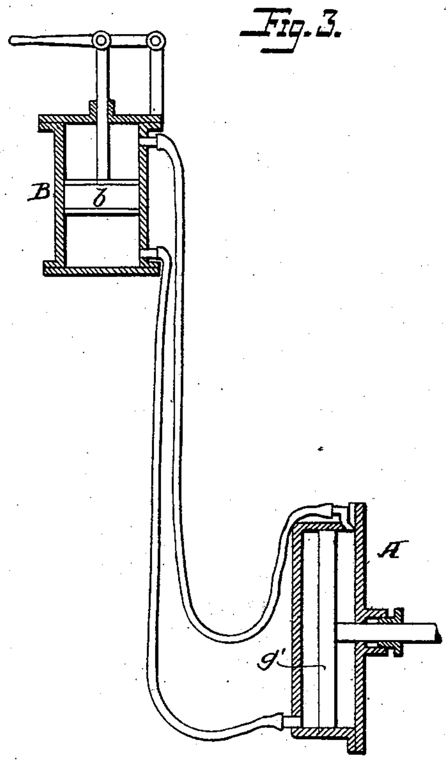


Fig. 3.



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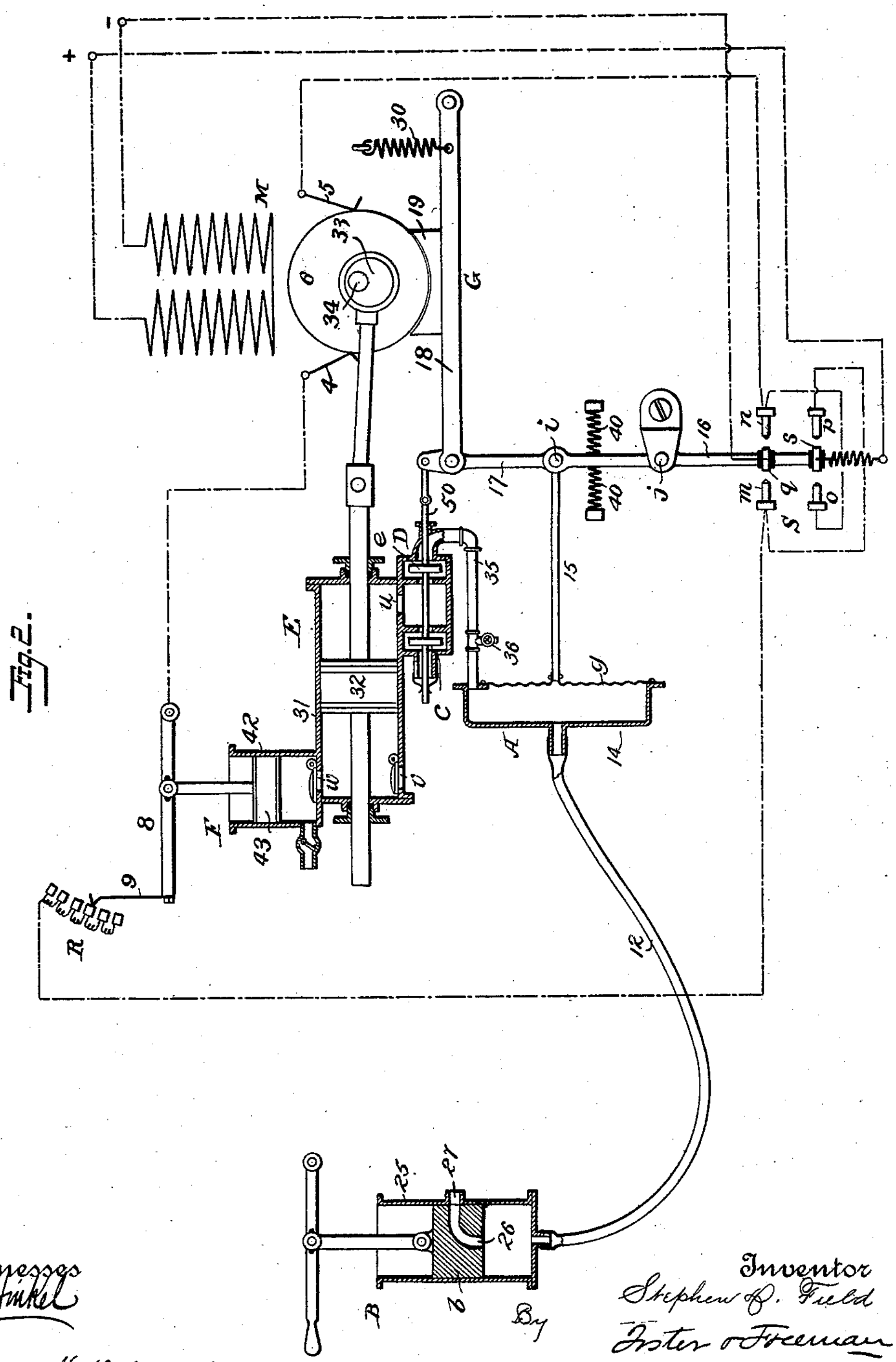

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR CONTROLLING MOTORS.

SPECIFICATION forming part of Letters Patent No. 566,070, dated August 18, 1896.

Application filed June 18, 1892. Serial No. 437,209. (No model.)

To all whom it may concern:

Be it known that I, STEPHEN D. FIELD, a citizen of the United States, residing at Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Apparatus for Controlling Motors, of which the following is a specification.

This invention relates to motor-engines, and more especially electric motors and means for controlling them from distant points—as, for instance, the cages of elevator apparatus; and it consists of certain means, fully set forth hereinafter, whereby such motors can be so controlled and in providing for shifting the controlling means from a distant point readily and with certainty, and, in the case of electromotor engines, without danger to the operator from the electric current.

In the accompanying drawings, Figure 1 is an illustration of my improvement in connection with an elevator. Fig. 2 is a diagrammatic view illustrating the construction and arrangement of parts and Fig. 3 is a view illustrating a modification.

The main actuating-engine M may, for certain purposes of my invention, be a motor of any suitable character, but, as shown, it is an electromotor, the field and armature circuits of which are controlled by the switch S, of any suitable construction. As shown, there are four contacts *m n o p* connected with the armature-commutator brushes 4 5, and the armature-circuit includes a resistance device R, all as indicated and as will be readily understood. The engine is also provided with a brake-wheel 6 and with a brake G, consisting, as shown, of a lever 18, provided with a shoe 19, and the latter is held against the wheel 6, when the parts are in a stopped position, by the action of a spring 30.

As shown, the switch S is in the form of an arm or lever 16, pivoted at *j*, the end carrying contacts *q s*, connected with conductors, including the field-coils in circuit and adapted to be brought in contact with the contacts *m o* or *n p*, according as the switch is swung in one direction or the other to reverse the direction of the current through the armature-coils.

The switch S is connected to operate the brake-lever 18 by means of a lever 17, which, with the switch-connecting rod 16, constitutes links of a toggle-joint, and to the joint *i* is connected in any suitable manner—as, for instance, by a rod 15—the diaphragm or piston of the switch-operating motor A.

As shown in Fig. 2, the motor consists of the casing 14, having a flexible diaphragm *g* at one side connected with the toggle, and the movement of the diaphragm in one direction or the other shifts the said toggle.

As shown in Fig. 3, the motor A may be a cylinder with a piston sliding therein, which piston is connected with the toggle-levers.

The diaphragm or piston of the motor A is moved in one direction or the other by an actuating fluid, which, in turn, receives its movement from a compressor B at a distant point. In the case of an elevator the distant point is the cage or platform of the elevator, and there is a flexible connection or channel between the motor-moving cylinder of the compressor B and the motor A, or in case the motor is of the form of the cylinder, as shown in Fig. 3, there may be two flexible connections in the form of two tubes passing from opposite ends of the pump B to opposite ends of the cylinder of the motor A, so that the movement of the piston *b* of the pump B will press upon the fluid on one side and exhaust it on the other and thereby shift the piston of the motor A, that actuates the control device of the elevator. In case there is but a single connecting-tube 12, as shown in Figs. 1 and 2, then the construction of pump or compressor B illustrated in Fig. 2 is preferable. Thus there is a cylinder 25, with a piston *b*, having an opening 26 from the bottom to one side, the bottom of the cylinder 25 communicating with the pipe 12, and at the center of the cylinder at one side is an exhaust-opening 27. When the plunger or piston *b* is depressed from a central position, the opening 27 is closed and the fluid in the bottom of the pump and the pipe 12 and motor A is compressed and the diaphragm or piston *g* is forced outward. If, on the contrary, the piston *b* is then raised, the diaphragm *g* returns to its normal position. If the piston *b* is raised from its central position, then the fluid is drawn in below the piston and the diaphragm *g* is carried in the opposite direction, these movements of the diaphragm shifting the switch so as to vary the direction of the current through the armature-coils and reverse the engine, or in case of a steam or hydraulic engine the valve or other controlling device is shifted and the engine is reversed, the engine, of course, being brought to a stop when the controlling device and the diaphragm g and the piston b are in their central or normal positions.

The fluid in the pump or compressor and the motor A may be air. I prefer to have air, because this acts as a non-conducting connection between the air-presser B and the motor A and serves to protect the operator from any possibility of injury by the electric current, however high the potential of the latter may be.

In order to maintain the position of the control device after the same has been moved by the actuating device in the cage and also to secure an automatic control of the engine, I provide means whereby the engine itself is made the means of maintaining the pressure or exhaust.

Where there is a double-acting motor, as shown in Fig. 3, a pump may be employed with means for throwing the pressure of the motor fluid upon one side or other of the piston g', but where it is single-acting, as shown in Fig. 2, I provide means whereby either a pressure or an exhaust is effected, and in any case I provide a regulated leakage, so that in case the engine does not operate at a speed sufficient to maintain the normal pressure or exhaust and hold the plunger or diaphragm in its proper position, then the plunger or diaphragm will resume its normal position or approach it and thereby break the current through the motor or stop the engine, and also, if desired, whereby in case the engine is started suddenly or is overloaded the resistance will be varied. The pump driven by the motor is also a safety device. It cuts the resistance out when the motor has obtained sufficient speed and allows it to drop in when the motor stops.

The construction which I prefer to use is best shown in Fig. 2, in which there is a pump E, having a cylinder 31 and piston 32, connected to be operated by an eccentric 33 upon the motor-shaft 34. As shown, there is a port u between the right-hand end of the cylinder 31 and a valve-casing D, in which there are two flexible valves c e on a rod 50 connected with the lever 17, and this valve-casing is also connected by a pipe 35 with the chamber of the motor A, and there is a cock 36 arranged at any suitable point and so set as to permit a regulated leakage from the pump E, casing D, pipe 35, or motor A.

To explain the operation of these devices, we will assume the parts to be in the position indicated in Fig. 2—that is to say, with the piston b of the pump in its intermediate position, and the valves c and e also intermediate of the two seats against which each of them works. At this time of course the pressure of air is the same on both sides of the diaphragm, but as soon as the piston b is forced down to carry its passage 26 past the port 27 then the column of air within the tube is compressed and the diaphragm is forced to the right and the upper end of the link 17 to the left, bringing the points q s into contact with the points m o and releasing the brake G from the brake-wheel. Thus the engine is started in a given direction, and the valves c and e, which, as before stated, are flexible valves, are carried to their seats at the left. The outer seat for the valve c has a port communicating with the atmosphere, while the outer seat for the valve e has a port communicating with the pipe 35, as already stated, and then as the piston 32 of pump E moves to the right the tendency will be to compress the air in casing D and force valve e outwardly, thereby permitting the air so compressed to pass behind the diaphram to maintain it in its outward position. This compression of air in casing D at the same time holds the valve c closely to its seat, but on the opposite stroke of piston 32 a suction or vacuum is produced which holds valve e closely to its seat and permits valve c to open and again fill the space with air, and this continues to be repeated as the engine continues to run in the same direction. Now if the piston b of pump B be moved upwardly to cause its passage to pass the port 27 then the operation of the parts is reversed, a vacuum being created behind the diaphragm, and which is continued to be maintained by the valves c e. Under these conditions the said valves are carried to their seats at the right, the outstroke of piston 32 sucking air from behind the diaphragm through the port of valve e and the instroke of said piston forcing such air out through the port of valve c. If, however, the engine M should move too slowly, so as not to maintain the pressure or vacuum by means of the pump E, then in that case the diaphragm g will tend to assume its normal position, this being permitted by the leakage through the cock 36, when the switch S will be brought to its central position and the current will be broken and the engine will be arrested.

Any suitable means may be employed for bringing the piston g normally to its central position. For instance, the piston or diaphragm may consist of a metal corrugated plate which naturally, when relieved of pressure, returns to this position, or there may be two springs 40 40 on opposite sides of the lever 16, as shown in Fig. 2, which tends to carry the latter to its normal position.

To prevent a sudden flow of current to the armature in starting, I automatically cut in the resistance in starting and cut it out as the motor attains its normal speed, after which the counter-electromotive force takes the place of the resistance, and if the motor is overloaded and slows down the resistance is automatically cut in to protect the armature from the abnormal current that might result from a decrease of the counter-electromotive force. Thus the left-hand end of the pump E will serve as a force-pump, admitting air through the port closed by the valve v and discharging it through a port closed by a valve w, which communicates with a cylinder 42 of the motor F, having a piston 43, connected with an arm 8, which carries the brush 9 of the resistance-coils R, the brush being in line with the armature-circuit. There is a regulated leakage from the motor F through an opening controlled by a valve 10, so as the engine attains and as it operates at the proper speed the pressure is sufficient to lift the piston 43 and cut out a certain amount of resistance. If the engine is overloaded and slows down, and the pressure maintained beneath the piston 43 is not sufficient, the latter descends and cuts through a portion of the resistance, thereby protecting the armature.

It will be apparent although I have shown certain constructions of pumps and motors and certain connections and valves, that many of these features may be altered without departing from the main features of invention. From this it will be seen that by the arrangement above described, should the motor stop, the pressure in the motor that controls the switch or other controlling device would at once be reduced, and the said device would tend to assume its normal position and move the controlling device, the current being cut off in case of an electromotor being employed, thereby preventing any danger of burning out the coils or closing the controlling device in case a steam or hydraulic engine were employed, thereby arresting the operation of the engine, and it will also be seen as the controlling device or switch is brought to its central position the brake is automatically applied.

It is of course not necessary to have the brake connected with the controlling device. It may be connected to be moved by a separate motor or electrically.

It will also be seen that the change in speed of the motor has the effect of varying the resistance.

Without limiting myself to the precise construction and arrangement of the parts shown and described, I claim—

1. The combination with the control device of an elevator apparatus, of the cage, a motor having a cylinder and piston connected with said control device, and a cylinder and piston upon the cage for operating said motor, flexible connections between the motor and said cylinder and motor fluid filling said cylinders and connections, and a lever for operating the piston of the cylinder, and means for maintaining the control device in position after adjustment, substantially as described.

2. The combination of an electromotor and its switch of a switch-motor and means for actuating the switch-motor from the cage, an outlet for a regulated leakage from the switch-motor and means for supplying fluid to the switch-motor connected with the main motor to be operated thereby, substantially as set forth.

3. The combination with the engine of an elevator and with the controlling device thereof, a motor for actuating said device and means for controlling said motor from the cage, an outlet for permitting a regulated leakage from said motor, means for supplying the motor with fluid connected to be controlled by the movements of the engine, substantially as set forth.

4. The combination of a motor, a controlling device and means for maintaining the same in its normal position, a motor for shifting the controlling device, a pump connected to be operated by the engine to supply said motor with fluid, a means for securing a regulated leakage of the fluid from the motor, substantially as set forth.

5. The combination of an electromotor, switch, switch-actuating motor and a compressor connected with the switch-motor to operate the same, a cock permitting the escape of a regulated amount of fluid from the switch-motor, and a pump connected to be operated by the electromotor, and with the switch-motor, substantially as set forth.

6. The combination of the engine, controlling device, motor A connected with the controlling device, and compressor connected with the motor A, and provided with a port 27, and piston b having an opening 26, substantially as described.

7. The combination of an electromotor, and electric circuit thereof, of a resistance in said circuit, a brush movable to cut in and out the resistance, a fluid-motor connected with said brush and provided with an opening for permitting a regulated escape of the motor fluid and means for supplying the motor fluid to the brush-motor connected to be controlled by the movements of the electromotor, substantially as set forth.

8. The combination with the cage of an elevator, of the main motor, the switch and switch-motor, the pump driven by the main motor provided with the port u and valve v, the casing communicating with said port u and connecting with the switch-motor and provided with ports and flexible valves, and the pump F connecting with the resistance R, all substantially as shown and described.

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

STEPHEN D. FIELD.

Witnesses:

JAMES S. FITCH,

O. B. WARING.