No. 803,832. PATENTED NOV. 7, 1905.

W. E. LAIRD.

MOTOR OPERATED SWITCH.

APPLICATION FILED FEB. 16, 1904.

2 SHEETS—SHEET 1.

Fig. 1.

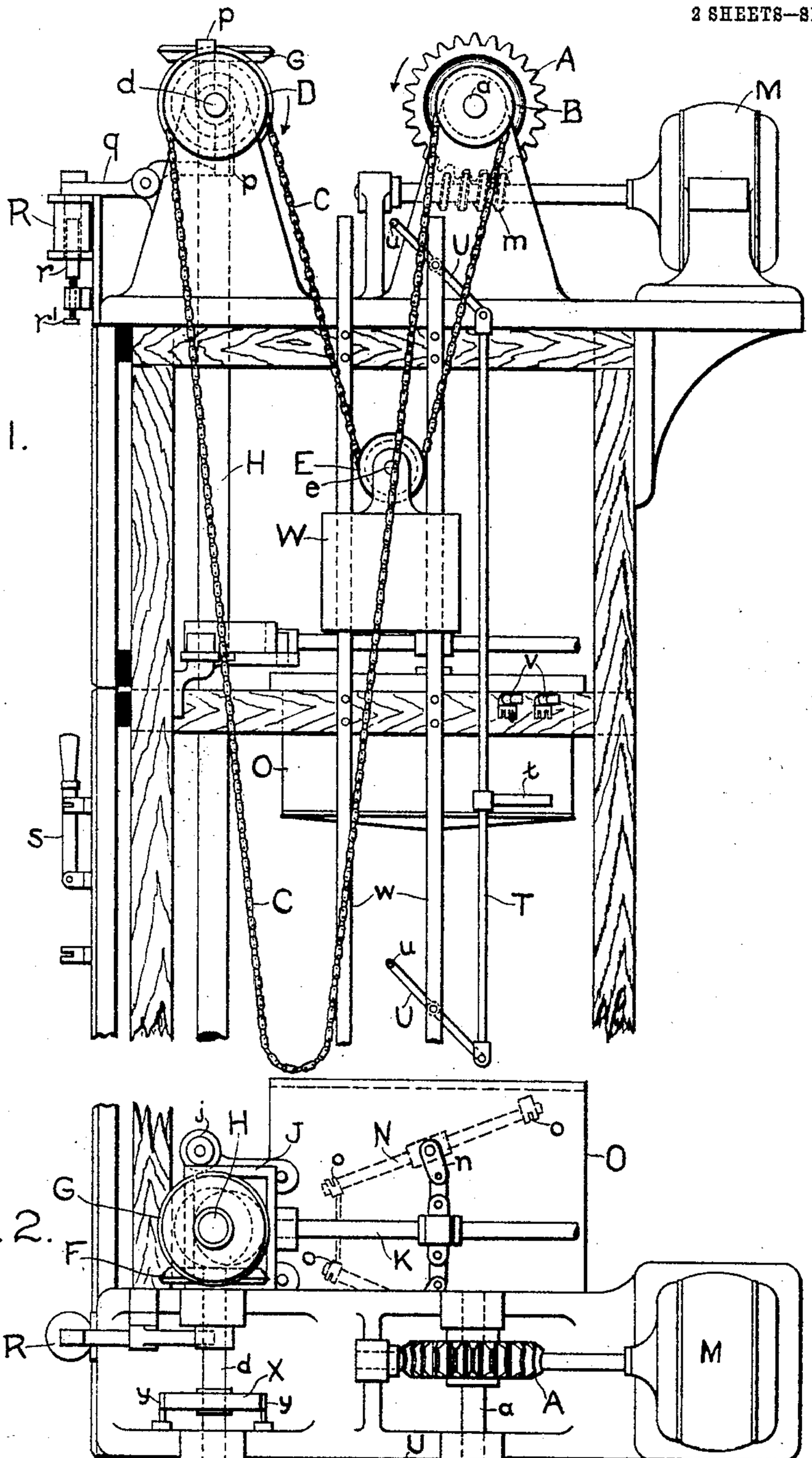

Fig. 2.

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2 SHEETS—SHEET 2.

Fig. 3.

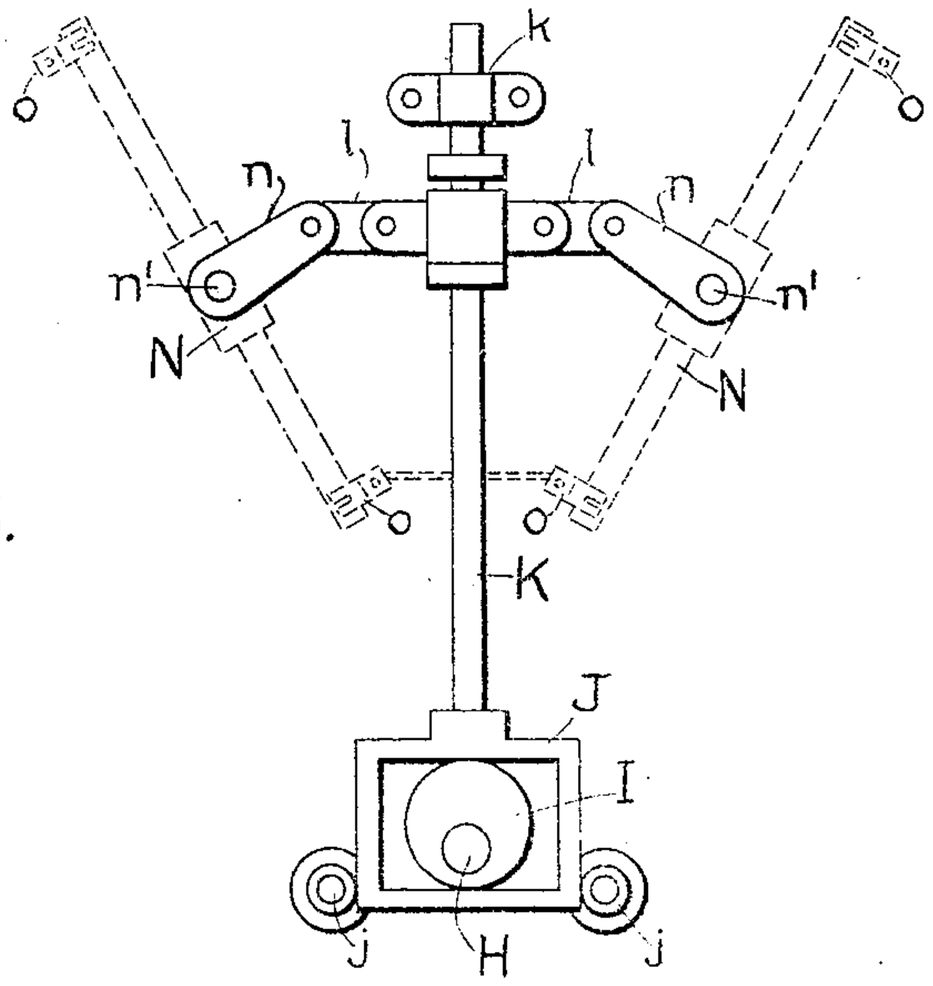
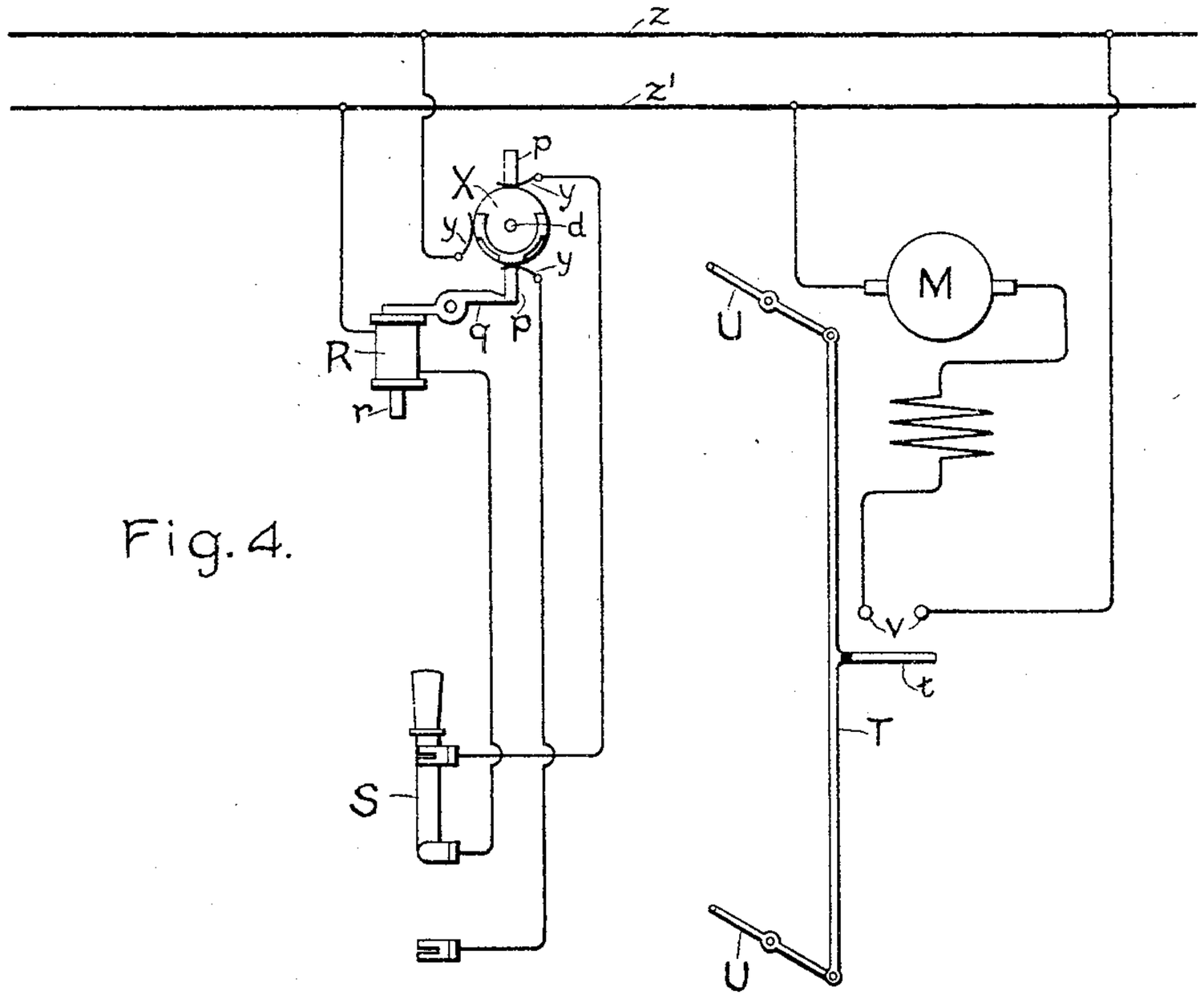


Fig. 4.



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MOTOR-OPERATED SWITCH.

No. 803,832. Specification of Letters Patent. Patented Nov. 7, 1905.

Application filed February 16, 1904. Serial No. 193,845.

To all whom it may concern:

Be it known that I, WESLEY E. LAIRD, a citizen of the United States, residing at Pittsfield, county of Berkshire, State of Massachusetts, have invented certain new and useful Improvements in Motor-Operated Switches, of which the following is a specification.

My invention relates to motor-operated switches for electric circuits; and its object is to provide a motor-drive which shall render it possible to obtain several operations of the switch from a single operation of the motor.

Motor-operated switches as they have been constructed heretofore have sometimes been arranged with the motor directly connected to the switch member, so that if an accident should occur to the motor the switch could not be operated, or the motor has sometimes been arranged to act upon a spring or similar device, so that by the use of a tripping mechanism a single operation of the switch could be obtained without starting up the motor. It is usually of great importance in the operation of a power plant that the main switches should be so controlled that the operating mechanism may be at all times reliable. With motor-operated switches there is always a chance that the motor or its circuit may be injured just at a time when it is imperative that the switch should be opened immediately. Where the motor is directly connected to the switch member, it would be impossible to open the switch by means of the motor in this case, and if the switch is operated by means of a spring or similar device which is set by the motor for each operation the danger is almost as great, for it might be found when the locking device was tripped to close the switch that the motor had for some reason failed. It would then be impossible to open the switch again if it should prove to be necessary to do so at once. The dangers mentioned above are all the more serious in view of the fact that motor-operating mechanisms are usually applied to switches which are too large or unwieldy to be operated by hand. Consequently if the motor-operating mechanism fails the attendant is practically helpless if the necessity of instantly opening the switch should arise. By my invention I so arrange the motor-drive that if the motor or its source of current should fail any desired number of operations of the switch may nevertheless be obtained.

My invention will be best understood by reference to the accompanying drawings, in which—

Figure 1 shows an elevation of a power-driven switch arranged in accordance with my invention. Fig. 2 shows a plan view of the same. Fig. 3 shows a plan view of the switch member, and Fig. 4 is a diagram showing the control-circuits.

Referring first to Figs. 1 and 2, M represents a small motor, preferably of the series type, which carries on its shaft the worm *m*. This worm engages a gear-wheel A on shaft *a*, so that when motor M is running shaft *a* is rotated. Shaft *a* carries the sprocket B. D is another sprocket-wheel mounted on a second shaft *d*. C is an endless chain which runs over sprocket-wheels B and D. Suspended from one loop of chain C is the sprocket-wheel E, which supports from its shaft the weight W, which rests against the lateral guides *w*. With this arrangement it is evident that if motor M drives gear-wheel A in the direction indicated by the arrow while sprocket-wheel D is held motionless the weight W will be raised. On the other hand, if motor M is stationary, thereby locking shaft *a* against rotation, and if sprocket-wheel D is free to turn the weight will fall, rotating sprocket-wheel D in the direction shown by the arrow. Mounted on the shaft D is the beveled gear F, which engages with beveled gear G on the vertical shaft H. Shaft H is arranged to operate by its rotation the switch member. The arrangement of the switch member is clearly shown in Fig. 3. I is a cam carried by vertical shaft H and engages the frame J, to which is secured the rod K. As shaft H is rotated frame J will be reciprocated by cam I and a longitudinal reciprocating motion will be given to rod K. The rollers *j* and the bearing *k* act as guides for rod K. Pivoted to rod K are the links *l*, which at their other ends are pivoted to the arms or levers *n*, mounted upon the rock-shafts *n'*. Rock-shafts *n'* carry the switch members N, which in the position shown in Fig. 3 engage the contacts *o*, which may be submerged in an oil-tank, such as O in Fig. 1. As shaft H is rotated half a revolution rod K

will be drawn forward and rock-shafts n' will be rotated by means of the links l. By the rotation of the rock-shaft n' switch members N are moved away from the contacts o and the circuit thereby interrupted. Any number of switch members may be operated by vertical shaft H.

Referring again to Fig. 1, it will be seen that the shaft d carries the levers p, one of which is always normally in engagement with the pivoted member q. In this way shaft d is normally restrained from movement under the influence of the weight W, which constantly tends to turn shaft d in the direction of the arrow in Fig. 1. R is a solenoid having a core r, supported by the adjustable screw r'. If solenoid R is momentarily energized, its core r will be drawn up, momentarily rocking pivoted member q on its pivot and releasing it from engagement with one of the levers p. Shaft d will then make a half-revolution under the influence of weight W and will be brought to rest again by the other lever p striking the pivoted member q. Thus by momentarily energizing solenoid R any number of times the shaft d may be given half a revolution each time, each half-revolution corresponding to a movement of the switch-rod K. The only limit to the number of operations of the switch that may thus be obtained is the length of the chain C, which may be made as long as is necessary to obtain any desired number of operations of the switch. Furthermore, the power available for each operation is always the same, since weight W exerts a constant force on shaft d.

In order to raise automatically the weight W when it is near its lowest position, I provide means controlled by the weight for closing the motor-circuit.

U U represent two pivoted levers, which carry at one end studs u, extending into the path of the weight W and adapted to be engaged thereby. Supported from the other ends of the levers U is a rod T, which carries the switch member t. Switch member t is adapted, when the rod T is raised, to engage the contacts v, and thereby close the motor-circuit. Thus as the weight W descends upon successive operations of the switch until it engages the lower arm or stud u rod T will be raised, the motor-circuit will be closed, and the motor will start up, rotating gear A in the direction of the arrow. This will continue until weight W strikes the upper arm or stud u, whereupon rod T will be lowered, opening the circuit of motor M and stopping the motor. The lower arm or stud u may be so placed that the weight will reach it some time before it has reached its lowest position. By this arrangement in case anything should have occurred to disable the motor warning will be given while there is still sufficient slack in chain C to enable the switch to be operated any desired number of times and furnish opportunity for repairing the motor. Thus a surplus number of operations is provided to fall back upon if the motor fails to start when it should. If the motor gives out at any other time, a still greater number of operations of the switch may be obtained, the number depending upon the position of the weight.

Mounted upon the shaft d is the commutator X, upon which bear the brushes y. These commutator-brushes are connected in the control-circuit for the tripping-coil, which will now be explained.

Referring to Fig. 4, $z\,z'$ represent the source of current for the control-circuit. The motor M is shown connected across the source with the circuit arranged to be opened and closed by the switch member t coöperating with the contacts v. The circuit of the tripping-solenoid R includes, besides the commutator X, a control-switch S, which may be automatically operated or manually operated, as shown, and which may be mounted at any distance from the main switch or upon the frame thereof, as shown in Fig. 1. With the switch S in the position shown and the commutator X as shown the circuit of solenoid R is open. If now it is desired to operate the main switch, controlling-switch S is thrown to its other position. The circuit of solenoid R will then be closed and the solenoid will draw up its core r, rotating pivoted member q and releasing the lever p. Shaft d will consequently be rotated by the weight W, as has been heretofore explained, but before half a revolution is made the circuit of the brush y, connected to the lower contact of switch S, will be open-circuited by commutator X, and solenoid R will consequently release its core. Pivoted member q will consequently return to its normal position, as shown, by gravity before the half-revolution is completed and will be in position to engage the other lever p and to stop the rotation of shaft D when half a revolution has been made. To secure further operation of the main switch, switch s is thrown to its other position, and the operation just described is repeated. In case the source of current $z\,z'$ should fail it is evident that the operation of the main switch may be readily secured by merely raising the core r by hand. The solenoid R and its circuit may be entirely omitted, if desired, and the tripping of the main switch controlled by hand. I prefer, however, to employ the solenoid and its controlling switch in order to enable the main switch to be controlled from any distance. Moreover, by this means automatic opening of the main switch may be obtained, if desired, by using a control-switch of the automatic overload or other well-known type.

Since the control-circuits of the motor and of the tripping mechanism are wholly independent and since the use of the endless chain permits wholly independent actions of the two

sprocket-wheels, it is evident that the switch may be operated at any instant regardless of whether the motor is in operation at that instant or not. Thus by my invention I am enabled not only to obtain a plurality of switch movements from a single operation of the motor and to have a surplus number of movements to fall back upon if the motor fails to start when it should, but also to operate the switch at any instant, whether the motor is at rest or is running.

I do not desire to limit myself to the particular construction and arrangement of parts here shown, since changes which do not depart from the spirit of my invention and which are within the scope of the appended claims will be obvious to those skilled in the art.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In combination, a motor, a shaft arranged to be driven thereby, a second shaft, a switch member arranged to be operated thereby, a weight supported between said shafts, means for energizing said motor to raise said weight, a catch for restraining the second shaft, and means for releasing said catch to permit the movement of the second shaft under the influence of said weight.

2. In combination, an electric motor, a weight arranged to be raised by said motor and thereby to store up the power delivered by said motor, a switch member, connections between said member and said weight whereby a plurality of operations of said member are obtained by the descent of said weight, and means for controlling the descent of said weight.

3. In combination, an electric motor, a weight arranged to be raised by said motor and thereby to store up the power delivered by said motor, a switch member, connections between said member and said weight whereby a plurality of operations of said member are obtained by the descent of said weight, means for controlling the descent of said weight, and automatic means for starting and stopping said motor at certain positions of said weight.

4. In combination, a weight, an electric motor, connections between said motor and said weight whereby the operation of the motor raises said weight, means controlled by said weight for starting and stopping said motor, a switch member, connections between said switch member and said weight whereby a plurality of operations of said member are obtained by the descent of said weight, and means for controlling the descent of said weight to operate the switch member as desired.

5. In combination, a switch member, means for applying to said member a constant force tending to operate said member, restraining means for said member, means for releasing said member to permit its operation by said force, an electric motor arranged when energized to renew said force, and automatic means for energizing said motor before the number of operations of said member obtainable from said force are exhausted.

6. In combination, an electric motor, a switch member, connecting means between said motor and said member adapted to store up the power delivered by said motor whereby a plurality of operations of said member may be obtained from a single operation of said motor, and automatic means for energizing said motor after a plurality of operations of said member, said connecting means being adapted to provide a surplus number of operations of said member if the motor fails to operate when energized.

7. In combination, an electric motor, a switch member, and mechanical connections between said motor and said member adapted to store up the power delivered by said motor whereby a plurality of operations of said member may be obtained from a single operation of said motor, said connecting means being adapted to permit the operation of said member at any instant regardless of the operation of said motor.

8. In combination, a switch member, means for mechanically storing power for a plurality of operations of said member, operative connections between said storing means and said member, a motor arranged to renew said power, and means for utilizing said power to operate said switch member regardless of the operation of said motor.

9. In combination, a switch member, means for mechanically storing power for a plurality of operations of said member, operative connections between said storing means and said member, a motor arranged to renew said power, and automatic means for energizing said motor before said power is exhausted.

10. In combination, an electric motor, a weight arranged to be raised by said motor, a switch member, connections between said member and said weight whereby a plurality of operations of said member are obtained by the descent of said weight, means for controlling the descent of said weight, and a switch in the circuit of said motor controlled by said weight.

11. In combination, an electric motor, a weight arranged to be raised by said motor, a switch member, connections between said member and said weight whereby a plurality of operations of said member are obtained by the descent of said weight, means for controlling the descent of said weight, and automatic means for energizing said motor before said weight reaches the lowest limit of its travel.

12. In combination, two rotatable shafts, a weight, operative connections between said weight and said shafts whereby said weight tends to rotate said shafts, an electric motor

arranged to drive one of said shafts to raise said weight, a switch member arranged to be operated by the second shaft, a catch for said second shaft, and means for releasing said catch to permit the operation of said member.

13. In combination, two rotatable shafts, a sprocket-wheel on each shaft, an endless chain supported from said sprockets, a weight supported by said chain, a motor arranged to drive one shaft, a switch member arranged to be operated by the second shaft, a catch for the second shaft, and means for releasing said catch.

In witness whereof I have hereunto set my hand this 12th day of February, 1904.

WESLEY E. LAIRD.

Witnesses:
AGNES M. CURTIN,
H. L. CURTIN.