G. A. BURNHAM.

SELECTIVE TIME LIMIT CONTROLLING DEVICE FOR ELECTRIC SWITCHES.

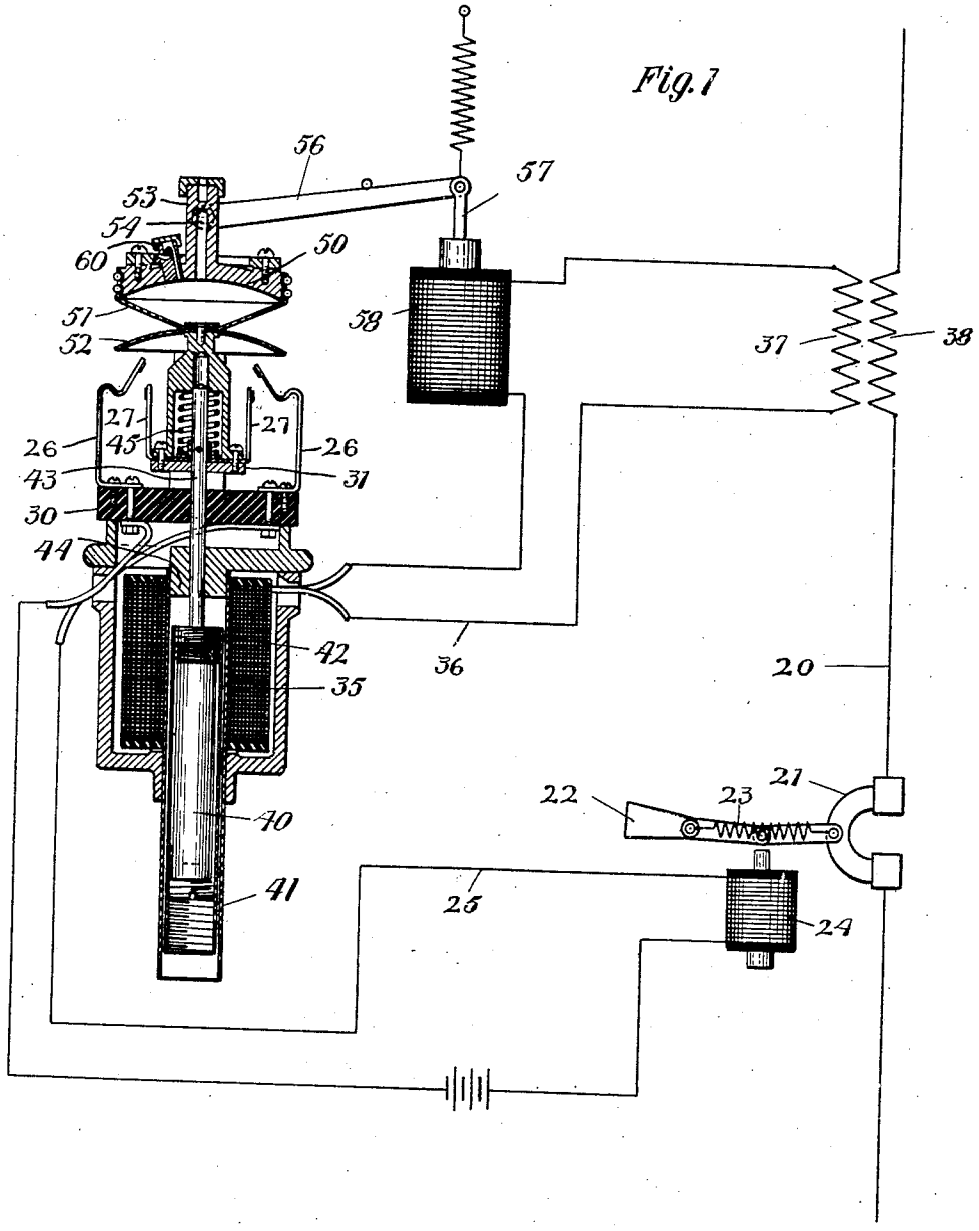
APPLICATION FILED JULY 28, 1911.

1,288,500.

Patented Dec. 24, 1918.

2 SHEETS—SHEET 1.

Fig. 1



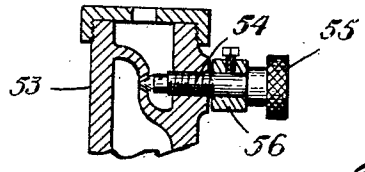


Fig. 2

Witnessess:

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J. L. O'Neill

Inventor:

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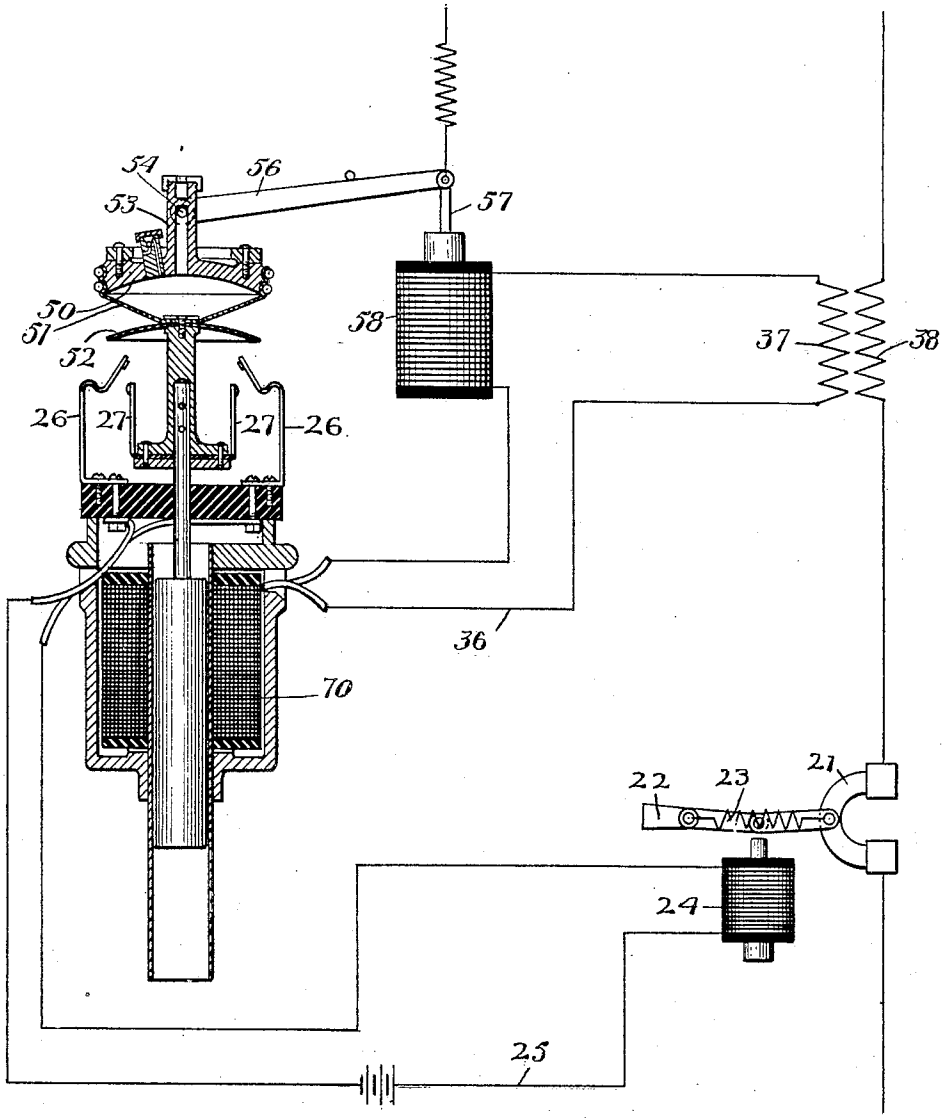


Fig. 3

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UNITED STATES PATENT OFFICE.

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SELECTIVE TIME-LIMIT CONTROLLING DEVICE FOR ELECTRIC SWITCHES.

1,288,500. Specification of Letters Patent. **Patented Dec. 24, 1918.**

Application filed July 28, 1911. Serial No. 640,992.

To all whom it may concern:

Be it known that I, GEORGE A. BURNHAM, a citizen of the United States, residing at Saugus, in the county of Essex and State of Massachusetts, have invented an Improvement in Selective Time-Limit Controlling Devices for Electric Switches, of which the following is a specification.

This invention relates to time-limit controlling-devices for electric-switches. Heretofore time-limit controlling-devices for electric-switches have been devised including operating-means for the switch, and a retarding-device to regulate the speed of motion of the time-controlled or movable element of said operating-means, whereby a prolonged period of time is consumed in operating the switch, and said retarding-device has been made manually adjustable so that the period of time consumed by the operating-means in operating the switch may be regulated, and means responsive to an overload has been employed for destroying the effective resistance of the retarding-device, so that the operation of the switch is substantially instantaneous. In order that time-limit controlling-devices shall be effective on different overloads, and particularly when it is desired that they shall be selective in action, it is necessary that the prolonged period of time required for the operating-means to operate the switch shall be variably adjusted by means controlled by the overload current, in order that it may be reduced more or less according to the strength of the overload.

This invention has for its object the construction of a time-limit controlling-device for electric-switches including operating-means for the switch and a retarding-device, whereby a prolonged period of time is required for the operating-means to operate the switch, and means, controlled by an overload current, to vary the length of said period of time, whereby it may be substantially reduced on a heavy overload, the reduction varying according to the strength of the overload; as for instance, said retarding-device may be regulated or controlled by the overload current, in such manner that the resistance offered by it is variable according to the strength of the overload, such adjustment permitting said retarding-device to offer less resistance on a heavy overload than on a light overload, so that the operating-means will be more quickly caused to operate the switch upon a heavy overload than upon a light overload, yet in any event a period of time of substantial duration is maintained.

The movable element of the operating-means may be arranged to receive a uniform thrust regardless of the strength of the overload, or a thrust which varies according to the strength of the overload, actuators designed to exert a uniform and also a variable thrust being here shown for illustration.

Figure 1 is a sectional view of a time-limit controlling-device for electric-switches embodying this invention.

Fig. 2 is a sectional detail view of the controlling-valve for the dash-pot.

Fig. 3 is a sectional view of a modified form of time-limit controlling-device to be referred to.

Referring to Figs. 1 and 2 wherein a single line-circuit is shown as a simple manner of illustrating my invention, 20 represents the circuit or line-wire, and 21, a switch of any suitable construction, but preferably of a type adapted to be operated automatically to open the circuit, and manually to close the same. A snap-switch of usual construction is here shown, having a hand-lever 22, and an actuating-spring 23. This is the switch which the time-limit controlling-device forming the subject-matter of this application is designed to operate automatically, to open the circuit 20.

The time-limit controlling-device of Fig. 1, involves operating-means for the switch, and means responsive to an overload current to actuate it or to control its operation, also a retarding-device, and means responsive to the overload current to adjust said retarding-device, whereby the period of time required for the operating-means to operate the switch is reduced according to the strength of the overload.

As here shown for the purpose of illustrating my invention said operating-means comprises a switch-controller of the electrical type, which is adapted, when operated, to open the switch, and an operating-device for the circuit of said switch-controller which requires a prolonged period of time to complete its operation and operate the switch-controller.

The switch-controller here shown consists of a solenoid 24, connected in a battery circuit 25, the armature of which is designed to en-

gage and operate a snap-switch to open the circuit 20, upon energization of the solenoid.

The operating-device for the switch-controller, as here shown, consists of circuit controlling-devices for the circuit 25, and a movable element to operate them. Said circuit controlling-devices comprise two pairs of circuit-contacts, one member of each pair being movable toward and from the other member, the movable members being time-controlled, so as to require a prolonged period of time to move and engage the other member.

26, 26 represent the stationary circuit-contacts and 27, 27 the movable circuit-contacts. The stationary circuit-contacts are supported upon a base-plate 30, of insulating material, and the movable circuit-contacts are supported upon a plate 31 which is movable, as hereinafter described to cause the circuit-contacts borne by it to engage the stationary circuit-contacts and close the circuit 25, and thereby operate the switch to open the circuit 20. As an actuator for the movable element bearing the circuit-contacts 27, a magnet or solenoid-coil 35 is here shown, which is included in a circuit 36, of a transformer, of which 37 is the secondary-coil, and 38 the primary-coil, and said primary-coil is included in the circuit 20, which is being controlled, so that the solenoid 35 is under the control of or responsive to an overload on the circuit 20. Said solenoid may be of any well known or suitable construction, but herein the coil is provided with a brass tubular lining within which is guided a soft iron core 40. Said core is adjustably arranged within a tubular carrier 41, to permit regulation of the gap between its upper end and a brass plug 42, by which the carrier is connected to the piston-rod 43. Said piston-rod passes through a hole in the cover of the magnet and is guided thereby, its limit of motion being determined by the end of the projection 44 on said cover. The piston-rod 43 is connected with a piston of a dash-pot through a helical spring 45, said spring being arranged in the recess formed in the lower part of the piston, against the top of which one end of the spring bears, the other end of the spring being secured to the rod by a pin, so that upward movement of the core acts to compress said spring and the spring in turn acts to lift the piston. In this construction movement of the core is dependent upon the strength of the overload, but movement of the piston is constant, or substantially so, regardless of the strength of the overload.

The plate bearing the movable circuit-contacts forms a part of or is attached to said piston, so that upward movement of the piston acts to move said circuit-contacts in a direction to engage the stationary circuit-contacts and close the circuit 25 of the switch-controller. As it is necessary that movement of the piston to cause the circuit-contacts to engage shall require a prolonged period of time, a retarding-device is provided to control the movement of the piston, and also to predetermine its speed of motion. The retarding-device shown in Fig. 1 will now be described.

50 represents a cup-shaped structure which forms the shell of a dash-pot, being supported by a bracket erected on the cover of the solenoid coil. The mouth of the dash-pot is covered by a flexible diaphragm 51, composed of flexible air-tight material, and said diaphragm is connected at its edges to the cup in any air-tight manner. The center of the flexible diaphragm is secured in an air-tight manner to a convex piston 52, having a curvature to conform to the face of the cup 50. The cup is shown as comparatively shallow since a short movement only is required. In the top of the dash-pot is a leak-valve of which 53 represents the valve-case having within it a partition wall formed with a hole through it, and 54 represents a needle-valve extended through the outer wall of the case, and adapted to enter said hole more or less as may be required for purposes of adjustment. The stem of said needle-valve is screw-threaded, so that it may be adjusted by turning it, and it has a finger-piece 55 by which it may be adjusted manually. Said needle-valve has connected with it an arm 56, which is extended radially therefrom, and said arm 56, has connected with it a core 57, of a solenoid 58, which is included in the transformer-circuit, so as to be controlled by an overload on the circuit 20, and upon the occurrence of an overload said solenoid 58 will respond according to the strength of the overload, and will act to turn the needle-valve and thereby automatically adjust it according to the strength of the overload. The leakage of air which is permitted by the needle-valve is sufficient to insure a longer time-limit adjustment of the dash-pot, by varying the resistance, and, as will be observed, such leakage of air may be regulated manually and also automatically.

In the top of the dash-pot is also mounted a ball-valve 60, normally closing a passage leading from the interior of the dash-pot to the atmosphere, which permits of the entrance of air to the dash-pot easily and quickly, when the parts are being restored to normal.

Assuming the device of Figs. 1 and 2 is connected in an electric-circuit substantially as shown, and an overload occurs on the circuit 20, the core of the actuating solenoid is drawn up and the spring compressed and said spring in turn raises the movable element or operating-device of the switch-operating means, and movement of said element is retarded by the dash-pot, and such

retarded movement is controlled or regulated by the leak-valve; and it will be noted that the operating-means for the switch is actuated by means operated by the overload, and its movement is regulated or controlled by means operated by the overload, that is to say, the prolonged period of time consumed by it in operating is varied according to the strength of the overload. It will be observed that the arm 56 is drawn down variable distances according to the strength of the overload and the leak-valve correspondingly opened, thereby to correspondingly reduce the period of time consumed by the switch-operating means in operating, but on all overloads of high current values said arm 56 is drawn down its maximum distance, and the leak-valve correspondingly opened its maximum distance, and the prolonged period of time is correspondingly reduced, but is the same for all overloads of high current values. Thus the device embodies the inverse time-limit feature on overloads up to a predetermined current value, and on overloads of all higher current values it embodies the definite feature.

Referring to Fig. 3, a solenoid 70, of ordinary construction is employed as the actuator for the switch-operating means, which is connected in the transformer-circuit, and its core is connected directly with the movable operating-device of the switch-controller, the spring being omitted, and in this construction the operating-device is moved positively by the core, so that its movement is dependent upon the overload and variable according to the strength thereof, instead of being constant regardless of the strength thereof, as shown by the device of Fig. 1.

The structure shown in the various figures are merely for the purpose of illustrating different embodiments of my invention, and it is obvious that changes may be made therein without departing from the spirit and scope of the invention.

In this specification the word "retarding-device" is used in a literal sense, to indicate a device which actually retards the operation of the switch and not an apparatus which merely operates slowly and is a retarding-device only in the sense that operating a contact with weak power constitutes retarding, as compared with operating it with high power.

I claim:—

1. A time-limit controlling-device for electric switches including in combination operating-means for the switch, a retarding-device for said operating-means, means to actuate said operating-means with a constant force, and means responsive to an overload current to variably adjust the retarding effect of said retarding-device and consequently the speed of operation of the operating-means for the switch according to the strength of the overload, substantially as described.

2. A time-limit controlling-device for electric switches including in combination operating-means for the switch, a retarding-device for said operating-means, means operated by an overload current for supplying power to said operating means, said operating means acting with substantially constant force to operate said switch, and means responsive to an overload current to variably adjust the retarding effect of said retarding-device and consequently the speed of operation of the operating-means for the switch according to the strength of the overload, substantially as described.

3. A selective time-limit controlling-device for electric-switches including in combination a switch-controller, an operating-device for said switch-controller, a retarding-device for said operating-device, means controlled by the overload current and adapted to actuate the operating-device with a substantially constant force, and means responsive to the overload current to regulate the speed of motion of the retarding-device, substantially as described.

4. A time-limit controlling-device for electric switches, comprising a switch having a movable element, a solenoid operating at a predetermined overload to compress a spring, a movable contact member for the switch and adapted to be operated by said compressed spring, a bellows device adapted to retard the speed of operation of said movable switch member, having an escape opening adapted to be varied in size according to the strength of the overload, substantially as described.

5. A selective time-limit controlling device for electric-switches including a solenoid responsive to an overload current, operating-means for the switch actuated thereby (a fluid-controller timing-device to regulate the speed of motion, a regulating-valve for said timing-device, and means controlled by the overload current to automatically open said valve by an amount varying according to the strength of the overload, and manual means to adjust the minimum opening of said valve whereby the speed of operation of the device may be set for a predetermined series of times, varying according to the strength of the overload up to a predetermined current value, and will be definite at all higher current values, substantially as described.

6. A selective time-limit controlling-device for electric-switches comprising a controlling-magnet adapted to compress a spring in response to an overload current, operating means for the switch actuated by the expansion of such compressed spring; a timing-device to regulate the speed of motion of said operating-means having a con-

trolling-valve, and means responsive to an overload current to variably control the movement of said valve up to a predetermined current value, and to open said valve fully on overloads of higher current values, substantially as described.

7. In a time-limit device, the combination of a device which is movable in response to an overload current, a member having an orifice, a fluid which such movement tends to force through said orifice, and means for variably adjusting the size of the orifice in response to an overload up to a predetermined current value, and manual means to adjust the minimum opening of said valve whereby the speed of operation of the device may be set for a predetermined series of times, varying according to the strength of the overload up to a predetermined current value, and will be definite at all higher current values, substantially as described.

8. A selective time-limit controlling-device for electric-switches including in combination operating-means for the switch, means to actuate said operating-means, a retarding-device connected with the operating-means to retard its operation, and means responsive to an overload current to variably adjust the speed of motion of said retarding-device according to the strength of the overload, up to a predetermined current value, and to definitely adjust its speed of motion on overloads of higher current values, substantially as described.

9. A selective time-limit controlling-device for electric-switches including in combination operating-means for the switch, means to actuate said operating-means, a retarding-device connected with the operating means to retard its operation, and means responsive to an overload current to variably adjust the speed of motion of said retarding-device according to the strength of the overload, up to a predetermined current value, and to definitely adjust its speed of motion on overloads of higher current values, said retarding-device having means permitting of its quick recovery upon cessation of the overload, substantially as described.

10. A selective time-limit controlling-device for electric-switches including in combination operating-means for the switch, a retarding-device for said operating-means, means to actuate said operating-means at a constant speed, and means responsive to an overload current to variably adjust the speed of motion of said retarding-device according to the strength of the overload, up to a predetermined current value, and to definitely adjust its speed of motion on overloads of higher current values, substantially as described.

11. A selective time-limit controlling-device for electric-switches including in combination operating-means for the switch, means controlled by an overload current to actuate said operating-means, a retarding-device to retard movement of said operating-means, and means also controlled by the overload current to vary the speed of motion of said retarding-device according to the strength of the overload, up to a predetermined current value, and to definitely adjust its speed of motion on overloads of higher current values, substantially as described.

12. A selective time-limit controlling-device for electric-switches including in combination operating-means for the switch, means controlled by an overload current to actuate said operating-means at a constant speed, a retarding-device for said operating-means, and means responsive to the overload current to variably adjust the speed of motion of said retarding-device according to the strength of the overload, up to a predetermined current value, and to definitely adjust its speed of motion on overloads of higher current values, substantially as described.

13. A selective time-limit controlling-device for electric-switches including in combination operating-means for the switch, means operated by an overload current to actuate said operating-means, a retarding-device to control the movement of said operating-means, and means controlled by the overload current to increase the speed of motion of said retarding-device according to the strength of the overload, thereby to reduce the time required for the operating-means to operate the switch according to the strength of the overload, up to an overload of a predetermined current value, and to definitely adjust its speed of motion on overloads of higher current values, substantially as described.

14. A selective time-limit controlling-device for electric-switches including in combination a controlling-magnet responsive to an overload current, operating-means for the switch actuated thereby, a retarding-device for said operating-means, and means responsive to an overload current to regulate the speed of motion of said retarding-device, up to a predetermined current value, and to definitely adjust its speed of motion on overloads of higher current values, substantially as described.

15. A selective time-limit controlling-device for electric-switches including a controlling-magnet responsive to an overload current, operating-means for the switch actuated thereby, a retarding-device for said operating-means, and means responsive to an overload current to reduce the resistance of said retarding-device according to the strength of the overload, up to a predeter-

mined current value, and to definitely reduce the resistance of said retarding-device on overloads of higher current value, substantially as described.

16. A selective time-limit controlling-device for electric-switches comprising a movable element, a controlling-magnet for said movable element arranged for operation by an overload current, a timing-device for said movable element, and means controlled by the overload current for variably adjusting said timing-device up to a predetermined current value, and for definitely adjusting said timing-device on overloads of higher current values, substantially as described.

17. A time limit controlling-device for electric switches, including in combination operating-means for the switch, a solenoid responsive to an overload current to actuate said operating-means, an air bellows arranged to be compressed by the closing movement of said operating means for the switch, a valve for said bellows, and a solenoid responsive to an overload current adapted to variably open the valve of said bellows in accordance with the strength of the overload, substantially as described.

18. A time-limit controlling-device for electric switches, including in combination operating-means for the switch, a solenoid responsive to an overload current to actuate said operating-means, an air bellows arranged to be compressed by the closing movement of said operating means for the switch, a valve for said bellows, and a solenoid responsive to an overload current adapted to variably open the valve of said bellows in accordance with the strength of the overload, and manual means to adjust the minimum opening of said valve whereby the speed of operation of the device may be set for a predetermined series of times, varying according to the strength of the overload up to a predetermined current value, and will be definite at all higher current values, substantially as described.

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

GEORGE A. BURNHAM.

Witnesses:
B. J. NOYES,
H. B. DAVIS.