G. A. BURNHAM.

TIME ELEMENT FOR CIRCUIT CONTROLLERS.

APPLICATION FILED DEC. 18, 1917.

1,313,877. Patented Aug. 26, 1919.

Fig. 1.

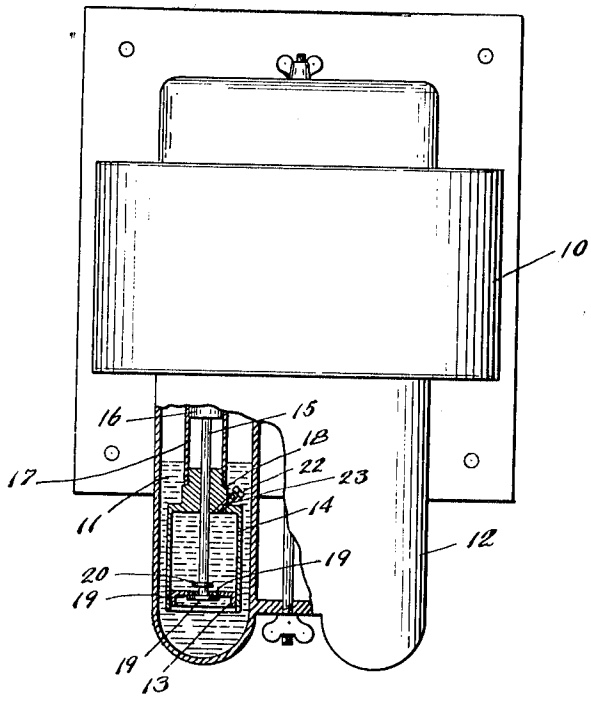


Fig. 2.

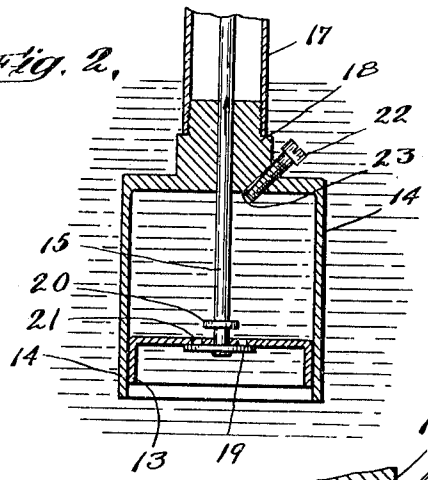
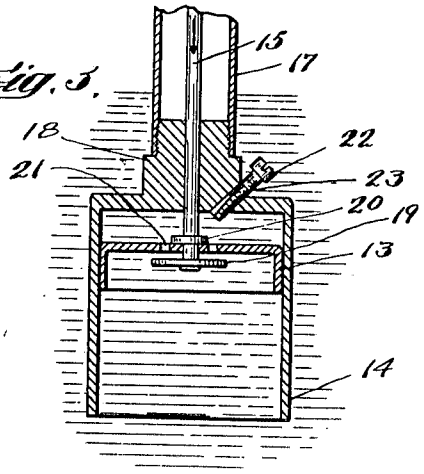


Fig. 3.



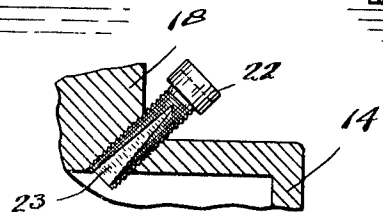


Fig. 4.

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UNITED STATES PATENT OFFICE.

GEORGE A. BURNHAM, OF SAUGUS, MASSACHUSETTS, ASSIGNOR TO SEARS B. CONDIT, JR., OF BOSTON, MASSACHUSETTS.

TIME ELEMENT FOR CIRCUIT-CONTROLLERS.

1,313,877. Specification of Letters Patent. **Patented Aug. 26, 1919.**

Application filed December 18, 1917. Serial No. 207,747.

To all whom it may concern:

Be it known that I, GEORGE A. BURNHAM, a citizen of the United States, and a resident of Saugus, county of Essex, and State of Massachusetts, have invented an Improvement in Time Elements for Circuit-Controllers, of which the following is a specification.

My invention relates to the time element of a solenoid operated circuit controller, and has particular reference to that type of time element in which a plunger or piston operates in a cylinder filled with oil or other fluid to force the oil or fluid therefrom through a restricted fluid path, upon effective energization of the solenoid, to thereby delay the action of the solenoid in controlling its circuit. Certain features herein shown and described are claimed in my copending application, Serial No. 169,228, filed May 17, 1917.

The object of my invention is in the provision of a time element, including a cylinder and piston movably arranged therein, that may be cheaply constructed and may give a comparatively long delayed action of the solenoid, and that has means whereby the time period may be easily and conveniently adjusted.

Figure 1 is an elevation, partly in section, of a time limit relay in which my invention is incorporated.

Fig. 2 is a sectional view of the time element with the plunger in unoperated position.

Fig. 3 is a sectional view of the time element with the plunger in an operated position.

Fig. 4 is an enlarged detail of the means for varying the time period.

As here shown, the time element is applied to a time limit relay in which the solenoids thereof are disposed in and inclosed by the inclosing casing 10. The time element is arranged within the well 11 of the casing 12, which is secured to and depends from the casing 10. The time element includes the piston 13, slidably arranged within the cylinder 14. The piston 13 is disposed upon the end of the piston rod 15, which is secured to the movable element or core 16 of the solenoid of the relay. The solenoid is wound upon or disposed over a tube 17, in which the core 16 is movably arranged. Said tube extends below the solenoid, and the inclosing casing 10 therefor, and is formed with an internally threaded extremity. The cylinder 14 of the time element is formed with a hub or extension 18, which is externally threaded and which is fitted within the end of tube 17, said tube and cylinder thereby forming a unitary structure.

The hub or extension 18 of the cylinder is provided with an opening therethrough, the axis of which is concentric with the axis of the cylinder and the piston rod 15 is extended therethrough, and is adapted to be a running fit therein, whereby there is but little possibility of oil leakage from the cylinder around the piston rod.

The time element, as before mentioned, is disposed within the well of the casing 12. Said well may contain sufficient oil to completely submerge the cylinder 14 of the time element. The piston 13 is loosely arranged upon the end of the piston rod 15, and is arranged to have a certain amount of restricted movement thereon, being limited in its movement in one direction along the rod by the flat plate 19, and in its other direction by the disk or abutment 20. The piston 13 is provided, near its central portion, with openings 21 therethrough, said openings being within the periphery of the flat disk 19, but without the periphery of disk or abutment 20.

The flat top of the piston 13 with the openings 21 therethrough, in conjunction with the disk 19 fixed to the piston rod 15 constitutes a valve adapted to be closed upon the upward motion of the piston to prevent egress of oil from the cylinder through the openings 21 and thereby to delay the action of the time limit relay; but is adapted to be opened upon the deënergization of the time limit relay, and the consequent downward movement of the movable element or core 16 to permit ingress of unrestricted oil to the cylinder and to thereby permit the rapid return or resetting of the relay to normal position.

It is seen that upon a movement of the piston rod 15 upon the energization of the solenoid of the time limit relay, that the flat plate 19 will be brought into contact with the flat surface of the piston 13, and thereby operates to close the openings through said

piston and prevent escape of oil from the space between the top of the piston and the top of the cylinder; but upon the deënergization of the relay, and the consequent release of the movable element or core 16 thereof from attracted position, the disk or abutment 20 of the piston rod will be moved into engagement with the piston and the plate 19 will be moved away from contact with the piston, thereby uncovering the openings 21 in the piston and permitting a rapid flow of oil between the piston and cylinder, and consequently permitting a rapid resetting of the relay to normal position.

The top of the cylinder 14 is provided with a threaded opening therein, as here shown, angularly disposed to the axis of the cylinder, and a screw 22 is adjustably arranged therein. Said screw is formed with a tapered portion 23 therein, the taper of which gradually increases from the head of the screw to the extremity of the screw, and said tapered portion is arranged to form a leakage path of variable area or resistance. It may be seen that as the screw 22 is withdrawn from engagement with the cylinder, the area of the tapered slot 23 or the opening through the cylinder is increased, and the area through which oil may flow from within the cylinder is increased, and thereby the time period of the device is increased.

The adjustment of the time period may be made anything from a minimum, with the screw in its outermost position; to a maximum, with the screw in its innermost position.

The piston 13 is open ended, and since the entire time element is immersed in a body of oil, the lower part of the piston is without effect in retarding the action of the movable element or core of the solenoid in its upward movement; consequently, the entire retarding effect of the time element is caused by the entrapping of oil between the top of the piston and the cylinder, and the upward movement of the piston forces oil from within the piston through the leakage path 23 to the body of oil surrounding the cylinder. Oil may also leak by the piston between the wells thereof, and the cylinder 14, to the body of oil. Such leakage may, however, be reduced to a minimum by accurate workmanship, and it is, moreover, constant.

I claim:—

1. A time element for circuit controllers comprising a cylinder having an open end, an inclosing casing therefor, a piston operably arranged within said cylinder, means to actuate said piston, means to entrap a body of oil between said piston and cylinder, and means to permit a restricted flow of oil from said cylinder upon actuation of the piston.

2. A time element for a circuit controller comprising a cylinder, a piston operably arranged therein, means to actuate said piston, means surrounding said cylinder arranged to contain oil in which said cylinder is immersed, unrestricted communicating means between one side of the piston and the oil in the surrounding means and restricted communicating means between the other side of the piston and the oil in the surrounding means.

3. A time element for circuit controllers comprising a cylinder immersed in a body of oil having an open end, a piston operably arranged in said cylinder, means to acutate said piston, and means providing a restricted opening in the other end of said cylinder.

4. A time element for circuit controllers comprising an inclosing case adapted to contain oil, a cylinder immersed in the oil contained therein, a piston operably arranged in said cylinder, said cylinder having an open end in communication with the oil in the container and a closed end, means to admit oil between the piston and the closed end of the cylinder and means extended through the closed end of the cylinder to admit a restricted flow of oil therefrom upon actuation of the piston.

5. A time element for circuit controllers comprising in combination with a tube extended from the controller and a movable element arranged within said tube, a cylinder secured to the end of said tube, said cylinder having a closed end adjacent the circuit controller and an open end remote therefrom, a piston operably arranged within said cylinder, a rod connecting the piston with the movable element of the controller extended through the closed end of the cylinder, means extended through the closed end of said cylinder providing an adjustable restricted opening therethrough, a casing inclosing the time element adapted to contain oil in which the time element is immersed, and valved means admitting an inflow of oil between said piston and the closed end of said cylinder.

6. A time element for circuit controllers comprising a cylinder immersed in oil having an open end, said cylinder having a reduced end portion for engagement with the tube of the circuit-controller, a piston movable within the cylinder, a leak valve in the upper end of the cylinder, a valve permitting free ingress of oil between the piston and the upper end of the cylinder, on the downward movement of the piston and a casing for oil surrounding the cylinder.

7. A time element for circuit-controllers comprising a cylinder immersed in oil having an open end, said cylinder having a reduced end portion integral with the body portion of the cylinder for engagement with the tube of the circuit-controller, a piston movable within the cylinder, a leak valve in

the upper end of the cylinder, a valve permitting free ingress of oil between the piston and the upper end of the cylinder, on the downward movement of the piston and a casing for oil surrounding the cylinder.

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

GEORGE A. BURNHAM.

Witnesses:
H. B. DAVIS,
T. T. GREENWOOD.