H. W. CHENEY.

TIME LIMIT PROTECTIVE DEVICE FOR ELECTRIC CIRCUITS.

APPLICATION FILED MAY 27, 1907.

962,817. Patented June 28, 1910.

Fig. 1

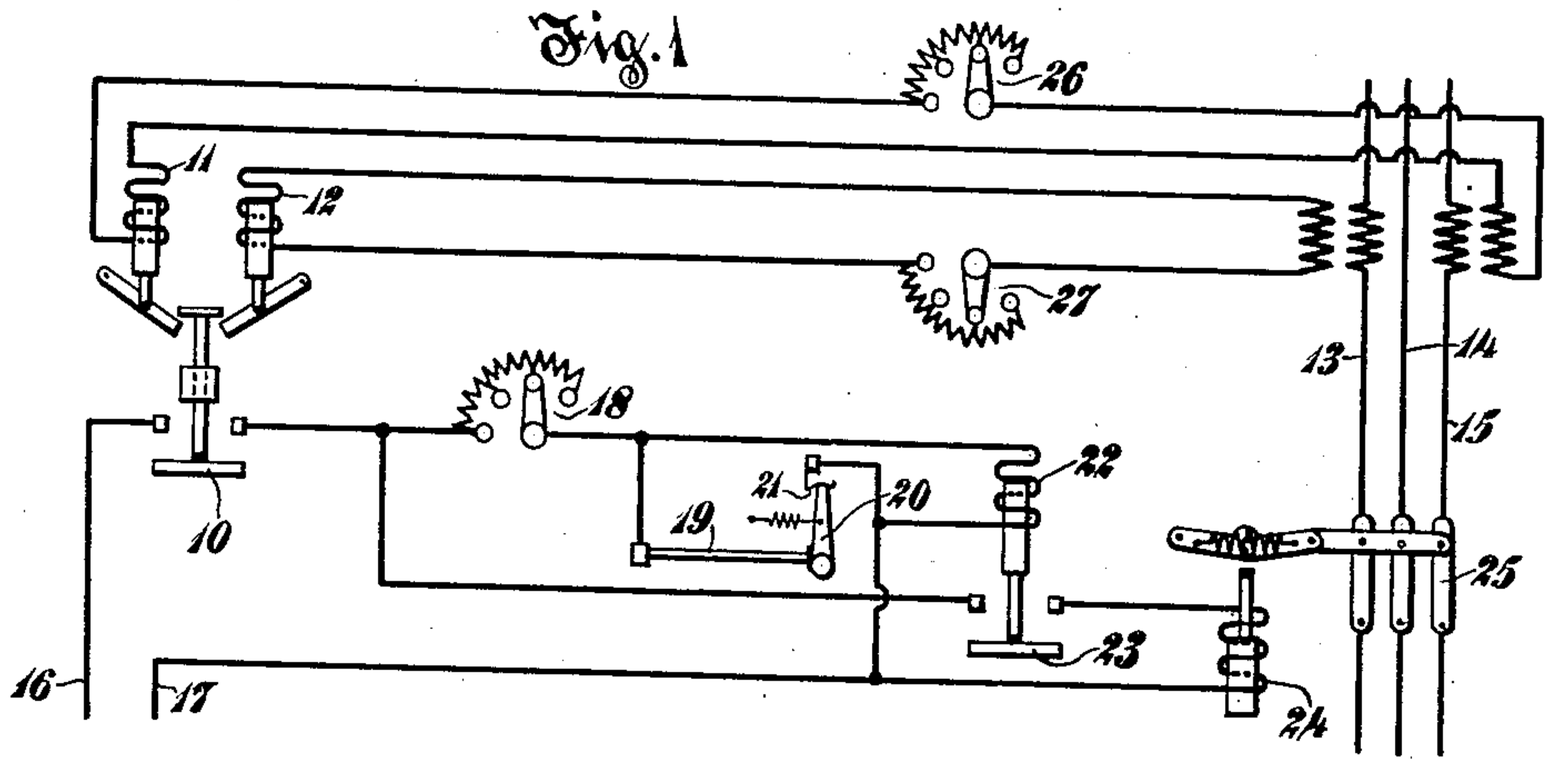


Fig. 2

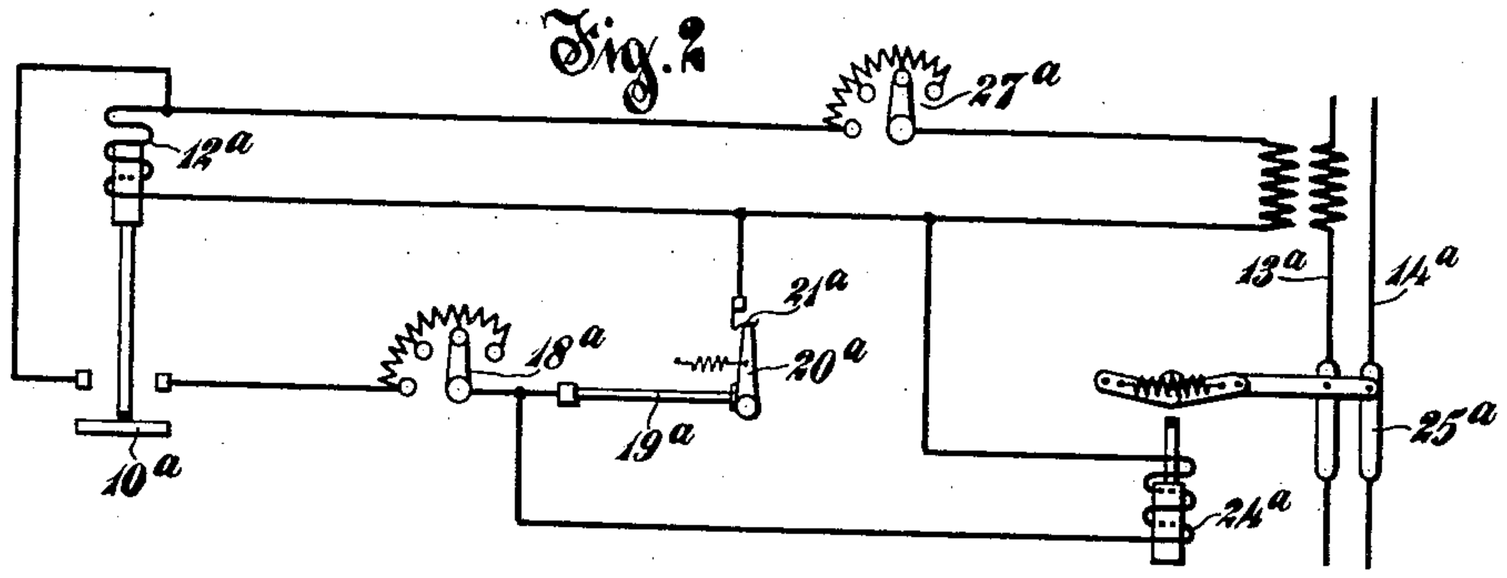
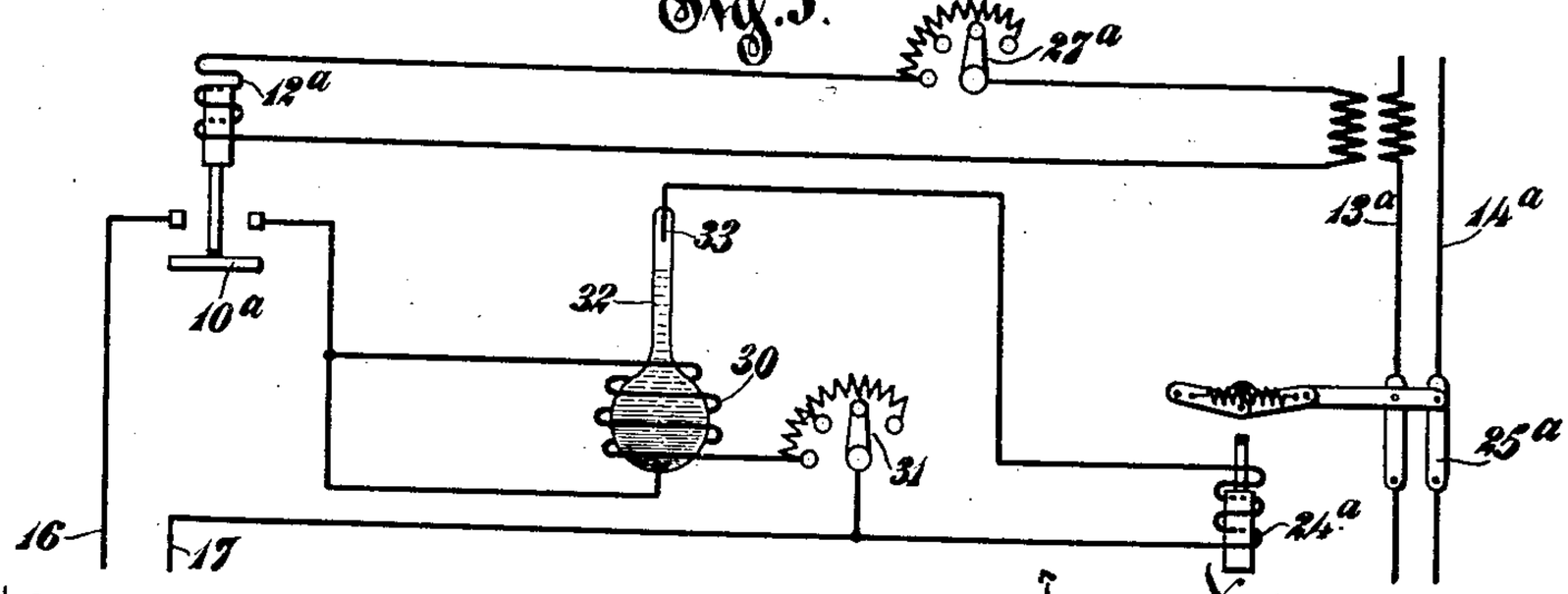


Fig. 3.



Witnesses

Oliver Sharman

Fred J. Kinsey

Inventor

Herbert W. Cheney

By Chas. E. Lord

Attorney

UNITED STATES PATENT OFFICE.

HERBERT W. CHENEY, OF NORWOOD, OHIO, ASSIGNOR TO ALLIS-CHALMERS COMPANY, A CORPORATION OF NEW JERSEY, AND THE BULLOCK ELECTRIC MANUFACTURING COMPANY, A CORPORATION OF OHIO.

TIME-LIMIT PROTECTIVE DEVICE FOR ELECTRIC CIRCUITS.

962,817. Specification of Letters Patent. **Patented June 28, 1910.**

Application filed May 27, 1907. Serial No. 375,830.

To all whom it may concern:

Be it known that I, HERBERT W. CHENEY, citizen of the United States, residing at Norwood, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Time-Limit Protective Devices for Electric Circuits, of which the following is a full, clear, and exact specification.

My invention relates to protective devices for electric circuits and especially to time limit overload circuit-breakers.

It is often desirable that momentary overloads in an electric circuit should be permitted but that continued overloads should cause an interruption of the circuit. Circuit-breakers have been provided with this end in view, and have operated with a greater or less degree of success.

It is the object of my present invention to provide a circuit-breaker for the same purpose which shall be more simple in principle and operation than any heretofore constructed and moreover shall be exact in its operation and easy of adjustment.

My invention comprises the combination of a body of matter which varies in volume as its temperature changes, means for causing the temperature of said body of matter to vary upon abnormal conditions in a circuit to be protected, and a circuit-breaker in said last named circuit arranged to be tripped when the volume of said body of matter reaches a predetermined value.

Other features of my invention will appear from the description and drawings and will be particularly pointed out in the claims.

The three figures of the drawing show diagrammatically three embodiments of my invention.

In Figure 1 the switch 10 is closed when either of the solenoids 11 or 12 raises its core in response to too large a current in any branch of a three-phase circuit 13—14—15. The closing of the switch 10 completes a circuit from any desired source of current 16—17, through the rheostat 18, rod 19, arm 20 and contact 21. When the parts 20 and 21 are in engagement, the rod 19 and said parts short-circuit a solenoid 22. The passage of circuit through the rod 19, however, heats the latter and causes it to expand at a rate determined by the position of the arm of the rheostat 18. When the rod 19 has expanded to a predetermined length it moves the arm 20 out of engagement with the contact 21, thereby breaking the short-circuit around the solenoid 22 to cause the latter to be energized to close the switch 23. The closing of the switch 23 completes the circuit of the solenoid 24, which when energized trips the circuit-breaker 25 in the three-phase circuit above referred to.

Should the abnormal current in the three-phase circuit not continue long enough to allow the rod 19 to expand sufficiently to break the short-circuit around the solenoid 22, the switch 10 will be allowed to open to break the circuit through said rod 19 to discontinue the heating and expansion of the latter. Thus momentary overloads are allowed while continued overloads are guarded against. The permissible duration of an overload is adjustable by the rheostat 18 while the value of the current at which the device operates is adjustable by the rheostats 26 and 27.

In Fig. 2 a modification of the arrangement of circuits is shown. Here solenoid 12^a closes switch 10^a upon the occurrence of an excessive load on the circuit 13^a—14^a. The closing of the switch 10^a completes a circuit through the rheostat 18^a, rod 19^a, arm 20^a and contact 21^a in a manner similar to that described in connection with Fig. 1. This circuit, however, is derived from the main circuit to be protected instead of from an auxiliary source of supply as in Fig. 1. Thus the rate at which the rod 19^a expands varies with the extent of the overload. The rod 19^a, arm 20^a and contact 21^a directly short-circuit the tripping solenoid 24^a of the circuit-breaker 25^a. When the rod 19^a has expanded sufficiently to break this short-circuit, the solenoid 24^a is energized to trip said circuit-breaker. As in Fig. 1 both the permissible duration of the overload and the maximum value of the normal load may be varied by the rheostats 18^a and 27^a respectively.

In Fig. 3 the part which expands on heating to control the tripping of the circuit-breaker is not heated by the passage of current directly through it but through a coil in proximity to it. Here as before the solen-

oid 12ª closes switch 10ª upon abnormal currents in the circuit 13ª—14ª. The closing of the switch 10ª, however, completes a circuit through a coil 30 and a rheostat 31. The coil 30 is placed around the bulb of a thermometer 32 and when carrying current heats the mercury or other liquid thereof to cause the latter to expand until it reaches the contact 33 near the top of the thermometer. When the mercury reaches the contact 33, a circuit is completed through the tripping solenoid 24ª of the circuit-breaker 25ª in the main circuit to be protected. The rate at which the mercury of the thermometer rises is adjustable by the rheostat 31, while as before the value of the current at which the switch 10ª closes is adjustable by the rheostat 27ª. In Fig. 3 as in Fig. 1 an auxiliary source of supply 16—17 is used, though if desired all the current may be derived from the main circuit. In any of the modifications, a cessation of the overload allows the switch 10 or 10ª to open to stop the expansion of the rod or of the mercury.

Many modifications may be made in the precise arrangements shown and described and all such which do not involve a departure from the spirit and scope of my invention I aim to cover in the claims.

What I claim as new is:—

1. In a protective device for electric circuits, a body of matter which varies in volume as its temperature changes, means for causing the temperature of said body of matter to vary upon abnormal conditions in a circuit to be protected, an electric circuit including said body of matter and arranged to have its condition as regards opening and closing reversed when the volume of said body of matter reaches a predetermined value, and a circuit-breaker in the circuit to be protected arranged to be tripped upon such reversal.

2. In a protective device for electric circuits, a body of matter which varies in volume upon changes in temperature, an electric circuit for heating said body of matter and including the latter and arranged to be completed upon abnormal conditions in a circuit to be protected, and a circuit-breaker in said last named circuit arranged to be tripped when the volume of said body of matter reaches a predetermined value.

3. In an overload protective device for electric circuits, a magnetically operated switch arranged to close when the current in a circuit to be protected exceeds a predetermined value, a body of matter which expands when heated and is arranged to be electrically heated by the passage of current through it when said switch is closed, and a magnetically tripped circuit-breaker in the circuit to be protected, the tripping magnet of said circuit-breaker being arranged to be energized when said body of matter has expanded to a predetermined value.

4. In combination, an electric circuit to be protected, a solenoid-operated switch arranged to be closed when more than a predetermined current flows in said circuit, a body of matter which expands on heating and which is arranged to be heated by current supplied through said switch while the latter is closed, a circuit including said body of matter and arranged to have its condition as regards opening and closing reversed when said body of matter has expanded to a predetermined volume, a solenoid arranged to be energized upon such reversal, and a circuit-breaker located in the circuit to be protected and arranged to be opened upon the energization of said last named solenoid.

5. In a protective device for electric circuits, a body of matter which varies in volume upon changes in temperature, an electric circuit for heating said body of matter and including the latter and arranged to be completed upon abnormal conditions in a circuit to be protected, a circuit-breaker in said last named circuit arranged to be tripped when the volume of said body of matter reaches a predetermined value, and means for varying the rate at which said body of matter heats.

6. In combination, an electric circuit to be protected, a solenoid-operated switch arranged to be closed when more than a predetermined current flows in said circuit, a body of matter which expands on heating and which is arranged to be heated by current supplied through said switch while the latter is closed, a circuit including said body of matter and arranged to have its condition as regards opening and closing reversed when said body of matter has expanded to a predetermined volume, a solenoid arranged to be energized upon such reversal, a circuit-breaker located in the circuit to be protected and arranged to be opened upon the energization of said last named solenoid, and means for varying the rate at which said body of matter heats.

7. In a protective device for electric circuits, a body of matter which varies in volume upon changes in temperature, an electric circuit for heating said body of matter and including the latter, means for energizing said circuit upon abnormal conditions in a circuit to be protected, and a circuit-breaker in said last named circuit arranged to be tripped when the volume of said body of matter reaches a predetermined value

In testimony whereof I affix my signature, in the presence of two witnesses.

HERBERT W. CHENEY.

Witnesses:

GEO. B. SCHLEY,

FRED J. KINSEY.