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 STATIC DEVICE FOR THE AUTOMATIC AND PROGRESSIVE
 CLOSING OF ELECTRIC CIRCUITS
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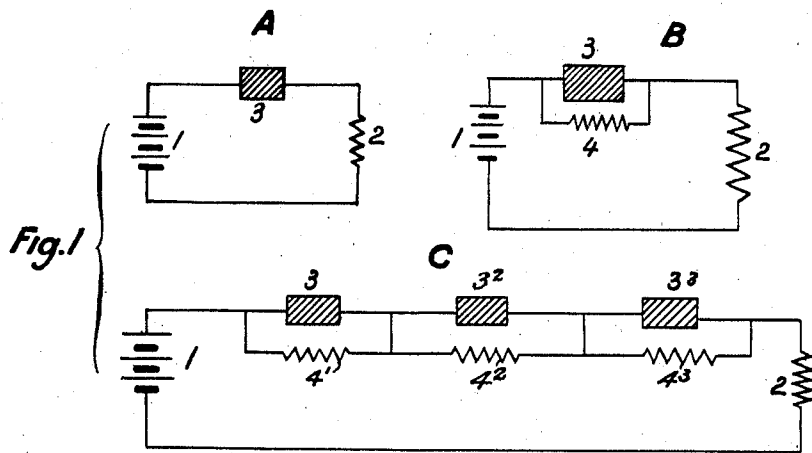


Fig. 2

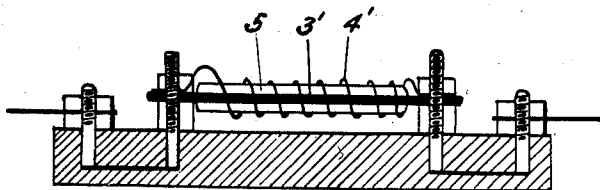
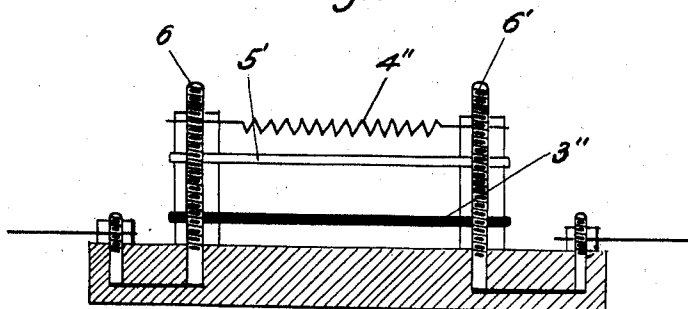


Fig. 3



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STATIC DEVICE FOR THE AUTOMATIC AND PROGRESSIVE CLOSING OF ELECTRIC CIRCUITS

Application filed September 30, 1927, Serial No. 223,122, and in France November 19, 1926.

The progressive establishment of the current in a circuit has hitherto only been effected automatically by the use of cumbersome mechanism and with a lack of reliability, by reason of the dependency upon movable elements.

Now the present invention furnishes a static solution of the problem by the use of a material of a high negative thermal coefficient of resistance, which is always in the circuit, above or in parallel with a fixed resistance, thereby insuring reliable operation.

In the first place in order that the heating speed of the substance may be sufficiently reduced, the conductor employed will be given a relatively large surface in relation to the mass.

A good example is a flattened bar or a thin band of variable conductive substance.

If the power to be absorbed is great, it is useless to expect a prolonged heating period.

According to the invention the special conductor is shunted by a fixed resistance, and the special conductor is so dimensioned that it allows the passage of a very weak current at the start. Under these conditions there are clearly two phases of conductivity. The fixed resistance permits the passage of a limited constant current and thereby heats the special conductor. After a period of heating said special conductor will short circuit the fixed resistance, so that said fixed resistance will cool off.

An improvement in this arrangement consists in advancing the second phase by heating the variable substance with the fixed resistance.

Another improvement consists in arranging several resistance elements in series, and shunting them by the substance with variable resistive power, care being taken to so arrange matters as to obtain different heating durations so as to avoid the simultaneous short circuiting of the elements.

The diagrams of Figure 1 show, by way of example, three methods of realizing circuits in conformity with the invention.

The diagram A functions under the action of the sole substance 3 in the circuit 1, 2, 3.

The diagram B gives an arrangement in which the action of the substance 3 is combined with that of the resistance 4 of fixed type, in parallel.

The diagram C shows an automatic rheostatic system, the whole constituted by three elements of resistance in series 4₁, 4₂, 4₃, each respectively short circuited by the substances having a negative co-efficient of temperature 3₁, 3₂, 3₃.

As will be understood these diagrams do not determine the action of the heat released by the resistance upon the substance with variable resistance.

This action, if it be desired to have recourse thereto, may be obtained in a definite manner by winding the fixed resistance upon the special substance with the interposition of an electric insulation between them so as to avoid circulating currents between the elements the potentials of which are not positively equal; this action could also be rendered adjustable by placing at a regulatable distance, a resistant element, heating the special substance in a suitable manner. If need be a reduction can be made in the speed of action of the fixed resistance by interposing a thermic screen 5 between the heating element and the substance, the screen being of asbestos, mica, or other product capable of resisting heat.

Figure 2 shows an example of realizing a combined arrangement comprising a heating element or fixed resistance 4' wound upon a refractory screen 5 mounted upon the variable element 3.

Figure 3 shows a slightly different realization in which a variation may be made in the relative position of the fixed resistance and of the substance.

In this figure there may be remarked the substance 3'' with variable conductivity, the thermic screen 5' and the resistance 3''.

By changing the height of the cylindrical stays placed upon the screw-threaded rods 6, 6' a modification is effected in the action of the fixed resistance upon the element 3''.

The screen 5, as will be understood, without departing from the spirit of the invention may realize different variations utilizing

ing either separately or in combination the arrangements indicated, or any other that may be equivalent.

What we claim and desire to secure by Letters Patent of the United States is:—

- 5 1. In a device for automatically varying the resistance of an electric circuit connected between an utilization apparatus and a terminal of the current source, a high negative temperature-coefficient variable resistance
10 element, and a second separate resistance element connected in parallel to only two points of said variable resistance element and arranged at an adjustable distance therefrom
15 to heat it by convection, the value of resistance of the second element being such that it is much less than the value of the cold variable element, and much greater than the value of the heated variable element.
- 20 2. In a device for automatically varying the resistance of an electric circuit connected between an utilization apparatus and a terminal of the current source, the combination of several resistance elements connected
25 in series, each comprising a high negative temperature-coefficient variable resistance element and a second separate resistance element connected in parallel to only two points of said variable resistance element and
30 arranged at an adjustable distance therefrom to heat it by convection, the value of resistance of the second element being such that it is much less than the value of the cold variable element, and much greater than the
35 value of the heated variable element.

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