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ELECTRIC REGULATOR WITH SHORT CIRCUITING DEVICE.
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ELECTRIC REGULATOR WITH SHORT-CIRCUITING DEVICE.

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To all whom it may concern:

Be it known that I, WILLIAM A. TURBAYNE, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Electric Regulators with Short-Circuiting Devices, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to automatic electric regulators having a short circuiting device for the regulating resistance.

One of the objects of the invention is to provide means for decreasing the resistance of a circuit to a point below the normal minimum value attainable with a regulating resistance connected in said circuit.

Another object is to provide a regulator of the variable pressure rheostat type having means for automatically short circuiting the regulating resistance.

Another object is to provide a regulator having a shunt circuit around the regulating resistance, the resistance of the shunt circuit under certain conditions of operation being reduced rapidly but in an appreciable interval of time, to prevent disturbances in the circuit which is being regulated.

The invention may be embodied in various forms. In the accompanying drawings I have illustrated one form of regulator for carrying out the invention. I do not limit myself to this form, however.

Figure 1 of the drawings illustrates somewhat diagrammatically the main elements of the preferred form of regulator. Fig. 2 is an elevation of the regulator in commercial form, showing the same mounted on a supporting panel.

The regulating resistance 1 is connected in the circuit to be regulated. This resistance is in the form of a variable pressure rheostat, comprising preferably a series of contacting carbon plates, the resistance of the series varying as the pressure on said carbon plates is increased or decreased. The pressure on the carbon plates is regulated by the controlling winding 2, which is preferably connected across the circuit to be regulated in order to respond to variations in voltage therein. The voltage winding or solenoid is provided with a plunger 3, which tends normally to remain in lowermost position due to its weight, which tendency may be assisted by a spring 3', if desired. The plunger, however, is adapted to be drawn up when the solenoid is energized. The mechanical connections between the plunger 3 and the variable pressure rheostat 1 include a bell crank lever 4, pivoted at the point 5, and connected to the lever 6, which is pivoted at the point 7, said lever being connected at an intermediate point to the movable terminal 8 of the variable pressure rheostat. The opposite terminal 9 of said variable pressure rheostat has a relatively fixed position during the major portion of the operation of the regulator, being mounted on the end of a lever 10 which is pivoted at the point 11 and normally maintained in the position shown in Fig. 1 by means of the spring 12, which forces the adjustable stop 13 against a fixed abutment, such for example, as the magnet frame 14. The upper end of the lever 10, therefore, constitutes a fixed stop under certain conditions, and when the plunger is drawn up in response to the energization of the voltage winding the movable terminal member 8 is moved away from the relatively fixed terminal member 9, to decrease the pressure on the series of carbon plates, and thereby increase the resistance thereof. The dash pot 15 is provided to steady the action of the moving parts.

If the terminal member 9 were mounted on or backed up against an absolutely fixed stop, it is apparent that the resistance of the variable pressure rheostat would be a minimum when the solenoid 2 was deenergized and when the plunger was in lowermost position. Even with the resistance at a minimum value, however, it has been found that with any appreciable lamp load a certain voltage drop exists across the series of carbon plates or carbon pile by reason of the intrinsic resistance of the material itself, that is the resistance of the carbon plates. In order, therefore, to decrease the value of the resistance in circuit to a point below the normal minimum value of the carbon pile, I provide preferably an auxiliary or short circuiting carbon pile 16, comprising a comparatively small number of carbon plates suit-
ably supported and having a terminal member 17 backed up against a fixed support 18. The other terminal member 19, comprising preferably a single carbon plate suitably mounted, is secured to the lower end of the lever 19. During the energization of the solenoid 2 the relative positions of the various parts are about as shown in Fig. 1, with a suitable air space or gap between certain of the carbon plates in the auxiliary carbon pile 16. This auxiliary carbon pile is suitably connected in a shunt circuit around the terminals of the main carbon pile 1, as indicated by the conductors 20 in Fig. 1. The shunt circuit is open, of course, due to the gap in the auxiliary carbon pile when the parts are as illustrated in said figure. Under these circumstances, the main carbon pile 1 is operated in the manner described above, entirely independently of the auxiliary carbon pile 16. When the plunger 3 moves to lowermost position, however, sufficient pressure is exerted on the upper carbon pile to overcome the pressure of the spring 12, whereupon the lever 19 moves about its fulcrum 11 and the gap in the auxiliary carbon pile 16 is closed up by the adjacent carbon plates coming into contact, and upon continued movement of the main lever 19 operating the pressure on the auxiliary carbon pile 16 is increased and the resistance thereof accordingly decreased to a point where the main carbon pile 1 is practically short-circuited. It will be seen that the two carbon piles 1 and 16 are substantially parallel in the arrangement illustrated. The lever which transmits pressure from the main to the auxiliary pile is pivoted between its points of attachment to said carbon piles, and accordingly applies the pressure to the auxiliary pile in a reverse direction to that in which the pressure is received from the main pile. This arrangement provides a compact structure. I do not limit myself to this relative arrangement of the carbon piles, however, or to the specific means for transmitting the pressure from one pile to the other, as said relative arrangement may be widely varied and the pressure transmitting means changed accordingly. With the arrangement described it is apparent that considerable pressure will be exerted upon the main carbon pile before the carbon plates of the auxiliary carbon pile are brought into engagement. Consequently, the resistance of the main carbon pile will be reduced as far as practical before the shunt circuit around said main carbon pile is closed. As the carbon plates in the auxiliary pile are ordinarily in very loose contact, no appreciable voltage variation will be shown in the circuit which is being regulated at the moment when the auxiliary carbons make contact, as there would be a certain voltage drop across the auxiliary pile at this time, which voltage drop, however, is rapidly eliminated as the pressure on the auxiliary pile increases. In the above I have shown the complete structural details for the regulator described in connection with Fig. 1. The same reference characters have been used to indicate corresponding parts.

The carbon plates of the regulating resistance 1 are confined by suitable insulating guides 21. The carbon plates of the auxiliary carbon pile are also confined by suitable insulating guides 22 and 23, which not only support these plates but prevent them from falling out when the plates are moved apart to form the gap. The spring 12 may be adjusted by the adjusting nut 24 to regulate the pressure necessary to close up the auxiliary carbon pile. The terminal member 19 is suitably insulated from its metallic backing and is rigidly secured thereto by any suitable means. It is apparent that the invention may be embodied in other forms and, accordingly, I do not desire to limit myself to the form described and illustrated. I desire to cover suitable equivalent means for accomplishing the desired results and falling within the scope of the appended claims.

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

1. An electric regulator, comprising a regulating resistance and a carbon pile resistance for short circuiting said regulating resistance, said carbon pile resistance having an air gap therein during the normal operation of said regulating resistance, whereby the short circuit is opened.

2. An electric regulator, comprising a regulating resistance and a carbon pile resistance for short circuiting said regulating resistance, said carbon pile resistance having an air gap therein during the normal operation of said regulating resistance, whereby the short circuit is opened, and means for closing said air gap when the value of said regulating resistance is a minimum.

3. An electric regulator, comprising a main carbon pile resistance, means for varying the pressure applied thereto, an auxiliary carbon pile resistance having an air gap, and means for closing said air gap upon the attainment of a predetermined pressure on said main carbon pile resistance.

4. An electric regulator, comprising a carbon pile resistance having a relatively stationary terminal member and having a relatively movable terminal member adapted, when moved, to vary the pressure applied to the carbon pile, said relatively fixed terminal member being yieldingly mounted.
whereby it may yield upon the attainment of a certain predetermined pressure on the carbon pile, said resistance being rendered inoperative for regulating purposes by said yielding.

5. An electric regulator, comprising a carbon pile resistance having a relatively stationary terminal member and having a relatively movable terminal member adapted, when moved, to vary the pressure applied to the carbon pile, said relatively fixed terminal member being yieldingly mounted, whereby it may yield upon the attainment of a certain predetermined pressure on the carbon pile, and a normally open circuit around said resistance, the yielding of said member acting to close said circuit.

6. An electric regulator, comprising a plurality of carbon pile resistances, each of said resistances having a relatively fixed and a relatively movable terminal member for varying the pressure thereon, the relatively fixed terminal member of one of said carbon piles being adapted to move under certain conditions of increased pressure, the movement due to said yielding being communicated to the movable terminal member of the other of said carbon piles.

7. An electric regulator, comprising a plurality of carbon pile resistances, and means for applying pressure directly to one of said resistances and indirectly through said resistance to the other, for increasing the pressure thereon, the compression of one of said carbon piles being delayed until the compression on the other of said carbon piles has reached a predetermined maximum.

8. An electric regulator having a plurality of carbon pile resistances and a single solenoid for applying pressure directly to one of said resistances and indirectly through said resistance to another resistance, the compression of one of said carbon piles being delayed until the compression on the other of said carbon piles has reached a predetermined maximum.

9. An electric regulator, comprising a plurality of carbon pile resistances, and means common to both for increasing the pressure thereon, the compression of one of said carbon piles being delayed until the compression on the other of said carbon piles has reached a predetermined maximum, the pressure applied to the first mentioned carbon pile being transmitted through the second mentioned carbon pile.

10. An electric regulator, comprising a plurality of carbon pile resistances, and means common to both for increasing the pressure thereon, the compression of one of said carbon piles being delayed until the compression on the other of said carbon piles has reached a predetermined maximum, the pressure applied to the first mentioned carbon pile being transmitted through the second mentioned carbon pile by a bodily movement of said second carbon pile.

11. An electric regulator, comprising a main carbon pile resistance and an auxiliary carbon pile resistance, means for compressing said main carbon pile resistance, and direct mechanical connections between said main carbon pile resistance and auxiliary carbon pile by pressure exerted through said main carbon pile.

12. An electric regulator, comprising a main carbon pile resistance and an auxiliary carbon pile resistance, means for compressing said main carbon pile resistance, and direct mechanical connections between said main carbon pile resistance and auxiliary carbon pile by pressure exerted through said main carbon pile and effecting a bodily movement thereof.

13. An electric regulator, comprising a plurality of carbon piles, one of said carbon piles having an air gap therein during normal operation of the regulator, the other of said carbon piles having a yielding terminal member and a movable terminal member for varying the pressure applied to the carbon pile, mechanical connections between said yielding terminal and the other carbon pile, whereby an increased pressure exerted by said movable terminal will cause a yielding movement of said yielding terminal to close up the air gap in the other carbon pile.

14. An electric regulator, comprising a plurality of carbon piles, one of said carbon piles being arranged in a shunt circuit around the other and having an air gap therein during normal operation of the regulator, the other of said carbon piles having a yielding terminal member and a movable terminal member for varying the pressure applied to the carbon pile, mechanical connections between said yielding terminal and the other carbon pile, whereby an increased pressure exerted by said movable terminal will cause a yielding movement of said yielding terminal to close up the air gap in the other carbon pile.

15. An electric regulator having a main carbon pile and an auxiliary carbon pile, terminal members therefor, a lever connecting a terminal member of said main carbon pile with a terminal member of said auxiliary carbon pile, said lever being pivoted intermediate its points of connection, and means for applying pressure to the opposite end of said main carbon pile, whereby a bodily movement of said carbon pile in one direction compresses said auxiliary carbon pile by a movement in the other direction.

16. An electric regulator having a pair of compressible resistances, electro-magnetic
means for varying said resistances, mechanical connections between one of said resistances and said means, and independent mechanical connections between said resistances.

17. An electric regulator having a pair of compressible resistances, said resistances being arranged parallel and side by side, electro-magnetic means for varying said resistances, mechanical connections between one of said resistances and said means, and independent mechanical connections between adjacent ends of said resistances.

18. An electric regulator, comprising a solenoid, a plunger therefor, a main carbon pile resistance having a movable terminal member and a yielding terminal member, mechanical connections between said movable terminal member and said plunger,

whereby energization of said solenoid acts to decrease the pressure exerted on said main carbon pile resistance to increase the resistance thereof for regulating purposes, an adjustable spring associated with said yield-
ing terminal member to determine the pressure at which said member shall yield, an auxiliary carbon pile resistance having a fixed terminal member and a movable terminal member, and mechanical connections between said movable terminal member and said yielding terminal member, said auxiliary carbon pile resistance having an air space between certain of its adjacent carbon plates, due to relaxation in the pressure applied thereto when said solenoid is energized, the deenergization of said solenoid resulting in a movement of said plunger to initial position, thereby increasing the pressure on said main carbon pile resistance to a point sufficient to cause the bodily movement thereof, whereby said auxiliary carbon pile is compressed to close up said air space and short circuit said main carbon pile.

19. The combination of a compressible variable resistance, electro-responsive means controlling the operation of said resistance, and means adapted to gradually reduce the voltage drop across said resistance and maintain it at any of a plurality of gradations during such reduction, after the resistance has substantially reached its stage of maximum compression, said last mentioned means being controlled by said electro-responsive means by pressure applied to said resistance after it has reached its stage of maximum compression.

20. The combination of a compressible variable resistance and means for gradually reducing the voltage drop across said resistance and maintaining it at any gradation during such reduction after the resistance has substantially reached its stage of maximum compression, said resistance and said means being electro-responsive controlled, said means being operated by force transmitted through said resistance.

21. The combination of a compressible resistance rheostat and means for gradually reducing the voltage drop across said resistance by gradually shunting current from the resistance to maintain said voltage drop at any gradation during such reduction after the resistance has substantially reached its stage of maximum compression, said rheostat and said means being electro-responsive controlled, the control of said means being by force transmitted through said resistance.

22. The combination of a rheostat and means gradually reducing the voltage drop across said rheostat and maintaining it at any of a plurality of gradations during such reduction after said rheostat has substantially reached its limit of operation, said rheostat and said means being electro-responsive controlled, the control of one of said elements being indirect by means acting directly upon the other.

23. The combination of a compressible resistance rheostat, electro-responsive means controlling the operation of said rheostat, and means adapted to gradually reduce the voltage drop across said rheostat and maintain it at any of a plurality of gradations during such reduction after said rheostat has substantially reached its limit of operation, said last mentioned means embracing shunting means for said resistance and said last mentioned means being controlled by said electro-responsive means acting indirectly thereon through said compressible rheostat.

24. The combination of an electrical circuit, a carbon pile in said circuit, an electromagnetic solenoid operating said pile to vary its resistance, and means adapted to gradually reduce the voltage drop across said resistance and maintain it at any of a plurality of gradations during such reduction, after the resistance of said circuit may be further reduced after the said pile has been compressed, said last mentioned means being controlled by said solenoid acting indirectly thereon through said carbon pile.

25. The combination of a carbon pile resistance, a member for varying the pressure applied thereon, a resilient member normally tending to increase said pressure, a resilient member limiting the pressure exerted by said first named resilient member, means for shunting said pile and gradually decreasing the voltage drop across the pile after the pile has reached said stage of limiting pressure, and electro-responsive means cooperating with said resilient members to determine the pressure on said pile, said shunting means being operated by pressure.
transmitted indirectly thereto through said pile.

20. Means for producing electric regulation comprehending regulating means having a range between certain limits, regulating means cooperating therewith and having a regulating effect beyond one of said limits combined with a means for gradually operating one of said means to its limit and then supplementing the effect thereof by operation of the other means, said last mentioned means being operated by a continued action of said operating means on said first regulating means after said first regulating means has reached its limit of effectiveness.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

WILLIAM A. TURBAYNE.

WITNESSES:

ALEX. RUSSELL,

F. J. CALLAHAN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D.C."