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ELECTRICAL REGULATING APPARATUS.

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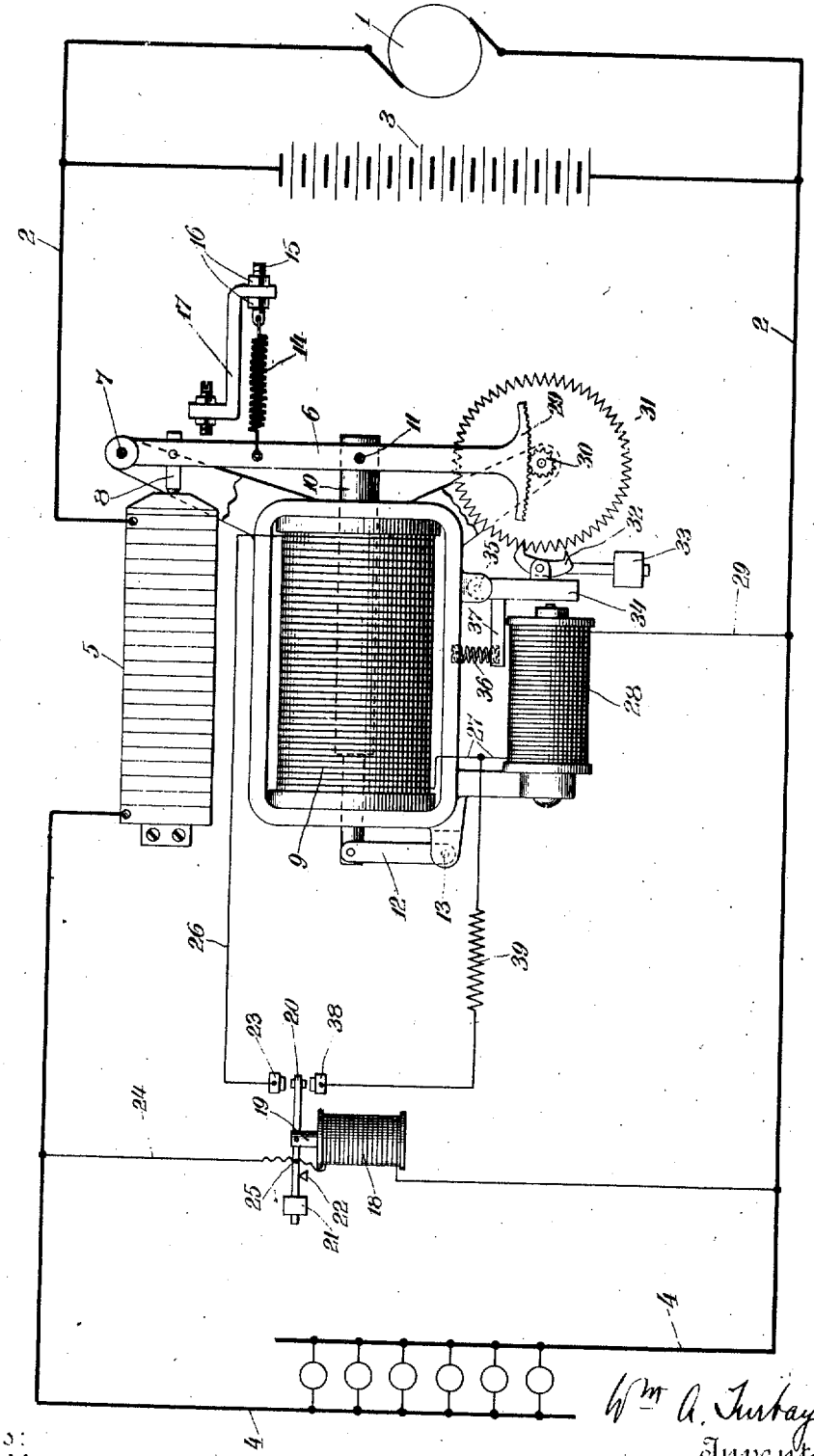
Patented Mar. 21, 1911.



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UNITED STATES PATENT OFFICE.

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ELECTRICAL REGULATING APPARATUS.

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To all whom it may concern

Be it known that I, WILLIAM A. TURBAYNE, a citizen of the United States, and a resident of Lancaster, in the county of Erie, State of New York, have invented certain new and useful Improvements in Electrical Regulating Apparatus, of which the following is a specification.

My invention relates to electrical regulating apparatus and I have shown one arrangement of my improvements especially adapted to a system in which the voltage on a work circuit is regulated and the work circuit is supplied from a source of variable electromotive force.

One object of my invention is to provide a system and arrangement by which the voltage applied to the consumption circuit may be automatically regulated in such a manner that the regulation is extremely fine and that the loss of energy in the regulating apparatus is reduced to a minimum.

In systems in which carbon piles have been used it is customary to provide an electromagnet near the pile for operating the same, which magnet is opposed by the action of a spring or some similar means. In such systems, regardless of the value of the two opposing forces, the only force available for varying the pressure of the carbon pile is the unbalanced component predominating either in the spring or magnet, and, with a slight voltage variation this component of force is very small in comparison with the two forces acting upon the pile. This causes the regulation to be poor and an excessive amount of energy to be used in the regulating apparatus. Also, in previous arrangements of this kind, as the magnet windings are continuously in circuit, they become considerably heated and the resulting increase in temperature in the windings alters their resistance and injuriously affects the regulation. If the magnet windings are in close proximity to the blocks of the carbon pile, as is customary, the heat may also affect these detrimentally. Also as parts of the regulating apparatus are normally in a condition of equilibrium, vibrations are apt to also injuriously affect the regulation, particularly with conditions of high battery voltage and low lamp load. If a dash-pot is used to eliminate these disturbances due to vibration the disadvantage arises that the density of the liquid varies considerably with temperature changes.

Various objects of my invention are to provide improvements which will obviate these and other disadvantages and in so doing I provide a means for locking the apparatus which operates the carbon pile so that the magnet need not be energized except when the system is undergoing regulation. Furthermore, I provide an electromagnet which is not directly subject to variations in the work circuit voltage but which is made to operate responsive thereto by means of an auxiliary electro-responsive device which throws such magnet into operation when it is desired to operate it responsively to variations in voltage on the work circuit.

My invention further includes automatic means for operating the locking device and means for damping the action of the operating mechanism so that it will work smoothly and efficiently.

Various other objects, features and advantages will more clearly appear from the detailed description given below taken in connection with the accompanying drawing which forms a part of this specification and which shows diagrammatically a system embodying one form of my invention and improvements.

In the drawing, 1 represents a main generator feeding the circuit 2, 2. Connected across the circuit 2, 2 is a storage battery 3 which is designed to be charged from the generator 1 and to feed the circuit 2, 2 when the generator 1 is not in operation.

4, 4 indicates a work or consumption circuit which may include lamps, or other translating devices and which is fed or supplied by the generator 1 or battery 3 through the circuit 2, 2. The battery 3 and generator 1 taken together form a source of variable electromotive force, since, when the generator is operating and the battery is charging therefrom the voltage applied to the circuit 2, 2 is somewhat greater than when the generator is inoperative and the battery 3 is supplying said circuit.

In order to maintain the voltage across the main circuit 4, 4 substantially constant I place in the circuit 2, between the battery 3 and the work circuit 4, 4 a variable resistance 5. For this variable resistance I preferably use a pile of carbon blocks as

shown, the resistance of which is varied by variations in pressure exerted thereupon by a lever 6 pivoted at the point 7. The lever 6 carries a pivoted member 8 for engaging with one end of the pile of carbon blocks. The lever 6 is controlled by means of a coil in the form of a solenoid 9 which operates upon a core 10 pivotally connected to the lever 6 at 11. The core 10 is pivoted at its other end to a link 12 which in turn is pivotally mounted to the framework at 13. When the solenoid 9 is energized this tends to attract the core 10 moving it to the left to cause the lever or arm 6 to compress the pile of carbon blocks 5. The action of the solenoid 9 is opposed by a spring 14 which may be adjusted by means of screw 15 and nuts 16 situated on frame piece 17.

Connected directly across the work circuit 4, 4 is a coil of an electromagnet 18. This coil is thus made responsive to variations in the voltage of the consumption or work circuit 4. The electromagnet is arranged to operate upon a core 19 which operates a switch member 20. The pull of the electromagnet 18 is normally balanced by means of a weight 21 secured to the switch member 20 on the opposite side of its fulcrum 22 from that on which a core 19 is situated. When the voltage on the work circuit drops the pull on the electromagnet 18 is decreased, thus allowing the switch 20 to contact with the terminal 23, so that the solenoid 9 is connected in circuit across the main line. This circuit may be traced as follows: conductor 24 connecting with the switch member or arm 20 at point 25, contact terminal 23, conductor 26, solenoid 9, conductor 27, magnet coil 28 and conductor 29. This current passing through the solenoid 9 energizes the same so that it exerts a pull upon the core 10 to cause the lever 6 to compress the pile of carbon blocks 5 so that the resistance in the circuit 2 between the source and work circuit is decreased, thus allowing the voltage at the work circuit to be increased and brought back substantially to its original or normal value.

The action of the lever 6 and its coöperating mechanism is dampened by means of a pawl and ratchet arrangement at its lower end. At its lower end the lever 6 carries a toothed segment 29 which engages with a pinion 30 fixedly secured to a ratchet wheel 31. The teeth of the ratchet wheel 31 are engaged by a pawl 32 carrying a weighted pendulum 33. As a pull is exerted on the lever 6 the ratchet wheel 31 is made to revolve but its speed is kept down because of the pawl and pendulum 32, 33. During this action the pawl 32 and pendulum 33 are held in a position so that the apparatus acts as an ordinary escapement, the operation of which may be varied by varying the length of the pendulum and the weight thereon. In order to lock the lever 6 and its appurtenant mechanism against operation it is only necessary therefore to lock the ratchet wheel 31 against revolution. To do this I pivotally mount the pawl upon a member 34 which in turn is pivotally mounted to the main frame at 35. A spring 36 acts upon an arm 37 which is fixedly secured to the member 34 and which normally tends to force the pawl 32 in thorough engagement with the teeth of the ratchet wheel 31 to lock the same against movement. Thus normally, the lever 6 and its appurtenant mechanism are locked against movement. In order to release or unlock this mechanism the magnet 28 is energized to attract its armature or member 34 so that the pawl 32 will be retracted to a position such that when taken in connection with the ratchet wheel 31 it will act as an ordinary escapement and will dampen the action of the lever 6 and consequently the operation of the carbon pile of the resistance 5. When, therefore, the solenoid 9 is energized to compress the carbon pile resistance 5, as above explained, the magnet 28 is energized at the same time to attract its armature 34 and thus release the pawl and ratchet mechanism 32, 31, so that the solenoid 9 can produce its proper effect upon the lever 6 and variable resistance 5. When the voltage on the work circuit 4, 4 has been brought back substantially to its original or normal value the switch member 20 returns to its original or normal position, thus opening the circuit between the switch member 20 and contact terminal 23 so that both the solenoid 9 and coil of the magnet 28 become deënergized. The deënergization of the magnet 28 again puts into operation the mechanism for locking the ratchet wheel 31 so that the operating mechanism is again locked in order to maintain the variable resistance in the condition required until further regulation thereof is necessary. When the voltage on the work circuit rises above the predetermined normal value the solenoid or electromagnet 18 attracts the core so that the switch member 20 contacts with contact terminal 38. This connection throws the magnet 28 into circuit without energizing the solenoid 9. The circuit which thus energizes the magnet 28 may be traced as follows: conductor 24, switch member 20, contact terminal 38, resistance 39, conductor 27, magnet 28 and conductor 29. The resistance 39 is added as a substitute for the solenoid 9 so that the current in magnet 28 will be substantially the same as before. This energization of the windings of magnet 28 causes it to attract its armature 34 so that the locking mechanism is again released. Now, however, the solenoid 9 is not energized and the spring 14 acts

upon the lever 6 and its appurtenant mechanism to withdraw the pressure upon the carbon pile resistance 5 so that the resistance thereof is increased in order to increase the drop in voltage between the source and work circuit 4, 4, so that the voltage thereof is brought back to substantially its normal value. When this normal value of voltage is again reached the switch member 20 returns to its intermediate position again, between the contacts 23 and 38, thus opening the circuit through the windings of the magnet 28, so that the locking means is again thrown into operation to maintain the various parts of the system and apparatus in that position and arangement until the system shall again need regulation.

From the above it will be evident that I have provided a system and improvements in regulating apparatus therefor which render the same economical and efficient in operation and construction and more effective for the purposes described. The various disadvantages of prior systems above pointed out are substantially eliminated and a regulating apparatus produced which has many new and useful features and improvements.

Although I have shown my improvements as applied to one specific form of system and in one particular form of apparatus it will be evident that there are many other forms and many arrangements of circuits and apparatus to which my invention and improvements may be applied. I do not, therefore, desire to be limited to the exact details shown and described but

Having fully and clearly explained my invention what I claim as new and desire to secure by Letters Patent is:

1. In an electrical system of distribution, a source of variable electromotive force, a work circuit fed thereby, a carbon pile resistance connected between the source and work circuit to maintain the voltage applied to the work circuit substantially constant, means for controlling the operation of said resistance to maintain the work circuit voltage substantially constant, and means for locking said controlling means against action while the work circuit voltage is substantially constant.

2. In an electrical system of distribution, a source of electromotive force and work circuit connected to be fed thereby, a carbon pile resistance in series with the work circuit to regulate the voltage applied thereto, means for operating said pile, an electroresponsive device for controlling said means to regulate the voltage at the work circuit, and apparatus for locking said operating means against operation responsive to variations in the electrical condition of the system.

3. In an electrical system of distribution, a source of variable electromotive force, a consumption circuit supplied thereby, means for regulating the voltage applied to the consumption circuit, a coil for controlling said means, means for controlling the action of said coil responsive to voltage variations of the consumption circuit and apparatus for locking said first mentioned means against operation when said second mentioned means is not in operation.

4. In an electrical system of distribution, a source of electromotive force, and work circuit supplied thereby, a carbon pile resistance in series with the work circuit between the source and work circuit, means for regulating said resistance to maintain the voltage upon the work circuit substantially constant responsive to variations in the work circuit voltage, means for locking said regulating means against action while the work circuit voltage remains substantially constant, and a device for releasing said locking means when the work circuit voltage varies substantially from said constant value.

5. In an electrical system of distribution, a source of variable electromotive force, a consumption circuit supplied thereby, a carbon pile in series with the consumption circuit regulating the voltage applied to the consumption circuit, an electroresponsive device for controlling said pile responsive to voltage variations of the consumption circuit, means for automatically locking said device against operation and apparatus for releasing said locking means when said electroresponsive device is in operation.

6. In an electrical system of distribution, a source of variable electromotive force, a consumption circuit supplied thereby, means for regulating the voltage applied to the consumption circuit, a magnet for controlling said means, means for locking said first mentioned means against operation, and a magnet for releasing said locking means when the operation of said first mentioned magnet is about to take place.

7. In an electrical system of distribution, a source of variable electromotive force, a consumption circuit supplied thereby, a carbon pile for regulating the voltage applied to the consumption circuit, a magnet for controlling said pile, means for locking said pile against operation, a magnet for releasing said locking means when said first mentioned means regulates, and an electroresponsive device for controlling the action of said magnets.

8. In an electrical system of distribution, a source of variable electromotive force, a consumption circuit supplied thereby, means for regulating the voltage applied to the consumption circuit, a magnet for controlling said means, means for locking said first

mentioned means against operation, a magnet for releasing said locking means when the actuation of said first mentioned means is about to take place and an electroresponsive device for controlling the action of said magnets responsive to voltage variation on the consumption circuit.

9. In an electrical system of distribution, a source of electromotive force, a work circuit in operative relation thereto, a variable resistance connected in series with the work circuit to regulate the voltage applied thereto, a coil and apparatus for controlling the action of said variable resistance, a device for locking said apparatus against action, an electromagnet for releasing said apparatus upon the energization of said first mentioned coil and a coil for controlling the action of said magnet responsive to voltage fluctuations on the work circuit.

10. In an electrical system of distribution, a source of variable electromotive force, a consumption circuit supplied thereby, a carbon pile for regulating the voltage applied to the consumption circuit and in series therewith, electroresponsive apparatus for controlling said pile, and automatic means for locking said first mentioned means against operation, including a device for damping the action of said apparatus.

11. In an electrical system of distribution, a source of variable electromotive force, a consumption circuit supplied thereby, means for regulating the voltage applied to the consumption circuit, an electroresponsive device for controlling said means, means for locking said first mentioned means against operation, including means for damping the action of the regulating means, and a coil for releasing said locking means upon the operation of said electroresponsive device.

12. In an electrical system of distribution, a source of variable electromotive force, a consumption circuit supplied thereby, means for regulating the voltage applied to the consumption circuit, an electroresponsive device for controlling said means, means for locking said first mentioned means against operation, and a coil for controlling said locking means upon the operation of said electroresponsive device.

13. In an electrical system of distribution, a source of variable electromotive force, a consumption circuit supplied thereby, a carbon pile resistance for regulating the voltage applied to the consumption circuit, an electroresponsive device for controlling the action of said pile, means for controlling the action of said device responsive to voltage variations of the consumption circuit and apparatus for locking said pile against operation when said controlling means is not in operation.

14. In an electrical system of distribution, a source of variable electromotive force, a consumption circuit supplied thereby, a carbon pile resistance for regulating the voltage applied to the consumption circuit, a coil and apparatus for controlling said carbon pile, means for locking said apparatus against operation, and an electroresponsive device for releasing said locking means upon the actuation of said apparatus.

15. In an electrical system of distribution, a source of variable electromotive force, a consumption circuit supplied thereby, a carbon pile resistance for regulating the voltage applied to the consumption circuit, a magnet and apparatus for controlling said carbon pile, means for locking said apparatus against operation, a magnet for releasing said locking means upon the energization of said first mentioned magnet and an electroresponsive device for controlling the action of said magnet responsive to voltage variations on the consumption circuit.

16. In an electrical system of distribution, a source of variable electromotive force, a consumption circuit supplied thereby, a carbon pile resistance for regulating the voltage applied to the consumption circuit, means for controlling the action of said carbon pile resistance, apparatus for damping the action of said controlling means and for locking said controlling means against operation when not affected by electrical fluctuations of the system.

17. In combination, a variable resistance, apparatus for controlling the operation of the same, a coil for controlling the action of said apparatus, means for locking said apparatus against operation, and an electroresponsive device for controlling both said coil and said locking means.

18. In combination, a carbon pile resistance, a lever for compressing the same, a solenoid for causing the actuation of said lever, means for automatically locking said lever against movement and means for automatically unlocking or releasing said locking means.

19. In combination, a variable resistance, a movable arm for operating the same, a solenoid for causing the actuation of said arm, means for locking said arm against movement, and an electroresponsive device for controlling said locking means.

20. In combination, a variable resistance, mechanism for operating said variable resistance, a magnet for actuating said mechanism, means for opposing the action of said magnet, means for locking said mechanism against operation, a magnet for controlling said locking means and a switch mechanism for causing said last mentioned magnet to be energized whenever said first mentioned magnet is energized.

21. In combination, a resistance, mechanism for controlling the operation of the same, an escapement mechanism for damp-

ing the action of said controlling mechanism and means for causing said escapement mechanism to lock said controlling mechanism against operation, responsive to variations in the operation of said controlling mechanism.

22. A carbon pile resistance, a movable controlling member therefor, a lock for said member and three electroresponsive devices, one arranged to act upon said member to move the same, one acting upon the lock for said member, and the third controlling the current to the other two.

23. A variable resistance, a movable controlling member therefor, a lock for said member and three electroresponsive devices, the first when suitably energized serving to actuate said member, the second when energized serving to release the lock for said member, and the third responsive to definite electrical fluctuations and arranged to control the energization of the first and second of said devices.

24. A carbon pile resistance, a movable controlling member therefor, a lock for said member, two electroresponsive devices, a switch for controlling the operation of said devices, a coil for controlling the operation of said switch, the first device when energized serving to actuate said member and the second device when energized serving to release the lock for said member.

25. The combination of a variable resistance, a movable member controlling the same, a lock for said member, a coil operatively related to said member to actuate the same, a coil and means for actuating and controlling said lock and an electroresponsive device controlling the action of said second coil.

26. The combination of a variable resistance comprising a pile of compressible resistance blocks, a movable member controlling the same, means for locking said member against operation, a coil operatively related to said member to control the same, a coil and means operatively related to said locking means to control and actuate the same, and an electroresponsive device governing both coils.

27. The combination of a variable resistance embracing a pile of resistance blocks, a movable controlling member therefor, a coil and a tension device operatively related to said member to cause the same to operate, a lock for said member and means for governing the action of said lock and the circuit to said coil.

28. The combination of a variable resistance, a movable controlling member therefor, a coil and a tension device operatively related to said member to cause the same to operate, a lock for said member, and means including an electroresponsive device for governing the action of said lock and the circuit to said coil and arranged to unlock said member when the circuit to said coil is closed.

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

WILLIAM A. TURBAYNE.

Witnesses:
RAYMOND HUMMELL,
W. H. PATTENDEN.