Aug. 28, 1928. 1,681,924

J. L. CREVELING

ELECTRIC REGULATION

Original Filed April 22, 1924

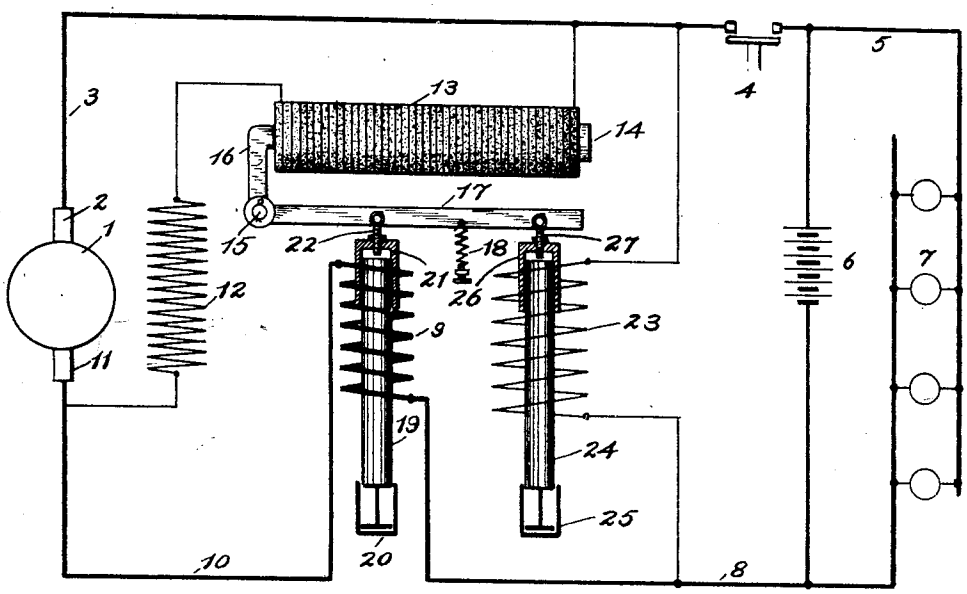


Fig. I.

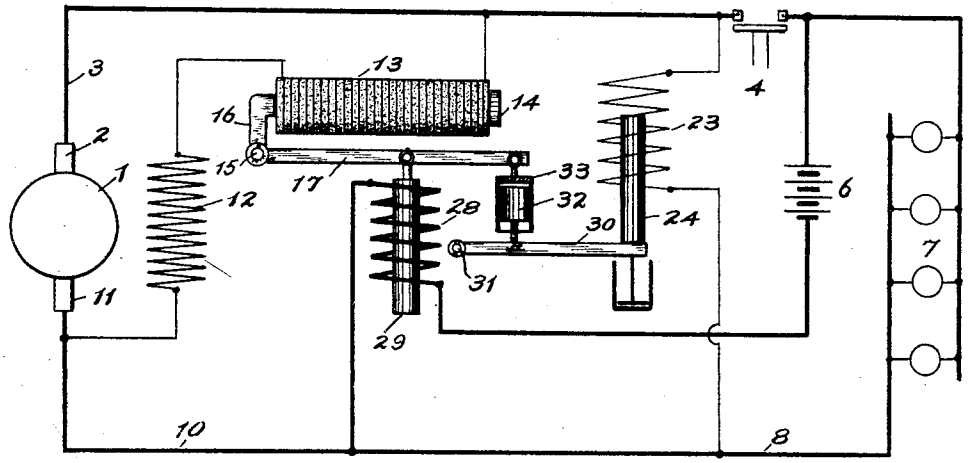


Fig. II.

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Patented Aug. 28, 1928. 1,681,924

UNITED STATES PATENT OFFICE.

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ELECTRIC REGULATION.

Application filed April 22, 1924, Serial No. 708,191. Renewed January 5, 1928.

My invention pertains to that class of electric regulation wherein a dynamo or other controllable source of electrical potential difference is to be automatically regulated in a predetermined manner. My invention is particularly applicable to electric systems wherein a variable speed dynamo or generator is used to operate lamps or other translating devices and charge a storage battery which maintains the translating devices when the generator is running at sufficiently low speed or is at rest, and is therefore particularly applicable to carlighting systems wherein the generator is driven from the car-axle.

Fig. I diagrammatically represents one type of such system embodying the essentials of my invention; and

Fig. II represents another type of system employing my invention.

In the drawing, referring particularly to Fig. I, 1 represents the commutator of any suitable type of variable speed generator the positive brush 2 of which is indicated as connected by wire 3 with one side of the usual automatic switch 4, adapted to close its circuit when the generator voltage is substantially equal to that of the battery and to open the circuit when the generator voltage falls, in such manner as to prevent back discharge from the battery to the generator. This switch is merely indicated, as this type of apparatus is now well-known in the art. The opposite side of the switch 4 is connected as by the wire 5 with the positive terminals of the translating devices 7 and the positive side of the storage battery 6. The negative terminals of the translating devices and the storage battery are connected with the wire 8 which is carried to one end of the solenoid or winding 9 having its opposite end connected as by the wire 10 with the negative brush 11 of the generator. The generator is provided with any suitable exciting means, in this instance indicated as a plain shunt coil 12 having in series therewith the regulating device 13, in this instance indicated as a carbon pile, one end of which rests against the abutment 14 while pressure is applied at the other end by means of a bell-crank lever pivoted as at 15 and having the short arm 16 and the long arm 17 to which may be attached the spring 18, for the purpose of adjustment. The coil 9 is shown as provided with a core of magnetic material 19 which the said coil tends to raise when energized, while the dashpot 20 serves as a guide for the bottom of said core and prevents too sudden movement of the same. The upper end of the said core 19 is shown as fitting closely within a cylinder 21 so as to form therewith an air dashpot. The cylinder 21 is indicated as threaded upon the rod 22, pivotally connected with the lever 17. 23 is a shunt or voltage coil across the generator circuit and is provided with a core 24 which it tends to raise when energized. The said core is provided with a dashpot 25 at its lower extremity and has its upper extremity fitted into a cylinder 26 so as to form an air dashpot therewith. The cylinder 26 is threaded upon the rod 27, pivotally connected with the lever 17.

In Fig. II like numerals are used to indicate like parts, and it will be noted that the battery 6 has its negative side connected with the negative generator lead 10 through the solenoid or winding 28 which surrounds a core 29 which is pivotally connected with the lever 17. The voltage coil 23 is indicated as having a core 24 connected with the lever 30, pivoted as at 31 and carrying a piston or plunger 32 surrounded by a cylinder or shell 33 so as to form an air dashpot therewith. The cylinder 33 is pivotally connected with the lever 17, as indicated.

An operation of my invention is substantially as follows:

Referring particularly to Fig. I, if the generator be at rest or operating at sufficiently low speed, the main switch 4 will be open, as indicated in the drawing, and the translating devices 7 may be supplied by the battery 6 in an obvious manner. If the generator speed be now raised until its voltage is slightly in excess of that of the battery, the switch 4 will be closed and current will flow from the generator through brush 2, wire 3 and switch 4 to the lamps or other translating devices 7 and battery 6, from which return is made through wire 8, coil 9 and wire 10, to brush 11. The current in coil 9 will tend to lift the core 19, and I so adjust these two instrumentalities that when the generator output reaches a desired maximum and gradually tends to exceed the same, coil 9 will lift the core 19 smoothly against the action of dashpot 20, if the same be employed, and cause the core to rise smoothly within the dashpot or cylinder 21 until contact is made with the screw 22, whereupon further motion of the core 19 will raise the

lever 17 and by swinging the lever 16 reduce the pressure upon the pile 13 and prevent this predetermined maximum current from being exceeded by cutting down the field of the generator. However, should a sudden rise in current tend to raise the core 19 with sufficient rapidity, the lever 17 will be raised almost instantly owing to the dashpot action of core 19 within cylinder 21, and then the cylinder 21 and core 19 will gradually approach each other until contact between the core 19 and screw 22 is made, when further upward motion of core 19 will affect the lever 17 as though mechanically united permanently therewith. If, now, the generator continue to charge the battery until its voltage rises to a predetermined limit which it is desired shall not be exceeded, I so adjust the core 24 and coil 23 that the said coil will, when this voltage is reached, raise the core 24 smoothly against the action of dashpot 25, if employed, and, through the dashpot effect of the core 24 within the cylinder 26, instantly affect the pile 13 through the lever 17—16, tending thereby to cause a slight falling off in the current in the coil 9 which will tend to allow the lever 17 to descend slightly, while the core 24 will be smoothly raised into contact with the screw 27, whereupon this core will control the lever 17 and, as the battery voltage rises and its current tapers off, core 19 will slowly descend into the position indicated in the drawing, whereupon it will play no part in the regulation which will be carried out by the voltage coil 23 the operation of which may be slightly modified, upon sudden changes, by the dashpot effect of the core 19 within the sleeve 21. If while so operating the current output should tend to rise beyond its predetermined limit for any cause, coil 9 will again raise the core 19 and instantly affect the adjustment of the pile 13 to control the generator through the dashpot effect of the core 19 within the sleeve 21.

An operation of that modification shown in Fig. II is substantially the same as that described with respect to Fig. I with the exception that it is the battery current in the coil 28 that affects the lever 17 through the instrumentality of its core 29, instead of the main circuit current as shown in Fig. I, it being obvious that the structures of either figure may be arranged to control the generator in response to either main circuit or battery circuit fluctuations. Further, the core 29 of the current coil is shown as permanently connected with the lever 17, which is affected by the voltage coil 23 through the instrumentality of core 24 operating upon the multiplying lever 30 which affects the lever 17 through the instrumentality of the dashpot 32—33. If the current coil 28 be regulating the generator, the operation of the coil 28 will be steadied by the dashpot 32—33, though, of course, the core 29 may be equipped with the dashpot as shown at 20 in Fig. I, if desired. If while thus operating under current control the maximum desired voltage is reached, coil 23 will lift core 24 and raise the lever 30 so as to affect lever 17 immediately through the instrumentality of dashpot 32—33, whereupon as the current in coil 28 falls off the lever 17 will tend to settle down, while the core 24 will tend to ascend until the plunger 32 reaches the end of the cylinder 33 whereupon upward movement of the core 24 will affect the lever 27 as though permanently mechanically coupled therewith.

From the foregoing it will be noted that I have produced a system wherein the current and voltage of a variable speed generator are both prevented from exceeding predetermined limits and that the instrumentalities which operate the field regulating device for thus controlling the generator are so connected by means of a dashpot or other suitable instrumentality that, regardless of their relative positions, when one is operating a very slight movement in the other produces an instantaneous effect upon the system tending to temporarily adjust the regulator, so to speak, before a more permanent adjustment is effected, in such manner as to cut down the so-called "transition period" which ordinarily takes place in regulators of this type when the regulation is brought about, more or less truly, by the voltage and current operated mechanism each affecting the regulator at the same time in such a manner as to somewhat interfere with the operation of each other.

Further, it will be noted that if, for example, the current affected coil has caused a considerable displacement of the lever 17, as when the generator is at very high speed, the voltage coil will at any time be capable of instantly affecting the pile 13 through the dashpot arrangement 26—24 or quite as quickly as this could be accomplished by means of a clutch connection between the core 24 and the lever 17, and with the advantage that the clutch connection would require some means of releasing it before the voltage coil would be capable of regulating throughout its entire range, while, in the present system, the dashpot arrangement would allow the core 24 to rise even while affecting the pile 13 until stopped by the screw 27 when the core 24 would occupy a position permitting it to operate the lever 17 throughout its entire range and thus attain a considerable advantage in operation over a clutch connection as well as simplicity of construction.

I do not wish in any way to limit myself to any of the details of construction or exact modes of operation outlined above which are given merely to portray examples of embodi-

ments of my invention, as wide departure may be made without departing from the spirit and scope of my invention which is as set forth in the following claims:

1. The combination with a variable speed generator and regulating means therefor, of a plurality of means for operating the regulating means and means connecting said operating means including a dashpot.

2. The combination with a variable speed generator and regulating means therefor, of a plurality of means for operating the regulating means and means connecting said operating means including an air dashpot.

3. The combination with a variable speed generator and regulating means therefor, of a plurality of means for operating the regulating means and means connecting said operating means including a fluid medium.

4. The combination with a variable speed generator and regulating means therefor, of a plurality of means for operating the regulating means and means connecting said operating means the effect of which is modified by the element of time.

5. The combination with a variable speed generator and regulating means therefor, of a plurality of means for operating the regulating means and means connecting said operating means including a device affected by the viscosity of an element thereof.

6. An electric regulator comprehending a regulating element, a plurality of means for independently affecting said element and means whereby said affecting means affect each other including a dashpot.

7. An electric regulator comprehending a regulating element, a plurality of means for independently affecting said element and means whereby said affecting means affect each other including a fluid medium.

8. An electric regulator comprehending a regulating element, a plurality of means for independently affecting said element and means whereby said affecting means affect each other including a device affected by the viscosity of an element thereof.

9. An electric regulator comprehending a regulating element, a plurality of means for independently affecting said element and means whereby said affecting means affect each other and which is affected by the element of time.

10. An electric regulator comprehending a plurality of separately operating affecting means and means whereby said operating means may instantly affect each other including a fluid medium.

11. An electric regulator comprehending a plurality of separately operating affecting means and means whereby said operating means may instantly affect each other including a portion the operation of which is affected by the element of time.

12. The combination with a variable speed generator and regulating means therefor, of current responsive means for operating said regulating means, voltage responsive means for operating said regulating means, and means whereby one responsive means cooperates with the other responsive means including a dashpot.

13. The combination with a variable speed generator and regulating means therefor, of current responsive means for operating said regulating means, voltage responsive means for operating said regulating means, and means whereby one responsive means cooperates with the other responsive means including a fluid medium.

14. The combination with a variable speed generator and regulating means therefor, of current responsive means for operating said regulating means, voltage responsive means for operating said regulating means, and means whereby one responsive means cooperates with the other responsive means including means the effect of which is modified by the element of time.

15. An electric regulator comprehending a regulating element, a plurality of means for independently affecting said element, and means whereby said affecting means may cooperate, including a dash-pot.

16. An electric regulator comprehending a regulating element, a plurality of means for independently affecting said element and means whereby said affecting means may cooperate, including a fluid medium.

17. An electric regulator comprehending a regulating element, a plurality of means for independently affecting said element and means whereby said affecting means may cooperate, including a device affected by the viscosity of an element thereof.

18. An electric regulator comprehending a regulating element, a plurality of means for independently affecting said element and means whereby said affecting means may cooperate, affected by the element of time.

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