J. L. CREVELING.

ELECTRIC REGULATION.

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1,011,165.

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Fig. 1.

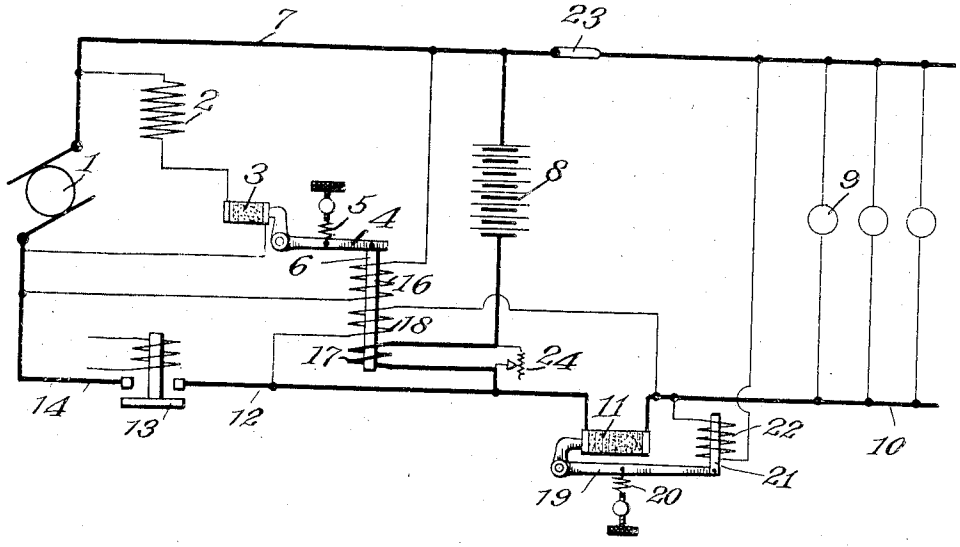
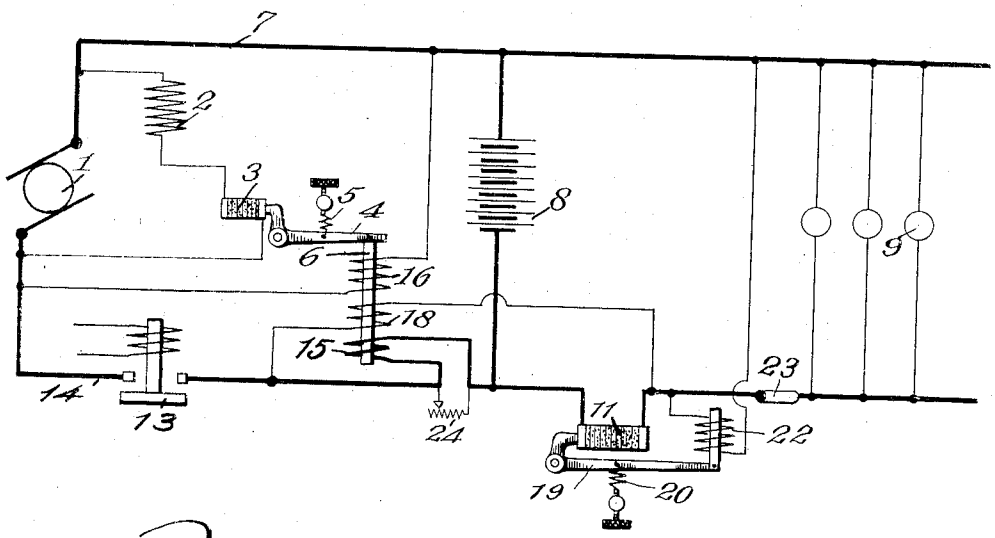


Fig. 2.



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ELECTRIC REGULATION.

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To all whom it may concern:

Be it known that I, JOHN L. CREVELING, a resident of New York, in the county and State of New York, have invented certain new and useful Improvements in Electric Regulation, as set forth in the annexed specification and drawing, forming a part thereof.

My invention pertains to that class of electric regulation wherein it is desired to automatically regulate a dynamo in accordance with the duties performed thereby.

Figure 1 of the drawing is a diagrammatic representation of one type of system of electric distribution comprehending my invention. Fig. 2 is a modified form of system employing my invention.

In the drawing, 1 represents a dynamo or generator provided with the usual field coil 2 having in series therewith a variable resistance 3, in this instance indicated as of the carbon pile variety for sake of illustration merely. Resistance 3 is controlled by the lever 4 normally drawn in an upward direction by the adjustable spring 5, tending to compact the carbons 3 and reduce the resistance thereof. The lever 4 is provided at one extremity with the core 6 of magnetic material, and it will be obvious that the generator may be controlled by motion imparted to the said core 6.

7 represents the positive lead of the generator which is connected with the positive side of the storage battery 8, and the positive terminals of the lamps or other translating devices indicated at 9 having their negative terminals connected with the wire 10 which is carried to one side of the regulating means 11, indicated as a carbon pile rheostat for sake of simplicity merely. The opposite terminal of the said carbon pile 11 is connected by the wire 12 with one side of the automatic switch 13, which may be of any of the well known varieties adapted to close the circuit when the generator voltage is substantially equal to that of the battery. The opposite terminal of the said switch is connected as by wire 14 with the negative terminal of the generator.

16 is the main solenoid for operating the generator regulator in accordance with voltage fluctuations and is, therefore, a fine winding in shunt across the generator circuit as indicated.

17 is a series winding of a few turns of heavy wire in series with the battery which tends to lower the standard voltage to be held constant throughout speed changes by the coil 16 by assisting the coil 16 when current flows from the generator through the battery, as will hereinafter more plainly appear.

18 is a coil in shunt around the regulating device or variable resistance 11, and so wound as to assist the coil 16 when traversed by current, due to the drop across the regulating element 11, as will hereinafter more plainly appear. The regulating element or resistance 11 is shown as operated by the lever 19 normally drawn in a downward direction as by the spring 20 tending to compact the carbons 11 and decrease the resistance thereof. The lever 19 is provided at one extremity with a core 21 surrounded by the solenoid 22, which when energized, tends to lift the core and increase resistance 11.

23 represents a switch in the lamp or translation circuit whereby the lamps or other translating devices may be cut out, and in this figure is shown in circuit with the main 7 so that opening of the said switch cuts out the coil 22 simultaneously with the translating devices.

24 is an adjustable shunt around the coil 17 for adjusting the current in said coil.

The system portrayed in Fig. 2 is the same as that portrayed in Fig. 1 with the exception that the coil 17 in series with the battery of Fig. 1 is suppressed, and the coil 15 in series with the generator main circuit employed in its stead, and the switch 23 is placed in the wire 10 in such manner that opening of the said switch throws out the translating devices but leaves the solenoid 22 in shunt across the translation circuit.

A practical operation of my invention is substantially as follows, referring particularly to Fig. 1:—If the dynamo be running at such speed that its voltage be in excess of that of the battery, switch 13 will be closed and current will flow from the generator through the shunt field 2 and resistance 3 in a well known manner, and the generator may be governed by proper manipulation of resistance 3. Current will also flow through the main 7, storage battery 8, coil 17, main 12, switch 13 and lead 14 to the generator. If the switch 23 be open, no current will flow through the lamps or translating devices 9, coil 22, resistance 11 or coil 18. Current will flow, however,

through the main regulating coil 16 in shunt across the generator, and I now so adjust the spring 5 that with the coil 17 substantially short-circuited, as by means of the shunt 24, the maximum voltage which it is desired to hold across the terminals of the storage battery 8, as for example their fully charged voltage, will be prevented from being exceeded throughout increases in speed by the coil 16 overpowering the spring 5 and increasing the resistance 3, in a well known manner. I now so adjust the shunt 24 that with the normal charging voltage, which is below the maximum voltage which would otherwise be held constant by the coil 16, that that portion of the said current flowing through the coil 17 will lower the standard voltage to be held constant by the coil 16 to that point necessary to maintain this normal charging current through the battery. Therefore, if this current be exceeded any considerable amount, the standard voltage maintained by the coil 16 will be lessened and too great a current which might injure the battery will be prevented from flowing therethrough. And, it will be obvious that as the voltage of the battery rises the strength of coil 16 will increase, and as this coil is the predominating and governing coil, as distinguished from the mere adjusting coil 17, this rise in battery voltage will cause the current to the battery to gradually lessen as its voltage rises, notwithstanding the attending diminution of current in the coil 17, and the battery charge will taper off and approach zero as the battery voltage increases, owing to the voltage control of the generator through coil 16. If, now, the batteries be quite charged and their voltage at or near the maximum desired to have impressed across the same, the coil 17 may be considered substantially inoperative, and the voltage upon the generator will be held from exceeding the maximum desired limit through the coil 16 and the batteries will be held in a fully charged condition with very little current flowing therethrough, and, therefore, with a small expenditure of energy. If, now, the lamp or translation circuit be thrown on and no regulating means were present for the translation circuit, the same would have a voltage equal to that across the generator and battery, which would be a voltage quite higher than that which the battery alone could supply to the translating circuit when the generator is inoperative. And, as it is desired to have the translating circuit voltage substantially constant, the translation circuit regulator is so adjusted that when the voltage across the translation circuit tends to exceed the normal voltage which the battery alone is capable of supplying, such increase taking place across coil 22 causes the lever 19 to be raised in opposition to the adjustable spring 20, and the voltage across the lamp circuit held substantially constant in a well known manner. This action of the lamp regulator causes a drop in potential across the same equal to the difference between the lamp circuit voltage and the generator and battery circuit voltage, and if this drop be considerable and the load upon the lamp circuit of appreciable dimensions, the loss in a resistance such as 11, which loss is merely dissipated in heat, is considerable, and one of the purposes of my present invention is to overcome or minimize such a loss. If the batteries be charged to a high state and the voltage has risen considerably, it very quickly falls to the normal when any load is placed upon the battery or even if the high charging voltage be not maintained across the same, and I so arrange the coil 18 that the drop across 11 caused by the operation of the lamp regulator causes the current in the coil 18 to assist the coil 16 and lower the voltage standard of the generator regulator in accordance with said drop, and in this way in an obvious manner when there is a load upon the lamp circuit the generator regulator has its adjustment changed so that instead of holding the maximum charging voltage upon the generator, it holds a voltage more nearly that of the normal charging voltage of the battery, and thus while a load is on prevents considerable waste which would otherwise take place in the resistance 11, and it will be noted that at all times the generator is protected against an excess current to the battery through the instrumentality of coil 17, the effect of which is negligible upon the ordinary fluctuations in voltage necessary to cause the predominating coil 16 to operate the regulator in accordance with speed changes.

The operation of the modification shown in Fig. 2 may be readily followed out from that above given with reference to Fig. 1, it being necessary to remember only that the entire current output of the generator is limited by the coil 15 readjusting the standard voltage of the voltage regulator in this system, instead of the battery current as in Fig. 1, and it being further remembered that the switch 23 in Fig. 2 even when open and cutting off the load upon the translation circuit leaves the coil 22 across said circuit which will operate the resistance 11 and use sufficient current to cause a drop across said resistance, which will cause current in the coil 18 to assist the coil 16 which may be utilized to assist in limiting the increase in voltage due to charging as may be desired by the proper proportioning of the coil 18, even with no working load upon the translating circuit, and in this way compensate in a measure for the lesser effect of the main

series coil when there is no load upon the translation circuit, and it is desired to have a battery charging current less than the total battery and translation circuit current, and the series coil is, therefore, weaker.

I do not wish in any way to limit myself to the exact details of construction nor the exact mode of operation set forth in this specification, the intention of which is merely to show and describe one type of system embodying the essentials of my invention, for it is obvious that wide departure therefrom 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 generator, a storage battery and a translation circuit, of means for regulating the generator responsive to voltage fluctuations, means for affecting the regulating means responsive to current fluctuations and means for affecting the regulating means responsive to voltage fluctuations in the translation circuit.

2. The combination with a generator, a storage battery, a translation circuit and regulator therefor, of a regulator for the generator, means for operating the same responsive to voltage fluctuations, means for adjusting the operation of the regulator responsive to current fluctuations and means for adjusting the regulator responsive to the operation of the translation circuit regulator.

3. The combination with a generator, a storage battery, a translation circuit and regulator therefor, of a regulator for the generator, means for operating the same responsive to voltage fluctuations, means for adjusting the operation of the regulator responsive to current fluctuations and means for adjusting the regulator affected by the operation of the translation circuit regulator.

4. The combination with a generator, a storage battery and a translation circuit, of a voltage operated regulator for the generator, a voltage operated regulator for the translation circuit, means whereby the generator regulator is affected by current changes and means whereby the generator regulator is affected by the operation of the translation circuit regulator.

5. The combination with a generator, a storage battery, a translation circuit and means for regulating the translation circuit, of means for preventing the generator voltage exceeding predetermined limits, means dependent upon current supplied by said generator for affecting the adjustment of said voltage limits and means affected by the operation of the translation circuit regulator for affecting said voltage limits.

6. The combination with a generator, a storage battery, a translation circuit and means for regulating the translation circuit voltage, of a voltage actuated regulator for the generator and means whereby the point of operation of said generator regulator is affected both by current supplied by the generator and the operation of the translation circuit regulator.

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