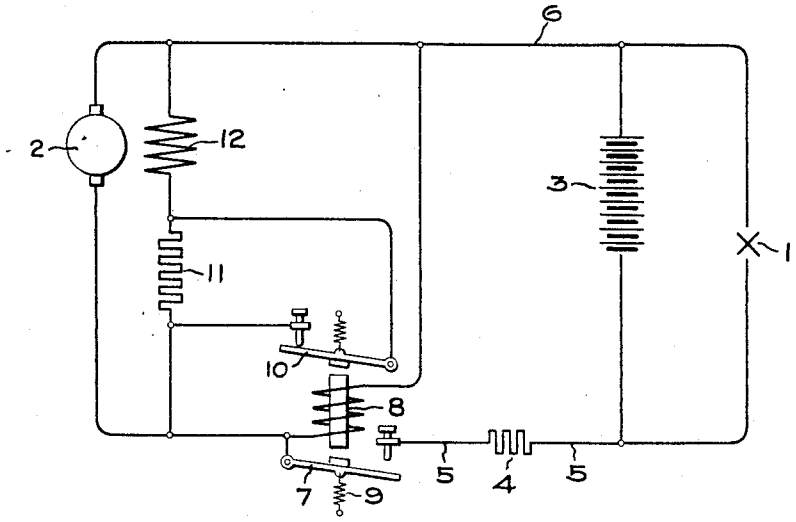
H. A. LAYCOCK.

SYSTEM OF DISTRIBUTION.

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1,180,776. Patented Apr. 25, 1916.




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# UNITED STATES PATENT OFFICE.

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## SYSTEM OF DISTRIBUTION.

1,180,776. Specification of Letters Patent. Patented Apr. 25, 1916.

Application filed March 1, 1912. Serial No. 680,876.

*To all whom it may concern:*

Be it known that I, HARRY A. LAYCOCK, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have made certain new and useful Improvements in Systems of Distribution, of which the following is a specification.

My invention relates to systems of distribution and is applicable to any system of distribution including a plurality of sources of current.

One object of my invention is to provide a simple and efficient constant current or constant potential system of distribution, including two sources of current and means for preventing the reversal of current through one of the sources, the invention being especially applicable where the sources are a generator driven at variable speeds and a storage battery. Obviously this object might be accomplished by including between the two sources of current a common form of reverse current switch. By my invention, however, I accomplish the result desired by employing a device less delicate than a reverse current switch, which is positive in its action, and of such design that a part of the regulator for the generator may serve both for this purpose and to control the switch.

In carrying out my invention, I use sources having substantially different voltages across their terminals and depend upon sufficient resistance in the connections from the major source to the minor source and the load, if any, to cut down the voltage applied to the load by the major source to substantially the value of the voltage applied to the load by the minor source. In such an arrangement, irrespective of any reverse current cut-out feature, where the minor source is a storage battery which is to be charged by the major source at variable times, and may be, at the commencing of the charging, more or less totally exhausted, the various parts may be so designed as to prevent the impression on the battery of a voltage greater than it should receive according to its state of discharge.

The cut-out switch I so design that it can close and be held closed only when it has impressed on it a high voltage, such as is supplied only by the major source. I connect it to the terminals of the major source. When the major source impresses a proper voltage on the system, the switch will be closed and held in that position until this source ceases to supply this voltage. Should the voltage of the major source fall below that of the minor source, the switch opens since the minor source not only supplies a lower voltage than the switch is designed to operate on, but this voltage is still further cut down by the resistance between the minor source and the switch.

In the accompanying drawings, I have illustrated diagrammatically a constant potential system involving my invention. The load 1 and the sources for supplying current to the load may be of any character. I have shown a generator 2 as the major source and a storage battery 3 as the minor source. Between these two sources I desire to have a substantial resistance, which preferably is in the form of a resistance member 4. Merely for the purpose of illustration, the load 1 may be regarded as requiring an impression of 6 volts. The battery 3 is then designed to deliver 6 volts. The generator 2 may be designed to impress 7 volts on the system, in which case the resistance 4 is of such size as to cut down, at normal load, the 7 volts of the generator to substantially the 6 volts desired for supplying the load. If the load is regarded as requiring normally 10 amperes, the member 4 should have a resistance of approximately 1/10 of an ohm.

The battery will preferably be charged when no current is being supplied to the load, and in such a case the resistance 4 will only cut down the voltage enough to prevent too great a rate of charging. If a charging rate of fifty per cent. of the maximum discharge rate is used, then the drop in the resistance 4 will be approximately ½ of a volt and the charging potential will be 6.5 volts. As the counter-electromotive force of the battery increases, the charging current will decrease until practically the full generator

potential is impressed on the battery, which is, therefore, able to give a discharge potential of 6 volts.

In one of the connections 5 and 6, in this case in the connection 5 is placed a cut-out switch 7. This switch is closed and held closed by the magnet 8, which is designed to close the switch at 7 volts and maintain it closed at and above this voltage. The spring 9, however, opens the switch when the voltage impressed on the magnet 8 falls substantially below 7 volts. It will be apparent that no current can be supplied by either of the sources to the other when the switch is open. The battery 3, however, is in a position to supply current to the load 1 at all times when the generator does not supply that load at a potential somewhat greater than that of the battery.

The magnet 8, may, as I have here shown it, be the magnet for operating the vibrator of the regulator of the generator 2, although, obviously this is not necessarily so. The regulator is of the common vibrating type, having a vibrator 10, which either directly or indirectly shunts a resistance 11 in series with the field 12 of the generator 2 at each vibration.

Supposing the generator to be driven at speeds varying from zero to an undetermined value, the operation is as follows: When the generator 2 is at rest and the switch 7 open, as shown in the drawings, the battery 3, which may be regarded as having previously been charged, supplies the load 1. While the generator is gradually acquiring speed, the vibrator 10 remains closed, shunting the resistance 11 until such time as the generator is driven at a speed at which it impresses at least 7 volts on the electromagnet 8. At this time the switch 7 is picked up and the connection between the two sources closed. Any increase in the voltage impressed on the electro-magnet causes the vibrator to be attracted to the magnet, thereby throwing the resistance 11 into the field circuit. The field is cut down a very considerable amount by the resistance, and on the consequent fall in voltage, the vibrator 10 is released and the shunt again closed. The vibrations occur with such great rapidity that the voltage impressed on the system is substantially constant.

The construction and operation of this type of regulator is well understood, and requires no further explanation. The switch 7 is made to operate slower than the vibrator 10 and remains closed during the momentary variations of the voltage below normal. The generator 2 now supplies to the terminals of the battery 3 and the load 1 only approximately 6 volts by reason of the resistance 4 and carries the load and recharges the battery 3. When the generator voltage again falls below the voltage of the battery, by reason of a decrease in speed or otherwise, the battery obviously will attempt to reverse the current through the generator. The battery can, however, only supply to the resistance 4 and the solenoid 8 in series, but 6 volts at most. The resistance absorbs a certain part of this voltage. There is, therefore, applied to the terminals of the electromagnet 8 less than 6 volts. As I have before said, this electromagnet is unable to maintain the switch closed against the spring 9 when it has impressed upon it a voltage much less than 7 volts. Therefore, as the generator slows up, the switch 7 of necessity opens due to this very appreciable difference in impressed voltage.

The battery 3 is recharged only after carrying the load 1 for variable lengths of time. The amount of discharge to which the battery is subjected is, therefore, variable. When the battery is in a nearly exhausted condition the generator tends to force a greater current through the battery than it should receive; in other words, the voltage impressed on the battery at charging should be less when the battery is in a more completely discharged condition, than when it is in a less completely discharged condition. The resistance 4, irrespective of the cut-out switch 7, is useful in maintaining on the battery terminals an impressed voltage of only the proper value. Following the well known law, the voltage absorbed by the resistance 4 increases with the increase of current through it. If the battery, therefore, is in a condition to receive a current of relatively large value, the voltage impressed upon its terminals is cut down. Should the battery, however, have a counter electromotive-force approximately equal to the electro-motive-force impressed on its terminals, the resistance 4 absorbs but little of the voltage supplied by the generator 2.

It will be understood that the values of current, voltage and resistance that I have hereinbefore assigned to the various parts are merely arbitrary and assumed for the purpose of illustration only.

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

1. A system of distribution, comprising a generator, a storage battery and a load connected in parallel, a resistance intermediate the generator and the storage battery and load, an electromagnet responsive to the voltage at the terminals of said generator, means controlled by said magnet arranged to hold the voltage of the generator constant, and a switch, also controlled by said magnet, controlling the connection between the generator and the resistance.

2. In a system of distribution, a storage battery, a generator for supplying a greater

voltage than the battery, connections therebetween, a resistance in one of said connections, a switch for making and breaking the circuit between the battery and the generator, an electromagnet having a coil connected to the connection containing the resistance at a point intermediate the resistance and the adjacent generator terminal and to the other connection and being capable of holding said switch closed only when energized by a voltage greater than the voltage supplied to it by the battery through the resistance, and a load connected to the terminals of said battery.

In witness whereof, I have hereunto set my hand this 29th day of February, 1912.

HARRY A. LAYCOCK.

Witnesses:

BENJAMIN B. HULL,

HELEN ORFORD.

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