I. LANGMUIR.

METHOD OF AND MEANS FOR OBTAINING CONSTANT DIRECT CURRENTS OR POTENTIALS.

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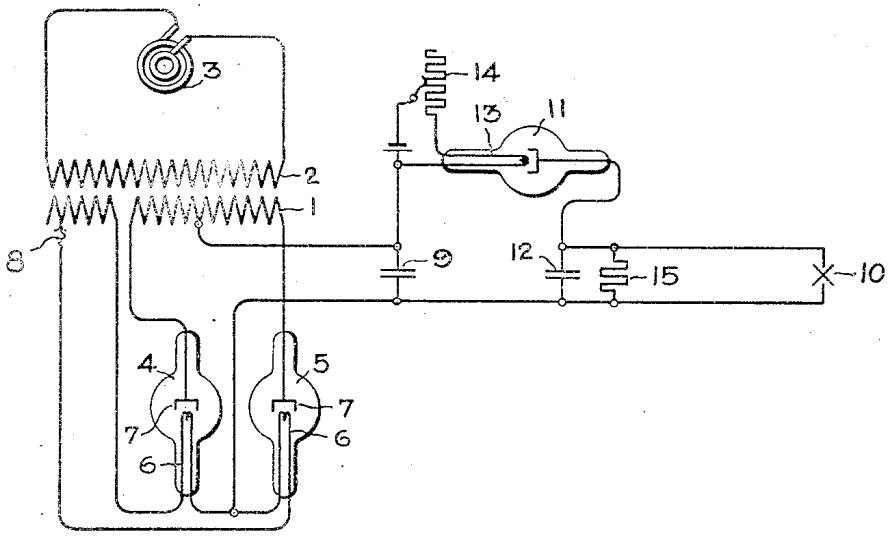
1,349,892. Patented Aug. 17, 1920.



Inventor:
Irving Langmuir,
by A. Underhill
His Attorney.

UNITED STATES PATENT OFFICE.

IRVING LANGMUIR, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

METHOD OF AND MEANS FOR OBTAINING CONSTANT DIRECT CURRENTS OR POTENTIALS.

1,349,892. Specification of Letters Patent. Patented Aug. 17, 1920.

Application filed December 22, 1915. Serial No. 68,287.

To all whom it may concern:

Be it known that I, IRVING LANGMUIR, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented new and useful Improvements in Methods of and Means for Obtaining Constant Direct Currents or Potentials, of which the following is a specification.

My present invention relates to means for obtaining direct currents or potentials of constant value from variable sources and more particularly from a source of alternating current.

Various means have heretofore been used for rectifying alternating currents and inductances and condensers have been employed for reducing the variations in the rectified current. While the rectified current which has been obtained in this way has been of sufficiently constant value for some purposes there are many cases in which the current variations are still great enough to be objectionable.

One of the objects of my invention is to provide a means for reducing these current variations to such a degree that they will not be noticeable in any organization in which the current may be utilized. A further object of my invention is to provide a means for obtaining a high direct current potential of practically constant value.

The features of my invention which I consider novel are pointed out with particularity in the appended claims. The invention itself, however, with further objects and advantages will best be understood by reference to the following description taken in connection with the accompanying drawing in which I have shown one embodiment of my invention.

As indicated in the drawing the alternating current to be rectified is derived from the secondary 1 of a transformer, the primary 2 of which may be connected to any suitable alternating current source such as the alternator 3. The rectifiers 4 and 5 which are employed in the present illustration are preferably of the incandescent cathode or kenetron, type comprising a filamentary cathode 6 and a cup shaped anode 7 both of which may be of tungsten inclosed in a highly evacuated envelop. A portion of the turns of the secondary 1 of the transformer are connected in series with the cathodes 6 for heating them to incandescence and the temperature of the cathodes may be regulated by varying the number of turns thus connected by the variable connection 8. By this means energy is fed unidirectionally to the condenser 9 which serves to store up that energy during the portion of each cycle during which it is receiving current and to supply the load 10 with energy through the remaining portions of each cycle. The energy thus stored up is fed to the load 10 through the current limiting device 11 which serves to provide a constant current to the load circuit. The current limiting device 11 may be of similar construction to the rectifiers 4 and 5 but preferably has different operating characteristics. In devices of this nature which operate with a pure electron discharge the current which will flow between the electrodes with any given cathode temperature varies with the 3/2 power of the impressed voltage up to a certain point, which may be called the saturation voltage beyond which further increase in voltage produces no appreciable increase in current. The maximum current which will flow however depends upon the cathode temperature, increasing with that temperature; hence if the temperature of the cathode 13 of this device is kept constant the current which will flow therethrough will be practically constant as long as the voltage impressed exceeds that required to produce the maximum current. The value of the current which will flow may conveniently be adjusted by varying the heating current by means of the variable resistance 14. With this arrangement it will be seen that as long as the potential of the condenser 9 does not fall below the saturation voltage of the current limiting device the rate at which energy is transferred to the utilization circuit will be constant. By the term "current limiting device" as used in this specification and the claims which follow I mean to imply a device having current characteristics similar to those above described in contradistinction to the usual impedance devices in which the current varies with the impressed voltage. If the device or devices which make up the load require a constant current for their op-

eration the desired current may be obtained by adjusting the resistance 14 to the proper value. If, however, the load requires constant potential for its operation or takes a variable current condenser 12, or resistance 15, or both may be connected in shunt thereto as indicated. Since the current through this resistance will be constant the difference of potential between its terminals will be constant and will remain substantially so as long as the current taken by the load is small in comparison with that flowing through the current limiting device. The condenser 12 assists in smoothing out any slight variations in potential due to variations in the current taken by the load 10. In case it is desired to secure current which will have even smaller variations than will be present in the current produced by the apparatus thus described, a second current limiting device similar to 11 may be placed between the condenser 12 and resistance 15 and the current consuming apparatus.

While I have described the application of my invention to the obtaining of direct current of constant value or constant potential from a source of alternating current, it will be apparent that it will also be of utility in obtaining constant potential or constant value direct current from other variable sources; as for example, the condenser 9, which in the embodiment which I have illustrated constitutes a variable source of current, might be replaced by any other variable voltage source provided the minimum voltage of the source does not fall below the saturation voltage of the current limiting device. The transformer and rectifiers might also be replaced by any other source of pulsating unidirectional current, with similar results. It will also be apparent that many modifications in the precise arrangement of the various devices used and in the specific form of the same may be made without departing from the scope of my invention as set forth in the appended claims.

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

1. The method of obtaining a direct current of constant value from an alternating current which comprises rectifying the alternating current, storing up the energy in a capacity, delivering it from the capacity to a utilization circuit through a current limiting device and maintaining the current through said device constant irrespective of the voltage applied thereto.

2. The method of obtaining a direct current of constant value from an alternating current which comprises rectifying the alternating current, storing up the energy in an energy storing device which is capable of receiving energy during a portion of each alternating current cycle and giving up the same during other portions of the cycle, delivering the stored up energy to a utilization circuit through a current limiting device and maintaining the current through said device constant irrespective of the voltage applied thereto.

3. The method of obtaining a direct current of constant value from a variable voltage source which consists in delivering current from said source to a utilization circuit through a current limiting device and operating the current limiting device in such a way that the current flowing therethrough is maintained substantially constant at a desired value over a range of voltages of the variable voltage source greater than the voltage required to produce a current of the desired value.

4. Means for obtaining a direct current of constant value comprising a source of alternating current, means for rectifying the alternating current from said source, an energy storing device for storing up the energy of the rectified current and a current limiting device having an operating range through which the current is independent of the voltage applied thereto for supplying the stored up energy to a utilization circuit at a substantially constant rate.

5. Means for supplying a load with a constant potential direct current comprising a source of alternating current, means for rectifying the current from said source, a condenser for storing up the energy of the rectified current and a current limiting device having an operating range through which the current is independent of the voltage applied thereto for supplying the stored up energy to a utilization circuit at a substantially constant rate.

6. The combination in a system of electrical distribution of a variable voltage source of energy, a load connected to said source, and a current limiting device in series with said load, said device being so adjusted that the current flowing therethrough will remain substantially constant at a desired value over a range of voltages greater than the voltage required to produce a current of the desired value.

7. The combination in a system of electrical distribution of a variable voltage source of energy, a load to be supplied with constant direct current from said source and a current limiting device in series with said load, said current limiting device comprising a cathode adapted to be heated to incandescence and an anode inclosed in a highly evacuated receptacle, the temperature of said cathode being so adjusted that the current passed by said device will remain substantially constant at a desired value over a range of impressed voltages greater than the voltage required to produce a current of the desired value.

8. The combination in a system of electri-

cal distribution of a source of alternating current, an incandescent cathode rectifier for rectifying the alternating current from said source, a condenser for storing up the energy of the rectified current and means comprising a current limiting device having an operating range through which the current is independent of the voltage applied thereto for supplying the stored up energy to a utilization circuit at a substantially constant rate.

In witness whereof I have hereunto set my hand this 21st day of December, 1915.

IRVING LANGMUIR.