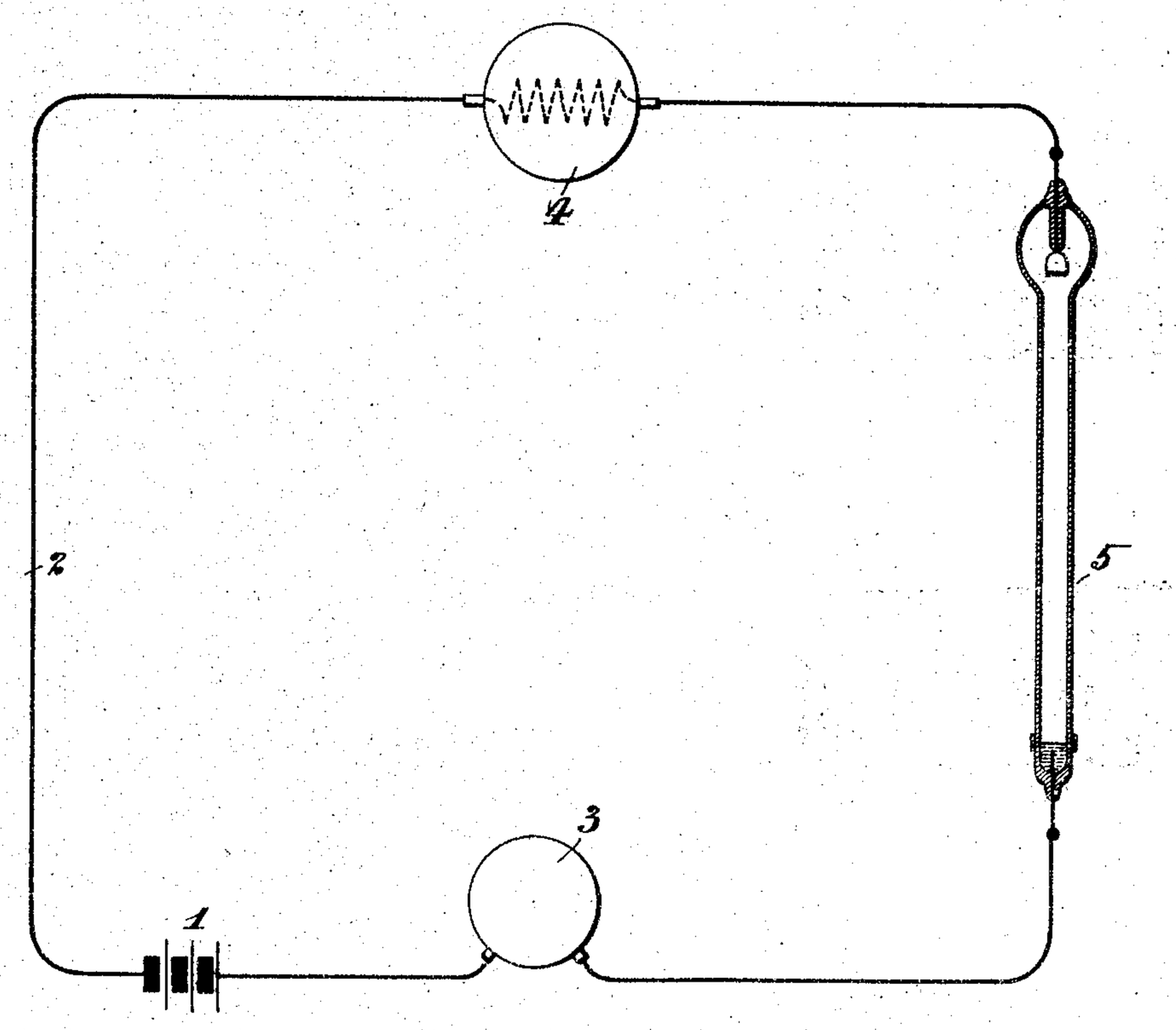
No. 781,001. PATENTED JAN. 31, 1905.

P. C. HEWITT.

MEANS FOR AMPLIFYING ELECTRICAL VARIATIONS.

APPLICATION FILED MAY 16, 1902.



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No. 781,001. Patented January 31, 1905.

UNITED STATES PATENT OFFICE.

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MEANS FOR AMPLIFYING ELECTRICAL VARIATIONS.

SPECIFICATION forming part of Letters Patent No. 781,001, dated January 31, 1905.

Application filed May 16, 1902. Serial No. 107,604.

To all whom it may concern:

Be it known that I, PETER COOPER HEWITT, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Means for Amplifying Electrical Variations, of which the following is a specification.

In certain patents granted to me September 17, 1901, attention is called to the fact that the resistance of an inclosed vapor or gas carrying current in an electric circuit varies inversely with the current carried by the vapor. Accordingly if a varying potential be applied to an apparatus of the general character described in the patents referred to a variation of current will take place in the inclosed gas or vapor, and this variation of current will affect the entire circuit in which the apparatus is included, and if the circuit is so arranged that the gas or vapor apparatus shall represent a considerable portion of the total resistance of the circuit the variations of current thus caused in the conducting gas or vapor will cause comparatively large variations in the entire circuit.

It is customary to operate electric circuits for various purposes by causing variations of potential in the circuit, such variations being utilized to influence appropriate receiving apparatus. In the present invention I avail myself of the peculiar features of electrical resistance in a gas or vapor conductor to vary or magnify the effects produced by potential variations in a circuit. By virtue of the described characteristics of gas or vapor conductors it is possible, for instance, to translate variations of potential in a circuit into variations of current or quantity, and inasmuch as the conducting gas or vapor responds practically instantaneously to the applied variations of potential, currents of any practical rapidity or frequency can be made to undergo the described transformation and produce their effects upon a suitable receiving apparatus. As the practical result of an increase of applied potential is an increased flow of current, the original electrical impulses in the circuit may produce magnified effects as compared with those which the same impulses would produce if applied directly to the receivers.

The drawing herewith is a diagram of a typical circuit embodying my invention.

In the drawing, 1 is a suitable source of current supplying a circuit 2. Included in the circuit are a transmitting or potential-changing apparatus 3 and a receiving apparatus 4. The transmitting apparatus may be a telegraph-relay, a telephone-transmitter, or any other device adapted to vary the potential of the current in the circuit 2. The receiving apparatus 4 may be any suitable receiver adapted to respond to variations of current in the line.

A circuit made up as described is common enough in the electrical arts. The improvement forming the subject of the present application consists in causing the described circuit to be affected by the peculiar action of an inclosed gas or vapor apparatus, (shown at 5.) This apparatus may be such an apparatus as described in my patents above referred to as a "gas" or "vapor" electric lamp, or it may be an apparatus generally similar to such a lamp, but having no light-giving quality by reason of being specially adapted to the purposes of this invention without regard to the matter of light. For this purpose the device may be made with a comparatively short gas or vapor path and having such cross-section that with the current normally traversing it the vapor or gas may become but faintly luminous. The resistance of the circuit outside the device 5 is practically constant except for the slight variations introduced through the instrumentality of the potential-changing apparatus 3. As the resistance of the device 5 varies substantially inversely with the quantity of the current flowing, or, to put it another way, requires a definite voltage to pass a definite current therethrough, any diminution, for instance, of the potential applied to its terminals by reason of an increase of resistance on the part of the device 3 will result in not only the diminution of flow of current due to the

increased resistance of the device 3, but also to an additional diminution due to the change brought about in the device 5 by the decreased current resulting from the decreased potential at the terminals of the device 5. Likewise an increase of potential at the terminals of the device 5, due to a change of resistance in the outside circuit, will cause an increase of current-flow therethrough greatly in excess of the change due to the change of resistance in the other portions of the circuit. In other words, the changes of resistance in other portions of the circuit than the device 5 bring about such variations of conditions in the device 5 as to augment the variations of current-flow through the entire circuit. It should be borne in mind, however, that the resistance of the other portions of the circuit than the device 5 serves in a measure as a balancing resistance for the device 5; otherwise a decrease of resistance in the external circuit might result in a continuing unchecked decrease of the total resistance of the circuit including the device 5. The device 5 itself, however, has in a measure a self-corrective tendency within certain limits, due to internal variations of resistance resulting from changes in its temperature. The temperature of the device 5 must be taken into consideration when measuring the device for ohmic resistance, as its ohmic resistance varies with the temperature which is brought about by variations in the flow of current and also by the surrounding conditions. The method of controlling these is set forth in the patents hereinbefore referred to. The variations in the amount of current through which the device 5 may be made to operate may be made quite wide by constructing it with the required heat-radiating capacity. It will now be understood that the receiving apparatus 4 will be affected by a comparatively large current and will respond with greater certainty and effectiveness than it otherwise would. The same amplification of the effects of potential changes in the circuit takes place whatever be the degree of potential increase or variation.

When the resistance of the element 5 is made a considerable portion of the total resistance of the circuit, the effect of the changes of resistance in the element named will be very marked, especially when the source of supply is great.

By reason of the gaseous condition of the conducting medium employed the gas or vapor apparatus responds instantly to potential changes in the current without essential loss of energy. In this respect it differs from other materials or substances, because in such other materials or substances work has to be done in the process of reducing the resistance whereby a loss of energy is caused and the time element becomes a considerable factor, while in my apparatus the amount of material so affected is so small that the energy required to produce the result may be practically neglected.

Means for starting the flow of current through the apparatus are set forth in the patents hereinbefore referred to.

I claim as my invention—

1. The combination in an electric circuit, of a source of potential variation, a receiving apparatus adapted to translate the variations caused by the source, and an inclosed gas or vapor conducting medium.

2. The combination in an electric circuit, of a source of potential variations, a receiver adapted to respond to changes of current in the circuit, and a quickly-responding inclosed gas or vapor conducting medium whose resistance decreases with increments of temperature.

Signed at New York, in the county of New York and State of New York, this 9th day of May, A. D. 1902.

PETER COOPER HEWITT.

Witnesses:

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