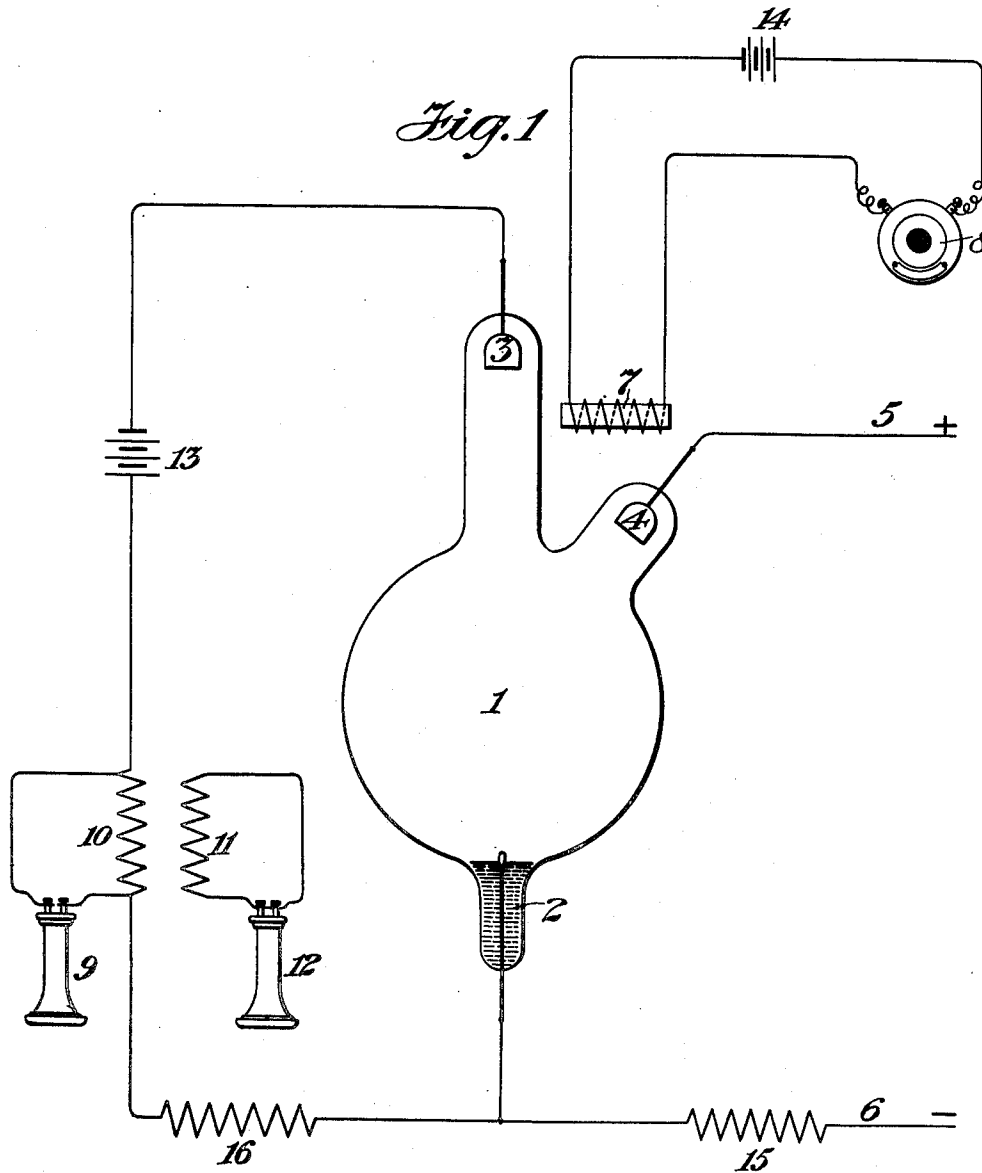


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 APPLICATION FILED JULY 7, 1904.

991,304.

Patented May 2, 1911.

2 SHEETS—SHEET 1.



Witnesses
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Peter Cooper Hewitt
 By *his* Attorney
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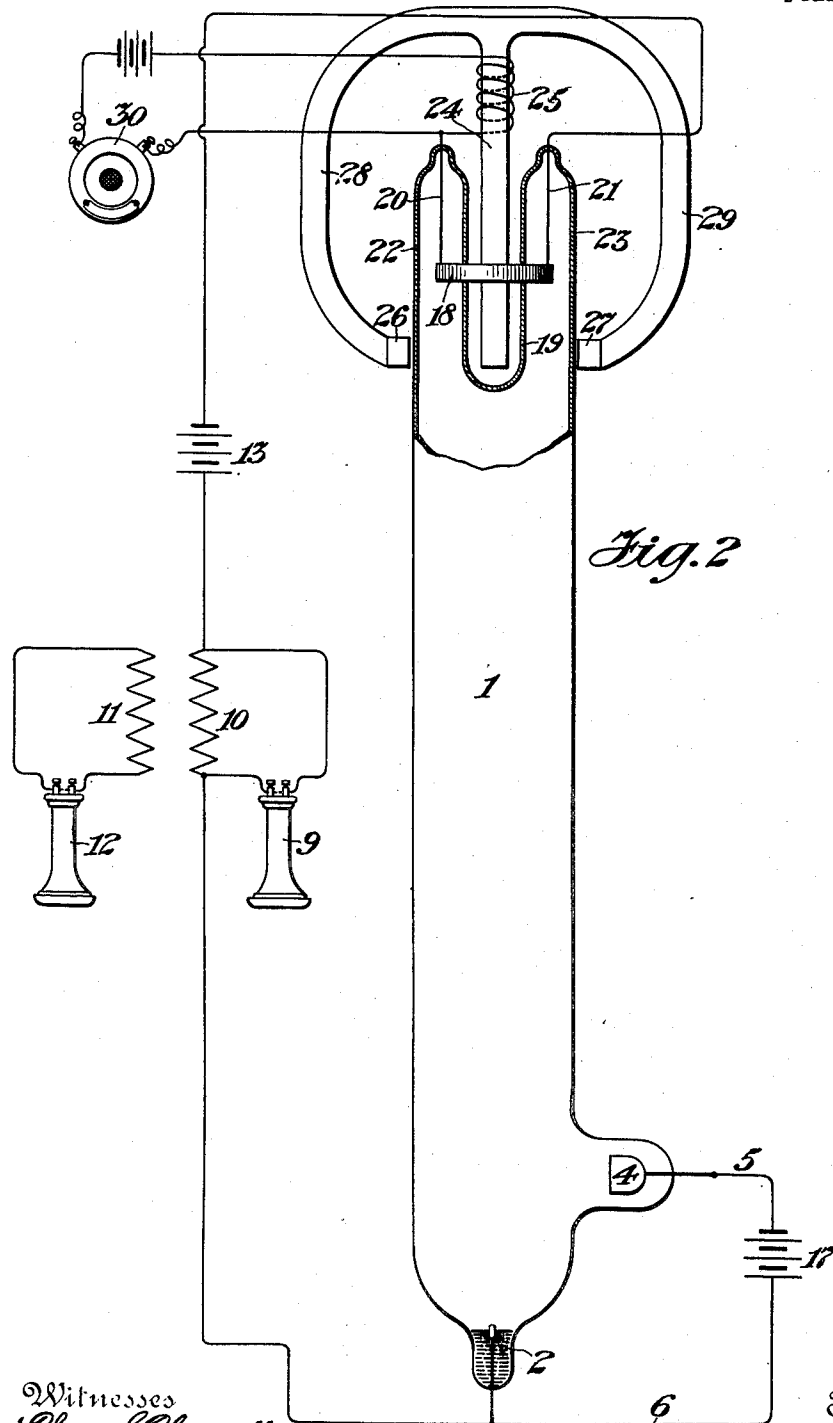


Fig. 2

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UNITED STATES PATENT OFFICE.

PETER COOPER HEWITT, OF NEW YORK, N. Y., ASSIGNOR TO COOPER HEWITT ELECTRIC COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

MEANS FOR REPRODUCING ELECTRICAL VARIATIONS.

991,304.

Specification of Letters Patent.

Patented May 2, 1911.

Application filed July 7, 1904. Serial No. 215,577.

to all whom it may concern:

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

The present invention relates to improvements upon the devices disclosed in Letters Patent of the United States Numbers 749,791 and 749,792, issued to me on the 19th day of January, 1904. In the earlier of the patents mentioned I describe means for reproducing variations of current in an electric circuit, such means consisting of an electro-magnet subject to the influence of said variations and a gas or vapor apparatus located in the field of force of the said magnet. In the present invention I make use of similar means, but with modifications which involve novel methods of operation and novel arrangement of apparatus.

In operating vapor electric apparatus of the general character described in my prior patents, it is found that a "bur" is produced at the positive electrode. This may appear in a visible form, as luminous radiations from the positive electrode or it may be incapable of being appreciated by the sense of sight. The appearance at the positive electrode may be described as a protuberance and the appearance of a protuberance is accompanied by a variation in the resistance at the positive electrode, which we may speak of as a protuberance resistance at the said electrode. The protuberance may be single or it may be a plurality of protuberances lying with an appearance of symmetry on the positive electrode under certain conditions. The protuberance acts as an interference to the positive current and this interference may be modified by means of a magnet, the material of the positive electrode, or by means of a particular construction of the surroundings of the positive electrode, so as to create variations of period in the current through the apparatus. By a proper proportioning of the various forces at work, the variations may be made very long, or may be superimposed on each other, or they may be variations so rapid as to be inaudible. The arrangement as a whole may be utilized

for creating different variations in the direct current in any circuit where such variations are necessary, for example, in multiplex telegraphy or kindred systems.

By the effects of variations produced upon the positive protuberance the operation of varying the field of force will produce a note commencing at the audible point and extending above that point to an indefinite region. Accordingly, if the field of force be varied by a microphone for example, the result should show a variation in its note corresponding to the variations of the microphone, whereby the apparatus may be caused to produce notes corresponding or inverse to the note of the microphone, whereby a telephone relay is provided, the correspondence or inversion, as the case may be, depending on whether the source of the magnetic field is a magnet whose force is varied by a coil, or whether the coil is a coil creating the magnetism itself. The current from the positive electrode gives a note which is constant and dependent on the conditions established. By means of a permanent magnet the point where the current passes from the positive electrode may be shifted so as to give a shriller note. By varying the connections so that the microphone is subject to the sound waves produced by a telephone instrument connected so as to give the note of the source, varying effects may be produced, the action being that the variations in the current from the microphone passing through the magnet coil influence the vapor path in various ways. A relation exists between the current and the magnetic force. The effects may be received by telephone receivers connected with primary and secondary coils as is illustrated in the accompanying drawings.

The invention will be better understood by referring to the accompanying diagrams, Figures 1 and 2, representing different embodiments of my invention.

Referring to the first figure of the drawing, 1 is a hermetically sealed vessel of glass or other suitable material containing a negative electrode 2, and positive electrodes, 3 and 4. The latter may be of some suitable material, such as iron, and the negative electrode may be of mercury or other conductor and preferably capable of low electrical re-

sistance, and having a point or equivalent projection from the surface. The electrode 4 is a supplemental electrode, the main electrodes being 2 and 3. The apparatus having been started, the negative electrode resistance may be maintained in a condition of being broken down by means of current flowing between the electrodes 4 and 2 and supplied through mains 5 and 6, connected with a source furnishing a supply of current in one direction. I may now place so as to influence the container 1, a magnet, 7, connected in circuit with a telephonic transmitter, 8, or other source of variation. In circuit with the main electrodes I may place a telephone receiver, or other receiver, 9, in shunt to a reactance coil, 10, which may be the primary of a transformer, the secondary of which is shown at 11 as being connected in a circuit with a second telephonic receiver, 12, in which case the first may be omitted, if desired. If, now, the transmitter 8 be affected by vibrations, say through the human voice, the variations of magnetic effect in the circuit including the magnet 7 will be reproduced in the vapor device 1 and consequently in the circuit connected with the main electrodes 3 and 2 of the said vapor device. Effects of the variations caused by the changes in the field of force of the magnet 7 being thus reproduced can be observed in the receiver 9 or the receiver 12, as the case may be. Inasmuch as a slight variation in the field of force of the magnet 7 may cause a considerable variation in the resistance of the vapor device, which last named variation will be reproduced in the receiving circuit, the apparatus as a whole may serve as a relay adapted to magnify the effects originally produced at the transmitter 8. In the circuit between the main electrodes 3 and 2 I include any suitable source of current, such, for example, as the battery, 13, indicated on the drawing, and further these effects may be amplified by including in the circuit a vapor device such as my lamps, care being taken to keep the negative electrode resistance in a state of good conductivity in which the resistance varies substantially inversely with the current, which forms a suitable proportion of the resistance of its circuit for augmenting the variations. The transmitter circuit also contains the usual battery, 14. In the circuit of the direct current source I may insert the resistance, as 15, and I may also insert the resistance, 16, in the circuit between the main electrodes. When placed in a similar manner as shown and described in Fig. 1 the magnet 7 will directly influence what I have called the protuberance resistance at the positive electrode. By thus influencing this resistance, the interference of the protuberance with the positive current is modified and thus variations of period in the current through the

apparatus are produced. It will be understood that a different location of the magnet 7, as by placing it lower down along the container would still produce variations in the resistance of the apparatus, which variations would be reproduced in the external circuit. The effects produced by such a relation of the parts has already been made the subject of patents issued to me; namely, 749,791 and 749,792.

In Fig. 2 I show a different embodiment of my invention, the parts 2 and 4 and the circuit 5 serving substantially the same function as before. In the circuit described I show in this instance a direct current source, 17, serving to keep the apparatus alive. The main positive electrode in this embodiment of the invention appears at 18 as a ring of conducting material surrounding a reentrant portion 19 of the tube or container 1. The ring 18 is supported upon lead-wires, 20 and 21, leading into the apparatus through tubular extensions, 22 and 23, respectively. Into the reentrant portion of the device I insert the core, 24, of a magnet, 25, the core may be provided with pole-pieces, 26 and 27, formed, respectively on arms, 28 and 29, which are in one piece with the core, 24, instead of a plain straight core. The pole pieces are so arranged as to lie outside the tube or container 1 in proximity to the positive electrode 18. The coils of the magnet 25 are connected with the terminals of a microphone or telephonic transmitter, 30. As before, the positive electrode is connected with a battery or other source 13 with one side of a reactance device 10, the other side of which is connected with the negative electrode 2. The reactance device 10 is, in this instance as before, the primary of a transformer and in shunt to the said primary is a telephonic receiver 9 while the secondary 11 of the said transformer is connected with a telephonic receiver 12. From what has been said respecting the action of the apparatus illustrated in Fig. 1, the action of this apparatus will be clearly understood.

I claim as my invention:—

1. As a means for reproducing the variations of current in an electric circuit, an electromagnet subject to the influence of said variations, and a gas or vapor apparatus of the character described located in the field of force of the said magnet, the magnet being placed in such relation to the positive electrode as to cause the variation of the protuberance resistance to be large relative to any variation produced by the said magnet in the vapor column resistance.

2. As a means for reproducing the variations of current in an electric circuit, an electro-magnet subject to the influence of said variations, and a gas or vapor apparatus, of the character described located in the field of force of the said magnet, the

magnet being placed in proximity to the positive electrode, a main circuit through the gas or vapor apparatus, and supplemental means for keeping the said apparatus

5 alive.

3. As a means for reproducing current variations in an electric circuit, an electro-magnet subject to the influence of said variations, a gas or vapor apparatus located in the field of force of the said magnet, means for passing electric current through said apparatus, and a receiving apparatus subject to the influence of variations of resistance in the circuit of the gas or vapor apparatus, in combination with supplemental means for maintaining the gas or vapor apparatus alive.

4. The combination with a vapor device including a hermetically sealed and completely exhausted container and an anode, and vaporizable reconstructing cathode therein, the said anode and the protuberance therefrom being located in a relatively narrow extension of the main body of said container, of a magnet adapted to receive and transmit variations of energy placed adjacent to said protuberance and varying the resistance thereof in relation to the variation of its received energy.

5. The combination with a telephonic transmitting circuit, a telephone receiver, a circuit including the latter, a gas or vapor path, means for passing electric current therethrough, said path being so related to the latter as to affect the same by variations of resistance in the circuit of the gas or vapor apparatus, and an electro-magnet traversed by electric currents due to effects in the transmitting circuit, and acting upon the gas or vapor path, and supplemental means for maintaining the gas or vapor electric apparatus alive.

6. The combination with a vapor device including a hermetically sealed and completely exhausted container, an anode, a vaporizable reconstructing cathode and a surface extending upward from the main surface of said cathode therein, of a magnet adapted to receive and transmit variations of energy located adjacent to said protuberance and producing therein a change of resistance corresponding to variations in its received energy, said resistance changes being relatively great as compared to any va-

riations in the resistance of the vapor column.

7. The combination with a hermetically sealed and completely exhausted container, a plurality of anodes and a vaporizable reconstructing cathode in said container, a solid in contact with the surface of said cathode, means for passing continuous current from one of the said anodes to said cathode and means for varying the resistance of a vapor path to another of said anodes by ether waves from an outside source of electrical variations, of a receiving circuit including a telephone and a source of electromotive force in circuit with said last named anode and said cathode.

8. The combination with a generator of energy variations in the ether, of a vapor electric device including a cathode and an anode, a source of current therefor and a receiving circuit sensitive to rapid variations of electrical energy, said circuit including a separate anode in said vapor electric device, together with means for causing said energy variations in the ether to produce variations in the vapor path to said separate anode.

9. The combination with a generator of energy variations in the ether, of a vapor electric device, including a cathode, an anode, and a relatively excessive condensing chamber, a suitable source of current therefor and a receiving circuit sensitive to rapid variations of electrical energy, said circuit including a separate anode in said vapor electric device, together with means for causing said electrical variations in the ether to produce variations in the vapor path to said separate anode.

10. In a system of electrical distribution the combination with a hermetically sealed exhausted container and a mercury cathode therein, of anodes therein, each anode being in a tubular extension of said container together with a separate source of current connected with each anode and the said cathode.

Signed at New York, in the county of New York, and State of New York, this 30th day of June A. D. 1904.

PETER COOPER HEWITT.

Witnesses:

WM. H. CAPEL,
GEORGE H. STOCKBRIDGE.