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C. F. BURGESS.

SYSTEM FOR THE RECTIFICATION OF ALTERNATING CURRENTS.

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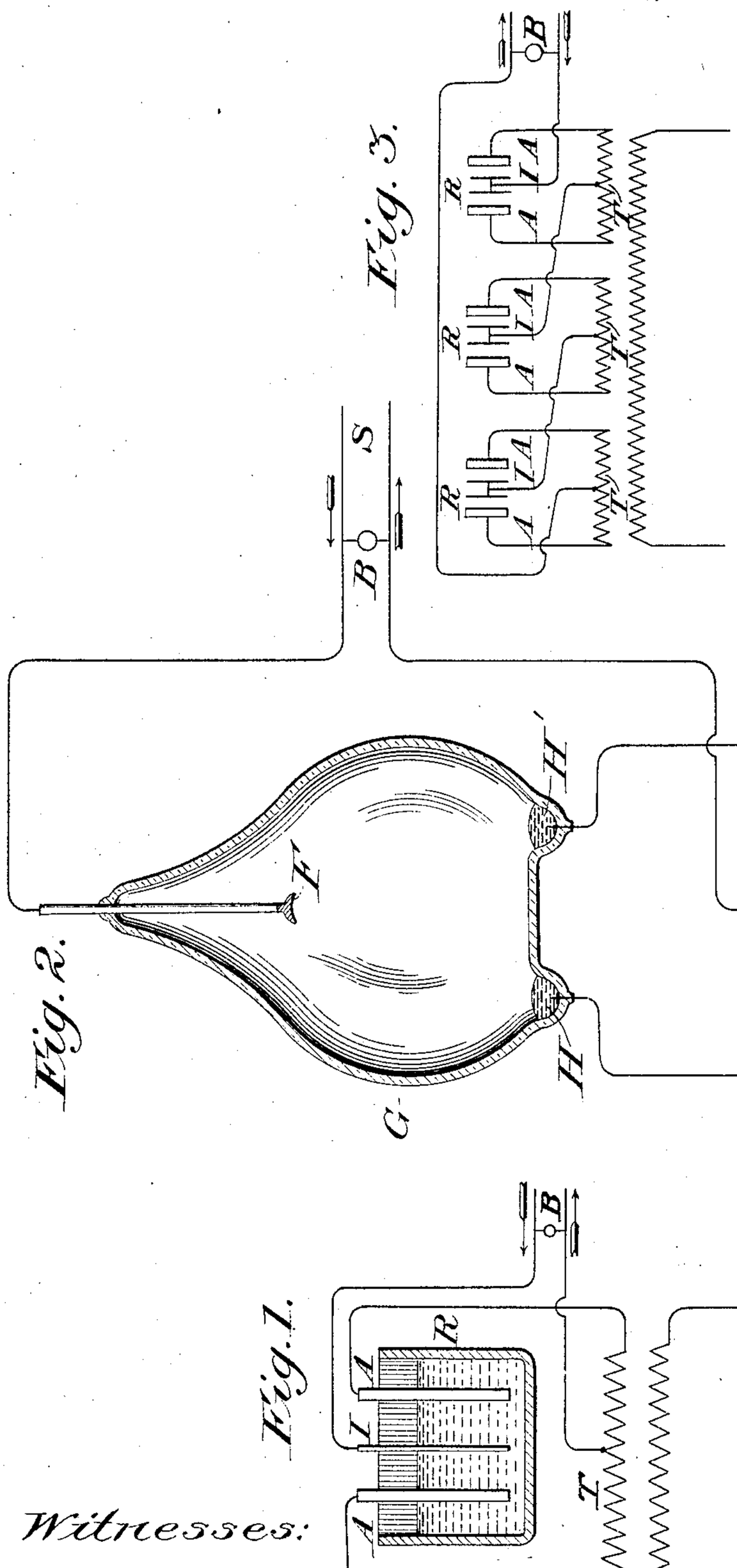

Fig. 3.

Fig. 2.

Fig. 1.

Witnesses:

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UNITED STATES PATENT OFFICE.

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SYSTEM FOR THE RECTIFICATION OF ALTERNATING CURRENTS.

SPECIFICATION forming part of Letters Patent No. 785,403, dated March 21, 1905.

Application filed August 15, 1903. Serial No. 169,622.

To all whom it may concern:

Be it known that I, CHARLES F. BURGESS, a citizen of the United States, residing at Madison, in the county of Dane and State of Wisconsin, have invented certain new and useful Improvements in Systems for the Rectification of Alternating Currents, of which the following is a specification.

In my copending application, Serial No. 147,461, filed March 12, 1903, I have described and claimed a system for the rectification of alternating currents, said system comprising asymmetric conductors of any desired or suitable type, an impedance or impedances, and connections between said asymmetric conductors and impedance or impedances, whereby a rectified current is obtained.

My present invention contemplates the use in a system of this character of asymmetric conductors arranged in series, whereby a higher value of pressure may be obtained.

The invention also contemplates the provision of asymmetric conductors of the electrolytic and also of other types of a novel form wherein two asymmetric conductors are arranged in opposition within a single containing vessel, said vessel being the electrolytic cell when the asymmetric conductors are of the electrolytic type and an exhausted or partially-exhausted globe, tube, or vessel when the asymmectric conductors are of the vacuum or vapor type, or in general a containing vessel of a form suited to the particular asymmetric conductor adopted, said containing vessel being provided with two asymmetric conductors arranged in opposition to each other.

It has been usual heretofore in rectifying systems to utilize four asymmetric conductors so connected in two pairs that one pair affords a path for the outflowing current and the other pair for the return-current. I have discovered that in a system of this kind, whatever be the nature of the asymmetric conductors employed, two of the cells or other asymmetric conductors, comprising one of the pairs above referred to, may be eliminated and a suitable impedance substituted therefor. By the term "impedance" as here used I mean any opposition which is set up in a circuit to the flow of an alternating current, and I include in the meaning of the term such means for effecting this result as an inductive device or inductance, a capacity, or a resistance, or any arrangement or combination of these or other means for accomplishing the result. It is to be expressly understood that my invention is not restricted to any particular form of impedance.

For a clear understanding of my invention reference is made to the accompanying drawings, wherein—

Figure 1 is a diagram illustrating the application of my system to a double asymmetric conductor of the electrolytic type. Fig. 2 is a similar diagram illustrating the use of a double asymmetric conductor of the vapor type; and Fig. 3 is a diagram showing a series connection for obtaining a higher value of pressure.

Referring to Fig. 1, R represents the containing vessel or electrolytic cell, and A A I the electrodes therein, the electrodes A consisting of aluminium or an aluminium alloy and the electrodes I of iron, lead, or other suitable material. T represents the source of alternating pressure, indicated as the secondary of a transformer. The extreme terminals of the transformer-secondary T are connected to the outer electrodes A A, and the intermediate terminal of the secondary is connected through translating devices B with the intermediate electrode I. It will be apparent that the resultant effect of this arrangement is that one side of the system is in operation during one half-wave and the other side during the other half-wave. The inductance to which the electrodes are connected may consist of an impedance-coil C, as shown in Fig. 2, or of part of an autotransformer, or various other arrangements may be employed, as will be apparent to one skilled in the art. For instance, suitable capacities, such as condensers, may be used. These and other modifications may be made without departing from the spirit of my invention. It will thus be seen that by connecting two asymmetric conductors in opposition in such manner that an alternating pressure applied to the two extreme terminals will allow little or no current to flow and connecting these

asymmetric conductors to the outside terminals of an inductance having an intermediate terminal a rectified current may be obtained in a branch between such intermediate terminal and the intermediate terminal of the asymmetric conductors. By such improvement the efficiency may be increased over previously-used methods, the simplicity and ease of operation are increased, and the means of connection to alternating-current circuits simplified. It will be understood that the current in the branch containing the translating devices may be regulated by rheostatic control in either the alternating or rectified branches and also by varying the ratio of transformation.

The expression "two asymmetric conductors arranged in opposition" as herein employed is intended to cover the inclusion of two such conductors of any type in opposition to each other in an electric circuit in such manner that little or no current can flow through them simultaneously by application of electric pressure to the outside or extreme terminals.

In the figures the asymmetric conductors are so arranged that the path of the current is from the intermediate terminal to the extreme terminals; but it will be obvious that their positions may be interchanged and that the current will then pass from the extreme terminals toward the intermediate terminal.

The electrolytic asymmetric conductor is illustrated in Fig. 1 merely by way of example, and it will be obvious that such construction may be applied to asymmetric conductors of the vacuum or vapor type or in general to conductors of any type wherein a containing vessel is used. In Fig. 2, for instance, I have illustrated an application of my system to an asymmetric conductor of the vapor type. Referring to said figure, G represents an exhausted or partially-exhausted globe provided with extreme terminals H H′, of mercury, and an intermediate terminal F, which may be of iron. This construction constitutes two asymmetric conductors arranged in opposition and permits little or no current to pass in the direction between the extreme terminals H H′ and the intermediate terminal F. Said intermediate terminal is connected, through the line-wires S and translating devices B, with the intermediate terminal of an impedance-coil C, and the extreme terminals H H′ are connected with the extreme terminals of said coil, precisely as heretofore described. It will be obvious that in this case, also, the transformer-secondary T may be utilized as the inductance. Any suitable means for rendering the mercury terminals active may be employed.

The pressure which can be applied to one set of asymmetric conductors is usually limited by several factors, including the breaking-down point of the conductors, their excessive heating, low efficiency, &c., and consequently the pressure of the rectified current may have a limiting value. Asymmetric cells will not usually operate satisfactorily in series. If so connected, the pressure is not distributed equally between the several cells, and these would therefore break down successively. To obtain a higher value of pressure, two or more sets of asymmetric conductors can be connected in series in the manner shown in Fig. 3, wherein R R R represent a number of pairs of asymmetric conductors, each pair consisting of two asymmetric conductors arranged in opposition, the outside terminals of each pair being connected to the outside terminals of a corresponding impedance, here shown as the secondary T of a transformer, and the intermediate terminal of each pair being connected to the intermediate terminal of another impedance, which may conveniently be the next impedance in the series.

I claim—

1. A system for rectifying alternating currents comprising two or more pairs of asymmetric conductors, each pair consisting of two asymmetric conductors arranged in opposition, the outside terminals of each pair being connected to the outside terminals of a corresponding impedance, and the intermediate terminal of each pair being connected to the intermediate terminal of another impedance, as set forth.

2. A system for rectifying alternating currents comprising two or more pairs of asymmetric conductors, each pair consisting of two asymmetric conductors arranged in opposition, the outside terminals of each pair being connected to the outside terminals of a corresponding impedance, and the intermediate terminal of each pair being connected to the intermediate terminal of the next impedance in the series, as set forth.

3. In a system for rectifying alternating currents, a container, and two asymmetric conductors therein arranged in opposition to each other, as set forth.

4. In a system for rectifying alternating currents, a container, two asymmetric conductors therein arranged in opposition to each other, and electrical connections to the outside and intermediate terminals of said asymmetric conductors, as set forth.

5. In an electrical converter, a series of coils inductively energized from a source of alternating current, a series of electrolytic cells adapted to pass current of one polarity and to resist the passage of current of opposite polarity, serially connected to said coils to secure an increased voltage in the converted current.

6. In an electrical converter, a source of alternating current, a series of coils inductively energized thereby, a series of electrolytic cells adapted to pass current of one polarity,

connections leading from the terminals of said coils to separate electrodes in said cells, and connections leading from intermediate points on said coils to transmitting-electrodes in said cells and connecting said coils and cells in series.

7. In an electrical converter, a source of alternating current, a primary coil traversed thereby, a series of secondary coils inductively energized, a series of electrolytic cells adapted to pass current of one polarity, and electrical connections connecting said secondaries and cells in series, to increase the potential of the converted current.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES F. BURGESS.

Witnesses:

W. D. HIESTAND,

FANNIE G. SANFORD.