

E. THOMSON.
VIBRATING RECTIFIER.
APPLICATION FILED JULY 1, 1911.

1,011,526.

Patented Dec. 12, 1911.

Fig. 1.

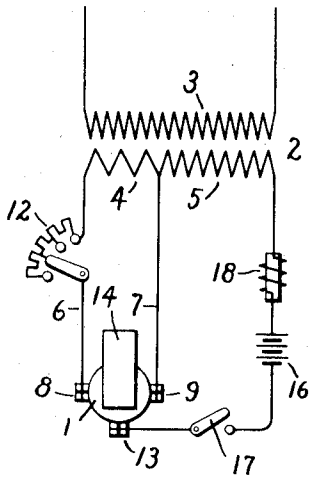


Fig. 3.

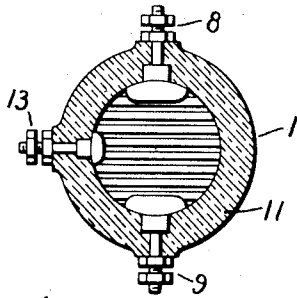


Fig. 4.

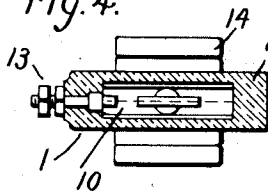


Fig. 5.

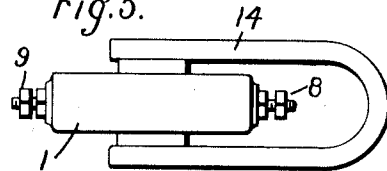


Fig. 2.

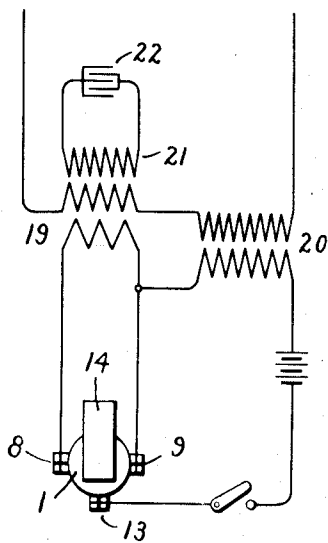


Fig. 6.

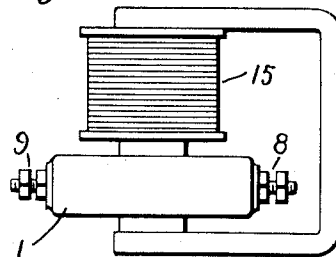
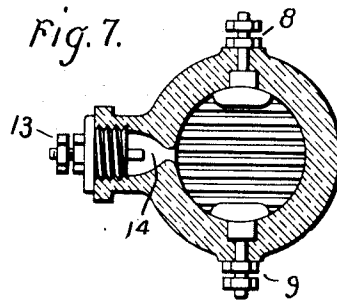


Fig. 7.



Witnesses:

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UNITED STATES PATENT OFFICE.

ELIHU THOMSON, OF SWAMPSCOTT, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

VIBRATING RECTIFIER.

1,011,526.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, ELIHU THOMSON, a citizen of the United States, residing at Swampscott, in the county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Vibrating Rectifiers, of which the following is a specification.

My invention relates to apparatus for converting alternating current into direct current, and comprises in particular a contact-making device containing a body of fluid, such as mercury, which is forced to vibrate in synchronism with the vibrations of the alternating current from which the direct current is to be derived, by the mutual reaction of an alternating magnetic field and a field of constant polarity. The mercury is properly connected to deliver impulses of current of constant polarity to an external circuit.

In the accompanying drawings, Figures 1 and 2 are diagrams illustrating circuit connections for utilizing my device; Fig. 3 is a longitudinal section and Fig. 4 a cross-section of the vibratory element; Figs. 5 and 6 are side elevations showing the vibratory element mounted on a permanent magnet and an electromagnet respectively, and Fig. 7 is a cross-sectional view of a modified form of vibrator.

Fig. 1 shows the vibrator 1 connected to the secondary of the transformer 2, the primary 3 of which is supplied with an alternating current. The secondary of the transformer is divided into two sections 4 and 5, the section 4 having few turns and being connected by means of conductors 6, 7 to terminals 8, 9 of the vibrator. These terminals make contact with a small quantity of mercury 10, partially filling the disk-like container 11 consisting of glass, porcelain, fiber or other suitable insulating material. The adjustable resistance 12 serves to regulate the alternating current traversing the body of mercury. The section 5 of a transformer, having a relatively greater number of turns than section 4, is connected on one side by means of conductor 7, common to both sections, to the terminal 9 of the vibrator and by this means to the mercury. The other terminal of the section 5 is connected to a third terminal 13 of the vibrator.

The receptacle 11 is placed between the

poles of either a permanent magnet 14, as shown in Fig. 5, or between the poles of a constantly excited electromagnet 15, as shown in Fig. 6, and is thus situated in the path of a magnetic field of constant polarity between the faces of the magnetic poles. As the mercury is traversed by an alternating current of relatively considerable value derived from the secondary 4, the alternating magnetic field which surrounds the mercury interacts with the magnetic field of the magnet and is driven synchronously with the alternations of the current to one side or the other of the receptacle 11, the tendency being for the mercury to move itself out of the magnetic field. It, therefore, makes and breaks contact with the terminal 13 once during each complete cycle and completes the circuit of the secondary section 5 during each alternate half wave. It may be adjusted, therefore, to deliver impulses of current of one polarity to the battery 16 when the switch 17 is closed. The bottom and top of the mercury-containing chamber is provided with shallow narrow grooves, as indicated in Fig. 3, running in a direction transverse to the line joining terminals 8 and 9 and therefore in the direction of motion of the oscillating mercury. These grooves allow air, or other gases, present in the receptacle to shift from side to side when the mercury vibrates. The grooves remain free from mercury, being quite fine and not being wet by the mercury. Of course, if desired, the receptacle 11 may be built airtight and evacuated so as to permit an easy shifting of the mercury from side to side. As the body of mercury has a certain inertia and, therefore, requires a definite interval of time in order to change its position, it is important that the reversal of the alternating current traversing the mercury should occur slightly in advance of the reversal of the current in the circuit containing the battery 16, in order to give the mercury time to make contact with the terminal 13. This displacement of the phase of the current in sections 4 and 5 respectively may be given by the reactance coil 18 in the battery circuit, as indicated in Fig. 1, causing the battery current to lag. The same purpose can be accomplished by causing the current in section 4 to slightly lead the phase of current in section 5 by the use of a con-

denser, as illustrated in Fig. 2. In this figure, the primary and secondary of section 19 are shown as being wound on a separate core from the primary and secondary of section 20. On the core on which the primary and secondary of section 19 are wound, there is an extremely fine winding 21 in inductive relation to both the primary and secondary of section 19. This winding is closed upon a condenser 22. In other respects the apparatus is the same as that already described. The object of the fine high potential winding 21 and the condenser 22 is to lead the phase of the current in the secondary of section 19 with respect to the current in the secondary of section 20, and thus to compensate for the inertia of the mercury body. As the space not filled with mercury in the receptacle 11 can be filled with an inert gas or evacuated, the terminal 13 may readily be kept clean and free from any oxidized film. However, if desired, the break of the circuit may occur entirely in the mercury itself, as shown in Fig. 7, in which the terminal 13 makes contact with a small body of mercury and the break in the circuit occurs at the narrow opening of the chamber 14 into the main chamber containing the oscillating body of mercury. The spark occurs between two mercury surfaces with manifest advantage in the way of a clean, unoxidized contact.

There is thus provided by my invention a very simple rectifier that requires no adjustment after it has once been set up, and in which there are no springs or other mechanical parts to produce difficulties.

What I claim as new, and desire to se-

cure by Letters Patent of the United States, is:—

1. The combination of a source of alternating current, a direct current load circuit, a body of fluid traversed by an alternating current and free to oscillate to establish contact with said load circuit and said source of alternating current, and magnetic means for causing said body of fluid to oscillate in synchronism with the alternating current.

2. The combination of a source of alternating current, a magnet of constant polarity, a body of mercury traversed by an alternating current in step with the alternations of said source situated in the field of said magnet and free to vibrate therein under the influence of its alternating magnetic field, and a terminal contacting with said mercury body for delivering alternate impulses of current as direct current.

3. In a vibrating rectifier, the combination of a magnet of constant polarity having an air gap between its poles, a body of mercury free to oscillate in said gap, a source of alternating current connected to said mercury, and means actuated by the oscillations of the mercury under the influence of its alternating magnetic field for delivering alternate impulses of current as unidirectional current.

In witness whereof, I have hereunto set my hand this twenty-ninth day of June, 1911.

ELIHU THOMSON.

Witnesses:

JOHN A. McMANUS, Jr.,
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