L. E. FRANCE.

ALTERNATING CURRENT RECTIFIER.

APPLICATION FILED MAR. 4, 1915.

1,179,515.

Patented Apr. 18, 1916.

2 SHEETS—SHEET 1.

Fig. 1.

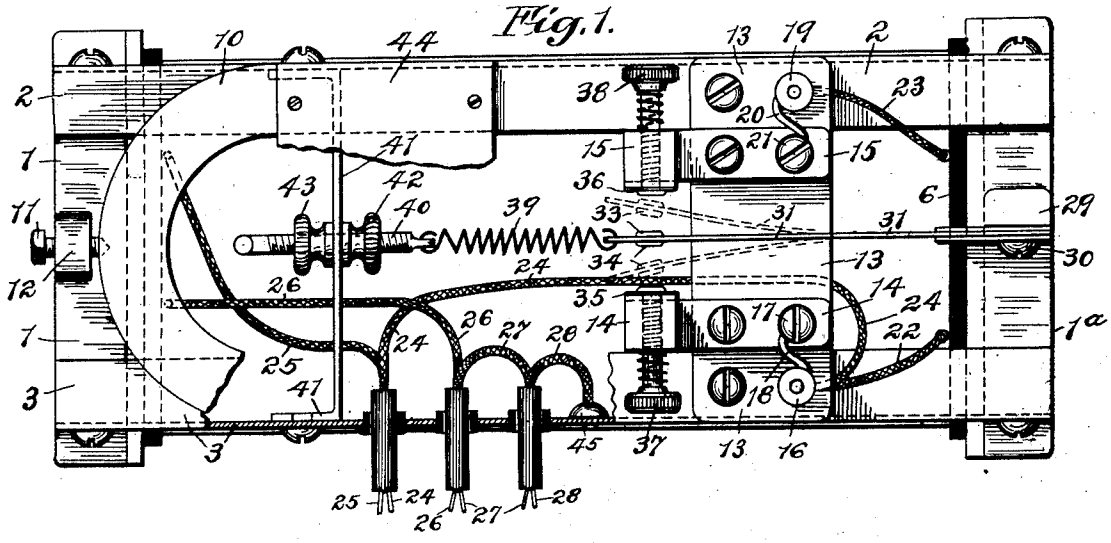
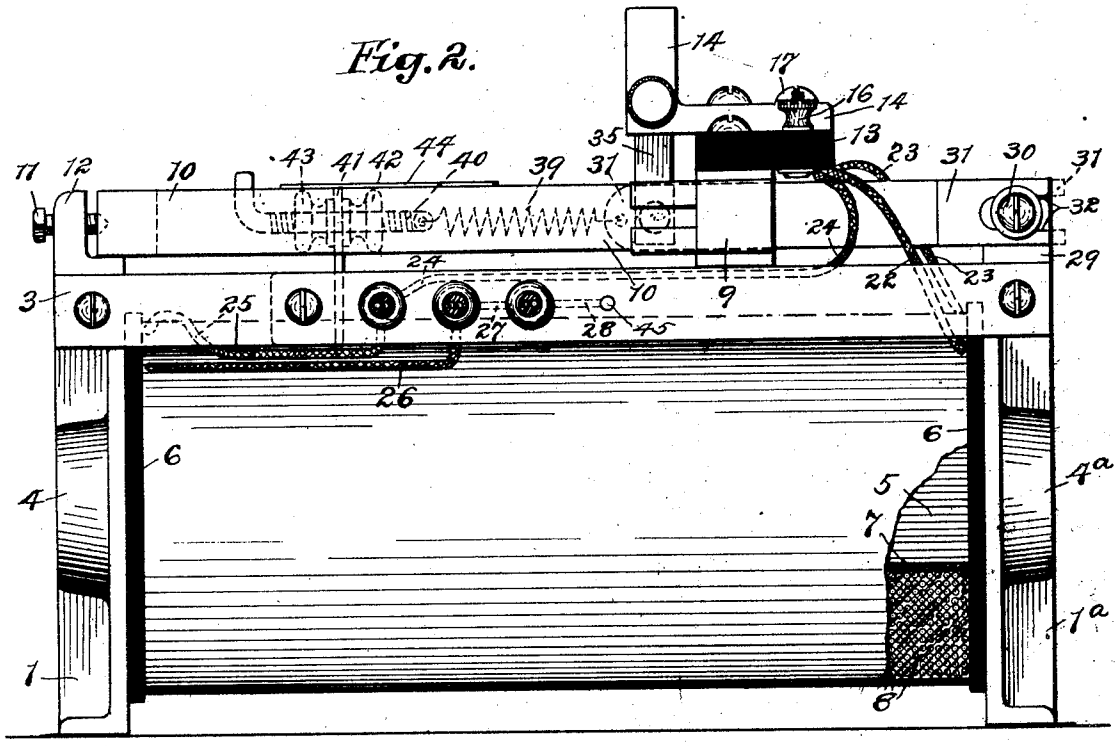


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

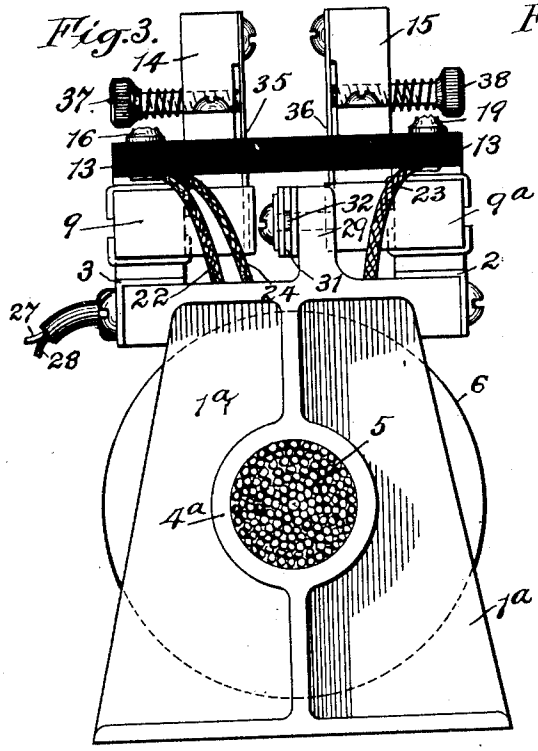


Fig. 4.

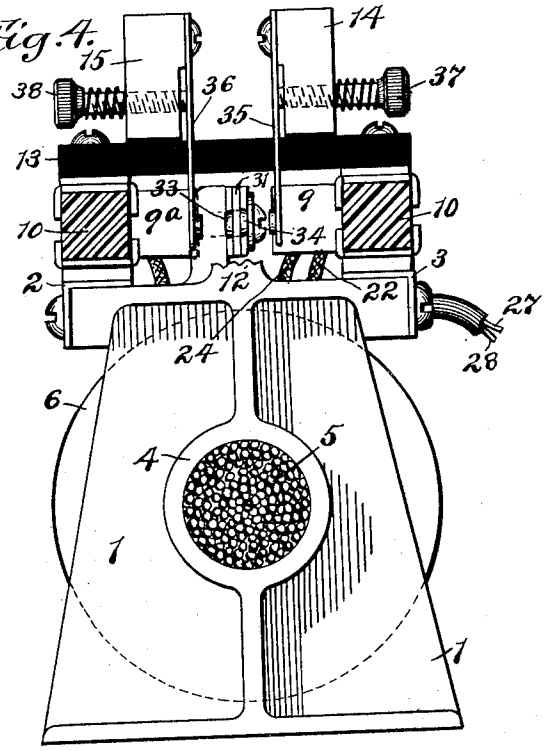
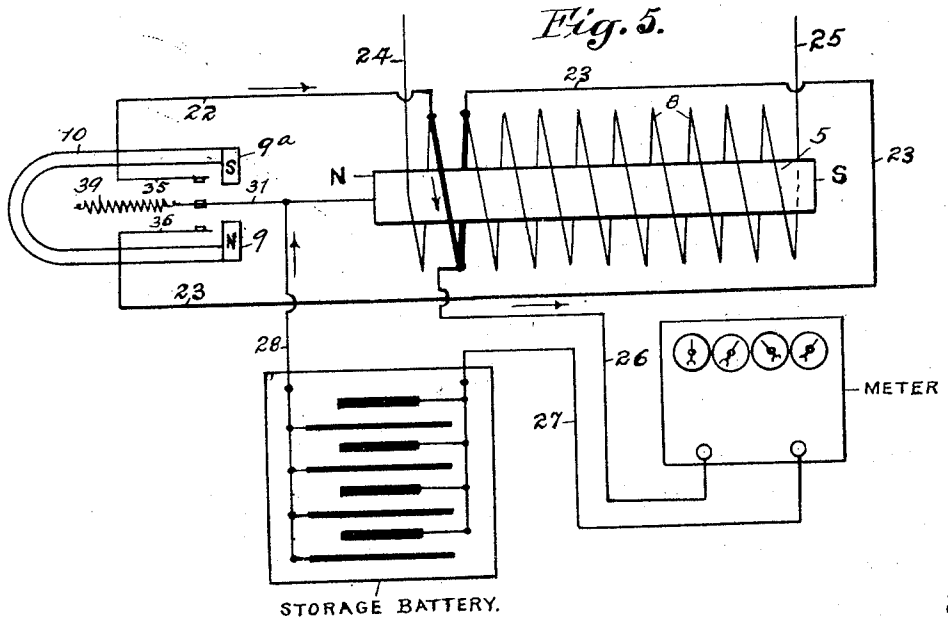


Fig. 5.



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ALTERNATING-CURRENT RECTIFIER.

1,179,515. Specification of Letters Patent. Patented Apr. 18, 1916.

Application filed March 4, 1915. Serial No. 12,198.

To all whom it may concern:

Be it known that I, LESTER E. FRANCE, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Alternating-Current Rectifiers, of which the following is a specification.

This invention relates to alternating current rectifiers of the vibrating type, for changing the direction of an alternating current to provide a direct current.

The instrument is particularly useful for charging batteries, but capable of other uses to which it is appropriate.

Vibrating rectifiers are of two types. In one, only one wave is utilized. In the other both waves are utilized, and this invention relates to the latter type. Some of these devices use auxiliary coils or relays which reduce the efficiency and which must depend upon an outside source of direct current, such as the battery which is being charged, and which have complicated parts which increase the cost of the device.

One object of this invention is to provide a simple and inexpensive device which does not require, for its operation, any outside source of direct current.

Another object of the device is to provide means for adjusting the vibrator so that it can be made to work on any frequency, and also compensate for the lag in the rectified current, thereby requiring no condensers or other systems of timing.

A further object of the invention is to secure sparkless operation of the contact points when supplying uni-directional current to a receiving circuit which may or may not have counter E. M. F., by providing means whereby the points shall not make or break contact until the voltage of the charging wave equals at least the voltage of the receiving circuit, when there will be no difference of potential between the points, and consequently no sparking. Therefore means are provided for varying the time of contact, and the duration of contact, to suit conditions.

A further object of the invention is to provide means to cushion the impact of the points and to permit the points to move together or with each other, as during the peak of the wave.

A further object of the invention is to provide an instrument which will automatically open the charging circuit so that the battery cannot discharge, if for any reason the rectifier should cease operating, as by interruption of the alternating current or otherwise.

The invention may be realized in a variety of structures, one of which is illustrated in the accompanying drawings in which,

Figure 1 is a top plan view of the instrument, parts being broken away. Fig. 2 is a side elevation, partly in section. Fig. 3 is an end elevation. Fig. 4 is an opposite end elevation, partly in section. Fig. 5 is a diagram of the circuits.

Referring specifically to the drawings 1 indicates a non-magnetic end piece, and 1^a an opposite end piece forming a magnetic path for the vibrating armature.

2 and 3 are side pieces or bars connecting the end pieces of the frame. The end pieces have sockets 4 and 4^a for the laminated core 5, and 6 indicates the insulating fiber disks for the ends of the coil.

7 is the tubular insulation between the core and the windings 8 of the transformer coil.

The permanent magnet 10 is supported on the frame and held by a screw 11 passing through the lug 12 on the end piece 1, and this magnet terminates in the pole pieces 9 and 9^a of opposite polarity.

13 indicates an insulating block or support for the conducting brackets 14 and 15 for holding the contacts to be described.

Fuses 18 and 20 are held between thumb nut 16 and screw 17, and thumb nut 19 and screw 21, at opposite sides respectively.

22 is a secondary lead from the coil to the binding nut 16, and 23 is a secondary lead, on the opposite side.

24 and 25 indicate the opposite side connections to the alternating current or supply line.

26 is the secondary lead from the coil to a meter, and 27 a lead from the meter to one side of the storage battery to be charged.

28 is a lead from the opposite terminal of the battery to a connection indicated at 45 (Fig. 2) which is in circuit with the vibrator. This comprises a spring tongue or plate 31 which is secured to a lug 29 on the end piece 1^a by means of a screw 30, the armature being adjustable lengthwise, to lengthen or shorten the same, by means

of a slot 32 through which the screw 30 extends. At its free end the armature or tongue has opposite contact points 33 and 34 which coöperate with points on opposite contact springs 36 and 35 which are fastened to and depend from the brackets 14 and 15 by means of screws 37 and 38. These contact springs may be adjusted toward or from the armature and it will be noticed that this varies the time of contact, as well as permitting the springs 35 and 36 to yield more or less, thereby cushioning the impacts and varying the period during which the points remain in contact.

At its free end the armature 31 is connected to one end of a spring 39 the other end of which is connected to a screw 40 supported by a cross piece 41 and held at adjustment by nuts 42 and 43, the spring being in alinement with the middle position of the tongue. The tension or adjustment of this spring varies or regulates the frequency of the vibration of the armature and also assists the adjustment for lag, and the spring opens the charging circuit at any interruption of the supply current.

44 is a name plate.

In operation current in one direction entering through the line 25, say, passes through the coil 8, the secondary or induced current of opposite direction flowing through the lines 26 and 27, battery, line 28, armature 31, the core 5 the field of which is transmitted through the magnetic end frame 1ª to the armature 31 inducing north polarity therein, causing the south pole 9ª of the permanent magnet 10 to attract the armature whose point 34 contacts with the point on the spring contact 35 which yields and permits the contact to hold or remain during the peak of the wave, the circuit being completed through the line 22 back to the secondary connection, the supply circuit being completed through the return 24. When the current enters through the supply line 24 it passes through the coil, the secondary or induced current of opposite direction passing through the leads 26 and 27 and through the battery to the armature in which opposite polarity is then induced, causing the same to be attracted by the north pole 9 of the permanent magnet, thereby closing the contacts 33 and 36 and completing the secondary circuit through the line 23 back to the secondary coil. Thereby the opposite waves of the alternating current are transformed into a unidirectional charging current through the battery. The secondary part of the coil 8 is symmetrical, that is, the connection of the line 26 is midway between the connections of the lines 22 and 23, with the coil.

As stated before the adjustment of the springs 35, 36 and 39 and the armature 31 permits the vibrations of the armature to be timed according to local conditions and to compensate for any lag in the rectified current, as well as to delay separation during the peak of the waves, and the points will not make or break contact until the voltage of the charging wave at least equals the voltage of the receiving circuit; hence sparking will be substantially avoided and discharge of the battery through the instrument is prevented.

What I claim as new is:

1. In a rectifier, the combination of an alternating current supply circuit, a direct current circuit having opposite contacts, a permanent magnet, and a vibrator energized by the alternating current and located in the field of the magnet and cooperating with the said contacts to close the direct current circuit.

2. In a rectifier, the combination of an alternating current supply circuit, a circuit for direct current derived therefrom and having opposite contacts, a vibrator magnetized by said alternating current, and a permanent magnet the opposite poles of which coöperate with said vibrator to alternately attract the same, the vibrator being located between the contacts to close therewith alternately.

3. In a rectifier, the combination of an alternating current supply circuit including the primary of an induction coil, a direct current circuit including the secondary of said coil and opposite contacts, a vibrator in said direct current circuit and in inductive relation to said primary, and located between said contacts to close therewith alternately, and a permanent magnet having poles on opposite sides of the vibrator.

4. In a rectifier, the combination of an alternating supply circuit, an open-ended induction coil whose primary is included in said circuit, a direct current circuit including a pair of opposite contacts and the secondary of said coil, a permanent magnet, and a spring contact armature in the direct current circuit and in the field of the core of the induction coil and vibrating between the poles of the magnet and in coöperation with said contacts.

5. In a rectifier, the combination of an alternating supply circuit including the primary of an induction coil, a direct current circuit including a pair of opposite contacts and the secondary of said coil, a magnet, and a vibrating contact armature in said direct current circuit and in inductive relation to said coil, and in the field of said magnet, said armature being located between said contacts and coöperating therewith.

6. In a rectifier, the combination of an alternating current supply circuit including an induction coil, a direct current

circuit having one connection at one side to said coil and having opposite branches symmetrically connected to said coil on opposite sides of said connection, and a contact in each branch, a permanent magnet, and a vibrating armature between the poles of said magnet and in inductive relation to said coil and included in said direct current circuit and arranged to close with said contacts alternately to make the circuit through said branches respectively.

7. In a rectifier, the combination of an alternating current supply circuit including the primary of an induction coil, a permanent magnet, a vibrating armature in the field of said magnet and connected to the core of said coil, and a derived circuit including the secondary of said coil and said armature, said derived circuit having opposite branches terminating in contacts on opposite sides of said armature and adapted to be alternately closed thereby.

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

LESTER E. FRANCE.

Witnesses:
JOHN A. BOMMHARDT,
J. B. DAVIS.