A. R. BULLOCK.

CURRENT CONVERTING DEVICE.

APPLICATION FILED AUG. 18, 1913.

1,204,740.

Patented Nov. 14, 1916.

2 SHEETS—SHEET 1.

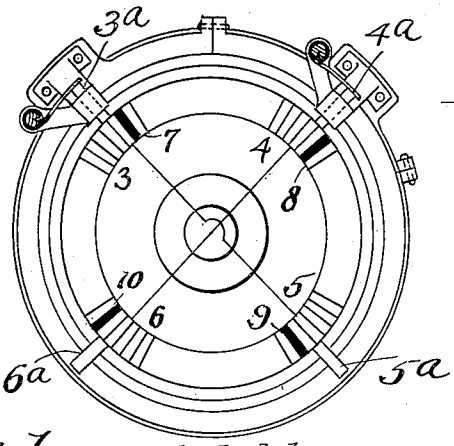
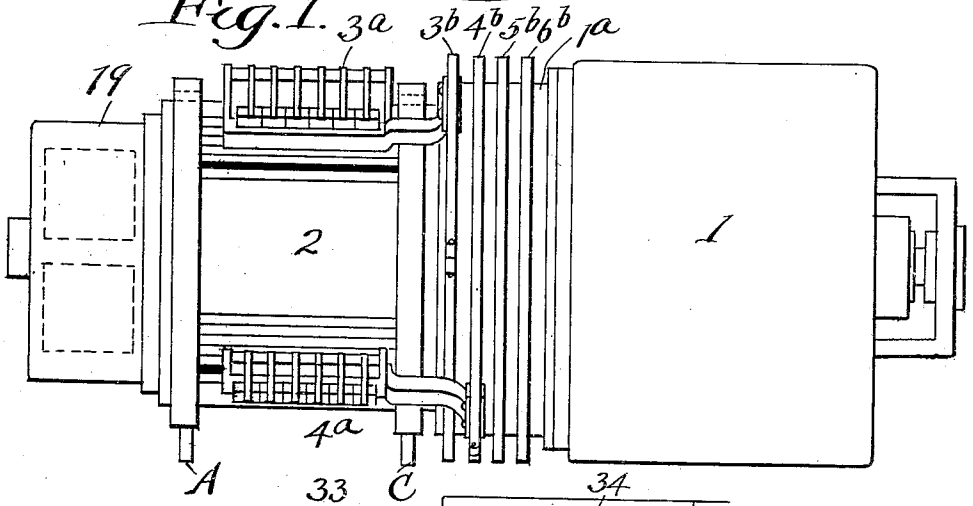


Fig. 2.

Fig. 1.



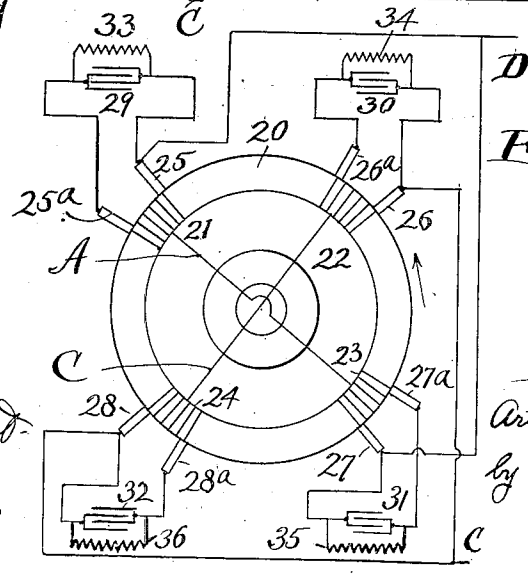


Fig. 3.

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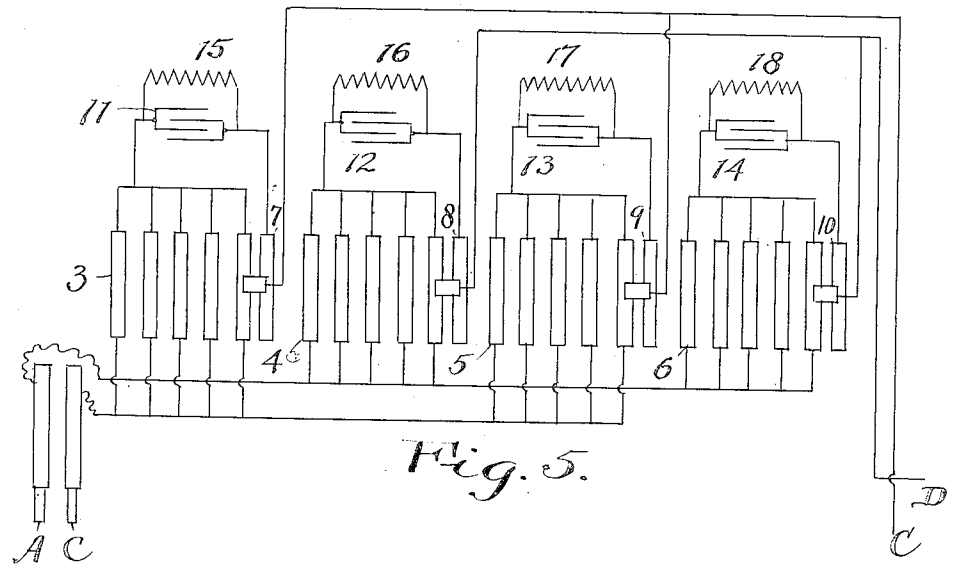


Fig. 5.

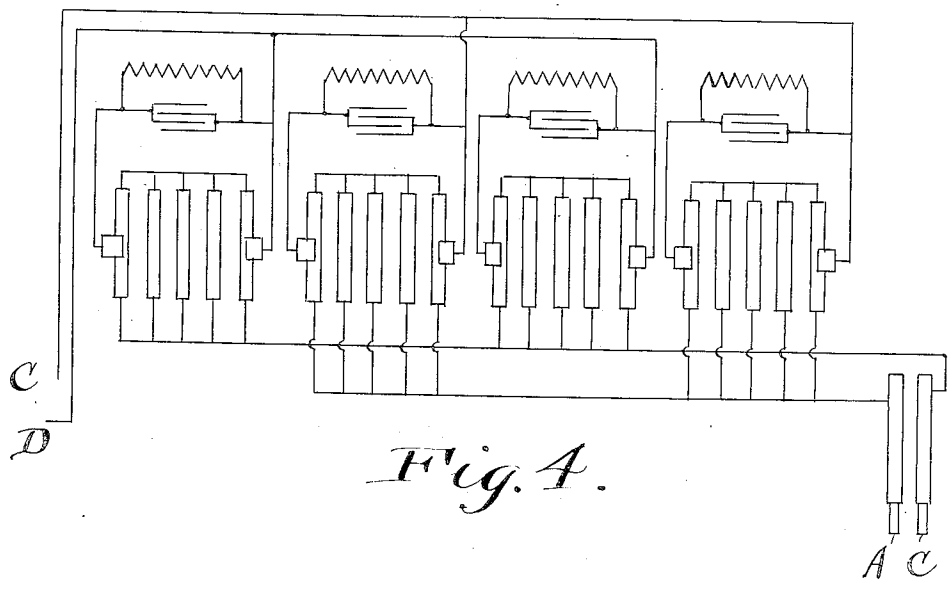


Fig. 4.

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UNITED STATES PATENT OFFICE.

ARTHUR R. BULLOCK, OF CLEVELAND, OHIO, ASSIGNOR TO HENRY C. LEE, TRUSTEE, OF LOS ANGELES, CALIFORNIA.

CURRENT-CONVERTING DEVICE.

1,204,740. Specification of Letters Patent. Patented Nov. 14, 1916.

Application filed August 18, 1913. Serial No. 785,242.

To all whom it may concern:

Be it known that I, ARTHUR R. BULLOCK, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Current-Converting Devices, of which the following is a full, clear, and exact description.

This invention relates to a device for converting electric current, either alternating current to direct current, or vice versa.

The object of the invention is to provide a machine which by the use of certain adjuncts may be operated with practically no sparking.

Generally speaking, the invention comprises the elements and combinations thereof set forth in the accompanying claims.

Reference should be had to the accompanying drawings, in which—

Figure 1 is a top plan view of one form of the machine; Fig. 2 is an end elevation with portions in section; Fig. 3 is a diagrammatic illustration of the manner in which the parts of the machine coöperate in one form of my device; Fig. 4 is a diagrammatic illustration of the electrical connections in one form of machine; and Fig. 5 is a diagram of the electrical connections in another form of my invention.

Devices of the general construction which is represented in this application wherein a rotating body with conducting segments thereon is employed in a manner such that the segments in coöperation with portions bearing thereon will rectify alternating current, or vice versa, have been open to the serious objection that at the time of the break between the brush and the segments on which they bear as the segments are rotated, there is considerable sparking which if not prevented may cause a larger arc to be set up, and flashing over between adjacent segments. With a machine which is handling currents of high value, an arc established in this way will do considerable damage to the machine and in other ways.

In this application, I am proposing one way in which the sparking and arcing may be reduced to a minimum and substantially eliminated.

I will explain the machine as adapted to rectify an alternating current, although it will be apparent that a direct current may be changed to an alternating current with this same machine.

When an alternating current is to be changed to a direct current, I employ a synchronous motor, which may be represented at 1. Upon an extension of the motor shaft there is mounted a rotating body 2 carrying conducting portions 3, 4, 5 and 6. These conducting portions or segments are made up of a number of small segments, which segments are all electrically connected to each other, save one, which will later be explained. The reason for making the conducting portions of a number of segments is simply for reasons of construction, and so far as the electrical features of this machine are concerned, the conducting portions 3, 4, 5 and 6, might as well be a single conducting strip.

The space upon the commutator between the conducting portions 3, 4, 5 and 6, is electrically dead, and might well be constructed of insulating material. However, in order to secure an even wearing of the surface of the commutator by the brushes passing over the commutator, I prefer to employ segments of copper which are spaced apart by mica insulation, as is the usual construction, and so arrange these segments that they shall not form any conducting portion of the segment.

Adjacent each conducting portion 3, 4, 5, 6 are segments 7, 8, 9 and 10 which are spaced from the conducting portions by means of an insulated space, which insulated space is of less width than the brush which bears upon the segments so that as the brushes pass from the conducting portions, they will short circuit the conducting portions with the segments 7, 8, 9 or 10 as the case may be, according to the conducting portion with which the brushes have been in engagement. It should be mentioned that I have employed four conducting portions and that the opposite conducting portions are electrically connected, as indicated in Figs. 2 and 5.

Brushes 3^a, 4^a, 5^a, and 6^a, are mounted in suitable supports, which supports are carried upon rings 3^b, 4^b, 5^b, and 6^b, which rings are frictionally or otherwise held upon an annular projection 1^a which is carried by the motor casing.

As will be seen by reference to the dia-

gram in Fig. 5, I employ condensers represented at 11, 12, 13 and 14, which condensers are connected in parallel with the conducting portions 3, 4, 5 and 6, and their adjacent segments 7, 8, 9 and 10. It will therefore be apparent that as the conducting portions rotate, and the brushes pass from the conducting portions to engage with the segments 7, 8, 9 and 10, as before explained, the brushes will connect the conducting portions and the adjacent segments. Therefore, as the current is broken between the brush and the conducting portion, there will be a condenser electrically connected in parallel with the break in the circuit between a brush and the conducting portion upon which it has borne, so that any current which would be flowing at the time of the break, will flow into the condenser and be absorbed therein. This will effectually take care of any current which may be flowing at the time of break between a brush and a conducting portion so that there will be substantially no sparking and no arcing. However, it must be borne in mind that the condenser having been charged, must discharge itself, for it cannot indefinitely take up these charges of current. If a condenser were to be used alone, it would discharge itself upon the next connection of a conducting portion, and its adjacent segment, and the discharging of the condenser would produce a sparking which would be very detrimental to the segments in that it would burn them and scar them so that the likelihood of arcing at the time of breaking of the circuit would be greatly increased. I have provided means for discharging the condensers so that each time a condenser is presented to absorb the current, at the time of break between a conducting portion and its brush, it will be substantially neutral, and thus in condition to absorb current. This I accomplish by placing a resistance in parallel with each condenser, as represented at 15, 16, 17 and 18. This resistance is chosen so that the current flowing at the time of break between a conducting portion and brush will pass to the condenser, and not to the resistance. However, as soon as the brush has entirely broken with a conducting portion, it will be seen that the condenser which has just been charged, is practically short-circuited through a resistance so that the condenser will discharge itself through this resistance as shown in Fig. 5. In other words, the condenser charge is dissipated and the condenser is thus in condition to receive a subsequent charge. A condenser or circuit having capacity which dissipates its charge may be embodied in forms other than that herein shown, the only requirement being that when used in a circuit such as herein shown its function and results shall be the same. I consider a condenser or circuit containing capacity, which is so arranged in a circuit as to receive and dissipate a charge, as the equivalent of the short circuited condenser herein shown. Of course, in a measure, this current is wasted, but the amount of current which is so expended, is not very large, so that the efficiency of the machine is not greatly reduced, and the loss thus occasioned is more than compensated by the fact that the machine is operable substantially in sparkless condition. These condensers and their resistances are mounted upon the shaft which carries the rotatable member 2, and are housed within a casing 19 which is also carried upon the shaft. This casing may be provided with suitable fan blades or other air stirring means, such that the condensers and their resistances are cooled as the machine is operated.

Another form of machine embodying the same principle is illustrated diagrammatically in Figs. 3 and 4. The machine as represented in these figures will be operated by a motor which will be a synchronous motor, in the event that alternating current is changed to direct. Upon the motor shaft will be mounted a rotatable body 20 provided with conducting portions 21, 22, 23 and 24, oppositely arranged conducting portions being electrically connected.

Four brushes 25, 26, 27 and 28 are so positioned as to simultaneously engage with the conducting portions before mentioned. Brushes 26 and 28 are electrically connected, while brushes 25 and 27 are electrically connected to form the terminals for the D C circuit. It will be understood that alternating current is fed to the conducting portions 21, 22, 23 and 24, by a means similar to that illustrated and described in connection with Figs. 1 and 2.

Associated with each brush is an auxiliary brush 25^a, 26^a, 27^a and 28^a. Each of these brushes is so positioned with respect to its principal brush that as the principal brush is just passing from contact with a conducting portion, its auxiliary brush is coming into full contact with the same conducting portion. Between each principal brush and its auxiliary brush, there is connected a condenser, the various condensers being represented at 29, 30, 31 and 32. Each of these condensers is connected in parallel with a resistance 33, 34, 35 and 36.

It will be apparent that in operation, as a principal brush is passing from contact with a given conducting portion, any current which may be flowing at the time of breaking, will find a path through the auxiliary brush and through the condenser. In this way, the condenser will be charged. The resistances in parallel with the condensers will operate in the same manner as heretofore described, and will thus always present a condenser in condition to absorb

current at the time of break between a principal brush and a conducting portion. The principal brushes and their auxiliary brushes will be mounted in a manner similar to that shown in Fig. 1.

As has before been suggested, the device is capable of changing alternating to direct current as explained, or direct current to alternating current. The only difference in construction incident to using the device in the two ways mentioned, is that the motor 1 must be a synchronous motor, if alternating current is rectified, whereas, if direct current is changed to alternating, an ordinary motor will suffice.

Having thus described my invention, what I claim is:

1. The combination with an alternating current circuit and a direct current circuit, of a device for connecting each side of one of said circuits alternately with the sides of the other circuit, in combination with a circuit containing capacity adapted to dissipate its charge, which circuit is introduced by the aforesaid device between coöperating sides of the A C and D C circuits at the time the connections between the circuits are broken.

2. In combination with an alternating current circuit and a direct current circuit, of a device for connecting each side of one of said circuits alternately with the sides of the other circuit, in combination with a circuit containing a condenser adapted to dissipate its charge, which circuit is introduced by the aforesaid device between coöperating sides of the A C and D C circuits at the time connection between the circuits is broken.

3. The combination with an alternating current circuit and a direct current circuit, of a device for connecting each side of one of said circuits alternately with the sides of the other circuit, in combination with a circuit containing capacity, which circuit is introduced by the aforesaid device between coöperating sides of the A C and D C circuits at the time connection between the circuits is broken, and means for causing the circuit containing capacity to continually discharge itself.

4. The combination with an alternating current circuit and a direct current circuit, of a device for connecting each side of one of said circuits alternately with the sides of the other circuit, in combination with a circuit containing a condenser, which circuit is introduced by the aforesaid device between coöperating sides of the A C and D C circuits at the time connection between the circuits is broken, and means for causing the condenser to discharge.

5. The combination with an alternating current circuit and a direct current circuit, of a device for connecting each side of one of said circuits alternately with the sides of the other circuit, in combination with a circuit containing a condenser, which circuit is introduced by the aforesaid device between coöperating sides of the A C and D C circuits at the time when the circuit is broken, and means for discharging the condenser as soon as it becomes charged.

6. A device for converting current comprising conducting portions, brushes bearing upon said conducting portions, a circuit containing capacity adapted to dissipate its charge, and means for connecting the said circuit between a brush and the conducting portion over which the brush is passing at the time of break.

7. In a device for converting current, comprising a body provided with rotatable conducting portions, brushes adapted to bear upon the said conducting portions, a circuit containing a condenser adapted to dissipate its charge, and means for connecting the said circuit between a brush and with a segment over which the brush is passing at the time of break.

8. The combination with an alternating current circuit and a direct current circuit, of a device for connecting each side of one of said circuits alternately with the sides of the other circuit, of a circuit containing a condenser, which circuit is introduced by the aforesaid device between coöperating sides of the A C and D C circuits at the time connection between the circuits is broken and a resistance in parallel with and connected at opposite ends of the condenser.

9. A device for converting current comprising conducting portions, brushes bearing upon said conducting portions, a circuit containing a condenser, a resistance in parallel with and connected to opposite ends of the condenser, and means for connecting the said circuit between a brush and a conducting portion over which the brush is passing at the time of break.

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

ARTHUR R. BULLOCK.

Witnesses:
A. J. Hudson,
L. I. Porter.