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MEANS FOR PRODUCING HIGH VOLTAGE

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Fig. 1.

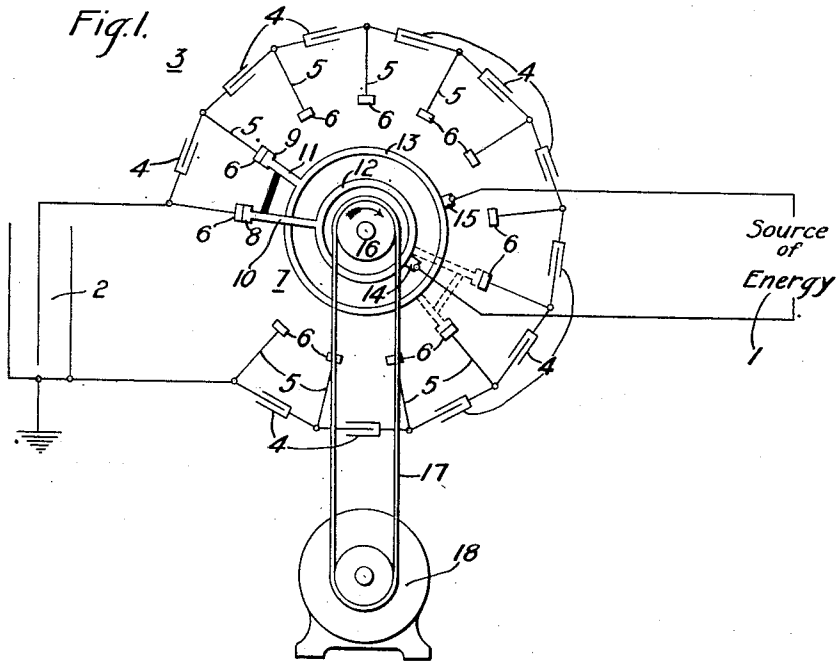
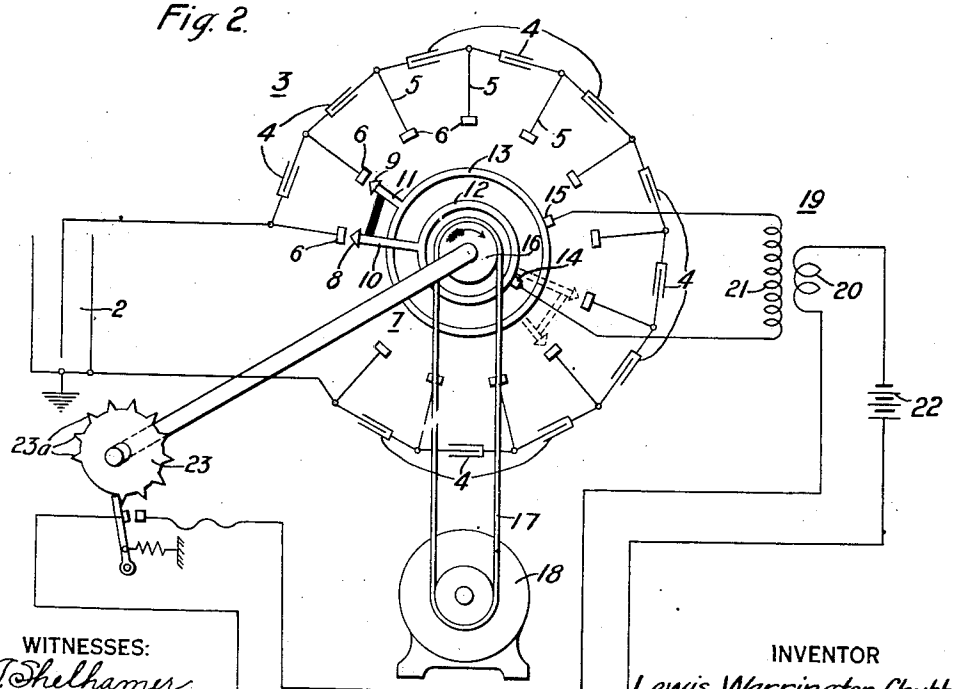


Fig. 2.



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UNITED STATES PATENT OFFICE.

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MEANS FOR PRODUCING HIGH VOLTAGE.

Application filed May 16, 1919. Serial No. 297,474.

To all whom it may concern:

Be it known that I, LEWIS WARRINGTON CHUBB, a citizen of the United States, and a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Means for Producing High Voltage, of which the following is a specification.

My invention relates to means for producing high voltage and it has particular relation to means for producing high unidirectional voltage such as is adapted for use in precipitating apparatus, ozonizers and the like.

In order to obtain unidirectional high voltage, it has been customary in the past to generate alternating-current voltage, transform the same to a high value and thereafter rectify to a direct-current voltage by the employment of hot-cathode converters or mechanical rectifiers of the lamp type. Such methods require extremely careful insulation of all of the alternating-current high-voltage apparatus and also involves the use of many separate units to produce the desired result, as well as having other serious defects, all of which are well known to those skilled in the art.

Another method of obtaining a high direct-current voltage which has been proposed contemplates the individual charging of any suitable energy-storing and restoring devices and then connecting these devices in series and discharging them through a consumption device, thereby obtaining a relatively high unidirectional voltage. I am aware that, in the past, systems of this kind have been proposed in which suitable switches were used to first place each individual energy-storing means in charging relation to a low-voltage source of energy, thereafter so operating as to connect the entire number of energy-storing means in series with the device which it was desired to supply with the high voltage and finally causing their discharge through the same.

In none of the systems contemplated in the prior art, however, has provision been made for continuously supplying a unidirectional high voltage to the desired consumption device after such voltage has been obtained by suitable multiplication from a low-voltage source. In all of the systems with which I am familiar, there is more or less interruption in the supply of the high voltage to the consumption device, and it is obvious that, in apparatus which requires continuous operation for the most beneficial results, such a method of supplying high voltage is extremely inefficient in operation.

This is particularly true in precipitating apparatus wherein the material which is suspended in the gas passing through the treating chamber should be continuously subjected to a high voltage to insure satisfactory results. For instance, in precipitating apparatus in which the fumes are treated to extract therefrom such valuable constituents as may have become suspended therein during smelting operations or the like, it is obvious that any cessation, even for a small interval of time, in the supply of operating voltage to the electrodes of the treating chamber and the consequent absence of corona discharge therein, will result in an appreciable amount of the suspended matter escaping from the treating chamber and the constituents contained therein being lost. Moreover, the corona, when obtained by an intermittent voltage, has either an instantaneous maximum density sufficient to cause a spark in the treating chamber or so low an average value of current that the suspended particles will not be effectively precipitated.

One object of my invention, therefore, is to provide a system in which energy-storing and restoring units of relatively low breakdown voltage and high capacitance are connected in series and are charged one at a time from a suitable low-voltage source in order to supply a unidirectional high voltage to the desired consumption apparatus and, moreover, to so construct a system of the designated character, that the supply of unidirectional voltage to the point of consumption will be continuous in all respects, even though it may be necessary to momentarily interrupt the supply of low voltage to the individual units.

In order to more fully understand my invention, reference may be had to the accompanying drawing, in which Fig. 1 is a diagrammatic illustration of a high-voltage producing system and the manner in which

the connections are made; and Fig. 2 is a diagrammatic view of a modification of a system of the character shown in Fig. 1.

Referring now more particularly to Fig. 1, a low-voltage source of energy is diagrammatically indicated at 1, while a consumption device 2 requires a unidirectional high voltage for satisfactory operation. A voltage-multiplying means 3 is disposed between the low-voltage source 1 and high voltage consumption device 2 and comprises a plurality of energy-storing and restoring units 4, here shown, for purposes of illustration, as condensers, which are connected in series. Extending between every two adjacent condensers are connections 5, terminating in circumferentially-disposed terminals 6—6. A rotary contacting device 7 comprises two terminal members 8 and 9 which are so positioned, with respect to the terminals 6—6, that any two of the same may be bridged when the device 7 is in a predetermined position. In the figure, I have shown the device 7, in full lines, as contacting with two of the terminals 6 at the left-hand of the figure, while, in dotted lines, is illustrated the position which it will occupy after it has been rotated, by suitable means, through approximately 180°.

The terminal members 8 and 9 are mounted at the ends of arms 10 and 11 which are formed of conducting material and are connected to, and carried by, slip rings 12 and 13, respectively. Brushes 14 and 15 bear upon the rings 12 and 13, respectively, and serve to connect the leads from the source of energy 1 to the continuously rotating contact terminals 8 and 9.

The rotation of the device 7 may be accomplished through the medium of a pulley 16, a belt 17, and any suitable operating means, here shown as a motor 18.

In the accompanying description of the operation of my invention, it will be observed that all of the condensers 4 are connected in series with the consumption device 2 and that the low-voltage source of energy is connected, through the slip rings 12 and 13, to the contacting terminals 8 and 9 carried on the device 7.

Assuming that the device is in the position shown in the full lines, the low-voltage source of energy will charge the energy-storing device 4 to its full voltage. As the contacting member 7 rotates in the direction indicated by the arrow, it will come successively into contact with the remaining energy-storing units which are distributed in a circumferential manner and, therefore, as contact is made with each pair of terminals, the associated condenser will be charged. After an entire revolution has been made, the contacting device 7 will repeat the above cycle of operations, and it is thus apparent that the condensers 4 are continuously charged in consecutive relation with a voltage equal to that of the low-voltage source of energy. Moreover, it will be observed that the distance between the last terminal 6 and the first one which the contactor was assumed to be touching is greater than the distance between the terminals 8 and 9 and, therefore, in passing from the last condenser of the series to the first unit thereof, the contacting device 7 cannot bridge the two terminals which are connected across the consumption device 2,

Although I have described the condenser units as being consecutively charged with a low voltage, it will be observed that the consumption device 2 is continuously connected across the entire series-connected plurality of condenser units and, therefore, is being continuously supplied with the additive voltage of the set of condensers. It is obvious that such operation is of extreme benefit in cases, such as have been above set forth, where a continuous unidirectional high voltage is required for satisfactory operation.

While I have illustrated but eleven condenser units as connected in series, it is obvious that the number is dictated solely by the amount of voltage required in the consumption device and the amount available at the source of energy. Moreover, it is apparent that any suitable contacting device may be substituted for the one shown at 7 as long as the desired operation, as above indicated, is obtained therewith, namely, the consecutive charging of each of the condenser units while the entire number is maintained in continuous series connection with the consumption device. It is also apparent that any other method of charging the series units, such as by oscillating rather than rotating the device 7, could be used.

Referring now to Fig. 2, a modification of the contacting device 7, adapted for use when the low-voltage source comprises a secondary coil of a relatively low-voltage jump-spark induction coil is shown.

A spark coil 19, comprises a primary or low-voltage coil 20 and a secondary high-voltage coil 21. The low-voltage primary coil 20 is energized from any suitable source, such, for instance, as a battery 22. The shaft to which the contacting device 7 is secured carries a star wheel 23 having as many "make-and-break" projections 23*a* thereupon as there are condensers 4 in the series-connected system of condensers, there being the necessary spacing between two of the teeth to allow for the space between the first and last contact terminals 6. These projections are adapted to open the primary curcuit of the spark coil 19 at the instant the contacting device 7 has its terminals disposed opposite to the terminals 6—6 and, therefore, a high voltage will be generated

in the secondary member 21, and a spark will pass across the terminal points 8—9 and 6—6 and charge the condenser. If the projections on the star wheel 23 are adjusted so that each of the condensers is charged in a like manner, it is apparent that a spark coil may be used as the low-voltage source of energy and, in some cases, this may be extremely desirable since, where only a small amount of power is necessary in the consumption device, such voltage of relatively high value may be used for the source, and this will result in a reduction of the number of energy-storing units which it is necessary to place in series.

Furthermore, I find that, at times, it is advantageous to employ a high-tension magneto as the source of energy.

It will be noted, in the above description, that I have not limited my low-voltage source to a direct-current device, and, in many cases, it will be desirable to use an alternating-current source of energy. The method of operation when a low-voltage alternating-current source is employed, together with the specific system and apparatus for practicing the same, is more fully described and specifically claimed in a copending application of Chester T. Allcutt, Serial No. 297,487, filed May 16, 1919, and assigned to the Westinghouse Electric & Manufacturing Company.

I have outlined, in the foregoing description, a system of "step-up" transformation, but it is obvious that my invention may be utilized with equal advantage in a "step-down" system.

While I have described but one embodiment of my invention, it is obvious that many modifications therein may occur to those skilled in the art, and I desire, therefore, that the appended claims shall be interpreted broadly, and be limited only by the showing of the prior art or by restrictions placed thereupon in this specification.

I claim as my invention:

1. The combination with a source of energy adapted to be intermittently active, and a unidirectional consumption device, of a plurality of energy-storing and restoring units connected in series, terminal members connected between said units, a contact device connected to said source and adapted to bridge two of said terminals at one time, means for rotating said contact device to connect said energy-storing and restoring units to said source, means associated with said rotative means for making said source active only during the time that two of said terminals are bridged, and means for connecting said consumption device in series with said plurality of units whereby it is continuously supplied with unidirectional energy.

2. The combination with a plurality of energy-storing and restoring units, of an inductive device having a low-voltage winding and having a high-voltage winding adapted for successive connection to said units, and means for intermittently interrupting the circuit of the low-voltage winding of said inductive device.

3. The combination with a plurality of energy-storing and restoring units connected in series relation, of an induction coil having two windings one winding being adapted for consecutive connection to said units, and means for intermittently interrupting the circuit of the other winding of said coil.

4. The combination with a plurality of energy-storing and restoring units connected in series relation, of an induction coil having a primary winding and having a secondary winding adapted for consecutive connection to said units, and means for regularly interrupting the circuit of the primary winding of said coil within predetermined limits.

5. The combination with a plurality of energy-storing and restoring units, of an induction coil having a low-voltage winding and having a high-voltage winding adapted for successive connection to said units, and means responsive to such connections for interrupting the low-voltage winding of said coil.

6. The combination with a plurality of energy-storing and restoring units connected in series relation, of an inductive device having two windings one winding being adapted for successive connection to said units, and means for interrupting the circuit of the other winding of said device concurrently with such connections.

7. The combination with a plurality of energy-storing and restoring units connected in series relation, of an induction coil having a primary winding and having a secondary winding adapted for consecutive connection to said units, and means actuated in accordance with such connections for interrupting the circuit of the primary winding of said coil.

8. The combination with a plurality of energy-storing and restoring units connected in series relation, of a source of energy for successively charging said units and means comprising an induction coil for rendering said source active only at predetermined intervals in rapid succession to produce a resultant voltage of momentary high value.

9. The combination with a plurality of energy-storing and restoring units connected in series relation, of a source of energy for successively charging said units and means comprising an induction coil and a timing device for rendering said source active only at predetermined intervals.

10. The combination with a plurality of energy-storing and restoring units connected

in series relation, of a source of energy for successively charging said units and means comprising an induction coil and a make-and-break device for rendering said source active only at predetermined intervals.

11. The combination with a source of energy adapted to be intermittently active, of a plurality of energy-storing and restoring units, terminal members connected between said units, means for connecting said source to successive pairs of said terminal members, and means associated with said connecting means for rendering said source active only during the time that a pair of said terminal members are bridged.

12. The combination with a source of energy adapted to be intermittently active, of a plurality of energy-storing and restoring units, terminal members connected between said units, a rotatable contact device connected to said source and adapted to bridge successive pairs of said terminal members, an induction coil having its two windings interposed between said source and said device, and means for interrupting the circuit of one winding of said coil in accordance with the degree of rotation of said device.

13. The combination with a source of energy adapted to be intermittently active, of a plurality of energy-storing and restoring units, terminal members connected between said units, a rotatable contact device connected to said source and adapted to bridge successive pairs of said terminal members, an induction coil having its two windings interposed between said source and said device, a timing mechanism rotatable with said contact device and adapted to interrupt the circuit of one winding of said coil when a pair of said terminal members are bridged by said device.

14. The combination with a source of energy adapted to be intermittently active, of a plurality of energy-storing and restoring units connected in series relation, terminal members connected between said units, a rotatable contact device connected to said source and adapted to bridge consecutive pairs of said terminal members, an induction coil having its high-voltage coil connected to said device and its low-voltage coil connected to said source, a timing mechanism rotatable with said device and adapted to interrupt the circuit of said low-voltage coil when a pair of said terminal members are bridged by said device.

In testimony whereof, I have hereunto subscribed my name this 14th day of May 1919.

LEWIS WARRINGTON CHUBB.