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L. W. CHUBB

MEANS FOR PRODUCING HIGH VOLTAGE

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Fig. 1.

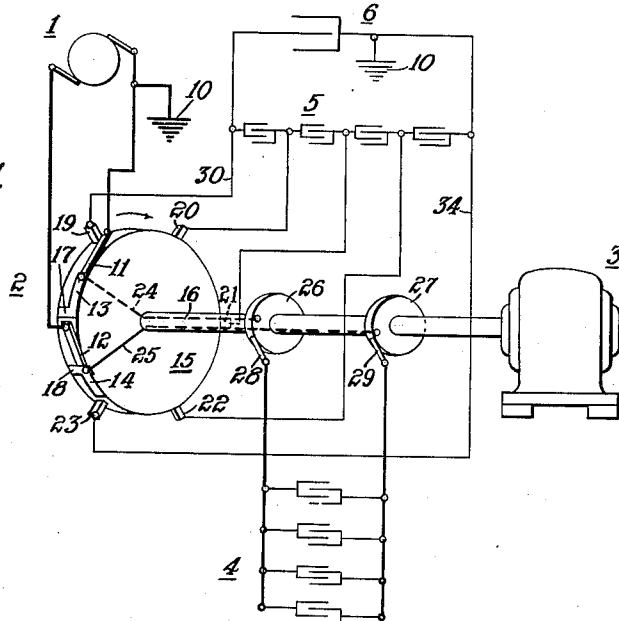


Fig. 2.

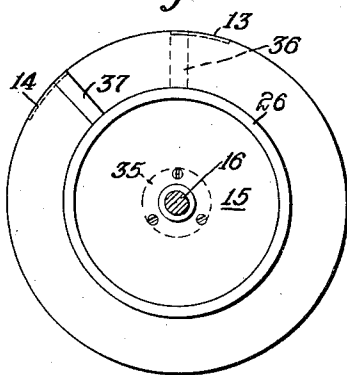


Fig. 3.

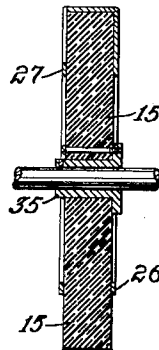
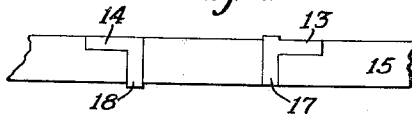


Fig. 4.



WITNESSES:

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MEANS FOR PRODUCING HIGH VOLTAGE.

Application filed January 20, 1921. Serial No. 438,671.

To all whom it may concern:

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

My invention relates to means for producing high voltages and it has special relation to the production of high unidirectional voltages, such as are adapted for use in precipitating apparatus, ozonizers, X-ray tubes, radio communication, and the like.

In the prior art, various devices have been proposed embodying a series of condenser units and rotatable charging apparatus therefor, whereby a relatively low initial voltage may be converted to a desirably high value. Such apparatus has been of particular value in connection with precipitating apparatus. However, one side of this type of apparatus is usually grounded and this fact has precluded the permissibility of a ground of either terminal of the initial voltage-generating apparatus. Consequently, such systems have often required considerable maintenance, or have entailed material loss through shut-down.

One object of my invention, therefore, is to provide a method and system of the above-indicated character, wherein the generator apparatus may be permanently grounded without danger to the apparatus and without effecting the reliability thereof.

More specifically stated, it is the object of my invention to provide an energy-storing means of relatively large capacity, such as a bank of parallel-connected condensers, which is intermittently connected to a low-voltage generator, and after disconnection from the generator, the storage means is successively connected to a series of energy-storing and restoring units, such as condensers, whereby the desired high unidirectional voltage is secured.

Other and more specific objects of my invention will become evident from the following detailed description, taken in conjunction with the accompanying drawing,

Figure 1 of which is a diagrammatic view

of a system organized in accordance with my present invention; and

Figs. 2, 3 and 4 are detailed views, in side elevation in transverse section, and in plan development, respectively, of a preferred form of construction of a portion of the apparatus that is shown in Fig. 1.

Referring to Fig. 1, the system here shown comprises a relatively low-voltage generator 1 of any well-known type, which is associated with a rotatable charging apparatus 2 that is driven by an electric motor 3 for the purpose of charging an energy-storing means of relatively large capacity, such as a bank of parallel-connected condensers 4. A plurality of series-connected energy-storing and restoring units, such as condensers 5, are adapted, through the agency of the charging apparatus 2, to be successively connected to the storage means 4, as subsequently described in detail, to impress and maintain a relatively high unidirectional voltage upon any desired consumption circuit, such as a precipitating apparatus 6.

It will be noted that one terminal of the generator 1 and also one terminal of the precipitating apparatus 6, are grounded, as indicated at 10. My present system is designed to permit of this novel arrangement, since the generator 1 is never directly in circuit with the precipitating apparatus 6. On the other hand, the generator 1 charges the storage means 4 and is then disconnected therefrom before the storage means successively discharges portions of its energy into the series-connected condenser units 5. Consequently, although the storage means 4 must be insulated from ground, the cost of such construction, compared with the cost of suitably insulating all coils and other parts of the generator from ground, is comparatively small, and I am thus enabled to provide a relatively inexpensive, although thoroughly reliable, system of the class set forth.

The rotatable charging apparatus 2 is diagrammatically illustrated as comprising a plurality of brushes 11 and 12 which are respectively connected to the terminals of the generator 1 and bear upon elongated contact segments 13 and 14 which are located near one peripheral edge of a rotatable disk

or cylinder 15 of insulating material. The disk 15 is rigidly mounted upon a suitable shaft 16 which, in turn, is directly, or otherwise suitably, coupled to the driving electric motor 3.

The contact segments 13 and 14 are provided, at their confronting ends, with laterally projecting lugs or ears 17 and 18, respectively, for the purpose of engaging, in pairs, a plurality of suitable brushes or terminal members 19 to 23, inclusive. These brushes are equally spaced around the periphery of the disk 15, with the exception that an arcuate distance of double the length between brushes, such as 19 and 20, is left between the brushes 23 and 19, whereby the generator-connected brushes 11 and 12 may suitably function, as hereinafter described in detail.

Although I have illustrated only five delivery brushes 19 to 23, inclusive, for connection to a series of four condenser units designated at 5, it will be understood that any suitable number of brushes and a corresponding number of condenser units may be employed to obtain any desired high voltage.

In the event of employing the illustrated five delivery brushes, the spacing thereof is substantially 60 degrees apart, 120 degrees being left between the brushes 19 and 23, as previously mentioned. The portions 17 and 18 of the rotatable contact segments 13 and 14 are thus also located substantially 60 degrees apart, whereby the two portions 17 and 18 may successively engage the pairs of brushes 19 and 20, 20 and 21, etc. The generator-connected brushes 11 and 12 bear upon the elongated contact segments 13 and 14, whereby a relatively long period of time is allowed for the complete charging of the storage means 4. Since the elongated contact segments 13 and 14 are located near one edge of the disk 16, while the lateral portions 17 and 18 are located near the other edge of the disk, there is no interference between the delivery brushes 19 to 23, inclusive, and the elongated segments 13 and 14.

For the purpose of connecting the contact segments 13 and 14 to the storage means 4, a plurality of suitable conductors 24 and 25 are connected to slip-rings 26 and 27, respectively, that are rigidly mounted upon, and insulated from, the driving shaft 16. Suitable brushes 28 and 29 bear upon the slip-rings 26 and 27 and are connected to the terminals of the circuit including the parallel-connected condensers 4.

The initial delivery brush 19 is connected, through conductor 30, to the common left-hand terminal of the series condenser circuit 5 and of the precipitation apparatus 6, while the last delivery brush 23 is connected, through conductor 34, to the remaining terminals of the two sets of appara-

tus. The intervening brushes 20, 21 and 22 are connected to points intermediate the respective pairs of condenser units 5.

The operation of my system may be briefly set forth as follows, rotation being considered as clockwise, as indicated by the arrow: Upon initial connection of the brushes 11 and 12 to the contact segments 13 and 14, as illustrated, energy from the generator 1 is transferred, through the slip-rings 26 and 27, to the storage means 4, and the charging operation continues for a relatively long period, depending upon the selected length of the contact segments 13 and 14. The storage means 4 is thus as heavily charged as may be desired.

After the brushes 11 and 12 have become disengaged from the contact segments 13 and 14, so that the generator 1 is no longer connected in circuit, the segment portions 17 and 18 come into contact with the brushes 19 and 20 to connect the left-hand condenser unit 5 to the storage means 4 for a short period of time. The segment portions 17 and 18 then pass on to subsequently engage the brushes 20 and 21, whereby the second condenser unit 5 in the series is charged. This operation is repeated until all condenser units of the set 5 are fully charged to maintain the desired high unidirectional voltage upon the precipitation apparatus 6. The contact segments 13 and 14 then again come into contact with the generator-connected brushes 11 and 12, whereby another charge is supplied to the storage means 4, which charge is consecutively distributed over the condenser units 5.

The desired high voltage may thus be maintained by reason of the continuous charging and discharging operations of the storage means 4, and such operations are maintained without any danger by reason of the permanent grounding of both the generator and the precipitator circuit.

Figs. 2, 3 and 4 provide a more accurate idea of the preferred relatively compact form of the rotative charging apparatus 2. The insulating disk 15 is provided with a central hub or sleeve 35 which may be rigidly secured to the driving shaft 16. The elongated contact segments 13 and 14 may be directly connected, by end-face strips 36 and 37, to annular members or rings 26 and 27 that are located on the opposite sides or faces of the disk 15, these rings serving as slip-rings upon which the brushes 28 and 29 may bear. In this way, a relatively compact and reliable structure is provided.

It will be seen that, by my invention, the production of a relatively high unidirectional voltage is maintained by employing a charging generator, a series of energy-storing and restoring units that are connected across the precipitating apparatus, and an intervening storage means of high capacity

which is alternately charged from the generator and fractionally discharged into the circuit comprising the series-connected condenser units 5. By this construction, permanent grounds of both the generator and the precipitating circuits may be maintained without affecting the operation of the system and to secure the previously-mentioned other advantages.

10 It should be noted that, while I have shown my apparatus in a simplified form for the sake of clearness, in practice it may be advisable to reduce the brush friction load and thus decrease the necessary size of the driving motor 3.

15 The only brushes bearing on the periphery of the large disk 15 will be those corresponding to the energy-storing device 4. All other brushes will make contact with slip-rings of relatively small diameter mounted on the shaft 16, thus materially reducing the driving friction in case a large number of condenser units 5 and corresponding brushes are used. The necessary electrical connections will be made by means of conductors, connected between the various slip-rings and suitable contact segments on the periphery of the disk 15 for co-operating with the brushes corresponding to the device 4.

20 Furthermore, by employing the arrangement shown in my copending application, Serial No. 428,984, filed Dec. 7, 1920, it is possible to use an alternating-current source of energy in lieu of the illustrated generator 1.

30 I do not wish to be restricted to the specific circuit connections, structural details, or arrangement of parts herein set forth, as various modifications thereof may be made without departing from the spirit and scope of my invention. I desire, therefore, that only such limitations shall be imposed as are indicated in the appended claims.

I claim as my invention:

45 1. The combination with a low-voltage source and a high-voltage unidirectional consumption device, of a plurality of energy-storing and restoring units connected in series relation, a rotatable member, a plurality of terminal members connected between said units and located near one side of said rotatable member, a plurality of contact members connected to the terminals of

said source and located near the other side of said rotatable member, a plurality of segments having portions adapted for engaging said contact members and subsequently engaging adjacent pairs of said terminal members, an energy-storing device, and a plurality of slip-rings for connecting the respective segments to the terminals of said energy-storing device.

2. The combination with a low-voltage source and a high-voltage unidirectional consumption device, of a plurality of energy-storing and restoring units connected in series relation, a rotatable member, a plurality of terminal members connected between said units and located near one side of said rotatable member, a plurality of contact members connected to the terminals of said source and located near the other side of said rotatable member, a plurality of segments having elongated portions adapted for engaging said contact members and relatively short portions for subsequently engaging adjacent pairs of said terminal members, an energy-storing device comprising a plurality of parallel-connected elements, and a plurality of slip-rings for connecting the respective segments to the terminals of said energy-storing device.

3. The combination with a low-voltage source and a high-voltage unidirectional consumption device, of a plurality of energy-storing and restoring units connected in series relation, a rotatable member, a plurality of terminal members connected between said units and located near one side of said rotatable member, a plurality of contact members connected to the terminals of said source and located near the other side of said rotatable member, a plurality of segments having portions adapted for engaging said contact members and subsequently engaging adjacent pairs of said terminal members, an energy-storing device, a plurality of slip-rings for connecting the respective segments to the terminals of said energy-storing device, and means for grounding one terminal of said source, and one terminal of the series circuit of said units.

In testimony whereof, I have hereunto subscribed my name this 11th day of January 1921.

LEWIS WARRINGTON CHUBB.