

C. E. SKINNER.
VOLTAGE REGULATOR.
APPLICATION FILED NOV. 13, 1902.

NO MODEL.

Fig. 1.

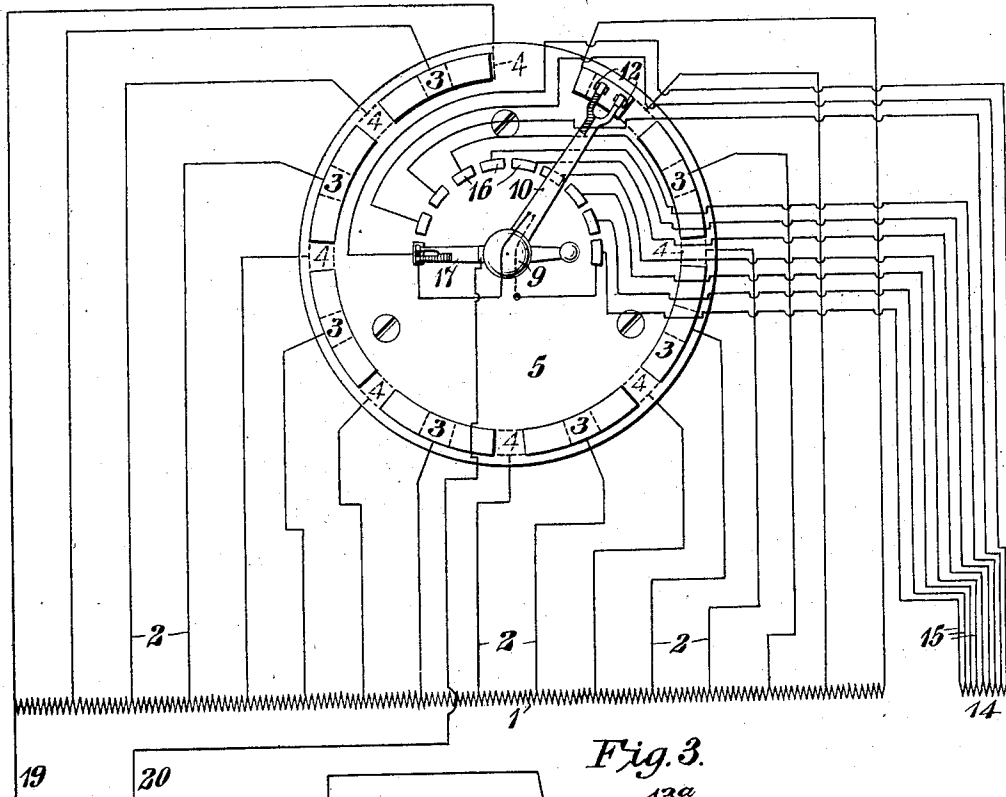
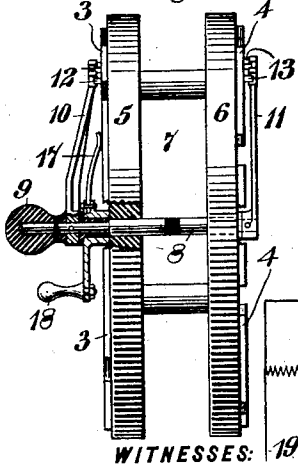


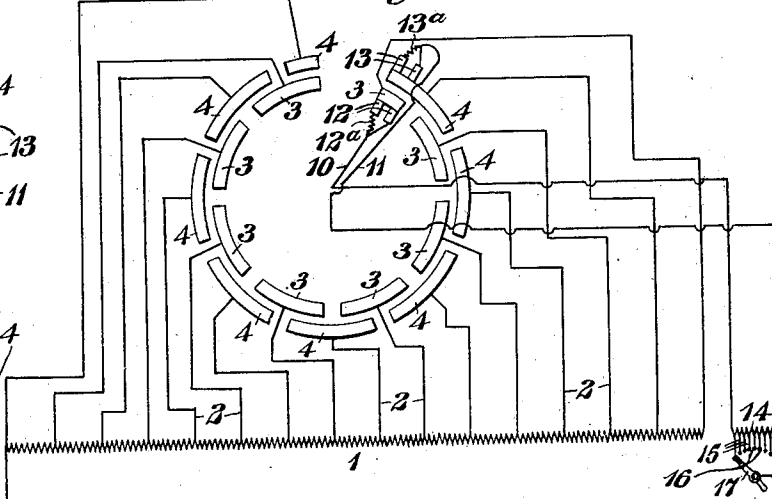
Fig. 2.



WITNESSES: 19

C. L. Belcher
J. C. Morse.

Fig. 3.



INVENTOR 20
Charles E. Skinner
BY
Haley & Co.
ATTORNEY.

UNITED STATES PATENT OFFICE.

CHARLES E. SKINNER, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

VOLTAGE-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 734,438, dated July 21, 1903.

Application filed November 13, 1902. Serial No. 131,131. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. SKINNER, a citizen of the United States, and a resident of Wilksburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Voltage-Regulators, of which the following is a specification.

My invention relates to apparatus for raising and lowering the voltage of alternating-current circuits; and it has for its object to provide a means for this purpose which shall so operate to effect the voltage adjustment uniformly and by small steps, and thus avoid injury to the contact-terminals and static strains upon the insulation of the apparatus which might result from the making and breaking of the circuit if the difference in voltage between successive breaks were considerable.

In the accompanying drawings, Figure 1 is a view, mainly diagrammatic in character, illustrating my invention; and Fig. 2 is a view, partially in side elevation and partially in section, of the switching devices shown in Fig. 1. Fig. 3 is a simplified diagram of the circuits.

My invention contemplates the employment of a main transformer one of the windings of which has a plurality of leads preferably equally spaced and extending therefrom to a series of contact-terminals and an auxiliary winding which also has leads extending therefrom to a suitable switching device and which has its end terminals connected to contact devices for making engagement with the contact-terminals of the main transformer-winding.

As illustrated in the drawings, the winding 1, which may be either the primary or the secondary winding of the main transformer or the single winding of an autotransformer, is provided with leads 2, here shown as equally spaced apart, though they might be unequally spaced, if desired. The leads 2 are alternately connected to contact-terminals 3 and 4, which, as here indicated, are arranged in two sets and mounted upon separate dial-plates 5 and 6, though they might, of course, be mounted upon the same surface.

The two dial-plates are indicated as fastened

together, so as to constitute a supporting-frame 7, and in this frame is journaled a shaft 8, having an operating-handle 9 at one end and having fastened to it arms 10 and 11, which are respectively provided with contact-terminal shoes 12 and 13. These shoes respectively make engagement with the stationary contact-terminal pieces 3 and 4, and each is made in two parts which are insulated from each other. The contact-terminal pieces comprised in the sets 3 and 4 are so disposed as to alternate in position and to overlap, so that the contact-shoe 13 makes engagement with each contact-piece of the set 4 while the shoe 12 is in engagement with the preceding contact-piece in the set 3 and so that it remains in contact with a given contact-piece while the shoe 12 passes from the preceding to the succeeding contact-piece of its set. While the circuit may or may not be opened when the shoes 12 and 13, respectively, pass from one contact-piece to the next in the series, I prefer to avoid opening the circuit by so proportioning the shoes that they will bridge the spaces between contact-pieces and to connect the two parts of shoe 12 by a preventive resistance 12^a and the two parts of the shoe 13 by a like resistance 13^a, as indicated in Fig. 3.

The arms 10 and 11 and their shoes 12 and 13 are permanently connected to the end terminals of an auxiliary transformer-winding 14, this winding being preferably adapted to the same voltage as is the section of the main transformer-winding, which is included between each two adjacent leads 2 and being subdivided by equally-spaced leads 15, which extend to contact-terminal pieces 16 on the dial-plate 5, this dial-plate being provided with a movable arm 17, which, as shown, is pivotally supported by the shaft 8 and has an operating-handle 18, so that its contact end may be moved over the contact-pieces 16 to cut the winding 14 progressively into and out of circuit.

The main circuit the voltage of which is to be varied by this apparatus has one side, 19, connected to one terminal of the main transformer-winding 1 and the other side, 20, connected to the switch-arm 17, as indicated.

The operation of the apparatus is as follows:

lows: Assuming that the arms 10 and 11 are in such positions that the entire winding 1 of the main transformer is in circuit and it is desired to reduce the voltage by decreasing the active length of the said winding, the arm 17 will be so placed that the conductor 20 may be connected directly to that half of the contact-shoe 12 which is in engagement with the first stationary contact-piece of the set, the corresponding half of the shoe 13 being out of engagement with the corresponding contact-piece of its set. The arms 10 and 11 may then be moved in clockwise direction by means of the operating-handle 9 until that half of the shoe 13 which is directly connected to one terminal of the winding 14 is brought into engagement with the first stationary contact-piece of its set, when the first section or division of the main transformer-winding will be connected in parallel with the winding 14 of the auxiliary transformer, the resistance and voltage of the circuit being the same as before the movement of the regulator-arms. The arm 17 may now be moved step by step from the terminal piece 16 corresponding to the arm 10 to that corresponding to the arm 11, thus gradually reducing the resistance and voltage until when the terminal piece 16 corresponding to the arm 11 is reached the voltage will be reduced by an amount corresponding to one section of the winding 1. The arms 10 and 11 may now be moved another step to bring the contact-shoe 12 into engagement with the second contact-piece of the corresponding set 3, the shoe 13 remaining in contact with the first contact-piece of its set 4 and the arm 17 remaining as it was. In this position the winding 14 will be in parallel with the second division of the main transformer-winding and the resistance and voltage will be the same as before the last-described movement of the arms 10 and 11. The arm 17 may now be gradually moved step by step until it is in engagement with the contact-piece 16 corresponding to the shoe 12, when the two sections of the main transformer-winding will be out of circuit and the resistance and voltage will be correspondingly reduced. This operation may be repeated until the voltage is reduced the amount desired, the operation being the same as that just described. In raising the voltage the operative steps will be the same except that the arms 10 and 11 will move in the opposite direction to that above described.

It will be seen that with this construction and arrangement of apparatus the desired variations in voltage are effected by minute

steps, and not only is the adjustment effected in a satisfactory manner, but dangers to the apparatus by reason of abrupt changes of the voltage of considerable degree are avoided.

As heretofore indicated, the switching apparatus may be varied within wide limits as to structure and relative arrangement of the parts, the apparatus shown being merely indicative of any suitably-operative means for effecting the desired result.

I claim as my invention—

1. In a voltage-regulator, the combination with a main transformer having a winding provided with leads extending from different points thereof, of a set of contact-terminals to which said leads are severally connected, a pair of contact-terminals arranged to make successive contact with the terminals of said set, an auxiliary transformer having a winding provided with leads extending from different points thereof and having its ends connected to said pair of contact-terminals, a set of contact-terminals to which said leads are severally connected and a movable contact-terminal adapted to make successive engagement with the terminals of said last-named set and connected to one side of the main circuit, the other side of said circuit being connected to one terminal of the main transformer-winding.

2. In a voltage-regulator, the combination with a main transformer having a winding provided with leads extending from different points thereof, of a set of contact-terminals to which said leads are severally connected, a pair of contact-terminals arranged to make successive contact with the terminals of said set, an auxiliary transformer having a winding adapted to the same voltage as one division of the main transformer-winding and provided with leads extending from different points thereof and having its ends connected to said pair of contact-terminals, a set of contact-terminals to which said leads are severally connected and a movable contact-terminal adapted to make successive engagement with the terminals of said last-named set and connected to one side of the main circuit, the other side of said circuit being connected to one terminal of the main transformer-winding.

In testimony whereof I have hereunto subscribed my name this 31st day of October, 1902.

CHARLES E. SKINNER.

Witnesses:

JAMES B. YOUNG,
BIRNEY HINES.