

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

NO MODEL.

Fig. 1.

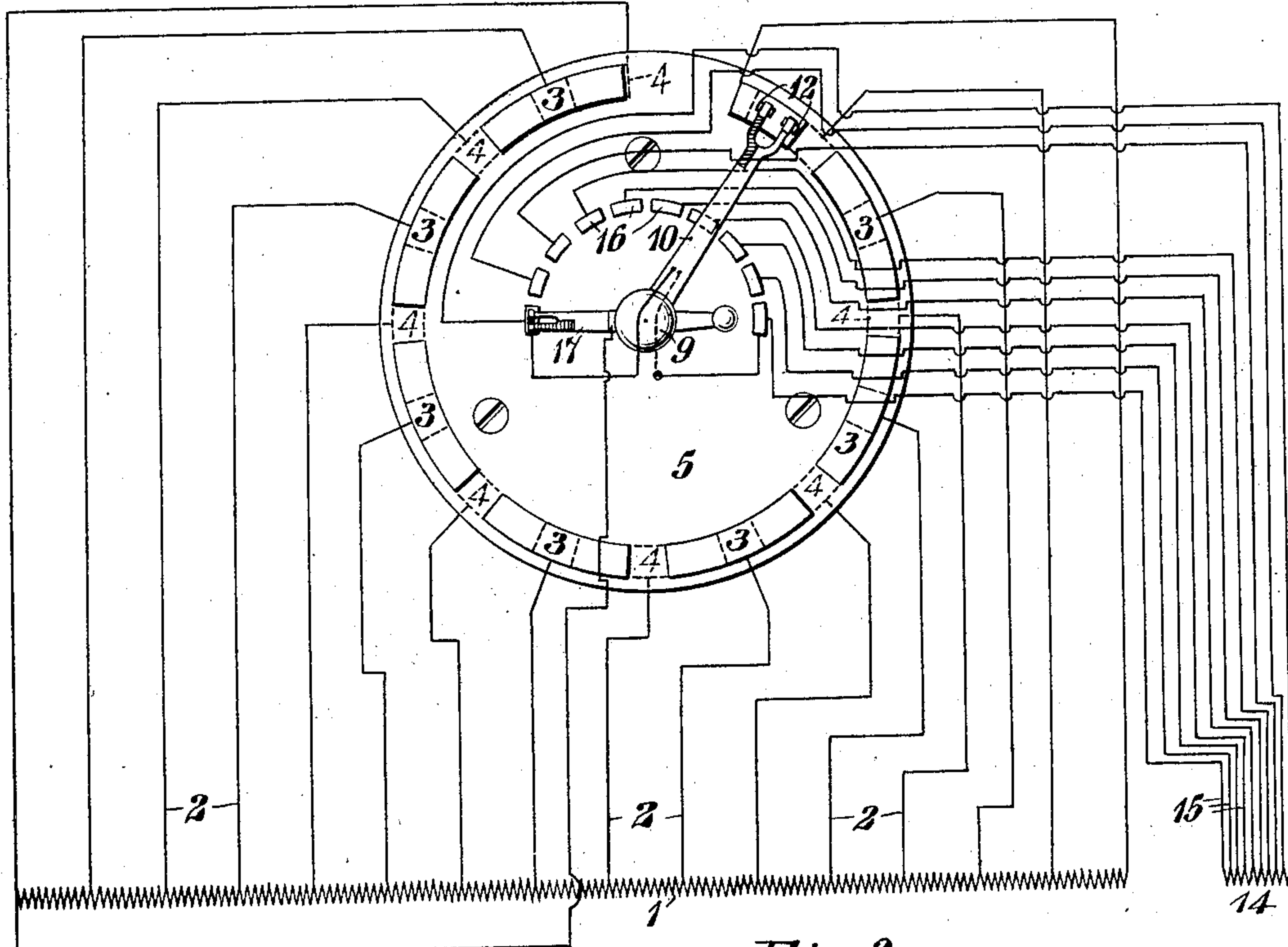


Fig. 3.

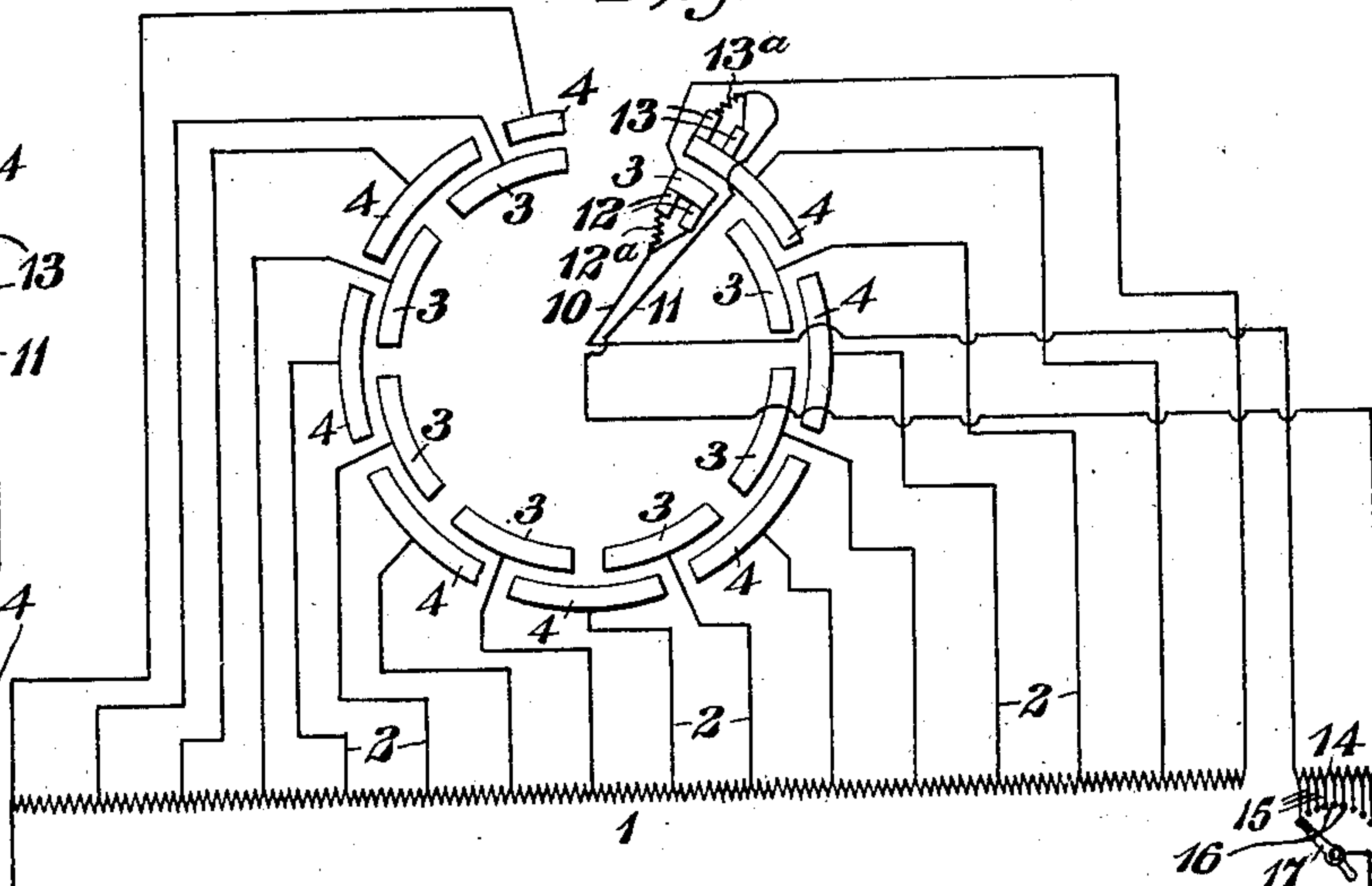
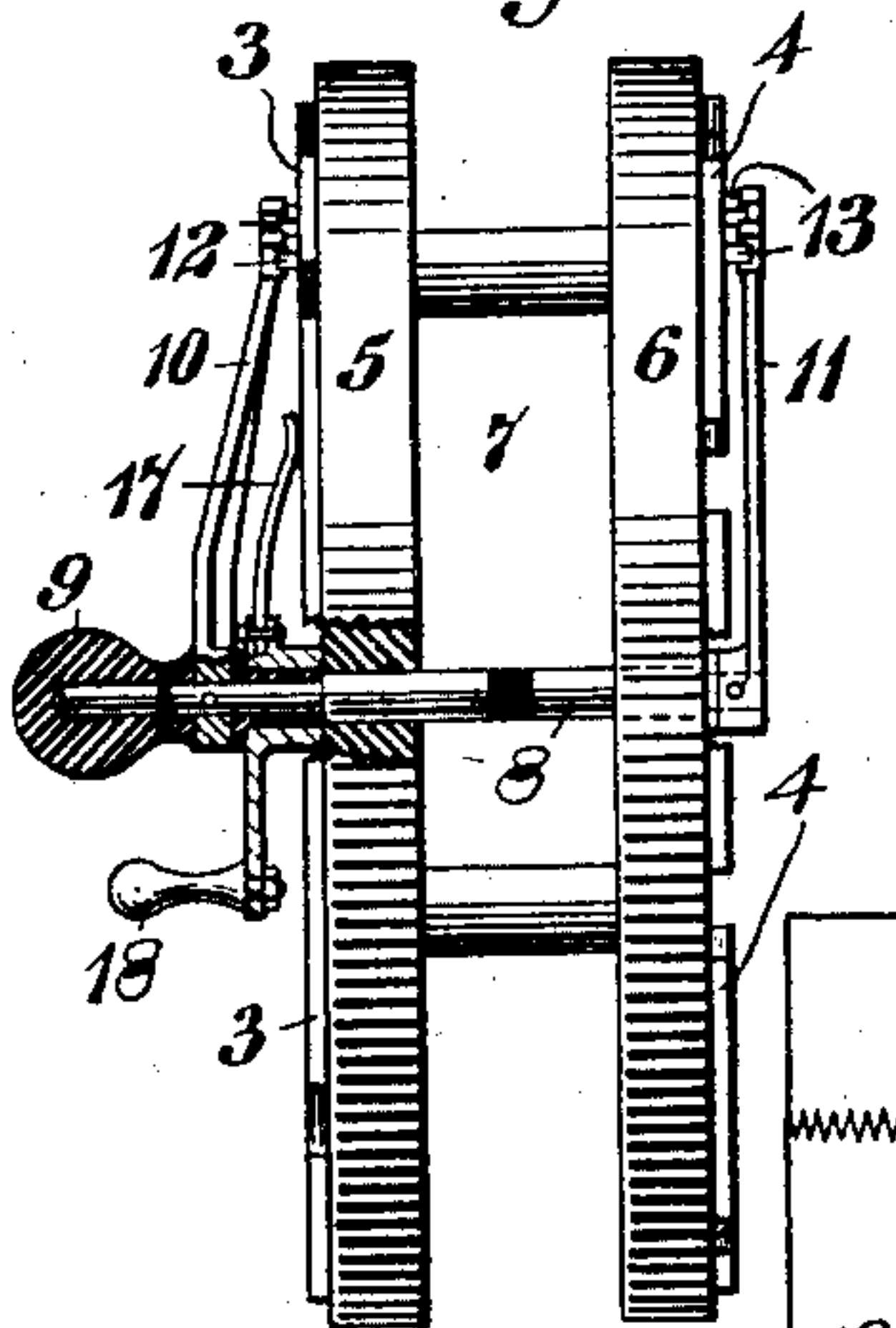


Fig. 2.



WITNESSES: 19

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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 Wilkinsburg, 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
 5 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
 10 set, the corresponding half of the shoe 13 be-
 ing out of engagement with the correspond-
 ing contact-piece of its set. The arms 10 and
 11 may then be moved in clockwise direc-
 15 tion by means of the operating-handle 9 until
 that half of the shoe 13 which is directly con-
 nected to one terminal of the winding 14 is
 brought into engagement with the first sta-
 tionary contact-piece of its set, when the first
 20 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 be-
 ing the same as before the movement of the
 25 regulator-arms. The arm 17 may now be
 moved step by step from the terminal piece
 16 corresponding to the arm 10 to that cor-
 responding to the arm 11, thus gradually re-
 ducing the resistance and voltage until when
 30 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 con-
 35 tact-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 re-
 maining as it was. In this position the wind-
 40 ing 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
 45 in engagement with the contact-piece 16 cor-
 responding to the shoe 12, when the two sec-
 tions of the main transformer-winding will
 be out of circuit and the resistance and vol-
 tage will be correspondingly reduced. This
 50 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
 55 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 effect- 60
 ed 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 ap- 65
 paratus may be varied within wide limits as
 to structure and relative arrangement of the
 parts, the apparatus shown being merely in-
 dicative of any suitably-operative means for
 effecting the desired result. 70

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 75
 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 wind- 80
 ing provided with leads extending from dif-
 ferent points thereof and having its ends con-
 nected to said pair of contact-terminals, a set
 of contact-terminals to which said leads are
 severally connected and a movable contact- 85
 terminal adapted to make successive engage-
 ment with the terminals of said last-named
 set and connected to one side of the main cir-
 cuit, the other side of said circuit being con-
 nected to one terminal of the main trans-
 former-winding. 90

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 95
 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 wind-
 ing adapted to the same voltage as one di- 100
 vision 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 con-
 tact-terminals to which said leads are sever- 105
 ally connected and a movable contact-termi-
 nal 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. 110

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

CHARLES E. SKINNER.

Witnesses:

JAMES B. YOUNG,
 BIRNEY HINES.