

June 17, 1924.

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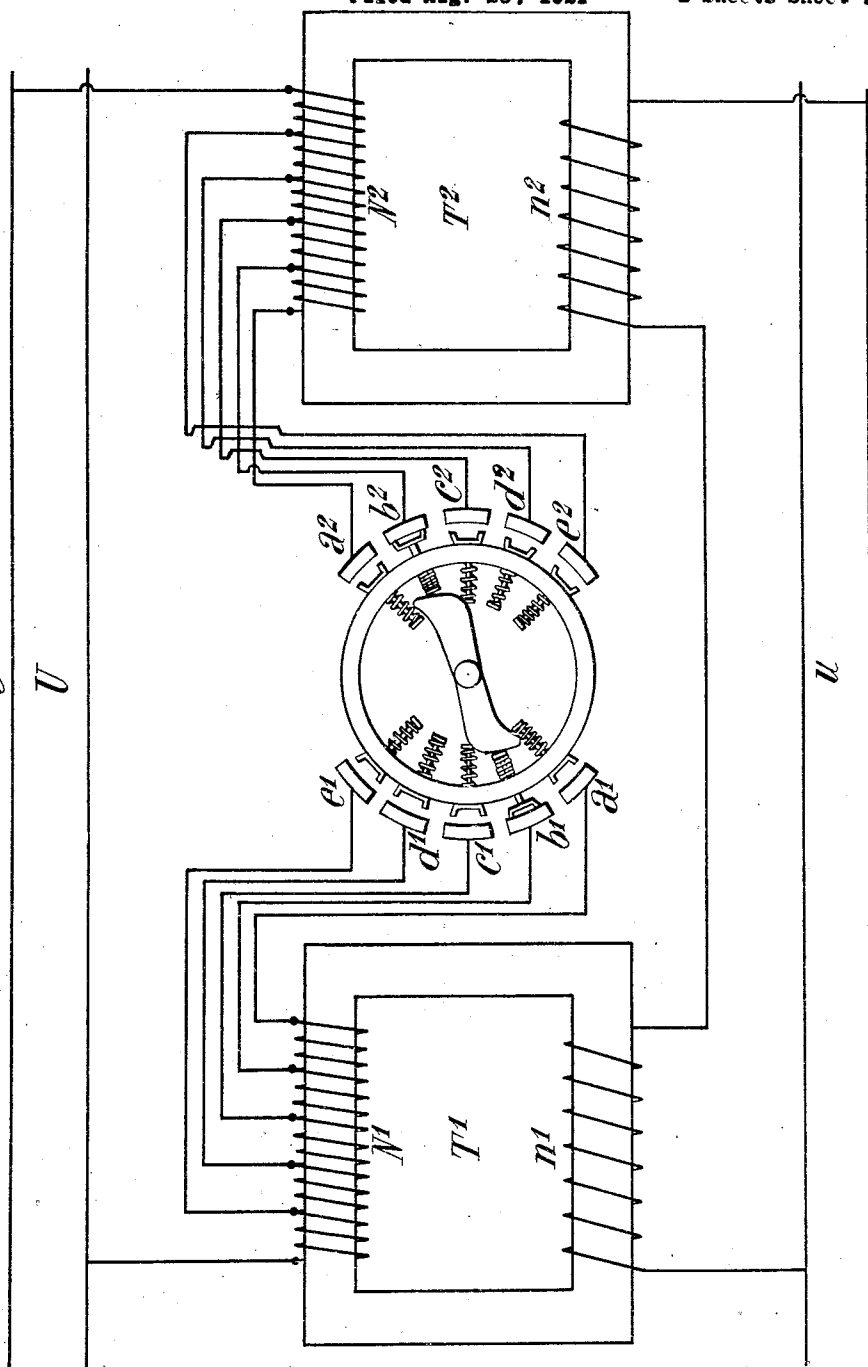
E. POIRSON

REGULATING TRANSFORMER

Filed Aug. 26, 1921

2 Sheets-Sheet 1

Fig. 1.



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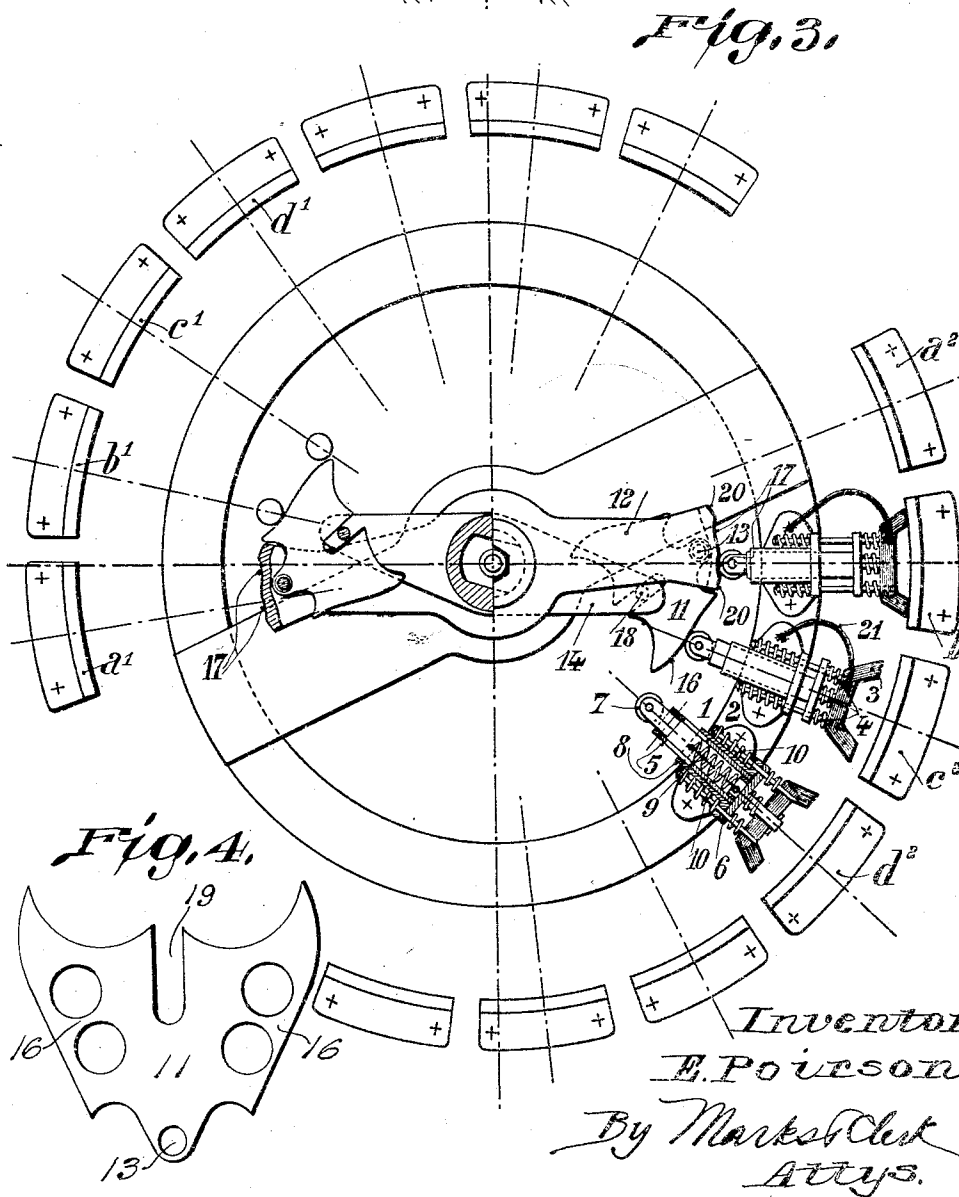
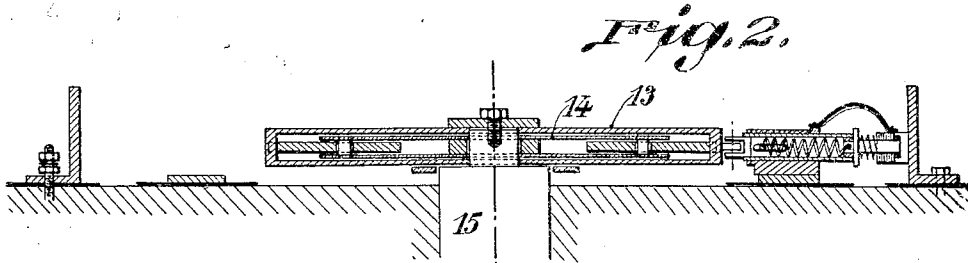
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Filed Aug. 26, 1921

2 Sheets-Sheet 2



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## UNITED STATES PATENT OFFICE.

EUGÈNE POIRSON, OF BELLEVUE, FRANCE, ASSIGNOR TO SOCIÉTÉ D'ELECTRO-CHIMIE  
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## REGULATING TRANSFORMER.

Application filed August 26, 1921. Serial No. 495,530.

*To all whom it may concern:*

Be it known that I, EUGÈNE POIRSON, a citizen of the French Republic, residing at 1 Allee Pompadour, Bellevue, Seine and Oise, France, have invented certain new and useful Improvements in Regulating Transformers, of which the following is a specification.

For controlling the voltage of alternating current circuits, use is generally made of an ordinary static transformer having several contact-pieces connected with varying lengths of the primary or of the secondary. However these arrangements necessitate the interruption of the circuit for effecting each change of contact-piece, and so, if it is desired to pass, with the circuit closed, from one contact-piece to another, it causes a breaking of the circuit when the contact leaves a contact-piece and before it reaches the following one, or, in cases where the contact pieces are closely arranged, a partial short-circuit of the winding when the contact reaches the new contact-piece before having left the preceding one. In both cases, the operation is objectionable, owing to the destructive arcs and to the rapid loading of the circuit.

This invention has for its object the provision of electrical and mechanical arrangements which eliminate these inconveniences and to permit, in practice, the control of the voltage of the circuit. For that purpose, instead of the usual single magnetic circuit, there are provided two magnetic circuits each carrying a primary and a secondary. The primaries are connected in series with the supply circuit and the secondaries are connected in series with the distributing circuit. The multiple contacts are connected with either the two primaries or with the two secondaries or, simultaneously, with both the two primaries and the two secondaries by means of a special switch which is devised in such a manner that

(a) On each transformer, the contact does not leave a contact piece before reaching the following one;

(b) The change from one contact-piece to the next one does not take place simultaneously on the two transformers, but on the contrary, successively and alternately on one and the other.

In the accompanying drawings and by way of example:

Fig. 1 is a diagrammatical view of the improved transformer, applied to a single-phase alternating current system.

Figs. 2 and 3 respectively illustrate in vertical section and plan view a form of construction of the switch made in accordance with the characteristic features of this invention.

Fig. 4 shows, on an enlarged scale, one of the reversible cams under the control of the control lever of the switch.

Referring to the drawing in detail, T' and T<sup>2</sup> indicate two magnetic circuits having respectively a primary N<sup>1</sup>, N<sup>2</sup>, and a secondary n<sup>1</sup>, n<sup>2</sup>. The primaries N<sup>1</sup>, N<sup>2</sup>, are connected in series with the conductors of the supply circuit U and the secondaries n<sup>1</sup>, n<sup>2</sup>, are connected in series with the distributing circuit u. The collections of current are effected either on the two primaries (Fig. 1) or on the two secondaries, or at the same time on the two primaries and on the two secondaries, this allowing to increase the range of control.

It is obvious that in the case of a poly-phase alternating current system, the same arrangements are used for each of the phases.

The changes of contact-pieces for varying the length of the active portions of the windings of the transformers are effected by means of a special multiple contact brush switch, which is devised in such a manner that the two contact brushes, respectively associated with the contact-pieces on each transformer, are mechanically coupled for avoiding the simultaneous short-circuiting of the two parts of the switch.

The contacts, on these two parts of the switch, and the corresponding contact brushes are, moreover so arranged that:

(a) On each transformer, the contact brush never leaves a contact piece before having reached the following one, so that no actual interruption of the circuit ever takes place;

(b) The change of contact-pieces does not simultaneously occur on both transformers, but on the contrary successively and alternately on one and on the other. Consequently as when one of the transformers is temporarily short-circuited by the contact-

brush of its switch changing from one contact-piece to another; the other transformer which is in series with the first one, at the primary as well as at the secondary, cannot be short-circuited at this moment, owing to the fact that the two contact brushes belonging to their respective switches are mechanically integral with each other.

The groups of contact-pieces associated with the transformers  $T^1$ ,  $T^2$ , are designated at  $a^1$ ,  $b^1$ ,  $c^1$ ,  $d^1$  and  $e^1$  and at  $a^2$ ,  $b^2$ ,  $c^2$ ,  $d^2$  and  $e^2$ , the first mentioned group being designated generally at  $A^1$  and the second mentioned group at  $A^2$ .

The contact pieces  $a^1$   $b^1$   $c^1$  . . .  $a^2$   $b^2$   $c^2$ , can be arranged on one and the same circumference (Figs. 2-3).

Opposite each of these latter is arranged a movable contact element 1. These contact elements are radially arranged on a conducting ring 2 and each is composed of a laminated brush 3, resiliently connected by springs 4, with the head 6 of a steel tubular rod 5, said head 6 serving as an abutment. At the other end of the rod 5, directed towards the center of the switch, is secured a roller 7 on which can act a cam adapted to push the said rod 5 without friction and the latter slides in a bronze sleeve 8 secured on the conducting ring 2.

A spring 9 is arranged within the tube 5 and is mounted for working by traction. It is combined with two other springs 10 which surround it and work by compression. This resilient system acts for holding the contactor 1 in released position or for suddenly breaking the contact when the outer thrust produced by the cam ceases to act on the corresponding rod 5.

A longitudinally slotted supporting lever 12 is journaled on a shaft 15 and double acting cams 11 are pivotally mounted at 13 in the ends of the slot of said lever, each cam 11 (Fig. 4) controlling a group of contact pieces  $A^1$  and  $A^2$ . A cam actuating arm 14 is mounted on the operating axis 15 and is arranged in the slot of the lever 12. These cams are constructed so as to progressively and successively push the movable brush carrying elements 1 against the contact-pieces corresponding thereto by means of one or the other of two inclined faces 16 formed on each of the said cams, according to the direction of movement of the lever 12. In the train of the working incline of each cam are provided two notches 17 and 17<sup>a</sup>. These notches are formed on the corresponding end of the lever 12, whilst the inclines 16 are constituted, as indicated, by the symmetrical sides of the rocking cam 11. These cams 11 are actuated by fingers 18 carried by the arm 14 and projecting in grooves 19 provided in the said cams 11 (Fig. 4). Two beveled portions are, moreover, formed on either side of the two notches 17, at each of

the ends of the lever 12 so as to connect these notches 17 and 17<sup>a</sup> with the corresponding incline 16 of the cam 11.

The operation of the switch is reversible, that is to say a change of the direction of actuation of the arm 14, produces automatically and before any displacement of the lever 12, the shifting or working of the cams 11, so that their opposite inclines 16 project from the leading edge of the lever, with respect to the direction of movement of said lever.

Whatever may be the direction of rotation of the arm 14, the successive application, in the suitable order, of the brushes 3 on the corresponding contact-pieces will therefore be effected, so that there will never be at the same time two brushes applied on the group of contact pieces  $a'$  —  $b'$  —  $c'$  and two brushes applied on the opposite group  $a^2$ ,  $b^2$ ,  $c^2$ , the switching taking place alternately on each of these series without any rupture of circuit being produced.

The conducting ring 2 serves as electric connection between the two groups of contact-pieces and each of the brushes 3 is electrically connected to this ring 2 by means of flexible conducting cables 21 preventing the formation of destructive arcs when the sliding contact of each tube 5 in its sleeve 8 takes place.

It will be noted that upon rotation of the arm 14, lever 12, and cams 11, the rollers 7 of the successive elements 1 come in contact, through the medium of the inclines 16, with the two notches 17 and 17<sup>a</sup> and then with the bevel portion 20. Beyond this bevel portion, these rollers are suddenly released and their resilient system brings them back, thus breaking the contact.

The whole of the contactor is preferably immersed in a vat containing insulating oil and the axis is controlled by a hand-wheel, by means of a worm transmission gear (not shown). This transmission gear is constructed in such a manner that a revolution of the hand-wheel determines an angular displacement of the arm 14 and cage 12 corresponding to the angle at the center made by the axes of two successive contact pieces.

What I claim as my invention and desire to secure by Letters Patent is:

In a transformer, two separate primary windings, two separate secondary windings, a group of contact pieces connected at various points in the length of one of said windings, a second group of contact pieces connected at different points in the length of another of said windings, the contact pieces of the respective blocks being circularly arranged, radially movable contacts movable into engagement with the contact pieces, an adjustable member pivotally mounted at the axis of the circular series of contact pieces, a cam actuating member mounted co-axially

with the first mentioned member, double act-  
ing cams pivotally mounted in the first men-  
tioned member adapted to successively en-  
gage and actuate the movable contact mem-  
5 bers associated with the contact pieces of the  
respective groups during the rotary move-  
ment of the first mentioned member in either  
direction, means carried by the cam actuat-  
ing member to move said cams into operative  
position according to the direction of move- 10  
ment of the first mentioned member, and  
means on the first mentioned member to en-  
gage the movable contact members and main-  
tain the latter in engagement with the con-  
tact pieces. 15

In testimony whereof I have affixed my  
signature.

EUGÈNE POIRSON.