

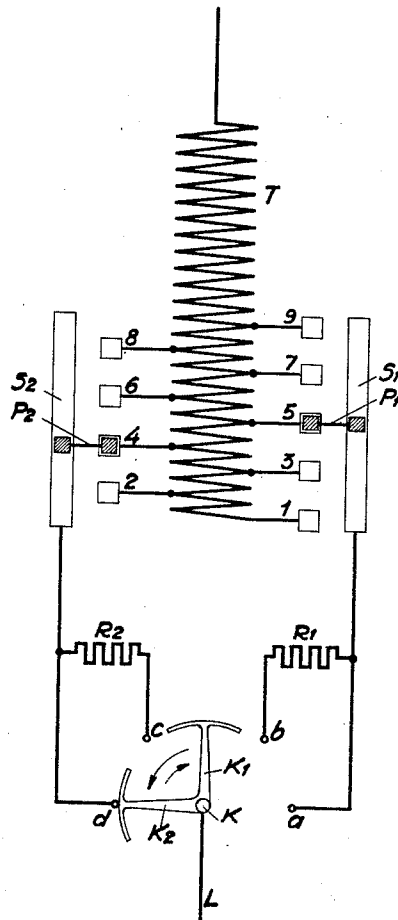
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VOLTAGE REGULATOR FOR TRANSFORMERS

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UNITED STATES PATENT OFFICE.

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VOLTAGE REGULATOR FOR TRANSFORMERS.

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Voltage regulators for transformers in which the shifting of the outgoing leads from one tap to another shall be possible during service, have hitherto been provided either with separate contactors for the different taps, or with a row of stationary contacts which by means of a sliding contact moving thereover can be connected, one after another, to a contact rail. The latter is connected to an outgoing lead, either to a line or to another transformer leg, depending upon whether the regulating is effected at the terminals or at the neutral point. In passing from one tap of the transformer to another, a resistance is first introduced between them, in order neither to break the current nor to short-circuit any part of the transformer. When sliding contacts have been used, the said resistance has either been movable together with these or it has been stationary and controlled by means of separate contacts. In the latter case, the resistance has generally been inserted between two contact rails running along the whole row of contacts. When the number of the taps is relatively large, both the aforesaid types of arrangement have resulted in constructions requiring much space.

According to the present invention the taps of the transformer are alternately connected to two rows of stationary contacts, each row being traversed by a sliding contact which connects it to a contact rail. Between these two contact rails, the resistance may be connected. In this way, by using four contact rows or rails side by side, the apparatus will obtain only about half of the length as when three rows or rails are used in the known way, and about one third of the length required for two rows (with movable resistance). Whether the contact rows are straight or circular, the dimensions of the regulator will be much more convenient, as soon as the number of taps reaches a certain value. Other advantages of the invention will be apparent from the following description of a preferred form thereof.

The accompanying drawing shows a diagram of connections of a voltage regulator according to the invention.

Referring to the drawing, T represents a transformer winding having nine taps connected to contacts 1-9. The latter are arranged in two rows, those having odd num-

bers in one and those having even numbers in another row. Along the former row runs a contact rail S_1 , and along the latter a corresponding rail S_2 . The contacts 1-9 may be alternately connected to these rails by means of sliding contacts P_1, P_2 . The outgoing lead L is connected alternately to the rails S_1, S_2 , either directly or through a resistance, by means of a sliding contact K, as will be more fully described hereinafter. In the form shown, the resistance is divided into two portions, R_1 and R_2 , connected respectively to the two rails S_1, S_2 .

In the position shown in the drawing, the outgoing lead is connected to the tap 4, while the shifting to the next lower tap has been prepared by connecting the tap 5 to the rail S_1 through the sliding contact P_1 . The said shifting comprises the following operations. The left branch K_2 of the sliding contact K, which has made contact before only with the contact d directly connected to the rail S_2 , now also touches the contact c which is connected to the rail S_2 through the resistance R_2 . Thereby no immediate alteration of the voltage conditions is caused. Soon after, however, the branch K_2 leaves the contact d , and about simultaneously the branch K_1 reaches the contact b which is connected to the rail S_1 through the resistance R_1 . In this position, the portion of the transformer winding lying between the taps 4 and 5 is closed over a resistance $R_1 + R_2$, while the outgoing lead is connected to the middle point of said resistance and has thus practically the medium voltage between 4 and 5. At the next instant, the resistance R_1 is short-circuited between a and b , whereby the voltage on the outgoing lead sinks practically to the voltage on 5, and immediately afterwards the connection at c is broken. Finally the resistance R_1 is disconnected by placing the branch K_1 right opposite a .

In making the next step in voltage-lowering direction, the sliding contact P_2 is first placed on the tap contact 6, whereupon the contact K is rotated back to the position shown in the drawing, when the procedure will be analogous to that just described.

By the division of the resistance into two parts R_1 and R_2 , which has been made possible by the division of the tap contacts, the advantage is gained that the resistance causing voltage drop during the shifting operation will be only half of that over which the

intermediary portion of the transformer is closed during the major part of said operation. Further the voltage on the outgoing lead will have an intermediate value between
5 the beginning and end values. The voltage regulation will thus be much more soft than without this division of the resistance. The invention is, however, also applicable in the latter case, it being possible to locate the
10 resistance as a whole between *c* and *d* or between *a* and *b*.

I claim as my invention:—

1. In voltage regulators for transformers, a transformer winding having a series of
15 taps, two rows of fixed contacts alternately connected to said taps, contact rails running along said rows, slidable contacts adapted to connect said rails respectively to the contacts of said rows, a resistance, an outgoing

lead, and contacts adapted to connect said
20 outgoing lead alternately to said contact rails and alternately over and past said resistance.

2. In voltage regulators for transformers, a transformer winding having a series of
25 taps, two rows of fixed contacts alternately connected to said taps, contact rails running along said rows, slidable contacts adapted to connect said rails respectively to the contacts of said rows, resistances connected to
30 said rails, an outgoing lead, and contacts adapted to connect said outgoing lead alternately to either of said rails directly and over one of said resistances.

In testimony whereof I have signed my
35 name to this specification.

ADOLF ROTH.