No. 857,062. PATENTED JUNE 18, 1907.

J. D. HILLIARD.

ELECTRICAL TRANSFORMER.

APPLICATION FILED NOV. 20, 1906.

Fig. 1.

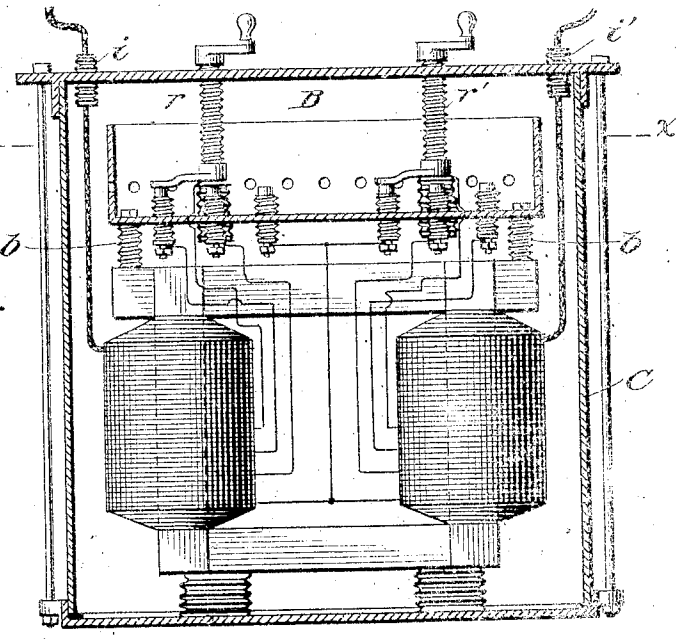


Fig. 2.

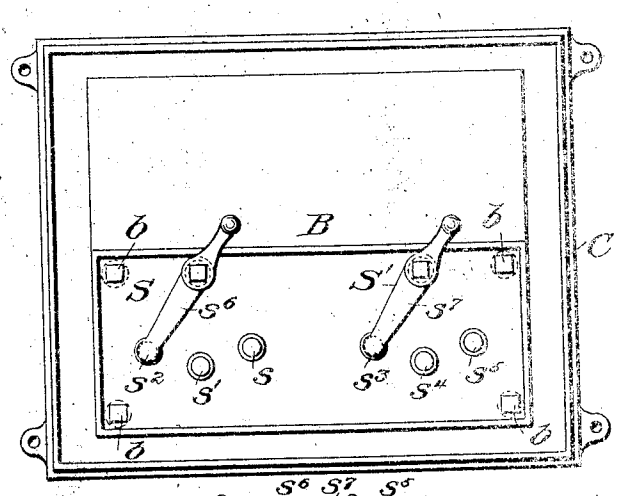
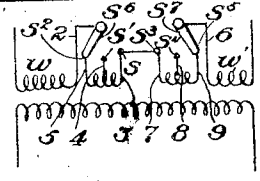


Fig. 3.



Witnesses

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ELECTRICAL TRANSFORMER.

No. 857,062. Specification of Letters Patent. Patented June 18, 1907.

Application filed November 20, 1906. Serial No. 344,203.

To all whom it may concern:

Be it known that I, JOHN D. HILLIARD, a citizen of the United States, residing at Albany, in the county of Albany and State of New York, have invented certain new and useful Improvements in Electrical Transformers, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates to electrical transformers, and especially to those which are mounted in cases filled with oil. Heretofore, such transformers have been built with taps connected to various points on the windings so that the ratio of transformation could be changed when desired; but the taps have been so located that in order to make the change, it has been necessary to unbolt the top of the transformer and feel around in the oil to find the proper contacts, or to withdraw the oil from the case so as to expose the same. Such procedure makes the work of changing very slow, and it is the object of my invention to produce an arrangement whereby it will be unnecessary to open the casing or to withdraw the oil, the change being made from the outside of the casing with speed and certainty.

In order to attain my object, I mount a switch or switches directly within the transformer casing, and operate the same by means of a rod or rods projecting through the top. The contact points of the switches are connected to various taps on the transformer windings, and each set is arranged on the arc of a circle having the switch arm and its controlling rod pivoted at its center. Suitable operating handles are provided, having indicating pointers and controlling fixed points on the top of the casing. The contact pieces and insulators are preferably inclosed in a case or compartment separate from that containing the transformer windings, so that any carbon which may be formed in the oil will be prevented from falling and being deposited upon the transformer windings.

With the arrangement thus outlined a change in ratio transformation can be made within one minute, whereas with the old method approximately an hour is required to do the same work. The handles for operating my switches are preferably corrugated pieces of wood or other suitable material protected at their lower ends by procelain insulators.

In the accompanying drawings Figure 1 is a sectional view of an oil switch with my invention applied thereto. Fig. 2 is a top plan view with the top of the switch casing removed. Fig. 3 is a diagram of the connections of the primary and secondary windings, and of the switches.

In the drawings I have illustrated a typical form of transformer included in a metal casing C provided with a cover secured thereon by bolts or otherwise in any well known or suitable manner. The casing is filled with oil to a level considerably above the top of the transformer core. The leads for the windings pass through the top of the casing, being protected by insulating bushings i and i'. From the windings taps 2, 3, 4, 5, 6, 7, 8, 9, are taken off, and it is by varying the connections between and among these taps that I effect the desired changes in my ratios of transformation. For this purpose I provide the switch box constituting the characteristic feature of my invention, which is shown at B, with two switches, S, S′, contained therein. The box itself is partly or wholly incased in the oil within the main casing C, and the switches are adapted to be operated by insulated spindles or rods r, r' extending up out of the box and through the top of the casing. Each of these rods or spindles is provided with a suitable grip, preferably corrugated, and with a porcelain or other insulator at the lower end. Danger in handling them is thus obviated. The box B is carried upon legs b, which also are in the form of corrugated insulating bodies, these corrugations in each case acting of course to increase the surface of the insulation. Secured in the bottom of the box, but insulated therefrom by suitable bushings, are two series of contacts s, s', s^2, s^3, s^4, s^5, arranged on the arc of circles whose centers are in the axes of the operating rods r, r'. Pivoted on each center, but insulated from the rod and the box, are switch blades s^6, s^7, which are adapted to be turned by the rods r or r' to sweep over the contacts s', s^2, s^3, s^4, s^5. Circuit connections to these blades may be completed in a variety of ways. I prefer to have the main taps 2 and 6 soldered into the lower end of the spindles of the switch blades, and with this arrangement it is of course desirable to either coil the wire of the taps or to form a pig tail, so as to prevent any undesirable torsional strain on the joint. The connection of the switches is shown diagrammatically in Fig. 3, wherein w and w' are the fixed or in-

variable portions of the secondary windings, from which the main taps 2 and 6 pass to the switch blades s^6 and s^7, being secured thereto in the manner already described. These blades may be turned about over to associated contacts, which are connected as follows: s, s^3, are connected together through the taps 3 and 7; s', s^2 are connected to different points on the windings of one side of the transformer by the taps 4 and 5, while s^4 and s^5 are similarly connected to intermediate points on the other side of the winding by the taps 8 and 9. By the word "side" in this respect I mean right or left, in a mechanical sense, not referring to the electrical relation of the windings. The reason I arrange my switches in this manner, providing two switches instead of one, is that I may preserve the symmetry of the windings, and keep them balanced. The box B is provided with small openings which allow the oil to circulate through it, and the switches are thus covered *in toto*, as regards their operating parts. At the same time, it is entirely unnecessary to remove the top of the casing in order to change the relation of the windings. Each handle or operating rod is provided with a pointer, set to coincide with the corresponding movable switch arm, and around this pointer on the arc of a circle are indicating points corresponding to the different contacts. Suitable legends may be placed upon the switches, so that the blades may be set with exactness.

It will be observed that many changes can be made in matters of detail without affecting my general design, and without departing from the characteristic features of the invention. For the basic purpose of effecting changes in the arrangement and connection of the windings, the box B is of course not indispensable, as the switches S, S' could be mounted either directly on the top of the core, or upon a mounting plate, or upon brackets secured to the lid of the casing, or in other ways. The manner I illustrate and describe, however, is preferable for several reasons. It maintains a semiclosed chamber for the switches, which will receive and retain any carbon particles which may be formed, and prevent their falling on the windings; it is easily applicable to several existing types of transformer and transformer casings; and it requires no special fittings or attachments on the transformer or transformer core.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In an electrical transformer, a core, primary and secondary windings on said core, a casing for said windings and core, and a switch within said casing, said switch having two or more fixed contacts connected to different points on the transformer windings, a movable contact for co-operating with said fixed contacts, said casing being filled with oil to a sufficient depth to cover all of said contacts, and an operating handle for the switch projecting out of the casing and provided with indicating points corresponding in position with the contacts, substantially as described.

2. An electrical transformer comprising a casing containing oil, two compartments in said casing, transformer windings immersed in the oil in one compartment and a regulating switch also immersed in oil in the other compartment, said switch having contact points on the transformer windings, and an operating handle projecting out of the casing, substantially as described.

3. An electrical transformer comprising a casing containing oil, a transformer core and windings immersed in the oil, a regulating switch for changing the ratio of transformation, comprising contacts connected to various points on the transformer windings, a separate inclosure also containing oil for said switch, insulating supports for said inclosure adapted to rest upon the transformer core, and an operating handle for the switch extending out of the casing, substantially as described.

4. An electrical transformer comprising a main casing containing oil, a core with primary and secondary windings immersed in the oil within the casing, a separate switch casing carried upon the transformer core and also immersed in the oil, a switch mounted in said separate casing and having contacts connected to taps from different points on one or both of the windings, and an operating handle for said switch extending out of the main casing through the top thereof, substantially as described.

5. An electrical transformer comprising a main casing containing oil, a core with primary and secondary windings immersed in the oil within the casing, a separate switch casing carried upon the transformer core and also immersed in the oil, a switch mounted in said separate casing and having contacts connected to taps from different points on one or both of the windings, and an operating handle for said switch extending out of the main casing through the top thereof, said handle being insulated from the operating parts of the switch lying within the casing, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN D. HILLIARD.

Witnesses:
C. E. PARSONS,
M. L. STEVER.