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A. R. LINDBLAD & O. STÅLHANE.

TRANSFORMER FURNACE.

APPLICATION FILED NOV. 5, 1906.

Fig. 1.

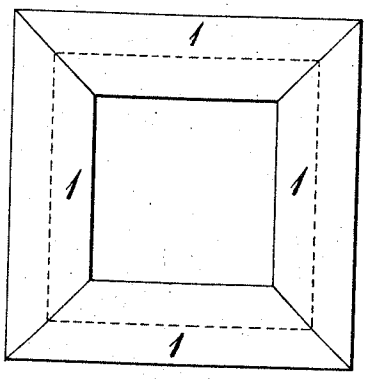


Fig. 2.

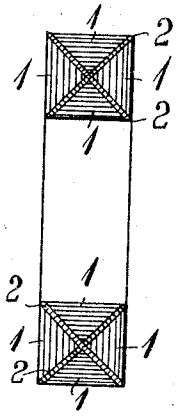


Fig. 3.

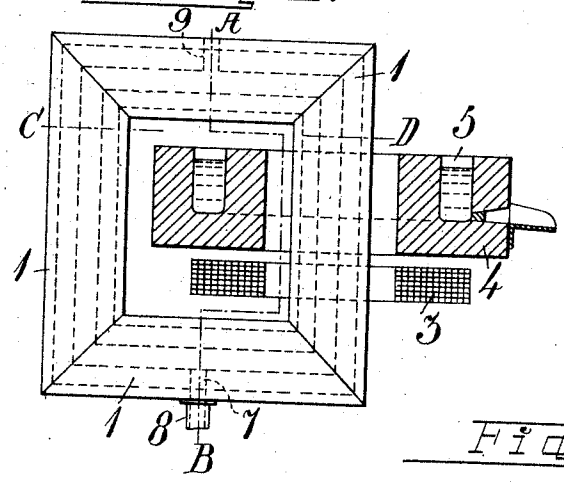


Fig. 4.

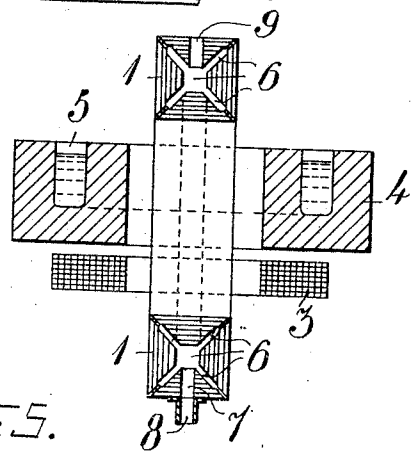
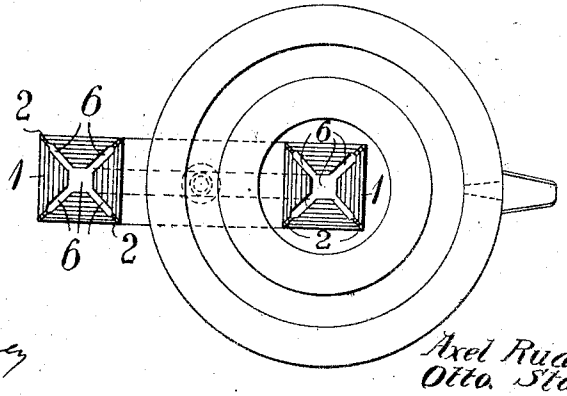


Fig. 5.



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UNITED STATES PATENT OFFICE.

AXEL RUDOLF LINDBLAD AND OTTO STÅLHANE, OF LUDVIKA, SWEDEN.

TRANSFORMER-FURNACE.

No. 880,547. Specification of Letters Patent. Patented March 3, 1908.

Application filed November 5, 1906. Serial No. 342,033.

To all whom it may concern:

Be it known that we, AXEL RUDOLF LINDBLAD and OTTO STÅLHANE, engineers, subjects of the King of Sweden, residing at Ludvika, in the Kingdom of Sweden, have invented new and useful Improvements in Transformer-Furnaces.

Heretofore in electric smelting furnaces of the transformer type, one of the greatest difficulties met with in practice consists in the considerable electromagnetic leakage and the shifting of the phases arising therefrom, which take place on account of the position of the primary coil or coils with regard to the secondary coil. In the usual type of transformers, for instance those used for transmission of power, this difficulty does not arise, as in such transformer the primary and the secondary coils may, in some way or other and without any inconvenience, be placed near to each other, for instance in such a way that one coil is placed concentrically around and near to the other coil. In a transformer furnace, however, for reasons of construction, such an arrangement is not possible, for even if the primary coil and the smelting bath be placed concentrically in relation to each other, the high temperature of the smelting bath makes it necessary that there be relatively great space between the primary coil and the smelting bath in order that a sufficient heat insulation may be provided. Therefore, in transformer furnaces other means must be used for reducing the magnetic leakage so that the working factor may not be too small, making the use of large and expensive machinery necessary.

According to observations made by us, in transformers of the construction hitherto used the leaking lines of force chiefly emanate from the edges of the sheets or lamellæ of iron of which the transformer core is composed. Thus, when the transformer core is formed with a rectangular cross section, most of the leaking lines of force emanate from those parts of the core which are formed of the edges of the said sheets or lamellæ, while only a relatively small number of the leaking lines of force emanate from the other parts of the core; or, in other words, the leaking lines of force pass more easily along the surfaces of the sheets of iron than across the same. This is also in accordance with theory, as the leaking lines of force which try to pass across the sheets of iron necessarily must be counteracted or restrained by the "screening action" which the iron sheets themselves exercise.

The present invention has for its object to construct an iron core for use in transformer furnaces, on the basis of the said observations, for the purpose of reducing the leakage as far as possible.

The idea of the invention broadly stated is, that the transformer core is so formed that its surfaces, as far as possible, are not formed of the edges of the iron sheets which constitute the transformer core, but are instead the iron sheets or lamellæ of which the transformer core is formed, so arranged that wherever the leaking lines of force try to escape or emanate from the iron core they are obliged to pass across a number of the said sheets of iron.

In order to make our invention more clear, it is described with reference to the accompanying drawing, in which, as examples, different forms of the same are illustrated.

Figure 1 is a front view of a rectangular transformer core constructed according to this invention; Fig. 2 shows a vertical cross section of the same; Fig. 3 shows in vertical section a transformer furnace ("induction furnace") provided with another form of transformer core constructed in accordance with the present invention and provided with means for cooling the same; Fig. 4 shows a vertical section on the line A—B in Fig. 3; and Fig. 5 is a horizontal section on the line C—D in Fig. 3.

In the form of the invention illustrated in Figs. 1 and 2, the iron core is composed of a number of parts or sectors 1 of triangular cross section, said sections being thus assembled or put together for forming the complete iron core so that the iron sheets forming a certain section 1 will be parallel with that side-surface of the complete transformer core which is formed of the same part or section. In order to prevent disadvantageous currents arising within the iron core, the several sections or parts 1 are separated from each other by means of a layer of insulating material 2. For also securing the effect desired in this invention at the corners of the transformer core, namely, the "screening action" of the iron sheets by which the reducing of the leakage is attained, the vertical legs of the same may suitably be connected with its horizontal parts in the manner shown in Figs. 1 and 3.

In Figs. 3, 4 and 5, 11 is the transformer

core, composed of a number of parts or sections 1, 3 the primary coil, and 4 the brickwork in which the furnace groove 5 is formed. According to the form of the invention illustrated by these figures, the sections or parts 1 forming the transformer core are formed with such a cross section that when said sections 1 are assembled or put together to form the transformer core passages or channels 3 are formed through which a cooling medium may be passed for cooling the iron core. For this purpose the iron core is provided with a port or opening 7 through which air from the pipe 8 may be introduced into the channels 6 and passed through the same, whereafter it is led off through the opening 9. Even in this form of the invention insulating material 2 is provided between the sections or parts for the purpose above stated.

Having thus described our invention we claim:

1. In an electric transformer furnace, a transformer core formed of an endless member composed of superposed plates or laminæ so arranged that a number of said plates or laminæ will be cut by any plane laid through the axis of the core.

2. In a transformer furnace, a transformer core formed of an endless member, the member in cross section being constituted of sector portions meeting at the axis of the member, the sectors being formed of superposed parallel plates or laminæ that in each sector are substantially perpendicular to the radius at the middle of the sector, each sector being separated by insulating material.

3. In a transformer furnace, a transformer core in the form of a rectangular ring, each side member being formed in section of four sector portions, composed of parallel sheets of magnetic material and separated by non-magnetic material, the sheets in each sector being parallel to form a substantially square outline.

4. In an electric transformer furnace, a transformer having a core formed of an endless annular member composed of superposed plates or laminæ, the plates being arranged around the axis of the annular member to intersect all lines of force radiating from the axis of the core.

In witness whereof, we have hereunto set our hands in presence of witnesses.

Signed at Söderbärke this 13th day of October, 1906, in the presence of witnesses.

AXEL RUDOLF LINDBLAD
OTTO STÄLHANE

Witnesses:
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