

O. FRICK.
ELECTRIC TRANSFORMER FURNACE.
APPLICATION FILED DEC. 26, 1906.

932,013.

Patented Aug. 24, 1909
3 SHEETS—SHEET 1.

Fig. 1.

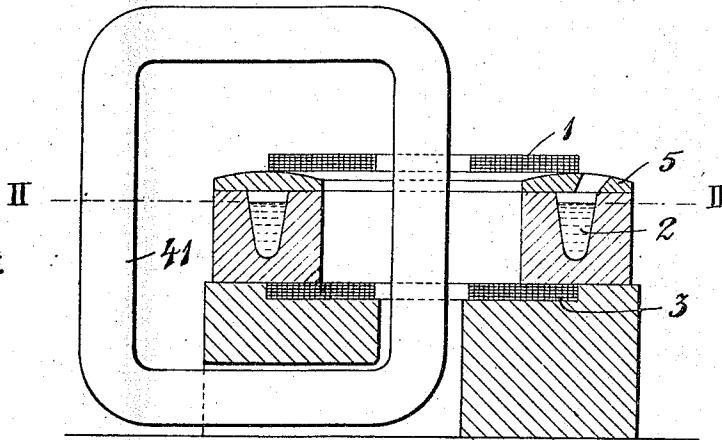
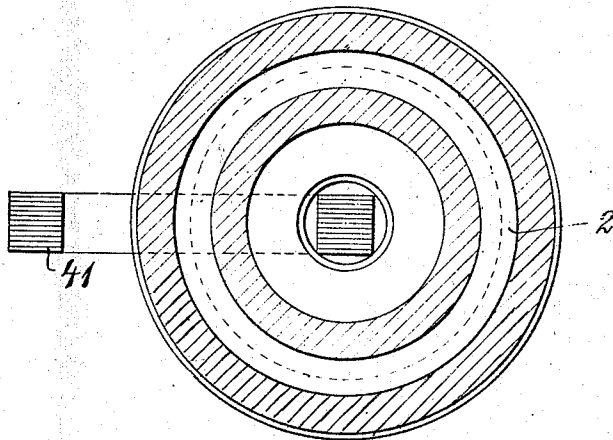


Fig. 2.



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Fig. 3.

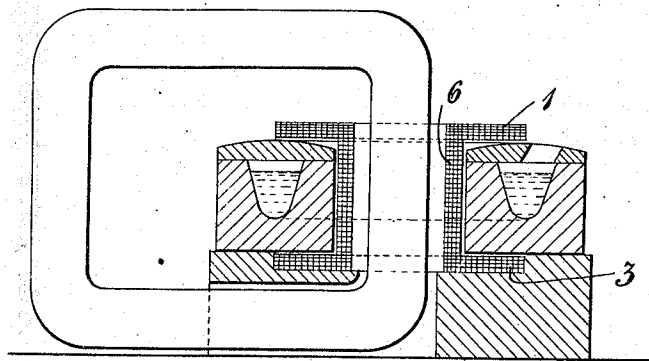
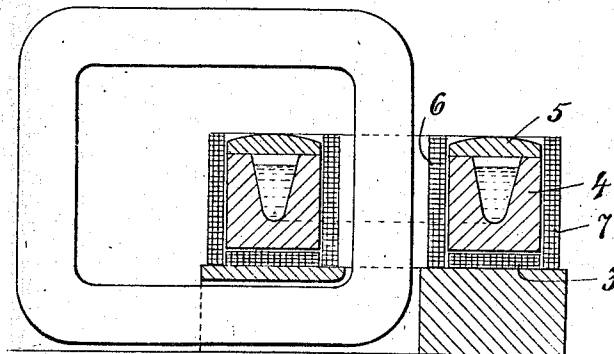


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 5.

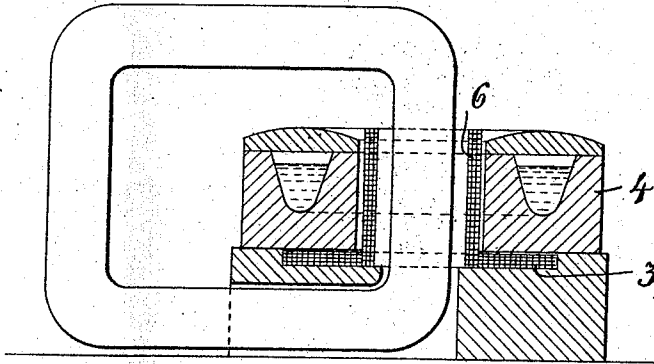
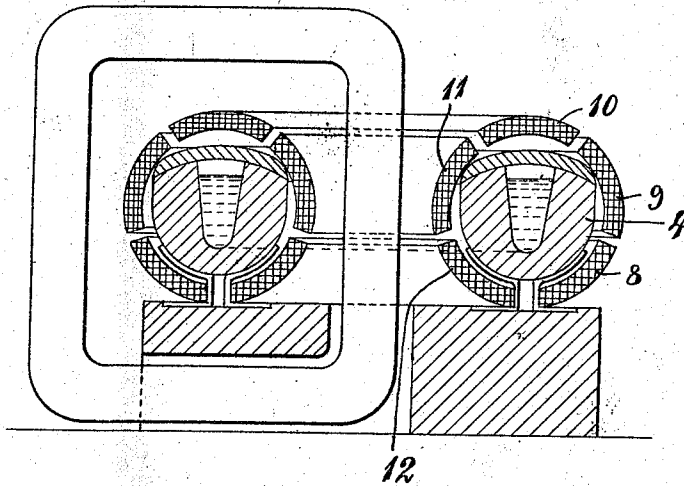


Fig. 6.



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UNITED STATES PATENT OFFICE.

OTTO FRICK, OF STOCKHOLM, SWEDEN.

ELECTRIC TRANSFORMER-FURNACE.

932,013.

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Application filed December 26, 1906. Serial No. 349,425.

To all whom it may concern:

Be it known that I, OTTO FRICK, a citizen of the Kingdom of Sweden, residing at Saltsjöbaden, Stockholm, Sweden, have invented new and useful Improvements in Electric Transformer-Furnaces, of which the following is a specification.

This invention relates to an improved electric transformer furnace in which the mass to be heated is contained in an annular hearth and is induced by means of a primary coil, the said coil and hearth being arranged on a closed iron core.

The object of the invention is to provide a transformer furnace having a low self-induction and accordingly a high power factor, so that the size of the generator plant connected to the furnace may be reduced to a minimum.

The invention consists chiefly in the combination of a masonry base with an annular hearth for the material to be treated forming the secondary circuit, a primary winding divided in coils placed so as to face more than one side of the hearth, and a closed magnetic core, one limb of which is surrounded by the hearth and by the said primary winding, and the other limbs of which are at such a distance from said winding that a free space is left between the iron and the primary winding.

The invention will be more particularly described herebelow with reference to the accompanying drawings showing several forms of the same.

Figure 1 shows a vertical section of a furnace having one coil above and one coil below the hearth. Fig. 2 is a horizontal section on line II—II in Fig. 1. Fig. 3 shows a vertical section of a furnace in which the primary winding incloses the hearth at the upper, inner and lower sides. Fig. 4 is a vertical section of furnace in which the primary winding incloses the hearth at the inner, lower and outer sides. Fig. 5 is a vertical section of a furnace in which the primary winding incloses the hearth at the inner and lower sides. Fig. 6 shows a furnace in which the primary winding substantially incloses the hearth.

Referring to Figs. 1 and 2, the furnace has a primary coil 1 above the melting-bath 2 and another primary coil 3 below the same, while the iron-core is so arranged that no iron or only a small quantity of iron is found in the leaking-fields arising around

the primary and secondary circuits. Each half of the primary winding forms a special leaking-field, and as the number of ampere-turns in each coil is only the half of that of an undivided winding of the same size and the self-induction is proportional to the square of the number of turns, the self-induction will, as is easily understood, be reduced to about the half of that of a furnace which is constructed in analogous manner in other respects, and has an undivided primary winding above or below the hearth, and this will be the case independently of the coils being connected in series or parallel. The coil 1 above the melting-bath should, suitably, be so arranged that it can be easily removed in order to make the cover 5 of the crucible accessible, and may for said purpose be composed of several small coils.

In the form shown in Fig. 3 the furnace is, besides the primary coil 1 above the hearth and the coil 3 below the latter, provided with a primary coil 6 inside the inner wall of the hearth, so that the primary winding as a whole is channel-shaped and incloses three sides of the hearth. By such an arrangement the self-induction caused by the primary leaking-field will be further diminished compared with the arrangement shown in Figs. 1 and 2, the leaking field within the volume inclosed by the said cross-section being highly suppressed.

In the modification shown in Fig. 4 the furnace has a coil 6 inside the inner wall of the hearth 4, another coil 3 below the hearth and a third coil 7 outside the hearth. In this arrangement the cover 5 of the crucible 4 is freely accessible.

In Fig. 5 is shown a further modification in which the coil 7 is dispensed with and in which the coil 3 does not extend to the full width of the hearth.

In the furnace shown in Fig. 6 the primary winding has the shape of a tube-shaped ring formed by coils 8, 9, 10, 11 and 12, inclosing the crucible 4 on all sides, on account whereof practically no primary leaking-field nor any self-induction caused thereby exists in the said arrangement.

The primary winding may in each case be divided in an arbitrary number of coils, and especially the parts of the winding above the crucible should be so arranged that they may easily be removed in order to make the cover of the crucible and the melting-bath accessible.

It will be noted from the foregoing that in the embodiments shown in Figs. 3 to 6 the primary winding is of channel-shaped cross-section, when the term channel is considered in its broad sense as meaning that through which anything passes.

I am aware that transformer furnaces have been proposed in which the primary circuit is divided in coils arranged above and below the annular hearth, and also that transformer furnaces are known in which are used iron cores, which are at a comparatively great distance from the primary and secondary circuits, and I do not regard such arrangement as novel *per se*, but

What I claim and desire to secure by Letters-Patent, is:

1. An electric induction furnace comprising a masonry base with an annular hearth for the material to be treated forming the secondary circuit of the furnace, a primary winding facing more than one side of the hearth, and a closed magnetic core, one limb of which is surrounded by the hearth and by the said primary winding, and the other limbs of which are at such distance from said winding that a free space is left between the iron and said winding.

2. An electric induction furnace comprising a masonry base having an annular hearth for the material to be treated, a primary winding facing the upper and lower sides of the hearth, and a closed magnetic core in inductive relation to the hearth and the primary winding, one limb of which core is

surrounded by the hearth and the primary winding and the other limbs of which are beyond the essential part of the leakage fields of the primary winding and secondary circuit formed by the hearth.

3. An electric induction furnace comprising a masonry base having an annular hearth for the material to be treated, a primary winding facing three sides of the hearth, and a closed magnetic core in inductive relation to the hearth and the primary winding, one limb of which core is surrounded by the hearth and the primary winding and the other limbs of which are beyond the essential parts of the leakage fields of the primary winding and secondary circuit formed by the hearth.

4. An electric induction furnace, comprising a masonry base having an annular hearth for the material to be treated, a primary winding facing all sides of the hearth, and a closed magnetic core in inductive relation to the hearth and the primary winding, one limb of which core is surrounded by the hearth and said primary winding and the other limbs of which are at such distance from said winding that a free space is left between the iron and the primary winding.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

OTTO FRICK.

Witnesses:

LUTHER J. PARR,
STANLEY C. PHILLIPS.