No. 873,861. PATENTED DEC. 17, 1907.

G. HOLMGREN.

ELECTRIC FURNACE.

APPLICATION FILED MAR. 6, 1907.

3 SHEETS—SHEET 1.

Fig. 1.

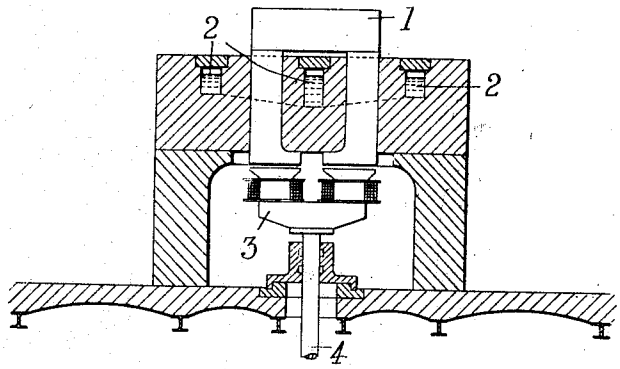
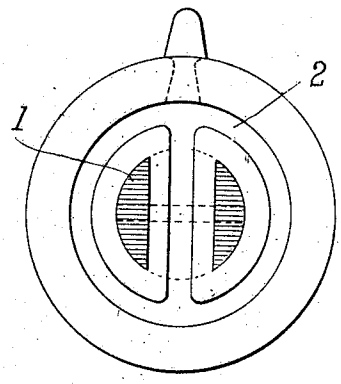


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3.

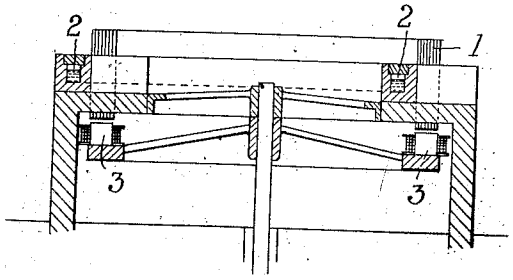


Fig. 4.

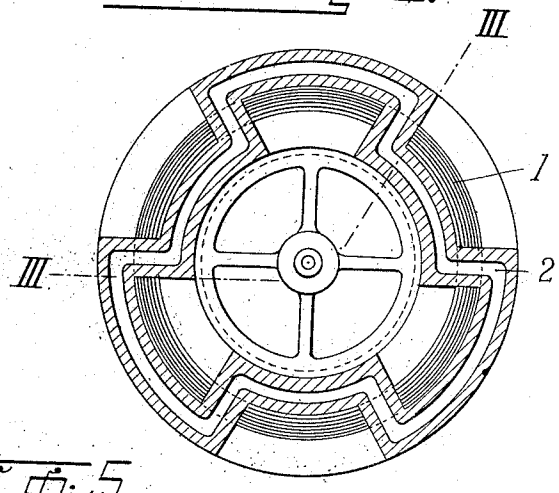
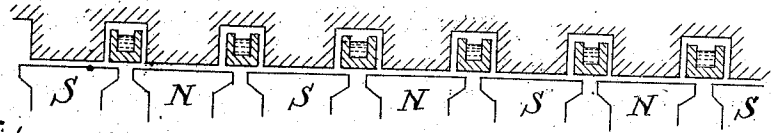


Fig. 5.



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No. 873,861. PATENTED DEC. 17, 1907.

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APPLICATION FILED MAR. 6, 1907.

3 SHEETS—SHEET 3.

Fig. 6.

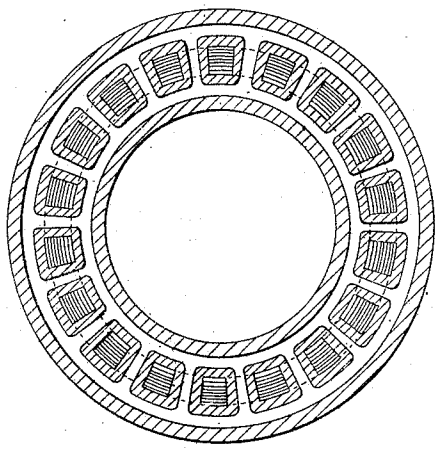


Fig. 7.

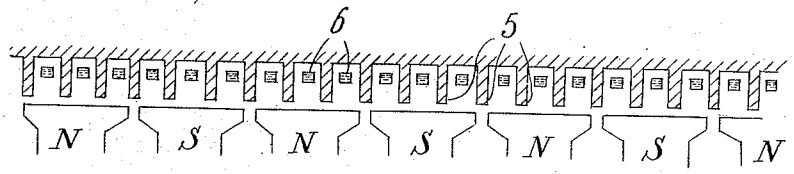


Fig. 8.

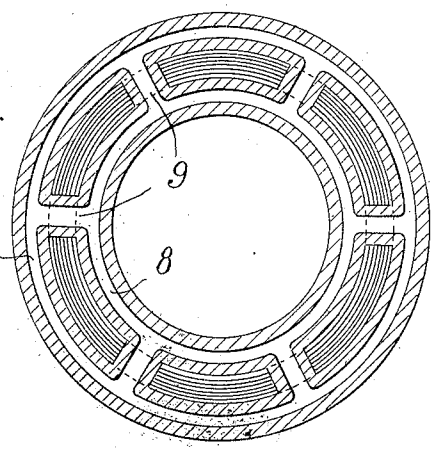
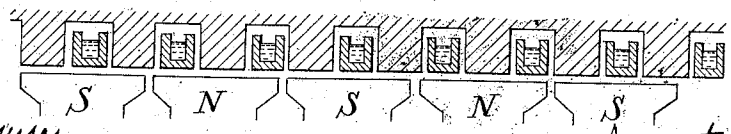


Fig. 9.



Witnesses

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UNITED STATES PATENT OFFICE.

GUSTAF HOLMGREN, OF WESTERÅS, SWEDEN.

ELECTRIC FURNACE.

No. 873,861. Specification of Letters Patent. Patented Dec. 17, 1907.

Application filed March 6, 1907. Serial No. 360,983.

To all whom it may concern:

Be it known that I, GUSTAF HOLMGREN, a citizen of the Kingdom of Sweden, residing at Westerås, Sweden, have invented new and useful Improvements in Electric Furnaces, of which the following is a specification.

This invention relates to improvements in electric furnaces.

As well known it has been proposed to use for metallurgical purposes electric furnaces carried out according to the principle of electric generators with rotating field magnet and stationary armature on which latter the metallurgical bath forms a short-circuited, induced conductor. In such furnaces heretofore known the field-magnet rotates around a horizontal shaft but as also the bath in the most cases should have a horizontal position one has been limited to the use of field-magnets and armatures having only two poles. Such a construction suffers, however, from several important disadvantages among which may be mentioned the violent vibrations arising during the operation of the furnace on account of the magnetic circuit being more or less fully broken two times during each revolution of the rotating field-magnet. Further the inevitable great self-induction in such single-phase furnace effects that the torque varies not only between null and a maximum but between positive and negative values which increases the vibrations in the furnace.

The object of the present invention is to provide an electric generator furnace in which the said inconveniences are removed.

The invention consists, principally, in that the field-magnet of the furnace is rotatable around a vertical shaft. By such an arrangement it will be possible to build furnaces with any number of poles and any number of magnetic circuits which are closed around the secondary conductor formed by the melting bath and with any number of phases. Hereby is provided an electric generator furnace having low self-induction, uniform torque, and small vibrations.

In the accompanying drawings I have shown substantially diagrammatically some forms of my invention.

Figure 1 shows a two-pole single-phase generator furnace in vertical section. Fig. 2 is a plan-view thereof. Fig. 3 shows a vertical section of a multi-pole single-phase generator on line III—III in Fig. 4, and Fig. 4 is a horizontal section thereof. Fig. 5 is a diagrammatic view of the furnace shown in Figs. 3 and 4. Fig. 6 is a horizontal section of a poly-phase furnace embodying my invention and Fig. 7 illustrates diagrammatically the pole-arrangement in said furnace. Figs. 8 and 9 are views corresponding to Figs. 6 and 7 of a second polyphase furnace.

The furnace shown in Figs. 1 and 2 has a U-shaped upright armature-core 1 around the vertical shanks of which the melting-bath 2 of the furnace forms two closed circuits communicating with each other. The rotatable field-magnet 3 has a vertical shaft 4 and two poles of segmental shape corresponding to the shape of the pole-surfaces of the armature-core. When the field-magnet 3 is in the position shown in Fig. 1 in relation to the armature-core, the magnetic circuit is closed through both circuits of the melting-bath. When the field-magnet has been turned 90° from the said position each half of the magnet circuit of the same is closed through one of the armature poles so that the magnetic flux does not pass through the closed circuits formed by the melting-bath. Nevertheless it is possible by giving the pole-pieces suitable dimensions to keep the total magnetic flux through the air-gap between the field- and armature-cores substantially constant. The variation of the number of lines of force inducing the melting-bath and of those short-circuited by the pole-pieces of the iron-cores takes place successively whereby vibrations in the iron-cores will in a very high degree be avoided and the self-induction of the furnace will be comparatively low.

Figs. 3–5 show a multi-pole furnace, the melting-bath 2 being arranged as a six-pole, single-phase short-circuited winding having one conductor for each slot and pole, while the field-magnet in accordance therewith has six poles. The armature-core 1 is annular and is provided with slots through which the brickwork inclosing the melting-bath passes.

In the form shown in Figs. 6 and 7 the melting-bath is so divided that the same corresponds to the winding of a three-pole generator or the short-circuited winding of an induction motor having a six-pole field-magnet. In Figs. 5 and 7 the poles of the

field-magnet are indicated by N and S, while 5 indicates the teeth of the armature-core and 6 cross-sections of the bath.

The furnace shown in Figs. 8 and 9 has a four-pole field-magnet and a melting-chamber consisting of two concentric channels 7 and 8 connected to each other by means of radial channels 9 placed at a distance from each other corresponding to 2/3 of the pole-pitch. The said furnace corresponds to a three phase generator having so called short coils and has the advantage of a small self-induction on account of the reduction of the currents flowing through the radial parts of the melting-bath.

The field-magnet in the forms shown in Figs. 6–9 may be carried out substantially in the same manner as in Fig. 3.

It is obvious that the invention is not limited to the forms shown in the drawings, in as much as the same may be modified as to the number of phases and poles at will. The field-magnet is shown as arranged below the armature-core but obviously it may be arranged above the same if desired.

The furnaces in question, especially those having closed concentric circuits, may advantageously be built as shaft-furnaces having the shaft arranged above parts of the bath, for instance the inner circuit or above the whole bath.

By dividing the melting-bath in two or more circuits a reduction of the self-induction of the furnace caused by the reduction of the current in each circuit will be obtained, while by the multi-phase arrangement a substantially constant torque of the furnace will be effected.

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

1. In an electric induction furnace the combination of a stationary iron core, a melting chamber inclosing said iron core, a rotary magnet, and a vertical shaft for said magnet.

2. In an electric induction furnace the combination of a stationary iron core, poles being provided on said iron core for forming a number of magnetic circuits, a melting chamber, a rotary magnet, and a vertical shaft for said magnet.

3. In an electric induction furnace the combination of a stationary iron core, poles being provided on said iron core for forming a number of magnetic circuits, two concentric melting chambers, radial channels between the poles of the said iron core connecting the said chambers, a multi-pole rotary magnet, and a vertical shaft for said magnet.

4. In an electric induction furnace the combination of a stationary iron core, poles being provided on said iron core for forming a number of magnetic circuits, a melting chamber inclosing the said iron core, a rotary magnet, having a less number of poles than the stationary iron core, and a vertical shaft for said magnet.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GUSTAF HOLMGREN.

Witnesses:

CONRAD DELMAR,

JOHN DELMAR.