April 9, 1935. J. KUNTZIGER ET AL 1,997,524

ELECTRICAL RESISTANCE FURNACE

Filed Sept. 12, 1932

Fig. 1.

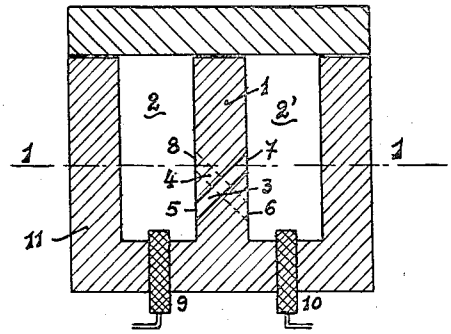


Fig. 2.

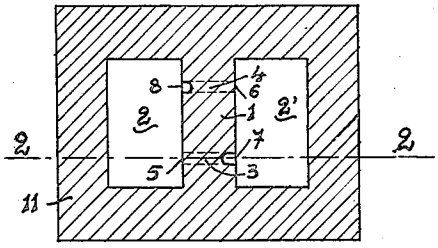
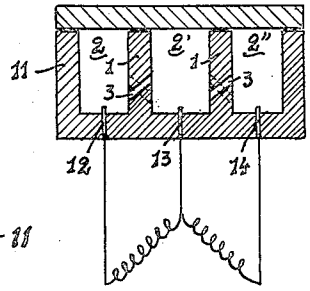


Fig. 3.



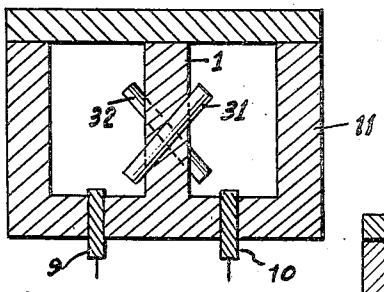


Fig. 6.

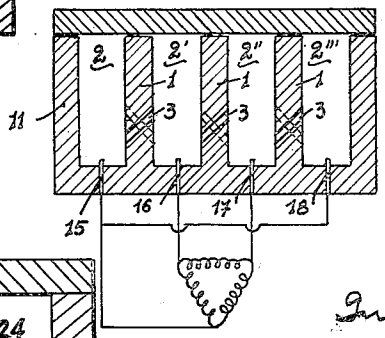
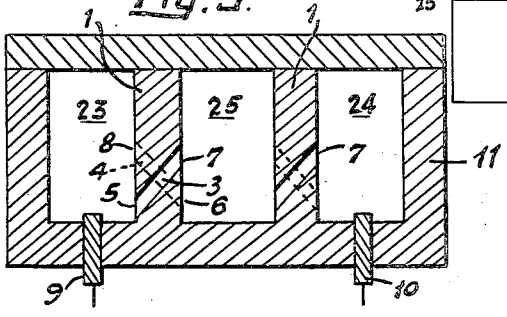


Fig. 4.

Fig. 5.



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ELECTRICAL RESISTANCE FURNACE

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Application September 12, 1932, Serial No. 632,810
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9 Claims. (Cl. 13—23)

The present invention has for its object an electrical resistance furnace in which the Joule effect is produced in channels filled with molten metal and disposed obliquely in such a way as to obtain a circulation of the liquid in consequence of the reduction of density due to the heating. In the simplest case, the furnace comprises two compartments separated by a vertical partition provided with two channels formed obliquely in its thickness and crossing one another. In this way, a first channel starts in the first compartment in order to open out into the second compartment at a level higher than its inlet orifice in the first compartment, and on the other hand, a second channel starts in the second compartment at the level of the inlet orifice of the first channel in order to open out into the first compartment at the level of the outlet from the first channel into the second compartment.

Thus these channels allow of obtaining, from one compartment to the other of the furnace, a thermo-siphonic flow which tends constantly to empty the compartments through the lower orifices of the channels and to fill them through the upper orifices. In this manner, the circulation of the liquid bath is ensured in such a way that the contents of the channels will be continually renewed.

There follows a rise of temperature of the bath which then receives the substances to be melted with or without other contributory substances.

In order better to illustrate the following explanation, the annexed drawing to which reference is made in the present specification, represents:—

Fig. 1 a diagrammatic section in elevation of a resistance furnace, for continuous or single-phase alternating current, along the line 2—2 of Fig. 2.

Fig. 2 a diagrammatic section along the line 1—1 of Fig. 1.

Fig. 3 a diagrammatic section in elevation of a two-phase resistance furnace.

Fig. 4 a diagrammatic section in elevation of a three-phase resistance furnace.

Figure 5, a diagrammatic section in elevation of a resistance furnace with one intermediate compartment without electrode; and

Figure 6 a diagrammatic section in elevation of a resistance furnace with heating channels constituted by tubes extending beyond the side faces of the partition provided with heating channels.

Referring to the above figures, in particular to Figs. 1 and 2, the structure of the single-phase furnace is represented by 11, while 1 represents the partition pierced by two channels 3 and 4 disposed obliquely and crossed so as to obtain a thermo-siphonic operation which tends constantly to empty the compartments 2 and 2', separated by the partition 1, through the lower orifices 5 and 6 of the channels 3 and 4, and to fill them through the upper orifices 7 and 8 of these same channels. Each of the compartments 2 and 2' will receive an electrode which can be placed in any manner whatever; for example, in the case of Figs. 1 and 2, the two electrodes 9 and 10 pass through the sole of the furnace.

Instead of being directly arranged in the partition 1, the channels such as 3 and 4 can be formed by tubes of refractory material, passing through the partition and extending more or less on either side.

The channels or tubes 3 and 4 can be straight or curved, of constant or variable cross-section. Instead of one pair of channels 3 and 4 (or tubes) in each partition 1, they can be employed in greater number, particularly with a view to reducing the results of the pinch effect.

Similarly the number of partitions such as 1 can be multiplied so as to group in series more or fewer compartments.

Lastly the furnace lends itself easily to feeding with two-phase or three-phase alternating current as shown by the diagrammatic sections in elevation of Figs. 3 and 4.

In Fig. 3, the furnace 11 comprises three compartments 2, 2', 2'', separated by partitions 1 provided with channels such as 3 and 4, and respectively fitted with electrodes 12, 13, 14, fed with two-phase current.

In Fig. 4, the furnace 11 comprises four compartments 2, 2', 2'', 2''', separated by partitions 1, provided with channels such as 3 and 4, and respectively fitted with electrodes 15, 16, 17, 18, fed with three-phase current.

In order to bring into service a furnace of this kind, the first step is to pour into the compartments such as 2, 2', a charge of liquid metal sufficient to reach a level exceeding that of the upper orifices 7 and 8 of the channels 3 and 4, enough to counterbalance by hydrostatic pressure the pinch effect. The electrodes 9 and 10 are then fed and the circulation of the liquid is at once established at the same time as the passage of the current.

The liquid bath of the furnace, of which the temperature rises, is then ready to receive the charges or additions of metals or fluxes.

Due to the mingling of the bath obtained by the circulation in the channels such as 3 and 4, the homogeneity of the furnace products is ensured. Pourings are effected when a certain level of liquid is attained in the furnace, in which there is left, as for starting, a quantity of metal sufficiently exceeding the upper orifices of the channels 3 and 4, if it be desired to continue the melting of fresh charges of metal; in the contrary case, the furnace is emptied completely.

This furnace is intended especially for the melting of metallic waste and principally of cast-iron turnings. In this last case there can with advantage be used as electrodes mild steel plates, not readily fusible, dipping into the bath or else passing through the sole and coming flush with its upper part.

According to Figure 5 the furnace comprises two compartments 23, 24 with electrodes 9, 10, these compartments being separated by an intermediate compartment without electrode, compartment 25 being separated from compartments 23, 24 by partitions 1, 1 provided with heating channels 3, 4 disposed as above. The compartments 23, 25, 24 are arranged in series.

According to Figure 6 the heating channels 3, 4 are formed by tubes 31, 32 of refractory material, extending beyond the side faces of the partition 1, the length of the channels being thus increased.

This furnace may evidently be tiltable, the axis of rotation being normal to the partitions such as 1 disposed parallel to each other.

It is obvious that the furnaces of the kind considered can be constructed in any dimensions with suitable materials and electrodes for the purposes contemplated.

What we claim is:

1. An electrical resistance furnace adapted to receive molten metal, comprising two compartments, a separating partition disposed between said compartments, a heating channel extending through said partition in a relation inclined to the horizontal, a second heating channel disposed in said partition in an opposite inclined relation, and electrodes, one of said electrodes located in each of said compartments and below the normal level of said molten metal, whereby heating of said metal is realized primarily in said inclined channels.

2. An electrical resistance furnace according to claim 1, characterized in that the electrodes are located at the bottom of each compartment.

3. An electrical resistance furnace according to claim 1, characterized in that the channels are inclined to the horizontal plane at an angle greater than 45 degrees.

4. A polyphase electric resistance furnace comprising a plurality of compartments adapted to contain fluid metal, the number of said compartments being one greater than the number of said phases, a plurality of electrodes, one of said electrodes located in each compartment below the normal level of liquid metal therein, said compartments being adjacent to each other, the intermediate compartments having common separating partitions, each of said partitions being provided with heating channels passing through the partition and oppositely inclined to the horizontal plane.

5. A polyphase electric resistance furnace comprising a plurality of compartments adapted to contain fluid metal, a plurality of electrodes, one of said electrodes located in each compartment below the normal level of liquid metal therein, said compartments being adjacent to each other, the intermediate compartments having common separating partitions, each of said partitions being provided with heating channels passing through the partition and oppositely inclined to the horizontal plane.

6. An electrical resistance furnace adapted to receive molten metal, comprising three compartments separated by two partitions, channels oppositely inclined to the horizontal plane in said partitions, electrodes located in the two extreme compartments below the normal level of said molten metal, whereby heating of said metal is realized primparily in said channels.

7. An electric resistance furnace comprising a plurality of compartments adopted to contain fluid metal, electrodes located in said compartments below the normal level of liquid metal therein, supplementary compartments interposed between said first mentioned compartments and adapted to contain fluid metal, separating partitions between all said compartments, said partitions being provided with heating channels passing through them and oppositely inclined to the horizontal plane.

8. An electrical resistance furnace according to claim 1, characterized in that the heating channels in the separating partition are constituted by tubes extending with their ends beyond the side faces of said partition.

9. An electric resistance furnace comprising a plurality of compartments adapted to contain fluid metal, partitions separating said compartments and each provided with a plurality of heating channels oppositely inclined to the horizontal plane and passing through said partitions, and electrodes disposed in several of said compartments and all located below the normal level of the liquid metal in said compartments, said compartments being so arranged that a compartment without electrode will be interposed between two compartments with electrodes.

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