Oct. 18, 1932. E. L. CROSBY ET AL 1,883,590

FURNACE LINING

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Fig. 1

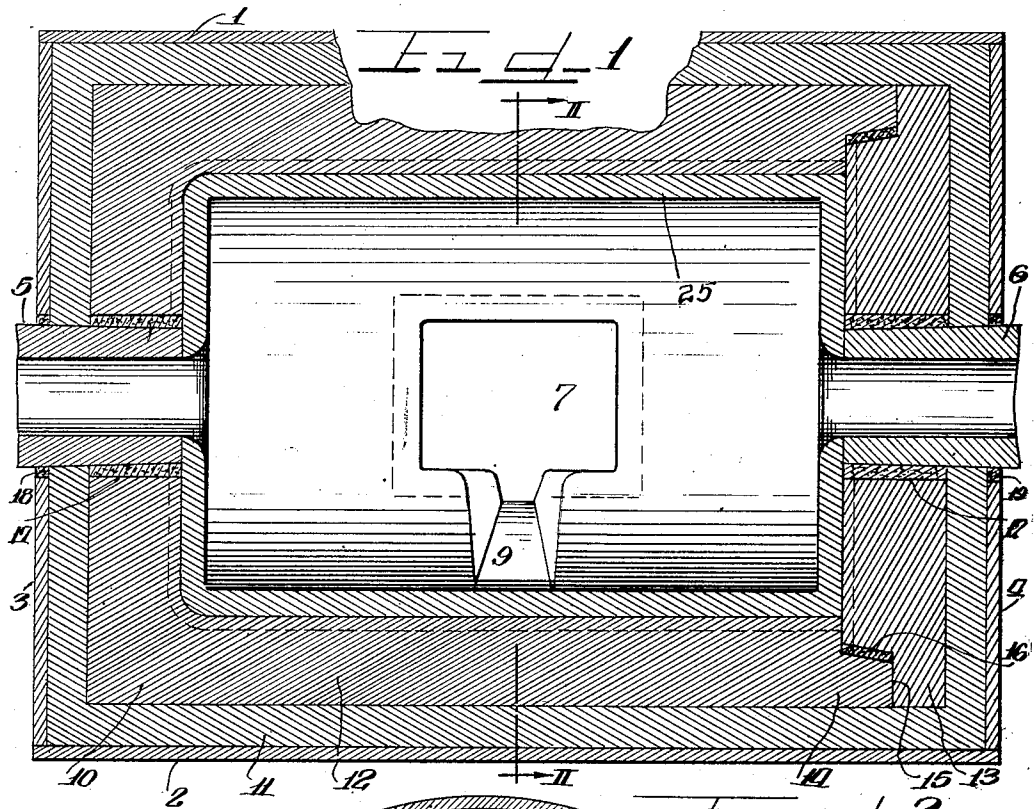
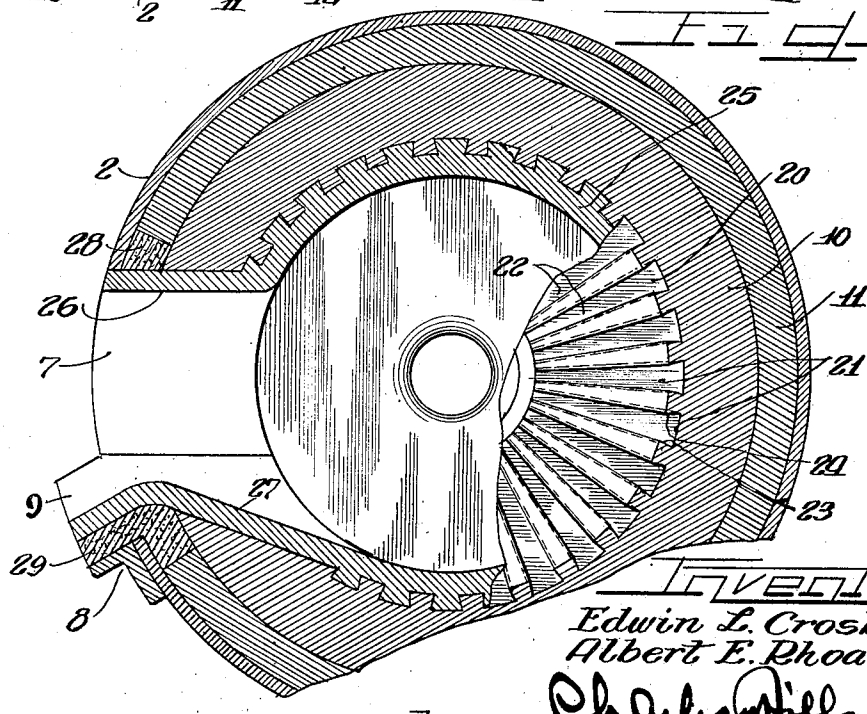


Fig. 2



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Fig. 3

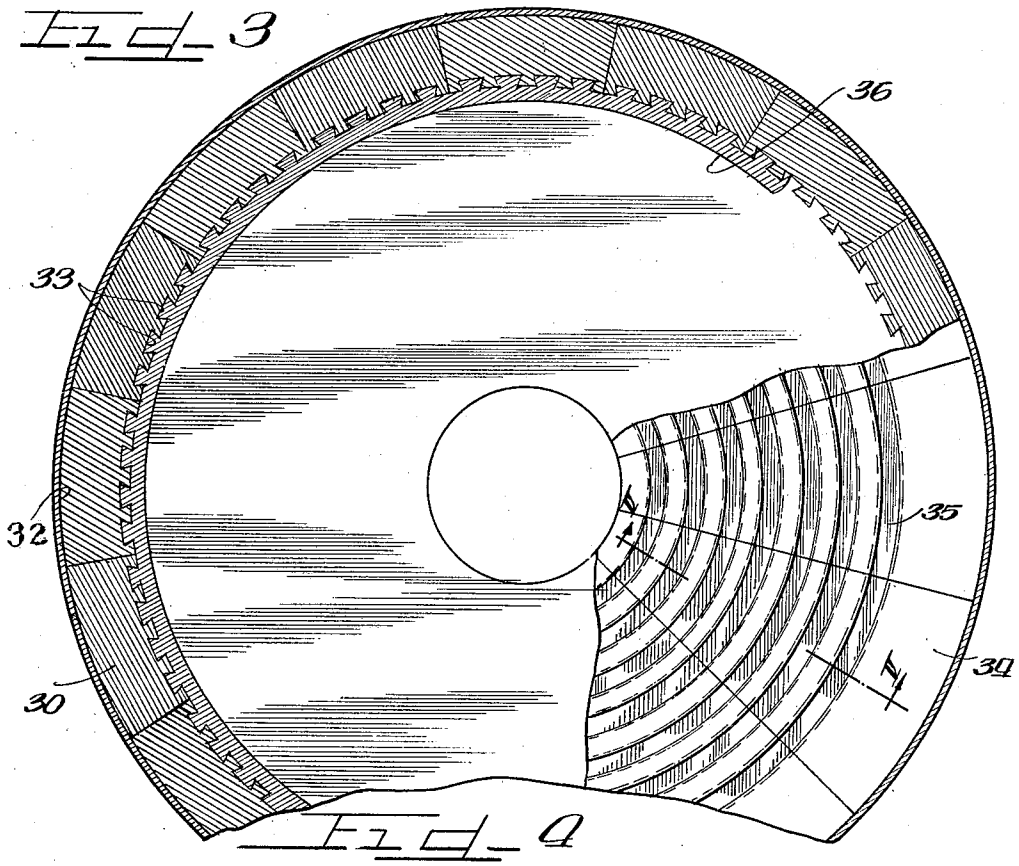
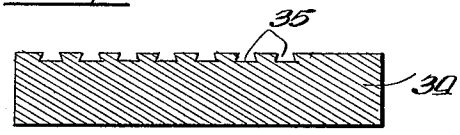


Fig. 4



Fig. 5



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UNITED STATES PATENT OFFICE

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FURNACE LINING

Application filed September 23, 1930. Serial No. 483,894.

This invention relates to a furnace lining and more particularly to a lining for an electric furnace.

On account of the extremely high temperatures that are often employed in electric furnaces, and more particularly when treating ferrous metals in electric furnaces, it is necessary to provide linings for the furnaces that will withstand the terrific heat to which they are subjected and also that will remain inert toward the contents of the furnace during treatment. While linings have heretofore been devised that are fairly suitable for use in electric furnaces employed largely for the remelting of lower melting, non-ferrous alloys, such as brass, prior commercial linings have not according to our own experience satisfactorily withstood the higher temperatures involved in the treatment of ferrous alloys. The difficulty has chiefly been in securing a permanent anchorage of the inner lining to the walls of the furnace, due largely to the unequal coefficients of expansion of the refractory materials employed for the purpose.

It is therefore an important object of this invention to provide an improved construction of lining for furnaces and more particularly for electric furnaces wherein exceptionally high temperatures are employed.

It is a further important object of this invention to provide a construction for furnace linings whereby a monolithic layer of highly refractory material may be keyed while in a plastic state to a backing of refractory brick or the like.

Other and further important objects of this invention will be apparent from the disclosures in the specification and the accompanying drawings.

This invention (in a preferred form) is illustrated in the drawings and hereinafter more fully described.

On the drawings:

Figure 1 is a longitudinal sectional view of an electric furnace showing the lining construction of our invention.

Figure 2 is a sectional view taken substantially on line II—II of Figure 1, with a part broken away to more clearly illustrate the construction of the lining.

Figure 3 is a sectional view of an electric furnace showing a modified lining construction and with a portion broken away.

Figure 4 is a plan view showing the inner surface of a brick used in the lining construction.

Figure 5 is a sectional view taken substantially on line V—V of Figure 3.

While it will be understood that the principles of our invention are applicable to the construction of linings for various types of furnaces, our invention is herein disclosed in connection with linings for electric furnaces because of its particular applicability to electric furnace constructions.

The reference numeral 1 indicates a shell of suitable structural material, preferably formed with a cylindrical body section 2 and circular, apertured end sections 3 and 4 connected to said body section 2. Hollow trunnions 5 and 6 extend through the apertures in said end sections 3 and 4, respectively, these trunnions 5 and 6 being mounted in any convenient manner to permit the rocking or oscillating of the furnace as a whole. The cylindrical shell section 2 is further provided with an opening 7 through which the furnace can be charged and which is adapted to be closed by a door (not shown). A suitably formed casting 8 is secured adjacent the lower edge of the opening 7 to the shell section 2 to provide a spout 9 for pouring the contents of the furnace.

An inner shell 10 of highly refractory brick or similar refractory material is positioned within the outer shell 1 in spaced relation thereto and the space thus formed filled with an insulating material such as finely powdered diatomaceous earth, indicated by the reference numeral 11. In the smaller types of electric furnace it is convenient to form the backing 10 in two sections only, comprising a main cylindrical section 12 closed at one end except for the aperture for the supporting trunnion and an end section or cover member 13 having an annular flange for closing the other end of said main section 12. The main backing section 12 is preferably

formed with an open end 14 having an annular groove to mate with a corresponding groove or cut-away portion 15 provided for the purpose in the end section 13. Both the tongue 14 and groove 15 are provided with tapered, spaced faces and a suitable cement 16 is placed in the space so formed to seal the joint between the end of the main backing section 12 and the end section 13. The openings 17 provided for the trunnions 5 and 6 in the end of the main backing section 12 and in the end section 13 are also made slightly bigger than said trunnions and the space so formed filled with cement. Similar places between the trunnions 5 and 6 and the end sections 3 and 4, as at 18 and 19, respectively, are filled with cement in like manner.

In the construction shown in Figures 1 and 2, the inner surfaces of the brick backing 10, comprising the main section 12 and end section 13, are provided with undercut grooves 20. Said grooves 20 extend longitudinally of the cylindrical portion of the brick backing 12 in parallel spaced rows 21 which are aligned with radially extending grooves 22 provided in the end main backing section 12 and the inner surface of the end section 13. The longitudinally extending grooves 20 are undercut, that is, provided with inwardly convergent walls, as at 23 and 24, in order to provide better anchorage for an inner, monolithic lining 25, which is applied in a plastic condition. The grooves 22, however, in the end wall of the main backing section 12 are not so undercut but are square cut grooves, although it will be understood that if desired both end backing walls may be made sectional and provided with undercut grooves. Either type of groove serves satisfactorily to anchor the monolithic lining 25 to the brick backing 10, although obviously an undercut groove is somewhat more efficient for this purpose.

The inner lining 25, which may be of any suitable highly refractory material, such as mullite, andalusite, sillimanite, carborundum or the like, is applied while in a plastic state by ramming the plastic mixture into place into the grooves 20 and 22 so as to form a substantially uniform layer over the entire surface of the brick backing 10. A monolithic lining is thus formed that is continuous except for the openings provided for the trunnions and for charging and pouring the contents of the furnace. Preferably, the monolithic lining 25 extends along the walls of the opening 7 to form a lining therefor as at 26 and for the spout as at 27, the joints between said extended portions 26 and 27 of the lining and the ends of the insulating layer 11 being sealed by cement as at 28 and 29, respectively.

In Figures 3 to 5 inclusive there is shown a modified lining construction in which the backing 30 is formed of a large number of separate bricks or blocks 31 having cylindrical outer surfaces 32. The inner surfaces of the blocks 30 are provided with undercut grooves 33 uniformly spaced to provide continuously extending parallel grooves the length of the cylindrical portion of the backing. The end walls of the backing 30 are formed of sector-shaped blocks 34 provided with grooves 35 curved along the arc of circles and properly aligned in the different sectors to produce concentric, spaced circular grooves in said end sections. The inner lining 36 is applied in the same manner as above described so as to become permanently anchored in the longitudinally extending, undercut grooves 33 of the blocks 31 and in the circular grooves 35 of the sector-shaped blocks 34.

The modified type of construction just described is better adapted for use in the lining of relatively large furnaces. It will be understood, however, that the form, size and arrangement of the various bricks or blocks making up the lining of this construction may be varied from that shown in the drawings. A principal feature of our invention is the provision of slots or grooves for the anchoring of the inner lining to the backing so as to overcome the tendency of the two to separate due to possible differences in their respective coefficients of expansion.

We are aware that many changes may be made and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and we, therefore, do not purpose limiting the patent granted hereon otherwise than necessitated by the prior art.

We claim as our invention:

1. A lining for a furnace, comprising a non-metallic, refractory backing in cylindrical form having undercut grooves and a monolithic layer secured thereto in said grooves of a highly refractory material capable of being applied in plastic form.

2. A lining for a furnace, comprising a slotted backing of highly refractory material comprising a cylindrical portion open at one end and a cover portion and a monolithic layer anchored thereto in said slots and continuously covering the face of said backing.

3. An electric furnace, comprising a cylindrical shell having openings therein, a sectional brick backing for said shell having undercut grooves on the inner surface thereof and a highly refractory non-metallic lining continuous with the exception of said openings, said highly refractory lining being anchored in the grooves of said brick backing.

4. An electric furnace, comprising a cylindrical shell having openings therein, a sectional brick backing for said shell having undercut grooves on the inner cylindrical surfaces thereof and registering square cut

grooves in the end surfaces thereof and a highly refractory lining continuous with the exception of said openings anchored in the grooves of said brick backing.

5. A refractory lining consisting of a cylindrical body portion having an open end and a closed apertured end, said open end having an annular groove, and a cover member adapted to close said open end and having an annular flange fitting into said groove and interior radial grooves, said body portion having interior parallel grooves and said closed end having interior radial grooves, all said grooves being adapted to receive and interlock therewith a moldable mixture.

6. A refractory lining consisting of a cylindrical body portion and a cover therefor, said body portion having an open end provided with an annular groove, a closed centrally apertured end, and an aperture in its wall, said body portion having also interior parallel dove-tailed grooves, said closed apertured end having interior dove-tailed radial grooves connecting with the parallel grooves aforesaid at the circumference of the closed end, and said cover having an annular flange adapted to enter the annular groove in the open end of the body portion and being provided with radial dove-tailed grooves and a central opening, said grooves being adapted to receive and retain a moldable mixture.

7. A lining for a furnace, comprising a non-metallic, refractory, sectional backing having preformed grooves upon its inner surface and a monolithic layer of highly refractory material extending into said grooves and thereby secured thereto, said lining being cylindrical in form.

8. In an electric furnace, a cylindrical shell of refractory material having one open end and a cover member designed to cooperate therewith, the surfaces forming the interior of the shell being grooved so that it may be coated with a plastic refractory material.

9. A refractory lining comprising a cylindrical body portion having an apertured end wall at one end and a full diameter opening at the other end, a closure for said full diameter opening, said closure and abutting body end having interfitting annular portions, said closed end and cover having radially extending grooves and said body portion having longitudinally extending grooves, all of said grooves being adapted to receive and interlock therewith a moldable mixture.

10. A refractory lining comprising a cylindrical body portion having an apertured end wall at one end and a full diameter opening at the other end, a closure for said full diameter opening, said closure and abutting body end having interfitting annular portions, said closed end and cover having radially extending dove-tail grooves and said body portion having longitudinally extending parallel dove-tail grooves, all of said grooves being adapted to receive and interlock therewith a moldable mixture.

In testimony whereof, we have hereunto subscribed our names at Chicago, Cook County, Illinois.

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