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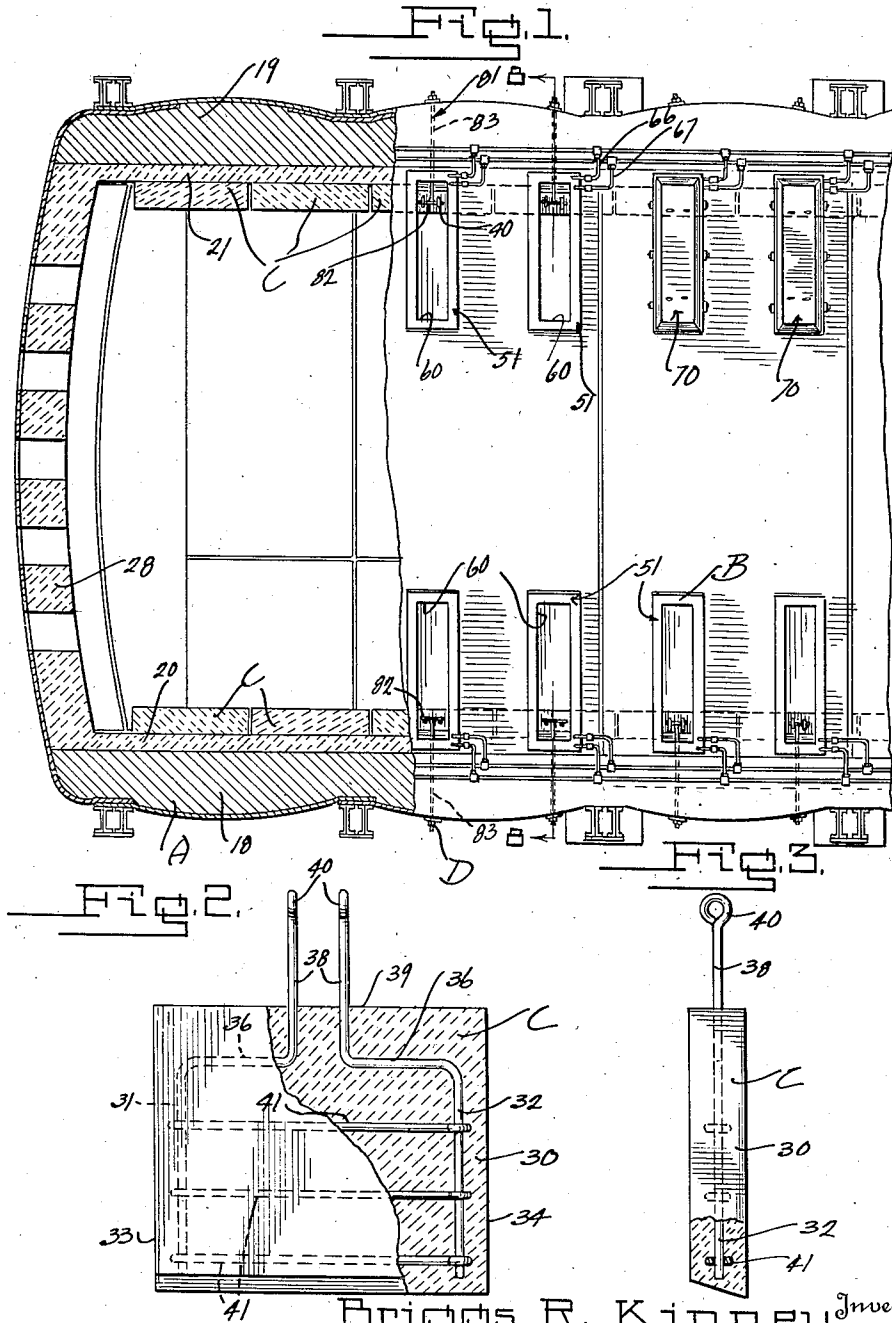
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REPLACEABLE LINER FOR REVERBERATORY FURNACES

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3 Sheets-Sheet 1



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3 Sheets-Sheet 2

Fig. 4.

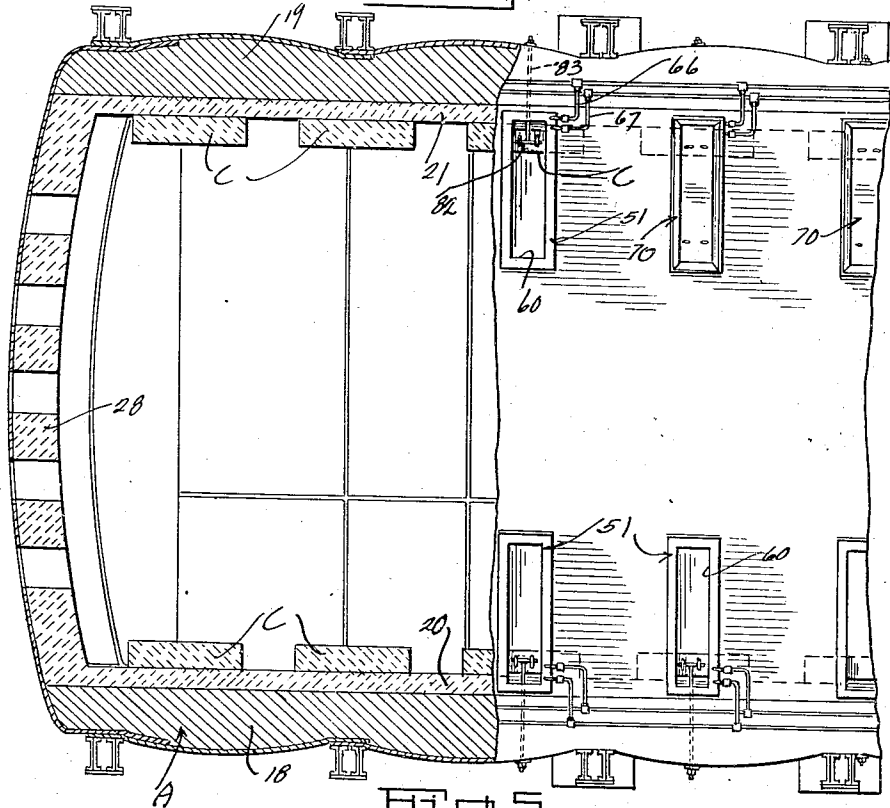


Fig. 5.

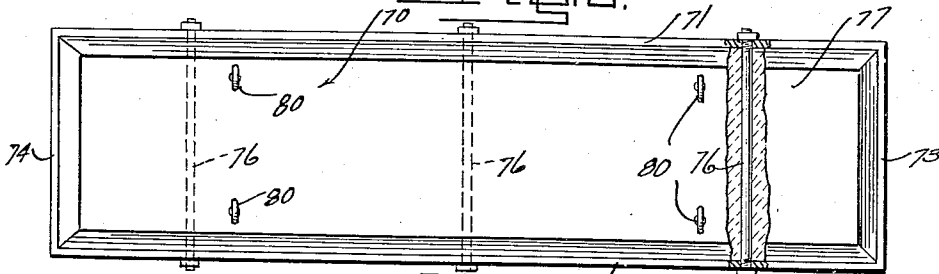


Fig. 6.

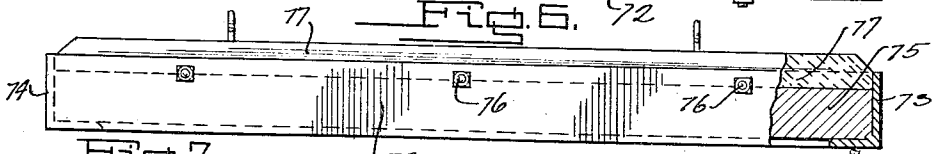
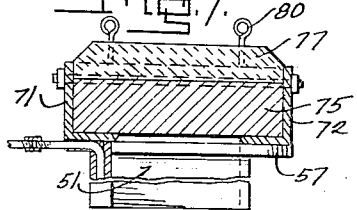


Fig. 7.



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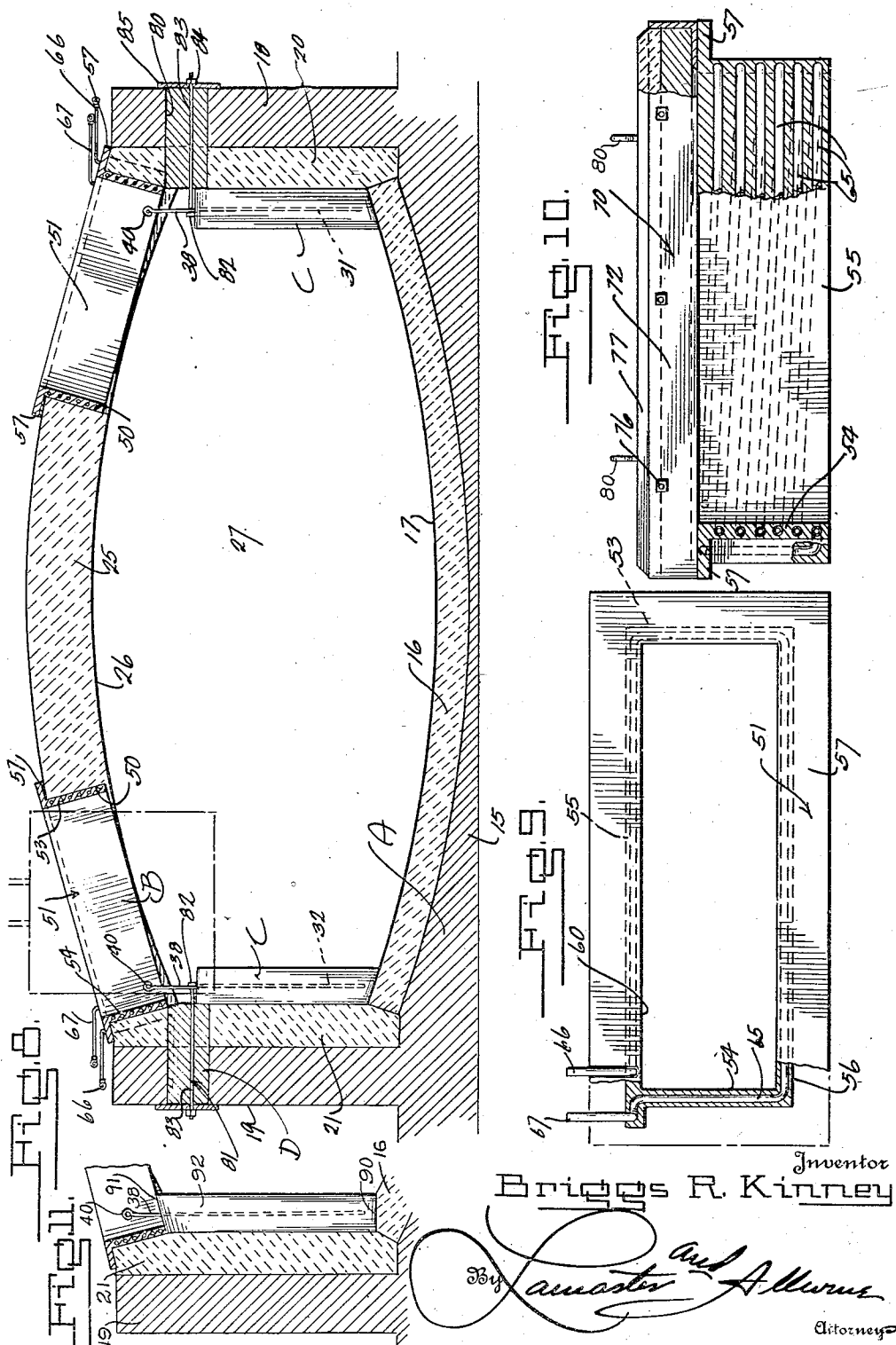
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3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE.

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REPLACEABLE LINER FOR REVERBERATORY FURNACES.

Application filed September 2, 1926. Serial No. 133,258.

This invention relates to improvements in reverberatory furnaces.

The primary object of this invention is the provision of a replaceable liner for use within reverberatory furnaces.

A further object of this invention is the provision of novel means for replacing a protecting lining within a stationary reverberatory furnace during furnace operation.

A further object of this invention is the provision of a novel sectional liner construction for the walls of reverberatory furnaces which is used to protect the expensive brick liners and walls provided for such furnaces, which ordinarily deteriorate rapidly due to the intensity of heat and deteriorating action of materials during the smelting operation.

While many schemes may be employed for constructing a reverberatory furnace with a replaceable lining, a preferred, economical, and efficient operation is that of constructing wall liners in sections, and altering the construction of the furnace walls to permit the placement and securing of the sections at different intervals along the length of the furnace.

Other objects and advantages of this invention will be apparent during the course of the following detailed description.

In the accompanying drawings, forming a part of this specification, and wherein similar reference characters designate corresponding parts throughout the several views,

Figure 1 is a fragmentary plan view, partly in section, of a reverberatory furnace, showing the altered construction thereof to receive the replaceable liner within the combustion chamber thereof.

Figure 2 is a fragmentary front elevation of a type of liner section which may be employed as a preferred construction.

Figure 3 is an edge elevation of one of the replaceable liner sections.

Figure 4 is a view of the furnace similar to Figure 1, but showing a different arrangement of the replaceable liner construction, which in the instance illustrated are spaced longitudinally within the furnace against the walls, to dissipate the heat of the molten material at the walls.

Figure 5 is an enlarged plan view, partly in section, of a closure which may be used in connection with openings in the top of the reverberatory furnace, into which openings the replaceable liner sections are lowered and

removed with respect to the combustion chamber.

Figure 6 is a side edge elevation of the cover illustrated in Figure 5.

Figure 7 is a transverse sectional view taken through the type of cover illustrated in Figures 5 and 6.

Figure 8 is a transverse sectional view taken through the furnace construction, showing the preferred support of the replaceable liner sections.

Figure 9 is a fragmentary plan view of a type of water cooled frame about the opening in the top wall of the reverberatory furnace through which the liner sections are replaceable and removable with respect to the furnace combustion chamber.

Figure 10 is a fragmentary sectional view taken through the frame illustrated in Figure 9, with the cover illustrated in Figure 5 in place thereon.

Figure 11 is a modified form of support for the replaceable liner wedged in a frictional manner within the furnace compartment against the walls thereof.

In the drawings, wherein for the purpose of illustration are shown preferred and modified details of the invention, the letter A may generally designate any approved type of reverberatory furnace, provided with an altered construction B to detachably receive the replaceable liner sections C, which are preferably detachably held in place in the combustion chamber of the reverberatory furnace A by means D.

The reverberatory furnace A for the most part is conventional, and it includes a preferably slag foundation 15, upon which the conventional silica or magnesite brick floor 16 is placed with the usual upwardly facing concave surface 17. The upstanding outer walls 18 and 19 are provided of the conventional furnace construction, having the usual inside walls 20 and 21 which are of silica or magnesite brick, of a special fire and heat resisting nature, since the wall portions 18 and 19 are formed of standard brick. The arch top wall construction 25 is of the usual concavo-convex formation, with the downwardly facing concave surface 26, which faces the floor 16 and provides therebetween the combustion chamber or compartment 27 wherein the work to be heated is placed. The furnace construction A furthermore includes end walls, such as the end wall 28

illustrated in Figure 1 of the drawings, at the fire end of the furnace, and the opposite end wall may be of the conventional construction.

In lieu of the floor and vertical side wall constructions above described, other types may be provided than that shown.

The liner sections C may be made of slag, brick, metal, or concrete. It may be made of other materials if found desirable, of a fire resisting or furnace wall protecting nature, and constructed of cementitious materials the same may be reinforced or unreinforced as desired. Special means may be provided for holding the same in place in the furnace against the side walls, or the same may be frictionally held in place in a resting relation against the side walls.

For the preferred construction the replaceable liner section C as illustrated in Figures 2 and 3 of the drawings, comprises a substantially rectangular shaped cementitious body 30, of any approved thickness, which is provided with vertical reinforcing rods 31 and 32 adjacent the side edges 33 and 34 thereof, which at their upper ends are intumed in aligning relation at 36, and at their free ends in spaced relation are upturned at 38, and extend above the top edge 39 of the body 30, and at their upper ends are preferably provided with transversely aligning eyes 40 adapted to receive a grappling hook or other handling means. Within the body of cementitious material is preferably cast a plurality of spaced horizontally disposed and parallel reinforcing rods 41, which at their ends are provided with eyes or other anchoring means secured to the vertical portions 31 and 32 above described, and as illustrated in Figures 2 and 3 of the drawings.

The roof or top construction 25 of the furnace is constructed in special manner to receive the detachable liner sections C, according to the form of invention herein described, but it is to be understood that the formation of the furnace may be other than that illustrated according to the different types of replaceable liners provided for the stationary type of reverberatory furnace. In the roof or top wall construction 25 along each longitudinal side wall of the furnace, the roof is provided with a series of spaced openings 50, spaced on predetermined centers, these openings being of rectangular formation with the length thereof extending transversely of the furnace longitudinal axis, as illustrated in Figure 1 of the drawings. As a preferred construction, the openings 50 are provided along each of the side walls, spaced on five foot centers longitudinally of the furnace, the openings being preferably one foot by 5' 3", with the length thereof arranged exactly at right angles to the longitudinal axis of the furnace.

These openings 50 may be provided directly in the roof construction or they may be formed with any approved framework with or without a water jacket, for which suitable removable covers are provided. As the preferred construction, each opening 50 is preferably provided with a water cooled frame construction 51, which includes a rectangular shaped body comprising the end walls 53 and 54, and the longitudinal side walls 55 and 56; these walls 53 to 56 inclusive having outwardly extending right angled supporting flanges 57 at the top margins thereof, which are adapted to rest upon the outer or exterior surface of the roof and top surface of the side wall portions 20 and 21 above described, with the rectangular shaped body walls of the frame 51 extending into the openings 50 in snug fitting relation therewith; it of course being understood that the frames 51 each provide passageways 60 therethrough communicating with the combustion chamber 27, and through which the removable liner sections C may pass on their way into or out of the furnace construction. The frames 51 are to be constructed of any suitable metal or material.

If the frames 51 are to embody water cooled arrangements, preferably the same comprises a piping arrangement consisting of a plurality of substantially horizontally disposed coils 65, spiralled within the side and end walls 53 to 56 inclusive, and at the free ends said piping including an entrance portion 66 and an exit pipe portion 67 which extend laterally from the flanges 57, and therebelow, in a non-interfering relation with the placement of the removable cover constructions 70; it being understood that these laterally extending pipe portions 66 and 67 may have any approved coupling for connection to a suitable water supply and disposal source and location. This water cooling arrangement is primarily provided for protection of the frame construction 51, although the same may be otherwise useful in the efficient placing and removal of the liner sections during furnace operation.

The preferred removable cover construction 70 for each of the openings 50 or frames 51 thereof is illustrated in detail in Figures 5, 6 and 7, and the same is rectangular in form, comprising side supporting angles 71 and 72, and end supporting angles 73 and 74, which are of angle metal and welded or otherwise secured at their ends, to provide upstanding side and end wall flanges and bottom horizontal flanges on each, the latter of which are adapted to support a body 75 of special brick material therein; it being adapted to transversely reinforce the side angles 71 and 72 by bolts 76. The brick body 75 may extend above the top of the side and end angles, but it is preferred to

support therein fire clay or brick dust 77 as illustrated in the drawings, the edges of which are beveled. In this event the top surface of the brick body 75 terminates in a plane below the top edges of the side flanges of the side and end angle walls as is well illustrated in Figures 6 and 7 of the drawings. The horizontal flanges of the side and end angles 71 to 74 inclusive rest upon the top flanges 57 of the opening frame work 51, to close the passageway or opening 60 therethrough, to consequently shut off the roof openings to the combustion chamber. For convenience in handling, the cover 70 may be provided with eye bolts 80 extending thru the body 75 and reinforced or otherwise supported in any approved relation on said cover plates.

The liner sections C may be placed in any approved relation along the furnace side walls, and the preferred construction is that illustrated in Figure 1 of the drawings, wherein the liner sections are placed in practically continuous relation along the wall portions 20 and 21 of the side wall constructions of the furnace, facing the combustion chamber 27, the lower edges of said liner sections C resting upon the top surface of the floor or bottom wall 16 adjacent the side walls.

Another arrangement is that illustrated in Figure 4, where for economical reasons the liners C are spaced slightly apart longitudinally of the side walls of the furnace. In this case the liner may be slag or of some similar material that will gradually dissolve or deteriorate in the molten bath. The melting or deterioration thereof will naturally take heat from the surrounding zone, and this in effect will protect the conventional furnace wall between the spaces at the side edges of the replaceable liners. Thus, by spacing the detachable liner sections longitudinally of the walls, an economical removable liner arrangement has been provided, which dissipates the heat from the conventional furnace walls in the bare spaces between the removable liner sections.

The replaceable liner section C may be removed or placed by means of an ordinary light travel crane or beam trolley. Such crane of course travels the length of the furnace and to place the liner C the same is carried by the crane to the place in the furnace where it is desired to be placed. The cover 70 is removed from such location, and the liner C is lowered into the furnace through the frame passageway 60, which also extends thru the roof 25, as above described, and in this lowered arrangement the plane of the liner section is of course at right angles to the plane of the side wall of the furnace against which it is placed, but after the same has been lowered into the furnace combustion chamber 27, the same is swung

to an angle of 90°, by any suitable means, until the plane thereof is parallel with the wall, and the same is then moved up against the wall surface of the combustion chamber, and lowered till its lower edge rests upon the bottom 16 adjacent the side wall. The liner is then secured to the side wall in any approved manner and the crane unhooked and the cover replaced. By arranging the axis of the openings in the roof preferably at right angles to the longitudinal axis of the furnace, the roof construction 25 is not weakened, and the full or continuous liner may be provided at each of the inside surfaces of the side walls of the reverberatory furnace.

Different means may be provided for holding the liner sections in place against the inner surfaces of the side walls of the reverberatory furnace, either by a positive securing or merely by wedging or friction engagement with the furnace walls. In the preferred instance some positive means is provided for holding the replaceable liner sections, which as is illustrated in Figure 8 of the drawings, consists in providing transverse openings 80 thru the side wall constructions of the furnace, from the exterior of the furnace side walls to the combustion chamber 27. After the liners have been lowered into place by the crane as above described, a special detachable bolt means secures the upper projecting ends 38 to the side walls and this special bolt means consists in providing a substantially T-shaped bolt or liner securing member 81, which includes a cross head 82 engageable across the inside edges of the upstanding shanks or portions 38 of the liner, and the same furthermore includes a stem 83 extending through the opening 80 to the exterior of the same where it detachably receives a nut 84 which engages against a detachable plate 85 which covers the opening 80 at the outer side of the wall, and is in positive engagement with the exterior surface of the furnace walls about the margins of the opening 80. The opening 80, after securing of the liner in place, may be filled with clay or other material, or it may be left blank if found suitable.

In lieu of the positive securing means D for each replaceable liner, the liner may have the bottom edge thereof shaped as illustrated at 90 in Figure 11 of the drawings, to rest on the side marginal edge of the bottom 15 of the furnace, and the upper edge 91 of replaceable liner may wedge against the lower surface of the roof 25 adjacent the side wall construction; the liner body 92 of course being sufficiently high to extend from the bottom to the roof in a wedge engagement with the facing surfaces thereof to frictionally hold the same in place. Various shapes of the bottom edges of the

liners may be provided, but in any event the bottom edge of the liner body may be sloped to suit the bottom surface upon which the same may rest. The two most important means of securing the liner in detachable position within the furnace combustion chamber is by wedging and by bolting.

From the foregoing description of this invention it is apparent that a reverberatory furnace has been provided, the maintenance of which is more economical than the ordinary reverberatory furnace, in that the replaceable liners are provided for the furnace, which are of a practical nature, considering the fact that reverberatory furnaces are of extreme length, an average length being 125', as will be well understood by anyone skilled in the art to which this invention relates. I of course understand that different types of liners have been provided for small firing apparatus, but am not aware that a replaceable liner for reverberatory furnaces has ever been provided which will meet the requirements incident to heating in a reverberatory type of furnace.

Various changes in the shape, size, and arrangement of parts may be made to the forms of invention herein shown and described, without departing from the spirit of the invention or the scope of the claims.

I claim:

1. In a reverberatory furnace construction the combination of stationary elongated floor, side walls, and roof supported by the side walls defining an elongated combustion chamber, and an easily replaceable and removable liner construction for the combustion chamber.

2. In a reverberatory furnace construction the combination of stationary elongated floor, side walls, and roof supported by the side walls defining an elongated combustion chamber, a detachable liner construction for the combustion chamber, along the side walls, and means formed in the roof to permit the removal or replacement of the detachable liner.

3. In a reverberatory furnace the combination of an elongated furnace construction comprising a floor, spaced side walls, and a roof, and providing an elongated combustion compartment therein, a replaceable liner construction for the combustion chamber, and means formed in the furnace construction to permit the placing of the liner during furnace operation.

4. In combination with a reverberatory furnace having a combustion compartment therein, a detachable side liner construction for the said compartment, and means formed in the furnace construction to permit the placing or removal of said liner during furnace operation.

5. In a reverberatory furnace construction,

walls, and a roof, a detachable sectional liner construction, and means formed in the furnace construction to permit the placing or removal of the sections of the liner sections in the furnace during furnace operation.

6. In a reverberatory furnace the combination of a floor, side walls, a roof having openings therein, and a removable liner construction for the furnace formed in sections adapted to be inserted thru said openings into the furnace.

7. In a reverberatory furnace the combination of a floor, side walls, a roof having openings therein, a removable liner construction for the furnace formed in sections adapted to be inserted thru the openings into the furnace, and means to detachably hold said sections in place against the facing walls within said furnace.

8. In a reverberatory furnace the combination of a floor, side walls, a roof having openings therein, a removable liner construction for the furnace formed in sections adapted to be inserted thru the openings into the furnace, means to detachably hold said sections in place against the walls within said furnace, and detachable cover plates for the openings in said roof.

9. In a reverberatory furnace the combination of an elongated floor construction, elongated spaced side wall constructions and an elongated roof wall, said furnace between the floor, roof and side walls providing a working receiving compartment, the roof having openings therein elongated transversely of the longitudinal center of the furnace, liner sections, said liner sections being adapted to be lowered through the openings in the roof into the furnace compartment, and means to detachably clamp said liner sections at the interior surfaces of the side walls in abutment therewith to act as a replaceable liner construction for the compartment of the furnace.

10. In a reverberatory furnace the combination of an elongated floor construction, elongated spaced side wall constructions and an elongated roof wall, said furnace between floor, roof and side walls providing a working receiving compartment, the roof having openings therein elongated transversely of the longitudinal center of the furnace, liner sections, said liner sections being adapted to be lowered through the openings in the roof into the furnace compartment, means to detachably clamp said liner sections at the interior surfaces of the side walls in abutment therewith to act as a replaceable liner construction for the compartment of the furnace, and detachable cover plates for the openings of said roof construction.

11. In a reverberatory furnace lining the combination of a reverberatory furnace including a floor, a roof, side walls of conven-

therein transversely elongated thereon at spaced intervals along said roof and adjacent the side walls, and sectional liners for placement in the furnace along the side walls to cover the same within said furnace, said sections of the liner being adapted to be lowered thru the respective adjacent openings of the roof or removed therethrough.

12. In a reverberatory furnace lining the combination of a reverberatory furnace including a floor, a roof, side walls of conventional formation, the roof having openings therein transversely elongated thereon at spaced intervals along said roof and adjacent the side walls, sectional liners for placement in the furnace along the side walls to cover the same within said furnace, said sections of the liner being adapted to be lowered thru the respective adjacent openings of the roof or removed therethrough, said openings in the roof having water cooled frames thereabout, and de-

tachable cover means for said frames and roof openings.

13. In a reverberatory furnace lining the combination of a reverberatory furnace including a floor, a roof, side walls of conventional formation, the roof having openings therein transversely elongated thereon at spaced intervals along said roof and adjacent the side walls, sectional liners for placement in the furnace along the side walls to cover the same within said furnace, said sections of the liner being adapted to be lowered thru the respective adjacent openings of the roof or removed therethrough, said openings in the roof having water cooled frames thereabout, detachable cover means for said frames and roof openings, and means anchored in the side walls of the furnace for detachably connecting the adjacent liner sections thereto.

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