

[54] **RABBLE FOR ROTARY HEARTH FURNACE**
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[52] U.S. Cl..... **432/235, 110/12, 432/233,**
 432/139, 432/124
 [51] Int. Cl..... **F27d 9/00**
 [58] Field of Search..... 432/77-82, 85,
 432/4, 173, 198, 233-239, 139, 151, 124;
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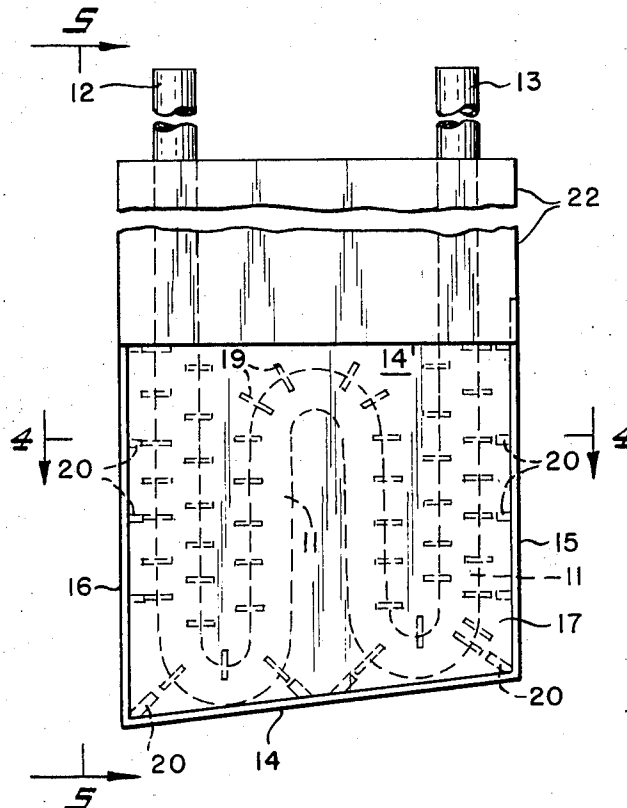
[57] **ABSTRACT**

A fluid cooled rabble construction comprising a plurality of conduits extending along the surface of the rabble. The conduits provide a passageway which is in the nature of a circuitous path and a suitable coolant is circulated therethrough to effect a cooling of the rabble. The rabble may comprise a box-like element formed of steel or the like to which the conduits are secured or the rabble may comprise a structure composed entirely of a suitable refractory or a combination of a refractory and a steel face and edges.

20 Claims, 13 Drawing Figures

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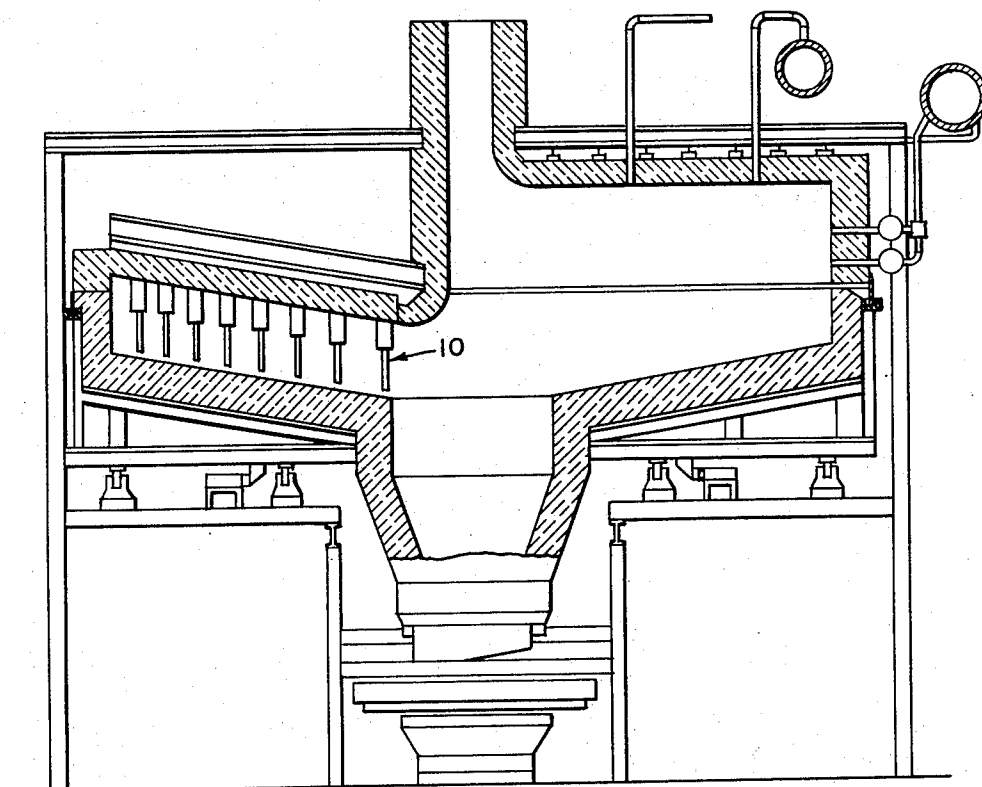


Fig. 1

Fig. 2

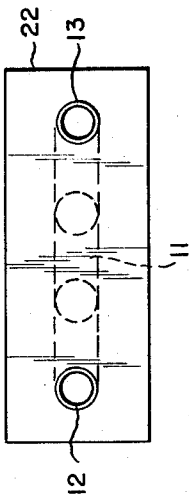


Fig. 5

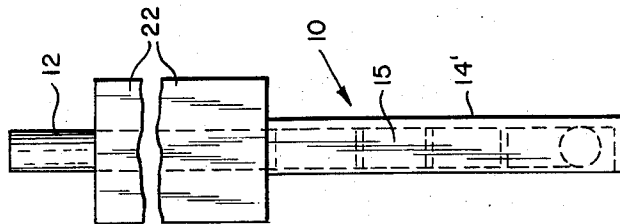


Fig. 4

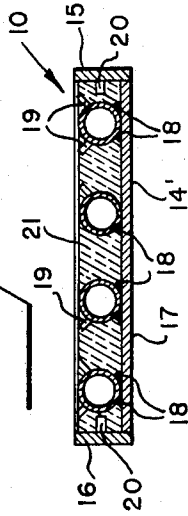


Fig. 3

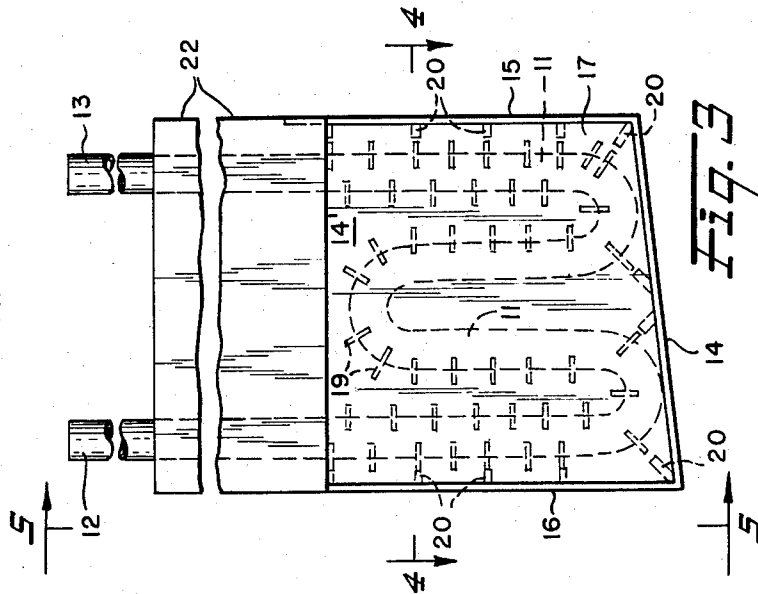


Fig. 6

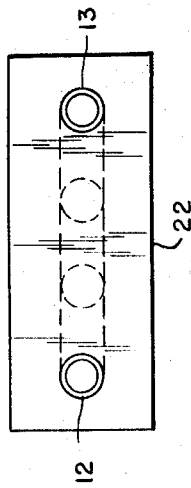


Fig. 9

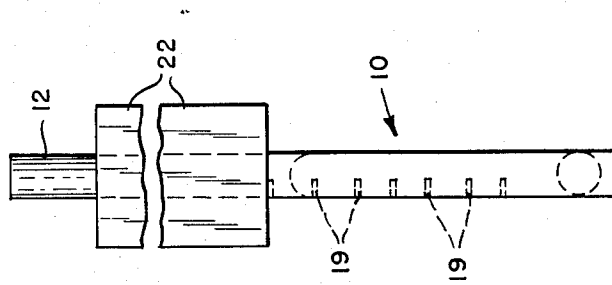


Fig. 7

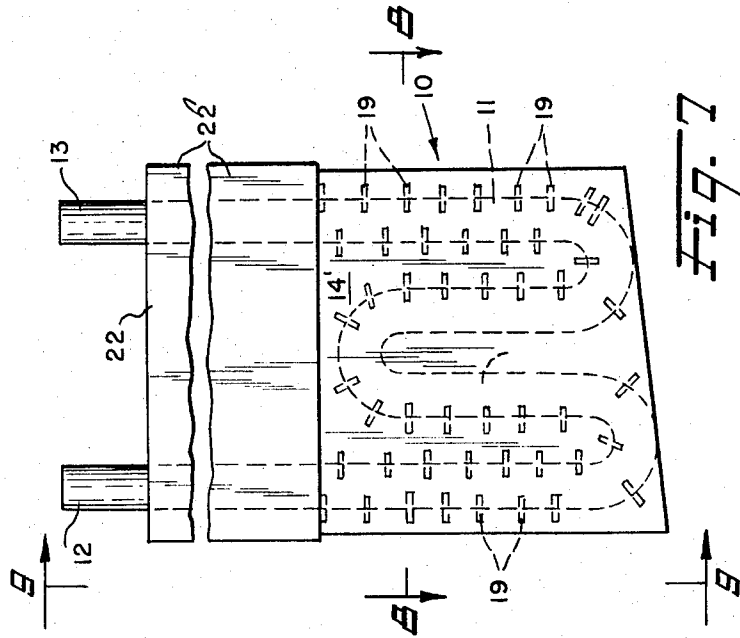
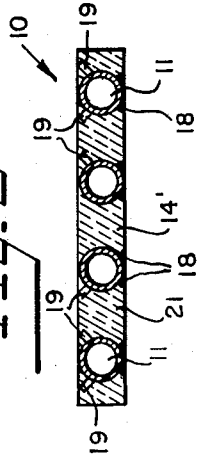
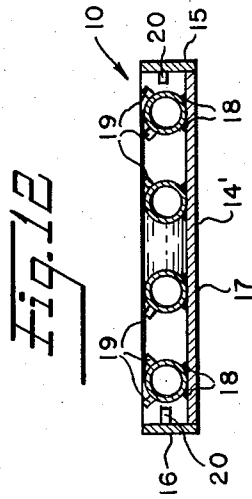
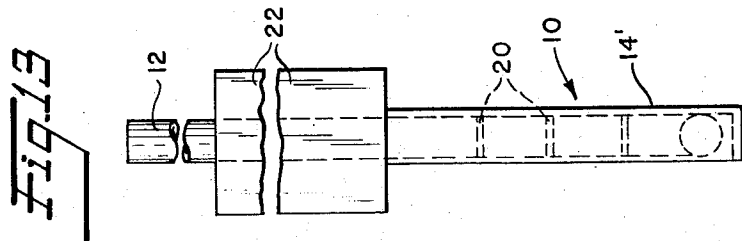
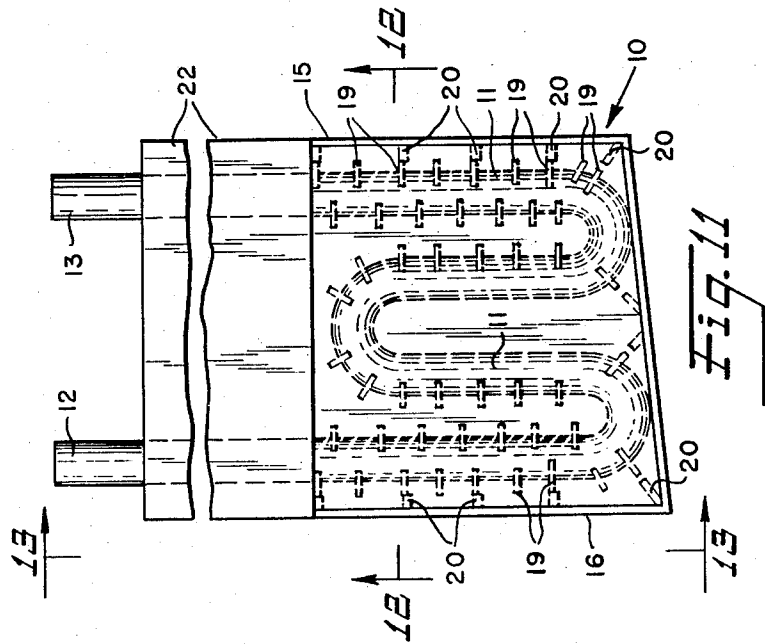
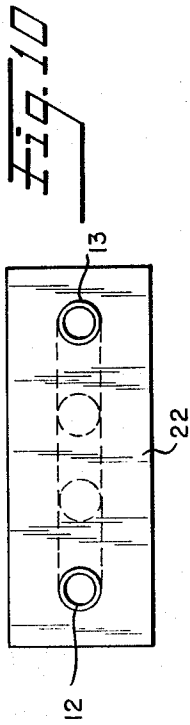


Fig. 8





RABBLE FOR ROTARY HEARTH FURNACE**BACKGROUND OF THE INVENTION**

Rabbles are commonly employed in various types of furnaces for effecting a turn over and advance of the materials being treated in such furnaces. Usually such furnaces comprise a stationary roof and a moving or rotating hearth mounted therebelow. Materials to be processed within such a furnace are usually fed onto the hearth in any known manner and as the hearth moves within the furnace, roof or otherwise supported rabbles engage the materials thereon to effect a turn over of the materials and in some instances, the rabbles are also used to advance the materials from the point of entry into the furnace to a point of exit therefrom. As can be appreciated, the employment of rabbles in a furnace for accomplishing these results pose some problems. One such problem is to construct a rabble in such a manner as to enable the same to be effectively employed in furnace structures wherein quite frequently the temperature therein exceed 2,500°F. Another problem presented is to provide for the elimination of the erosive action of the materials on the hearth against the material employed in the formation of the rabble. Still another problem presented is to effect as large a cooling area for the rabble as is permissible considering the physical dimensions of the rabble, such as the height thereof, the wall thickness of the rabble, width, etc.

With the above in mind it is the primary object of the invention to construct a rabble with coolant passage-ways associated therewith so as to obviate the deterioration of the components of the rabble when the same is exposed to high temperatures.

Another object of the invention is to form a rabble of a suitable refractory material with coolant conducting passage-ways extending therein whereby the transfer of heat into the rabble walls and passageways therein is minimized.

Another object of the invention is to construct a rabble of a suitable refractory material with coolant conducting passageways extending therein and to combine the same with a steel facing extending across the front face and side walls of the refractory so as to resist the erosive action of the material on the hearth against these portions of the rabble.

Another object of the invention is to provide a coolant conducting passageway for a rabble which is devoid of any obstructions therein to thereby insure a smooth flow of the coolant therethrough.

Another object of the invention is to utilize means associated with the coolant conducting passageways to effect a better bond of the refractory material with the said passageways.

A still further object of the invention is to provide a rabble with coolant conducting passageways associated therewith and wherein said passageways are formed of a plurality of straight tubular sections and reverse bends extending between the straight tubular sections to thereby increase the effective cooling areas for the rabble.

Another object of the invention is to provide a plurality of support bars extending inwardly of the side steel wear plates of the rabble so as to assist in retaining the wear plates on to the refractory material and to also

serve to conduct heat from the said side plates to the coolant conducting passage-ways.

Other objects and advantages of the invention will become apparent as the following description of certain present preferred embodiments thereof are herein-after described.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional view taken through one type of a furnace wherein baffles of the present invention may be employed.

FIG. 2 is a top plan view of the rabble shown in FIG. 3 of the drawings.

FIG. 3 is a perspective view of one form of rabble constructed in accordance with the present invention.

FIG. 4 is a section taken on line 4—4 of FIG. 3, looking in the direction of the arrows.

FIG. 5 is a section taken on line 5—5 of FIG. 3, looking in the direction of the arrows.

FIG. 6 is a top plan view of the rabble shown in FIG. 7 of the drawings.

FIG. 7 is a perspective view of a modified form of rabble constructed in accordance with the present invention.

FIG. 8 is a section taken on line 8—8 of FIG. 7, looking in the direction of the arrows.

FIG. 9 is a section taken on line 9—9 of FIG. 7, looking in the direction of the arrows.

FIG. 10 is a top plan view of the rabble shown in FIG. 11 of the drawings.

FIG. 11 is a perspective view of a still further modification of the rabble constructed in accordance with the present invention.

FIG. 12 is a section taken on lines 12—12 of FIG. 11 of the drawings, looking in the direction of the arrows, and,

FIG. 13 is a section taken on lines 13—13 of FIG. 11, looking in the direction of the arrows.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings wherein like numerals are employed to designate like parts throughout the several views, reference numeral 10 designates a rabble and the manner of constructing the same will be set forth with more particularity hereinafter.

The rabble of the present invention may be employed in furnaces having different hearth configuration. For instance, in Kemmerer et al. U.S. Pat. No. 3,475,286, which is incorporated herein by reference, there is shown therein rabbles which are roof supported and extend downwardly to a position in close proximity to a rotary hearth. In this prior patent there is disclosed the employment of rabbles in association with an inclined hearth having a continuous sloping surface and a hearth formed of a plurality of concentrically arranged steps. The aforesaid patent does not show the rabbles in association with a flat hearth. However, it is pointed out the rabble of the instant invention can be as effectively employed with a hearth formed of a horizontally extending flat surface.

The action of the rabbles in turning over and advancing the materials on the hearth progressively inwardly towards a central discharge pit is clearly shown and described in the aforesaid Kemmerer et al. patent.

The rabble of the present invention comprises a plowlike member of a substantially flat formation having a circuitously arranged coolant conducting passageways 11 associated therewith. An inlet 12 and an outlet 13 is provided as clearly shown in the drawings and the same are connected in any known manner to a suitable reservoir or header means (not shown) one such reservoir or header containing the coolant to be fed to the inlet 12 of the passageways 11 and another reservoir or sump for receiving the coolant emerging from the exit end of the passageways. A suitable pump mechanism (not shown) is employed for forcing the coolant fluid through the aforesaid passageways.

Referring now more particularly to FIGS. 2 to 5 inclusive of the drawings, there is disclosed therein one type of rabble constructed in accordance with the concept of the present invention. The rabble as shown in these figures of the drawings comprises a slanted bottom wall 14, a front face 14' and side walls 15 and 16. This rabble is intended for use in a furnace having an inclined hearth.

However, in cases where the rabble is to be used in a furnace having a plurality of concentric steps or in a furnace having horizontally extending flat hearth, the bottom wall of the baffle is not inclined as shown, but extends in a straight line from the aforesaid side walls 15 and 16 so as to enable the same to plow or turn over the materials on the stepped or flat hearth.

The rabble shown in FIGS. 2 to 5 inclusive of the drawings comprises a face plate 17 which extends throughout the height and width of the rabble. The face plate may be constructed of steel or other metal found suitable to withstand the high temperatures within the furnace. Side walls 15 and 16 are likewise formed of steel or like metal and these walls may be formed integral with the face plate or secured thereto in any known manner as by welding, or the like. Thus, the rabble shown in FIGS. 2 to 5 inclusive of the drawings comprises what may be termed a box-like structure with the back and top wall omitted. Mounted within the said box-like member are the passageways 11. Passageways 11 preferably comprise one continuous conduit formed in the shape of a modified W or if desired, the same may be formed in the shape of a plurality of straight and bent or curved sections joined together in any known manner to produce the design shown in FIG. 3 of the drawings. The aforesaid passageways are secured to the rear of the face plate 17 as by welding shown generally at 18. Mounted on the conduits forming the passageways 11 are a plurality of steel clips 19 which extend outwardly therefrom for a purpose to be more fully described hereinafter. Also, a plurality of support bars 20 are spaced along the inside walls 15 and 16, as shown in FIGS. 2 to 5 of the drawings. To construct a rabble such as shown in these figures of the drawings, the passageways 11 formed as aforesaid are welded or otherwise secured to the face plate 17 of the box-like member. Then, a suitable moldable refractory is placed within the aforesaid box-like member. The support bars 20 and clips 19 will engage with the refractory and when the same hardens, the bars and clips will be embedded in the refractory and will serve to retain the refractory within the box-like enclosure. Also, the support bars 20 which extend inwardly from the steel edges 15 and 16 will serve to conduct heat from these side walls to the coolant conducting passageways 11. A rabble constructed as aforesaid is supported from the

roof 22 of the furnace and the same is adapted to extend to a position in close proximity to the moving hearth for the purpose previously described. The mounting of the rabbles in the roof of the furnace may be made in accordance with the teaching of Kimmerer et al. U.S. Pat. No. 3,475,286, aforesaid, wherein the rabbles are adjustably supported in the roof so that the same may be independently adjusted in their disposition with respect to the hearth and the materials thereon so that they may be varied as conditions demand.

Shown in FIGS. 6 to 9 inclusive of the drawings is a modified type of a cooled rabble wherein the same comprises a coolant conducting passageway which is embedded in a suitable refractory material 21. In this modification of the invention, the passageways 11 for the coolant are formed as described with reference to FIGS. 2 to 5 of the drawings. Clips 19 are mounted in any known manner on the conduits forming the aforesaid passageways and when the refractory is molded around the passageways, the clips will be embedded in the refractory to thereby assist in retaining the refractory on to the passageways. The passageways 11 are provided with a coolant inlet 12 and an outlet 13, each connected to a suitable reservoir, as aforesaid. To construct a rabble such as shown in these figures of the drawings, one need only to position the passageways 11 in a suitable mold and to thereafter fill the mold with a suitable refractory material and allowed to harden. The clips 19 on the passageways 11 will assist in retaining the refractory material on to the aforesaid passageways.

Shown in FIGS. 10 to 13 inclusive of the drawings is a further modified form of the rabble. In these views of the drawings, the rabble comprises a merely box-like member having a front face plate 17 and side walls 15 and 16. The face plate and side walls are constructed of a suitable metal and the same may be formed integral or the side walls may be secured to the face plate in any known manner as by welding, etc. As described with respect to FIGS. 2 to 5 of the drawings, the passageways 11 are formed of one continuous conduit with portions thereof bent to form a modified W, or if desired, the same may be formed of a plurality of straight and bent or curved sections joined together in any known manner. Clips 19 are mounted in any manner on the exterior of the conduits forming the passageways 11. Essentially, the rabble shown in FIGS. 10 to 13 inclusive of the drawings may be termed a cooled metal rabble. The passageways 11 are secured to the face plate 17 as by welding 18 and the support bars 20 extending inwardly of the side walls 15 and 16 and the clips 19 mounted on the conduits forming the passageways will serve to extract heat from the immediate area of the rabble and direct the same to the coolant conducting passageways. In this type of rabble, it has been found that the same may be constructed without the employment of a refractory as previously described, and the rabble, by reason of the coolant conducting passageways in contact therewith will function as intended, notwithstanding the excessive temperatures to which the rabble is exposed.

The arrangement of the coolant conducting conduits in the manner aforesaid, provides for a larger surface area of the rabble to be cooled thereby, and a smooth flow of coolant therethrough is assured since there are no obstructions to retard the flow of the coolant.

The configuration of the passageways 11 has been described as being in the shape of a modified W. However, this shape is employed only to illustrate one form of configuration for the passageways, and it is to be understood that a different configuration for the passageways could be equally as effective to provide for a properly cooled rabble. The arrangement of the passageways, however, should be one wherein the conduits forming the same traverse the area of the rabble in a back and forth direction and be devoid of any obstructions which would impede the flow of coolant there-through.

In the aforesaid Kemmerer et al. U.S. Pat. No. 3,475,286, the rabbles shown therein are employed to advance the materials on the hearth from the periphery thereof to a soaking pit which is located centrally of the furnace. Obviously, the rabble of the present invention could be equally applied to a furnace wherein the materials to be processed therein are fed to the central portion of a hearth and caused to travel outwardly to the periphery of the hearth for exit therefrom.

As can be appreciated, a rabble constructed in accordance with the present invention will enable the fabrication thereof with a minimum of equipment. Actually, all one needs to fabricate the rabble is the conduit, refractory material and steel plate for the front and side walls. The simplicity of the arrangement of these components will enable one to assemble the same in the field or on site and the parts of the rabble which are subject to wear and abrasion can be readily replaced on site without the necessity for complete replacement of the entire rabble.

The rabble has been described as roof supported. However, it is pointed out the rabble constructed aforesaid could be as equally effective in its intended purpose if the same is mounted within the furnace and retained therein by means other than the roof, such as a rabble supporting arm extending within the furnace, or the like. Also, a liquid or a gas may be employed as the cooling medium for the rabble.

In the foregoing specification we have illustrated and described certain presently preferred embodiments of our invention. However, it will be understood that this invention may be otherwise embodied within the scope of the following claims.

What is claimed is:

1. A fluid cooled rabble comprising a plow-like member adapted to be supported from the roof of a furnace and extending to a position in close proximity to a hearth within said furnace, said plow-like member including a face plate, side walls, and a circuitously disposed substantially continuous piping extending along the said face plate, and side walls, said piping having an inlet and an outlet for a coolant circulated there-through.

2. The structure recited in claim 1 wherein said piping is secured to said face plate.

3. The structure recited in claim 1 wherein a refractory material extends between the piping and said side walls.

4. The structure recited in claim 1 wherein said face and side walls comprise metallic members.

5. The structure recited in claim 1 wherein said slow-like member comprises a box-like member having a

face and side walls and wherein said piping is secured to said face.

6. A fluid cooled rabble comprising a plow-like member adapted to be supported within a furnace with one end thereof extending to a position in close proximity to a hearth within said furnace, said plow-like member including a face plate, side walls, and a circuitously disposed substantially continuous tubing extending along the said face plate and side walls, said conduit having an inlet and an outlet for a coolant circulated there-through.

7. The structure recited in claim 6 wherein said tubing is secured to said face plate.

8. The structure recited in claim 6 wherein a refractory material extends between the tubing and said side walls.

9. The structure recited in claim 6 wherein said face and side walls comprise metallic members.

10. The structure recited in claim 6 wherein said slow-like member comprises a box-like member having a face and side walls and wherein said tubing are secured to said face.

11. A fluid cooled rabble comprising a plow-like member adapted to be supported within a furnace with one end thereof extending to a position in close proximity to a hearth within said furnace, said plow-like member including a face plate, side walls, a circuitously disposed substantially continuous piping along the said face plate and side walls, clips mounted on said piping and support bars extending from the said side walls, said clips and said support bars assisting in the transfer of heat from within the said rabble to the said piping.

12. The structure recited in claim 11 wherein said piping is secured to said face plate.

13. The structure recited in claim 11 wherein a refractory material extends between the piping and said side walls.

14. The structure recited in claim 11 wherein said face and side walls comprise metallic members.

15. The structure recited in claim 11 wherein said plow-like member comprises a box-like member having a face and side walls and wherein said piping are secured to said face.

16. A fluid cooled rabble comprising a plow-like member adapted to be supported within a furnace and extending to a position in close proximity to a hearth within said furnace, said plow-like member including a face plate, side walls, and a piping extending along and secured to the said face plate, and side walls, said piping having an inlet and an outlet for a coolant circulated there-through.

17. The structure recited in claim 1 wherein said piping is secured to said face plate.

18. The structure recited in claim 1 wherein a refractory material extends between the piping and said side walls.

19. The structure recited in claim 1 wherein said face plate and side walls comprise metallic members.

20. The structure recited in claim 1 wherein said plowlike member comprises a box-like member having a face plate and side walls and wherein said piping is secured to said face plate.

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