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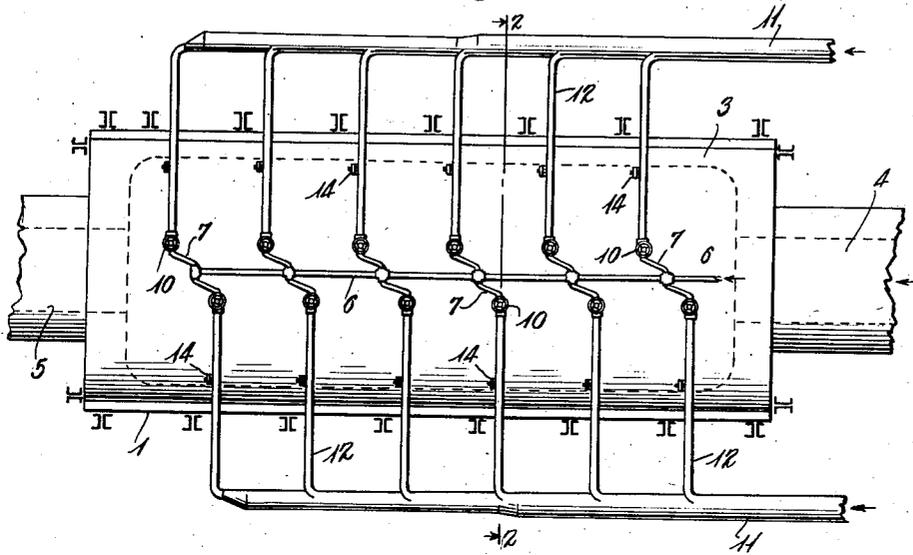
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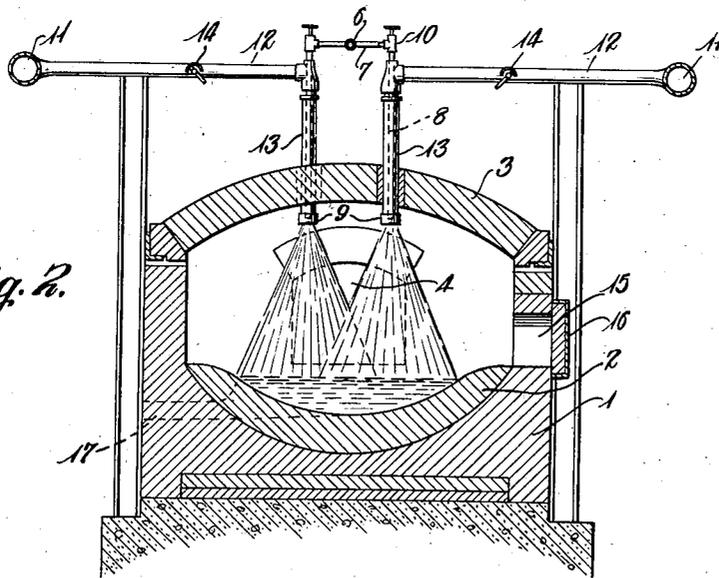
FURNACE AND ITS METHOD OF OPERATION

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*Fig. 1.*



*Fig. 2.*



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## FURNACE AND ITS METHOD OF OPERATION

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9 Claims. (Cl. 263—52)

My invention relates to furnaces and their method of operation and more particularly has reference to improvements in the heating process of my prior Patent No. 1,812,563, June 30, 1931, said process having special utility in the art of metallurgy for the production of steel, iron, ferro-chrome and other metals and alloys.

In my prior patent referred to, I have disclosed and claimed a heating process wherein the charging material on the hearth is heated by flame impingement against the surface thereof, the flames being generated by means of burners mounted in the furnace roof or arch and being directed downwardly onto the charge under high velocity. According to the specific operation illustrated in the patent, the total air for combustion of the fuel is supplied with the latter through the furnace roof. This presents somewhat of a problem in large furnaces and always involves considerable expense in the installation of the large pipes or conduits necessary to carry the large volumes of air required for combustion of the fuel over the top of the furnace and through the burner blocks.

It is a principal object of the present invention to simplify and reduce the cost of the installation for supplying the air to top fired furnaces, such as illustrated in my prior patent referred to.

According to the present invention, the air required for combustion of the fuel is supplied in part with the fuel through the furnace roof and in part through ports in an end of the furnace. That is to say, the total combustion supporting medium is divided between the fuel supply means and an end wall of the furnace, a portion thereof being projected downwardly into the furnace with the fuel and the remaining portion thereof being passed in a generally horizontal direction through the furnace. For greatest simplification of the apparatus, the air introduced through the end wall of the furnace constitutes the major portion of the combustion supporting medium while only a minor portion thereof is supplied through the furnace roof with the fuel. For example, in the case of oil firing, 90% of the air for combustion purposes may be introduced through ports in the ends of the furnace and the remaining 10% supplied with the fuel through the burner blocks in the furnace roof. These proportions are, of course, quite variable according to the type of burner, the viscosity of the oil, the temperature at which it is introduced to the furnace and other factors.

The invention is of special utility in the use

of liquid fuel or oil since when burning gaseous fuel, it is not necessary to introduce any of the air required for combustion through the roof. However, in the case of gaseous fuel, it may be desirable in some instances to introduce a portion of the total combustion air with the fuel through the burner blocks or ports in the roof.

For more detailed understanding of the invention, reference will be had to the accompanying drawing, wherein—

Figure 1 is a plan view of an apparatus capable of carrying out the process and

Figure 2 is a sectional view on the line 2—2 of Figure 1 and showing the charge in melted form.

Referring more particularly to the drawing, at 1 is shown a furnace of the open hearth type, having the usual hearth 2 and arched roof 3. An air inlet conduit 4 and a discharge conduit 5 for combustion products are provided at opposite ends of the furnace. The air supplied to conduit 4 may be preheated in a recuperator or regenerator in the customary manner and the arrangement is such as to permit the alternate introduction of air to and discharge of combustion products from each end of the furnace as in the usual open hearth furnace operation.

An oil supply manifold 6, over the top of the furnace, communicates through branches 7 with each of the fuel inlet pipes 8 projecting through arch 3 into the furnace and terminating in orifices or nozzles 9. Each fuel pipe 8 is provided with a valve 10 for independently controlling the fuel supply to the several orifices. The fuel inlet pipes are spaced throughout the furnace roof in sufficient number to cover the charge on the hearth with flame, as in my prior patent above referred to.

Above the furnace, on opposite sides thereof, are air manifolds 11 having branches 12 leading to pipes 13 surrounding the fuel pipes 8 for supplying additional air to the furnace in admixture with the fuel. Each of the branch lines 12 is provided with an independently operable valve 14 for controlling the quantity of additional air admitted to the furnace through each of the pipes 13.

The material to be heated is supplied to the furnace through opening 15 having closure 16 and the molten material is discharged from the furnace through outlet 17.

In operation, a charge of the material to be heated having been placed upon the hearth, the major quantity of the air required to support combustion, say 90%, is introduced to the furnace through conduit 4 in a horizontal or slightly

downward direction and is caused to travel through the furnace in a generally horizontal plane. At the same time, oil and the minor portion of the air for combustion thereof are introduced through the furnace roof by the means already described, the streams of admixed fuel and air being projected downwardly with sufficient pressure to penetrate the moving stream of air and combustion products and to forcibly impinge upon the charge. The fuel is burned while thus impinging against the surface of the material undergoing heating and preferably the entire charge is blanketed with flame, thus generated near the surface thereof.

From the foregoing it will be seen that by introducing the major quantity of the air required for combustion through an end or ends of the furnace, the greater part of the overhead air supply means shown in my prior patent referred to is eliminated while still obtaining all the advantages of the patented process.

Having thus described my invention, I claim:

1. In the operation of open hearth furnaces, the method which comprises charging the material to be treated onto the furnace hearth, introducing substantially all of the fuel required for the operation of the furnace to the upper portion of the furnace above the hearth and projecting the same downwardly toward the hearth, burning the fuel with air adjacent the material on the hearth, introducing a portion of the air to the upper portion of the furnace with the fuel and simultaneously introducing another portion thereof through a side of the furnace to flow in a substantially horizontal direction through the furnace over the material on the hearth.

2. A method for operating furnaces which comprises introducing substantially all of the fuel required for the operation of the furnace through the furnace roof and projecting the same downwardly toward the furnace floor, burning the fuel in the furnace, introducing the major quantity of air required for combustion of the fuel through a side of the furnace in a generally horizontal direction, and simultaneously introducing a minor proportion of the air through the furnace roof with the fuel to be projected downwardly therewith.

3. In a heating method of the character wherein the material to be heated is placed on a furnace hearth and blanketed with flame, the improvement which comprises introducing admixed fuel and air to the upper portion of the furnace and projecting the same downwardly in a plurality of streams toward the material on the hearth, and simultaneously introducing additional air substantially free of fuel through a side of the furnace in a generally horizontal direction.

4. A heating method which comprises charging the material to be heated on a furnace hearth and covering the major portion of the surface of the charge with flame, introducing substantially all of the fuel required for the generation of said flame to the furnace at a plurality of spaced points above the hearth and directing the same in streams downwardly toward the material on

the hearth, supplying the major portion of the air required for combustion of the fuel through a side of the furnace, and simultaneously supplying the remaining portion of the air with said downwardly directed streams of fuel.

5. In the operation of top-fired open hearth furnaces wherein the fuel is projected downwardly toward the furnace hearth, the improvement which comprises passing the major portion of the air required for combustion of the fuel through the furnace in a generally horizontal direction, and simultaneously supplying the remaining portion of the air to the furnace in admixture with the downwardly projected fuel, said major portion of the air being introduced to the furnace unadmixed with fuel and the total fuel for the furnace operation being introduced with said remaining portion of the air.

6. In the operation of open hearth furnaces, the method which comprises projecting a plurality of streams of admixed oil and air downwardly from the upper portion of the furnace toward the furnace hearth, the quantity of air so admixed with the oil being only a minor portion of the air required for combustion of the oil, and simultaneously passing the remaining portion of air necessary for the combustion of the oil into the furnace unadmixed with fuel and in a generally horizontal direction.

7. In the operation of oil fired furnaces wherein the oil is projected downwardly from the upper portion of the furnace toward the furnace hearth, the method which comprises supplying the major portion of the air required for combustion of the oil through an end of the furnace in a generally horizontal direction, and simultaneously introducing the remaining portion of the air in admixture with the downwardly projected oil, said major portion of the air being introduced to the furnace substantially free of fuel.

8. A heating process which comprises placing a charge of the material to be heated on the hearth of a furnace, introducing oil through the furnace roof above the hearth in sufficient quantity to supply substantially all of the heat for the furnace operation and directing the same downwardly under pressure against the charge, burning the oil while impinging on the charge, introducing the major portion of the air required for combustion of the oil to the furnace in a substantially horizontal direction, and simultaneously supplying the remaining portion of the air to the furnace in admixture with the oil.

9. A heating process which comprises placing a charge of the material to be heated on the hearth of a furnace, supplying oil in a plurality of streams projected downwardly from the roof of the furnace toward the hearth, the amount of oil so introduced being sufficient to blanket the charge with flame, introducing the major portion of the air required for combustion of the oil through an end wall of the furnace in a generally horizontal direction, and simultaneously supplying the remaining portion of the air through the furnace roof together with said oil streams.

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