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CONTINUOUS HEATING FURNACE

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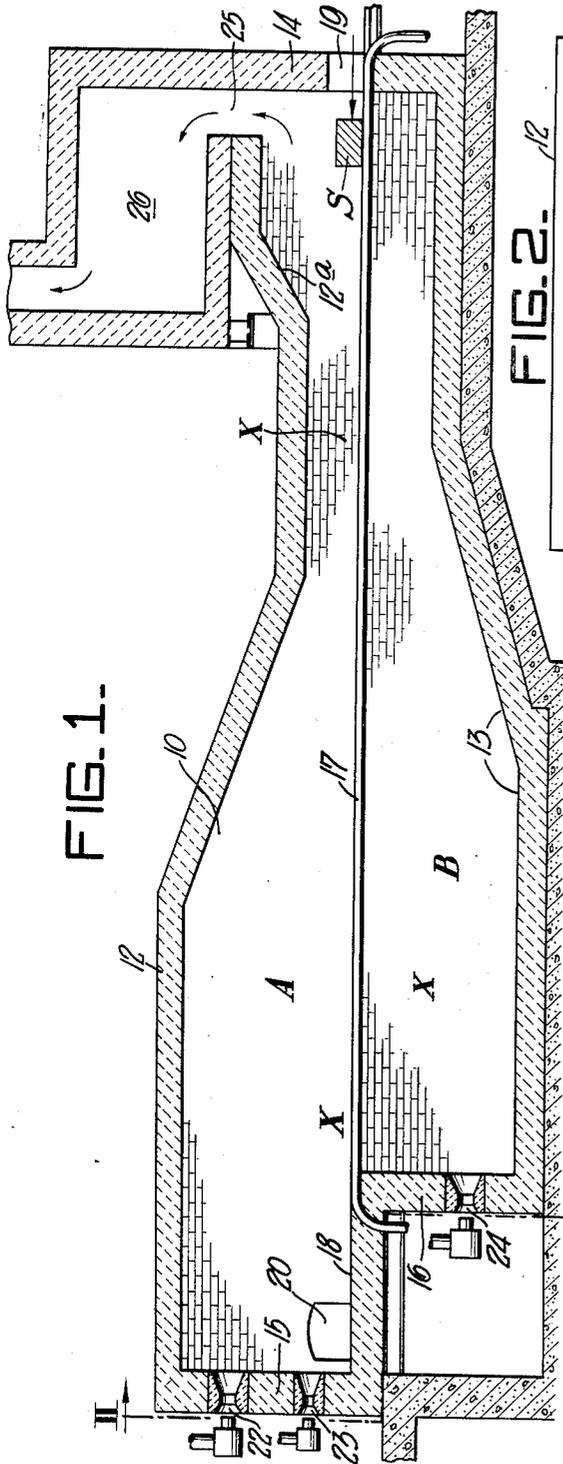


FIG. 1.

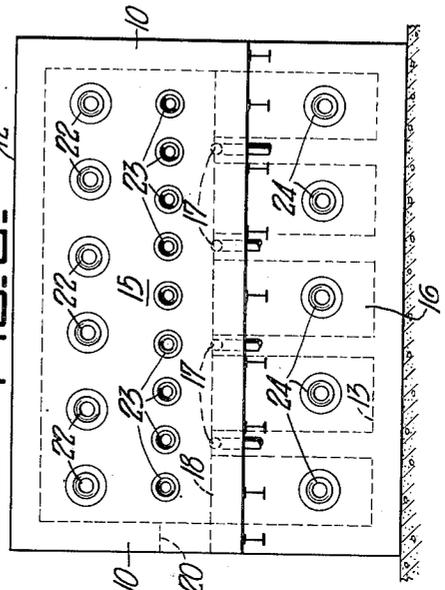


FIG. 2.

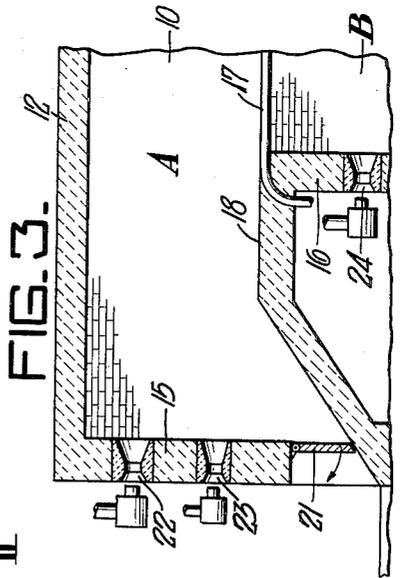


FIG. 3.

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UNITED STATES PATENT OFFICE

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CONTINUOUS HEATING FURNACE

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1 Claim. (Cl. 263—6)

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This invention relates to improvements in furnaces for continuous heating of articles such as billets, blooms, slabs or the like.

An object of the invention is to provide a heating furnace which is highly flexible in its operation and efficient over widely varying operating rates.

A further object is to provide a heating furnace which has but two heating zones, thereby eliminating the complexities that arise in three zone furnaces, and which has an improved burner arrangement that promotes operating flexibility and efficiency.

A more specific object is to provide a heating furnace which has a horizontal hearth and skids and two heating zones, one above the hearth and one below, and in which the zone above the hearth has a set of relatively large burners and a set of smaller burners, both of which sets are at the exit end and either or both of which can be fired at any time depending on the operating rate.

In accomplishing these and other objects of the invention, I have provided improved details of structure, preferred forms of which are shown in the accompanying drawing, in which:

Figure 1 is a vertical longitudinal sectional view of an improved furnace which embodies features of the present invention;

Figure 2 is an elevational view from the exit end taken substantially on line II—II of Figure 1; and

Figure 3 is a fragmentary longitudinal sectional view of a modification.

Figures 1 and 2 show a continuous heating furnace which comprises side walls 10, a roof 12, a bottom 13, an entry end wall 14, and upper and lower offset walls 15 and 16 at the exit end. Within the enclosure formed by these walls there are the usual horizontal skid pipes 17, which occupy roughly 85 percent of the furnace length, and a hearth 18 which occupies the remainder of the length toward the exit end from said skids. The entry wall 14 has an opening 19 through which articles S, such as billets, blooms or slabs, are introduced to the skids for heating in the usual way. After traveling the length of the skids and hearth, where they are heated to an appropriate temperature for hot working, the articles are pushed from the furnace through an opening 20 in one of the side walls, also in the usual way. Alternatively the articles can drop from a door 21 in the exit end wall 15, as illustrated in Figure 3.

In accordance with the present invention, the

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furnace has only two heating zones A and B, the former above the hearth and skids and the latter below the skids. Zone A is equipped with a row of main top burners 22 and a row of smaller auxiliary burners 23 below said main burners. Both sets of burners 22 and 23 are in the upper wall 15 at the exit end. Zone B is equipped with a row of main bottom burners 24 in the lower wall 16 at the exit end. The products of combustion from both zones discharge through flues 25 which open through the furnace roof 12 adjacent the entry end wall 14. The furnace is equipped with the usual recuperator 26, which preferably is situated directly over the flues 25. Preferably the roof 12 has a raised section 12a adjacent the entry end of the furnace which helps to apply more heat to the cold articles as they are introduced, aids in recuperation and helps to prevent "sting out" at the entry opening 19.

In operation, the furnace can be fired using either (a) the main bottom burners 24 and main top burners 22, (b) the main bottom burners 24 and auxiliary top burners 23, or (c) all three sets of burners. The first mode of firing is for normal rates of operation, the second for substantially lower rates, and the third for substantially higher rates. In addition the auxiliary burners 23 can be used as mill delay burners to hold the furnace at proper temperature during shut downs. Preferably the furnace has at least three temperature control points which are located as indicated at X in Figure 1 and at which the usual automatic temperature controls are connected. Such an arrangement assures proper heating at any operating rate from a few tons per hour to more than 150 tons per hour and automatically takes care of firing the furnace during mill delays.

I am aware that mill delay burners as such are known and also that two zone furnaces are known. Nevertheless, I believe it is novel to equip a two zone furnace with auxiliary burners which can be used either in conjunction with the other burners to regulate heating of the furnace or else as mill delay burners. Such a burner arrangement offers the advantage of operating flexibility already referred to and in addition shortens the hearth length for a furnace of any given capacity.

While two embodiments of my invention have been shown and described, it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claim.

I claim:

A continuous heating furnace comprising side

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walls, a roof, a bottom, an entry end wall, an upper vertical wall at the exit end, a lower vertical wall at the exit end offset inwardly from said upper vertical wall, said walls, roof and bottom forming an enclosure, horizontal skids supported in said enclosure and extending from said entry end wall to said lower vertical wall and spaced above said bottom, a horizontal hearth within said enclosure and extending from said lower vertical wall to said upper vertical wall, the upper surface of said hearth being in the same horizontal plane as those of said skids, said side walls, roof, upper vertical wall, hearth and the upper surface of said skids defining a first heating zone, said side walls, bottom, lower vertical wall and the undersurface of said skids defining a second heating zone, there being but two heating zones within said enclosure, said enclosure having a discharge opening adjacent the exit end of said hearth, a row of main top burners located in the upper portion of said upper vertical wall for supplying heat to said first heating zone, a row of auxiliary top burners located in the lower portion of said upper vertical wall directly under said main top burners and disposed in relation to said hearth so as to supply heat to articles thereon immediately prior to their discharge

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through said discharge opening, and a row of main bottom burners in said lower vertical wall for supplying heat to said second heating zone, said enclosure having a flue opening adjacent the entry end in communication with both of said zones, said roof having a relatively high horizontal portion adjacent the exit end, a downwardly sloping portion extending from said horizontal portion toward the entry end, a relatively low horizontal portion extending from said sloping portion toward the entry end and forming a knuckle, and an upwardly sloping portion extending from said last named horizontal portion, said upwardly sloping portion defining with the other walls an expansion chamber beyond said knuckle, said flue opening extending from said expansion chamber.

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