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W. C. DRAKE ET AL

FURNACE

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2 Sheets-Sheet 1

Fig. 1.

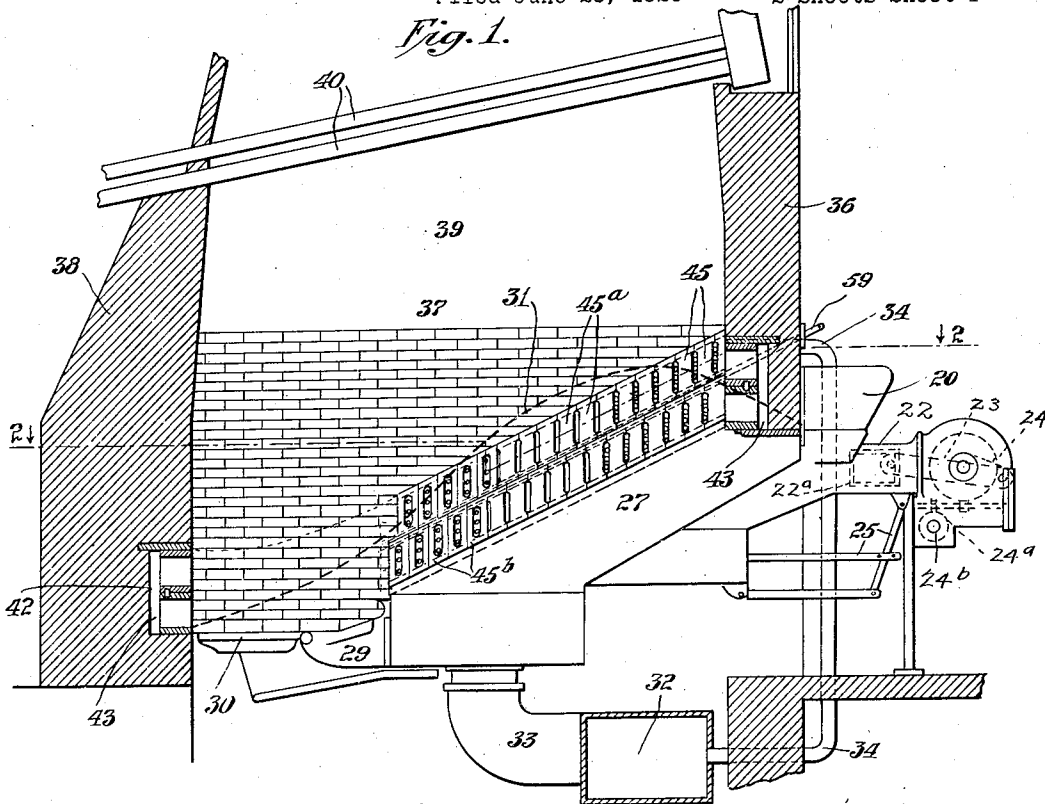
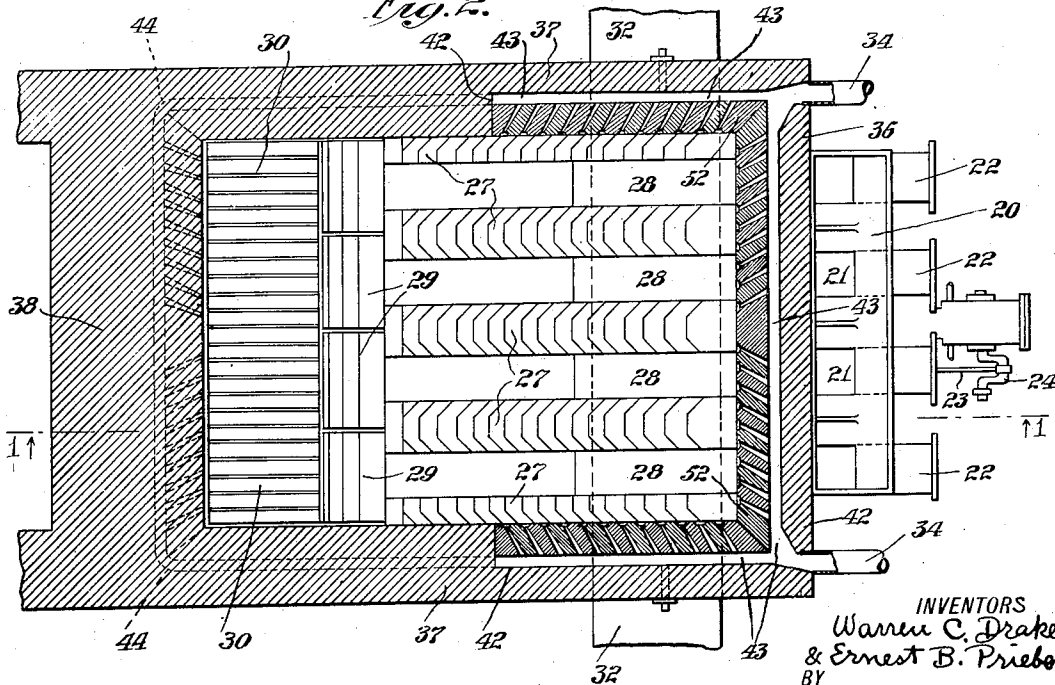


Fig. 2.



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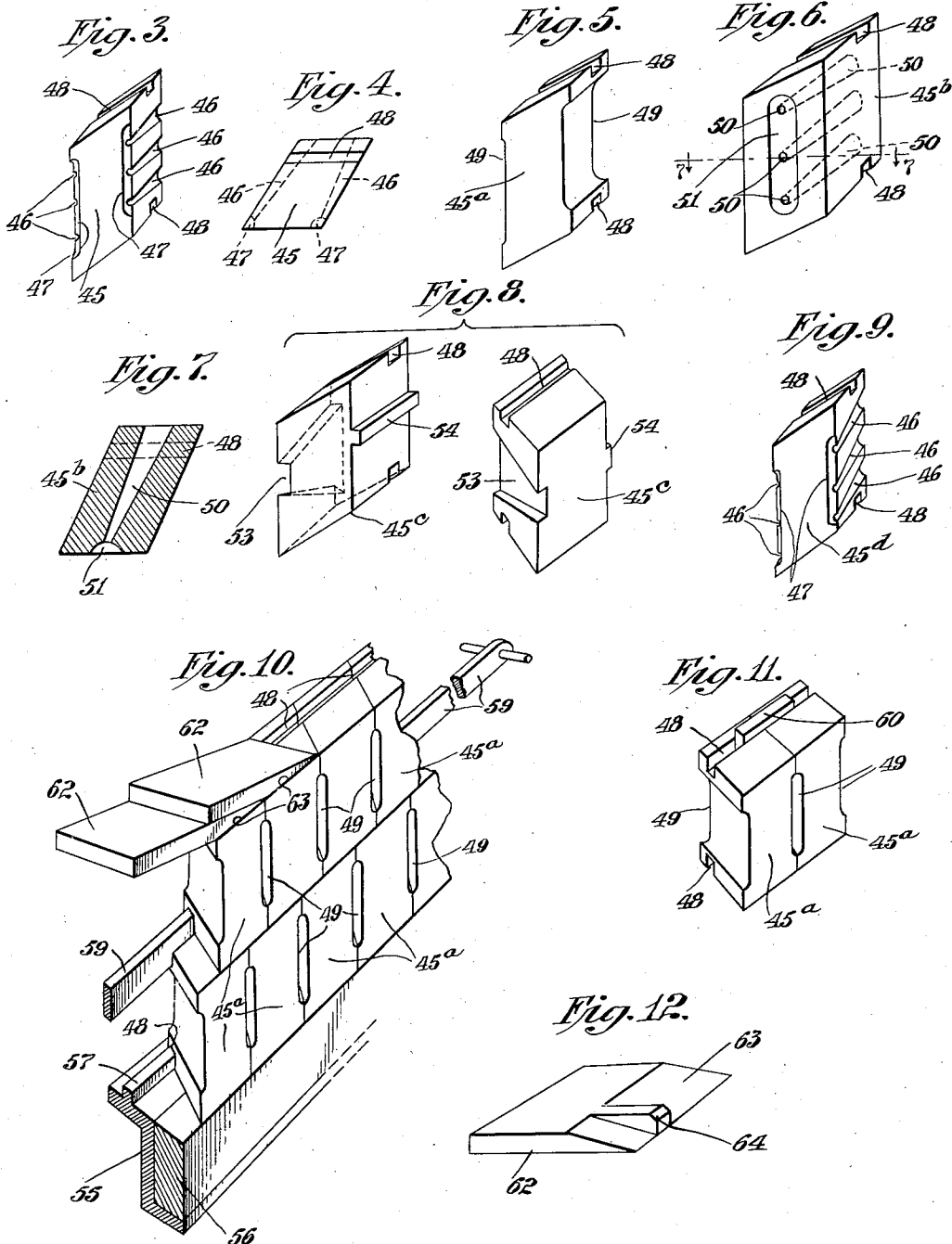
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

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FURNACE.

Application filed June 25, 1920. Serial No. 391,604.

This invention relates to furnaces, and more particularly to furnaces wherein the walls are formed with perforations or apertures for the injection or admission of air to the combustion chamber, for example, directly into the fuel bed. It has already been known to supply air under pressure in this manner for the purposes of protecting the walls against excessive heat, and promoting combustion, and minimizing the formation of clinkers and the adherence thereof to the walls. The main object of the present invention is to provide a furnace or furnace wall of the general character and for the purposes mentioned but of improved efficiency, durability, and convenience. The further objects and advantages of the invention will be explained in the hereinafter following description of one or more embodiments, or will be apparent to those skilled in the art.

To the accomplishment of such objects and advantages the present invention consists in the novel furnace, furnace wall, wall element or brick, and the features of construction, arrangement, combination, and detail herein illustrated and described.

In the accompanying drawings forming a part hereof, Figure 1 may be considered a vertical longitudinal section taken substantially on the line 1—1 of Fig. 2, and showing a furnace of the underfeed type with inclined grate, and embodying the features of the present invention.

Figure 2 is a plan view taken partly in horizontal section on the line 2—2 of Fig. 1.

Figure 3 is a perspective view of one form of block adapted to be employed in building the perforated portion of the wall shown in Figs. 1 and 2; and Figure 4 is a plan view thereof.

Figure 5 shows in perspective a second or modified form of block adapted to give a somewhat different but equivalent form of wall.

Figure 6 shows in perspective a third form or modification of furnace wall block; and Figure 7 is a horizontal section thereof.

Figure 8 shows in perspective a pair of blocks of a still different form.

Figure 9 shows a still different form of block.

Figure 10 in perspective shows a portion of one of the furnace side walls partly disassembled to show the structure and arrangement of the elements.

Figure 11 indicates a modification in the mode of bonding or locking together two successive tiers of blocks.

Figure 12 in perspective shows one of the overlying bricks or cover tiles of Figs. 1 and 10 but inverted.

The invention may be applied to furnaces of various types, for example, the underfeed type, which is shown in Figs. 1 and 2. In these figures is indicated a fuel hopper 20 having openings 21 leading downwardly into a series of ram boxes or casings 22, within which reciprocating rams 22^a operated by connecting rods 23 extending from a crank shaft 24. The crank shaft is shown as driven by worm gearing 24^a from a power actuated shaft 24^b. Connections 25 are shown for agitating certain portions of the grate.

The coal thrust inwardly by the rams, flows upwardly so as to overlie the furnace grate, consisting of a series of tuyère boxes 27 and between them a series of retorts 28. This entire structure is shown as inclined toward the furnace rear in a well known manner. At the foot of the inclined grate is a grate section 29, and to the rear of that a dumping grate 30 adapted to be dropped and lifted periodically.

The general outline of the fuel bed lying upon the grate 27—28—29—30, may be as indicated by the broken line 31 in Fig. 1.

The furnace may be fed by forced draught, and for this purpose a main air duct 32 is shown leading from a blower or other source of air under pressure. The pipe 33 is shown leading from the air duct 32 to the tuyère boxes, whereby air for combustion is forced into the under side of the fuel bed in a well known manner. Leading also from the main air duct 32 are shown pipes 34 which extend to the air passages in the walls as will be described.

The furnace front wall 36, side walls 37, and bridge wall 38 afford a combustion chamber 39 above which may be a boiler of any type.

Each of the four walls, or one or more of them, at the point where the air is to be admitted or injected, is recessed at its inner side, forming a cavity 42 within which are mounted special furnace wall elements adapted to afford apertures or perforations for conducting the air to the combustion chamber. Between the perforated portion of each wall and the outer or body portion

thereof, is formed a space 43 connecting with the air pipes 34 already mentioned and conducting the air supply to the inwardly directed perforations of the wall. A passage 44 is provided by which the air is also conducted to the space 43 within the rear or bridge wall of the furnace.

The perforated portion of each wall is shown as built up of a plurality of blocks, bricks, or tiles, arranged to give an inner surface which is flush with the general surface of the wall. These special blocks may be of different forms, as will be described, and are such as to give certain advantageous features and result, as will be made clear. Such a block 45 is shown in Figs. 3 and 4, and in the upper or righthand portion of Fig. 1. A different form of block 45^a is shown in Fig. 5, and at the intermediate portion of the side wall in Fig. 1. Another form of block 45^b is shown in Figs. 6 and 7 and in the lower or left portion of Fig. 1. In each case it will be noticed that the block is of rhomboidal-shape so that the several blocks, where they lie contiguous to each other, meet so that they fit snugly together, affording a solid and durable wall. It will also be observed that the supporting parts below the perforated wall, and the wall bricks or tiles above it, are shaped to conform to the general slanted character of the perforated area and the fuel bed.

It is an important and valuable feature of the present invention that the inwardly directed air perforations are formed at a substantial incline. Thus, in the side walls, as best seen in Fig. 2, the apertures are directed inwardly and at a forward slant. This not merely gives a motion to the air in the general direction of the advance of the fuel bed but tends to protect the perforated wall against injury and clogging by the advancing fuel. A better co-operation occurs with this novel arrangement. On the front wall as indicated in Fig. 2, the apertures are preferably directed at a slant toward the axis or generally toward the center of the furnace which may in certain circumstances bring about a substantial benefit in the operation of the furnace.

The detail structure of the blocks 45 is best seen in Figs. 3 and 4. The wall apertures for the supply of air to the fuel bed are not formed by perforations through the body of each block but are formed by grooves or channels 46 at the upright edges of each block. These air grooves 46 are shown as tapered so as to give a greater force and the effect of a nozzle at the orifice. Three grooves 46 are shown at each side edge of each block, and these may be semi-circular in cross-section and arranged to register with the corresponding grooves of the adjacent block, so as to afford circular wall apertures.

In order to minimize the possibility of blocking the orifices of the perforations 46, each block is shown as formed with one or more shallow depressions or recesses 47 at its inner face. Each of the air orifices is then made to discharge at the narrow face recess or depression thus formed, and, being inset and protected, the flow of air is maintained with greater uniformity.

Each block 45 is further provided with upper and under grooves 48 for the purpose of bonding or interlocking the furnace wall elements, as will be described.

In the furnace block 45^a, shown in Figs. 1 and 5, the features are similar to the block 45 but the three separate grooves 46 are replaced by a single wide groove 49, which is of uniform height but in width is tapered or converging from rear to front as shown.

The block shown in Figs. 1, 6 and 7, differs from the preceding in that the air perforations are formed by tapering interior holes 50 through the body of the block. Three such apertures are shown, and their orifices discharge through a shallow depression 51 at the face of the block.

With each of the three forms of block described, the apertures are directed horizontally into the combustion chamber, and the blocks are fitted together and arranged so as to afford the air passage 43 behind them; and in Fig. 2 are shown special terminal blocks 52 at the end of each tier, to facilitate fitting of the blocks into the furnace walls.

A somewhat different form of block is shown in Fig. 8. Two similar adjacent blocks are here shown somewhat separated. They are constructed to afford the tapering air perforations without the employment either of the holes 50 through the body of the block, as in Figs. 6 and 7, or registering grooves, as in Figs. 3 and 4. The left side edge of each block is shown provided with a tapered recess 53, and the co-operating face of the next block is without recesses and may be provided with a rib 54 acting to divide the recess 53 into two separate air apertures.

With the structures previously described, the air apertures are directed horizontally into the fuel bed or combustion chamber; but in some cases it is advantageous to direct the incoming air at a downward slant as tending to give better action and more efficient protection to the walls. Such a structure is indicated in Fig. 9, where the apertures are slanted both downwardly and toward the furnace rear, the block being otherwise similar to those already described.

An important feature in the present invention is the bonding together or interlocking of the special wall elements described. Each tier of the special blocks is

registered and bonded with that above and below, or with the furnace parts above or below the same. For this purpose the blocks are specially constructed, for example, by the grooves 48, before mentioned, adapted to co-operate with locking members to give inter-engagement.

Fig. 10 shows a solid side wall or bed casting 55 which underlies the entire system of special furnace blocks. This is shaped to accommodate a refractory facing or brick 56 for the protection of the metal, and the upper rear portion of the casting 55 is formed with a longitudinal bonding portion or rib 57. A tier of assembled furnace blocks 45^a is shown as resting on the elements 55 and 56, with the grooves 48 of the blocks engaging the rib 57 of the supporting bed plate. A second tier of blocks 45^a is indicated above the first tier in this figure, and the two are shown united by a bonding or locking rod 59 which may be drawn out from the front to permit disengagement of the blocks, as also indicated in Fig. 1. In place of a bonding rod 59 engaging the whole length of the two tiers of blocks, a number of separate bricks 60, as shown in Fig. 11, may be employed for the purpose.

Each side wall 37, as seen in Fig. 1, is preferably made up of horizontally laid bricks or tiles. In order to properly assemble the inclined tiers of special blocks with such a wall structure, we have provided a series of special overlying or cover tiles or bricks 62, best shown in Fig. 10 and separately in inverted position in Fig. 12. Each of these has a beveled under side 63, and a rib 64 projecting downwardly therefrom adapted to engage in the locking grooves 48 at the top sides of the blocks.

It will thus be seen that we have described a furnace and one or more forms of furnace wall and wall blocks embodying the principles and attaining the advantages of the present invention. Since various mat-

ters of combination, arrangement, design and detail may be modified without departing from the principles involved, it is not intended to limit the present invention to such matters, except so far as specified in the appended claims.

What is claimed is:

1. A furnace wall comprising inclined tiers of blocks constructed to afford air apertures to the fuel bed, an inclined support for said blocks, and horizontal elements overlying and interengaging the topmost tier of blocks, and means for supplying forced draft to such inlets.

2. A furnace wall as in claim 1 and wherein the lowermost tier of blocks engages the support by a tongue and groove engagement.

3. A furnace wall as in claim 1 and wherein the block is grooved both above and below to engage bonding means.

4. A furnace wall as in claim 1 and wherein the horizontal overlying elements or bricks are constructed for bonding engagement with the topmost tier of bricks.

5. In an automatic underfeed furnace the combination of means for supporting and progressively advancing the fuel bed at a substantial incline from the fuel entrance downwardly toward the fuel discharge, furnace walls enclosing the combustion chamber, and each side wall arranged to confine laterally the inclined fuel bed at one side, and comprising in its structure an inclined tier or tiers of apertured refractory blocks of rhomboidal cross section, the incline of each tier corresponding substantially with that of the fuel bed, and the blocks arranged so that their apertures may deliver air directly into the fuel bed, and means for supplying air under forced draft to such block apertures.

In testimony whereof, we have affixed our signatures hereto.

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