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W. A. GILCHRIST

CONSTRUCTION OF FURNACE WALLS AND ARCHES

Filed Feb. 20, 1920

Fig. 1.

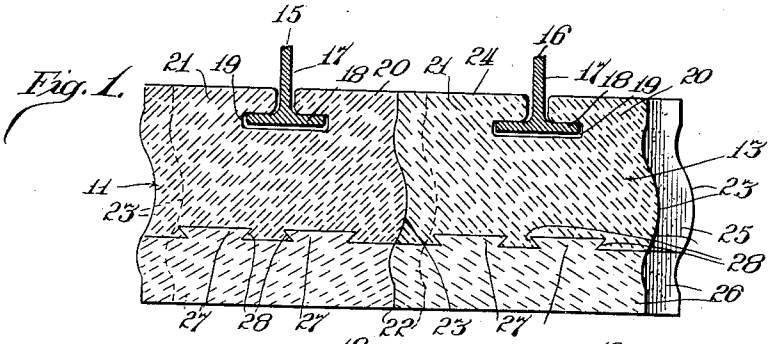


Fig. 2.

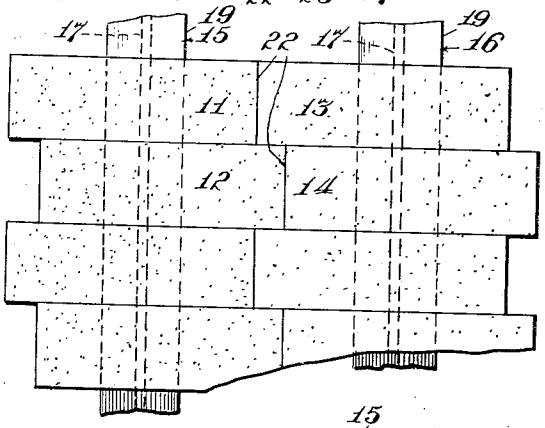


Fig. 3.

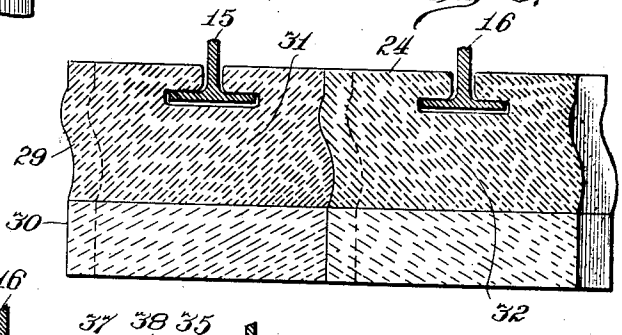
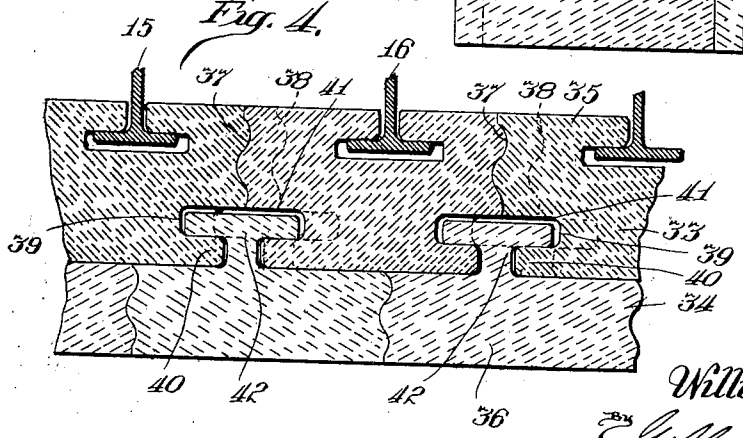


Fig. 4.



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UNITED STATES PATENT OFFICE.

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CONSTRUCTION OF FURNACE WALLS AND ARCHES.

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The invention relates to furnaces, particularly those employed for heating steam boilers, but is not limited in its application to furnaces used for any one purpose. The object of the invention is to so improve the construction of furnace walls, and arches as to greatly increase their durability at high temperatures, render them less liable to injury or destruction by expansion and contraction resulting from changes in temperature, and to reduce the heat losses which usually occur whether from conduction through the furnace walls, radiation of heat from the outer surfaces of the walls or by convection on account of the movement of air currents or furnace gases through or within the walls.

While tiles or blocks of refractory material having reasonably satisfactory durability at high temperatures are available for the construction of furnace walls and arches, the design of modern furnaces frequently requires that these tiles or blocks shall be supported from metal beams or the like and those tiles which are suitable for exposure to high temperatures do not have the required heat insulating property to afford proper protection to the metal beams from which they are hung or to prevent loss of heat by radiation from the outer surfaces of the furnace walls. Furthermore, as these tiles must be loosely hung or supported to permit of their expansion and contraction with changes in temperature, difficulty has been experienced in constructing furnace walls without openings or passages through which heat may escape by convection. The invention accordingly contemplates the construction of furnace walls, arches and the like from tiles without intervening openings forming continuous passages for air currents or furnace gases and in a manner to afford improved protection against conduction of heat to the supporting beams and the outside of the furnace.

In the accompanying drawings:—

Fig. 1 is a detail sectional view of a furnace wall or arch showing one way in which the invention may be employed;

Fig. 2 is a detail inside face view of the wall or arch illustrated in Fig. 1, and

Figs. 3 and 4 are each similar to Fig. 1, but show modifications of the invention.

When the invention is employed for the construction of a so-called flat furnace arch, the tiles, as 11, 12, 13, 14, of which the arch is composed are preferably arranged in parallel rows with a separate metal beam, as 15, 16, for supporting the tiles of each row. As shown, each of the beams 15, 16, comprises an upright web 17 and foot flange 18, and each of the tiles 11, 12, 13, 14, is provided in its upper portion with a T slot 19 into which the lower portion of the web 17 and foot flange 18 of the corresponding beam is entered by endwise movement of the tile along the web.

To avoid a continuous line of contact between the tiles of adjacent rows, each tile is desirably formed with its T slot 19 at one side of the mid-width of the tile whereby the parts, as 20, 21, of each tile at the two sides of the corresponding beam are of unequal width. In using tiles of this form, the consecutive tiles, as 11, 12, in each row are preferably arranged with their wider portions, as 21, at opposite sides of the beam while the arrangement of the corresponding tiles, as 13, 14, in the next adjacent row is reversed in this respect. A broken or interrupted line of contact 22 is thus provided between the tiles of adjacent rows. Furthermore, to provide a better contact between the meeting faces of the corresponding tiles, as 11 and 13, of adjacent rows, the said meeting faces of the tiles may be formed of a complementary irregular outline, as at 23.

Conduction of heat to the supporting members, as 15, 16, and to the outer or upper surface, as 24, of the furnace wall or arch may be greatly reduced by forming the outer or upper part of the wall or arch from an insulating material. For this purpose blocks pressed from a diatomaceous earth, such as kieselguhr, may be employed, but as such blocks are not sufficiently durable at high temperatures to serve as a furnace lining, a refractory or abrasion resisting material should then be employed in the construction of the inner or under portion of the wall or arch. As shown in Fig. 1, each tile, as 11 and 13, comprises upper and lower blocks 25, 26, with the upper block 25 formed from the said heat insulating material while the lower block 26 will be formed from one of the usual refractory materials, such as fire clay, although carborundum may be used for the lower block 26 when resistance to abrasion is particularly desired. The material used for the refractory blocks may also be selected with

reference to its ability to reflect, radiate or absorb heat. In Figs. 1 and 2, the upper and lower blocks 25, 26, are mechanically connected as by being formed with interlocking tongues and grooves 27, 28, upon their meeting faces.

In the form of construction illustrated in Fig. 3, the two blocks, as 29, 30, from which each tile, as 31 or 32, is composed, are permanently united by an adhesive bond. The construction is otherwise the same as that illustrated in Figs. 1 and 2, the blocks 29 being formed from the said heat insulating material and the blocks 30 from refractory material, the refractory material being of the said abrasion resisting kind if desired.

In the form of construction illustrated in Fig. 4, two layers 33, 34, of tile are employed. The tile 35 constituting the upper or outer layer 33 are composed of insulating material while the tile 36 constituting the layer 34 are composed of refractory material.

If supporting beams, as 15, 16, are used, the tile 35 are preferably engaged with these beams in the manner already described with reference to the tile 11, 12, 13, 14 illustrated in Figs. 1 and 2, thereby providing relatively off-set lines of contact 37, 38, between adjacent pairs of corresponding tiles in different rows.

When the said heat insulating and refractory materials are employed in separate tiles, the tile 36 constituting the refractory layer 34 may be interlocked with and supported by the tile 35. As shown, the corresponding tiles 35 of adjacent rows are each formed with notches 39 having underhung walls 40, whereby inwardly facing T slots 41 are provided between adjacent tiles of the outer layer and the tiles 36 of the other layer are each formed with a T head 42 for engagement with one of the said T slots.

It will be observed that when the tiles 35 are formed to provide the relatively offset lines of contact 37, 38, between the tiles of adjacent pairs, the corresponding T slots 41 are likewise relatively offset. It therefore follows that whatever opening may thus be provided by looseness of fit of each T head 42 in the corresponding slot 41 extends in a direct line only through the length of a single tile and the corresponding openings between adjacent sets of tiles do not connect to form a continuous passage for air currents or furnace gases. The employment of heat insulating and refractory materials is important in providing a durable construction without large losses of heat by conduction through the wall or arch and radiation from its outer surface while the arrangement of tiles, regardless of the character of materials employed therein, is likewise of importance in preventing heat losses by the passage of currents of air or furnace gases through the wall or arch. The invention is not limited to the use of a single layer of heat insulating material or of refractory material. In this connection it may be observed that the use of heat insulating material for the tile 35 has a special application when continuous ventilating passages are avoided, for the cooling effect of the movement of air currents through such passages is not obtained.

Owing to the heat insulating character of the blocks 25, 29, and tile 35, and the protection thus afforded to the beams 15, 16, the invention may be employed for the construction of furnace walls and arches of irregular or unusual shapes heretofore believed impractical.

I claim as my invention:

1. A furnace wall or roof comprising in combination, two layers of blocks of different character with respect to their heat insulating and refractory properties, the blocks of one layer being of heat insulating material and the blocks of the other layer being of refractory material and having portions interlockingly engaged with portions of said heat insulating blocks and being supported thereon and covering the same upon the inside of the furnace.

2. A furnace wall or roof comprising in combination, two layers of blocks of different character with respect to their heat insulating and refractory properties, the blocks of one layer being of heat insulating material and the blocks of the other layer being of abrasion resisting refractory material and having portions interlockingly engaged with portions of said heat insulating blocks and being supported thereon and covering the same upon the inside of the furnace.

3. A furnace wall or roof comprising in combination, an outer layer composed of compressed kieselguhr and an inner layer composed of compressed carborundum, the carborundum layer having a portion interlockingly engaged with a portion of the kieselguhr layer and being supported thereby and covering the same upon the inside of the furnace.

4. A furnace wall or roof comprising, in combination, two layers of different character with respect to their heat insulating and refractory properties arranged in inner and outer layers, respectively and interlocked mechanically, the outer layer being composed of heat insulating material and the inner layer being composed of abrasion resisting refractory material.

5. In a furnace wall or roof, in combination, inner and outer layers of blocks of heat insulating and refractory materials, respectively, the blocks of each layer being arranged in parallel rows and corresponding blocks in adjacent rows of the outer layer

being relatively offset in the direction of length of the rows, adjacent blocks in each row of the outer layer being notched to provide T slot openings between the blocks, the said T slot openings in adjacent rows of blocks being relatively offset in accordance with the offset arrangement of the corresponding blocks, and T heads formed on the blocks of the inner layer entering the said T slots.

6. In a furnace wall, arch or the like, in combination. a plurality of laterally separated parallel beams, blocks of heat insulating material supported by the beams, each block being engaged with one beam only and completely covering the adjacent side of the beam, adjacent blocks supported by different beams being provided with companion notches forming a T slot between the blocks, and other blocks having T heads engaged with the said T slots, the last-mentioned blocks being of refractory material.

7. In a furnace wall, arch or the like, in combination, a plurality of laterally separated parallel beams, blocks of heat insulating material constituting one wall layer supported by the beams, each block being engaged with one beam and extending at opposite sides of the same, and other blocks constituting a different wall layer each interlocked with two of the first-mentioned blocks between the beams, the second-mentioned blocks being of refractory material.

8. In a furnace wall, arch or the like, in combination, a plurality of laterally separated parallel beams, blocks of heat insulating material constituting one wall layer supported by the beams, each block being engaged with one beam and extending at opposite sides of the same, adjacent blocks supported by different beams being provided with companion notches forming a T slot between the blocks and other blocks constituting a different wall layer each having a T head engaged with one of the said T slots, the second-mentioned blocks being of refractory material.

9. In a furnace wall, arch or the like, in combination, a plurality of laterally separated parallel beams, blocks of heat insulating material constituting one wall layer supported by the beams, each block being engaged with one beam and extending at opposite sides of the same in different amounts, the wider parts of adjacent blocks on the same beam being at opposite sides of the beam and the wider parts of adjacent blocks on different beams being extended in the same direction, the said adjacent blocks on different beams being provided with companion notches forming a T slot between the blocks and other blocks constituting a different wall layer, each having a T head engaged with one of the said T slots, the second-mentioned blocks being of refractory material.

10. In a furnace wall, arch or the like, in combination, a plurality of metal beams constituting a supporting frame, and two layers of blocks of different character with respect to their heat insulating and refractory properties, the blocks of one layer being of heat insulating material and being engaged with and covering one side of the beams and the blocks of the other layer being of refractory material and being connected to the said heat insulating blocks and covering the same at the side remote from the beams.

11. In a furnace wall or roof, the combination of block supporting beams, heat insulating blocks supported by said beams and serving to protect the same from the furnace heat, and refractory blocks interlockingly engaged with said heat insulating blocks to form a refractory furnace lining supported on the insulating blocks.

12. A furnace wall comprising, a plurality of beams, insulating blocks interlockingly engaged with said beams and entirely inclosing the engaged parts of said beams, and refractory blocks interlockingly engaged with the insulating blocks and supported thereby, said refractory blocks being adapted to completely seal the wall surface and to absorb and reflect heat, said insulating blocks being adapted to shield the beams from high furnace temperatures.

13. A furnace wall comprising a plurality of layers of blocks, the layers having dissimilar refractory and heat insulating characteristics, each layer having portions interlocking with portions of the adjacent layers, each inner layer being supported on each adjacent outer layer, the innermost layer having primarily refractory qualities, the outermost layer having primarily insulating qualities.

14. In a furnace wall or roof, in combination, inner and outer layers of blocks, the blocks of each layer being arranged in parallel courses, and complementary interlocking projections and notches formed in the blocks of the two layers, such projections and notches being arranged in an equally spaced series in each course of blocks with those of one course offset from those of the next adjacent course in the direction of the length of the courses.

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