Nov. 24, 1936. F. H. BANKERT 2,061,822

FURNACE WALL AND BLOCK UNIT FOR MAKING THE SAME

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Fig. 1.

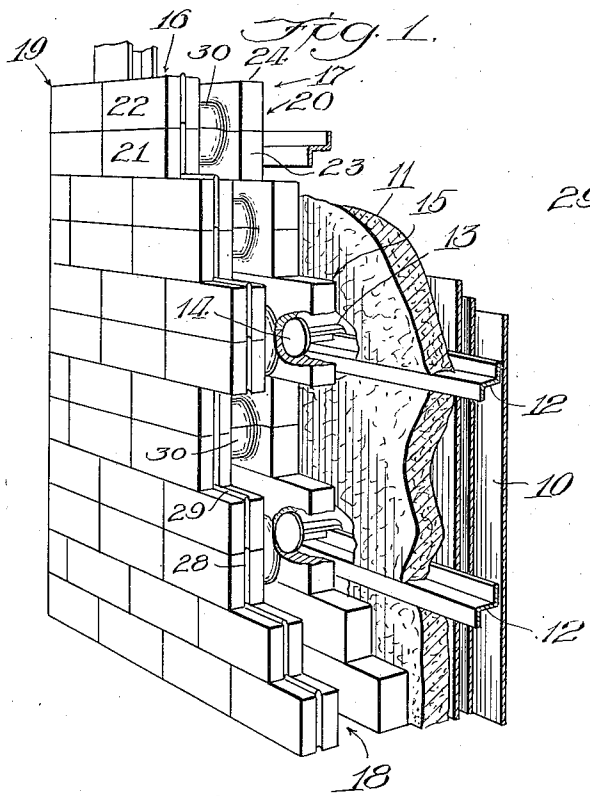


Fig. 2.

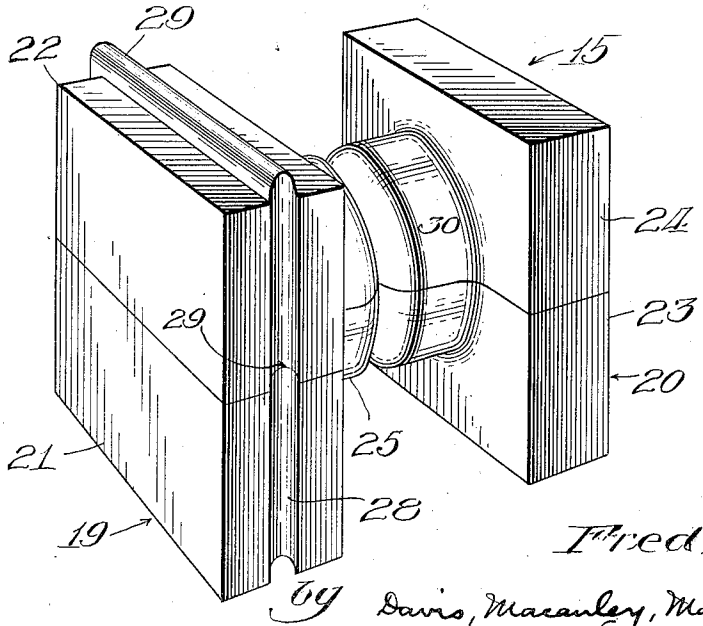
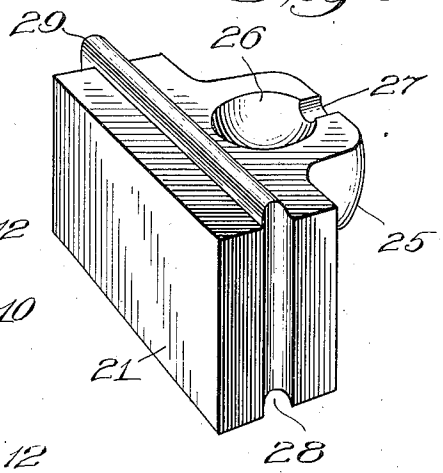


Fig. 3.



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Fig. 4.

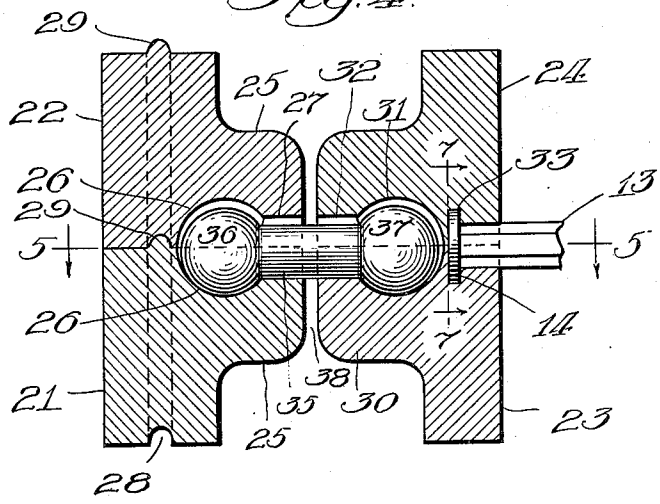


Fig. 5.

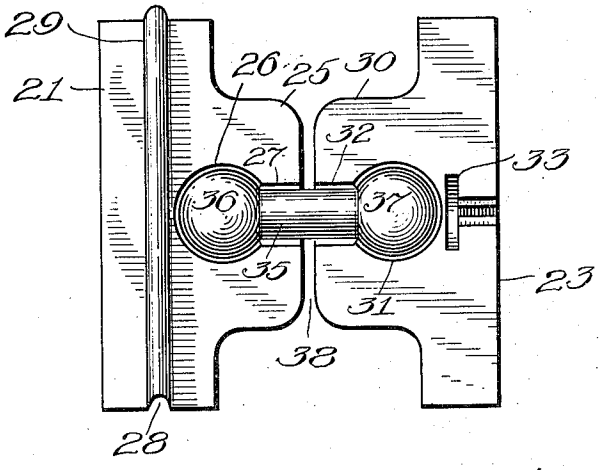


Fig. 7.

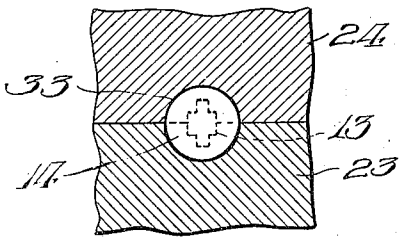
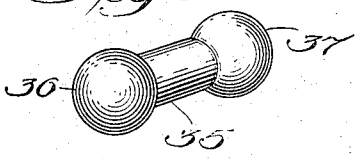


Fig. 6



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UNITED STATES PATENT OFFICE

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FURNACE WALL AND BLOCK UNIT FOR MAKING THE SAME

Fred H. Bankert, Ottawa, Ill., assignor to Chicago Retort & Fire Brick Co., Chicago, Ill., a corporation of Illinois

Application April 12, 1935, Serial No. 15,956

6 Claims. (Cl. 72—101)

My invention relates to furnace walls and blocks for making the same and is more particularly concerned with the so-called air-cooled type of wall and the component block units.

In the operation of modern furnaces, the tendency is towards increasingly higher temperatures and this development has become more pronounced with the advent of pulverized coal. Solid furnace walls cannot withstand these higher temperatures and this condition obtains particularly in those regions where the coal burned has an ash fusing temperature that is either medium or low. The chemical affinity, in the presence of the high temperature, between the basic ash and the acid refractory in the wall necessarily requires that the solid wall type of installation either operate at low temperatures, or, in other words, low capacity, or be subject to high maintenance cost because of the necessity for frequently renewing the furnace wall.

It has been ascertained that if the furnace wall is cooled in some manner so that it has a temperature below the slagging point of the ash, it is possible to prevent the formation of the corrosive, molten slag. A common furnace wall construction of this kind is composed of a block or unit having a portion which is exposed to the fire and an external portion which is suitably anchored to the outside framework of the furnace, these portions being connected by a curved and tapering neck. When these blocks are laid in courses to build a furnace wall, there is thus provided a furnace section and an exterior section which are spaced from each other sufficiently to provide a passage therebetween for the circulation of cooling air.

While the foregoing type of construction has proved effective as regards the cooling of the furnace section of the wall, experience has indicated that this arrangement is subject to certain objectionable, operating disadvantages. The furnace section of these blocks are exposed to very high temperatures, while the anchored section of the same block is comparatively cool so that differential strains are set up in the blocks to an extent that frequently cause the neck connecting the sections to crack, thus entailing a replacement of the entire block. This replacement also becomes necessary where the action of gases and slags in the furnace has destroyed the furnace section of the block, although the exterior section is still in a usable condition. Such blocks are therefore characterized by a high maintenance cost. Moreover, as at present designed, these blocks are of such a size and shape that they must be manufactured by an expensive hand type of molding process, since they cannot be made by the ordinary machinery employed for manufacturing other refractory shapes.

It is, therefore, one object of my invention to devise a unit which is adapted to form a part of an air-cooled furnace wall and which is composed of separable furnace and exterior blocks so arranged that the furnace blocks can be replaced without disturbing or requiring a replacement of the exterior blocks.

A further object is to devise a unit of the character indicated which is so disposed with reference to other units that when laid in courses to form a furnace wall, sufficient space is provided between the blocks to provide for a free circulation of cooling air, a high rate of heat transfer through the furnace block portion of the unit and a high ratio of heat-absorbing surface to heat-dissipating surface, the furnace blocks being additionally so connected to the exterior or anchored blocks of the wall that the former are capacitated to move independently of the exterior wall section, whereby any tendency to set up differential strains in the unit is substantially eliminated.

A further object is to provide a unit in which the furnace and exterior or anchored blocks are linked together by a substantially universal connection and, especially, one operating on the ball and socket principle, so that the block can expand or contract in any direction without substantial strain.

A further object is to devise a unit which is composed of separable parts, whereby the furnace block portions thereof can be made of a special and more expensive refractory material, while the other parts of the unit can be made of ordinary refractory clay.

A further object is to provide a unit so constructed and arranged as to size and shape that they can be readily formed by machines now in common use in the industry.

A further object is to devise a fire wall constructed of the foregoing units which will be characterized by a considerably greater free air space per square foot of heating surface than air-cooled furnace walls now in common use, thus providing for the circulation of a greater volume of air per unit of wall area and raising the rate of transfer across the furnace blocks to thereby increase the efficiency of the wall and the life of the refractory.

These and further objects of my invention will

be set forth in the following specification, reference being had to the accompanying drawings, and the novel means by which said objects are effectuated will be definitely pointed out in the claims.

In the drawings:

Figure 1 is a perspective view, partly in section, of a portion of a furnace wall built with my improved unit.

Fig. 2 is an enlarged, perspective view of a complete wall unit.

Fig. 3 is a perspective view of one of the parts of the furnace block portion of the unit.

Fig. 4 is a sectional elevation of the unit showing the link employed to connect the furnace and exterior or anchored blocks of the unit.

Fig. 5 is a plan view of the lowermost part of the unit as viewed along the line 5—5 in Fig. 4, looking in the direction of the arrows.

Fig. 6 is a perspective view of the connecting link between the blocks.

Fig. 7 is a section along the line 7—7 in Fig. 4, looking in the direction of the arrows and showing an end view of the anchor which is employed to fasten the exterior blocks of the unit to the framework of the furnace.

Referring to the drawings, the numeral 10 designates the outer sheathing or covering of the furnace which is inner-lined by the customary layer of insulation 11. A portion of the usual framework of the furnace is indicated by the spaced, parallel Z-bars 12 to which are secured the outer ends of anchors 13 whose inner ends are enlarged to provide disk-heads 14 that are recessed and held within the exterior or anchored block portions of wall units 15.

The parts above described are customary in furnace constructions and in and of themselves form no part of the present invention which relates more particularly to the wall proper and the component units thereof.

As with furnace walls now in common use, the unit 15 when laid in courses to compose a furnace wall provides a furnace section 16 and an exterior section 17 which are separated by a space 18 through which is circulated the cooling air.

In general, my improved wall unit 15 is composed of three generic parts, namely, an inner or furnace block 19, an exterior or anchored block 20 and a link which connects these blocks together, as hereinafter described. The furnace block 19 is preferably composed of two parts 21 and 22, while the exterior block 20 is likewise composed of two parts 23 and 24, each of these parts being generally of a rectangular conformation, and when employed to form walls, the parts 22 and 24 are laid upon the parts 21 and 23, respectively, in the usual courses.

The furnace block part 21 is provided on its rear face with an inwardly extending boss 25 which is provided with a cavity 26, preferably shaped as a part-sphere, and which communicates with the innermost face of the boss 25 by means of a groove 27. The block part 22 is formed similarly to the block part 21, so that when the part 22 is laid on the part 21, the part-spherical cavities 26 in the bosses 25 complement each other, as do the bosses 25 to provide a complete and preferably circular boss. Also, the edge faces of the blocks 21 and 22 are preferably provided with the groove 28 and tongue 29 which interlock when the parts are laid in the usual manner to minimize leakage of air and/or gas through the joints between the block parts.

The exterior block part 23 is also provided on its inner face with a parti-circularly shaped boss 30 which projects, when the units are assembled in a complete wall, toward the similarly shaped boss 25 on the block 21. As before, the boss 30 is also provided with a parti-spherical shaped cavity 31 which connects with the inner face of the boss 30 by means of a groove 32. The block part 23 is also provided with a recess 33 that is spaced from the cavity 31 and which is intended to receive substantially one-half of the head 14 of the anchor 13, as well as the connecting neck portion of this anchor, whereby the block part 23 is anchored to the framework of the furnace. The block part 24 is shaped and arranged in a manner identical to that above described for the block part 23, so that when the former block is laid upon the latter block, as clearly shown in Fig. 2, there is formed a circularly shaped boss by the complementary portions 30 that extends toward the similarly shaped boss formed by the bosses 25, the former boss also having a spherically shaped cavity similar to that present in the boss formed by the boss part 25.

In building a wall with my improved unit, the lowermost courses thereof are laid by the block parts 21 and 23. The spacing of these block parts provides the cooling air passage 18 as determined by a connector link 35 which is preferably shaped and arranged as a dumb-bell and whose ball-shaped ends 36 and 37 are placed in the cavities 26 and 31, with the connecting portion of the link between the ends thereof lying in the grooves 27 and 32. The upper block parts 22 and 24 are then laid on the parts 21 and 23, as indicated in Figs. 2 and 4, thus completing the lowermost course of units.

Preferably, the diameter of each connector is somewhat less than the diameter of the cavity which receives them, and the same relation exists between the diameter of the cylindrical connecting portion of the link and the grooves 27 and 32. Since the exterior block 20 of the unit is fixed to the framework of the furnace, it is therefore possible for the furnace block 19 to move substantially in any direction while expanding or contracting without any strain being set up in the unit. Moreover, it will be noted from Fig. 4, that a space 38 is provided between the ends of the bosses provided on the inner faces of the furnace and exterior block, so that the link 35 is also exposed to the cooling action of the circulating air.

With my improved unit, it is possible to make the furnace blocks 19 of special and more expensive refractory material, compared to the composition of the exterior blocks 20, thereby permitting the use of higher temperatures in the furnace without any reduction in the longevity of the unit. Also when it does become necessary to replace the furnace block portions of the unit, the nature of the construction is such that the exterior blocks 20 need not be disturbed which results in a clear saving over existing practice and a consequent saving in the maintenance cost of furnace walls.

The staggered or echeloned disposition of the bosses on the inner faces of the furnace and exterior blocks enables the air to circulate freely in the passage 18, while at the same time causing frequent changes or reversals in directions of the moving air to thereby provide for a better wiping and heat-absorbing action with respect to the inner faces of the furnace blocks

and their attached bosses. Finally, each of the component parts of my improved unit can be readily made by any of the machines now in common use in the industry. It will also be understood that the unit is not restricted to use in the building of furnace walls, since the placing of the furnace and exterior blocks in a horizontal position also enables them to be readily employed in the construction of furnace floors of the air-cooled type; hence the term "wall," as used in the claims, is to be regarded as including floors and the like.

I claim:

1. A furnace wall comprising a plurality of blocks arranged in courses to provide furnace and exterior sections spaced to provide a passage for the circulation of cooling air between the sections, each block having a boss of substantial size projecting toward the other section and including a socket, and link means having parts fitting in the sockets for connecting the furnace and exterior blocks together in pairs to permit expanding and contracting movements of the furnace sections, the ends of the bosses of the furnace and exterior blocks being spaced to expose a portion of the link means to the cooling air and the bosses acting to deflect the air currents while moving through the passage.

2. A unit comprising furnace and exterior blocks spaced to provide a passage therebetween for the circulation of cooling air and adapted to be laid in courses to form an air-cooled furnace wall, each block comprising a pair of complementary, separable parts each having complementary socket cavities, and a link having ends receivable in the sockets to connect the furnace and exterior block parts.

3. A unit comprising furnace and exterior blocks spaced to provide a passage therebetween for the circulation of cooling air and adapted to be laid in courses to form an air-cooled furnace wall, each block comprising a pair of separable parts, and link means loosely connecting the furnace and exterior block parts.

4. A unit adapted to form part of an air-cooled furnace wall comprising furnace and exterior blocks spaced to provide a passage therebetween for the circulation of cooling air, each block comprising a pair of complementary separable parts each having complementary socket cavities and bosses of substantial size projecting from the opposed faces of each toward the other parts, and a link having its ends receivable in the sockets for connecting the furnace and exterior block parts together, the ends of the bosses of the furnace and exterior blocks being spaced to expose a portion of the link to the cooling air and the bosses acting as air deflectors.

5. A block unit having the shape of a rectangular prism and adapted to form part of a furnace wall construction provided with a cooling air passage, the unit comprising a pair of separable parts each having complementary projections extending from that face which defines a portion of the passage to form a boss of substantial size for deflecting air currents moving through the passage, and each projection including complementary socket cavities adapted to receive one end of a link interconnecting with another unit across the passage.

6. A unit adapted to form part of an air-cooled furnace wall comprising furnace and exterior blocks spaced to provide a passage therebetween for the circulation of cooling air, each block comprising a pair of complementary separable parts each having complementary bosses of substantial size projecting from the opposed faces of each toward the other parts, the bosses including complementary socket cavities, and a link having its ends receivable in the sockets for connecting the furnace and exterior block parts together.

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