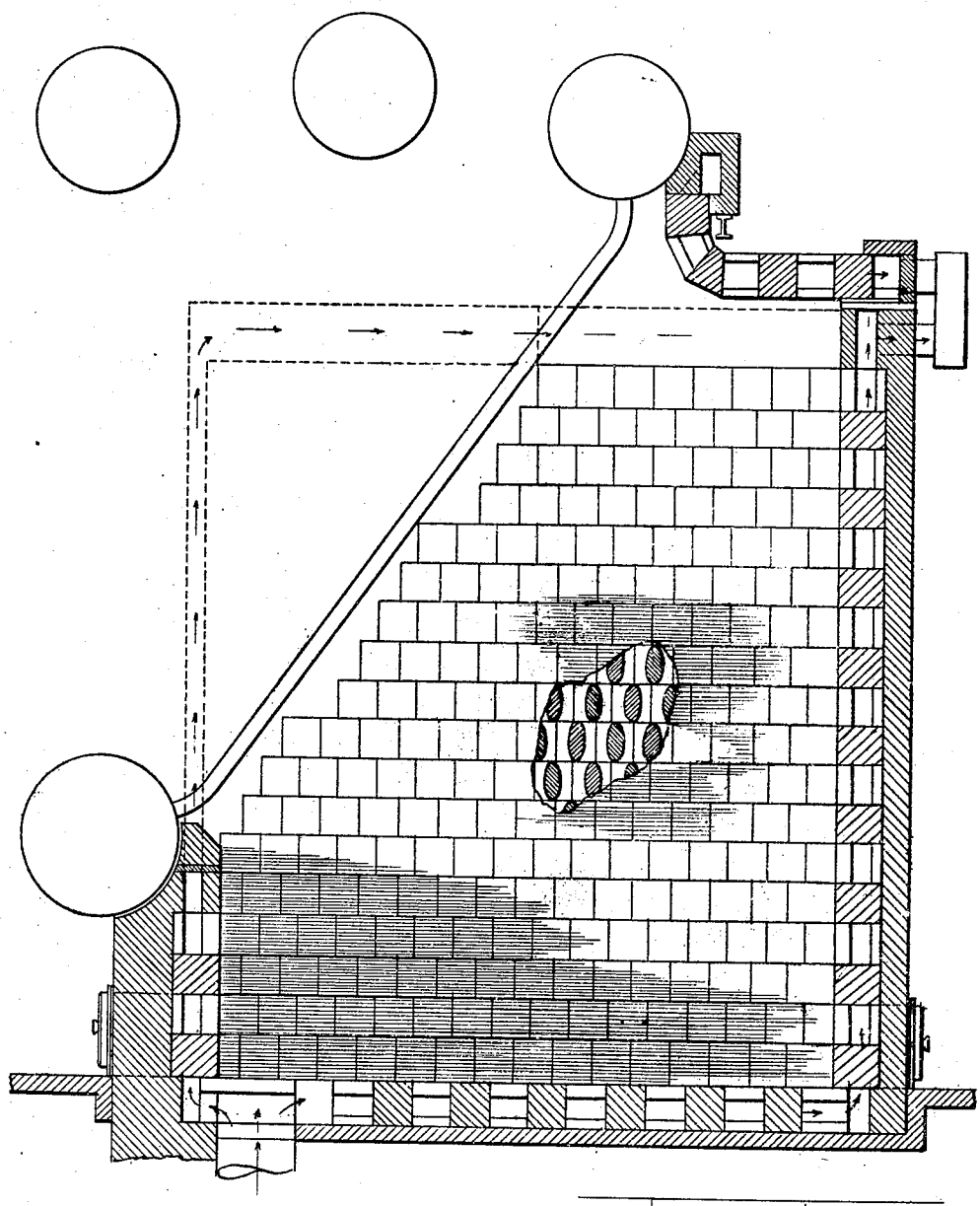
April 29, 1930. V. G. LEACH 1,756,031

AIR COOLED FURNACE BLOCK

Filed May 29, 1926 2 Sheets-Sheet 1

FIG. 1



INVENTOR
Vernon G. Leach

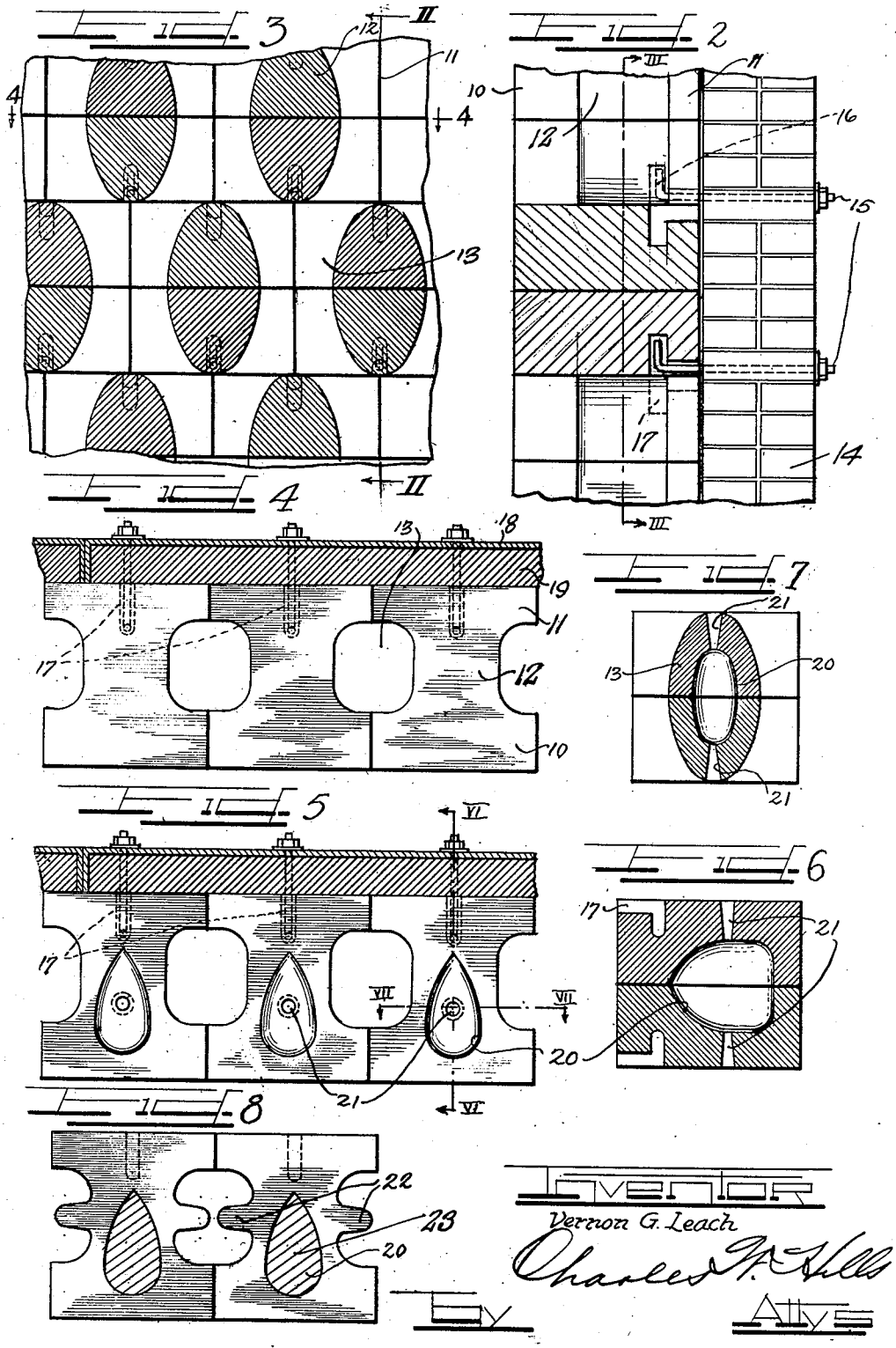
BY Charles D. Wills

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April 29, 1930. V. G. LEACH 1,756,031

AIR COOLED FURNACE BLOCK

Filed May 29, 1926 2 Sheets-Sheet 2



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Patented Apr. 29, 1930 1,756,031

UNITED STATES PATENT OFFICE

VERNON G. LEACH, OF CHICAGO, ILLINOIS

AIR-COOLED FURNACE BLOCK

Application filed May 29, 1926. Serial No. 112,517.

This invention relates to furnace blocks designed more particularly for the construction of air cooled furnace walls. They are also adapted, however, for the construction of heat economizers, and other purposes.

Blocks for air cooled furnace walls have been designed having vertical passages through the blocks communicating with horizontal longitudinal grooves in the top and bottom of the block.

Blocks for air cooled furnace walls are subjected to very trying conditions due to strains and stresses set up by great variations in temperature between the different parts of the block. While this is true of any furnace wall it is especially so where the blocks are provided with passages for cold air. In such cases the difference in temperature between the front and back portion of the blocks may easily be as high as 500° C. If the front and back portions are connected at their center portions only the front and back portions are free to expand and contract independently without producing strains in the connecting portions of block. If, however, as in the constructions heretofore proposed the front and back portions of the block are connected peripherally the full effect of relative expansion and contraction of such portions is thrown onto the connecting portions of the block.

All of the desirable characteristics of firebrick, such as high refractoriness, and superior behavior against spalling, slagging, shrinkage and deformation, cannot be developed to a maximum degree in one product. The brick may be strong in some respects and relatively weak in others, or, as is usually the case, the various properties may all be developed to a medium degree with none of them outstanding.

In order to resist slags the brick should be of dense, finely ground material, and hard burned to keep the permeability to a minimum. Slags tend to seep into the larger pores, surround individual grains of clay and remove them either mechanically or by solution. On the other hand, a dense, finely ground and hard burned block has a greater tendency to spall than a coarse, porous, light burned block. Then in addition to spalling, there may be "pinching" caused by the hot ends of the brick expanding more than the cooler portions, with the result that the ends are placed under tension, and, being weak under such stresses, are torn off and fall into the furnace.

Both spalling and pinching are reduced very largely by connecting the front and back portions at their center portions only giving much greater freedom of expansion and contraction than is the case with blocks having their front and back portions connected peripherally.

Hence, by using central connecting means, blocks of greater density, of more finely ground material and harder burned may be used without sacrificing resistance to spalling and pinching.

One of the principal objects therefore of the present invention is to provide a furnace block in which strains and stresses due to variations in temperature in different portions of the block are reduced to a minimum.

Other and further important objects of this invention will be apparent from the disclosures in the specification and the accompanying drawings.

This invention (in a preferred form) is illustrated in the drawings and hereinafter more fully described.

On the drawings:

Figure 1 is a vertical section through a furnace with walls built of blocks constructed in accordance with the present invention.

Figure 2 is a vertical transverse section through a wall built of modified form of construction of blocks.

Figure 3 is a vertical section on the line III—III of Figure 2.

Figure 4 is a horizontal section through a wall built of the blocks shown in Figures 2 and 3 but having another form of external supporting wall, the section being taken between the two halves of the block.

Figure 5 is a section similar to Figure 4 showing another form of block.

Figure 6 is a revolved section of the block on the line VI—VI of Figure 5.

Figure 7 is a section on the line VII—VII of Figure 5.

Figure 8 is a plan view of the lower half of a still further form of block.

As shown on the drawings:

The blocks shown in Figure 1 on the one hand and Figures 2, 3, and 4 on the other are the same in construction except that in the latter figures the blocks are made in two halves adapted to be united, either prior to or at the time the wall is built. For convenience the blocks will be described as if all were constructed integrally and this applies not only to the blocks shown in Figures 2, 3, and 4 but also to those shown in Figures 5, 6, 7, and 8.

The blocks shown in Figures 1 to 4 inclusive comprise a front portion 10 and a rear portion 11 connected together by a central portion 12. This central portion is of less width than the block and preferably decreases in thickness towards both top and bottom. Further, to facilitate the flow of air through the wall the central portion 12 is preferably of streamline cross-section. Where the portions 10 and 11 join the portion 12 the surfaces of the block are advantageously rounded to avoid sharp corners at which cracks are likely to develop. As the central portions 12 are of less width than the blocks channels are formed on either side so that when the blocks are arranged in juxtaposition a passage 13 is formed between the blocks for the passage of the air used to cool the furnace wall.

In building a wall of such blocks the latter are arranged in staggered relation, as shown more particularly in Figures 1 and 3 so that the air impinges first on the central portion 12 of one block and then on that of another and cannot flow along any one path wholly unimpeded. In this way the transference of heat from the blocks to the air used to cool the furnace walls is greatly facilitated.

As the central portions 12 are of stream line cross-section the formation of dead air spaces is avoided. The avoidance of sharp entering angles also serves the same purpose.

Under the intense heat generated in a furnace the blocks or cementing material therebetween is apt to disintegrate or crack and some at least of the blocks are, therefore, preferably locked to and supported by the external wall of the furnace. In Figure 2 this external wall is a brick wall 14 through which extend bolts 15 having hooked inner ends 16 adapted to enter recesses 17 in the blocks.

In this manner each block may be held in place independently of the others and also, not being bonded to the external wall, may be replaced without removing or disturbing any of the other blocks.

In practice the bolts 15 will not be tightened until after the furnace has been fired once to allow the wall to assume a more or less permanent set. These bolts 15 serve to prevent not merely the falling of the wall in case some of the lower blocks crumble, but also bulging, leaning or distortion of the wall as a whole without specific complete failure of any individual blocks.

In a furnace wall the parts corroded most rapidly are those along the joints between the blocks. With the construction shown the joints come at the thinnest parts, that is where the cooling effect of the air has the greatest effect. Moreover, to aid the cooling effect of the air on such parts the cement used is preferably one having a relatively high heat conductivity. Such a cement may be made by mixing such materials as carborundum, alundum or chromite with a suitable binder such as fireclay, silicate of soda or wood pulp.

In Figure 4 a different form of external wall is shown comprising a sheet iron or steel frame 18 with a back 19 formed of cementitious material of low heat conductivity apertured for the passage of the bolts 15.

The blocks shown in Figures 5, 6, 7, and 8 are formed with cavities 20 inside the portions 12 to aid the transference of heat away from the front portion of the block. This is accomplished by radiation from the front face of the cavity rearwardly or else by filling the cavity with material having a high heat conductivity such as carborundum as indicated at 23 on Figure 8. Where the cavities are left empty apertures 21 may advantageously be provided to allow the cooling air to pass through the cavities.

In case the blocks crack through the central portion thereof air will flow into the furnace from these cavities and so cool the edges of the cracks in the blocks and retard their corrosion.

In Figure 8 a still further modification is shown in the form of ribs 22 arranged vertically on the center portions 12 of the blocks. These ribs increase the area exposed to the cooling air and therefore facilitate the transfer of heat to the latter.

It will be understood that blocks constructed in accordance with the present invention may be used to form an arch or bridgewall as well as the side and bottom walls of a furnace. The blocks may also be set vertically, horizontally, or leaning.

I am aware that many changes may be made, and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I therefore do not purpose limiting the patent granted hereon, otherwise than necessitated by the prior art.

I claim as my invention:

1. A furnace block composed of fire clay having two rectangular portions integrally connected by a tie which has a portion of an-

nular cross section of less width than the block.

2. A furnace block composed of heat resisting material having two rectangular portions connected by a hollow portion of less width than the block, and a filling of material having a relatively high heat conductivity in said hollow portion.

3. As an article of manufacture, a furnace block of two sections, each section comprising two rectangular end portions and an integral tie of less width than the rectangular end portions and having a face in the same plane as one face of the rectangular end portions, the said integral tie having a longitudinal recess in that face which is in the same plane as one face of the rectangular end portions, whereby when the two sections are cemented together a block is formed with a tie having a hollow portion.

4. As an article of manufacture, a furnace block of two sections, each section comprising two rectangular end portions and an integral connecting portion which is substantially stream-lined semi-oval in vertical section, the said connecting portion having a face in the same plane as one face of the rectangular end portions and having a recess in that face.

5. As an article of manufacture, a furnace block of two sections, each section comprising two rectangular end portions of unequal thickness and an integral connecting portion which is substantially stream-lined semi-oval in vertical section, the said connecting portion having a face in the same plane as one face of the rectangular end portions and having a recess in that face.

6. As an article of manufacture, a furance block of two sections, each section comprising two rectangular end portions and an integral connecting portion which is substantially stream-lined semi-oval in vertical section, the said connecting portion having a face in the same plane as one face of the rectangular end portions, the said connecting portion having curved end surfaces merging into adjacent surfaces of the end portions whereby to avoid sharp angles.

7. As an article of manufacture, a furnace block of two sections, each section comprising two rectangular end portions and an integral connecting portion which is substantially stream-lined semi-oval in vertical section, the said connecting portion having a face in the same plane as one face of the rectangular end portions and having a recess in that face, the said connecting portions having curved end surfaces merging into adjacent surfaces of the end portions whereby to avoid sharp angles.

8. A furnace wall composed of a plurality of furnace blocks laid in courses, each block being of two sections, each of said sections comprising rectangular end portions and an integral connecting portion which is substantially stream-lined semi-oval in vertical section, the said connecting portion having a face in the same plane as one face of the rectangular end portions and a recess in that face, the connecting portion having curved end surfaces merging into the adjacent surfaces of the rectangular end portions, the said sections being adapted to be laid together to form a block having rectangular end portions and an ovate-cylindraceous connecting portion, the said blocks being laid adjacent each other at their rectangular ends, and the courses being laid to present tortuous conduits for cooling air.

In testimony whereof I have hereunto subscribed my name.

VERNON G. LEACH.