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Square Checker-Brick

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This invention relates to checkerbricks, and more particularly to those which interlock with one another.

The stoves that heat the air for blast furnaces contain checkerwork formed from checkerbricks that either are solid and laid up in such a way that passages are formed around them, or else are provided with vertical gas passages and are laid as a solid mass. It is with the second kind of checkerwork that this invention is concerned. Herefore, the space between the checkerwork and stove shell has been filled with refractory material in a futile attempt to hold the bricks together. The heat in the stove and age cause the bricks to swell or grow and then a reduction in temperature causes them to contract and pull away from one another. The swelling has caused the checkerwork to push in the side of the stove's combustion chamber, while the separating of the bricks causes their gas passages to get out of alignment.

It is an object of this invention to provide a checkerbrick which can be interlocked with like bricks so that the checkerwork will hold itself together and can be spaced from everything around it. Another object is to provide interlocking bricks that are square and need not have any gas passages between themselves.

In accordance with this invention our checkerbrick is square and has a plurality of vertical gas passages extending through it. The brick has upper and lower faces provided with integral lugs by which the bricks are locked together. One of the faces has at its corners square lugs which are located at the corners of a square center lug that has an area substantially equal to the combined areas of the corner lugs. As a result, an oblong recess having an area equal to at least half of the area of the center lug is formed at each side of that lug between the corner lugs at that side. The opposite face of the checkerbrick has four oblong side lugs that are opposite the recesses at the other side of the brick. These lugs therefore leave four square corner recesses at their ends, while one square center recess is formed in the area surrounded by the side lugs. The area of the center recess is substantially equal to the combined area of the corner recesses. In constructing checkerwork from such bricks they can be laid in several different patterns with the lugs and recesses in one course interfitting with the lugs and recesses in other courses above and below them to lock the bricks against horizontal movements.

The preferred embodiment of the invention is illustrated in the accompanying drawings, in which:

Fig. 1 is a central vertical section through a blast furnace stove;

Fig. 2 is an enlarged horizontal section through the stove, looking down on the checkerwork;

Fig. 3 is a greatly enlarged fragmentary plan view of the checkerwork, showing the upper course and successive underlying courses broken away in part;

Fig. 4 is a vertical section taken on the line IV—IV of Fig. 3;

Fig. 5 is an isometric view of a brick; and

Fig. 6 is an enlarged isometric view of the same brick turned the other side up.

Referring to Figs. 1 and 2 of the drawings, a typical hot blast stove has a metal shell 1 lined with refractory material 2. Inside of the stove at one side there is a refractory wall 3 that curves inward away from the lining to form a combustion chamber 4 which extends from the bottom of the stove to the bottom of its dome 5. Near the bottom of the stove its side wall and the outer wall of the combustion chamber are provided with a port 6 for a gas burner (not shown). The hot gases produced in the combustion chamber pass out of its top and then back down through checkerwork 7, with which the rest of the stove is filled. The checkerwork is supported above the stove base by a suitable perforated support 8, so that the gases leaving the bottom of the checkerwork can flow down and out of the stove through a port 9 in its side wall. After the checkerwork has been heated in this manner for a sufficient length of time, the burner is turned off and air is delivered to the bottom of the checkerwork through port 8. The air is heated by the hot checkerwork and then flows down into the combustion chamber and out through a hot blast outlet 10 to a blast furnace.

In accordance with this invention, the bricks 12 that form the checkerwork are square and provided top and bottom with certain lugs and recesses so that they will interlock with one another. They also are provided with vertical gas passages to provide a large number of small flues extending throughout the height of the checkerwork. As shown in Figs. 5 and 6, one of the horizontal faces of each checkerbrick has a square lug 13 at each corner integral with the rest of the brick. These four lugs are located at the corners of a large, square center lug 14, also integral with the brick. The area of the center lug is substantially four times as great as the area of any of the corner lugs. Thus, if four
of these bricks are laid side by side in a square, the four corner lugs at the four adjoining corners of the bricks will form a large square lug having substantially the same areas as one of the center lugs. All of these lugs preferably taper away from the brick to a slight extent to facilitate ejecting the bricks from the molds in which they are made. It will be seen in Fig. 6 that the arrangement of lugs is such that an oblong recess 15 is formed between each side of the center lug between the corner lugs at that side. Preferably, the width of each corner lug is slightly less than one quarter the width of the brick, thereby spacing the corner lugs from the corners of the center lug, so that each oblong recess will be a little longer than the width of a center lug or the combined widths of two corner lugs. This assures a loose but effective fit in the recesses of the lugs in an adjoining course of bricks. It also allows a greater tolerance in the size of the bricks than could be accommodated heretofore, thereby providing for normal variations in brick sizes without requiring excessive grinding.

As shown in Fig. 5, the opposite face of the brick has four integral lugs 17 projecting from it. Each lug is oblong and opposite to one of the recesses 15 at the other side of the brick. The area of each lug is substantially equal to half the area of the center lug 14. These lugs also may be tapered slightly and have their adjacent corners spaced apart a very short distance. The four oblong lugs leave four square corner recesses 18 at their ends, while a large square recess 19 is formed in the area surrounded by the side lugs.

Of course, the area of the center recess is substantially equal to the combined areas of the four corner recesses.

The checkerbrick is provided with a plurality of vertical gas passages 21, for hot gases and air blast, connecting its upper and lower faces, to permit the bricks to be laid up in different ways and yet have aligned gas passages so that vertical flues will extend from top to bottom of the checkerwork, each brick having sixteen passages. These are located in uniform distances apart in four uniformly spaced rows, so that whether a brick overlaps an entire brick or only a half or quarter of it, the passages of the two bricks will be in vertical alignment. It will be seen that each passage extends through each corner lug, two through each oblong lug, and four through each center lug. In addition, it is desirable to connect the four central passages by means of a depression 22 in the center of the center lug. This helps balance the gas pressure in the different flues in the well known manner.

With checkerbricks of the construction herein shown and described, checkerwork can be constructed in which the bricks will lock themselves against horizontal movements that would separate them and permit them to shift out of line. Consequently, the checkerwork can be formed as a cohesive unit which, as shown in Fig. 2, can be spaced from the surrounding walls of the stove and combustion chamber without requiring the customary surrounding filler of refractory material to hold the bricks in place. The bricks are thereby allowed a space in which to swell without exerting dangerous pressure against the combustion chamber wall.

The preferred, but not the only, way of laying the bricks is illustrated in Figs. 2, 3 and 4 of the drawings. Starting with the bottom course, called A, that and the next course B constitute a pair of adjoining courses in each of which the bricks are laid side by side in straight rows, with the bricks in alternate rows staggered and inverted relative to the bricks in the rest of the rows in the same course. All of the straight rows in these two courses A and B extend in the same direction. This is clearly shown in Fig. 3. It also will be seen there that the oblong lugs on top of course A are each located beside a pair of corner lugs at the adjoining corners of a pair of bricks in the next row, thereby forming a large square lug of the same size as a center lug 14. In order to lock the oblong lug and the corner lugs beside it together, whereby to interlock three bricks, the rows of bricks in course B are staggered relative to the underlying rows so that the center recesses in the bottoms of the bricks in course B will fit down over the square groups of lugs just mentioned. By staggering the rows in any given course, shifting of any brick crosswise of a row is resisted by the two bricks it straddles in the row beside it, whereby some of the lateral strain is taken off the lugs.

The bricks in the pair of courses C and D are laid in the same way as in courses A and B, except that the straight rows extend at right angles to the straight rows of A and B. As a result, some straight vertical joints extend one direction across the checkerwork, while other straight vertical joints extend 90° in the first direction. The next pair of courses, E and F, are laid the same as A and B, so the laying design starts over again and is repeated every four courses. The result is checkerwork in which the bricks lock one another together in all horizontal directions to prevent shifting of the bricks and their misalignment of the passages forming the flues.

As shown in Fig. 2, half bricks 24 may be used in spaces too small for whole ones but too large to leave vacant.

Our checkerbricks can be nested and shipped on edge, thereby protecting the lugs of one brick from another being damaged in transit. Nesting the bricks for shipment is also a good way to check them for size. If they will nest, they will lay up properly in checkerwork.

According to the provisions of the patent specifications, we have explained the principle of our invention and have illustrated and described what we now consider to represent its best embodiment. However, we desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

We claim:

1. A square checkerbrick having upper and lower faces provided with integral lugs, one of said faces having at its corners square lugs located at the corners of a square center lug that has an area substantially equal to the combined areas of the corner lugs, whereby an oblong recess having an area equal to at least half of the area of the center lug is formed at each side of the center lug between the corner lugs at that side, the opposite face of the checkerbrick having four oblong side lugs opposite said recesses, whereby four square corner recesses are formed at the ends of the side lugs and one square center recess is formed in the area surrounded by the side lugs, the area of the center recess being substantially equal to the combined areas of the corner recesses, and the checkerbrick being provided with a plurality of gas passages connecting its upper and lower faces.

2. A square checkerbrick having upper and lower faces provided with integral lugs, one of
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said faces having at its corners square lugs located at and spaced slightly from the corners of a square center lug that has an area substantially equal to the combined areas of the corner lugs, whereby an oblong recess having an area equal to at least half of the area of the center lug is formed at each side of the center lug between the corner lugs at that side, the opposite face of the checkerbrick having four oblong side lugs opposite said recesses with the adjacent corners of the side lugs spaced slightly apart, whereby four square corner recesses are formed at the ends of the side lugs and one square center recess is formed in the area surrounded by the side lugs, the area of the center recess being substantially equal to the combined areas of the corner recesses, and the checkerbrick being provided with a plurality of gas passages connecting its upper and lower faces.

3. A square checkerbrick having upper and lower faces provided with integral lugs, one of said faces having at its corners square lugs located at the corners of a square center lug that has an area substantially equal to the combined areas of the corner lugs, whereby an oblong recess having an area equal to at least half of the area of the center lug is formed at each side of the center lug between the corner lugs at that side, the opposite face of the checkerbrick having four oblong side lugs opposite said recesses, whereby four square corner recesses are formed at the ends of the side lugs and one square center recess is formed in the area surrounded by the side lugs, the area of the center recess being substantially equal to the combined areas of the corner recesses, and the checkerbrick being provided with a plurality of gas passages connecting its upper and lower faces, the checkerwork being constructed from pairs of adjoining courses of said bricks laid side by side in straight rows with the bricks in alternate rows staggered and inverted relative to the bricks in the remaining rows of the same course, all of the straight rows in the two courses forming each pair extending in the same direction, the straight rows in alternate pairs of courses extending at right angles to the rows in the remaining pairs of courses, the rows in each course being staggered relative to the rows in the adjoining course of the same pair, and the oblong lugs on top of each course being located beside pairs of corner lugs in the rows beside them to form square lugs that project up into square recesses in the bottom of the overlying course.

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