Feb. 22, 1938. H. L. SMALLEY 2,108,871

CHECKERWORK

Filed May 26, 1937 2 Sheets-Sheet 1

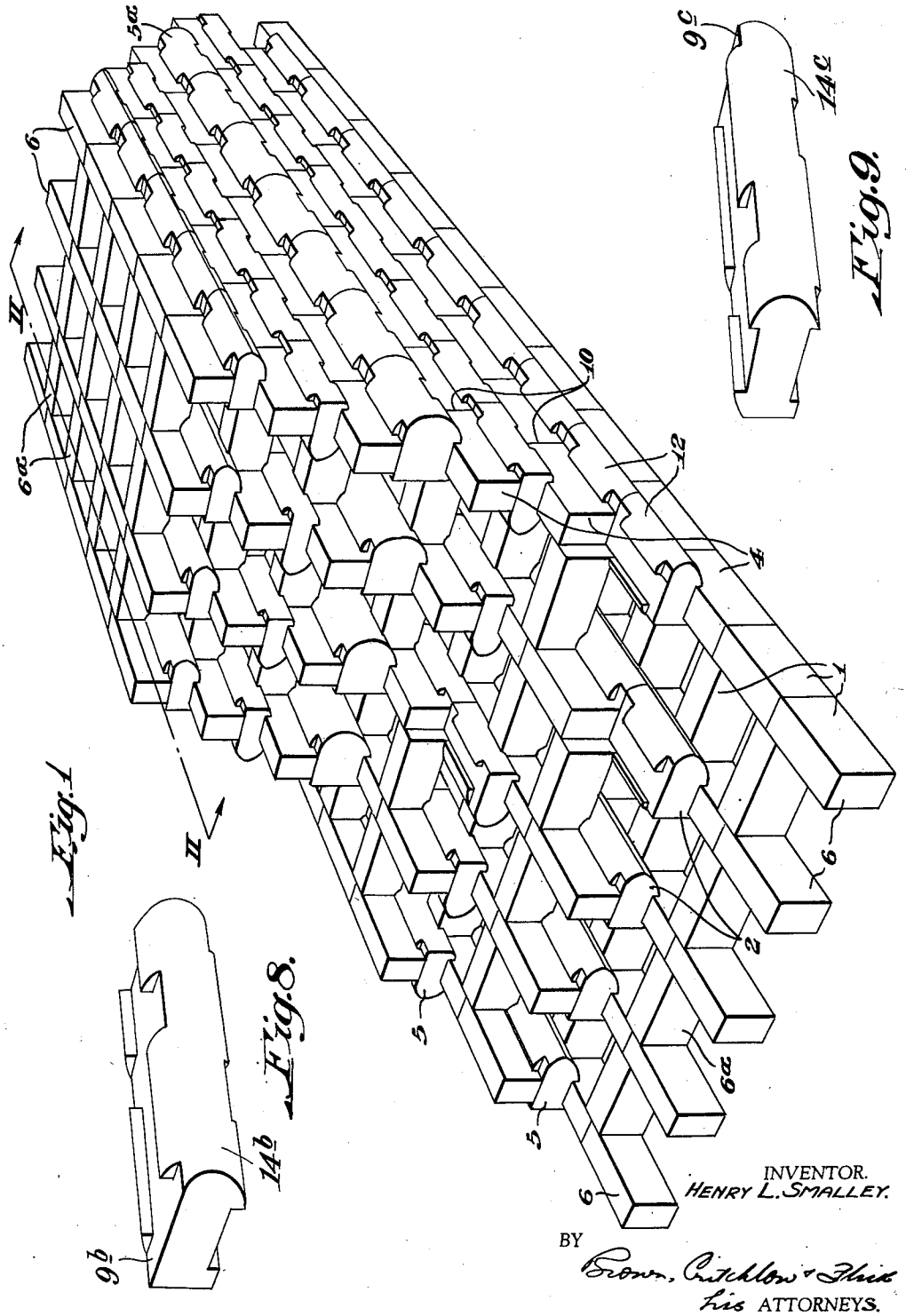


Fig. 1.

Fig. 8.

Fig. 9.

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Fig. 4

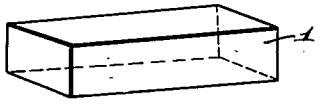


Fig. 5

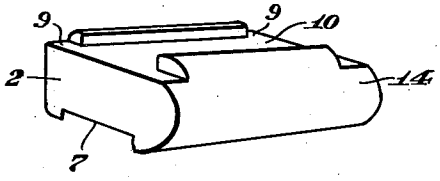


Fig. 6

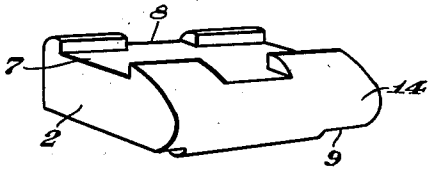


Fig. 7

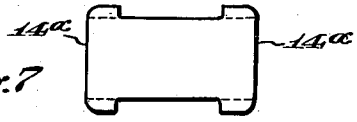


Fig. 2

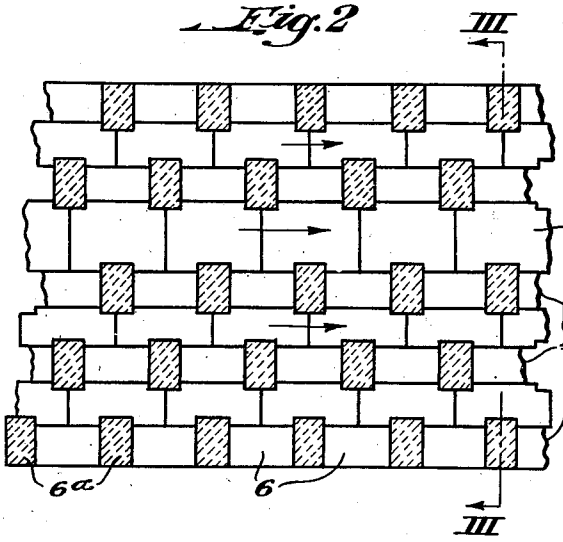
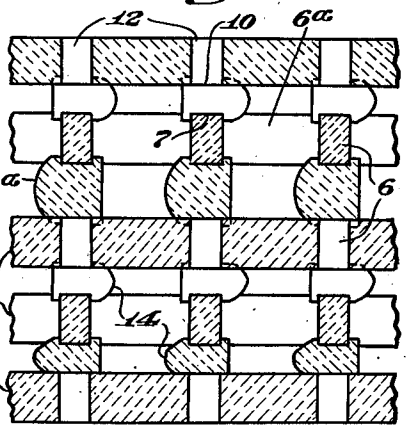


Fig. 3



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UNITED STATES PATENT OFFICE

2,108,871

CHECKERWORK

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Application May 26, 1937, Serial No. 144,907

9 Claims. (Cl. 263—19)

This invention relates to regenerative furnaces and, more particularly, to a regenerative checker-work for such furnaces.

Many elements enter into the ability of a regenerative checker-work to function efficiently. For one thing, the weight per cubic foot of the regenerative checker-work should be as high as possible to provide the maximum heat storage capacity for the regenerator. Also, the checker-work should be constructed to produce a maximum area of heat transfer surface and a large volume of brick per cubic foot of checker chamber. Another, and very important, factor is the ability of the regenerative checker-work to distribute the air and gases passing through it and over its surfaces. This last-mentioned factor, in reality, controls the others for the air must be distributed before full advantage can be taken of the other factors.

However, an undesirable feature of many regenerative checker-works available heretofore is that dust from the furnace gases deposits on the surfaces of the bricks forming the checker-work. This accumulation of dust not only retards the flow of gases through the regenerative checker-work but also retards heat exchange between it and the gases passing therethrough. Oftentimes, severe fouling of the checker-work, rather than the condition of the furnace brick-work, brings the furnace campaign to a close. Obviously, it is highly desirable to maintain the surfaces of the checker-work as free as possible from these dust deposits. Heretofore, the removal of the dust deposits has been difficult, and often it has entailed rebuilding the structure with replacement of damaged brick, or special constructions open to various disadvantages have been necessary.

An object of this invention is to provide a regenerative checker-work which minimizes dust accumulation and which can readily be freed from dust deposits.

Another object of this invention is to provide a regenerative checker-work which is constructed to distribute gases flowing therethrough over the surfaces thereof for optimum heat exchange.

Another object of this invention is to provide high weight of checker brick per cubic foot of regenerative checker-work volume.

A further object is to provide a regenerative checker-work which is easily installed and which, once installed, is of a solid, durable construction.

Still another object is to provide a regenerative checker-work which is constructed largely from bricks of ordinary rectangular form, i. e., straights, and which is easily constructed.

The invention will be described with particular reference to the drawings, in which Fig. 1 is a perspective view of a checker-work constructed in accordance with its preferred embodiment; Fig. 2 a sectional view taken on line II—II of Fig. 1; Fig. 3 a sectional view taken on line III—III of Fig. 2; Fig. 4 a perspective view of a straight; Figs. 5 and 6 perspective views taken from the top and bottom, respectively, of the stretchers used in constructing the checker-work shown in Figs. 1 to 3; Fig. 7 an end elevation of a modified form of stretcher; Fig. 8 a perspective view of a right-hand stretcher; and Fig. 9 a perspective view of a left-hand stretcher.

The checker-work shown in the drawings is constructed from brick shapes 1 (Fig. 4) and 2 (Figs. 5 and 6). It is constructed largely from ordinary straights 1 that are disposed on edge in courses 4. The courses 4 comprise a plurality of longitudinally aligned and abutted straights 1 forming parallel rows 6 spaced to receive similar straights extending between the rows 6 and aligned in rows 6a normal to the rows 6. In each course rows 6 and 6a thus cooperate to form separate flue openings, as seen in the drawings.

The courses 4 are separated by intermediate courses 5 built from aligned and abutted special shapes, or stretchers, 2 (Figs. 5 and 6) which mount the straights 1. To this end they are provided on one face with a longitudinal groove 7 adapted to receive the edge of bricks 1. This is traversed midway of the brick length by a similar but transverse groove 8. The opposite face is recessed at each end to provide portions 9, Fig. 5, of such length that when two of the stretchers are abutted there is formed a groove which receives the edge, or side, of straights 1 with a slight clearance. The recesses 9 are connected by a longitudinal groove 10 similar in width to the groove 7.

As shown in Figs. 1 to 3, the stretchers 2 form a plurality of rows, or intermediate courses, 5 which are parallel to and disposed between the rows 6. Preferably the stretchers are mounted, as seen best in Fig. 1, with the grooves 7 pointed downward and thus engaging a lower row 6, while grooves 10 are turned upward to receive the edges of the straights in the overlying row 6. The rows of stretchers thus combine with the rows 6 to form a plurality of walls 12 that extend from the top to the bottom and from end to end of the checker-work so that each adjacent pair of walls forms a separate flue through the checker-work. The transverse grooves 8 and the recesses 9 are aligned transversely of the checker-work 2 and receive the edges of the straights forming the

rows 6a. From Fig. 1 it will be seen that the straights 1 forming the rows 6a extend between adjacent pairs of the walls 12 transversely of the flue formed thereby. As the recessed portions 9 are at the ends of the stretchers 2, and the transverse grooves 8 are at the center of the opposite sides thereof, the straights which are positioned thereby are staggered, as best shown in Fig. 2. By thus staggering the straights forming the rows 6a, the gases passing through the flues formed by walls 12 are forced to follow a tortuous path so that they must contact the surfaces of the cross rows 6a, thus affording maximum heat exchanging contact.

The spacing of the cross checkers is governed, of course, by the length of the stretchers 2, so the flue size can be varied by the use of stretchers of appropriate length. Thus, using 9 x 4½ x 3-inch straights and stretchers of the same dimensions, the cross straights will be on 9-inch centers, providing a flue opening six inches square. If a larger opening is needed, the stretchers can be made longer, say ten inches, which would give an opening 6 x 7 inches. And the stretchers can be made to take other sizes of straights, or to vary the distance of the straights, according to need.

The stretchers 2 are provided on one side with noses 14 that protrude into the flues of the checker work and which produce turbulence in the gases flowing through the checker-work. In the construction shown, noses 14 project in opposite directions from adjacent courses of the stretchers 2, as seen particularly in Fig. 3. The noses may of course be disposed in arrangements other than shown in the drawings. With ordinary 9-inch straights the stretchers shown suffice for building the particular structure shown. With larger sizes of brick, or for other nose dispositions, it may be necessary to use right- and left-hand stretchers, as those skilled in the art will understand. Thus in Fig. 8 the nose portion 14b is to the right of the recessed end portion 9b, while in the left-hand stretcher shown in Fig. 9 the nose portion 14c is to left of the end portion 9c when looking axially along the stretchers when they have recessed end portions at the top of the closer end thereof. It will be seen that the stretcher courses are formed by alternately positioned lefts and rights which are placed with the recessed portions 9b and 9c abutting whereby the noses project in the same direction. By use of these stretchers, standard 9" straights can be used to complete the construction, if desired. In all events, the rows 6a may be kept on 9" centers even though 13½" stretchers are used. A further feature of the left- and right-hand straights is that they may be formed in any suitable length whereby the transverse rows 6a may be spaced as desired.

Also, noses may be provided on both sides of the stretchers, as shown at 14a, Fig. 7. Such a construction is advantageous because it permits regulation of the size of the vertical flue opening within rather wide limits, using standard straights and no special shapes other than the stretchers.

Since the stretcher courses 5, which separate the courses 4, have no transverse members, longitudinal openings are formed which are open from end to end of the checker-work between the courses 4. The arrows in Fig. 2 indicate typical examples of these openings which extend the width and length of the separate flues of the checker-work. To expedite the lancing, and thereby the cleaning, of the checker-work, I prefer to provide at least one course 5a, and preferably several spaced courses, of the stretchers 2 that are appreciably thicker than the others. This facilitates the introduction of steam or air pipes, or other cleaning apparatus, into the checker-work so that the accumulated dust can be easily and rapidly removed from the surfaces of the checker-work without structural change thereof. Since the thickness of the stretchers governs the height of these vertical flue openings, it will be seen that these flues can be varied in height, particularly for lancing purposes. Also, courses 5a of such thicker stretchers may be disposed as often as need be to provide enough horizontal flues for adequate lancing. Thus, instead of being disposed as shown, courses 5a may be alternated with the thinner stretcher courses to provide a substantial number, say five to seven, of horizontal lancing flues at the top of the structure.

The checker-work construction provided by the invention permits the ready insertion of steam or air pipes therein and is designed to allow the ejected steam to directly impinge on a large area of the surface thereof, i. e., this being a good method of cleaning checker-works. By providing a plurality of separate flues in my checker-work, I not only keep eddy currents to a minimum, but also facilitate the cleaning thereof by permitting steam pressure to be built up in the separate flues due to the relatively small volume thereof.

A particular advantage of this construction is that the checker-work is composed largely of straights. These can be molded with vacuum to provide high density bricks with consequent maximum capacity for heat storage. High pressure molding is not applicable to irregularly shaped bricks so that the potential heat storage of the checker-work provided by this invention is raised by utilizing a large proportion of straights in its construction. These dense bricks also provide a high weight of checker brick per cubic foot of checker volume. Since the majority of the bricks used in this invention are of ordinary rectangular shape, e. g., standard straights, and the positioning bricks are adapted to receive the rectangular bricks, the checker-work is easily constructed, and, once built, of a solid, durable nature.

The provision of a large number of standard straights permits the use of a relatively large volume of brick per cubic foot of checker chamber. This, in turn, provides a large area of heat transfer surface per cubic foot of checker chamber.

The staggered flue openings through the checker-work 2 function to distribute the gases over the surfaces of the checker-work. This provides ample opportunity for the absorption of heat by the checker brick from the heated gases, or the release of heat to incoming air. Thus full advantage can be taken of the potential heat storage capacity of the checker-work. At the same time, the transient gases only directly impinge on the bottom (or top) surfaces of the straights forming the rows 6a. This means that there is only a minimum opportunity for accumulation of dust in the checker-work.

Various modifications are permissible. For instance, walls 6 may be built from 9x4½ straights which are 3, 2½ or 2 inches thick, or of other thicknesses. As the thickness is reduced, the brick are laid on smaller flue centers, thus increasing the number of flues which increases the area of exposed heat-exchanging surface.

Other advantages also accrue from the inven-

tion. Among them reference may be made to ease of stacking standard shapes, and high salvage recoveries in rebuilding checkers built in accordance with the invention.

According to the provisions of the patent statutes, I have explained the principle and construction of my invention, and have illustrated and described what I now consider to be its best embodiment. However, I 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.

I claim:

1. A regenerative checker-work comprising the combination of a plurality of courses formed from straights arranged in spaced parallel rows, intermediate courses of stretcher brick disposed between adjacent rows of said straights and forming therewith a plurality of vertical walls adjacent pairs of which cooperate to form separate flues, and straights extending between said parallel rows of straights for exposure to gases passing through said flues.

2. A regenerative checker-work comprising the combination of a plurality of courses comprising aligned and abutted straights arranged in spaced parallel rows, and straights extending between said rows; and intermediate courses of stretcher brick disposed between and in alignment with adjacent pairs of said rows and forming vertical walls therewith adjacent pairs of which form separate vertical flues, the straights extending between said rows in any course being staggered relative to those in the next adjacent courses, and said stretcher brick forming passages open from end to end of the flues.

3. A regenerative checker-work comprising the combination of a plurality of courses comprising aligned and abutted straights arranged in spaced parallel rows, and straights extending between said rows; and intermediate courses of stretcher brick disposed between and in alignment with adjacent pairs of said rows and forming vertical walls therewith adjacent pairs of which form separate vertical flues, said stretcher brick forming horizontal passages open from end to end of the flues and being provided with nose portions extending into the flues.

4. A regenerative checker-work comprising the combination of a plurality of courses comprising aligned and abutted straights arranged in spaced parallel rows, and straights extending between said rows; and intermediate courses of stretcher brick disposed between and in alignment with adjacent pairs of said rows and forming vertical walls therewith adjacent pairs of which form separate vertical flues, the straights extending between said rows in any course being staggered relative to those in the next adjacent courses, said stretcher brick forming passages open from end to end of the flues, and said stretcher brick being provided with nose portions that protrude into the flues and distribute transient gases over the surfaces of the checker-work.

5. A regenerative checker-work comprising the combination of a plurality of courses comprising aligned and abutted straights arranged in spaced parallel rows, and straights extending between said rows; and intermediate courses of stretcher brick disposed between and in alignment with adjacent pairs of said rows and forming vertical walls therewith adjacent pairs of which form separate vertical flues in the checker-work, said stretcher brick having longitudinal grooves in both the top and bottom surfaces thereof engaging with the straights forming said courses, and said intermediate courses positioning said courses of straights in spaced relation and forming passages between said courses open from end to end of the flues.

6. A regenerative checker-work comprising the combination of a plurality of courses comprising aligned and abutted straights arranged in spaced parallel rows, and cross straights extending between said rows; and intermediate courses of stretcher brick disposed between and in alignment with adjacent pairs of said rows and forming vertical walls therewith adjacent pairs of which form separate vertical flues in the checker-work, said stretcher brick having longitudinal grooves in both the top and bottom surfaces thereof which engage with the straights forming said courses, and having on both faces transverse grooves receiving said cross straights, said intermediate courses positioning said courses of straights in spaced relation and forming passages therebetween open from end to end of the flues, and the straights extending between said rows in any course being staggered relative to those in the next adjacent courses.

7. A regenerative checker-work comprising the combination of a plurality of courses formed from aligned and abutted straights arranged in spaced parallel rows, and cross straights extending between said rows; and intermediate courses of aligned and abutted stretcher brick disposed between and in alignment with pairs of said rows from adjacent courses of straights and forming vertical walls therewith, adjacent pairs of the walls forming separate vertical flues in the checker-work, said stretchers having longitudinal grooves in both the top and bottom surfaces thereof engaging with and positioning the straights forming said rows and having on both faces transverse grooves receiving said cross straights, said intermediate courses positioning said courses in spaced relation to form passages therebetween open from end to end of the flues, and said stretchers being provided with noses protruding into the flues and distributing transient gases over the surfaces of the checker-work.

8. A regenerative checker-work comprising the combination of a plurality of courses formed from aligned and abutted straights arranged in spaced parallel rows, and cross straights extending between said rows; and intermediate courses of aligned and abutted stretcher brick disposed between and in alignment with pairs of said rows from adjacent courses of straights and forming vertical walls therewith, adjacent pairs of the walls forming separate vertical flues in the checker-work, said stretchers engaging with the straights forming said rows and having transverse grooves in one surface thereof intermediate the extremities of said stretchers and recessed portions in the opposite surface thereof at the extremities of said stretchers engaging with and positioning said cross straights, adjacent recessed portions forming transverse grooves at the ends of said stretchers when said stretchers form said intermediate courses, said transverse grooves thereby staggering said cross straights in any course relative to those in the next adjacent courses, and said intermediate courses positioning said courses of straights in spaced relation to form passages therebetween open from end to end of the flues.

9. A regenerative checker-work comprising the combination of a plurality of courses formed

from aligned and abutted straights arranged in spaced parallel rows, and cross straights extending between said rows; and intermediate courses of aligned and abutted stretcher brick disposed between and in alignment with pairs of said rows from adjacent courses of straights and forming vertical walls therewith, adjacent pairs of the walls forming separate vertical flues in the checker-work, said stretchers having longitudinal grooves on the top and bottom surfaces receiving and positioning the straights forming said rows and having transverse grooves in one surface thereof intermediate the extremities of said stretchers and recessed portions in the opposite surface thereof at the extremities of said stretchers engaging with and positioning said cross straights, adjacent recessed portions forming transverse grooves at the ends of said stretchers when said stretchers form said intermediate courses, said transverse grooves thereby staggering said cross straights in any course relative to those in the next adjacent courses, and said intermediate courses positioning said courses of straights in spaced relation to form passages therebetween open from end to end of the flues.

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