May 9, 1933. J. P. GRILLI 1,908,143

CHECKERWORK

Filed June 18, 1932

Fig. 1.

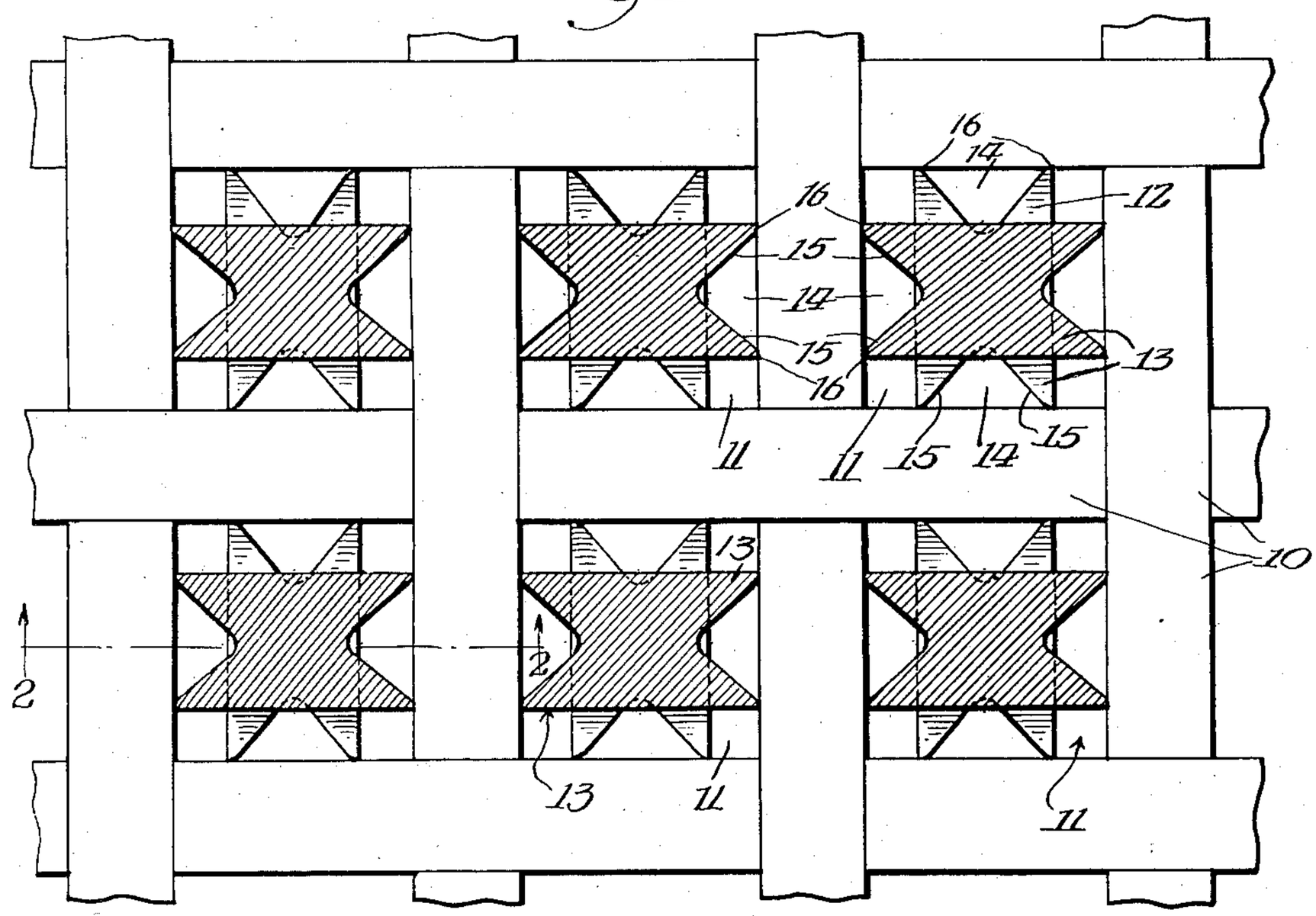


Fig. 2

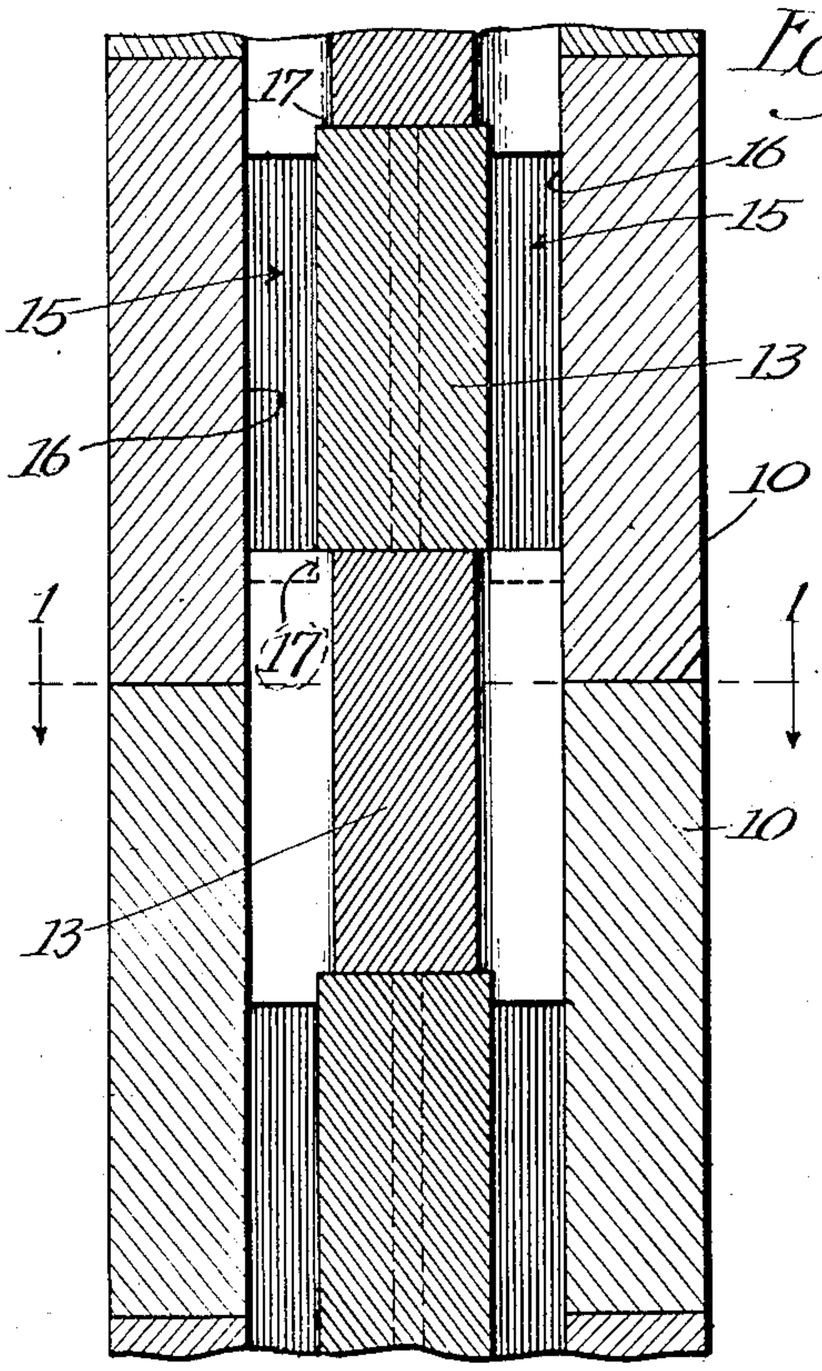
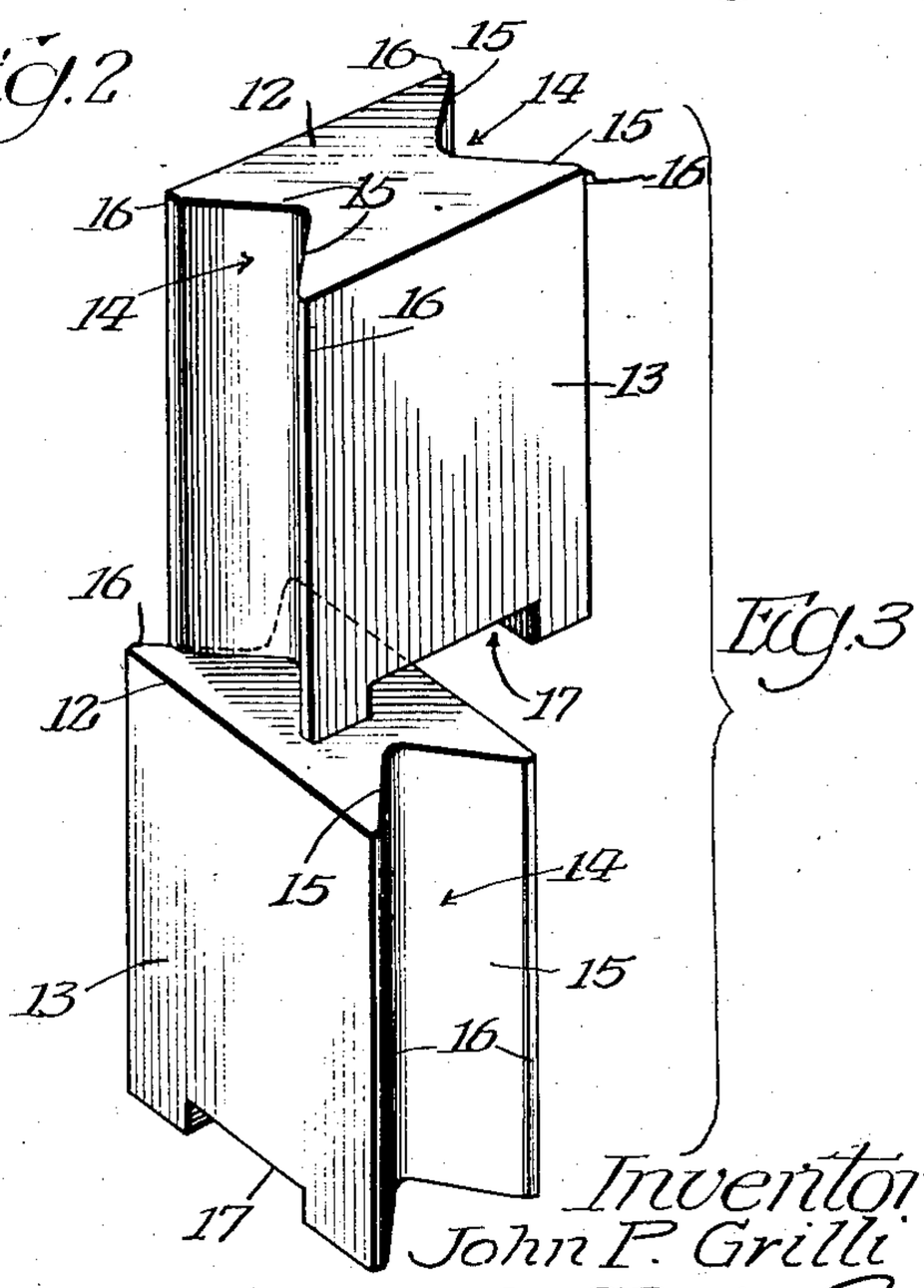


Fig. 3



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UNITED STATES PATENT OFFICE

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CHECKERWORK

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This invention relates to a new and improved checkerwork for regenerators, and more particularly to checkerwork especially adapted for use in connection with hot blast stoves of the types used with blast furnaces, used in the production of pig iron.

Hot blast stoves or the like consist of shells which are filled with brick checkerwork, the function of the brick being to absorb the heat from the products of combustion of from 20% to 40% of the top gases from the furnace, which are cleaned before burning in the hot blast stoves, and to give up heat to the air to be used in running the furnace.

The efficiency of a hot blast stove, or similar regenerative apparatus depends primarily upon the efficiency of the heat transfer. The heat transfer rate per square foot of heating surface depends upon the hydraulic diameter of the flues, the mass velocity in the flues, the degree of turbulence of flow in the flues, the thickness of the brick in the flues, and the temperature differential between the brick and the gases in the flues.

There have been constructed many types of so-called high efficiency hot blast stoves checkerwork, but as these checkerworks used large brick and were of complicated geometric design, the cost amounted from two to three times the cost of an ordinary hot blast stove.

These types of checkerwork brick also are subjected to large internal stress in the brick, and this results in much spalling and cracking of the brick, and as the flues in these bricks are usually small, the spalling and cracking soon plugs up the flues to the passage of gases.

To overcome the high cost of complicated geometric shaped brick, and other disadvantages, the checkerwork as shown in Patent 1,815,905, issued July 28, 1931, was invented, has been installed in several plants, and has given fair results from a heat transfer standpoint, but from a structural point of view, lacks stability.

This is caused by the more rapid heating and cooling of the inserts which cause a rapid wear of the feather edge of the filler which are disposed in the corners of the flues formed by the flue bricks. It has also been found that in the alternate heating and cooling of the checkerwork, filler brick placed diagonally in the checker flue, will finally act as wedges, and cause misaligning of all the checkerwork which will result in making the hot blast stove inoperative.

In flues in which the filler brick are arranged diagonally thereacross, the bricks of the flues which prevent the fillers from turning is lost for heat transfer purposes, for the reason that there will be an extended contact between the lateral faces of the fillers at the ends thereof and the proximate faces of the bricks of the flue.

It is one of the objects of the present invention to overcome these difficulties and objections and to reduce to a minimum the so-called contact area between the filler bricks and the flue walls, thereby providing a maximum exposed contact area of the filler and brick for the gases.

In the accompanying drawing:

Figure 1 is a view partly in top plan, partly in horizontal section of a checkerwork constructed in accordance with the principles of this invention, and as taken on line 1—1, Figure 2.

Figure 2 is a detail, vertical sectional view taken on line 2—2, Figure 1, on an enlarged scale.

Figure 3 is a detail perspective view of two of the filler bricks separated.

In carrying out this invention, rectangular bricks 10 are preferably used to build up the body of the checkerwork, and these are laid in such a manner that rectangular openings or flues 11 will be formed extending vertically through the checkerwork. Each course of rectangular brick 10 is preferably laid so as to break joint with the next adjacent courses.

The numeral 12 designates a filler brick which is shown having two vertical planes of symmetry and is of a considerably larger diameter in cross section in one direction than in a transverse direction, so as to produce a filler brick which is comparatively thin with respect to its width, and this brick

is of a size to extend entirely across the opening 11 in the checkerwork so as to contact with opposite walls of the opening and so that the sides 13 are spaced from the opposite walls of the flue opening 11. The narrower vertical faces or sides of the brick are cut away or recessed as at 14 to provide each with a channel which extends for the entire length of the brick and opens through the ends thereof. The walls of the recesses 14 preferably converge from the outer edges of the brick inwardly and meet at points spaced a considerable distance from the transverse center of the brick so as to form clearly defined substantially sharp or feather edges 16 extending for the entire length of the brick.

Tho bottom of the brick is recessed as at 17 and the width of the recess on the major axis of the brick is only slightly greater than the width of the brick on its minor axis, so that when the brick 12 are superposed, the top of the lowermost brick will enter the recess 17 of the next adjacent uppermost brick and will form an interlocking or interengaging means between the bricks to hold them against relative lateral displacement.

The bricks thus constructed are superposed within the flue openings 11 and the bricks are so arranged that the plane of symmetry corresponding to the width of alternate bricks will intersect the corresponding plane of the next adjacent bricks in the same vertical series, and the bricks are of such a size that the edges 16 will form a minimum contact with the walls of the flue openings 11.

The edges 16 also serve the purpose of preventing the bricks from turning in the flue opening and the interlocking means between the bricks hold them against relative displacement within the flue openings.

These filler bricks afford an increased heating surface together with an increased volume of heat absorbing material per unit of checkerwork volume, and it will be manifest that the filler brick not only divides the flue opening 11 into smaller flues, but the recessed portions 14 will form clearly defined flues and being arranged in staggered relation with respect to each other, will cause an increased turbulence of the gas within the flues while flowing therethrough.

Each of the brick is so designed that four lines of contact only will be formed with the vertical walls of the checker flues, thereby preventing the loss of the corners, as is the case with diagonally arranged filler brick.

In the present invention the filler brick divides the flue area into smaller flues which have a much smaller hydraulic diameter, and this greatly increases the heat transfer rate.

The filler brick are maintained in vertical alignment by the interlocking of the ends thereof, that is by the projection of the end of one of the bricks into the recess 17 of the next adjacent brick, and furthermore the filler brick constructed and arranged as herein shown, assist in bracing the rectangular brick 10 and assists in maintaining the uniformity of the vertical flues.

While the preferred form of the invention has been herein shown and described, it is to be understood that various changes may be made in the details of construction and in the combination and arrangement of the several parts, within the scope of the claims, without departing from the spirit of this invention.

What is claimed as new is:—

1. A checkerwork construction, comprising a plurality of rectangular brick built up to form rectangular vertical flues, and a vertical series of filler bricks, each of said filler bricks engaging the vertical flues on four lines of contact.

2. A checkerwork construction, comprising a plurality of rectangular brick built up to form rectangular vertical flues, and a vertical series of filler bricks, each of said filler bricks engaging the vertical flues on four lines of contact and remote from the corners of the flue.

3. A checkerwork construction, comprising a flue rectangular in cross section, and a vertical series of filler bricks within and set at right angles to opposite faces of the vertical walls of the checker flues.

4. A checkerwork construction, comprising a plurality of rectangular brick built up to form rectangular vertical flues, and a vertical and superposed series of filler bricks, the proximate ends of adjacent filler brick being interlocked against relative axial displacement.

5. A checkerwork construction, consisting of flues, filler bricks within the flues, and interlocking means between the proximate ends of adjacent filler brick whereby adjacent brick are maintained against relative axial rotation.

6. A checkerwork construction comprising a plurality of rectangular brick built up to form rectangular vertical flues, and a vertical series of filler bricks within the flues, said filler bricks having a plurality of sides parallel to vertical walls of the checker flue, and normal to the other vertical walls.

7. A checkerwork construction comprising a plurality of rectangular brick built up to form rectangular vertical flues, a vertical series of filler brick within the flue, and cooperating means on said filler brick to prevent relative axial shifting on one another.

8. A checkerwork construction comprising a plurality of rectangular brick built up to form rectangular vertical flues, and a vertical series of filler brick within the flues, said filler brick being comparatively wide with relation to its thickness, the sides of the brick being parallel to the vertical walls of the checker flues.

9. A checkerwork construction comprising flues rectangular in cross section, and a series of filler brick within the flues, said filler brick being comparatively wide with relation to its thickness, the vertical ends of each of the filler bricks being shaped to form planes at an angle of less than ninety degrees from the contacting wall of the vertical flue.

10. A checkerwork construction comprising a plurality of rectangular bricks built up to form rectangular vertical flues, and a series of filler brick within the flues, said filler bricks having means engaging the flue walls remote from the corners thereof to prevent shifting, and being installed in staggered relation to one another.

11. A checker work, comprising a flue angular in cross section, and a vertical series of filler brick, each of said filler bricks engaging only the vertical walls of the flue remote from the corners of the flue.

12. A checkerwork comprising a flue angular in cross section, filler blocks in the flue, portions of the periphery of said blocks being reduced to form laterally spaced clearly defined contact edges engaging only the vertical walls of the flue remote from the corners of the flue.

13. A checkerwork comprising a flue angular in cross section, an a series of superposed filler brick within the flue, each of the bricks being comparatively thin with relation to the width of the brick, portions of the periphery of the thinner edges of the bricks being shaped to form spaced clearly defined contact edges of a thickness considerably less than the thickness of the brick, extending lengthwise of the brick and engaging the walls of the flue remote from the corners of the flue, each of the bricks being so arranged that its greatest transverse horizontal axis will be disposed to intersect the greatest horizontal transverse axis of each of the filler bricks thereabove and therebelow.

14. A checkerwork comprising a flue angular in cross section, a series of superposed filler brick within the flue, each of the bricks being comparatively thin with relation to the width of the brick, portions of the periphery of the thinner edges of the bricks being shaped to form clearly defined spaced contact edges of a thickness considerably less than the thickness of the brick extending lengthwise of the brick and engaging the walls of the flue remote from the corners of the flue, each of the bricks being so arranged that its larger transverse horizontal axis will intersect the greatest horizontal transverse axis of each of the filler bricks thereabove and therebelow, and interengaging means between the proximate ends of adjacent bricks for maintaining them against relative displacement.

15. A checkerwork comprising a vertical flue rectangular in cross section, and a series of superposed filler brick in the flue, each of said bricks being so channeled in oposite vertical faces that resultant spaced pairs of edges thereof respectively contact with each of the two opposite walls of the flue and the lateral faces of the brick being spaced from opposite walls of the flue, the bricks being shaped to form spaced clearly defined feather edges extending lengthwise of the brick and forming contact with the flue wall, said bricks being so superimposed that a vertical plane of symmetry of each brick is transverse to the corresponding plane of the next adjacent bricks thereabove and therebelow.

16. A checkerwork comprising a vertical flue rectangular in cross section, and a series of superposed filler brick in the flue, each of said bricks being comparatively wide with relation to its thickness, the width of the brick being such that the longitudinal edges of the brick will contact opposite walls of the flue, the thickness of the brick being such that the lateral faces of the brick will be spaced from opposite walls of the flue, portions of the longitudinal edges of the brick on the greatest transverse axis being recessed to form clearly defined contact edges to engage the flue wall and extending lengthwise of the brick and spaced laterally from each other to form a passage therebetween, said filler bricks being so superimposed that the greatest transverse diameter of each brick will be transverse to the greatest transverse diameter of the next adjacent brick.

17. A checkerwork comprising a vertical flue rectangular in cross section, a series of superposed filler brick in the flue, said filler brick being comparatively wide with relation to its thickness each of said bricks having a greater transverse diameter of a length that the edges of the brick will contact opposite walls of the flue, and a smaller transverse diameter of a size that the lateral faces of the brick on the smaller diameter will be spaced from opposite walls of the flue, the end of the bricks on the greatest transverse diameter being shaped to form spaced clearly defined edges extending lengthwise of the brick and forming contacts with the flue wall, said filler bricks being so superposed that the greatest horizontal transverse diameter of each brick will intersect the greatest horizontal trans-

verse axis of the next adjacent brick thereabove and therebelow, and interlocking means between the proximate ends of adjacent bricks.

In testimony whereof I have signed my name to this specification, on this 15th day of June, A. D. 1932.

JOHN P. GRILLI.