April 3, 1934. A. L. FOELL 1,953,342

CHECKERWORK CONSTRUCTION

Filed Oct. 11, 1932 2 Sheets-Sheet 1

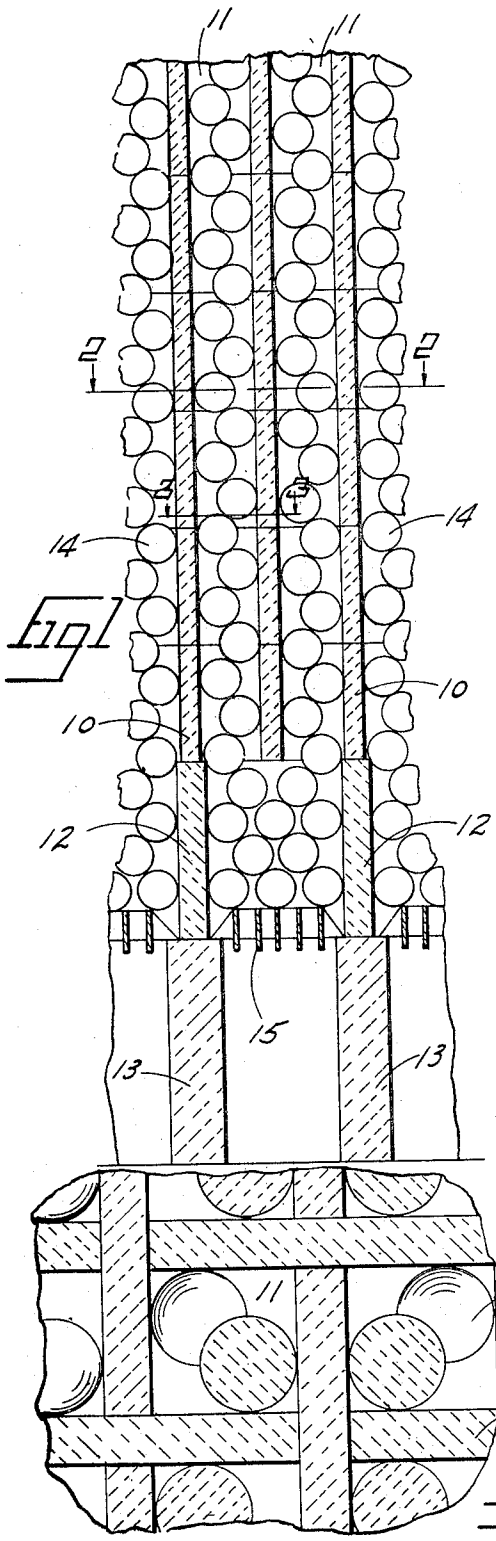


Fig 1

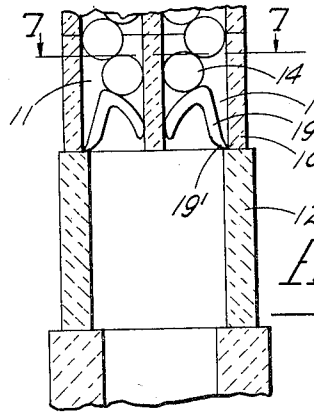


Fig 6

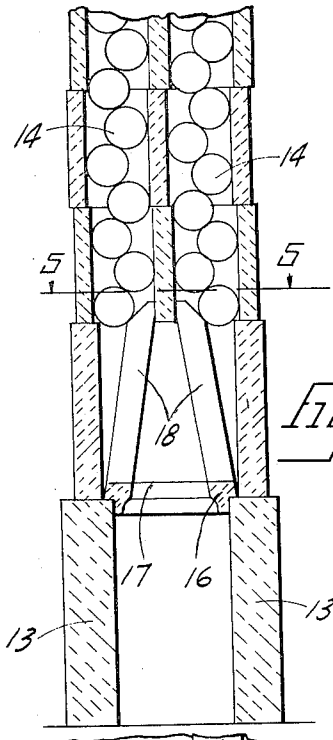


Fig 4

Fig 2

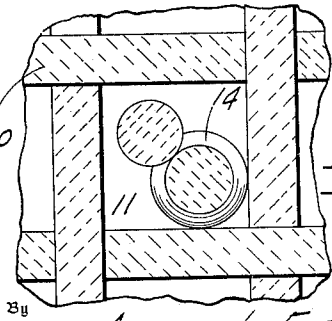


Fig 3

Inventor

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CHECKERWORK CONSTRUCTION

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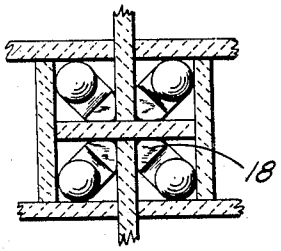


Fig 5

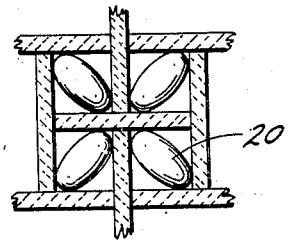


Fig 9

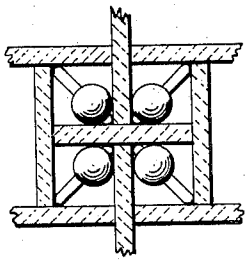


Fig 7

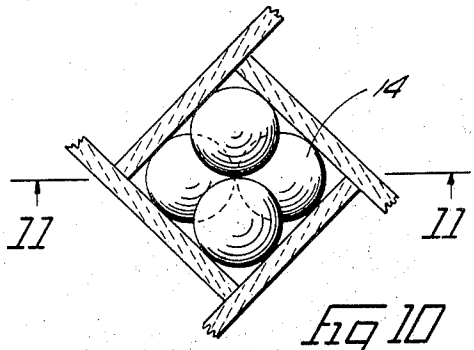


Fig 10

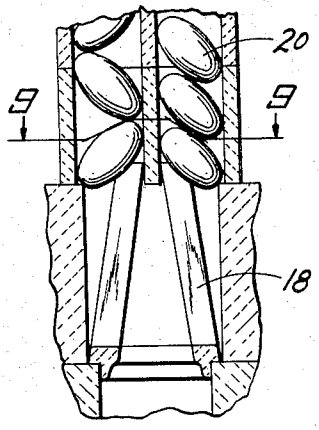


Fig 8

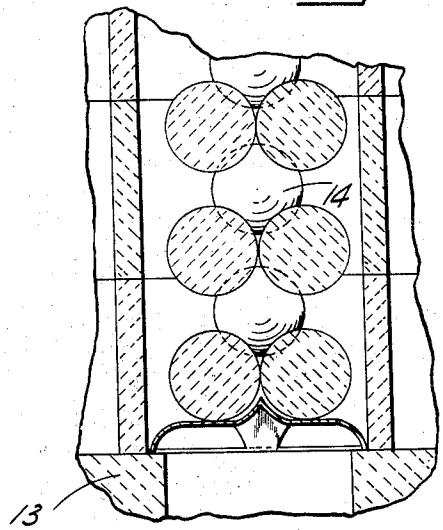


Fig 11

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Patented Apr. 3, 1934

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UNITED STATES PATENT OFFICE

1,953,342

CHECKERWORK CONSTRUCTION

Adolph L. Foell, Cleveland Heights, Ohio

Application October 11, 1932, Serial No. 637,260

7 Claims. (Cl. 263—51)

This invention relates to regenerative heaters and more particularly to an improved form of checker work construction especially adapted for use in hot blast stoves for blast furnaces and the like.

Although my invention is adapted to be used in many types of apparatus in which refractory material is arranged in what is commonly known as checker work, the following description and the accompanying drawings illustrate my invention applied to the usual form of hot blast stove. I do not, however, limit myself to this specific application as it will be readily understood by those skilled in the art that my invention may be applied to other uses.

A great many of the hot blast stoves now in existence contain checker work comprising relatively large checker openings of round, square, rectangular or other cross sectional shape laid up of ordinary rectangular brick or special shaped tile. In the usual type of hot blast stove the checker work is provided with vertically extending openings or flues which are adapted to alternately convey the hot gases to heat and the air to be heated by the checker work and in this way effect the desired heat transfer in the usual manner. Stoves of this type with large checker openings have a necessarily limited amount of heating surface and, in many cases, the amount of heating surface is insufficient to properly serve the present day demand for higher hot blast temperatures and more efficient stove operation. With the advent of improved methods of cleaning the blast furnace gas which is used to heat the hot blast stoves the above noted large checker openings are no longer necessary for the purpose of stove cleaning and it has been found that by reducing the size of the checker openings and increasing the amount of heating surface per unit of stove volume much greater hot blast stove efficiency is obtained.

In many instances the above noted large checker stoves are still capable of many years of service and therefore cannot justifiably be replaced by new stoves having smaller checker openings and greater surface even though the need of increased heating surface strongly exists. It is, therefore, among the objects of my invention to provide means for increasing the heating surface of the existing checker work of hot blast stoves and the like without the necessity of completely rebuilding the checker work.

Other objects of my invention are: the provision of a filler brick which can be readily inserted in the checker openings of existing hot blast stoves regardless of whether the checker openings or flues are perfectly true in size from top to bottom or are irregular due to unavoidable discrepancies in the original laying up of the checker brick work or subsequent shifting of such brick work during operation; the provision of filler bricks for checker work which are self aligning and self arranging in orderly fashion when placed in the checker openings; the provision of filler bricks which can be easily handled and placed in existing checker work and which may be easily removed when and if desired; the provision of a checker work construction in which the desired turbulence in the flow of gas or air through the flues is obtained thereby increasing the efficiency of the heat transfer; the provision of means for improving the efficiency of the present large checker hot blast stoves and the like at a minimum cost of manufacture and installation.

The above and other objects of my invention will appear from the following description of a preferred form thereof, reference being had to the accompanying drawings. Broadly, it may be stated that I propose to increase the heating surface and the volume of the refractory material of a checker work installation by placing spherical or otherwise suitably shaped bodies of refractory material into each of the checker openings or flues and properly supporting such refractory bodies in the checker opening.

In the drawings—

Figure 1 is a vertical section through a portion of the checker work of a hot blast stove.

Figure 2 is an enlarged horizontal cross section of the checker work shown in Figure 1 and taken on line 2—2 of Figure 1.

Figure 3 is a fragmentary view generally similar to Figure 2 but taken on line 3—3 of Figure 1.

Figure 4 is a view similar to Figure 1 but showing a modified form of support for my filler bodies.

Figure 5 is a horizontal section taken on line 5—5 of Figure 4.

Figure 6 is a fragmentary sectional view of the lower ends of the flues of a hot blast stove illustrating another form of support for the filler brick.

Figure 7 is a horizontal section taken on line 7—7 of Figure 6.

Figure 8 is a view generally similar to Figures 1 and 4 but showing a spheroidal form of filler brick.

Figure 9 is a horizontal section taken on line 9—9 of Figure 8.

Figure 10 is a plan view of a flue illustrating

a modified arrangement of spherical filler brick.

Figure 11 is a vertical sectional view taken on line 11—11 of Figure 10.

Figure 1 illustrates a common form of checker work construction in which rectangular brick 10 are laid up in layers or courses in such a manner that vertical openings or flues 11 are formed. The brick 10 are supported by the refractory supporting members 12 and 13 or by any other suitable supporting means.

For purposes of description we may assume that the kind of checker work illustrated is such as is employed in one of several types of hot blast stoves in use prior to the advent of the improved present day methods of cleaning the gases which are used in firing hot blast stoves. In order to adapt this type of stove to the present day relatively clean gas operating conditions and secure the highest efficiency therefrom I propose to insert in the flues 11 a plurality of spherical bodies 14. These bodies or filler bricks 14 are made of suitable refractory material and are preferably inserted into the flues or openings 11 from the top of the stove. To maintain the filler brick 14 in position in the flues I provide a grating 15, which may be of metal or refractory material, supported on the arch members 13 and which, while it permits the free flow of gas through the flues 11, supports the filler brick 14 which are inserted in the flues.

I prefer to make the spherical filler brick 14 of smaller diameter than the smallest cross sectional dimension of the flue openings. The flue openings which are illustrated and in general use are of square cross section and it will be clearly seen from Figure 2 that the successive filler brick 14 will assume their positions in diagonally opposite corners of the flue openings 11. Thus, the brick 14 will naturally fall into a staggered or stepped arrangement in the flues 11. Although I do not wish to limit myself to any specific size of filler brick, I have found that, in using spherical filler brick in checker work having square flue openings, it is desirable to make the spherical fillers of a diameter equal to substantially two-thirds of the side of the square flue openings as this proportion greatly increases the heating surface of the checker work and offers the minimum of resistance to the passage of gas and air through the stove.

Figure 3, which is a cross section taken through the point of tangency between two adjacent filler brick 14, illustrates the fact that, when spherical filler brick having a diameter equal to substantially two-thirds of the side of the square flue opening are used, the maximum total obstruction of the original flue opening is never greater than the central cross sectional area of one of the spherical bodies.

I have also found that by varying the diameter of the spherical fillers it is possible to vary the amount of added heating surface per unit of stove checker work volume and to vary the amount of added refractory volume per square foot of added heating surface. In a general way, as the diameter of the spherical fillers is increased the amount of added heating surface per unit of stove checker work volume is decreased and the volume of refractory per square foot of added heating surface is increased. This characteristic makes possible the convenient selection of a filler to best serve the individual requirements of any stove or set of stoves.

In Figures 4 and 5 a modified form of support for the filler body 14 is illustrated. This support consists of a base member 16 adapted to be supported by the arch members 13 and having a relatively large central aperture 17. The filler supporting arms or columns 18, four in number in the fragmentary views illustrated, are preferably made separate from the bottom support 16 and rest on and extend upwardly and inwardly therefrom. It will be seen from Figure 8 that the upper ends of the members 18 provide an effective support for the bottom filler bricks.

In Figures 6 and 7 another modified form of filler support is illustrated which consists of an inverted hook shaped member 19, preferably of refractory material, although heat resisting metal may be used, which is adapted to be inserted into the flue openings from the bottom thereof and to extend diagonally across the openings. These supports 19 are so shaped that they may be readily inserted into the bottom of the flue opening but will be firmly held in position and prevented from dropping out by the weight of the filler bricks 14. However, if it is desired to remove the filler bricks 14 from any flue or flues 11, it is only necessary to insert a suitable tool into the bottom of the flue and against the member 19 and swing the member about its lower end 19', which is supported on the ledge formed at the joint between the supporting members 12 and the refractory bricks 10, to effect its removal and permit the refractory balls 14 to drop out of the flue.

In Figures 8 and 9 I have shown a modified form of refractory body adapted to be inserted in the flues of the checker work of hot blast stoves and the like. In this form of my invention the filler brick 20 are spheroids of substantially ellipsoidal form and may be disposed in the flues in the staggered or stepped arrangement, described above in reference to the preferred spherical filler units, as shown in the left hand flue of Figure 8 or in the parallel axis arrangement of the right hand flue (Figure 8).

A modified arrangement of spherical filler brick is shown in Figures 10 and 11. In this application of my invention the ball shaped fillers 14 have a diameter equal to approximately five-eighths of the side of the square flue opening. When these relatively small fillers are used they arrange themselves in layers or courses in the flues, alternate courses extending across opposite diagonals of the flue. This arrangement may be desirable in some cases and indicates the installation flexibility of my filler brick.

From the above description it will be seen that I have provided a filler brick which may be readily installed in present day types of checker work and which may also be readily removed when desired.

It will be understood that the filler bricks will be made of such dimensions and used in proper quantities to give the desired increase in refractory volume and heating surface for any particular installation. As compared with filler bricks with which I am familiar and which must be accurately fitted into the checker work flues, my spherical or ellipsoidal bodies obtain distinct advantages, among which are the following:

The elimination of the painstaking effort required to individually place each piece of the present fitted types of filler bricks into long irregular and slightly varying checker flue openings.

The elimination of the necessity of measuring, by trial or otherwise, the variations in the checker openings to determine the exact size proposed

fillers of the present day fitted types must be made to properly serve a specific application.

The elimination of the possibility of not being able to apply fillers in all flue openings of a stove or parts of any individual flues due to disalignment of the flues or the courses of brick making up the checker work.

The elimination of close manufacturing tolerances which must be maintained in the manufacture of filler brick now in use.

A substantial reduction in the amount of spalling of fillers during operation.

Increased strength of spherical filler brick, due to their form, which eliminates breakage in handling and in installation. Due to their shape less resistance to the flow of gases is offered by the spherical filler brick when inserted into stove flues and the addition of a much greater amount of heating surface per unit of stove volume is effected than has been obtained with any previously proposed filler brick with which I am familiar.

Although I have described in considerable detail the forms of my invention illustrated in the accompanying drawings it will be understood by those skilled in the art that modifications and variations may be made in the specific form of filler brick utilized, the method of supporting the fillers, etc., without departing from the spirit of my invention. I do not, therefore, wish to be limited to the exact forms herein shown and described, but claim as my invention all embodiments coming within the scope of the appended claims.

I claim:

1. Checker work construction of the type described having vertically extending flues, spherical filler brick disposed in said flues and means for supporting said filler brick in said flues.

2. Checker work construction of the type described having vertically extending flues, spherical filler brick disposed in said flues and removable means for supporting said spherical filler brick in said flues.

3. In checker work construction having vertically extending flues, a plurality of spherical filler brick disposed in said flues, said filler brick being of a diameter equal to substantially two-thirds of the smallest cross section dimension of one of said flues.

4. Checker work construction having flue openings of square cross section extending therethrough, spherical filler brick disposed in said flue openings, said filler brick being of a diameter equal to substantially two-thirds of the side dimensions of the square cross section of one of said flue openings.

5. In a structure of the type described having a vertical flue, a plurality of substantially spherical filler bricks disposed in vertically stepped arrangement in the flue and means for supporting said filler bricks in the flue, said means comprising a hook shaped member extending across said flue and adapted to support and be held in position by the weight of the filler bricks.

6. In a structure of the type described having a vertical flue, a plurality of substantially spherical filler bricks disposed in vertically stepped arrangement in the flue and means for supporting said filler bricks in the flue, said means comprising a removable member extending across the bottom portion of said flue and adapted when in one position to be freely movable vertically upwardly in said flue and to be wedged across the flue by the weight of the filler bricks, and when in another position to be freely movable vertically downwardly in said flue.

7. Checker work construction of the type described having vertically extending flues, substantially spherical filler brick disposed in said flues, and removable means disposed at the lower end of each of said flues for supporting said spherical filler brick in said flues.

ADOLPH L. FOELL.