June 6, 1933. O. NYGAARD 1,912,912

FURNACE WALL

Filed Oct. 26, 1928 3 Sheets-Sheet 1

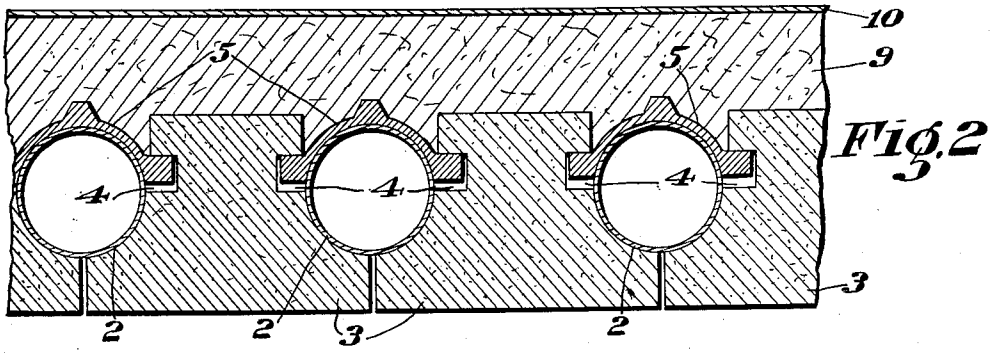


Fig. 2

Fig. 1

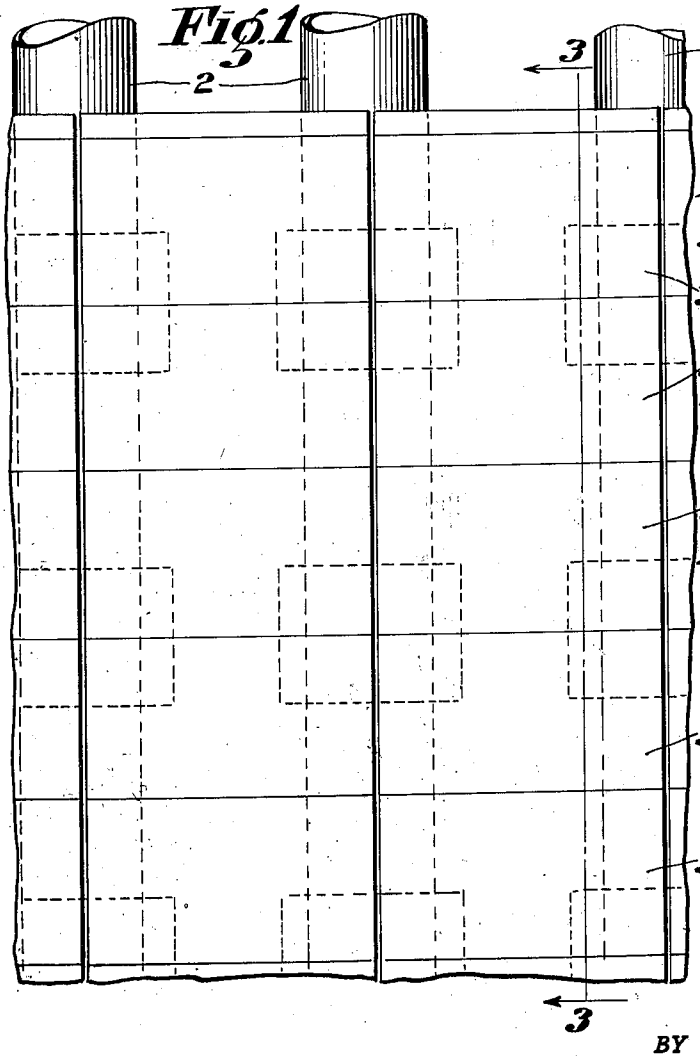
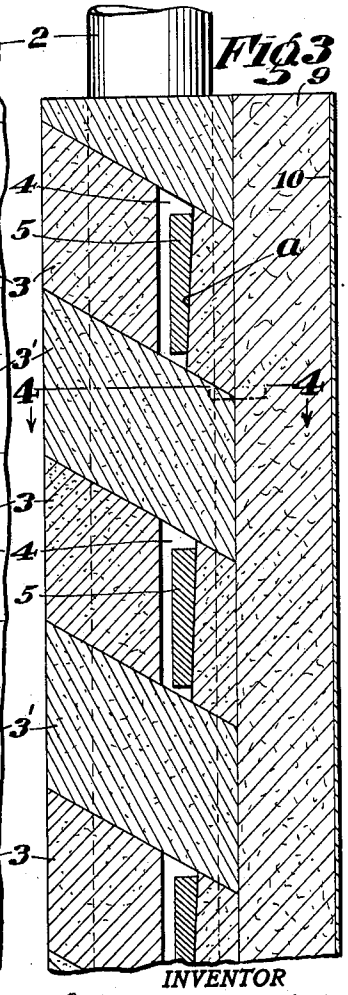


Fig. 3



INVENTOR
Oscar Nygaard,
BY
J. H. McCready,
his ATTORNEY

June 6, 1933. O. NYGAARD 1,912,912

FURNACE WALL

Filed Oct. 26, 1928 3 Sheets-Sheet 2

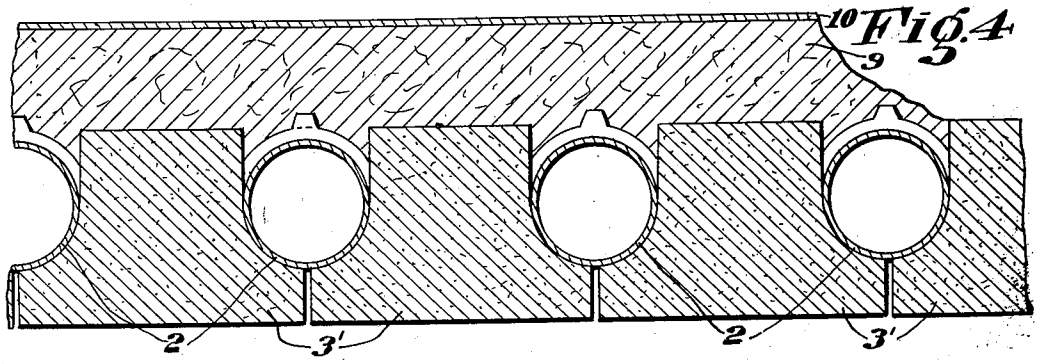


Fig. 4

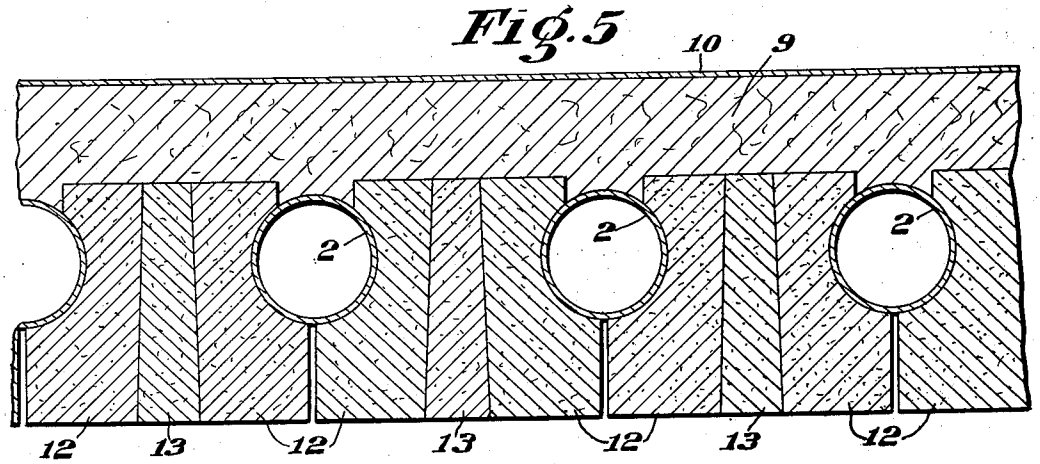


Fig. 5

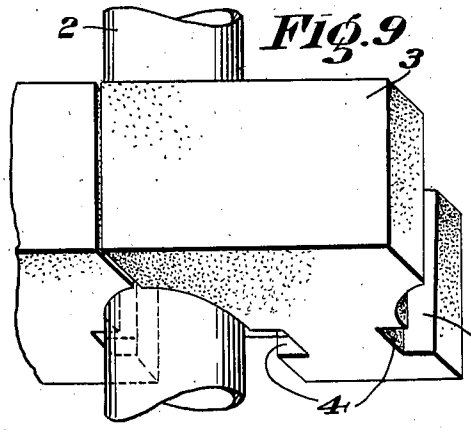


Fig. 9

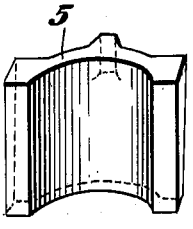


Fig. 10

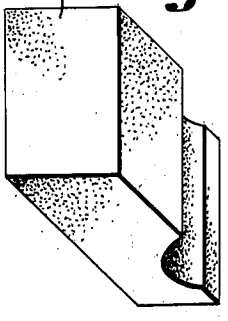


Fig. 11

INVENTOR
Oscar Nygaard,
BY
J. F. McCready,
his ATTORNEY

June 6, 1933. O. NYGAARD 1,912,912

FURNACE WALL

Filed Oct. 26, 1928 3 Sheets-Sheet 3

Fig. 6

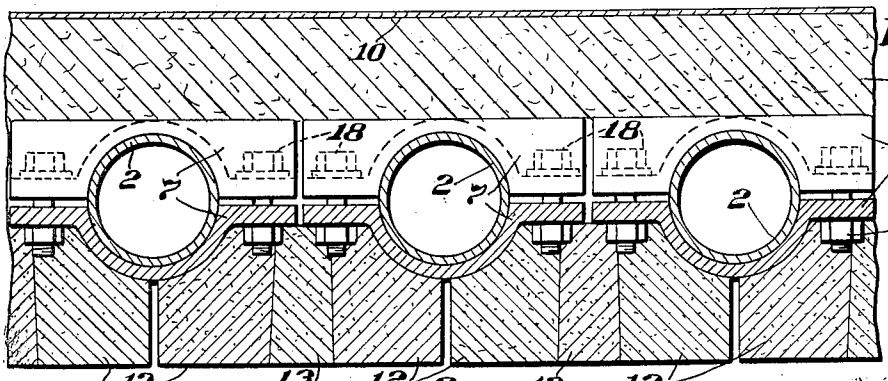


Fig. 7

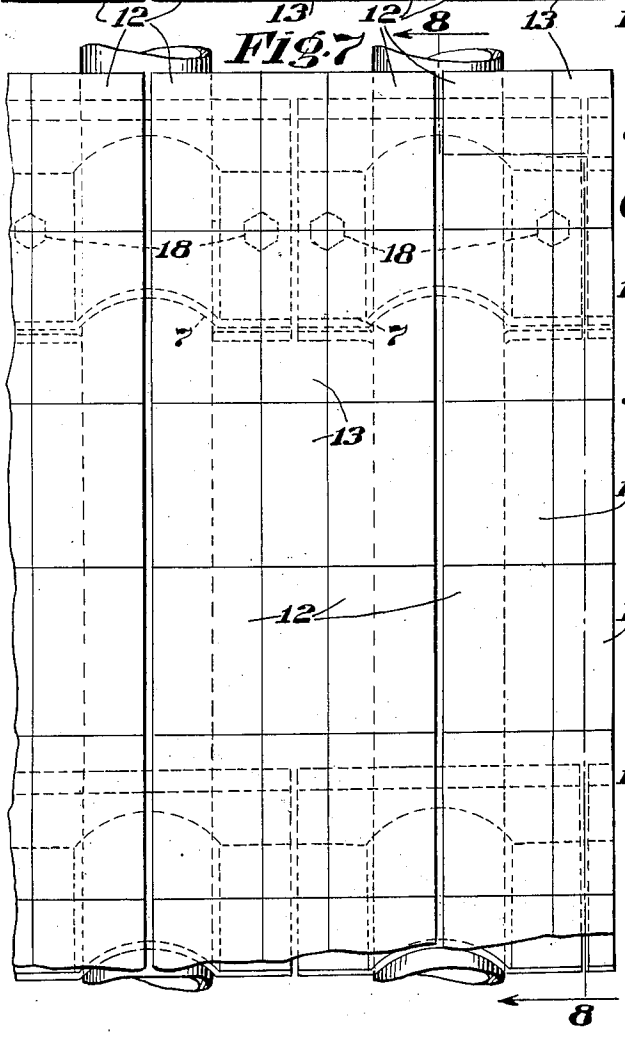
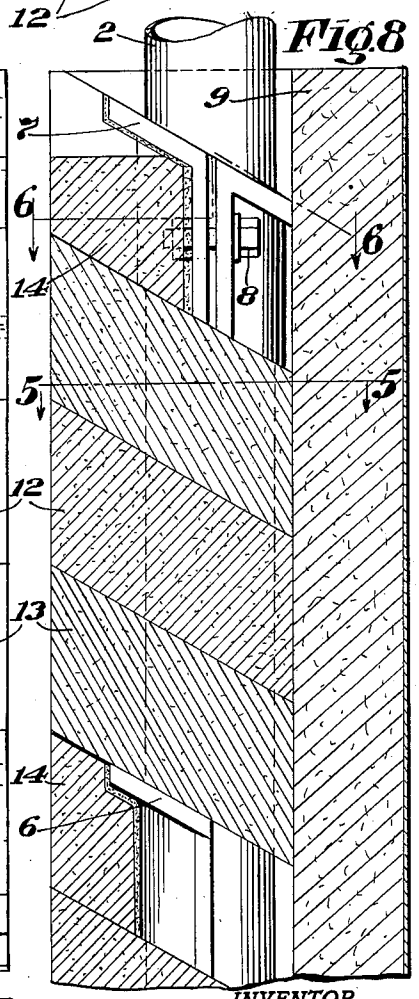


Fig. 8



INVENTOR
Oscar Nygaard,
BY
J. H. McCready,
his ATTORNEY

Patented June 6, 1933 1,912,912

UNITED STATES PATENT OFFICE

OSCAR NYGAARD, OF SAUGUS, MASSACHUSETTS

FURNACE WALL

Application filed October 26, 1928. Serial No. 315,279.

This invention relates to furnace walls of the water cooled type and to bricks for use in building such walls. Walls of this character are rapidly coming into favor and are commonly referred to as "water cooled walls" even though the cooling medium circulated through the tubes in the walls may be steam.

The present invention aims to improve such walls with a view to reducing the expense of manufacture and facilitating repair work, while at the same time providing a wall construction which will give long and efficient service. The invention is especially concerned with the means for holding the bricks of the wall in place, and it is one of the objects of the invention to devise a construction which will facilitate the initial installation of the wall while permitting the removal of the bricks from the fire face of the wall when repairs are necessary.

The nature of the invention will be readily understood from the following description when read in connection with the accompanying drawings, and the novel features will be particularly pointed out in the appended claims.

In the drawings,

Figure 1 is a front elevation of a section of water cooled wall constructed in accordance with this invention;

Fig. 2 is a horizontal sectional view of the wall shown in Fig. 1;

Fig. 3 is a vertical sectional view of said wall approximately on the line 3—3, Fig. 1;

Fig. 4 is a horizontal sectional view on the line 4—4, Fig. 3;

Fig. 5 is a horizontal sectional view of another wall construction embodying this invention, the section being taken approximately on the line 5—5, Fig. 8;

Fig. 6 is a horizontal sectional view of said wall approximately on the line 6—6, Fig. 8;

Fig. 7 is a front elevation of a portion of said modified construction;

Fig. 8 is a vertical sectional view on the line 8—8, Fig. 7;

Fig. 9 is an angular view showing certain details of the wall construction shown illustrated in Figs. 1, 2 and 3;

Fig. 10 is a perspective view of the wedge used in said wall; and

Fig. 11 is a perspective view of one of the bricks used in the wall shown in Figs. 5 to 8, inclusive.

Referring first to Figs. 1 to 4, inclusive, the wall construction there shown comprises a series of upwardly extending parallel tubes 2 designed to convey water, steam, or some other fluid medium. Associated with these tubes are blocks or bricks 3 made of some refractory material, such as fire clay or silicon carbide, the latter material usually being preferred. It will be seen from an inspection of the drawings that in the particular construction shown each block or brick is designed to span the space between two adjacent tubes, and it includes a front portion which lies in front of the tubes and serves to protect them, and also a portion which extends backwardly between the tubes and usually somewhat beyond the rearward sides of the tubes. Each brick also has curved faces to fit against the tubes, and certain of the bricks, in addition, are grooved vertically, as indicated at 4 in Figs. 2 and 3. These grooves are formed in the extension which lies between adjacent tubes, and they are designed to receive the opposite edges of wedges 5. The wedges may conveniently be made of cast iron or other suitable metal, and each wedge is grooved vertically to fit partly around one of the tubes, while its opposite edges enter the grooves of the bricks 3 at opposite sides of the tube. The construction of these bricks and the wedges is well shown in Figs. 2, 9 and 10. It is preferable to taper the rearward wall of each groove, as indicated at *a*, Fig. 3, and to make the contacting edge 5 of the wedge of a corresponding taper so that a long bearing will be provided between each wedge and the walls of the bricks which it engages. This provides a simple, convenient and economical arrangement for holding the bricks to the tubes.

Preferably both the upper and lower surfaces of the bricks are inclined downwardly

and rearwardly, as clearly shown in Fig. 3, so that the bricks are held by gravity in contact with the tubes. The bricks are arranged in vertical rows, resting one on the other, and a vertical series of bricks may be supported on a bracket welded or clamped to one of the tubes. Fig. 8 shows a bracket at 6 which is welded to the tube 2; and another bracket 7 comprising two members clamped rigidly to the tube by bolts 8 is shown in Figs. 6 and 8. The upper faces of these brackets are inclined backwardly at the same angle as the upper and lower faces of the bricks so that each brick resting on a bracket gravitates toward the tube to which the bracket is secured.

It is not necessary to clamp each of the bricks to the tubes, and Figs. 3 and 4 show bricks 3′ located between the bricks 3 and which are not clamped against the tubes but are simply held in place by their contact with the inclined surfaces of the bricks above and below them.

It will be clear that a wall of this construction can be erected rapidly and that bricks of the character shown can be manufactured economically and are of such a character that they are not subject to excessive breakage. In a wall of this character the space behind the tubes and the bricks associated with them is usually filled in with insulating material 9, and a sheet metal back 10 is located immediately behind it. This insulating material may consist of asbestos, magnesia, common brick, or the like.

If it becomes necessary to replace a broken brick, one or more of the bricks 3′ closely adjacent to the broken brick may be removed at the fire face of the wall simply by pulling it out of its operative position. Enough of these bricks are removed to permit access to the broken brick, or to permit the removal of the wedges which hold the bricks 3 that must be removed in order to make the necessary repairs. The pieces of the broken brick can then be removed, the cavity in the wall cleaned out, and new bricks replaced, this entire operation being performed while working at the fire face of the wall and without disturbing the backing 9 or shell 10.

Figs. 5 to 8, inclusive, show another form of wall in which a somewhat different arrangement is employed for locking the bricks in their operative positions in contact with the tubes. The main body of this wall is made up of bricks 12, Figs. 5, 6, 8 and 11. Each of these bricks has a groove in one side thereof to receive and partly encircle a tube 2, and the face of the brick which is to be exposed to the fire is formed at one end thereof. The upper and lower surfaces of these bricks are rearwardly inclined as are the bricks 3 and 3′, and a vertical series of bricks is supported on brackets such as those shown at 6 or 7, Fig. 8, having correspondingly inclined upper surfaces so that each brick tends to slide backwardly by gravity either upon the surface of the bracket or the brick on which it rests. In this manner the bricks are held by gravity in contact with the tubes. At the same time the weight of the bricks is taken by the brackets and through them transmitted to the tubes.

In order to lock the bricks 12 against lateral movement away from the tubes, locking bricks 13 are located at intervals between the bricks 12. These bricks preferably, although not necessarily, are wedge shaped and have a slight taper from front to rear, as clearly shown in Fig. 5, and they have inclined upper and lower surfaces so that they will fit into a space of the same vertical dimensions as one of the bricks 12. One of these bricks is located between each pair of bricks 12 which lie between adjacent tubes 2, and by their contact with the rearwardly extending portions or projections of these bricks they positively lock the latter against any movement laterally away from the tubes. At the same time they can be withdrawn from the fire face of the wall, after which the bricks 12 which they lock in position can be moved inwardly toward each other and then withdrawn from the wall.

This wall construction also, like that previously described, can be laid up rapidly, is easily repaired, and is made of brick which are of such shape that they are not subject to serious breakage due to changes in temperature.

In both of the walls shown special bricks 14, Fig. 8, are required to fill in the spaces immediately in front of the brackets 6 or 7, and it is preferable to use cement between these bricks and the brackets in order to hold them more securely in place, afford better protection for the brackets, and to locate the special bricks more accurately.

While I have herein shown and described typical embodiments of my invention, it will be understood that the invention may be embodied in other forms without departing from the spirit or scope thereof.

Claims on subject matter common to this application and my copending application Serial No. 326,736 are presented in the present case, the claims in said copending application being limited to subject matter not disclosed in the present application.

Having thus described my invention, what I desire to claim as new is:

1. In a furnace wall, the combination of a series of upwardly extending parallel tubes, bricks having face portions to protect parts of the tubes and rearward projections extending between and fitting snugly against adjacent tubes, said bricks resting one upon another and the upper and lower faces of the bricks being downwardly

and rearwardly inclined whereby the bricks tend to gravitate toward the tubes, and members engaging said projections of some of said bricks and locking the bricks to the tubes.

2. In a furnace wall, the combination of a series of upwardly extending parallel tubes, bricks having face portions to protect parts of the tubes and rearward projections extending between and fitting snugly against adjacent tubes, said bricks resting one upon another and the upper and lower faces of the bricks being downwardly and rearwardly inclined whereby the bricks tend to gravitate toward the tubes, and wedges spanning the backs of certain of the tubes and engaging said projections of some of said bricks for locking the bricks to the tubes.

3. In a furnace wall, the combination of a series of parallel tubes, bricks associated with said tubes, said bricks having face portions lying in front of portions of the tubes and also having projections extending rearwardly from said face portions into the spaces between and fitting snugly against adjacent tubes, and locking bricks located between the first mentioned bricks and holding the latter bricks against removal from the tubes, said locking bricks being removable from the wall at the fire side thereof.

4. In a furnace wall, the combination of a series of parallel tubes, bricks associated with said tubes, said bricks having face portions lying in front of portions of the tubes and also having projections extending rearwardly from said face portions into the spaces between and fitting snugly against adjacent tubes and locking bricks located between the first mentioned bricks and holding the latter bricks against movement toward each other laterally away from the tubes, said locking bricks being removable from the wall at the fire side thereof.

5. In a furnace wall, the combination of a series of parallel tubes, bricks associated with said tubes, said bricks having face portions lying in front of portions of the tubes and also having projections extending rearwardly from said face portions into the spaces between and fitting snugly against adjacent tubes, said bricks resting one upon the other and the upper and lower faces of the bricks being downwardly and rearwardly inclined whereby the bricks tend to gravitate toward the tubes, and locking bricks extending between said projections of adjacent bricks and holding the latter bricks against movement toward each other laterally away from the tubes.

6. In a furnace wall, the combination of a series of upwardly extending parallel tubes, bricks having face portions to protect parts of the tubes and rearward projections extending between adjacent tubes, said bricks resting one upon another and the upper and lower faces of the bricks being downwardly and rearwardly inclined whereby the bricks tend to gravitate toward the tubes, and brackets rigid with said tubes and having rearwardly inclined faces supporting certain of said bricks.

7. In a furnace wall, the combination of a series of upwardly extending parallel tubes, bricks having face portions to protect parts of the tubes and rearward projections extending between adjacent tubes, said bricks being arranged in rows parallel to said tubes and the upper and lower faces of the bricks being downwardly and rearwardly inclined, and brackets rigid with said tubes and supporting a series of bricks in one of said rows.

8. In a furnace wall, the combination of a series of upwardly extending parallel tubes, bricks arranged in rows parallel to said tubes and having face portions lying in front of said tubes in protective relation to them and additional parts extending rearwardly between said tubes and fitting snugly against the tubes, said bricks resting one upon another and having downwardly and rearwardly inclined upper and lower faces to cause the bricks to be held by gravity in contact with the tubes, certain of said bricks being supported in said wall for sliding movement forwardly and upwardly out of the wall at the fire side thereof.

9. In a furnace wall, the combination of a series of upwardly extending parallel tubes, bricks arranged in rows parallel to said tubes and having face portions lying in front of said tubes in protective relation to them and additional parts extending rearwardly between said tubes and fitting snugly against the tubes, said bricks resting one upon another and having downwardly and rearwardly inclined upper and lower faces to cause the bricks to be held by gravity in contact with the tubes, and additional means for fastening certain of said bricks to the tubes.

10. In a furnace wall, the combination of a series of upwardly extending parallel tubes, bricks arranged in rows parallel to said tubes and having face portions lying in front of said tubes in protective relation to them and additional parts extending rearwardly between said tubes and fitting snugly against the tubes, said bricks resting one upon another and having downwardly and rearwardly inclined upper and lower faces to cause the bricks to be held by gravity in contact with the tubes, and wedges cooperating with certain of said bricks to lock them to the tubes.

11. In a furnace wall, the combination of a series of upwardly extending parallel tubes, bricks arranged in rows parallel to said tubes and having face portions lying in

front of said tubes in protective relation to them and additional parts extending rearwardly between said tubes and fitting snugly against the tubes, said bricks resting one upon another and having downwardly and rearwardly inclined upper and lower faces to cause the bricks to be held by gravity in contact with the tubes, and locking members spanning the backs of the tubes and engaging said projections of some of said bricks at opposite sides of the tubes for locking the bricks to the tubes.

12. In a furnace wall, the combination of a series of upwardly extending parallel tubes, brackets secured rigidly to said tubes, said brackets having upper faces inclined downwardly and rearwardly, and a series of bricks supported by each bracket, each of said bricks having upper and lower surfaces inclined downwardly and rearwardly with the lowermost brick of each series resting on one of said brackets and the other bricks of the series resting upon each other, and said bricks being shaped to fit snugly against the tubes, whereby they will be held by gravity against the tubes.

13. A brick for furnace wall construction comprising a body of refractory non-metallic material having curved faces at opposite sides thereof to fit snugly against tubes which are spaced apart, said brick also having a front face portion lying in front of said curved faces, and grooves in said sides extending approximately parallel to the axis of said curved faces and located behind said curved faces, said brick also having upper and lower surfaces which are downwardly and rearwardly inclined with reference to the front face portion of the brick.

14. In a furnace wall, the combination of a series of upwardly extending tubes, bricks associated with said tubes and located in protective relationship to them, certain of said bricks resting one upon the other, and brackets rigid with said tubes and having downwardly and rearwardly inclined upper faces supporting certain of said bricks, the latter bricks having downwardly and rearwardly inclined faces to rest on said brackets.

15. In a furnace wall, the combination of a series of upwardly extending parallel tubes adapted to conduct a fluid medium, refractory blocks arranged in rows parallel to said tubes, said blocks having face portions lying in front of said tubes in protective relationship to them, and brackets welded to the tubes at intervals along the lengths thereof for supporting said blocks, said brackets having inclined surfaces for supporting said blocks and said blocks having correspondingly inclined surfaces resting on the brackets, the inclination of said inclined surfaces of the blocks and brackets being such as to cause the blocks to gravitate toward the tubes and to be held by gravity in contact with them.

16. In a furnace wall, the combination of a series of upwardly extending parallel tubes spaced apart and located closely adjacent to each other, said tubes being adapted to conduct a fluid medium, brackets rigid with said tubes and spaced along the lengths of the tubes, refractory blocks supported on said brackets in position to protect said tubes at the fire sides thereof, said blocks being grooved to fit against the tubes to promote the transfer of heat to the tubes, and said brackets and blocks having cooperating inclined supporting surfaces for causing the blocks to gravitate toward the tubes and to be held in contact with them by gravity.

17. In a furnace wall, the combination of a series of upwardly extending parallel tubes spaced apart and located closely adjacent to each other, said tubes being adapted to conduct a fluid medium, brackets rigid with said tubes and spaced along the lengths of the tubes, refractory blocks supported on said brackets and having face portions overlying the fire sides of the tubes in protective relationship to the tubes, the rearward sides of said blocks being grooved to fit snugly against the tubes, said brackets and blocks having cooperating supporting surfaces inclined to cause said blocks to gravitate toward the tubes and to be held in contact with them by gravity, the blocks being free for removal from said wall at the fire side thereof by movement upwardly and forwardly away from the tubes.

OSCAR NYGAARD.