

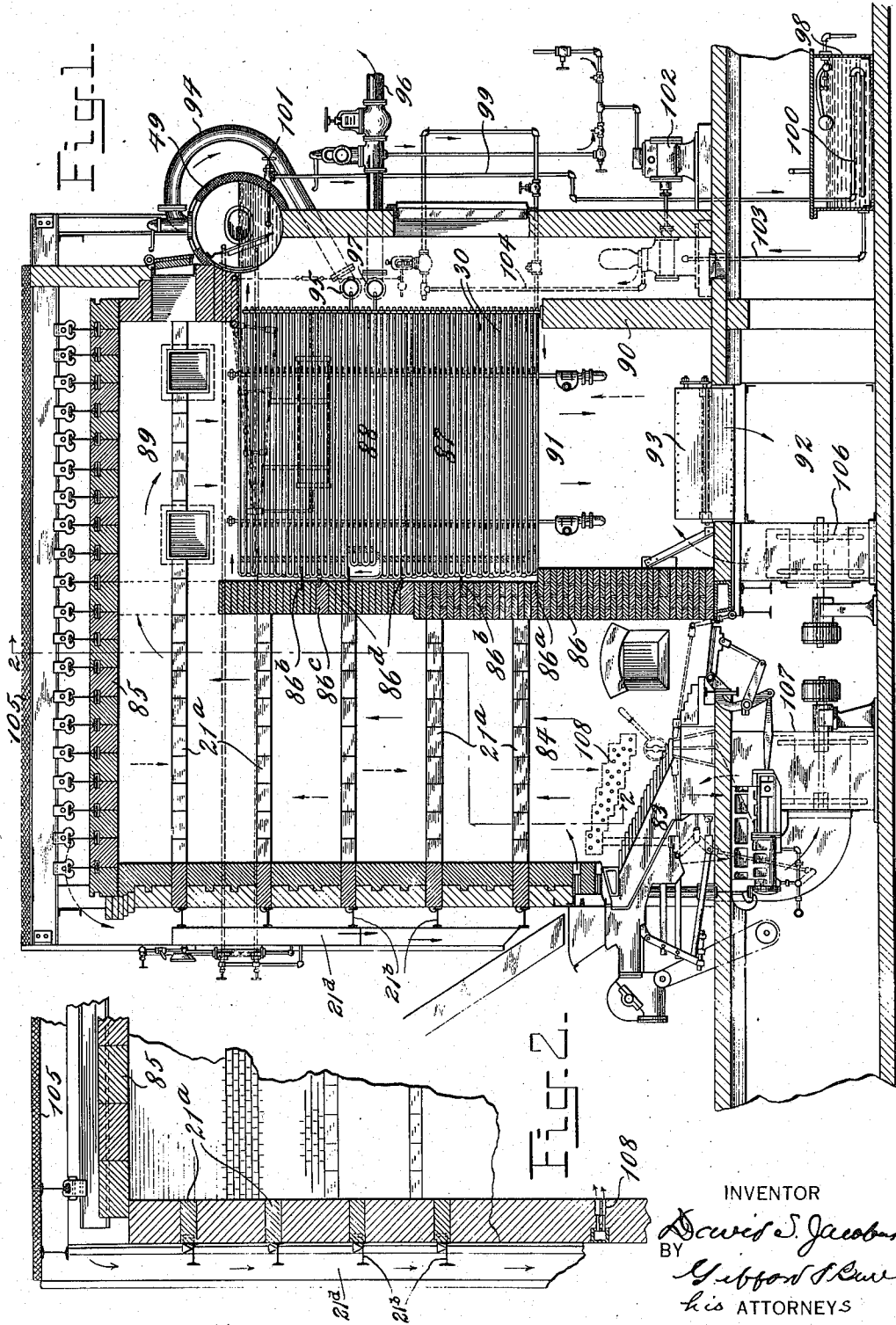
Dec. 2, 1924.

1,517,291

D. S. JACOBUS

BOILER AND SETTING THEREFOR

Original Filed Feb. 17, 1922 5 Sheets-Sheet 1



INVENTOR

BY *David S. Jacobus*
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his ATTORNEYS

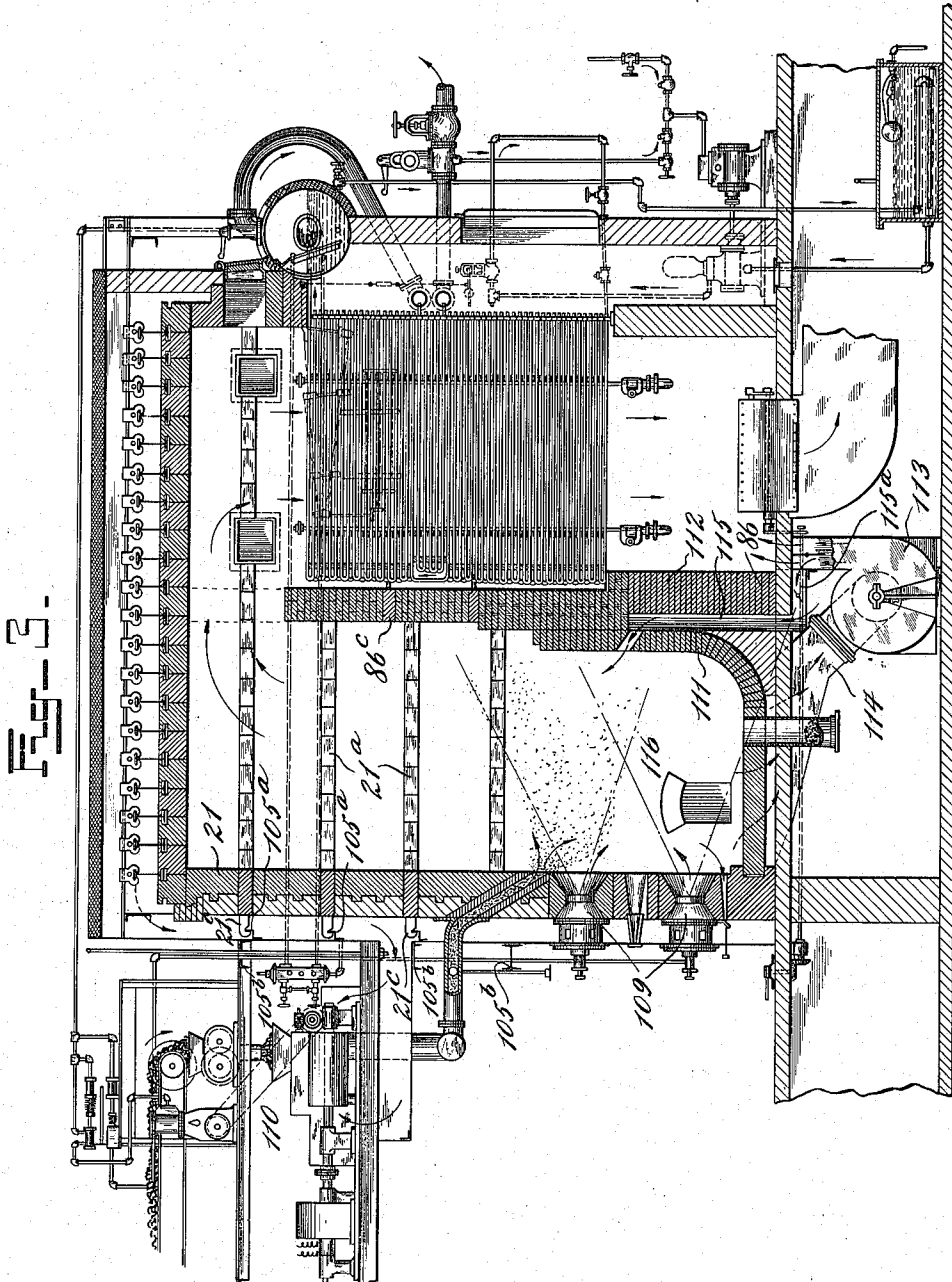
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BOILER AND SETTING THEREFOR

Original Filed Feb. 17, 1922 5 Sheets-Sheet 2



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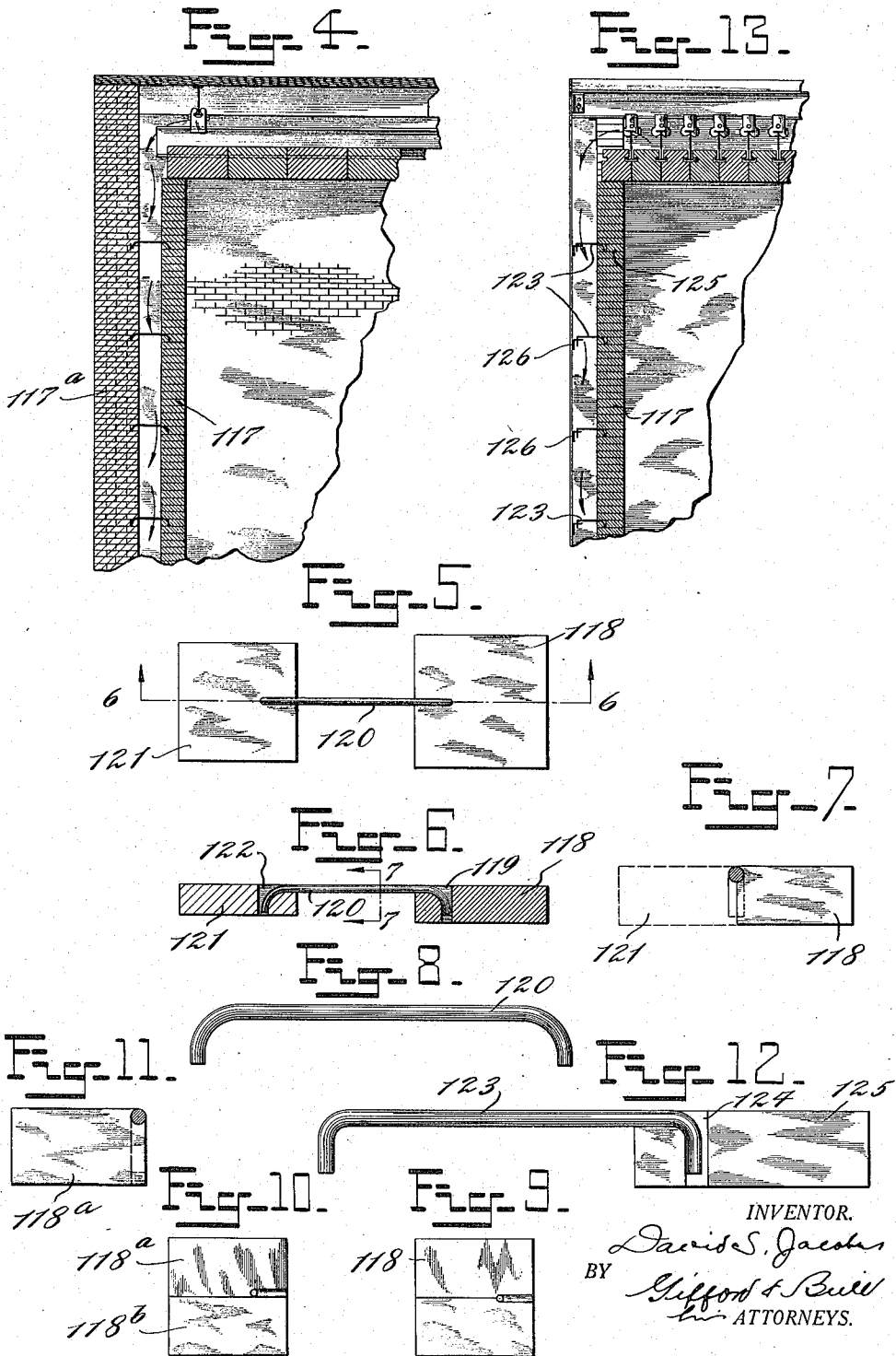
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BOILER AND SETTING THEREFOR

Original Filed Feb. 17, 1922 5 Sheets-Sheet 3



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BOILER AND SETTING THEREFOR

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Fig. 14.

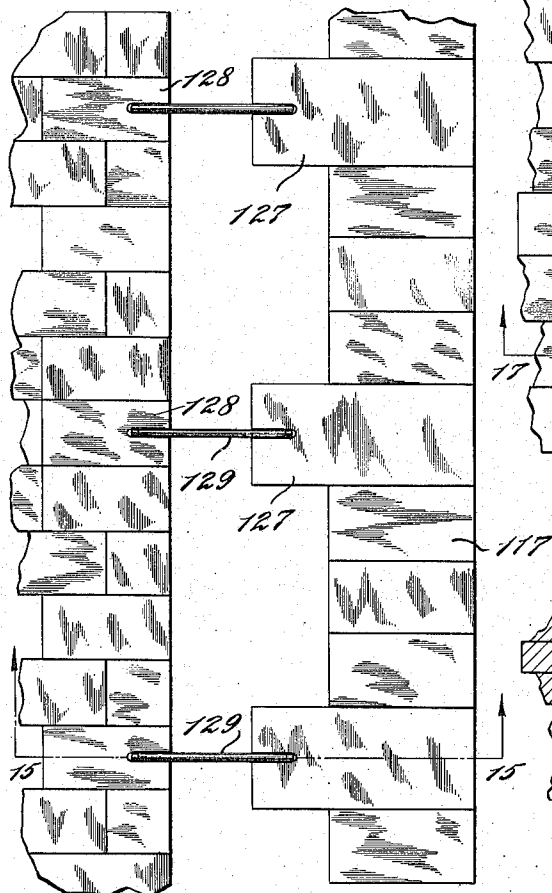


Fig. 16.

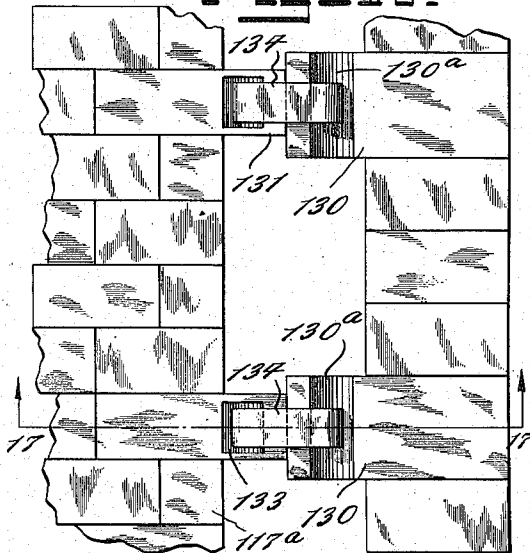


Fig. 17.

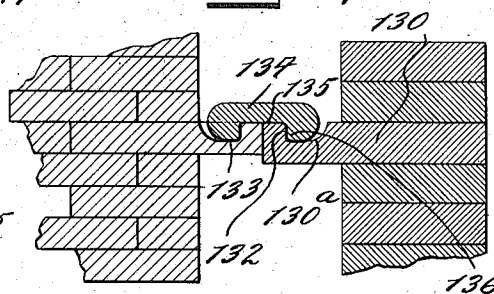
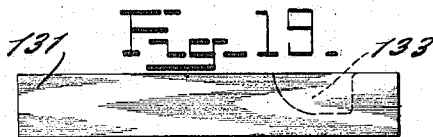
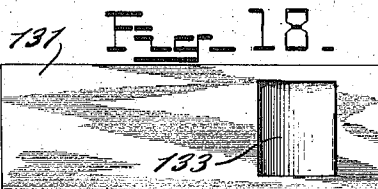
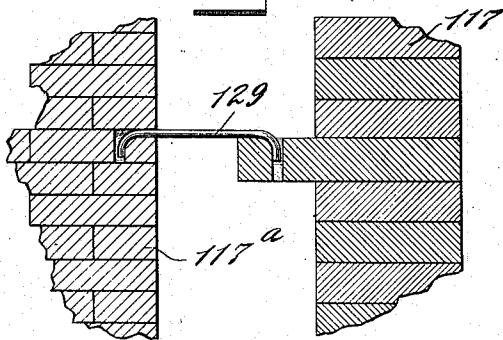


Fig. 15.



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Fig-20.

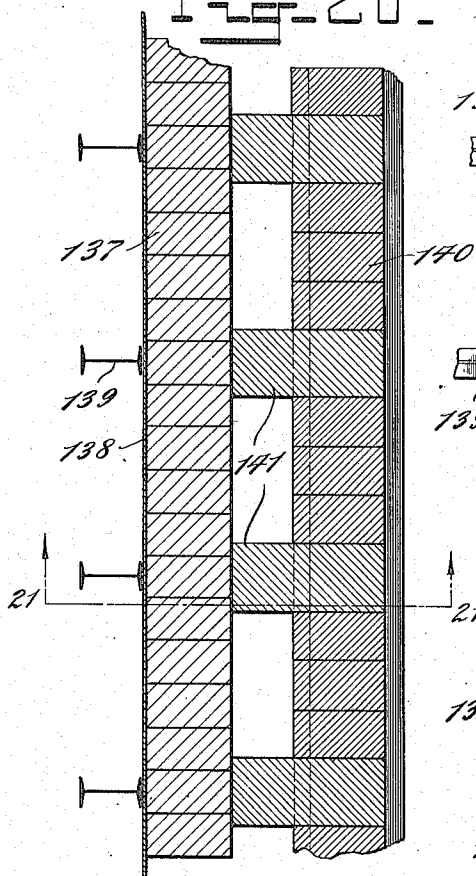


Fig-23.

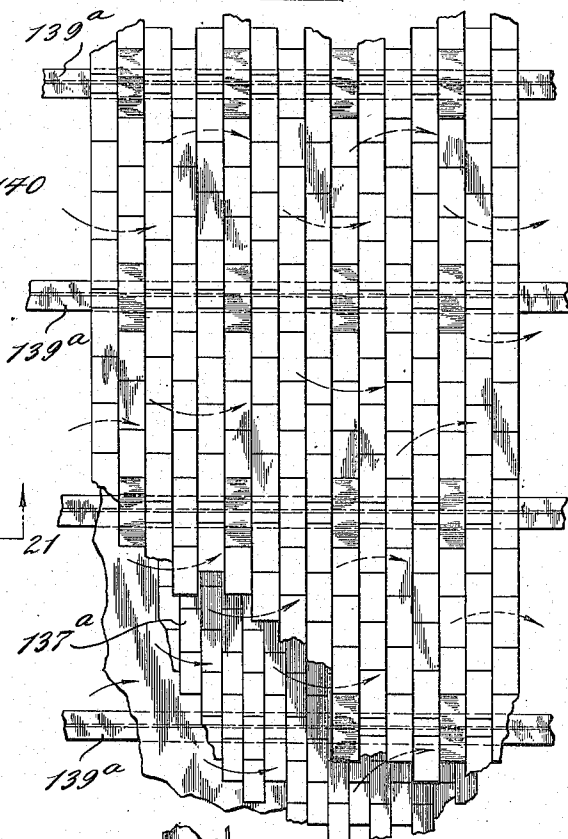


Fig-21.

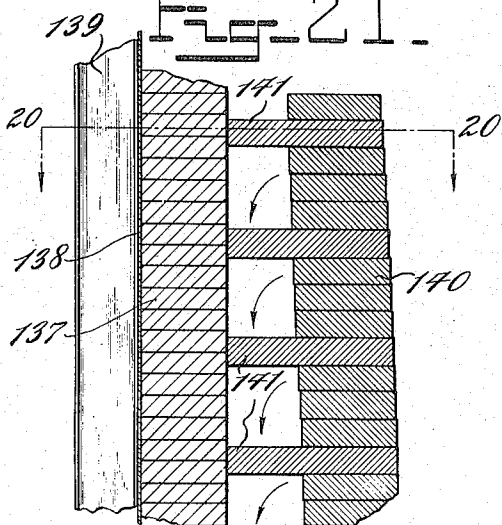
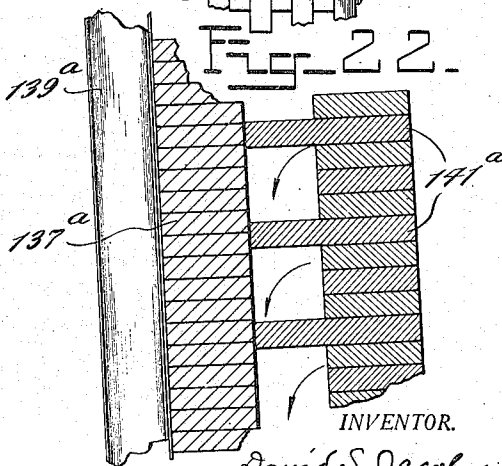


Fig-22.



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UNITED STATES PATENT OFFICE.

DAVID S. JACOBUS, OF JERSEY CITY, NEW JERSEY, ASSIGNOR TO THE BARCOCK & WILCOX COMPANY, OF BAYONNE, NEW JERSEY, A CORPORATION OF NEW JERSEY.

BOILER AND SETTING THEREFOR.

Application filed February 17, 1922, Serial No. 537,154. Renewed April 25, 1924.

To all whom it may concern:

Be it known that I, DAVID S. JACOBUS, a citizen of the United States, residing at Jersey City, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in a Boiler and Setting Therefor, of which the following is a specification.

One of the objects of my invention is the provision of novel means for ventilating furnace walls.

Other objects of my invention will appear in the specification and will be particularly pointed out in the claims.

My present application is a continuation in part of my application Serial No. 401,568, which was filed in the Patent Office on or about August 6, 1920.

My invention will best be understood by reference to the accompanying drawings, in which like reference characters indicate like parts, and in which Figure 1 is a longitudinal section through a boiler and its setting embodying my invention; Fig. 2 is a section taken on the plane of the line 2—2 of Fig. 1; Fig. 3 is a longitudinal section similar to Fig. 1 but illustrating a boiler adapted for burning either oil or powdered fuel, or both; Fig. 4 is a vertical sectional view through a portion of the furnace wall and the outer walls spaced therefrom, and illustrating a modified arrangement for holding the walls in alinement and spaced relation; Fig. 5 is a plan view of special tiles of the inner and outer walls, respectively, illustrating a tie-piece in position in the tiles; Fig. 6 is a sectional view taken along the plane of the line 6—6 of Fig. 5; Fig. 7 is a sectional elevation taken along the plane of the line 7—7 of Fig. 6; Fig. 8 is a side view, on an enlarged scale, of the tie and spacing piece illustrated in Fig. 6; Fig. 9 is a plan view similar to Fig. 5, illustrating right and left adjacent tiles, and with the tie and spacing piece omitted; Fig. 10 is a view similar to Fig. 9 of a modified arrangement of special tiles; Fig. 11 is an end view of the special tile of Fig. 10; Fig. 12 illustrates a modified form of special tile and spacing piece; Fig. 13 is a vertical sectional view through a furnace wall and through a metallic casing spaced therefrom, and illustrating means for holding the furnace wall and an outer casing in spaced re-

lation: Fig. 14 is a horizontal sectional view taken between two courses of bricks of two spaced walls and illustrating a modified arrangement of tying the walls together; Fig. 15 is a vertical sectional view through the wall of Fig. 14 and along one of the tie-pieces; Fig. 16 is a sectional view, similar to Fig. 14, illustrating a further modified arrangement for holding two walls in spaced arrangement; Fig. 17 is a vertical section taken along the line 17—17 of Fig. 16; Fig. 18 is a plan view of one of the bonding tiles of the outer wall of Figs. 16 and 17; Fig. 19 is a side view of the tile shown in Fig. 18; Fig. 20 is a horizontal sectional view taken along the line 20—20 of Fig. 21 and illustrating a modified arrangement for holding two walls in alinement and in spaced relation; Fig. 21 is a vertical sectional view taken along the line 21—21 of Fig. 20; Fig. 22 is a vertical sectional view, similar to Fig. 21, but illustrating both walls inclined, and Fig. 23 is an elevation, taken from within the furnace, of the parts illustrated in Fig. 22.

Figs. 1 and 2 illustrate a boiler of the series type embodying my invention, which is fired by a stoker 83, which is here shown as of the underfeed type. The gases are directed from the furnace chamber 84 by the roof baffle 85 over the intermediate wall 86, the gases then passing downwardly over the boiler and superheater tubes 87 and 88, respectively, a chamber 89 above the tubes serving to distribute properly the gases among the various tubes. In the form here shown, the lowermost of the headers 30, and thereby one end of the boiler, is supported on a cross-wall 90, which, with the headers, forms the front wall for the flue 91. The lower part of the wall 86 is thickened and forms a shelf, at 86^a, which comes beneath the rounded ends of the tubes, thus forming a support for the other end of the boiler. The bent ends of the tubes are also supported by members 86^b projecting from the wall and by the spacing strips 39. Hooked members 86^c also extend from the bonding tiles 86^c and engage the looped ends of the tubes, thereby holding the wall in position. From this flue the gases are directed to the outlet flue 92, dampers 93, operated by connections extending to a point without the boiler, being provided for controlling the

flow of the gases. The steam pipe 94 connects the steam space of the steam and water drum 49 to the upper header 95 of the superheater, the outlet pipe 96 for the superheater being connected to the lower header 97.

From the drum 49, a regulated amount of water passes to the feed tank 98 by a pipe 99. In the form here illustrated, the lower end of the pipe 99 is preferably formed with a perforated loop 100 near the bottom of the feed-water tank, so that the heated water will mingle with the water in the feed tank. The pipe 99 has a throttling-valve 101 to effect the regulation.

A steam pump 102 draws the feed water from the feed tank 98 through the pipes 103 and forces it through the pipe 104 to the lowermost header of the boiler. The steam and water in the boiler tubes flows upward, accordingly, in a direction opposite to the flow of the gases, so that the counterflow principle is established.

In accordance with my invention, the air which is used in the stoker, or other fuel-burning device, is preferably passed over the setting of the boiler, in order to utilize any heat radiated thereby and, at the same time, to cool the walls. A casing 105 is, accordingly, provided around the setting and spaced therefrom on its sides, and in front and above the boiler, as shown. The walls 21 are built up in part of horizontal rows of grooved bonding tiles 21^a. The bonding tiles are held by cast-iron pieces which engage the grooves of the tiles and which, in turn, engage with the horizontal fixed stiffening members 21^b. The rows of bonding tile are placed near together, to hold the wall in complete alinement. Cast-iron pieces 21^c are so arranged that they may slide from side to side over the horizontal members 21^b, and are so constructed that the wall can expand upward without causing them to bind and bring excessive strain on the bonding tile. The wall may, therefore, expand in both directions without producing any great strain on the bonding tile, and an arrangement is thereby provided in which the wall can be kept in alinement without breaking the bonding tile. The upper part of the casing 105 is held in alinement by means of vertical members 21^d attached to and spaced at intervals along the horizontal stiffening members 21^b. The transverse wall 86 (indicated above the wall by dotted lines) extends across the space between the setting and the casing 105 on the sides. This wall is held in alinement by means of the horizontal rows of bonding tile shown in cross-section at 86^c.

By extending the metallic connecting members across the air space, the flow of the air used for cooling the walls keeps the metallic members cool.

Air is forced into the space between the setting and the casing at the rear of the wall 86 and at the bottom of said space by a fan 106, which takes the air from outside the casing. The air is forced upwardly between the casing and the walls of the setting which come at the sides of the boiler, to the top of the setting. The air flows over the top of the setting and from thence downwardly over the sides and front of the furnace to the fan 107. By circulating the air in the way described, it flows in a generally reverse direction to the flow of the hot gases, and the cooler air comes in contact with the coolest part of the setting.

From the fan 107 the air passes to the stoker, except for a small part, which is supplied to the furnace side-wall cooling device 108. By providing the two fans, as described, the air may be circulated over the setting without undue leakage through the walls, as the fans may be operated to give any desired pressure in the space between the casing and the walls.

The boiler illustrated in Fig. 3 is, in general, similar to that shown in Fig. 1, but is adapted for burning either oil or powdered fuel, or both, the oil-burners being indicated at 109 and the powdered-fuel apparatus at 110, a suitable refractory lining 111 for the furnace chamber being provided, against which the flame or the fuel cloud, as the case may be, impinges. In this figure, the intermediate cross-wall 112 is of a slightly modified form, to accommodate itself to the refractory lining 111. The air circulation is here maintained by a single fan 113, which takes air from the outside through a flue 114 and forces it around the setting, in the manner described in connection with Fig. 1, to either the oil-burning apparatus 109 or the powdered-fuel apparatus 110, as indicated by arrows. A passage 115, in this construction, conducts a regulated amount of air from the fan 113 to the furnace chamber 116, the regulation being secured by adjusting the damper 115^a.

Bonding tiles 21^a and 86^c are placed in the furnace walls 21 and 86, respectively, to hold them in alinement. The cast-iron pieces 21^c, which engage with the bonding tiles, hook over the edges of horizontal Z-bars 105^a, which are attached to the outer casing. The air which is forced between the walls and the casing, passes between the cast-iron pieces 21^c. The casing is reinforced by the horizontal stiffening members 105^b which are placed outside of the casing.

Figs. 4, 5, 6, 7, 8 and 9 illustrate a device in accordance with my invention for holding two walls in alinement and in spaced relation. The furnace wall 117 is provided with special bonding tiles 118, having recesses 119, in which the inner curved end

of the tie-piece 120 is received. The outer wall 117^a is similarly provided with special tiles 121 provided with recesses 122 in which the outer ends of the tie and spacing pieces 120 are received. The ends of the pieces 120 are so formed that they may be introduced into place in the outer wall after the latter is constructed. This would be done before building up the inner wall. With the arrangement illustrated in Fig. 4, the inner furnace wall is made thinner than standard furnace walls. By employing thin furnace walls, the cooling effect of the air circulated between the outer wall and the furnace walls is greater than it would be with thicker furnace walls, as there is a less resistance to the passage of heat through the thinner walls. Where furnace temperatures are excessively high, the interior of the wall, that is, the furnace side of the wall, will fuse and slough off. By making the inner furnace wall thin and laying up the same entirely of solid fire-brick, as illustrated, an excessive furnace temperature would simply thin the walls down to a point where the cooling effect, due to the circulation of the air, would check any further fusing or sloughing off of the brick, as when the wall became sufficiently thin the inner face of the wall would be maintained at a considerably lower temperature than that of the furnace. Figs. 4 to 8 illustrate the preferred arrangement for tying and spacing the walls.

In Figs. 10 and 11 I have illustrated special tiles 118^a in which the recess or slot for engaging the tie and spacing piece is formed in one side in such a way that the tie and spacing piece may be introduced into place with a full brick 118^b laid up directly against the side of the special tile.

In place of making the special brick or tile so that the tie and spacing pieces can be introduced after one of the walls is laid up, they may be made as indicated in Fig. 12 in which the ends of the tie-pieces are bent more sharply than the tie-piece illustrated in Fig. 8 and in which the recess 124 of the special tile 125 conforms to the bent end of the tie and spacing piece 123. With such an arrangement, the tie and spacing pieces would be laid up with the wall and could not be hooked in after the wall is laid.

In Fig. 13 I have illustrated a further modification of my invention, in which the inner furnace wall is also thinner than in ordinary constructions and in which the wall is laid up of solid fire-brick and is spaced from an outer casing, the casing being particularly advantageous where the same is located above a stoker. Spacing pieces 123, which are preferably of the form best shown in Fig. 12, are formed of a cylindrical iron piece bent at the ends, as indicated, so that one end engages a recess 124 in a special tile

125, the opposite end of the spacing piece preferably being similarly bent and engaging an opening in an angle-iron 126 secured in the casing. In the claims, I have defined as a wall the member spaced from the furnace wall, and intend to cover by this term either an outer brick wall or a metal casing, or both. The form of brick and spacing pieces shown in Fig. 6, in which it is possible to introduce the spacing piece after one of the walls is laid, is preferable for most work to that shown in Fig. 13.

In Figs. 14 and 15 I have illustrated a further modified arrangement, in which one of the walls, preferably the inner wall 117, is provided with special tiles 127, which project outwardly beyond the face of the wall and in which the special tiles 128 of the outer wall 117^a may be formed similarly to those illustrated in Fig. 5. With the arrangement here shown, the tie-pieces 129 having bent ends, may be inserted in the outer wall and the opposite end then dropped into the recess of the special tile 127.

Figs. 16, 17, 18 and 19 illustrate a further modification, in which the inner and outer walls are provided with special tiles 130 and 131, respectively, which preferably abut against each other, as indicated. The tile 130 is preferably provided with a groove 130^a formed with a vertical shoulder at 132, as illustrated in Fig. 17, while the tile 131 is preferably formed with a groove 133 similar in form to the groove 130^a but extending only partially across the tile, as indicated in Fig. 16. A tie-piece 134 is provided on its lower side with a recess 135 adapted to engage the inner ends of the tiles, as best shown in Fig. 17, and having shoulders 136 for engagement with the shoulders formed by the grooves on the two abutting tiles.

Figs. 20 and 21 illustrate a further modification of my invention in which the outer wall 137 is vertically disposed and laid against a plate, or plates, 138, which engage vertical buckstays 139. The inner wall 140 is upwardly and outwardly inclined and is provided with separated spacing tiles 141 which lean against the inner face of the outer wall, so that the gravity component of the inner wall serves to maintain the outer wall in position against the buckstays and, at the same time, maintains the inner wall in spaced relation to the outer wall.

Figs. 22 and 23 illustrate still a further modification, in which the buckstays 139^a are inclined and the outer wall 137^a leans against the buckstays, the inner wall being provided with spaced tiles 141^a which rest against the inner face of the outer wall to maintain the inner wall in alignment and in spaced relation to the outer wall.

The air which enters the furnace is preheated by contact with the boiler setting,

thus increasing the efficiency of the furnace and assisting in the maintenance of the setting by cooling the walls.

What I claim and desire to secure by Letters Patent of the United States is:

1. In a steam boiler, a furnace and boiler setting, an outer wall spaced from the walls of said setting, a forced-blast fuel-burning device for said furnace, and means for passing air through the space within said outer wall to said furnace, the air flowing in a generally reverse direction to that of the hot gases so that the coldest air comes in contact with the coolest part of the setting.
2. In a steam boiler, a furnace comprising a stoker and boiler heating flue connected thereto, an outer wall spaced from the walls of said furnace, a forced-blast fuel-burning device for said furnace, a fan for forcing air through the space within said outer wall, and a second fan disposed adjacent said stoker for forcing air thereto.
3. In a steam boiler, a furnace; a flue disposed beside the furnace, a steam boiler disposed within the flue, an outer wall spaced from the furnace and flue, and means for passing cooling air upwardly within said outer wall over the walls of said flue and downwardly over the walls of said furnace.
4. In a steam boiler, a furnace, a forced-blast fuel-burning device therefor, a flue disposed beside said furnace, a steam boiler disposed within said flue, an outer wall spaced from the walls of said furnace, and means for forcing air within said outer wall upwardly over the walls of said flue and downwardly over the walls of said furnace to said fuel-burning device.
5. In a steam boiler, a furnace, a forced-blast fuel-burning device therefor, a flue disposed beside said furnace, a steam boiler disposed within said flue, an outer wall spaced from the walls of said furnace, a fan for forcing air within said casing upwardly over the walls of said flue and downwardly over the walls of said furnace, and a second fan disposed adjacent said stoker for forcing the air from the space within said casing to said fuel-burning device.
6. In a steam boiler, a boiler setting, an outer wall spaced from the walls of said setting, means for passing air through the space between the two walls; the vertically extending walls of the setting comprising courses of blocks, one or more of the courses having grooved blocks, a fixed cross member and metallic tie-pieces engaging the fixed cross member and the grooves of the blocks, and arranged to allow the blocks to move in any direction in a generally vertical plane, the tie-pieces assisting in holding the walls in proper alinement.
7. In a steam boiler, a boiler setting, an outer wall spaced from the walls of said setting, means for passing air through the space between said walls, the walls of the setting comprising courses of blocks, one or more of the courses having grooved blocks, a fixed cross member and metallic tie-pieces engaging the fixed cross member and the grooves of the blocks, and arranged to allow the blocks to move in any direction in a generally vertical plane, the tie-pieces assisting in holding the wall in proper vertical alinement, and means associated with said fixed member for maintaining said outer wall in alinement.
8. A setting for a boiler, comprising a wall having parallel rows of bonding tile for holding the wall in alinement, an outer wall spaced from the walls of said setting fixed supporting members engaging both the bonding tile and the casing, and means for passing air through the space between said outer wall and the walls of the furnace.
9. In a steam boiler and its setting, a fuel-burning device, a flue enclosed by the walls of the setting for conducting gases from said fuel-burning device, a steam boiler located in said flue, an outer wall spaced from said walls, a fan for forcing air through the space between said furnace walls and said outer wall, and a second fan located between said first fan and said fuel-burning device for forcing air delivered from said first fan to said fuel-burning device.
10. In a steam boiler and its setting, a fuel-burning device, a flue enclosed by the walls of the setting for conducting gases from said fuel-burning device, a steam boiler located in said flue, an outer wall spaced from said furnace walls, a fan located beneath the boiler floor for forcing air through the space between said furnace wall and said outer wall, and a second fan located between said first fan and said fuel-burning device and beneath the boiler floor for forcing air delivered from said first fan to said fuel-burning device.
11. In a steam boiler and its setting, a fuel-burning device, a combustion chamber in which the gases from said fuel-burning device pass upwardly and a flue in which said gases pass downwardly, a steam boiler located in said flue, said combustion chamber and said flue being enclosed by the walls of said setting, an outer wall spaced from the walls of said setting, means forming with said casing an air passage in the space between said outer wall and said furnace walls and opposite said combustion chamber and said flue, and a fan for forcing air through said passage in a direction opposite to the flow of gases in said combustion chamber and said flue.
12. In a steam boiler and its setting, a fuel-burning device, a combustion chamber in which the gases from said fuel-burning device pass upwardly and a flue in which said gases pass downwardly, a steam boiler

located in said flue, said combustion chamber and said flue being enclosed by the walls of said setting, an outer wall spaced from the walls of said setting, means forming
 5 with said casing an air passage in the space between said outer wall and said furnace walls and opposite said combustion chamber and said flue, a fan for forcing air through said passage in a direction opposite
 10 to the flow of gases in said combustion chamber and said flue, and a second fan located between said first fan and said fuel-burning device for forcing air delivered from said first fan to said fuel-burning device.
 15 vice.

13. In a steam boiler and its setting, a fuel-burning device, a combustion chamber in which the gases from said fuel-burning device pass upwardly and a flue in which
 20 said gases pass downwardly, a steam boiler located in said flue, said combustion chamber and said flue being enclosed by the walls of said setting, means forming
 25 with said casing an air passage in the space between said outer wall and said furnace walls and opposite said combustion chamber and said flue, a fan located beneath the boiler floor for forcing air through said passage in a direction opposite to the flow of
 30 gases in said combustion chamber and said flue, and a second fan located between said first fan and said fuel-burning device and beneath the boiler floor for forcing air delivered from said first fan to said fuel-burning device.
 35

14. In a steam boiler, a boiler setting, an outer wall spaced from the walls of said setting, the vertically extending walls of the setting comprising courses of blocks, one or more of the courses having grooved blocks, a fixed cross member located between said furnace walls and said outer wall, and metallic tie-pieces engaging the fixed cross
 40 member and the grooves of the blocks, and arranged to allow the blocks to move in any direction in a generally vertical plane, the tie-pieces assisting in holding the wall in proper vertical alinement, and connections between said fixed cross member and
 45 said outer wall for holding the latter in alinement, the parts being constructed and arranged to permit of the passage of air vertically in the space within said casing.
 50

15. In a steam boiler and its setting, a fuel-burning apparatus, a flue, a steam boiler having heating surface located in said flue, a combustion chamber, the gases passing in opposite directions in said combustion chamber and said flue, and means for conducting air over the walls of the setting enclosing said flue and said combustion chamber in opposition to the flow of gases therein to the fuel-burning apparatus.
 55

16. In a steam boiler and its setting, a

fuel-burning apparatus, a flue, a steam boiler having heating surface located in said flue, a combustion chamber, the gases passing upwardly in said combustion chamber and downwardly in said flue, and means for
 70 conducting air over the walls of the setting enclosing said flue and said combustion chamber in opposition to the flow of gases therein to the fuel-burning apparatus.

17. In a steam boiler and its setting, a
 75 furnace wall, a second wall spaced from said furnace wall and forming a flue through which cooling air may be passed, means for maintaining both of said walls in alinement and in spaced relation and permitting relative
 80 movement between the two, and means for conducting cooling air through the space between said walls.

18. In a steam boiler and its setting, a
 85 furnace wall, a second wall spaced from said furnace wall and forming a flue through which cooling air may be passed, means for maintaining both of said walls in alinement and in spaced relation and permitting relative movement between the two, and means for conducting cooling air through the space between said walls and to the furnace.
 90

19. In a steam boiler and its setting, a
 95 furnace wall, a second wall spaced from said furnace wall and forming a flue through which cooling air may be passed, a fixed member located adjacent to said walls, and means cooperating with said fixed member for maintaining said walls in alinement and in spaced relation.
 100

20. In a steam boiler and its setting, a furnace wall, a second wall spaced from said furnace wall and forming a flue through which cooling air may be passed, a fixed
 105 cross member located between said walls, and means associated with the respective walls and cooperating with said fixed member for holding said walls in alinement and in spaced relation.
 110

21. In a steam boiler and its setting, a thin furnace wall, a second wall spaced from said furnace wall and forming a flue through which cooling air may be passed, means for
 115 maintaining both of said walls in alinement and in spaced relation and permitting relative movement between the two, and means for conducting cooling air through the space between said walls.

22. In a steam boiler and its setting, a furnace wall not more than ten inches in thickness, a second wall spaced from said furnace wall and forming a flue through which cooling air may be passed, means for maintaining both of said walls in alinement and in spaced relation and permitting relative movement between the two, and means for conducting cooling air through the space between said walls.
 120
 125

23. In a steam boiler and its setting, a
 130

- furnace wall not more than ten inches in thickness laid up of solid fire-brick, a second wall spaced from said furnace wall and forming a flue through which cooling air may be passed, means for maintaining both of said walls in alinement and in spaced relation and permitting relative movement between the two, and means for conducting cooling air through the space between said walls.
24. In a steam boiler and its setting, a furnace wall laid with a single course of fire-bricks, a second wall spaced from said furnace wall and forming a flue through which cooling air may be passed, means for maintaining both of said walls in alinement and in spaced relation and permitting relative movement between the two, and means for conducting cooling air through the space between said walls.
25. In a steam boiler and its setting, a furnace wall not more than ten inches in thickness, an outer wall spaced from said furnace wall and forming therewith an air passage, and means comprising two fans for causing air to pass through said passage, the respective fans being located at opposite ends of said passage.
26. In a steam boiler and its setting, a furnace wall, an outer wall spaced from said furnace wall to form an air passage, and tie-pieces joining said walls to maintain them in spaced relation and constructed and arranged to permit relative motion between the two walls in a direction parallel to the planes of said walls.
27. In a steam boiler and its setting comprising a stoker, a furnace wall, brick walls on the sides of the furnace and spaced therefrom, and a front wall consisting of a metallic casing spaced from the front furnace wall, means for holding the furnace walls and the outer walls in alinement and in spaced relation, and means for passing cooling air between the spaced walls.
28. A furnace wall, comprising an inner and an outer wall spaced apart to permit the passage of air through such space, and tie pieces spaced apart and connecting the inner and outer walls across such space and constructed and arranged to permit relative motion between the two walls in a direction parallel to the plane of the wall.
29. A furnace wall, comprising an inner and an outer wall spaced apart to permit the passage of air through such space, said inner wall having a plurality of courses of tile therein, and tie pieces connecting said tile with the outer wall across such space and constructed and arranged to permit relative motion between the two walls in a direction parallel to the plane of the wall.
30. A vertically extending furnace wall, comprising an inner wall and an outer wall spaced apart to permit the passage of air through such space, and metallic tie pieces spaced apart and connected to said inner wall and engaging fixed portions of the outer wall, said tie pieces being located in such space and constructed and arranged to permit relative motion between the two walls in a direction parallel to the plane of the wall.
31. A vertically extending furnace wall, comprising an inner wall and an outer wall spaced apart to permit the passage of air through such space, said inner wall having a plurality of courses of tile therein, and metallic tie pieces connected to said tile and engaging fixed portions of the outer wall, said tie pieces being located in such space and constructed and arranged to permit relative motion between the two walls in a direction parallel to the plane of the wall.
32. In combination, a furnace provided with a wall comprising an inner and an outer wall spaced apart, means for passing air between said walls for cooling the same and for supplying said air to furnace for combustion, the inner wall having a plurality of courses of tile therein, and tie pieces connecting said tile with the said outer wall across the space between the two and constructed and arranged to permit relative motion between the two walls in a direction parallel to the plane of the wall.
33. An air cooled furnace wall comprising an inner wall and an outer wall spaced from said inner wall, bonding tiles in said wall, metallic members located within the space between said inner and outer walls and engaging said bonding tiles to maintain said walls in alignment, and means for passing cooling air through the space between said inner and outer walls and over said members.
34. An air cooled furnace wall comprising an inner wall and an outer wall spaced from said inner wall, bonding tiles in said wall, metallic members provided with hooked ends which rest in openings in said bonding tiles and located within the space between said inner and outer walls and engaging said bonding tiles to maintain said walls in alignment, and means for passing cooling air through the space between said inner and outer walls and over said members.
35. An air cooled furnace wall comprising an inner wall and an outer wall spaced from said inner wall, bonding tiles in said wall, metallic members provided with hooked ends which rest in openings formed in the sides of said bonding tiles and located within the space between said inner and outer walls and engaging said bonding tiles to maintain said walls in alignment, and means for passing cooling air through the space between said inner and outer walls and over said members.

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36. An air cooled furnace wall comprising an inner wall and an outer wall spaced from said inner wall, bonding tiles in said wall, metallic members provided with hooked ends which pass downwardly into openings in said bonding tiles and located within the space between said inner and outer walls and engaging said bonding tiles to maintain said walls in alignment, and means for passing cooling air through the space between said inner and outer walls and over said members.

37. An air cooled furnace wall comprising an inner wall and an outer wall spaced from said inner wall, bonding tiles in said wall, metallic members provided with hooked ends which pass downwardly into openings formed in the sides of said bonding tiles and located within the space between said inner and outer walls and engaging said bonding tiles to maintain said walls in alignment, and means for passing cooling air through the space between said inner and outer walls and over said members.

38. An air cooled furnace wall comprising an inner wall and an outer wall spaced from said inner wall, bonding tiles in said wall, metallic members provided with hooked ends which pass downwardly into openings formed in the sides of two adjacent bonding tiles and located within the space between said inner and outer walls and engaging said bonding tiles to maintain said walls in alignment, and means for passing cooling air through the space between said inner and outer walls and over said members.

39. An air cooled furnace wall comprising an inner wall and an outer wall spaced from said inner wall, bonding tiles in said wall, metallic members provided with hooked ends so arranged that they may be introduced in place in the bonding tiles when the latter are laid up in the wall and do not project beyond the outer face of the wall, said metallic members being located within the space between said inner and outer walls and engaging said bonding tiles to maintain said walls in alignment, and means for passing cooling air through the space between said inner and outer walls and over said members.

40. An air cooled furnace wall comprising an inner wall and an outer wall spaced from said inner wall, bonding tiles in said wall, metallic members provided with hooked ends, one of the hooked ends of each member passing downwardly into an opening in the bonding tiles and the other end engaging an opening in a part carried by said outer wall, said metallic members being located within the space between said inner and outer walls and engaging said bonding tiles to maintain said walls in alignment, and means for passing cooling air through the space between said inner and outer walls and over said members.

41. An air cooled furnace wall comprising an inner wall and an outer wall spaced from said inner wall, bonding tiles in said wall, metallic members provided with hooked ends, one of the hooked ends of each member passing downwardly into an opening in the bonding tiles and the other end engaging an opening in a part carried by said outer wall, said metallic members being located within the space between said inner and outer walls and engaging said bonding tiles to maintain said walls in alignment, and means for passing cooling air through the space between said inner and outer walls and over said members, said bonding tiles projecting into the air space so that the members which serve to keep the furnace wall in alignment come entirely outside of the furnace wall.

42. A furnace wall comprising inner and outer spaced walls, and members for maintaining said walls in spaced relation, the ends of said members passing inside of the surface of one of said walls, and the parts being so constructed and arranged that said members may be placed in position in said wall after the wall is laid up.

43. In furnace construction, an inner wall and an outer wall spaced from said inner wall, a metallic member for maintaining said inner wall in position and having at least a portion thereof located within the space between said inner and outer walls, and an inlet and an outlet for the space between said walls, whereby cooling air may be passed through said space and over a portion of said metallic member.

44. In furnace construction, an inner wall and an outer wall spaced from said inner wall, the inner wall being provided with bonding tiles, means comprising metallic members engaging said bonding tiles for maintaining said inner wall in position, and having at least a portion thereof located within the space between said inner and outer walls and an inlet and an outlet for the space between said walls whereby cooling air may be passed through said space and over a portion of said metallic members.

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