Oct. 11, 1938. D. S. JACOBUS 2,132,419

FURNACE WALL

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Fig. 2

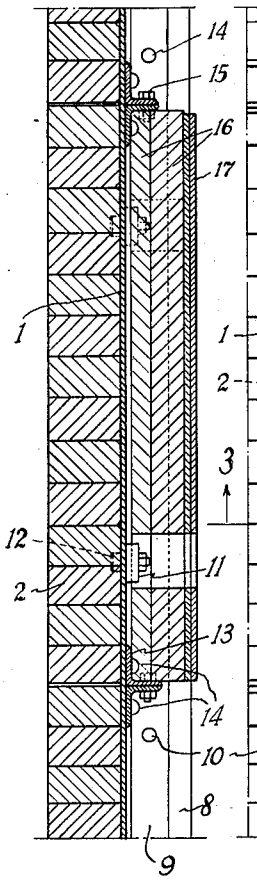


Fig. 1

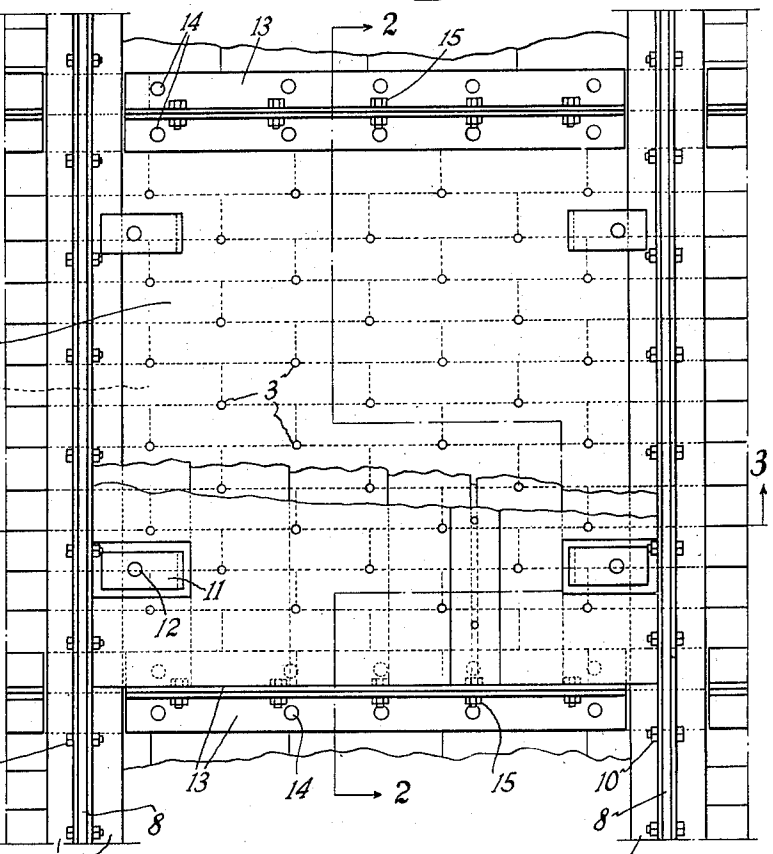


Fig. 3

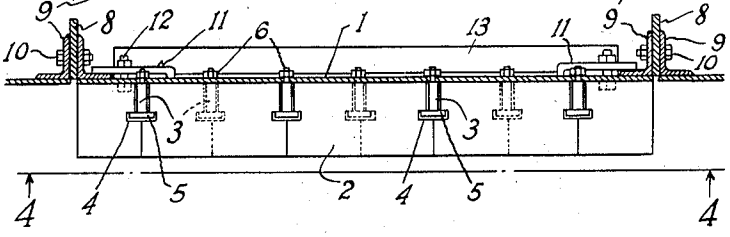
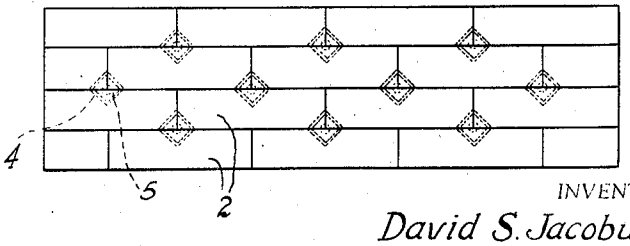


Fig. 4



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FURNACE WALL

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Fig. 7

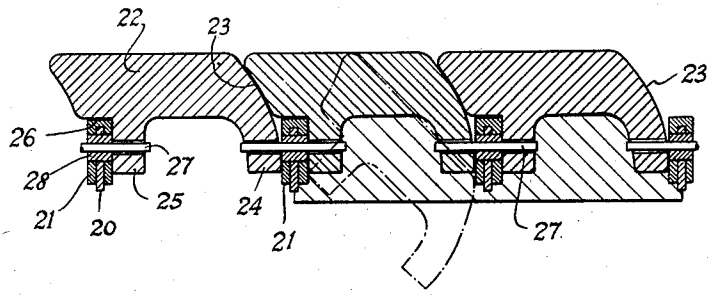


Fig. 6

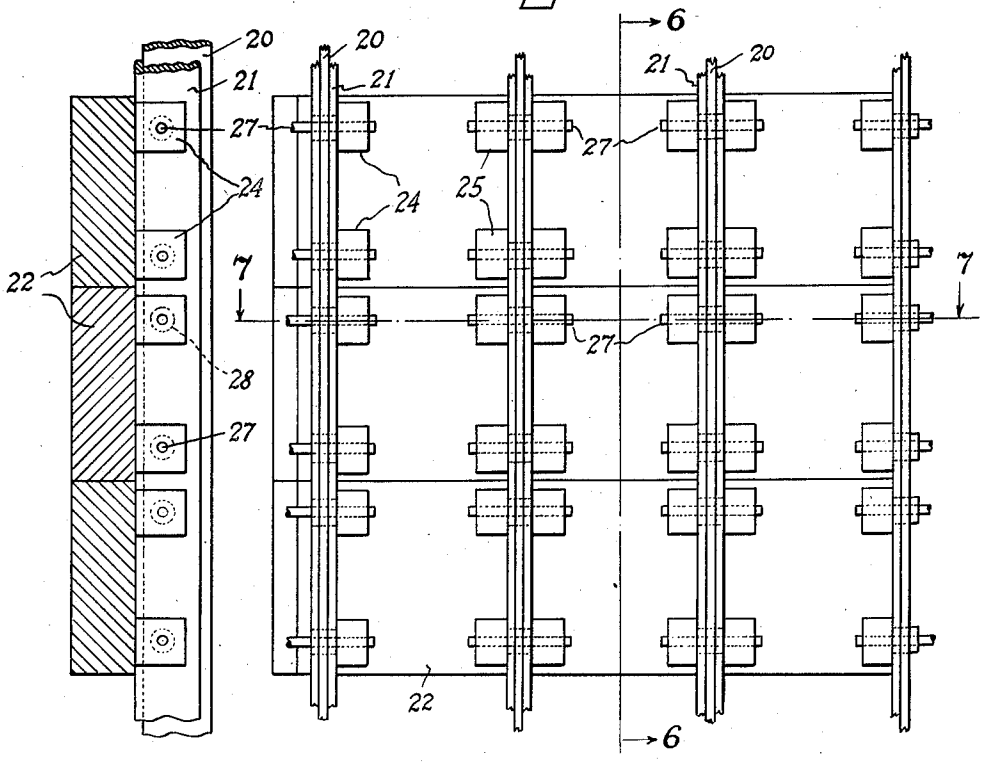


Fig. 5

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Fig. 9

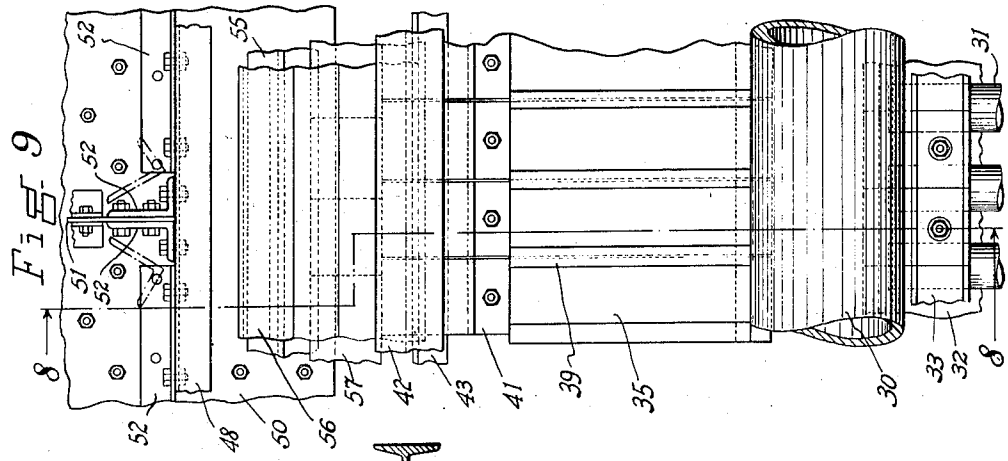


Fig. 8

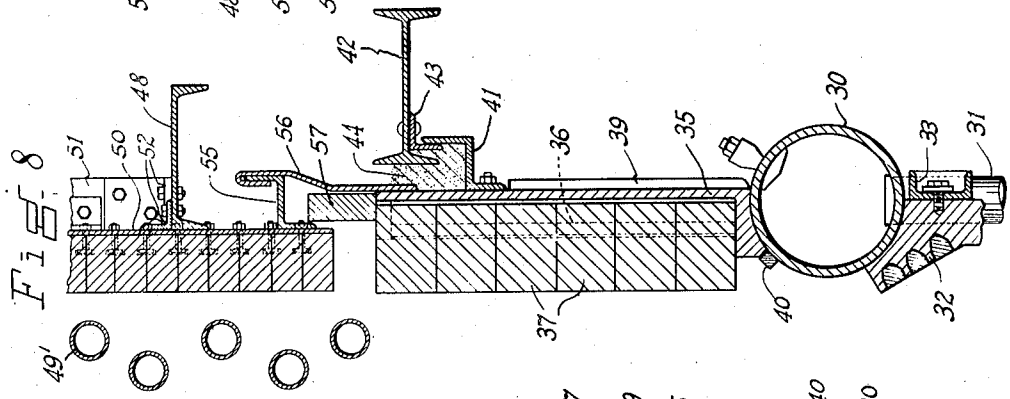


Fig. 10

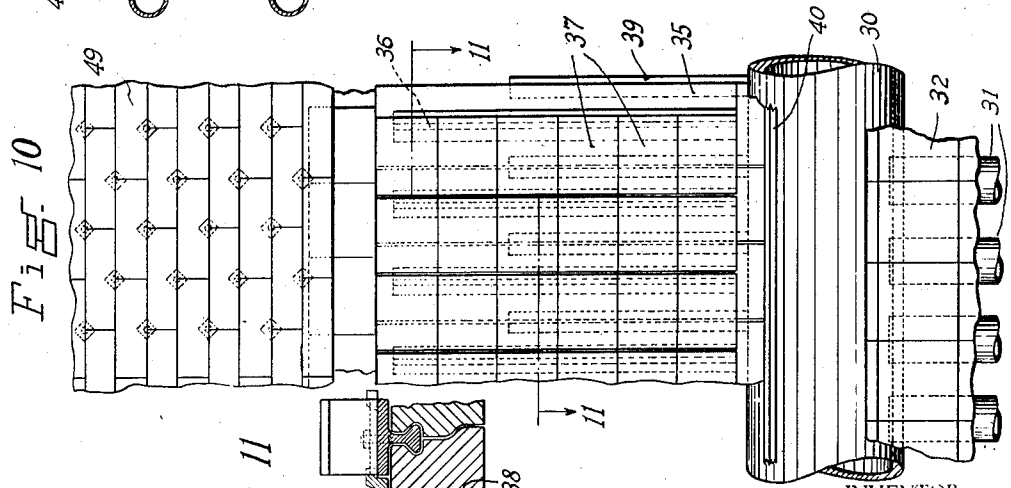
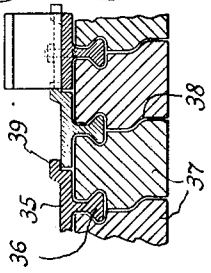


Fig. 11



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UNITED STATES PATENT OFFICE

2,132,419

FURNACE WALL

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Continuation of application October 28, 1927, Serial No. 229,326. This application September 20, 1935, Serial No. 41,448. In Canada September 7, 1929

39 Claims. (Cl. 122—235)

This invention relates to a furnace wall for a boiler. The wall has a lower portion supported from below and an upper portion suspended from above with a sliding joint between the portions. The invention will be understood from the description in connection with the accompanying drawings, in which:

Fig. 1 is a side view of the upper portion of the wall partly broken away showing an illustrative embodiment of that part of the invention.

Fig. 2 is a section along the line 2—2 of Fig. 1.

Fig. 3 is a section along the line 3—3 of Fig. 1.

Fig. 4 is a view from the inside of the furnace along the line 4—4 of Fig. 3.

Fig. 5 is a side view showing a modification.

Fig. 6 is a section along the line 6—6 of Fig. 5.

Fig. 7 is a section along the line 7—7 of Fig. 5.

Fig. 8 is a vertical section through portions of the wall supported from above and below, respectively, and showing another modification of the upper portion of the wall.

Fig. 9 is a side view of Fig. 8 partly broken away.

Fig. 10 is a view of Fig. 8 partly broken away and viewed from the other side.

Fig. 11 is a section along the line 11—11 of Fig. 10.

In the drawings, reference character 1 indicates a metal plate or section that is illustrated as being square in shape, although shapes such as rectangular, for example, may be used. The upper portion of the furnace wall is installed opposite the water tubes of the boiler or in a position where it is not subjected to the maximum degree of heat. Since there is not sufficient room to remove the tile from the inside on account of the presence of the boiler tubes, this portion of the wall is made up of panels that may be removed from the outside. Brick or tile 2 are supported on the furnace side of the plates 1 by means of bolts 3. The bolts 3 are provided with enlarged heads 4 that fit in grooves 5 in the tile. The grooves 5 are provided at the corners of one row of tile 2 and near the middle of an adjacent row, as most clearly indicated in Fig. 4 so as to provide staggered joints. Nuts 6 on the threaded ends of the bolts 3 keep the same in place on the plates 1.

Vertical metal supports 8 are provided at intervals along the outside of the wall. Angle bars 9 are bolted to the sides of the supports 8 by means of bolts 10. Clamps 11 that are attached to the plates 1 by means of the bolts 12 fasten the sections or panels to the flanges of the angle bars 9. Angle bars 13 are riveted along the upper and lower edges of the plates 1 as shown at 14, and the free flanges of these angle bars 13 are bolted together by means of the bolts 15.

If desired, a casing may be installed on the outside of the wall. This casing may comprise layers of insulating material 16 and a sheet of metal 17. The supplementary casing is indicated only in front of one of the panels in Figs. 1 and 2, but may extend over as large an area of the wall as is desirable.

When it is desired to remove a panel from the outside, the angle bars 9 at each side of the panel or plate 1 are removed, and the bolts 15 of the angle bars 13 are taken out. The supports 8 are sprung over bodily slightly away from each other, whereupon the panel together with the tile attached thereto can be taken out between the supports 8.

In the modification shown in Figs. 6 and 7, the vertical metal supports 20 are surrounded on both sides, with insulating material 21 and tile may be removed one at a time from the outside of the furnace. Each tile 22 is provided with a rounded edge 23 to facilitate inserting and removing the same, as indicated in dotted lines in Fig. 7. Each tile is provided with two pairs of lugs 24 and 25, the pair of lugs 24 being flush with the edge 23 of the tile and the pair 25 being offset from the other edge a short distance to leave a seat 26. Metal pins 27 pass through holes in the lugs on the tile and corresponding holes in the supports 20. A sleeve of insulating material 28, such as porcelain, is provided for the pins 27 where they pass through the holes in the supports 20.

It will be obvious that the tile 22, as shown in Figs. 5, 6 and 7, can be removed from the outside of the furnace wall simply by removing the corresponding pins 27 and pulling the tile outwardly to the dotted line position in Fig. 7.

In the illustration shown in Figs. 8 to 11 in which the upper suspended section and the lower section supported from below are shown with a slip joint between them, a wall section that is removable from the outside is shown installed above the cross drum or header 30 below the slip joint and another section somewhat similar to that shown in Fig. 1 removable from the outside is installed above the slip joint so that the removable sections will be opposite the space occupied by the inclined tubes 49' of the water tube boiler that is located above the furnace in the usual manner. Furnace wall cooling tubes 31 are connected to the header 30 and are lined on the furnace side with high heat resisting tile

32 that is retained in contact with the tubes 31 by means of the fastening means 33. Metal plates 35 with bulbed ribs 36 are supported upon the header 30 and these plates in turn support the tile 37. The tile 37 are provided with grooves to fit over the bulbed ribs 36 in the well known manner. The tile are provided with curved edges 38 to prevent the escape of radiant heat and to protect the bulbed portions 36. The plates 35 are provided with offset overlapping edges 39 to prevent escape of heat. The lower ends of the plates 35 are extended to provide a stop for the tile 37 and also to provide a large area of contact of the plates 35 with the outside surface of the drum 30. A steel strip 40 is welded or otherwise secured to the drum 30 to keep the tile holding plates 35 in place. A horizontally extending Z-bar 41 is bolted to the plates 35 on the outside near the upper ends thereof and a cross support 42 in the form of an I-beam is located in proximity to the Z-bar 41. An angle iron 43 is riveted to the support 42 and it is so located that one flange thereof bears against the inside of a flange of the Z-bar 41, so that the support 42 will keep the wall from falling inwardly, and at the same time will permit expansion and contraction. The space between the outside flange of the Z-bar 41 and the plates 35 may be filled with insulating material 44.

A cross beam or girder 48 is located a short distance above the support 42 and serves to support a wall that is made up of tile 49 that are supported by the plates 50 in a manner similar to that already described in connection with Figs. 1 to 4. Vertical supports 51 have their lower ends resting upon the girder 48 and angle irons 52 attach the supports 51 to the girder 48 and the plates 50 to the supports 51. A horizontal Z-bar 55 is bolted to the plates 50 near the lower ends thereof and a plate 56 that is provided with a bent upper edge is suspended from the flange of the Z-bar 55. The lower edge of this plate 56 lies along the outer sides of the plates 35 and provides a gas seal between the two sections of the wall, and at the same time permits expansion and contraction between the two. A row of tile 57 may be laid along the top of the tile 37 between the plate 56 and a flange of the Z-bar 55, thus protecting the plate 56 from excessive heat. It will be understood that the modifications shown in Figs. 1 to 7 may be installed above the portion of the wall that is supported on the header 30 to form the portion of the wall opposite the boiler tubes with a slip joint between the two portions to provide for expansion and contraction. In each case, the upper portion of the wall can be removed in the sections from the outside. Changes and modifications can be made without departing from the spirit or scope of the invention.

This application is a continuation of my earlier application Ser. No. 229,326, filed on October 28, 1927.

What is claimed is:

1. In a furnace, a lower wall section including a header and a row of wall tubes communicating with the header and extending downwardly therefrom, an intermediate wall section receiving support from the header and including vertical rows of superposed refractory wall elements extending a substantial distance above the header, a third wall section positioned above and in substantial alignment with the other two sections and supported independently of those sections, said third wall section including vertical rows of superposed ceramic refractories, and a furnace wall sealing structure contacting with the second and third wall section to maintain a gas-tight joint between those sections while permitting those sections to move relative to each other while under the influence of changes due to differences in temperatures of the different wall sections, the ceramic refractories of the intermediate and third sections being maintained in groups which are replaceable without access thereto from the interior of the furnace.

2. In a furnace, a wall section including an upper header, and wall cooling tubes communicating with the header and extending downwardly therefrom, a refractory faced intermediate wall section supported by the first mentioned section, a third and upper wall section above and in substantial furnace wall face alignment with the other sections, means for supporting the third wall section independently of the other sections, and a slip joint furnace seal structure between the refractory faced wall section and the upper wall section for permitting relative movement of those sections while maintaining a gas-tight joint therebetween, the intermediate and third sections including ceramic refractories which are replaceable by movement toward the exterior of the furnace and without access thereto from the interior of the furnace.

3. In a furnace, an upwardly expanding wall section including an upper header, spaced wall cooling tubes extending downwardly from the upper header, closure members for the spaces between said tubes, and a refractory faced wall section positioned above and in substantial alignment with the first mentioned section and supported thereby, said refractory faced wall section including groups of ceramic refractories which are replaceable by movement toward the exterior of the furnace only and without access thereto from the interior of the furnace.

4. In a furnace, an upwardly expanding wall section including spaced wall cooling tubes, and an upper header, a second wall section supported by the first mentioned wall section, superposed ceramic refractory members providing a refractory facing for said second section, a third wall section including ceramic refractory members, a support for the third wall section maintaining it independently of the other two sections and in substantial alignment with the second wall section, and a slip joint and furnace seal structure between the second and third wall sections preventing the escape of furnace gases while permitting relative movements between the third section and the second, the second and third sections having their ceramic refractory members maintained in groups which are separately replaceable without access thereto from within the furnace.

5. In a steam boiler and furnace organization, a lower furnace wall section including an upper header and spaced wall cooling tubes communicating therewith and extending downwardly therefrom, an upper wall section positioned alongside and parallel to tubes forming a part of the steam generating surface of the boiler and so arranged relative to external supports that it is removable by movement away from those tubes and without access from the interior of the organization, refractory facing members secured to the upper wall section, and a slip joint and boiler seal structure between the upper and lower wall sections for preventing the escape of furnace

gases while permitting relative movement between said sections.

6. In a steam boiler and furnace organization, a lower furnace wall section including an upper header and spaced wall cooling tubes communicating therewith and extending downwardly therefrom, inclined steam generating tubes for the boiler, an upper wall section located alongside and parallel to the generating tubes and so constructed and arranged so as to be removable by movement away from those tubes and without access thereto from within the furnace, refractory facing members secured to the upper wall section, and a slip joint and boiler seal structure between the upper and lower wall sections for maintaining a gas-tight joint between the sections while permitting relative movement between them.

7. In a steam boiler and furnace organization, a lower furnace wall section including an upper header and spaced wall cooling tubes communicating therewith and extending downwardly therefrom, inclined steam generating tubes for the boiler, an upper wall section located alongside and parallel to the steam generating tubes and so constructed and arranged relative to supports that they are removable separately without access thereto from the interior of the boiler or furnace, refractory facing members secured to the upper wall section, and slip joint and boiler seal structure between the upper and lower wall sections for maintaining a gas-tight joint while permitting relative movements of said sections.

8. In a furnace and boiler organization, a lower wall section including a header and a row of wall tubes communicating with the header and extending downwardly therefrom, an intermediate wall section receiving support from the header and including refractory wall elements, inclined steam generating tubes for the boiler, a third wall section above the other two sections and supported independently of those sections so as to form a gas pass wall alongside and parallel to the generating tubes, and a furnace wall sealing structure contacting with the second and third wall sections to maintain a gas-tight joint between those sections while permitting the sections to move relative to each other while under the influence of changes due to difference in temperature of the different wall sections, the intermediate and third wall sections having refractory facing elements which are independently replaceable without access thereto from the interior of the furnace or boiler.

9. In a furnace and boiler organization, a lower wall section including an upper header and wall cooling tubes communicating with the header and extending downwardly therefrom, a refractory faced intermediate wall section supported by the first mentioned section, inclined steam generating tubes of the boiler, a third and upper wall section closely adjacent and parallel to the generating tubes, means for supporting the third wall section independently of the other sections, and a slip joint furnace seal structure between the refractory faced wall section and the upper wall section for permitting relative movement of those sections while maintaining a gas-tight joint therebetween, the third wall section including refractory face elements removable by movement outwardly of the wall and without access thereto from the interior of the furnace or the boiler.

10. In a furnace and boiler organization, an upwardly expanding wall section including an upper header, spaced wall cooling tubes extending downwardly from the upper header, closure members for the spaces between said tubes, a refractory faced second wall section above the first mentioned section and supported thereby, inclined steam generating tubes for the boiler, a third wall section independently supported and positioned alongside and parallel to the generating tubes, and a slip joint furnace wall sealing structure between the second and third wall sections, said third wall section including ceramic refractory members maintained in groups which are replaceable without access thereto from the interior of the furnace or boiler.

11. In a furnace, an upwardly expanding wall section including spaced wall cooling tubes, and an upper header, a second wall section supported above the first mentioned wall section, ceramic members providing a refractory facing for said second section, a third wall section, steam generating tubes closely adjacent and parallel to the third section, a support for the third wall section maintaining it at the level of and parallel to the generating tubes independently of the other two sections, and a slip joint and furnace seal structure between the second and third wall sections maintaining a gas-tight joint while permitting relative movements between the third section and the second, the third wall section including ceramic facing elements which are removable outwardly of the furnace without access thereto from the interior of the furnace or boiler.

12. In a furnace, an upwardly expanding wall section including spaced wall cooling tubes, and an upper header, a second wall section supported above the first mentioned wall section, ceramic members providing a refractory facing for said second section, a third wall section, steam generating tubes closely adjacent and parallel to the third section, a support for the third wall section maintaining it independently of the other two sections, and a slip joint and furnace seal structure between the second and third wall sections maintaining a gas-tight joint while permitting relative movements of the third and second sections, the third wall section including panels each supporting a plurality of ceramic refractory wall elements in such a manner that the elements are bodily removable outwardly of the furnace with the panels and without access thereto from the interior of the furnace or boiler.

13. In a furnace, a lower wall section including refractory elements secured to horizontally spaced upright wall members, an intermediate wall section positioned immediately above said lower section, upright tiers of ceramic refractories in the intermediate section, upright metallic panels forming a furnace closure outwardly of said refractories, upright tile aligners held fixed relative to the panels against movement transversely of the wall section and maintaining the refractories in tier formation, and means including said aligners providing for the removal and replacement of said refractories without access thereto from the interior of the furnace, the refractories of individual tiers being removable independently of other tiers.

14. In a furnace wall construction, structural supporting members, a lower wall section including refractory elements held in wall forming position by spaced uprights, an intermediate wall section, an upper wall section having a slip joint relation to the intermediate section, said intermediate section including tiers of refractory tile or brick separately removable and replaceable without access thereto from the interior of the fur-

nace and without the removal of separate refractory elements of either of the other sections.

15. In a furnace wall, a plurality of lower wall sections each including refractory furnace face elements held in wall forming position by spaced uprights, a plurality of intermediate wall sections, and upper wall sections in the form of wall panels separately removable and replaceable without access thereto from the interior of the furnace and without the disturbance of adjacent panels, the intermediate sections including tiers of refractory tile or brick with the tiers separately replaceable without access thereto from the interior of the furnace and without removal of separate refractory elements of another wall section.

16. In a furnace wall, a slip joint between adjacent portions of said wall, and means holding individual portions of said wall in such a manner that they may be removed from the outside, said means comprising tile supporting members.

17. In a furnace wall, a slip joint between adjacent portions of said wall, and means holding individual portions of said wall in such a manner that they may be removed from the outside, said means comprising tile supporting members that are fastened together.

18. In a furnace wall, a slip joint between adjacent portions of said wall, and means holding individual portions of said wall in such a manner that they may be removed from the outside, said means comprising bulb beam supports for tile.

19. In a furnace wall, a slip joint between adjacent portions of said wall, and means holding individual portions of said wall in such a manner that they may be removed from the outside, said means comprising bulb beam supports for tile having overlapping edges.

20. In a furnace wall, a slip joint between adjacent portions of said wall, means holding individual portions of said wall in such a manner that they may be removed from the outside, supports for said wall and means for fastening said wall to said supports.

21. A furnace wall comprising an upper portion having tile removable from the outside, means for holding said tile in place in such a manner that they may be removed without injuring the tile, a lower portion, and a slip joint between said portions.

22. A furnace wall comprising an upper portion having tile removable from the outside, means for holding said tile in place in such a manner that they may be removed without injuring the tile, a lower portion, and a slip joint between said portions, said lower portion being supported from below.

23. A furnace wall comprising an upper portion having tile removable from the outside, means for holding said tile in place in such a manner that they may be removed without injuring the tile, a lower portion, and a slip joint between said portions, said lower portion being supported from below and said upper portion being suspended.

24. In a furnace wall, a slip joint between adjacent portions of said wall, and means holding individual portions of one of said wall portions in such a manner that they may be removed from the outside without injury, said means comprising members for holding refractory elements.

25. In a furnace wall, a slip joint between adjacent portions of said wall, means holding individual portions of one of said wall portions in such a manner that they may be removed from the outside without injury, said means comprising members for holding refractory elements, and means to prevent said wall from falling inwardly or outwardly.

26. In a furnace, a structural framework, separate metallic wall plates, ceramic bricks or tile supported by the plates and forming a furnace face contacted by the flame and gases of the furnace, means rigidly securing the tile on the plates so that they are bodily movable therewith, the plates with their rigidly attached tile forming independently movable wall panels removable outwardly of the furnace without disturbing adjacent panels, and means engaging the structural framework for independently securing the wall panels in their operative positions.

27. In a furnace, a structural framework including spaced columns, separate metallic wall plates, ceramic bricks or tile supported by the plates and presenting a furnace face contacted by the flame and gases of the furnace, means fixed to the plates rigidly securing the tile on the plates so that they are bodily movable therewith, the plates with their rigidly attached tile forming independently movable wall panels removable outwardly of the furnace without disturbing adjacent panels, and means engaging the structural framework for independently securing the wall panels in their operative positions.

28. In a furnace, a structural framework, separate metallic wall plates, ceramic bricks or tile supported by the plates and forming a furnace face contacted by the moving furnace gases, means rigidly securing the tile on the plates so that they are bodily movable therewith, the plates with their rigidly attached tile forming independently movable wall panels removable outwardly of the furnace without disturbing adjacent panels, means engaging the structural framework for independently securing the wall panels in their operative positions, and flanged refractory engaging portions at the margins of the panels engaging parts of the framework.

29. In a furnace, a structural framework, separate metallic wall plates, ceramic bricks or tile supported by the plates and forming a furnace face contacted by moving furnace gases, means including interengaging formations on the plates and the tile rigidly securing the tile on the plates so that they are bodily movable therewith, the plates with their rigidly attached tile forming independently movable wall panels removable outwardly of the furnace without disturbing adjacent panels, and means engaging the structural framework for independently securing the wall panels in their operative positions.

30. In a furnace wall, a lower furnace wall section, a support near the top of said section, a second section located above the first and including tile maintained by the support, a flat metallic structure constituting a backing for the tile, and means fixed with reference to said structure and holding the tile in wall formation, said structure and means being so constructed and arranged relative to the tile that the latter may be removed and replaced from a position exteriorly of the wall.

31. In a furnace, a lower wall section including refractory elements secured to horizontally spaced upright wall members, an intermediate wall section positioned immediately above said lower section, upright tiers of refractories in the intermediate section, upright metallic panels forming a furnace closure outwardly of the re-

fractories, upright tile aligners held in fixed relation to the panels transversely of the wall section and maintaining the refractories in the separate tiers, means including said aligners providing for the removal and replacement of said refractories without access thereto from the interior of the furnace, the refractories of individual tiers being removable independently of other tiers, and an upper wall section forming a continuation of the furnace wall face of the other sections and having an expansion joint relationship with the intermediate section at the top of the latter.

32. In a sectional furnace wall construction, a lower wall section including wall tile secured to spaced upright wall members forwardly thereof, a second wall section above the lower section and including tiers of tile, flat upright metallic structures positioned outwardly of the tile and having aligned inner surfaces forming parts of a substantially air-tight furnace enclosure, and spaced upright tile aligning portions spaced inwardly of said structures and fixed with reference thereto, means providing for the removal and replacement of said tile by movement outwardly of the furnace without access to the sections from the interior of the furnace, and an upper wall section positioned above the second section with an expansion joint therebetween.

33. In a sectional furnace wall construction, a lower wall section including wall tile secured to spaced upright wall members forwardly thereof, a second wall section above the lower section and including tiers of tile, flat upright metallic structures positioned outwardy of the tile and having aligned inner surfaces forming parts of a furnace enclosure, and spaced upright tile aligning portions spaced inwardly of said structures and associated therewith so as to be held against movement transversely of the second section, means providing for the removal and replacement of said tile by movement outwardly of the furnace without access to the sections from the interior of the furnace.

34. In a furnace, buckstay steelwork, composite encasement units, means connecting the units to the steelwork so that they are wholly supported thereby, and means connecting adjacent units to form an airtight furnace encasement; said units combining in separate wall panels, a firebrick furnace lining, thermal insulation, and a sheet metal exterior panel between which and the lining the insulation is held in position, the firebrick lining consisting of tile or brick a plurality of which are removable as a unit and replaceable without access thereto from the interior of the furnace.

35. In a sectional furnace wall construction, buckstay steelwork, wall panel constructions including groups of firebrick separately supported by the steelwork, thermal insulation material supported by the steelwork exteriorly of the firebrick, sheet metal furnace encasement panels secured to the steelwork exteriorly of the insulation material to complete an airtight furnace encasement, and means whereby the groups of firebrick may be replaced without access thereto from the interior of the furnace.

36. In a sectional furnace construction, a wall section including separate columns of refractory furnace face elements, means providing compression support for said columns, separate upright aligners for the columns extending upwardly from said means and arranged so as to be separately tiltable with reference to said means to permit the separate columns to accordingly tilt, and means near the upper ends of the aligners acting as stops to limit the tilting of the upper ends of the columns toward the interior of the furnace.

37. In a furnace wall, separate columns of individual refractory furnace face elements, means on which the columns are supported so that they may be separately removed and replaced without access thereto from the interior of the furnace, and stops limiting the tilting movement of the columns on said means toward the interior of the furnace.

38. In a furnace, a lower furnace wall section, means near the top of said section acting as a support, a second section located at a higher level than the first and including tile, a panel-like flat structure rearward of the tile, and means for holding the tile in wall formation, said structure and means being so constructed and arranged relative to the tile that the latter may be removed and replaced without access to the wall from the interior of the furnace.

39. In a water tube steam generator, a furnace, inclined steam generating tubes extending toward an end wall of the furnace and exposed to heat of the furnace gases, a furnace side wall including furnace wall tubes extending upwardly to positions adjacent the zone of the generating tubes, a non-metallic intermediate wall section extending above the side wall and supported thereon, other non-metallic refractories forming an upper wall having its lower end adjacent the top of said non-metallic wall section, means connecting the generating tubes and furnace wall tubes into fluid circulation, means for independently supporting the upper wall, and means maintaining a gas-tight joint between the intermediate and upper walls while permitting relative movements thereof.

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