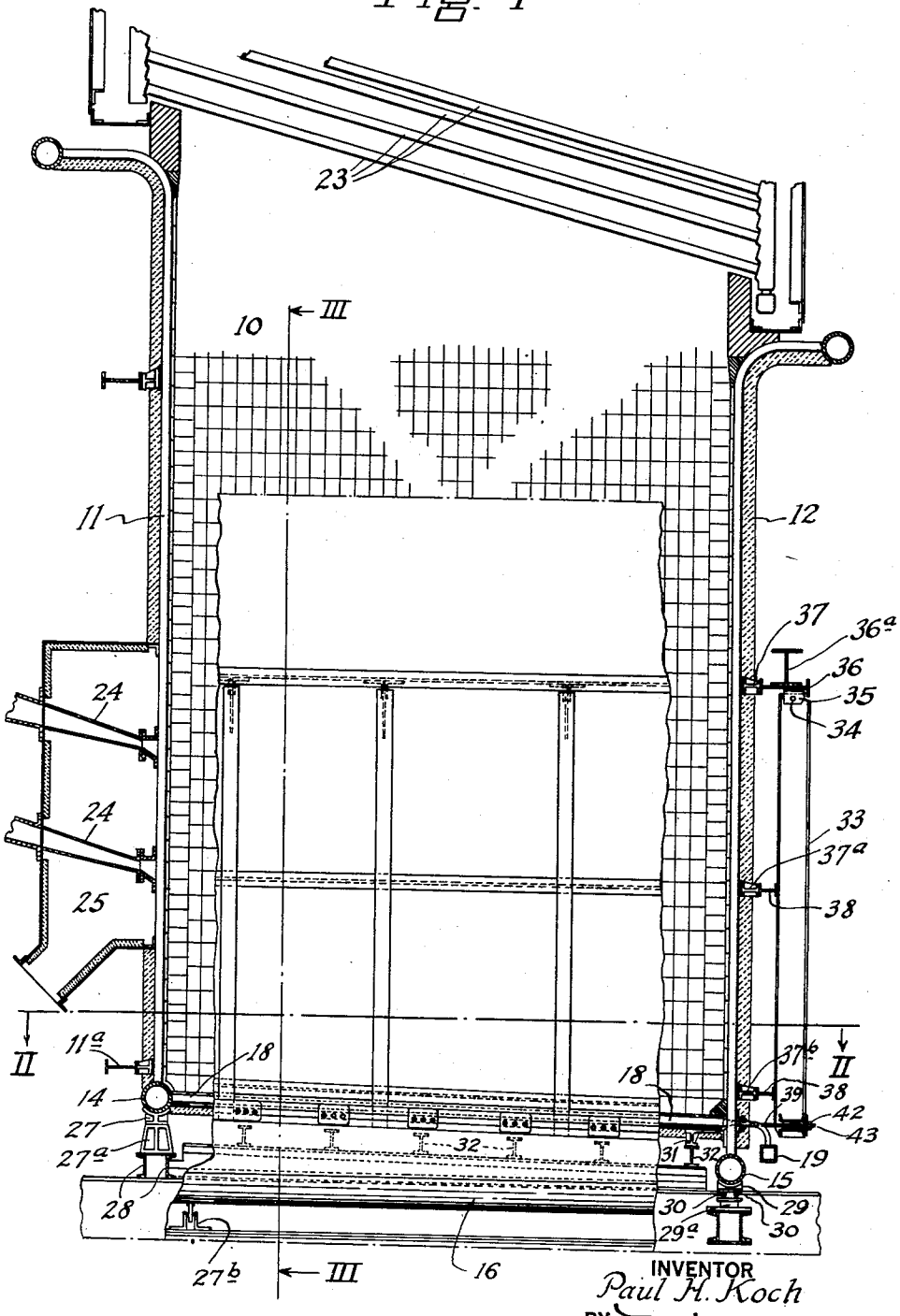
Dec. 17, 1935. P. H. KOCH 2,024,232

FURNACE

Filed Aug. 3, 1932 4 Sheets-Sheet 1

Fig. 1



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Dec. 17, 1935. P. H. KOCH 2,024,232

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Fig. 2

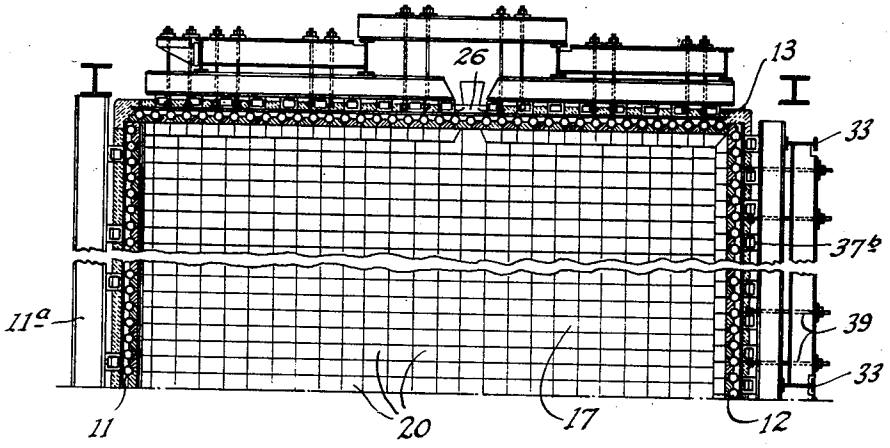
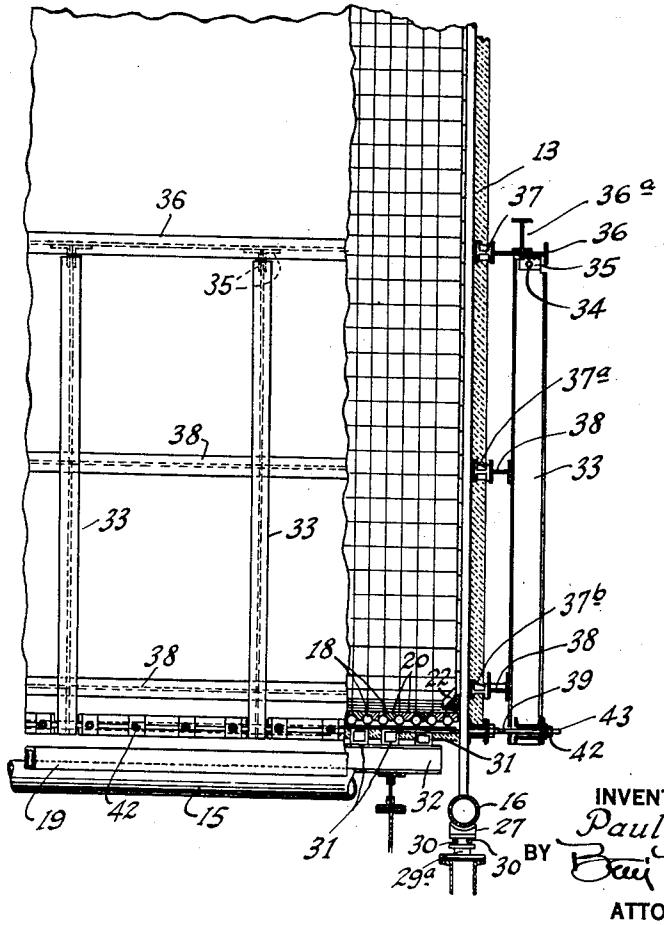


Fig. 3



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FURNACE

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Fig. 4

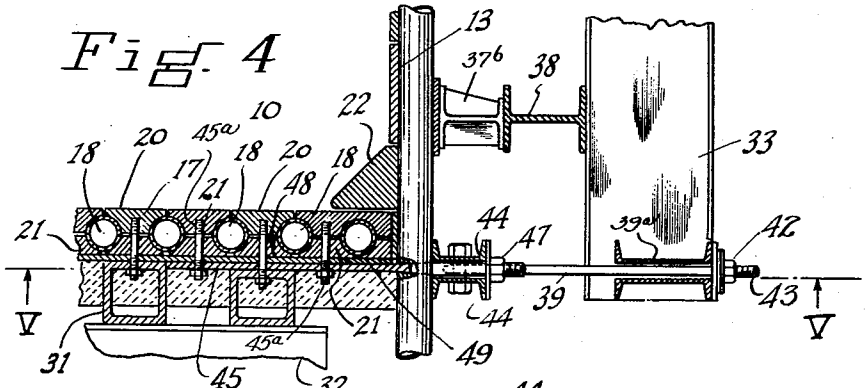

Fig. 5

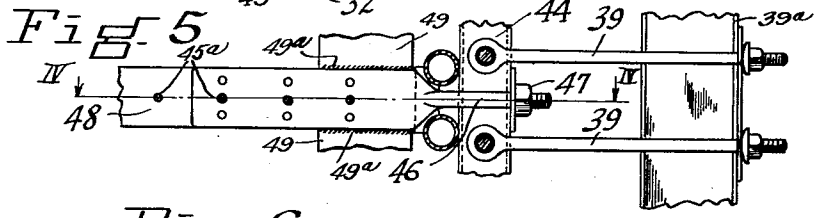

Fig. 6

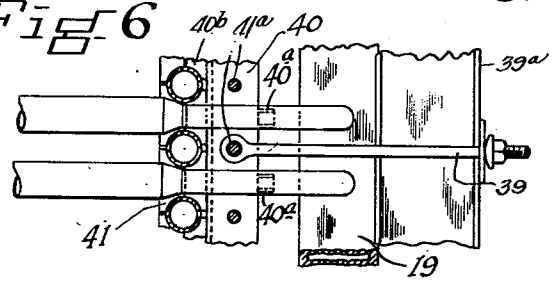

Fig. 7

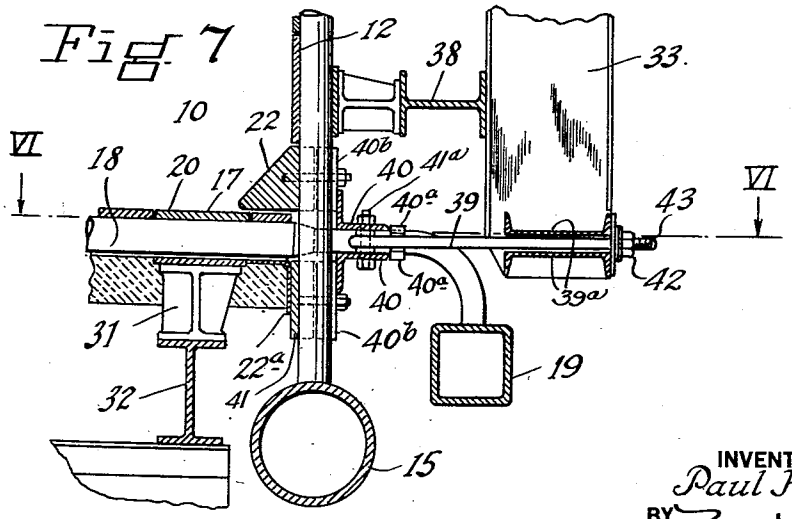

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Fig. 8.

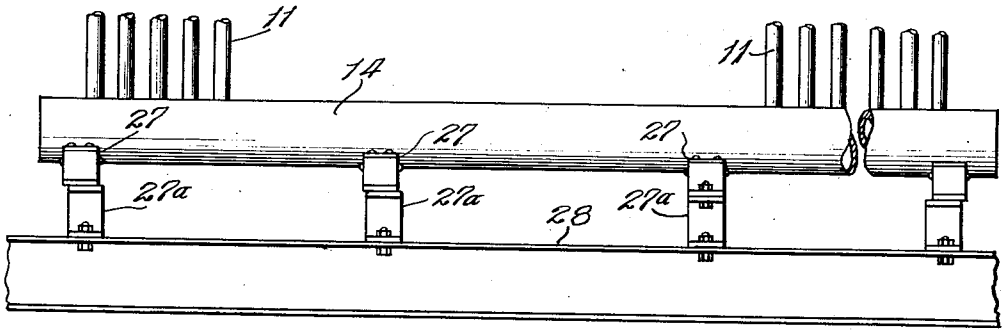
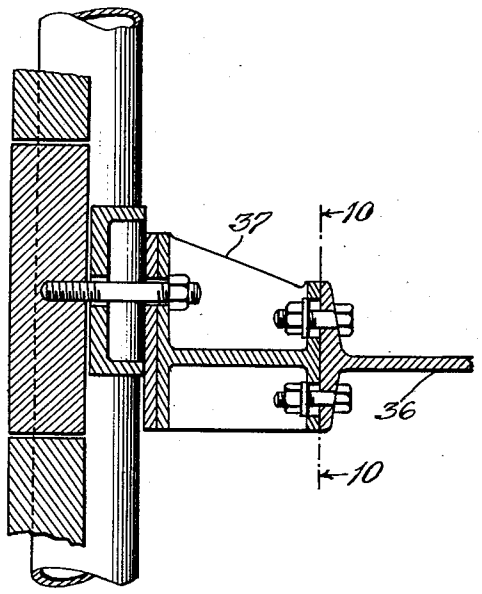


Fig. 9.



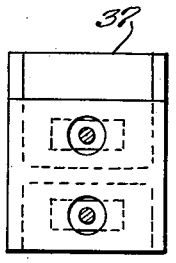
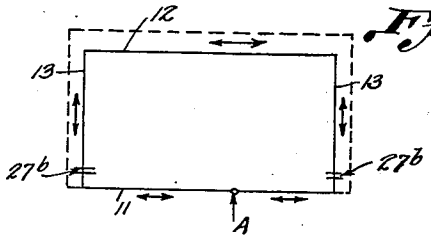


Fig. 10.

Fig. 11.



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Patented Dec. 17, 1935

2,024,232

UNITED STATES PATENT OFFICE

2,024,232

FURNACE

Paul H. Koch, Westfield, N. J., assignor to The Babcock & Wilcox Company, Bayonne, N. J., a corporation of New Jersey

Application August 3, 1932, Serial No. 627,316

25 Claims. (Cl. 122—235)

My invention relates to a furnace and is applicable to a boiler furnace having water-cooled walls and a water-cooled floor.

One object of the invention is the provision of supporting means for the walls and floor of a furnace. A further object is the provision of such means in a form which will restrain the furnace against all motion at one point and permit expansion of the furnace away from that point while fully supporting the same. Still a further object is the provision of a furnace construction wherein the walls are held firmly against the floor to prevent leakage into or out of the furnace. Other objects will appear upon consideration of the present specification.

The invention is shown by way of illustration in the accompanying drawings wherein—

Figure 1 is a vertical longitudinal midsection through a furnace and part of a boiler above said furnace, a part of the furnace being shown in elevation, all constructed in accordance with the invention,

Fig. 2 is a partial horizontal section on the line II—II of Figure 1,

Fig. 3 is a partial elevation of the furnace as viewed from the right in Figure 1 partly shown in section along the line III—III of Figure 1,

Fig. 4 is an enlarged sectional view showing the detailed construction in the lower right-hand portion of Fig. 3, the section being taken on the line IV—IV of Fig. 5,

Fig. 5 is a view of the construction illustrated in Fig. 4 as indicated by the line V—V thereon,

Fig. 6 is a plan view of the construction illustrated in Fig. 7 along the line VI—VI,

Fig. 7 is an enlarged sectional view showing the detailed construction of the elements illustrated in the lower right-hand portion of Figure 1,

Fig. 8 is a fragmentary front elevation of the wall support and restraining means,

Fig. 9 is a fragmentary side sectional view of the wall support,

Fig. 10 is a detail section taken on the line 10—10 of Fig. 9, and

Fig. 11 is a diagrammatic view illustrating the direction of movement of the walls and floor of the furnace due to expansion and contraction thereof.

In the construction which is shown in the drawings for purposes of illustration, there is a furnace 10 having a front wall 11, a rear wall 12 and side walls 13—13. The walls are of the usual water tube and block construction having lower headers 14, 15, and 16—16, respectively, at the lower ends of the tubes therein.

A floor 17 is provided at the bottom of the furnace, this floor comprising a series of parallel tubes 18 each connected to the front lower header 14, and each being reduced in outer section near its other end to pass between the wall tubes in the rear wall 12, beyond which they are connected into a box header 19. The tubes 18 preferably slope downwardly toward the rear of the furnace to promote circulation through them and to facilitate collection of slag on the floor, the box header 19 being at the downtake end of their connections with the boiler. Blocks 20 overlie the floor tubes 18 and provide the surface of the furnace floor. Clamps 21 may be provided on the opposite sides of the tubes 18 partly surrounding the same and connected in the usual, or any convenient manner, with the blocks 20 to hold the latter in place. Ledge blocks 22 are preferably provided along the corners formed between the walls and the floor to reduce any possible thrust of "growing" slag upon the walls.

Lower tubes 23 of a boiler above the furnace 10 are illustrated in Figure 1. For simplicity, however, steam and water connections between the boiler and the wall and floor tubes are not illustrated, such connections being well known in the art.

Pulverized fuel burners 24 and a secondary air-box 25 are shown in connection with the front wall of the furnace, and a slag tap opening 26 is illustrated in one of the side walls of the furnace as in Fig. 2.

In accordance with my invention I anchor one of the walls, for example, the front wall 11, at one point so as to prevent movement of the wall at that point and I support the remaining portions of such one wall, the other walls, and the floor so that they are permitted to move toward and away from such point of anchorage incident to expansion and contraction. I also lash or connect the upright walls 11, 12 and 13 to the edges of the floor or bottom wall 17 so that spreading or movement of the floor and walls due to changes of temperature or any other strains or forces, will not result in the leakage of slag.

The supporting structure for the front wall 11 is shown in Fig. 1, and more clearly in Fig. 8, as being a plurality of spaced saddles 27 fixed to the header 14 and resting on shoes 27a, the latter being rigidly connected to a pair of supporting channels 28, which form a part of the main supporting structure for the furnace. As shown in Fig. 8, one of the saddles 27 is rigidly fixed by

bolts to its respective shoe 27a and thereby forms the means for anchoring the front wall at one point. The remaining saddles 27 are free to slide on the upper surface of their respective shoes, thus providing for movement of the wall 11 toward and away from the point of anchorage due to expansion and contraction. The front wall is further restrained by means of I-beams 11a which are a part of the fixed external supporting structure of the furnace and prevents outward movement of the wall 11 at the elevation at which such beam is located.

If desired, the structure shown for slidably supporting the remaining parts of wall 11 may be replaced by roller supports such as are disclosed in Fig. 1 in connection with the rear wall 12 and in Fig. 3 in connection with the side wall 13. These roller supports comprise saddles 29 constructed slightly different from the saddles 27. The saddles 29 are fixed to their respective headers 15 or 16 and rest upon rolling elements, here shown as balls 30, which in turn are carried by a supporting bed plate 29a. While I have shown balls 30 as the means providing the rolling support, it is to be understood that other means may be resorted to without departing from the spirit of the present invention, for example, I might choose to use cylindrically-shaped rollers instead of the balls. It will thus be seen that I have provided a slidable support for the rear wall 12 and side walls 13 as well as the unrestrained portions of the wall 11.

The side walls may move outward or toward the point of anchorage with the outer extremities of wall 11 and, as stated, provision is made for movement of the side walls due to expansion and contraction thereof. However, movement of the side walls due to their own expansion and contraction should not affect the front wall. To this end, I provide a guide construction 27b which locates each header 16 at the end adjacent the wall 11 with respect to the main furnace supporting structure. The guide constructions 27b permit movement of the wall 11 and the walls 13 in directions parallel to the plane of wall 11 and also permit movement of walls 13 due to expansion and contraction thereof, but the guide constructions prevent the latter movement of walls 13 from affecting front wall 11.

The different movements of the walls 11, 12 and 13 will be readily understood from an examination of Fig. 11, wherein I have indicated diagrammatically the furnace and by arrows the direction in which the walls and floor expand and contract with respect to the point to which the front wall 11 is anchored. The reference character A denotes the point of anchorage of wall 11 and the arrows parallel to the wall 11 indicate the expansion and contraction of this wall due to changes in temperature within the furnace, or for any other causes incident to furnace operation. The guide constructions 27b are indicated and the arrows parallel to walls 13 indicate the direction of movement of these walls due to expansion and contraction, the arrows parallel to the wall 12 indicate the direction of movement of this wall. The dotted lines indicate in an exaggerated way the position of the walls 11, 12 and 13 when fully expanded.

As the header 14 serves both the tubes forming the wall 11 and the tubes forming the bottom wall or floor 17, the wall 17 is also anchored at one point and expands both longitudinally and transversely from this point. The floor is slidably supported, as will presently appear, and is connected or lashed at its edges to the walls 12 and 13 to prevent separation of the walls from the floor and consequent leakage of molten slag. The floor 17 is slidably supported by shoes 31 which may be fixed to the floor by the same means as are provided for securing the blocks 20 and clamps 21 to the tubes. The bottom surface of the shoes 31 slidably engage I-beams 32, which are a part of the main furnace supporting structure. The bottom surface of the shoes 31 are preferably machined to facilitate sliding thereof on the I-beams.

Other forms of slidable support, both for the walls through their lower headers and for the floor, may be provided without departing from the spirit of the present invention. In any event, one wall of the furnace has one point fixed and the entire furnace is slidably supported permitting expansion thereof in any direction away from and contraction toward the fixed point. The structural support whereby such motion of the walls and floor is permitted may be formed of rolling supports, as well as the illustrated supports which are shown to be in slidable contact.

Means is also provided for restraining or limiting movement of the rear wall and side walls of the furnace. This means is shown as comprising a plurality of vertically disposed buckstays 33 which are pivoted in their upper ends at intermediate points in the vertical extent of the adjacent walls. The buckstays 33 are pivoted as indicated at 34 to angle irons 35 carried by supporting I-beams 36, which together with a second I-beam 36a attached thereto, form a part of the main supporting structure for the furnace. Buckstay clamps or blocks 37 are rigidly attached to the walls and are in sliding contact by a slot and washer connection with the interior face of the I-beams 36. This construction provides for movement in the plane of the wall, but prevents outward or inward movement of the walls at the point of connection with the beam 36. Other buckstay clamps or blocks 37a and 37b slidably contact in a similar manner with compression elements in the form of beams 38 connecting the buckstays 33 and movable therewith. The beams 38 serve to transmit forces between the walls and the buckstay elements.

As will presently appear, the buckstay elements 33 are so arranged with respect to the lower portions of the side and rear walls and are so connected thereto as to stiffen the lower portions of such walls and at the same time permit movement of the lower portions of such walls and floor incident to expansion and contraction.

The walls 12 and 13 are lashed or connected to the floor by means of tension members or tie-rods 39 which connect the lower ends of the pivoted buckstays to the floor, and the buckstays acting through the compression elements 38 transmit the tension forces set up by the tie-rods 39 into compression forces acting against the walls 12 and 13.

The means for lashing the rear wall 12 to the floor 17 is clearly illustrated in Figs. 6 and 7. Channels 40 are disposed transversely of and at each side of the lower and reduced ends of the floor tubes 18. The channels engage at one side lugs 40a which are welded to the top and bottom sides of the tubes 18 and engage at the other side clamps 40b which serve to hold blocks 41 and 22 on the wall tubes. The blocks 22 have been previously described as ledge blocks for closing the spaces between the wall tubes and for relieving thrust of the slag pool on the side and rear

walls. The blocks 41 also close the spaces between the wall tubes. An angle plate 22a serves as a sealing means to aid in preventing leakage of slag. Bolts 41a connect the channels to the tubes and one end of the rods 39 is pivotally connected to the bolts, the other end of the rods pass between spaced channels 39a, the latter rigidly connecting the outer ends of buckstays 33 for movement in unison about their pivots. Nuts 42 on the threaded outer ends 43 of the rods 39 serve to tighten the connection with the channels 39a and buckstays 33. Thus the wall 12 is firmly held against the floor 17.

The manner of lashing or connecting the floor to the side walls 13 is illustrated in Figs. 4 and 5. The outer ends of the tie-rods are connected to the buckstays 33 and through the compression members or beams 38 to the wall 13 in the same manner as was previously described. The inner ends of the tie-rods are connected to spaced channel sections 44 which are arranged above and below rounded extensions 46 of plate members 45. The plate members extend transversely of the tubes 18 and are secured to other plates 48 also extending transversely of the tubes 18. The plates 45 and 48 are secured to the floor by bolts 45a which also serve as the means for securing the blocks 20 and clamps 21 to the tubes. Plates 49 extend between the spaced plates 48 and are connected thereto by any suitable means, such for example, as welding as indicated at 49a. The rounded outer ends 46 of plates 45 are threaded and nuts 47 serve to connect the plates 45 to the channel sections 44, and hence the floor to the tie-rods. It will thus be seen that the side walls 13 are securely lashed to the floor in the same manner as the rear wall is lashed to the floor.

An additional feature of the construction is illustrated in Fig. 2 wherein the horizontal longitudinal members external to the furnace wall, are broken up, that is to say, a member does not extend continuously across the wall. Sliding contact between the wall and these members is provided in the same manner as has been described in connection with the blocks 37 and the I-beams 38. The purpose of such a construction is to allow for the fact that the wall being heated to a greater degree will expand to a larger extent than will these external members.

When the furnace here illustrated is actually built, it is found desirable to anticipate the expansion of the floor, and to deflect each wall inwardly toward its lower end. Thus, when the furnace is put into operation, and becomes heated, the floor expands and the lower ends of the walls are deflected outwardly. The wall then becomes straight. It is necessary, of course, to provide the proper initial clearances between adjacent wall ends in order that proper contact may be made between them when each wall becomes straight. It is also necessary to make appropriate adjustment of the nut 42 on the end of the tie-rod 39 in order that the pivoted buckstay 33 may be properly stressed.

It will be noted that in the present construction there is little relative movement between the walls and the floor. A constant seal against slag leakage is, therefore, maintained.

Other forms of the invention which do not depart in principle from the description given above or from the appended claims will readily suggest themselves to those dealing with the furnace problem.

With this understanding,

I claim:

1. In a furnace, four walls, a floor comprising water tubes surrounded by said walls and connected thereto, means for restraining one of said walls against all motion at one point therein, means providing slidable support for the rest of the restrained wall, for said other walls, and for said floor, and means for exerting limited restraint upon the wall opposite said restrained wall.

2. In a furnace, four walls, a floor comprising water tubes surrounded by said walls and connected thereto, a fixed support, a wall connection fixed to the support for restraining one of said walls against all motion at one point therein, means providing slidable support for the rest of the restrained wall, for said other walls, and for said floor, a pivoted buckstay mounted for exerting limited restraint upon the wall opposite said restrained wall, connections between the buckstay and the floor, and a wall stop carried by the buckstay and contacting with a wall.

3. In a furnace, walls, a floor comprising water tubes surrounded by said walls and connected thereto, means for restraining one of said walls against all motion at one point therein, rolling elements providing support for the rest of the restrained wall, other rolling elements providing support for the other walls, and means providing slidable support for the floor.

4. In a furnace, walls, a floor comprising water tubes surrounded by said walls and connected thereto, means for restraining one of said walls against all motion at one point therein, rolling elements providing support for the rest of the restrained wall, other rolling elements providing support for the other walls, and means providing slidable support for the floor, in combination with means for exerting limited restraint upon the wall opposite said restrained wall.

5. In a furnace, walls, a floor comprising water tubes surrounded by said walls and connected thereto, a fixed support, a wall connection fixed to the support for restraining one of said walls against all motion at one point therein, rolling elements providing support for the rest of the restrained wall, other rolling elements providing support for the other walls, means providing slidable support for the floor, in combination with a pivoted buckstay mounted for exerting limited restraint upon the wall opposite said restrained wall, connections between the buckstay and the floor, and a wall stop carried by the buckstay and contacting with a wall.

6. In a furnace, a front wall, a fixed support, a wall connection fixed to the support for restraining said front wall against all motion at one point therein, a back wall opposite said front wall, side walls, rolling elements providing support for the unrestrained parts of said front wall, rolling elements providing support for said back wall and said side walls, pivoted buckstays mounted for exerting limited restraint upon said back walls and said side walls, connections between the buckstay and the floor, and a wall stop carried by the buckstay and contacting with a wall.

7. In a furnace, a front wall, a fixed support, a wall connection fixed to the support for restraining said front wall against all motion at one point therein, a back wall opposite said front wall, side walls, a floor surrounded by said walls, means providing slidable support for said floor, rolling elements providing support for the unrestrained parts of said front wall, rolling ele-

ments providing support for said back wall and said side walls, pivoted buckstays mounted for exerting limited restraint upon said back wall and said side walls, connections between the buckstay and the floor, and a wall stop carried by the buckstay and contacting with a wall.

8. In a furnace, a front wall, a fixed support, a wall connection fixed to the support for restraining said front wall against all motion at one point therein, a back wall opposite said front wall, side walls, a floor comprising water tubes surrounded by said walls and connected thereto, and means providing slidable support for said floor, in combination with rolling elements providing support for the unrestrained parts of said front wall, rolling elements providing support for said back wall and said side walls, pivoted buckstays mounted for exerting limited restraint upon said back wall and said side walls, connections between the buckstay and the floor, and a wall stop carried by the buckstay and contacting with a wall.

9. A slag tap furnace comprising, in combination, a floor including spaced cooling tubes and adapted to support a pool of slag deposited from the products of combustion, walls including spaced cooling tubes and extending to positions below the floor level, tension members connected to the floor tubes, buckstays pivoted at their upper ends at positions considerably above the furnace floor, means connecting the tension members and the buckstays, compression members interposed relative to the walls and the buckstays to press the walls against the marginal portions of the floor, a fixed support, a rigid connection between the support and one wall at one position along that wall, and supports for other parts of the last mentioned wall and the floor permitting these parts to move toward or from the position of said connection with the fixed support.

10. A slag tap furnace, comprising, in combination, means for burning a slag producing fuel in the furnace, a floor constructed to sustain a pool of slag and including spaced cooling tubes, walls about the floor and including spaced wall tubes, a fixed support, a rigid connection between the support and the floor and one wall of the furnace at one position, secondary wall supports providing for movement of the parts of that wall remote from said connection toward or away from said position, floor supports providing for movement of the floor toward or from said position, means connected to the floor tubes and contacting with another wall of the furnace to provide an increase or decrease in the cross section of the furnace near the slag pool greater than at the top of the furnace while maintaining the last named wall in slag tight contact with the floor.

11. A slag tap furnace, comprising, in combination, means for burning a slag producing fuel in the furnace, a floor constructed to sustain a pool of slag and including spaced cooling tubes, walls about the floor and including spaced wall tubes, a fixed support, a rigid connection between the support and the floor and a part of one wall of the furnace at one position, secondary wall supports providing for movement of the other parts of that wall toward or away from said position, floor supports providing for movement of the floor toward or from said position, means connected to the floor tubes and contacting with another wall of the furnace to provide an increase or decrease in the cross section of the furnace near the slag pool greater than at the top of the furnace while maintaining the last named wall in slag tight contact with the floor.

12. A slag tap furnace comprising, in combination, a front wall including wall cooling tubes, a burner secured at a position on that wall for burning a slag producing fuel in the furnace, a fixed support adjacent said position, a floor adapted to maintain a pool of slag in the furnace and including spaced floor cooling tubes, a rigid connection between the support and said wall at one point adjacent said position, secondary wall supports on both sides of said connection, secondary floor supports, and other furnace walls including wall cooling tubes, and means for pressing the walls into slag-tight engagement with the floor, the front wall and the floor being movable relative to the secondary supports.

13. A slag tap furnace, comprising, in combination, means for burning a slag producing fuel in the furnace, a floor constructed to sustain a pool of slag and including spaced cooling tubes, walls about the floor and including spaced wall tubes, a fixed support, rigid connection between the support and the floor and a part of one wall of the furnace at one position, secondary wall supports providing for movement of the other parts of that wall toward or away from said position, floor supports providing for movement of the floor toward or from said position, means connected to the floor tubes and contacting with another wall of the furnace to provide an increase or decrease in the cross section of the furnace near the slag pool greater than at the top of the furnace while maintaining the last named wall in slag tight contact with the floor, and a guide device acting on two of said walls to maintain one edge of each against movement transversely of the plane of said one wall.

14. A slag tap furnace, comprising, in combination, means for burning a slag producing fuel in the furnace, a floor constructed to sustain a pool of slag and including spaced cooling tubes, walls about the floor and including spaced wall tubes, a fixed support, rigid connection between the support and the floor and one wall of the furnace at one position, secondary wall supports providing for movement of the parts of that wall remote from said connection toward or away from said position, floor supports providing for movement of the floor toward or from said position, and means connected to the floor tubes and contacting with another wall of the furnace to provide an increase or decrease in the cross section of the furnace near the slag pool while maintaining the last named wall in slag tight contact with the floor, said means including compression parts contacting with and acting upon the side walls at vertically spaced positions at appreciable distances above the slag pool.

15. A slag tap furnace comprising, in combination, a floor constructed to sustain a pool of slag and including spaced cooling tubes, walls including spaced cooling tubes and extending to positions below the floor level, buckstay elements movably supported exteriorly of the walls, compression members interposed between the buckstay elements and the walls, tension members connecting the floor tubes and the buckstay elements whereby the latter force the compression members against the walls and the walls are pressed against the marginal portions of the floor, a fixed support, a rigid connection between the support and one wall at one position along

that wall, and supports for other parts of the last mentioned wall and the floor providing for movement of these parts toward or from the position of said connection with the fixed support, this combination of elements providing for greater increases and decreases in the cross sectional area of that part of the furnace adjacent the slag pool than that part which is adjacent the top of the furnace without impairing the maintenance of the slag pool.

16. A slag tap furnace comprising, in combination, a floor constructed to sustain a pool of slag and including spaced cooling tubes, walls including spaced cooling tubes and extending to positions below the floor level, force-transmitting members disposed exteriorly of the furnace walls, tension members respectively connecting the floor with the force-transmitting members, compression members interposed respectively between the force-transmitting members and the furnace walls whereby the forces set up by the tension members will be transmitted to the walls through the compression members and the walls will be pressed against the marginal portions of the floor, a fixed support, a rigid connection between the support and one wall at one position along that wall, and supports for other parts of the last mentioned wall and the floor providing for movement of these parts toward or from the position of said connection with the fixed support.

17. In a slag tap furnace, the combination of upright fluid cooled walls defining a combustion chamber, a fluid cooled floor extending transversely between the walls and constructed to sustain a pool of molten slag thereon, a rigid support, means adjacent the meeting edges of one upright wall and the floor for anchoring such wall and floor to the rigid support, and means for supporting the other walls and the remaining portions of the floor and providing for movement thereof incident to expansion and contraction and means providing a liquid tight connection between the marginal edges of the floor and the upright walls.

18. In a slag tap furnace, the combination of upright fluid-cooled walls defining a combustion chamber, a fluid-cooled floor extending transversely between the walls and constructed to sustain a pool of molten slag, a rigid support, means for anchoring one of the upright walls at a point adjacent the lower portion thereof to the rigid support, means connecting said one wall to the floor, means for movably supporting the remaining portions of said one wall, the remaining upright walls and the floor to provide for the movement thereof relative to the point of anchorage due to expansion and contraction, and means providing for the maintenance of a liquid-tight connection between the upright walls and the floor.

19. In a slag tap furnace, the combination of upright fluid-cooled walls defining a combustion chamber, a fluid-cooled floor extending transversely between the upright walls and constructed to sustain a pool of molten slag, a rigid support, means for anchoring one of the upright walls and the floor at one point to the rigid support, means for movably supporting the remaining portion of said one wall, the floor, and the remaining upright walls to permit movement thereof relative to the point of anchorage due to expansion and contraction, and means connecting the floor and walls to prevent the leakage of molten slag therebetween.

20. In a slag tap furnace, the combination of upright walls defining a combustion chamber and composed of upright tubes with closure means between the tubes, a floor disposed transversely of the bottom of the combustion chamber and constructed to sustain a pool of molten slag, the flooor comprising a row of spaced tubes and closure means betweer the tubes, a header extending across the lower ends of the tubes forming one of the upright walls and common to both the tubes of said one wall and to the tubes of the floor, means for rigidly anchoring the header at one point to a fixed support, and supporting means for the remaining portions of said header, said one furnace wall and the floor, and providing for movement thereof toward and away from the point of anchorage to permit expansion and contraction.

21. In a furnace, the combination of upwardly-extending walls defining a combustion space, a boiler in communication with said space, a floor extending transversely beneath said space and constructed to sustain a pool of molten slag, each of said walls and the floor comprising spaced cooling tubes having circulatory connections to the boiler and means for closing the spaces between tubes, means for positively connecting the peripheral edges of the floor with the lower portions of the upwardly-extending walls so as to prevent the leakage of slag therebetween, and means for supporting said walls and floor in such a manner as to provide for movements thereof incident to expansion and contraction without impairing the aforesaid connecting means between the walls and floor.

22. In a furnace, the combination of upwardly-extending walls defining a combustion space, a boiler in communication with said space, a floor extending transversely beneath said space and constructed to sustain a pool of molten slag, each of said walls and the floor comprising spaced cooling tubes having circulatory connections to the boiler and means for closing the spaces between tubes, means for positively connecting the peripheral edges of the floor with the lower portions of the upwardly-extending walls so as to prevent the leakage of slag therebetween, and means for supporting said walls and floor and for preventing bodily displacement of the entire assembly while insuring freedom of expansion of the members locally in such a manner as not to impair the integrity of the structure or the tightness of the joints between the floor and walls.

23. In a furnace, the combination of means defining a combustion chamber including upwardly-extending walls and a floor, lateral stiffening and positioning means for at least one of the walls and comprising a fixed abutment support restraining the stiffened wall against outward movement at points intermediate the heights thereof, and relatively stiff elongated members, each member being pivotally connected at one end to a support and extending downward along the lower portion of the stiffened wall and positively connected at its lower end to said one wall.

24. In a furnace, the combination of upwardly-extending walls defining a combustion space and comprising spaced cooling tubes; a bottom extending transversely beneath said space and constructed to sustain a pool of molten slag resulting from the combustion of fuel in said space; and lateral stiffening and positioning means for at least one of the walls and comprising a fixed abutment support restraining the stiffened wall

against outward movement at points intermediate the height thereof, a plurality of upwardly-extending relatively stiff members disposed at the outside of the stiffened wall, means for pivotally connecting the upper ends of the stiff members to the abutment support so as to provide for movement of the lower portions of the members in directions toward and away from the stiffened walls, and means for positively connecting the lower portions of the stiff members to the lower portions of the stiffened wall.

25. Apparatus according to claim 24 wherein means is provided for securing the lower portions of the stiff members to the bottom so as to prevent the separation of the stiffened wall from the bottom.

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