July 24, 1962 L. S. LONGENECKER 3,045,994

FURNACE BACK WALL CONSTRUCTION

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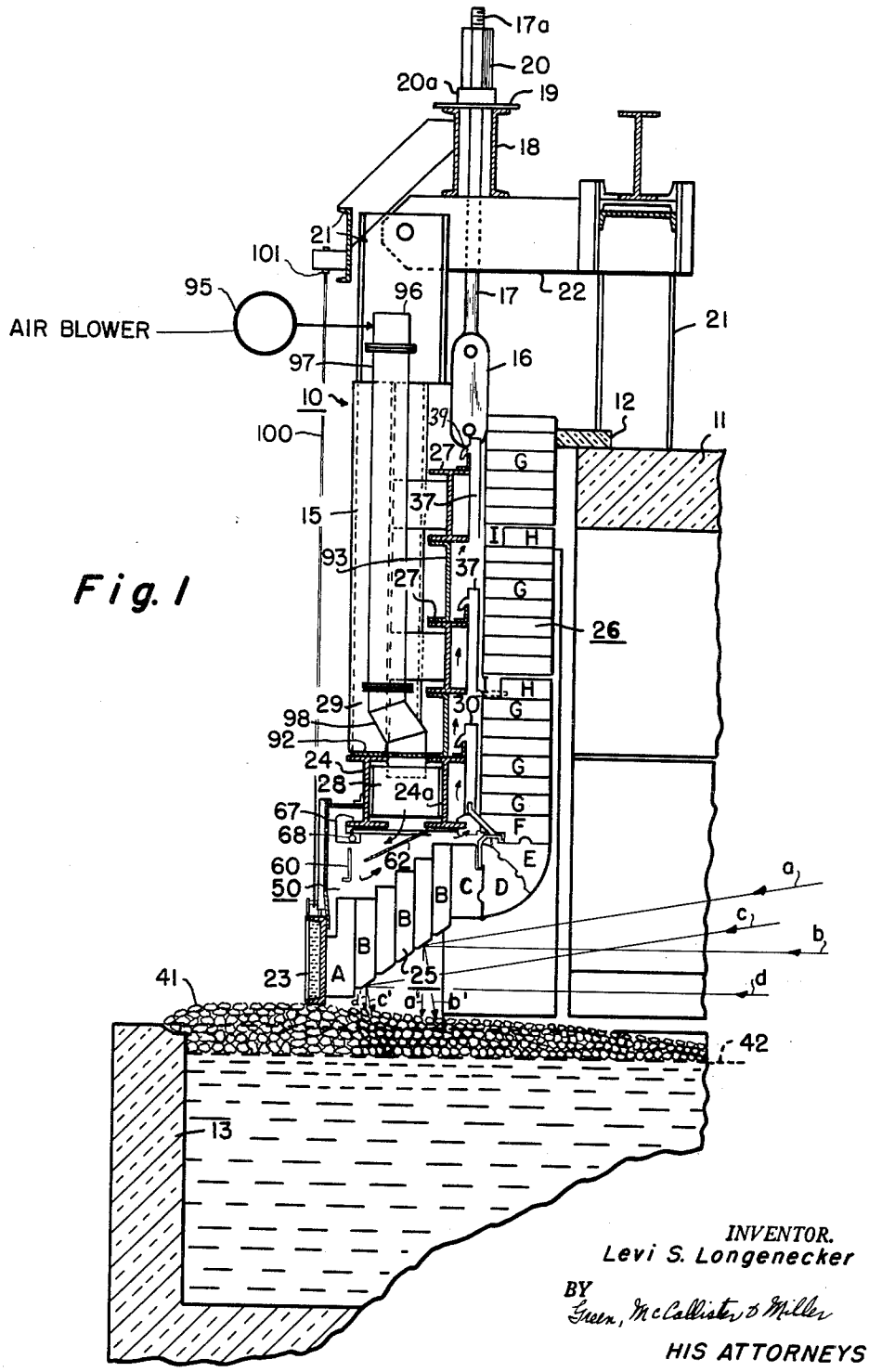


Fig. 1

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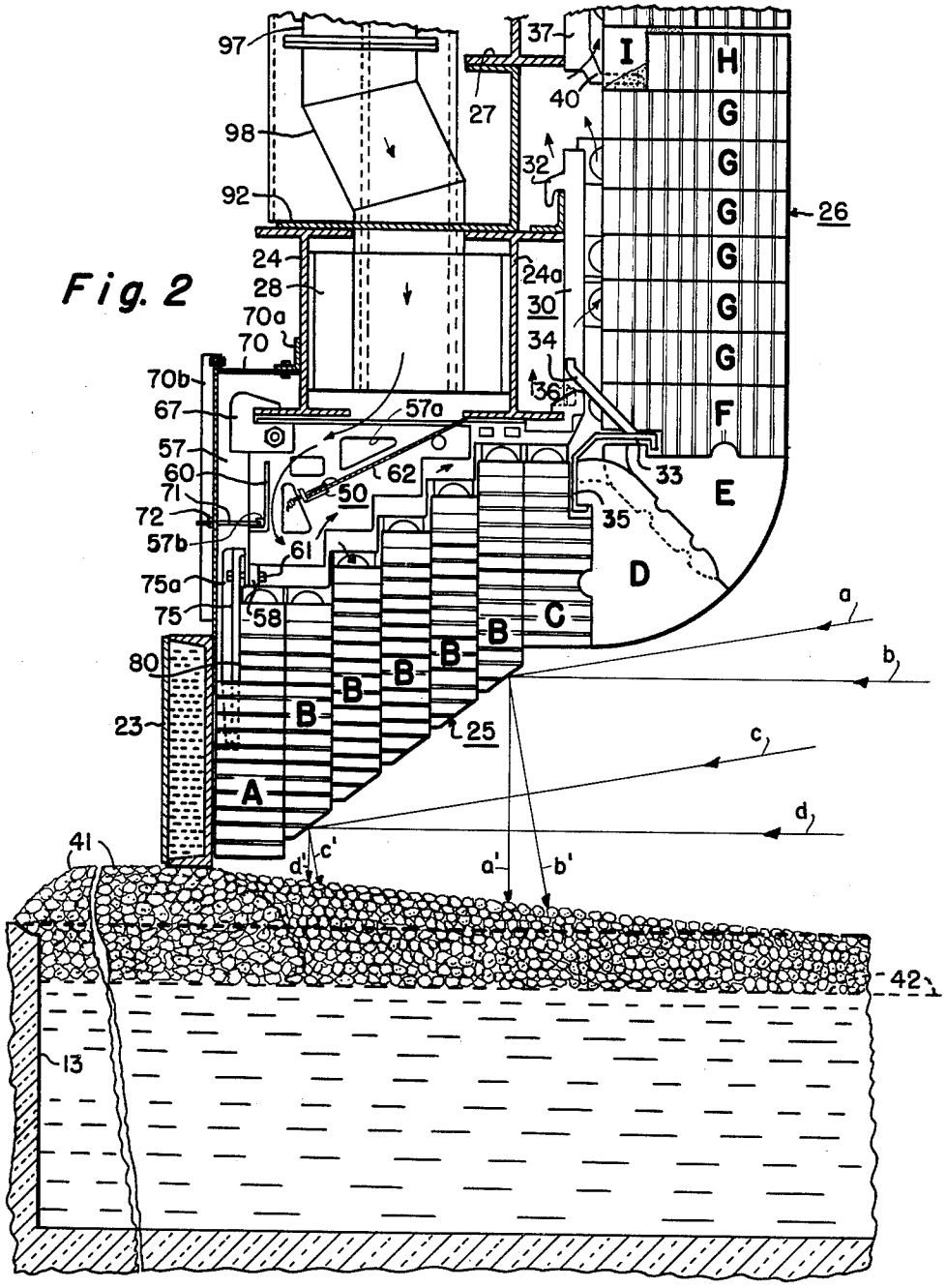
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FURNACE BACK WALL CONSTRUCTION

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Fig. 2



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FURNACE BACK WALL CONSTRUCTION

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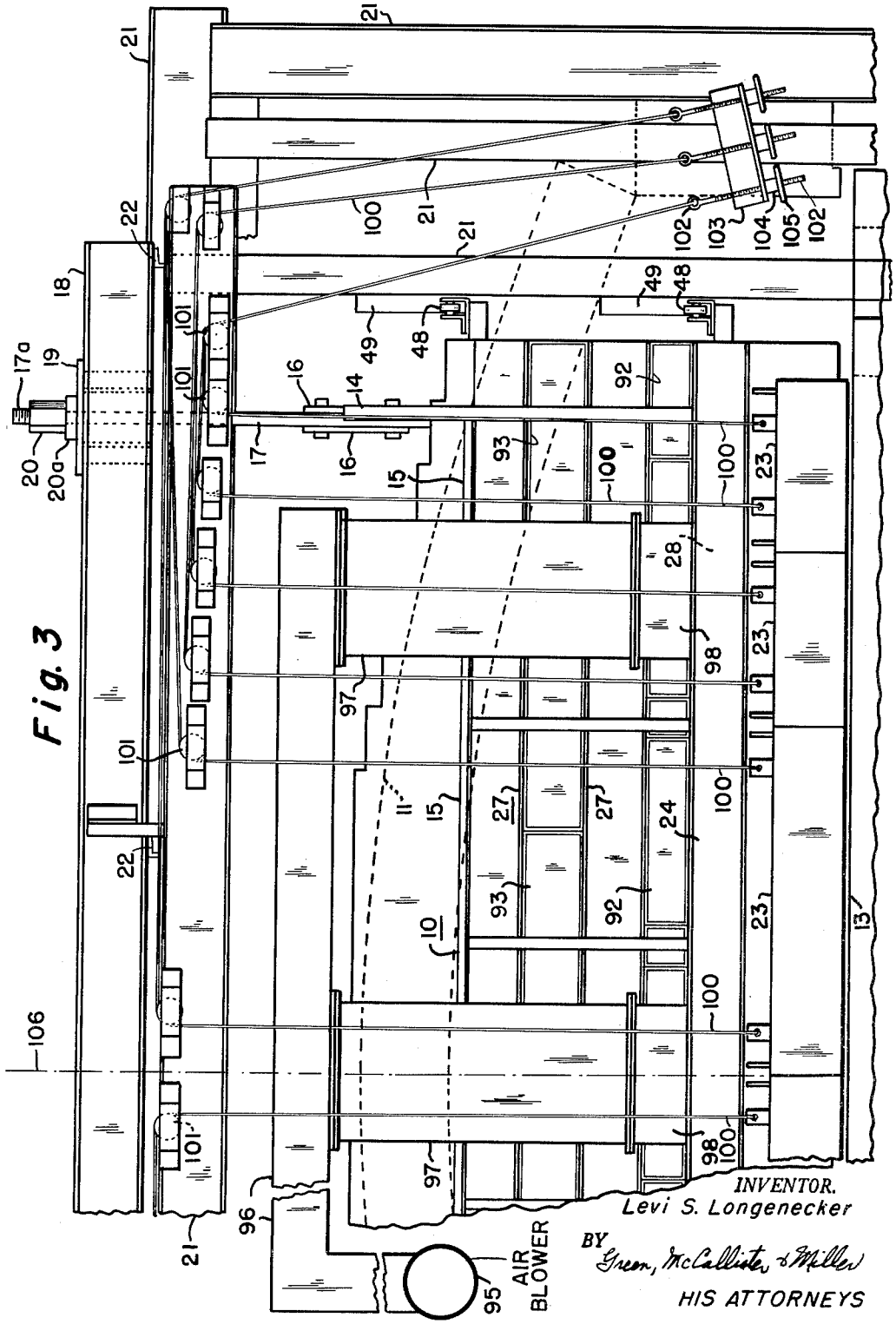


Fig. 3

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FURNACE BACK WALL CONSTRUCTION

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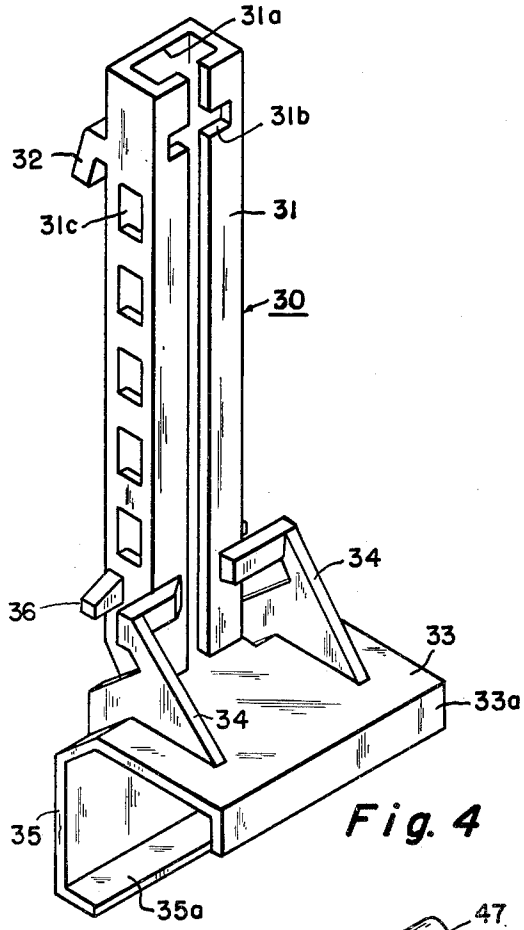


Fig. 4

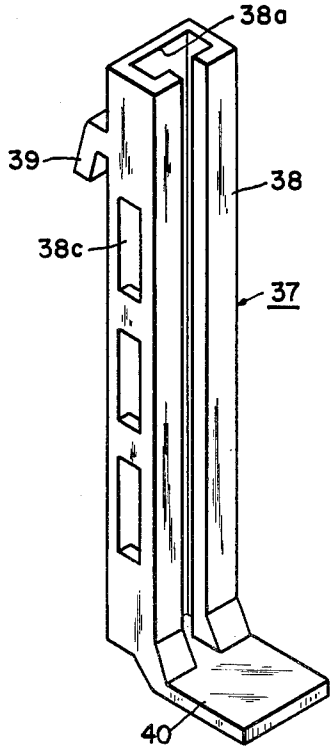


Fig. 5

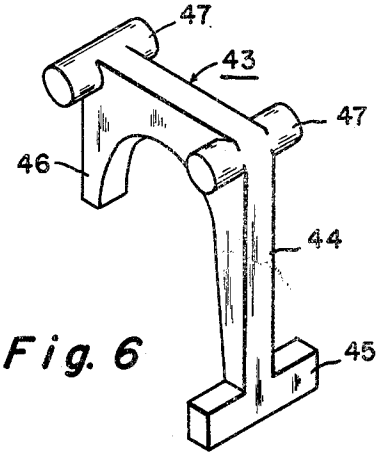


Fig. 6

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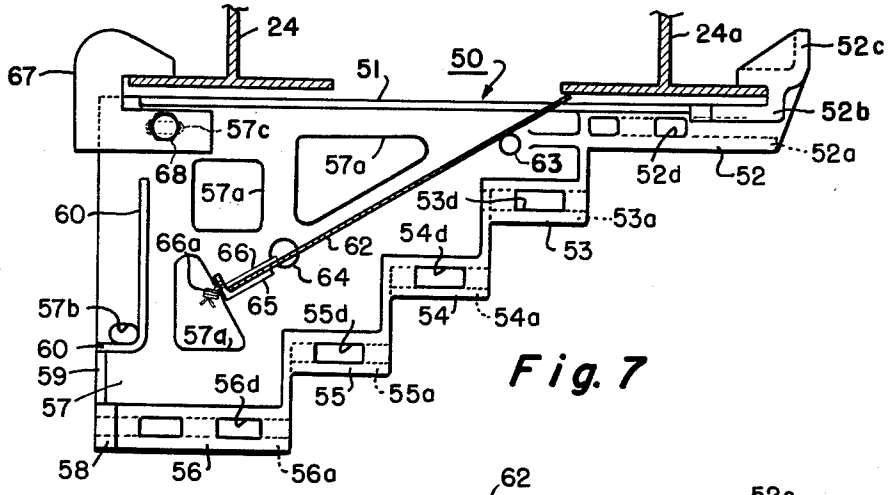


Fig. 7

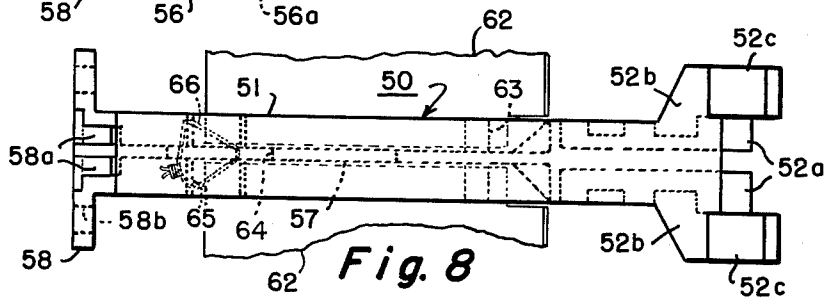


Fig. 8

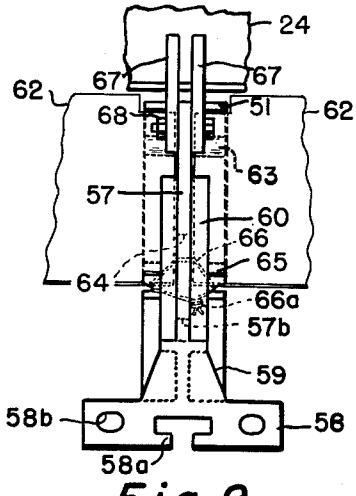


Fig. 9

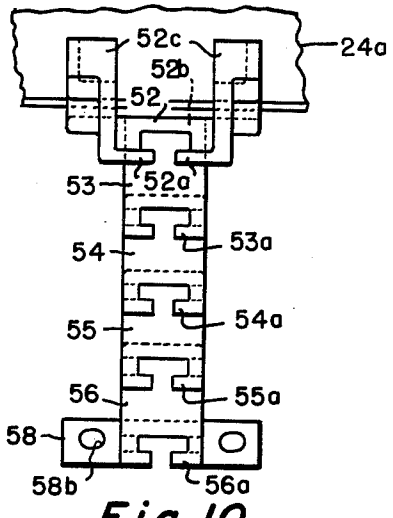


Fig. 10

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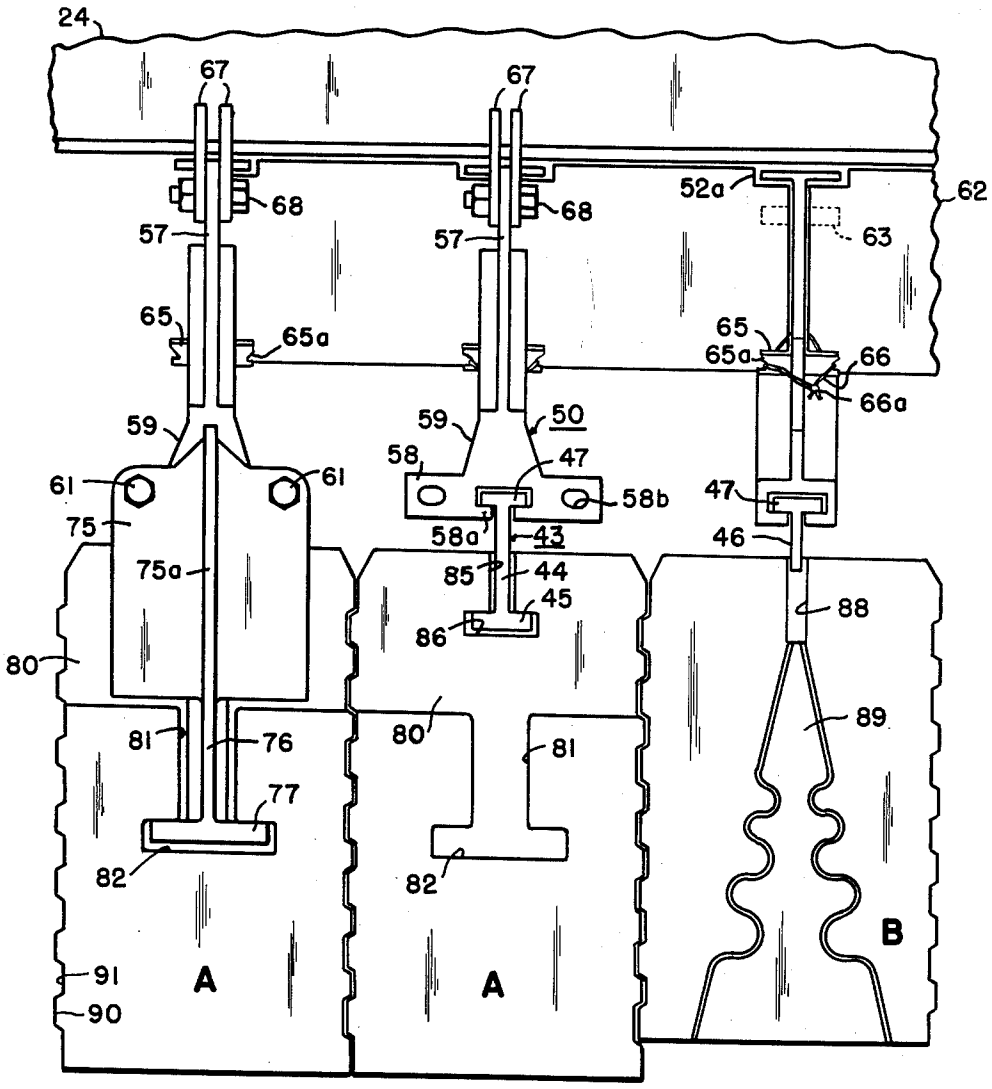


Fig. 11

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FURNACE BACK WALL CONSTRUCTION

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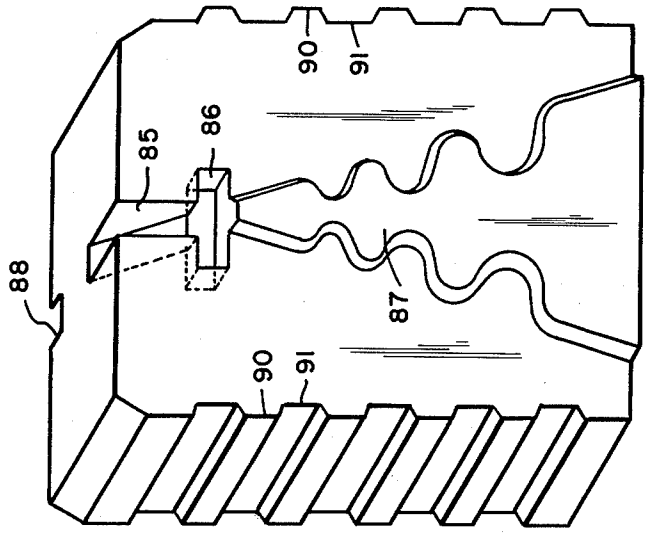


Fig. 12

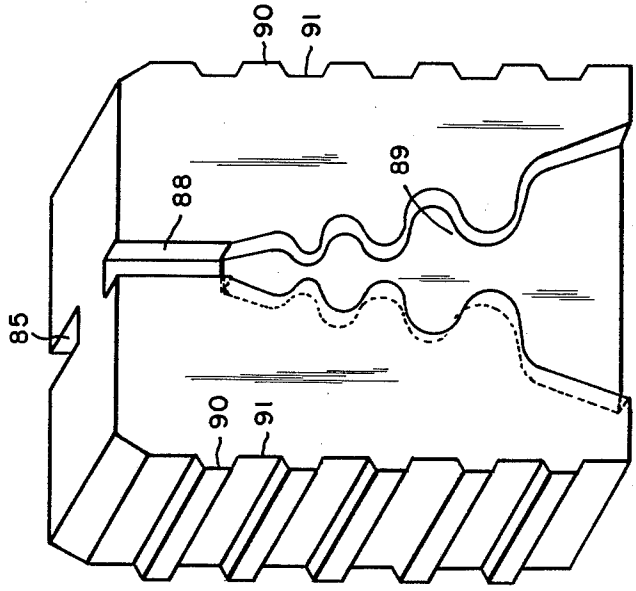


Fig. 13

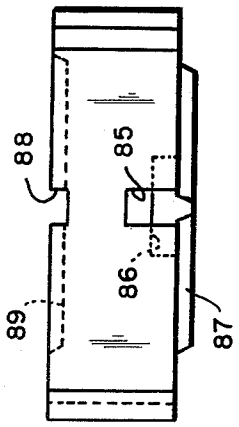


Fig. 14

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United States Patent Office 3,045,994 Patented July 24, 1962

3,045,994

FURNACE BACK WALL CONSTRUCTION

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Filed Aug. 16, 1960, Ser. No. 50,005
8 Claims. (Cl. 263—46)

This invention pertains to an improved furnace for melting materials, such as vitreous materials used in making glass, and particularly to an improved furnace back wall construction for increasing the life of the back wall and the efficiency of the furnace.

The invention deals with a back wall such as is employed adjacent the charging bay or fritting chamber of a furnace structure. Such a back wall utilizes a steel or metal frame structure or structural assembly, a vertical wall part for closing-off an open back end of the furnace melting chamber, and a backwardly-projecting wing or apron part of substantially horizontal positioning that is adapted to lie above or closely adjacent to the charging bay or doghouse of the furnace and to, with such bay, define a charging or feed opening. It is well recognized that a back wall construction should have an as close as practicable relationship with respect to the charging bay, so as to minimize heat losses and to, as quickly as possible, melt the frit and other materials as they are added. However, the opening should be of a size sufficient for the feeding operation and should enable a positioning, particularly of the apron or wing part, sufficiently above the charging bay, such that the back wall will have a reasonable period of operating life from the standpoint of its structural steel members and refractory parts. A back wall for this purpose is customarily suspended, being mounted independently of the walls and roof of the furnace, and having means for vertically adjusting it so as to adjust the size of the feed opening.

Due to the intense heat involved in the melting operation, some tendency for the flame to at least occasionally sting-out through the charging opening, etc., it has been found advisable to provide active cooling means to protect the back wall, particularly as to its wing or nose part. In this connection, I provide the refractory back face of the apron part with protective water jackets, and actively apply cooling air to the outer or top ends of the refractory tile members, to not only cool the refractory tile members, but also the metal or steel structural support members and hanger brackets and hangers.

The present invention deals with the problem of providing a more efficient minimized size of feed opening for the furnace, of making a more effective utilization of the heat generated in the furnace to quickly and fully melt the charging materials, of minimizing heat loss from the feed opening and adjacent the charging bay or chamber that leads to the main furnace chamber or pot. It involves the utilization of an improved flow of cooling fluid, the elimination of the need for smooth surface mortar or cement joints between rows of refractory tile members, and a construction of the metal or steel structure as well as a manner of suspending the refractory tile members to minimize the deteriorating effect of intense heat on the tile members and, at the same time, to increase the melting efficiency of the furnace.

It has thus been an object of my present invention to devise a new and improved form of back wall construction for a melting furnace; and particularly, from the standpoint of its wing or apron part;

Another object has been to provide a furnace back wall that makes possible a more intense and efficient heating of the charged materials in the furnace while, at the same time, minimizing wear and tear on the refractory and metal materials of the back wall;

Another object of my invention has been to devise a furnace back wall whose wing or apron part is inclined or sloped and employed in such a manner as to provide for radiant heat refraction into the charging bay of the furnace, and to make possible a relatively small feed or charging opening, while increasing the life of the back wall construction, particularly from the standpoint of its refractory lining;

A further object of my invention has been to develop an improved cooling system and structural arrangement of a furnace back wall and to do so in such a manner as to provide for a more efficient utilization of the heat of the furnace for melting the charging materials and for a better dissipation of heat from the back wall to increase its operating life;

These and other objects of my invention will appear to those skilled in the art from the illustrated embodiment, the drawings and the claims.

In the drawings, FIGURE 1 is a side section in elevation along the center line of a furnace, particularly illustrating my improved form of back wall construction as utilized in connection therewith;

FIGURE 2 is a side section in elevation on an enlarged scale of the structure of FIGURE 1, particularly illustrating the stepped construction of the apron part of my new and improved back wall construction;

FIGURE 3 is a fragmental end view in elevation of the furnace of FIGURES 1 and 2 on a slightly smaller scale than FIGURE 1; and particularly illustrating structural members, the manner of suspending the back wall, the relationship of the back wall with respect to the furnace roof, air seals, and an air piping system for supplying cooling fluid to the back wall;

FIGURE 4 is an enlarged isometric view in elevation of a box-like upright metal nose post or casting employed in my back wall structure;

FIGURE 5 is an isometric view on the scale of FIGURE 4 of a box-like metal hanger bracket or casting for main portions of the vertical part of my back wall construction;

FIGURE 6 is an isometric view in elevation on the scale of FIGURES 4 and 5 of a metal hanger employed for the refractory tile members of my back wall;

FIGURE 7 is a side sectional detail in elevation on an enlarged scale as to FIGURE 2 and showing the construction and mounting of a metal step-down apron bracket or casting of my construction and also illustrating baffling for directing cooling fluid therealong;

FIGURE 8 is a top plan view of the apron bracket or casting of FIGURE 7 on the scale of such figure;

FIGURE 9 is an end view in elevation on the scale of and taken from the left of FIGURES 7 and 8, illustrating the back end of the apron bracket or casting;

FIGURE 10 is an end view in elevation on the scale of and taken along the right side of FIGURES 7 and 8;

FIGURE 11 is an enlarged back view in elevation on a larger scale than FIGURE 2 and a slightly smaller scale than FIGURE 12, illustrating the mounting of selected tile of adjacent refractory tile member rows of the apron or wing part with respect to each other and individually, and from the standpoint of an overhead hanger system; in this figure, the first row (to the left) shows an end refractory tile as held in position by an end or heel clamp of FIGURE 2, the intermediate or second row illustrates the same tile but with the end clamp removed, and the third (or right-hand) row illustrates a second tile in a suspended relationship and from the standpoint of its grooved face side;

FIGURE 12 is an enlarged elevation of refractory tile members that are employed in both the vertical and the apron parts of my back wall construction, taken from a tongue face side thereof;

FIGURE 13 is a view similar to FIGURE 12, taken from the grooved face side of the refractory tile; and

FIGURE 14 is a top plan view of the tile of FIGURES 12 and 13 and on the same scale as such figures.

As shown in FIGURE 1, I have provided a back wall construction **10** that is suspended adjacent the open back end of a furnace that has a refractory roof **11**, and that is sealed with respect thereto by sealing block or tile **12**. A fritting chamber, doghouse or charging bay **13** is shown extending backwardly from the bottom of the furnace and beyond the back wall **10** to define a feed opening with a lower, surmounting, somewhat horizontal, apron or wing part **25**. An adjustable steel or metal support structure **15** for the adjustable back wall is carried by a pair of links **16** and a pair of adjustment rods **17** from an overhead, cross-framing beam member assembly or pair **18** that rests on a pair of longitudinal members **22** (see also FIGURE 3). The beam structure **18** and **22** is secured to and cooperates with top and side frame members or buckstays **21**, shown particularly in FIGURE 3.

The rods **17** are adjustably suspended from the beam assembly **18** by means of nuts **20**, anti-friction thrust bearing collars **20***a*, and washers **19**. This support structure may be similar to the structure shown and described in my Patent No. 2,272,217 of February 10, 1942.

The back wall has row assemblies of refractory tile which make up its apron or wing part **25** and its upright or vertical wall part **26**. The apron part **25** comprises a group of refractory tile members assembled as a series of backwardly-projecting rows in a side-by-side, longitudinally-abutting and positive interlatching relationship with each other. Each row, as shown particularly in FIGURES 1 and 2, is made up of a series of tile members, consisting of end tile A and C and intermediate tile B. Swing-in mounted nose tile D and E are employed to connect the apron part **25** with the vertical wall part **26**. Nose tile D and E may be of a type and mounting shown and described in my Patent No. 2,806,452 of September 17, 1957. The vertical part **26** of the back wall is made up of a bottom support tile F, intermediate tile G and ship-lap expansion joint tile H and I. As shown particularly in FIGURES 1 and 2, the back end tile members A of the longitudinally-extending tile rows of the apron part **25** are provided with metal water-jackets, chests or back face coolers **23**.

A pair of horizontally spaced-apart, lower I-beam members **24** and **24***a* that are carried by the suspended wall frame structure **15**, are employed to suspend the refractory tile of the nose part **25** through the agency of a step-down apron bracket or casting **50**, see also FIGURES 2 and 7. The vertical wall part **26** is carried by vertically spaced-apart I-beam members **27** and the inner beam member **24***a* of the nose part. A nose post or casting **30** cooperates with the beam member **24***a* to suspend the nose tile or block D and E, as well as the lower portion of the vertical wall part **26**. Vertical nose brackets **37** cooperate with I-beam members **27** to suspend the upper portions of the vertical back wall part **26**.

As shown particularly in FIGURES 1, 2 and 3, enclosed wind boxes **28** are carried between the I-beam members **24** and **24***a* and are supplied with cooling fluid (such as air) under pressure from a remotely-positioned blower **95**, through an overhead manifold **96**, vertical supply pipes **97**, and offset end connectors **98**. In this manner, I actively supply cooling fluid to the outer reaches or ends of the tile members of the parts **25** and **26**, as well as to adjacent structural metal members and hangers, as controlled or directed by baffling, air-sealing or end and side closure members, and a throat defined by the corner joining the wall parts **25** and **26** and the bottom flange of beam member **24***a*. The arrows of FIGURES 1 and 3 show the flow of cooling air under pressure downwardly from the wind boxes **28**, between beams **24** and **24***a*, along the apron castings **50**, around a baffle **62** of each casting, upwardly along the outer reaches or upper ends of the tile members of the apron part **25**, up along the inside of beams **24***a* and **27**, along outer reaches of the nose block D and E, past closure plates **92** and **93**, along the outer reaches or ends of the tile members of the vertical wall part **26**, and into the atmosphere from the upper end of the wall part **26**.

As shown particularly in FIGURE 4, the nose post casting or hanger bracket **30** for each tile row is constructed to provide a pivot support for the nose block D and E, as well as a vertical support for the lower portion of the refractory tile of the vertical part **26** of the back wall. The bracket **30** has a vertically-extending or upright box-like portion **31** that has a longitudinally or vertically-extending, inner slotted portion therealong that is open to a guide bore **31***a*. The guide bore **31***a* is shown open at its top end to facilitate the vertical introduction and removal of hangers **43** (see FIGURE 6). This provides a T-shaped slide-guide suspension means for the hangers **43**. A cross slot **31***b* is located adjacent the upper end of the box-defining portion **31** to also provide for inner side entrance and removal of the hangers **43** from the guide slot. A series of spaced-apart windows or ventilation openings **31***c* are provided along the sides of the box-like portion **31** for cross-circulation of cooling fluid during its movement along the back wall construction.

A backwardly-projecting lug **32** extends from the box portion **31** to hook over a channel carried by the beam member **24***a* (see FIGURE 2) and suspend the bracket therefrom to project downwardly along side edges of the flanges of such beam member. A pair of oppositely-positioned side lugs **36**, adjacent the lower end of the box-like portion **31**, are adapted to engage with a latching lug **52***c* on the inner end of the hanger casting **50**. A base or shelf portion **33** projects forwardly from the lower end of the box portion **31** and is reinforced in its positioning by a pair of legs **34**. The shelf **33** has a channel-shaped end portion **33***a* to define an upper support latch for the nose block E. A vertically-extending wall **35** projects downwardly from the shelf **33** and has an angle-shaped supporting edge **35***a* to engage with and latch-support the nose block D. It will be seen that the pivot-supporting mounting or suspension of the nose block D and E is effected by the nose post **30**, independently of the apron bracket or casting **50**.

The hanger bracket or casting **37** (see FIGURE 5), like the bracket **30**, has an upright or vertical box-like portion **38** which has an open, vertical, inner side slot to slidably receive hangers **43**. A longitudinal guide bore **38***a* is open at its upper end to facilitate vertically introducing and removing the hangers **43**. The box-like portion **38** also has side or cross-flow ventilation windows **38***c* and a backwardly-projecting mounting lug **39** (see also FIGURE 1) that is adapted to engage over a channel piece carried by one of the support beams **27**. A forwardly-projecting shelf **40** at the lower end of the box-like portion **38** serves as a segregating support for a section of refractory tile of the vertical part **26** so as to support the closure block I that cooperates with main closure block H.

Metal hangers **43** of somewhat inverted U-shape for the refractory tile are disclosed in FIGURE 6. As shown, such hangers at one end have a projecting latch leg portion **44** that carries a latch foot portion **45** extending at right angles thereto to define an inverted T-shape latching portion that is adapted to engage within side-mounted, inverted T-shape, top-latching slot portions **85** and **86** of one side face of the refractory tile, see FIGURE 11. The opposite end of the hanger **43** has a shortlength, I-shaped, leg portion **46** that is adapted, as shown in FIGURE 11, to enter a side-mounted, I-shaped, top-latching slot portion **88** of an opposite side face of the refractory tile. A pair of cylindrically-shaped suspension knuckles, rod-like projections or roller-shaped lugs **47** extend from the opposite sides at opposite ends of the upper or bridging portion of the hanger **43** to span and move along the slotted,

box-like portions of the hanger brackets 43, see for example, the box portion 31 of the nose post 30, the box portion 38 of the vertical bracket 37, and the box portions of the apron bracket 50. The knuckles 47 are adapted to enter through a cross-slot, such as 31*b* of the nose post casting 30 and 52*a* to 56*a* of the apron bracket or casting 50, and through an open-end slot of the bore 31*a* of the nose post bracket 30 or of the bore 38*a* of the vertical bracket 37 and to slide along their associated hanger bracket. The leg portions 44 and 46 of the metal hangers 43 provide a balanced, two-point suspension, individually and independently for each tile member, such that the tile members are not dependent on their interlatching relation with adjacent tile members for their suspension. In addition to a special type of metal nose post bracket 30, I also employ a special construction of metal step-down wing or apron bracket 50, see FIGURES 7 to 10, inclusive.

With particular reference to FIGURES 2 and 7 to 10, inclusive, the step-down wing bracket or apron casting 50 has a substantially horizontal, longitudinally-extending top flange 51 and a vertically-projecting, centrally-disposed plate or wall 57 that projects downwardly from the top flange 51. The wall 57 carries a series of serrated, stepped or offset box-like portions 52 to 56 along its longitudinal extent to provide a series of hanger-supports that are adapted to suspend refractory tile members A, B and C therefrom in a staggered relation to define a backwardly-declining wall lining that extends from the inside of the furnace outwardly along an outwardly or backwardly-converging inclined plane above the charging bay 13 and towards the furnace feed opening. The box portions have side windows or openings 52*d*, 53*d*, 54*d*, 55*d* and 56*d* for circulatory cross-movement of cooling air therethrough.

The box portion 52 has an upwardly-projecting forward-end clamp or lug 52*c* to engage over an inner portion of the bottom flange of the beam member 24*a* and latch therewith. As will be noted, the box portions have guide slots 52*a* to 56*a* that are open at their forward ends to facilitate the insertion of the hangers 43 in a longitudinally-slidable, downwardly-suspended relationship therefrom. The box-like portion 56 is also open at its back end through an end flange or mount 58, see slotted portion 58*a* of FIGURE 9.

The back end of the step-down nose bracket 50 is removably secured to an outer bottom flange portion of the outer beam 24 by a pair of clamp-on brackets or lugs 67. It will be noted that the brackets 67 are secured to project upwardly from the face of the vertical wall 57 by a bolt and nut assembly 68 that extends through a hole 57*c*.

The vertical wall plate 57 also has side windows 57*a* and 57*b* therein for air circulation. A pair of angle-shaped, vertical reinforcing side ribs 60 which are extensions of a pair of vertical end portions 59, project upwardly from the lowermost or end box portion 56 along opposite sides of the plate 57. A centrally-disposed baffle plate assembly 62 is, at its upper end, pivotally mounted on the wall 57 by a cross-positioned pivot pin 63 to incline backwardly-downwardly therefrom. The two side parts of the inclined baffle assembly 62 define a baffle of a width substantially equal to the width of the top flange 51, so that the parts on opposite sides of the wall 57 provide a guide path for cooling air moving downwardly from the wind box 28. A cross opening 64 in the wall 57 has a wire loop 66 extending therethrough. The sides of the wire loop 66 are adapted to extend along notches in a cross-extending tie bracket 65, so that when the ends 66*a* of the wire loop are lapped or knotted with respect to each other, a desired pivot-positioning of the side baffle assembly 62 is attained, see FIGURES 7 and 8.

As shown particularly in FIGURE 2, a back end baffle structure is secured to project backwardly and downwardly from the beam member 24 and consists of an angle-piece 70*a*, a horizontal or top cover plate 70, and a vertical back cover plate or piece 70*b*. The lower portion of the vertical baffle plate 70*b* is removably secured in position by a U-shaped bolt 71 having nuts 72 on its threaded ends. The loop of the U-shaped bolt 71 extends through a hole 57*b* in the wall 57 of the step-down nose bracket to project backwardly therefrom.

As indicated by the arrows of FIGURE 2, air introduced under pressure into the wind box 28 flows downwardly between the beam members 24 and 24*a*, backwardly along the top side of the baffle assembly 62, between the baffles 62, downwardly and then upwardly-forwardly along the box portions of the casting 50, to not only cool the metal work, but also outer or upper ends of the refractory tile members suspended thereby. Since each longitudinal row of the apron block or tile is adapted to be supported by one of the step-down brackets or castings 50, it will be apparent that cross-flow between adjacent apron brackets is accomplished through their side openings and that cross-flow also occurs through the side windows of their box portions. The arch suspension of the hangers 43 provides spacing between them and their suspended tile members through which cross flow is also accomplished.

In FIGURES 12 to 14, inclusive, I have illustrated the construction of the refractory tile members, employed both in the vertical wall part 26 as well as in the apron wall part 25. Each tile is of substantially rectangular shape, with opposed, substantially planar wide side faces and connecting, relatively narrow, opposed edge faces. Each tile has a somewhat pyramidal or tree-shaped, grooved, latching portion 89 that is centrally-disposed along one of its planar side faces and projects therealong in a diverging relationship toward the bottom or inner end of the tile. This same side face of the tile has an I-shaped suspension slot portion 88 that is open at its top or outer end to receive the stem or leg 46 of a metal hanger 43; the opposite side face has a suspension slot portion 85 that is open at its upper or outer end and is sloped downwardly-outwardly to receive leg portion 44. The slot 85 terminates at its bottom end in a cross slot portion 86 to latch-receive the foot 45 of the hanger. The slots 85 and 86 provide for a swing-in mounting of the tile member and together define a somewhat inverted T-shaped suspension-latching slot. The opposite face side of the tile, shown in FIGURE 12, has a tongue portion 87 that is complementary with and is adapted to latch-engage with the groove portion 89 of an abutting or adjacent tile of the same row. It will be noted that the portions 87 and 89 have rounded corners along their side convolutions and are substantially tree-shaped.

The narrow or edge faces or sides of the refractory tile are corrugated or have a series of transverse or cross-extending alternate tongues and grooves 90 and 91 that extend at right angles to the tongue and groove latching portions of the wide side faces and that, for a given tile, are, on one side edge, in an offset or staggered relationship with those on the opposite side edge, so that adjacent rows of tile may have an edge-interlatching relationship with abutting tile of adjacent rows of a nature that permits slidable longitudinal movement of one tile of one row with respect to an adjacent tile of an adjacent row, but prevents vertical or depthwise movement in either direction at right angles or perpendicular to the rows. It is thus important that, as shown in FIGURE 11, the tile members of each row are latched by the tongue and groove portions 87 and 89 in such a manner that their opposed narrow edge faces are aligned on a pair of opposed longitudinal planes along such row.

Referring again to FIGURE 2 of the drawings, and also to FIGURE 11, the back end or lowermost tile A of each row of the apron wall part has an indented or inwardly-offset upper side face portion 80 to receive an end clamp, bracket or heel plate member 75. The member 75 has a vertical rib 75*a* which projects downwardly to define a leg portion 76 and a cross latching foot portion 77 to fit within inverted T-shaped slotted portions 81 and

82 that are open to the ledge defined by the inwardly-offset portion 80 of the tile A. The end clamp member 75 is removably mounted in a clamping relationship against the front face of the end tile A by a pair of nut and bolt assemblies 61 whose bolts extend through holes 58*b* in a bottom mounting piece or flange 58 of the last box portion 56 of the step-down casting or bracket 50, see also FIGURES 9 and 10. As shown in FIGURE 9, the mount 58 has an open-end slide slot defined by its central portion 58*a* to facilitate the end insertion and removal of the metal hangers 43.

Each water cooler or chest 23 is suspended or hung by a pair of cables 100 (see FIGURE 3) from sheaves or pulleys 101 that are rotatably carried by an overhead member of buckstay structure 21 of the stationary frame structure. The other ends of the cables 100 are secured to the eyelets of threaded eye stems 102 that extend through a mount head 103 that is secured to a side member of the buckstay structure 21. A threaded adjustable hand wheel 105 is positioned on each stem 102 and has a spacer collar portion 104 that abuts the head 103. It is thus apparent that the chests 23 may be lifted above tile rows of the apron part 25 when tile members are to be replaced, and that the adjustment means 105 enables an operator to accurately adjust the vertical positioning of each chest 23 (see FIGURE 1) with respect to the solid material or frit 41 being charged, so as to skim its upper surface during its introduction into the doghouse 13 of the furnace. Any or all of the block rows of the apron part 25 may be removed, as desired. Each step-down apron casting or bracket 50 may be removed by removing back end clamps 67 and unlatching its opposite clamp end or lug 52*c* from the beam 24*a*.

As illustrated particularly in FIGURE 1, the open back end of the furnace 11 whch has the feed opening is substantially closed-off by the vertical part 26 of the back wall construction 10. The apron part 25, and particularly the refractory lining defined by backwardly-extending rows of refractory tile members thereof, defines a backwardly-declined or converging wall lining, the tile members of whose rows are staggered with each other along the rows to define a backwardly-declining wall that reaches close proximity to the feed opening which it surmounts, away from the inside or interior of the furnace. This inclined relationship of the apron wall part 25 provides a greatly increased efficiency of melting action and particularly, adjacent the feed opening or in the doghouse 13. In the first place, the amount of sting-out introduced into the plant or furnace building from the feed or charging opening is limited to the minimum, and in the second place, a radiation effect is produced that is advantageous.

A conventional apron or wing wall defines a lining that extends substantially on a horizontal plane, such that radiant heat from the furnace chamber (see arrows *a*, *b*, *c* and *d*) strikes against the vertical ends of the inner tile members of the tile members rows and is refracted back in substantially the same direction. In accordance with my novel construction, however, radiant heat, represented by the arrows *a*, *b*, *c* and *d*, reflected from the main portion of the furnace chamber and its melting bath, will be refracted in the direction of the arrows *a'*, *b'*, *c'* and *d'* upon the material adjacent the feed opening of the doghouse 13. By providing a sloped lining wall, radiant heat is refracted towards the solidified feed material 41 and adjacent melted material 42 to quickly heat the entering charge and make it molten as it moves from the feed opening, so that a much improved efficiency in the melting operation is accomplished. I also minimize wear and tear on the nose tile D and E and on the apron tile A, B and C, make possible a smaller size of feed opening, and provide an inwardly-enlarging preliminary melting chamber between the material in the doghouse and the refractory lining.

I have been able to employ this new conception as to a staggered apron wall by devising an apron wall whose individual tile members are suspended on both face sides by individual metal hangers, whose side and edge faces are depthwise interlatched with adjacent tile members, and whose hangers are suspended by an improved form of hanger bracket or casting. It will be noted that the tongue and groove portions on the side faces of the tile members also provide a cross-latching action between the side faces of tile members of each row. I have eliminated dependence on mortar or cement as the sole means of joining tile members of adjacent tile member rows with respect to each other in an apron wall. The wall may be built-up by first suspending tile member A of a proposed row, then adding the tile members B and C, etc.

The successful provision of side edge latching between tile rows is important in view of the increased heat in the doghouse area, due both to the use of radiant heat and the desirability of a substantially close positioning of the back end of the apron wall 25 with respect to the bath surface. As a result of the use of fully interlocked tile members of my construction, I have been able to successfully operate at high furnace temperatures and to use a pressure application of cooling fluid to effect a better and more efficient cooling action. It is well known that cooling fluid applied to a cement joint tends to produce ratholing which increases in size progressively; thus, a pressure application of cooling fluid is made fully practical by my form of joint construction.

I provide side and end closure plates and also baffling for directing a positive pressure flow of cooling fluid along the outer or top ends of the refractory tile members of my back wall, provide windows in the metal hanger brackets or castings and between the metal hangers and the tile members for cross circulation therethrough, and direct the fluid first upon the metal members and the refractory members of the apron part which is the part subjected to the greatest and most severe fluxing. I then flow or direct the cooling fluid upwardly along the vertical wall metal hanger brackets, the hangers, and the tile members and between them through the agency of side windows.

For a doghouse or charging bay 13 of about 20 feet in width, I may apply about 10,000 cu. ft. per minute of cooling air at about 5 to 6 inches of water pressure at the top manifold 96. Thus, the prevention of leakage and ratholing between tile member joints becomes of increasing importance when the pressure and volume are increased to the above values from, for example, a relatively low pressure and a volume, for example, of 5,000 cu. ft. per minute.

What I claim is:

1. In a furnace back wall for suspension along an open back end and above a backwardly-projecting charging bay of a melting furnace and wherein the back wall has a metal structural member assembly that carries a refractory lining in a suspended relation therefrom to define a substantially vertical back wall for closing-off the open back end of the furnace forwardly of the charging bay, an apron backet carried by the structural member assembly and projecting longitudinally from the back wall backwardly along and above the charging bay, a refractory tile member row, open-end mounting portions along said apron bracket in a downwardly-backwardly stepped progression therealong from the interior of the furnace, metal hangers projecting downwardly from and removably positioned, along said mounting portions, said tile member row having refractory tile members carried in a suspended backwardly stepped-down relation by said hangers away from the interior of the furnace, and bottom end portions of said tile members being sloped backwardly to define a common backwardly-declining plane along the lower reaches of said row in such a manner that radiant heat from the furnace strikes against said plane and is refracted towards the charging bay to aid in heating and melting charging material being introduced thereto.

2. In a furnace back wall as defined in claim 1 wherein said apron bracket has lug means at its front and back end portions transversely-slidably positioning it for longitudinal movement on the structural frame assembly, and one of said portions is longitudinally-adjustably secured adjacent the back end of said apron bracket.

3. In a furnace back wall as defined in claim 1 wherein, said mounting portions are endwise-open box-like portions, said hangers are slidably positioned for movement endwise into and out of said box-like portions and individually suspend each tile member in a balanced relationship and independently of adjacent tile members of said tile member row, and adjacent tile members of said row have opposed vertical wide side faces provided with complementary tongue and groove portions that latch-engage them together against vertical and horizontal movement with respect to each other and align opposed vertical edge faces of the tile members on a pair of opposed longitudinal planes along said row.

4. In a furnace back wall as defined in claim 3 wherein, a group of said apron brackets are carried in a transversely spaced-apart relation by the structural member assembly, each apron bracket is of the defined construction and each carries a tile member row of the defined construction and latched relation of the tile members of said tile member row, and the tile members of each row have a series of cross-extending alternate tongues and grooves along their opposed vertical edge faces that are in a staggered relation with each other, and the alternate tongues and grooves of each row having a longitudinally-slidable vertically-interlatching relation with the alternate tongues and grooves of the tile members of adjacent tile member rows.

5. In a furnace back wall for suspension along an open back end and above a backwardly-projecting charging bay of a melting furnace and wherein the back wall has a metal structural member assembly that carries a refractory lining in a suspended relation therefrom to define a substantially vertical back wall for closing-off the open back end of the furnace forwardly of the charging bay, an apron bracket carried by said structural member assembly and projecting from the back wall backwardly above and along the charging bay, a refractory tile member row, a series of mounting portions along said apron bracket that are stepped downwardly-backwardly away from the interior of the furnace, metal hangers removably positioned along said mounting portions, said tile member row having refractory tile members individually carried by said hangers in an inwardly-backwardly stepped-down relation away from the interior of the furnace, the tile members of said row having backwardly-sloped bottom end portions that define a backwardly-declining plane along the lower reaches of said row and above the charging bay in such a manner that radiant heat from the furnace will strike said plane and be refracted downwardly towards the charging bay to aid in heating and melting charging material being introduced thereto, a wind box carried by the structural member assembly above said apron bracket and open downwardly to said apron bracket, said apron bracket carrying baffling therealong above said tile member row and said hangers to direct cooling fluid under pressure from said wind box backwardly-downwardly therealong and upwardly-forwardly along an inclined plane above upper end portions of said refractory tile and substantially vertically along the structural member assembly and outer reaches of the refractory lining of the back wall.

6. In a furnace back wall as defined in claim 5 wherein, said baffling has a top flange extending along said apron bracket, said apron bracket has a substantially vertical wall extending centrally-downwardly from said top flange, said baffling also has a central-positioned downwardly-backwardly-inclined baffle member carried by said vertical wall below said top flange and a substantially vertical back baffle carried by said vertical wall in a spaced relation with said top flange and said inclined baffle member to direct the cooling fluid backwardly-downwardly along and upwardly-forwardly along said vertical wall.

7. In a furnace back wall for suspension along an open back end and above a backwardly-projecting charging bay of a melting furnace and wherein the back wall has a metal structural member assembly that carries a refractory lining in a suspended relation therefrom to define a substantially vertical back wall for closing-off the open back end of the furnace forwardly of the charging bay, an apron bracket carried by the structural member assembly and projecting longitudinally from the back wall backwardly along and above the charging bay, said apron bracket having progressive backwardly-downwardly-offset box-like open-end mounting portions therealong, a refractory tile member row, each tile member of said row having opposed substantially planar vertical side faces and narrow opposed vertical edge faces, the opposed planar side faces of each tile member having endwise upwardly-open mounting slot portions therein, metal hanger members having an upper pair of spaced-apart cylindrically-shaped contact portions each providing a substantially single line contact within the box-like mounting portions of said apron bracket and being endwise-removable from said box-like mounting portions, each of said hangers having a spaced-apart pair of downwardly-projecting leg portions to engage within the mounting slot portions of said tile members to suspend them as a tile member row along said apron bracket, one side face of each tile member having a latching groove portion extending vertically therealong from the mounting slot portion thereof and in a widened relation towards the bottom end of said tile member, the opposite side face of each tile member having a tree-shaped latching tongue portion therealong extending vertically-downwardly from the mounting slot portion thereof and that is complementary with and that latches with the groove portion of an adjacent tile member of said row to hold adjacent tile members against vertical and transverse movement with respect to each other along said row and align opposed vertical edge faces of the tile members on a pair of opposed longitudinal planes along said row, each tile member of said row having a series of alternate cross-extending tongue and groove portions along its opposed edge faces, the tongue and groove portions of the opposed edge faces of each tile member extending substantially perpendicular to the latching tongue and groove portions of the opposed side faces, the tongue and groove portions on one edge face of each tile member being in a staggered relation with the tongue and groove portions on the opposed edge face thereof.

8. In a furnace back wall as defined in claim 7 wherein, a group of said apron brackets are carried in a transversely-spaced relation by the structural member assembly, a group of tile member rows are provided and each tile member row is suspended by said hangers from one of said apron brackets, the tile members of one row have the tongue and groove portions of their edge faces in a horizontally-slidable and vertically-latched relation with the tongue and grove portions of the tile members of adjacent tile member rows, and the vertical edge faces of the tile members of each row lie along a common longitudinal plane that is common to the tile members of an adjacent vertically-latched row.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,045,994 July 24, 1962

Levi S. Longenecker

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 7, line 35, for "whch" read -- which --; column 8, line 58, for "backet" read -- bracket --; column 10, line 34, strike out "tree-shaped"; line 60, for "grove" read -- groove --.

Signed and sealed this 4th day of December 1962.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents