Oct. 30, 1962 P. J. MARTIN ETAL 3,061,295

OPEN HEARTH FURNACE

Filed Feb. 15, 1961 4 Sheets-Sheet 1

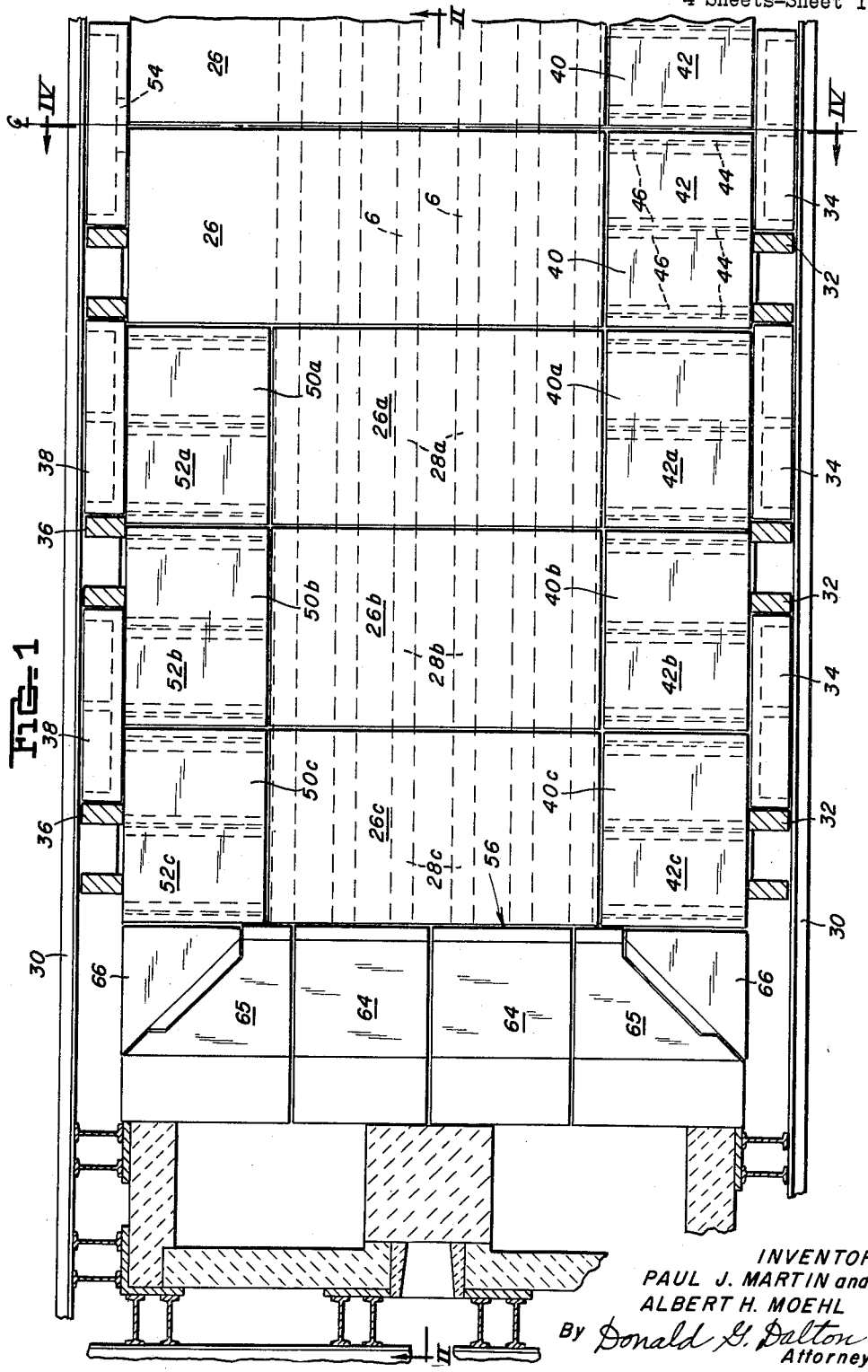


FIG. 1

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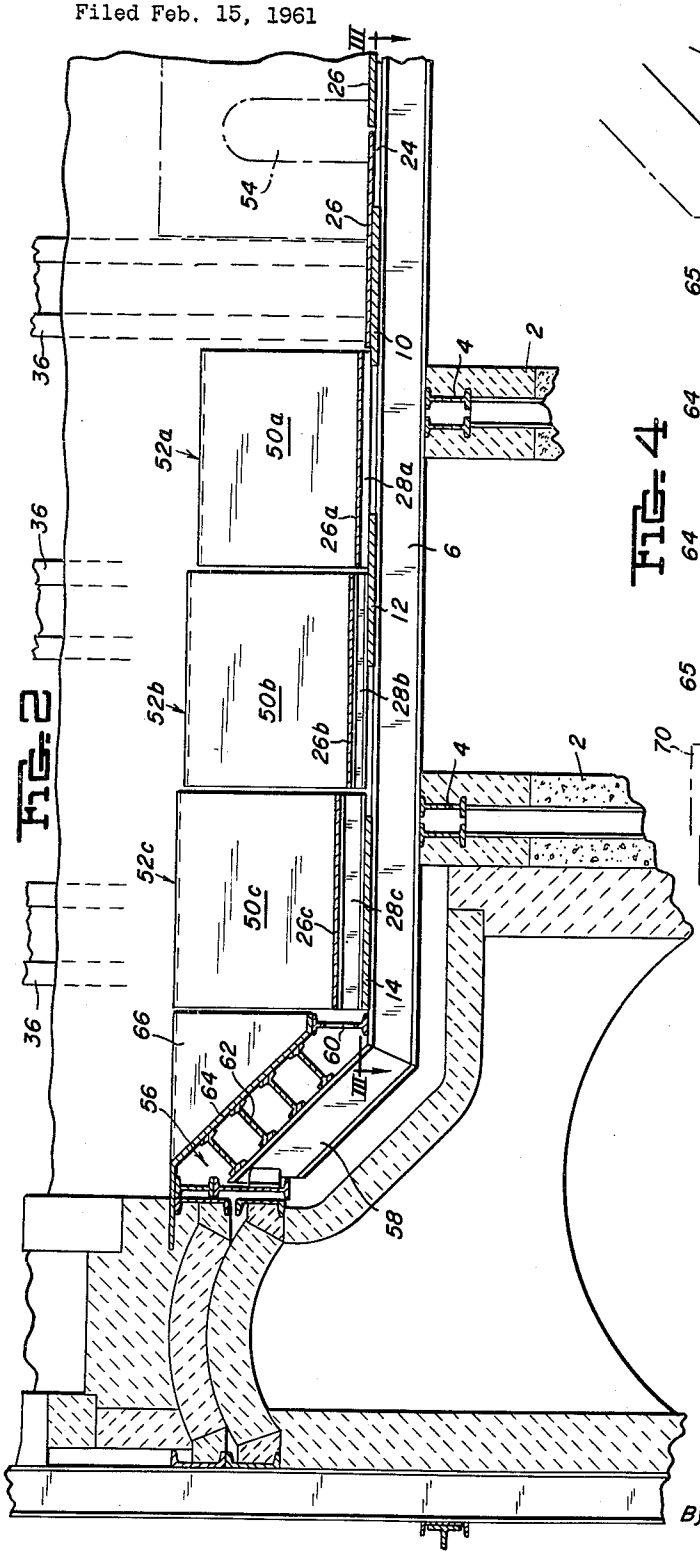


FIG. 2

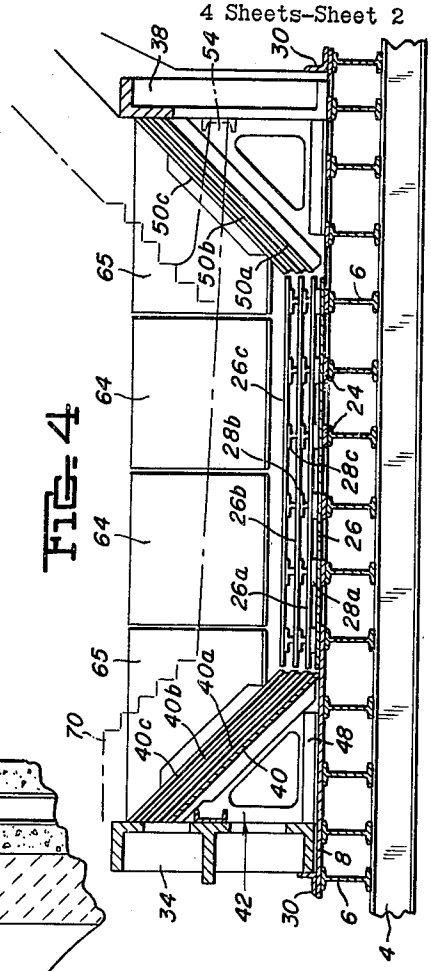


FIG. 4

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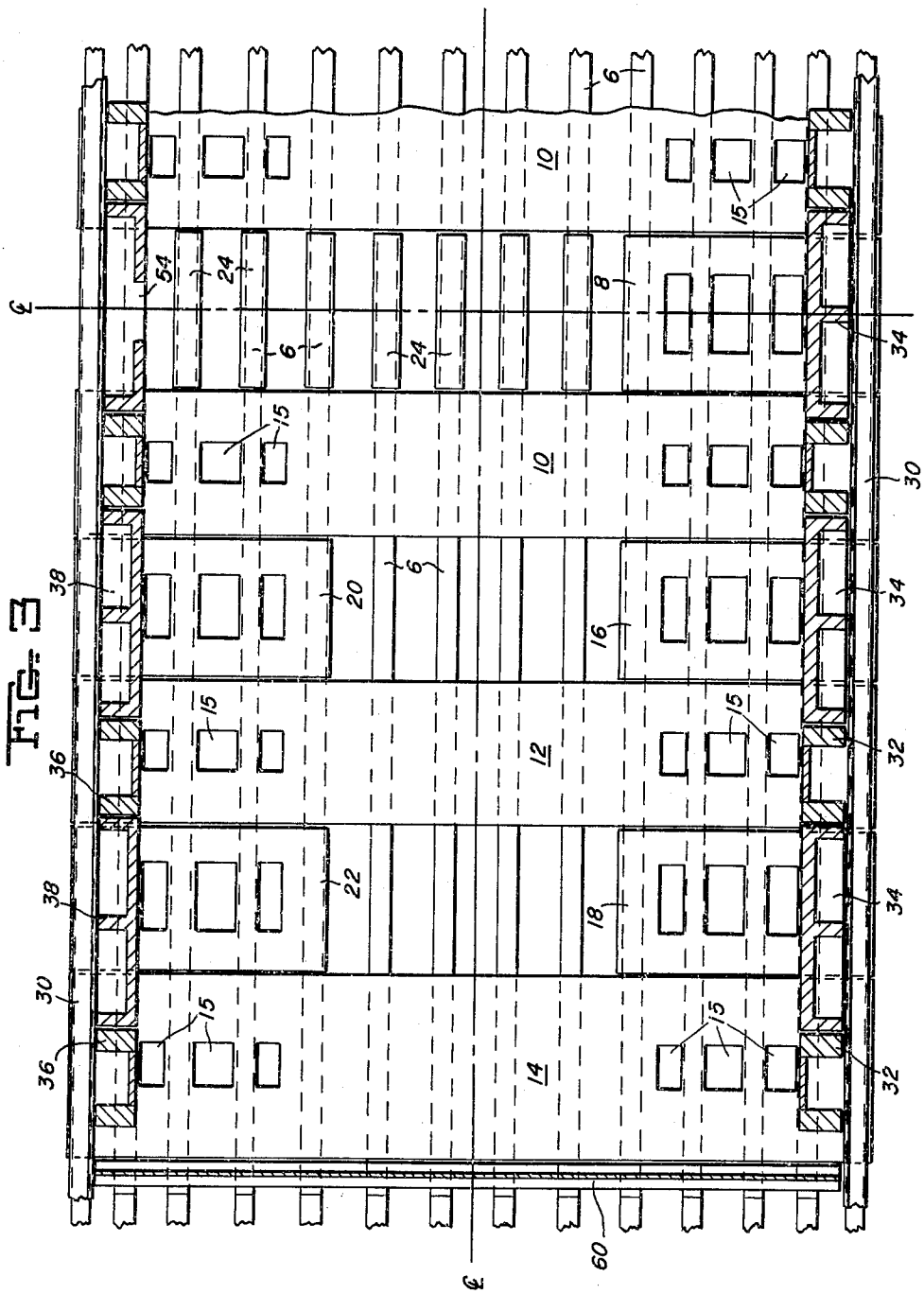


FIG. 3

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FIG. 5

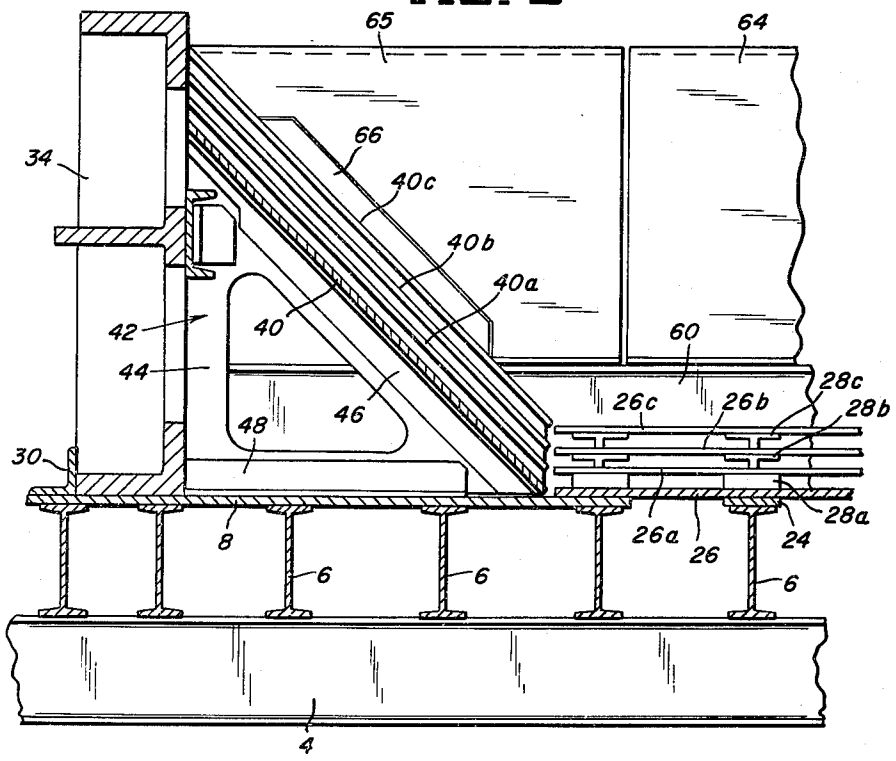
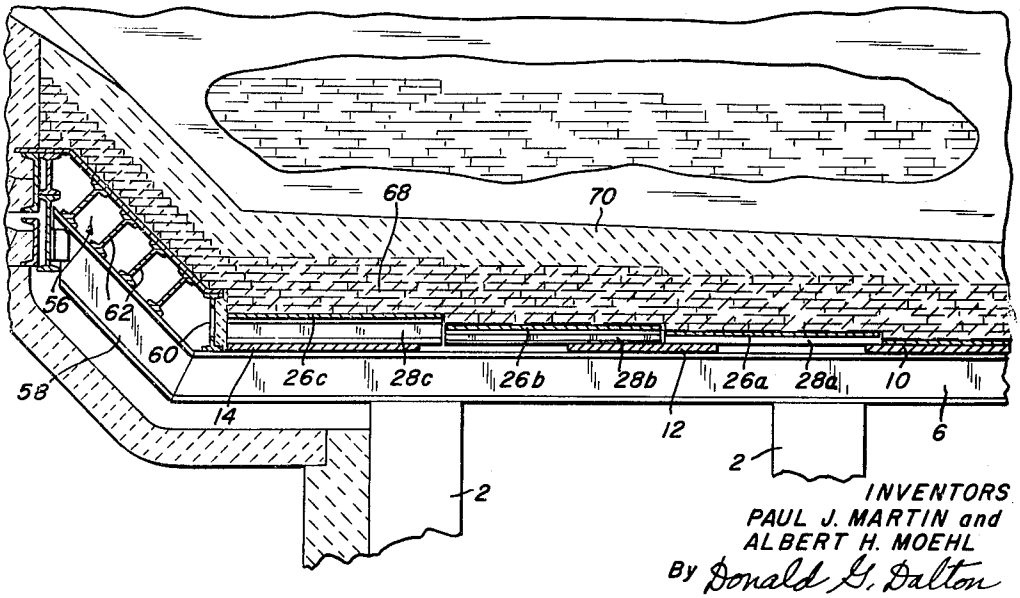


FIG. 6



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OPEN HEARTH FURNACE

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7 Claims. (Cl. 263—46)

This invention relates to an open hearth furnace for the production of steel and more particularly to a furnace such as shown in Suydam Patent No. 2,866,628 dated December 30, 1958. Such furnaces consist essentially of a furnace chamber constructed of refractory masonry which is externally supported and bound by a steel framework. The bottom of the furnace chamber has a dished refractory hearth which receives the molten bath. For various reasons, such as those set forth in the Suydam Patent, it is desirable to have the bottom and sides of the hearth uniform in thickness. The Suydam Patent has a hearth bottom of uniform thickness, but by laying the longitudinal side walls at a uniform thickness, the bottom of the bath continues to get wider as it gets shallower away from the furnace transverse center line. The construction of the Suydam patent is also such that it could not be made applicable on an existing furnace but rather it would have to be a completely new rebuild. Construction is also such that in building up the hearth one course of bricks in the front and back walls must be feathered (bevel cut) to take care of the slanting pan plate. This is an expensive and time consuming operation.

It is therefore an object of our invention to provide an open hearth furnace in which the thickness of the hearth bottom and side walls is economically made substantially uniform throughout.

Another object is to provide such a furnace in which the supporting steel framework requires only minor modifications to those most commonly used.

A further object is to provide such a furnace in which standard refractory brick shapes can be used without feathering thereof.

A still further object is to provide such a furnace in which the hearth is air cooled.

These and other objects will be more apparent after referring to the following specification and attached drawings, in which:

FIGURE 1 is a plan view of the steelwork supporting the hearth;

FIGURE 2 is a view taken on the line II—II of FIGURE 1;

FIGURE 3 is a view taken on the line III—III of FIGURE 2;

FIGURE 4 is a view taken on the line IV—IV of FIGURE 1;

FIGURE 5 is an enlarged view showing details of the steelwork at one end of the hearth; and

FIGURE 6 is a longitudinal sectional view showing one half of the hearth.

Referring more particularly to the drawings, reference numeral 2 indicates columns for supporting transverse beans 4 upon which longitudinal beams 6 are supported in the usual manner. A filler plate 8 is attached to the top of the beams 6 at the front of the furnace and extends on both sides of the transverse center line of the furnace toward the rear of the furnace to a point adjacent the bottom of the hearth as best shown in FIGURES 3 and 4. The construction of the furnace on each side of the transverse center line is essentially the same so that only the construction of one half of the furnace will be shown and described. Filler plates 10, 12 anl 14 are fastened to the tops of beams 6 in spaced apart relationship and extend from the front to rear of the furnace.

Openings 15 are provided in the filler plates 10, 12 and 14 to permit passage of cooling air. Filler plates 16 and 18 are provided in the spaces between the plates 10, 12 and 14 at the front of the furnace and extend toward the rear of the furnace the same distance as plate 8. Similar filler plates 20 and 22 are provided at the rear of the furnace. Air circulating openings are also provided in plates 16, 18, 20 and 22 as shown. Filler plates 24, having the same thickness as plates 8 and 10, are provided on top of each of the beams 6 at the transverse center of the furnace and a pan plate 26 is mounted on top of the plates 10 and 24 at the transverse center of the furnace as best shown in FIGURES 1 and 4. A single pan plate may be substituted for the two pan plates 26. Pan plates 26*a*, 26*b* and 26*c* extend from the front to back of the hearth bottom of the furnace at different elevations than the pan plate 26; the pan plate 26*a* being at a higher elevation than plate 26, pan plate 26*b* being at a higher elevation than plate 26*a* and pan plate 26*c* being at a higher elevation than pan plate 26*b*. For this purpose beams 28*a*, 28*b* and 28*c* are mounted on top of the filler plates, additional filler plates being provided as required on top of beams 6 in the spaces between plates 10, 12 and 14.

Longitudinal angles 30 are fastened to the top of filler plates 8, 10, 12, 14, 16, 18, 20 and 22 at the front and rear of the furnace. Spaced apart buckstays 32 are mounted on top of the spacer plates at the front of the furnace with apron plates 34 extending between the buckstays. In like manner buckstays 36 are provided at the rear of the furnace with apron plates 38 extending therebetween. As best shown in FIGURES 4 and 5 stepped chill plates 40, 40*a*, 40*b* and 40*c* are provided at the front of the furnace and cooperate with chill plates 26, 26*a*, 26*b* and 26*c*, respectively; the lower ends of plates 40, 40*a*, 40*b* and 40*c* terminating adjacent to and approximately at the same level as plates 26, 26*a*, 26*b* and 26*c*, respectively. The chill plates 40, 40*a*, 40*b* and 40*c* are supported by wind boxes 42, 42*a*, 42*b* and 42*c*, respectively. The wind boxes, except for dimensions, have essentially the same construction so that only one will be described. As best shown in FIGURES 1 and 5 the wind box 42 consists of three gusset plates 44 reinforced with angles 46 fastened to plate 40 and horizontal angles 48 secured to the filler plates and beams 6. The wind boxes 42, 42*a*, 42*b* and 42*c* are also secured to the apron plates 34, slotted holes (not shown) being provided in plates 34 to permit movement of the wind boxes with respect thereto. Stepped pan plates 50*a*, 50*b* and 50*c* are supported by wind boxes 52*a*, 52*b* and 52*c*, respectively, at the rear of the furnace in line with pan plates 26*a*, 26*b* and 26*c*, respectively. The construction and arrangement of wind boxes 52*a*, 52*b* and 52*c* is essentially the same as that of wind box 42 so that the details thereof will not be described. There is no slanting pan plate at the rear of the furnace opposite pan plate 40 since pan plate 26 extends to the rear of the furnace with the usual tap hole 54 being provided at the transverse center of the furnace. A wind box 56 is provided at each end of the furnace as is usual in open hearth furnaces. No novelty is claimed for this part of the furnace, but it will be seen from FIGURES 2 and 6 that slanting beams 58 are attached at the end of each beam 6 and a transverse beam 60 is mounted on top of the ends of beams 6 and extends the full width of the furnace. Transverse beams 62 are mounted on top of the beams 58 and extend the width of the furnace. Plates 64 (FIGURES 1 and 2) are mounted on top of the beams 62 at each side of the longitudinal center line of the furnace. Reinforced plates 65 and 66 extend from each of the plates 64*a* to the plates 40*c* and 50*c*. If desired

plates 65 and 66 may be combined into a single bent plate. Refractory bricks 68 are laid up on top of each of the plates 26, 26a, 26b, 26c, 40, 40a, 40b, 40c, 52a, 52b, 52c, 64, 65 and 66 in such a manner as to give a uniform thickness throughout. It will be seen from FIGURE 6 that no feathering of the bricks is necessary and that the bricks are covered by a rammed refractory 70 to provide a hearth having substantially uniform wall thickness throughout. The construction of the structural work is also such that cooling air can flow beneath the refractory hearth to prevent overheating thereof.

While one embodiment of our invention has been shown and described, it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims.

We claim:

1. An open hearth furnace comprising a dished refractory hearth section, vertical buckstays at the front and rear of the furnace, spaced generally parallel longitudinal beams beneath said hearth section arranged with their flanges substantially horizontal, the top flanges being in one plane and the bottom flanges in a second plane, a plurality of substantially horizontal pan plates extending transversely of the furnace on each side of the transverse center of the furnace and having front and back ends, means for supporting said pan plates on said beams at different elevations, said pan plates being arranged in stepped fashion with the end plates being at the highest elevation and the end of each plate adjacent the transverse center of the furnace being substantially vertically above the plate at the next lower elevation, a wind box associated with the front end of each pan plate, a wind box associated with the back end of at least the pan plates removed from the transverse center of the furnace, a pan plate supported by each of said wind boxes and sloping upwardly and outwardly from a position adjacent the associated horizontal pan plate, bricks supported on said pan plates, and rammed refractory on said bricks, the combined thickness of said bricks and refractory being substantially uniform throughout the hearth section.

2. An open hearth furnace comprising a dished refractory hearth section, vertical buckstays at the front and rear of the furnace, spaced generally parallel longitudinal beams beneath said hearth section arranged with their flanges substantially horizontal, the top flanges being in one plane and the bottom flanges in a second plane, a plurality of substantially horizontal pan plates extending transversely of the furnace on each side of the transverse center of the furnace and having front and back ends, means for supporting said pan plates on said beams at different elevations, said pan plates being arranged in stepped fashion with the end plates being at the highest elevation and the end of each plate adjacent the transverse center of the furnace being substantially vertically above the plate at the next lower elevation, a wind box associated with the front end of each pan plate, a wind box associated with the back end of at least the pan plates removed from the transverse center of the furnace, a pan plate supported by each of said wind boxes and sloping upwardly and outwardly from a position adjacent the associated horizontal pan plate, the length of said pan plates longitudinally of the furnace being selected to be a multiple of the length of standard bricks, a wind box at each end of the hearth section, sloping pan plates on each of said last named wind boxes, standard bricks supported on said pan plates, and rammed refractory on said bricks, the combined thickness of said bricks and refractory being substantially uniform throughout the hearth section.

3. An open hearth furnace comprising a dished refractory hearth section, vertical buckstays at the front and rear of the furnace, spaced generally parallel longitudinal beams beneath said hearth section arranged with their flanges substantially horizontal, the top flanges being in one plane and the bottom flanges in a second plane, a substantially horizontal pan plate mounted on said beams adjacent the transverse center of the furnace, said pan plate having a front and rear end and extending from the rear buckstays to a line inward from the front buckstays, a wind box extending from the front buckstays inwardly to a position adjacent said pan plate, a sloping pan plate supported by said wind box and sloping upwardly and outwardly from a position adjacent the front end of said first named pan plate, a plurality of substantially horizontal pan plates on each side of the first named pan plate and having front and back ends, each of said plurality of pan plates extending outwardly on each side of the longitudinal axis of the furnace to a line inward from the buckstays, means for supporting each of said plurality of pan plates on said beams at different elevations than the first named pan plate and each other, the elevation of the first named pan plate being the lowest and the other pan plates being arranged in stepped fashion with the end pan plates being at the highest elevation, a wind box at each end of each of said plurality of pan plates extending outwardly to the adjacent buckstays, a sloping pan plate supported by each of said last named wind boxes and sloping upwardly and outwardly from a position adjacent the associated horizontal pan plate, bricks supported on said pan plates, and rammed refractory on said bricks, the combined thickness of said bricks and refractory being substantially uniform throughout the hearth section.

4. An open hearth furnace comprising a dished refractory hearth section, vertical buckstays at the front and rear of the furnace, spaced generally parallel longitudinal beams beneath said hearth section arranged with their flanges substantially horizontal, the top flanges being in one plane and the bottom flanges in a second plane, a substantially horizontal pan plate mounted on said beams adjacent the transverse center of the furnace, said pan plate having a front and rear end and extending from the rear buckstays to a line inward from the front buckstays, a wind box extending from the front buckstays inwardly to a position adjacent said pan plate, a sloping pan plate supported by said wind box and sloping upwardly and outwardly from a position adjacent the front end of said first named pan plate, a plurality of substantially horizontal pan plates on each side of the first named pan plate and having front and back ends, each of said plurality of pan plates extending outwardly on each side of the longitudinal axis of the furnace to a line inward from the buckstays, means for supporting each of said plurality of pan plates on said beams at different elevations than the first named pan plate and each other, the elevation of the first named pan plate being the lowest and the other pan plates being arranged in stepped fashion with the end plates being at the highest elevation, a wind box at each end of each of said plurality of pan plates extending outwardly to the adjacent buckstays, a sloping pan plate supported by each of said last named wind boxes and sloping upwardly and outwardly from a position adjacent the associated horizontal pan plate, the length of said pan plates longitudinally of the furnace being selected to be a multiple of the length of standard bricks, a wind box at each end of the hearth section, sloping pan plates on each of said wind boxes, bricks supported on said pan plates, and rammed refractory on said bricks, the combined thickness of said bricks and refractory being substantially uniform throughout the hearth section.

5. An open hearth furnace comprising a dished refractory hearth section, vertical buckstays at the front and rear of the furnace, spaced generally parallel longitudinal beams beneath said hearth section arranged with their flanges substantially horizontal, the top flanges being in one plane and the bottom flanges in a second plane, filler plates mounted on top of said beams, a substantially horizontal pan plate mounted on top of said filler plates adjacent the transverse center of the

furnace, said pan plate having a front and rear end and extending from the rear buckstays to a line inward from the front buckstays, a wind box extending from the front buckstays inwardly to a position adjacent said pan plate, a pan plate supported by said wind box and sloping upwardly and outwardly from a position adjacent the front end of said first named pan plate, a plurality of substantially horizontal pan plates on each side of the first named pan plate and having front and back ends, each of said plurality of pan plates extending outwardly on each side of the longitudinal axis of the furnace to a line inward from the buckstays, means for supporting each of said plurality of pan plates on said beams at different elevations than the first named pan plate and each other, the elevation of the first named pan plate being the lowest and the other pan plate being arranged in stepped fashion with the end pan plates being at the highest elevation, a wind box at each end of each of said plurality of pan plates extending outwardly to the adjacent buckstays, and a sloping pan plate supported by each of said last named wind boxes and sloping upwardly and outwardly from a position adjacent the associated horizontal pan plate.

6. An open hearth furnace comprising a dished refractory hearth section, vertical buckstays at the front and rear of the furnace, apron plates extending between said buckstays, spaced generally parallel longitudinal beams beneath said hearth section and said buckstays arranged with their flanges substantially horizontal, the top flanges being in one plane and the bottom flanges in a second plane, filler plates mounted on top of said beams, at least part of said filler plates having air circulating openings therein and extending beyond said buckstays, longitudinal angles fastened to said filler plates on the outside of said front and rear buckstays, a substantially horizontal pan plate mounted on top of said filler plates adjacent the transverse center of the furnace, said pan plate having a front and rear end and extending from the rear buckstays to a line inward from the front buckstays, a wind box extending from the front buckstays inwardly to a position adjacent said pan plate, a sloping pan plate supported by said wind box and sloping upwardly and outwardly from a position adjacent the front end of said first named pan plate, a plurality of substantially horizontal pan plates on each side of the first named pan plate and having front and back ends, each of said plurality of pan plates extending outwardly on each side of the longitudinal axis of the furnace to a line inward from the buckstays, means for supporting each of said plurality of pan plates on said beams at different elevations than the first named pan plate and each other, the elevation of the first named pan plate being the lowest and the other pan plate being arranged in stepped fashion with the end pan plates being at the highest elevation, a wind box at each end of each of said plurality of pan plates extending outwardly to the adjacent buckstays, and a sloping pan plate supported by each of said last named wind boxes and sloping upwardly and outwardly from a position adjacent the associated horizontal pan plate.

7. An open hearth furnace comprising a dished refractory hearth section, vertical buckstays at the front and rear of the furnace, apron plates extending between said buckstays, spaced generally parallel longitudinal beams beneath said hearth section and said buckstays arranged with their flanges substantially horizontal, the top flanges being in one plane and the bottom flanges in a second plane, filler plates mounted on top of said beams, at least part of said filler plates having air circulating openings therein and extending beyond said buckstays, longitudinal angles fastened to said filler plates on the outside of said front and rear buckstays, a substantially horizontal pan plate mounted on top of said filler plates adjacent the transverse center of the furnace, said pan plate having a front and rear end and extending from the rear buckstays to a line inward from the front buckstays, a wind box extending from the front buckstays inwardly to a position adjacent said pan plate, means attaching said wind box to the adjacent apron plate, a sloping pan plate supported by said wind box and sloping upwardly and outwardly from a position adjacent the front end of said first named pan plate, a plurality of substantially horizontal pan plates on each side of the first named pan plate and having front and back ends, each of said plurality of pan plates extending outwardly on each side of the longitudinal axis of the furnace to a line inward from the buckstays, means for supporting each of said plurality of pan plates at different elevations than the first named pan plate and each other, the elevation of the first named pan plate being the lowest and the other pan plate being arranged in stepped fashion with the end pan plates being at the highest elevation, a wind box at each end of each of said plurality of pan plates extending outwardly to the adjacent buckstays, means attaching said wind boxes to the adjacent apron plates, a sloping pan plate supported by each of said last named wind boxes and sloping upwardly and outwardly from a position adjacent the associated horizontal pan plate, the longitudinal length of said pan plates being selected to be a multiple of the length of standard bricks, a wind box at each end of the hearth section, sloping pan plates on said wind box, standard bricks supported on said pan plates, and rammed refractory on said bricks, the thickness of said bricks and refractory being substantially uniform throughout the hearth section.

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