



April 10, 1956

C. J. BARKLEY

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SUPPORTING STRUCTURE FOR AN OPEN HEARTH FURNACE

Filed Jan. 27, 1953

7 Sheets-Sheet 2

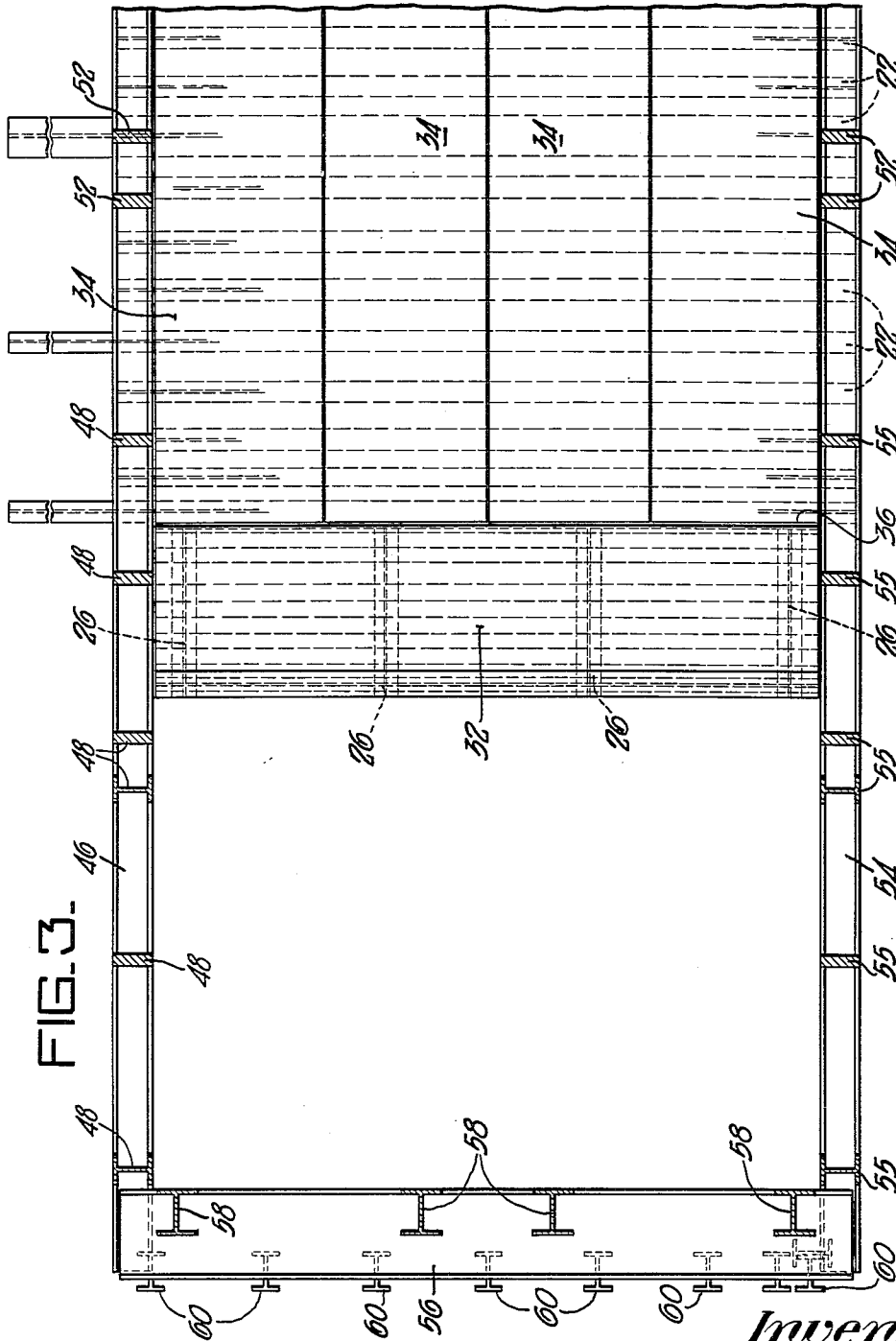


FIG. 3.

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April 10, 1956

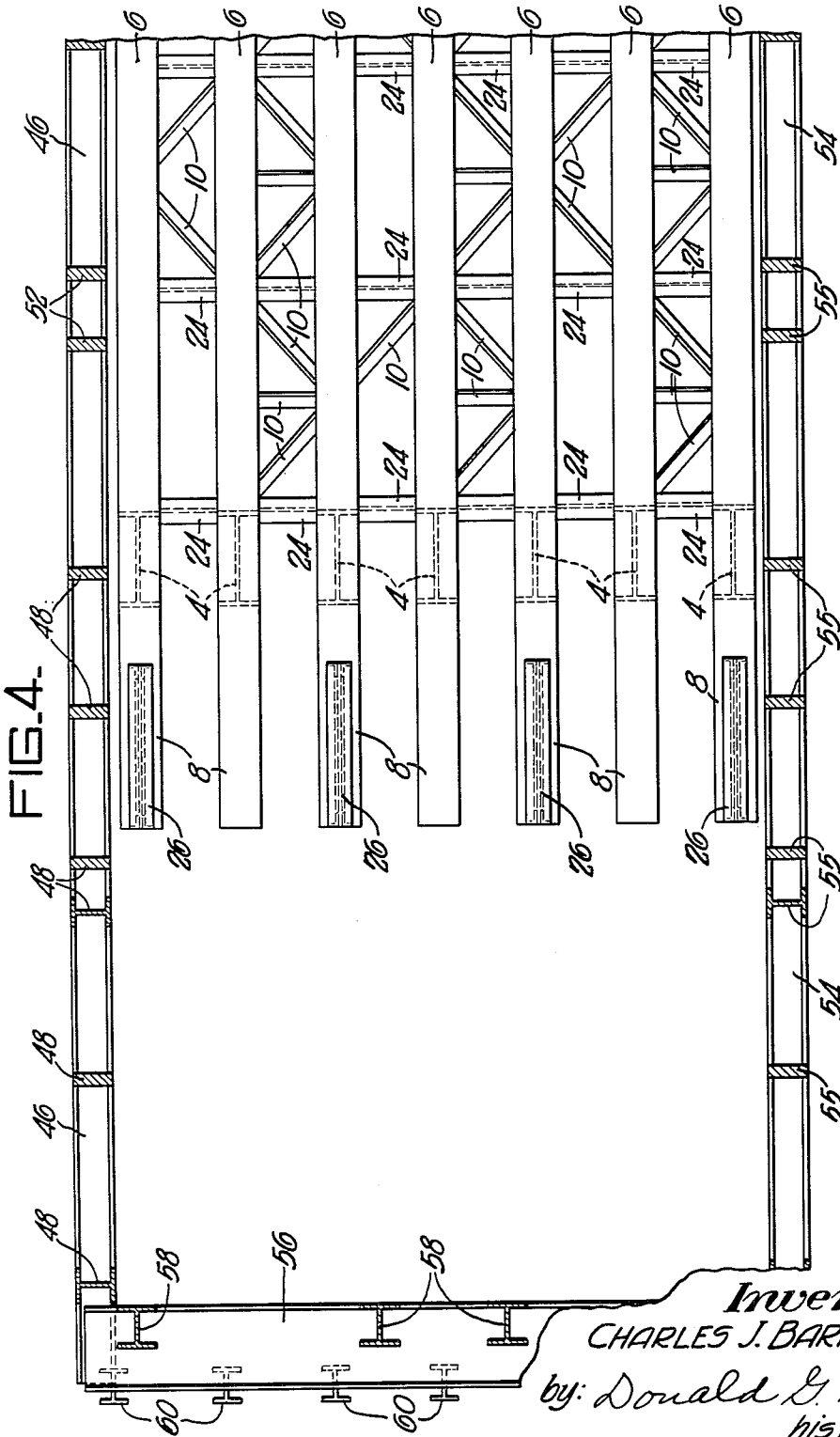
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7 Sheets-Sheet 3



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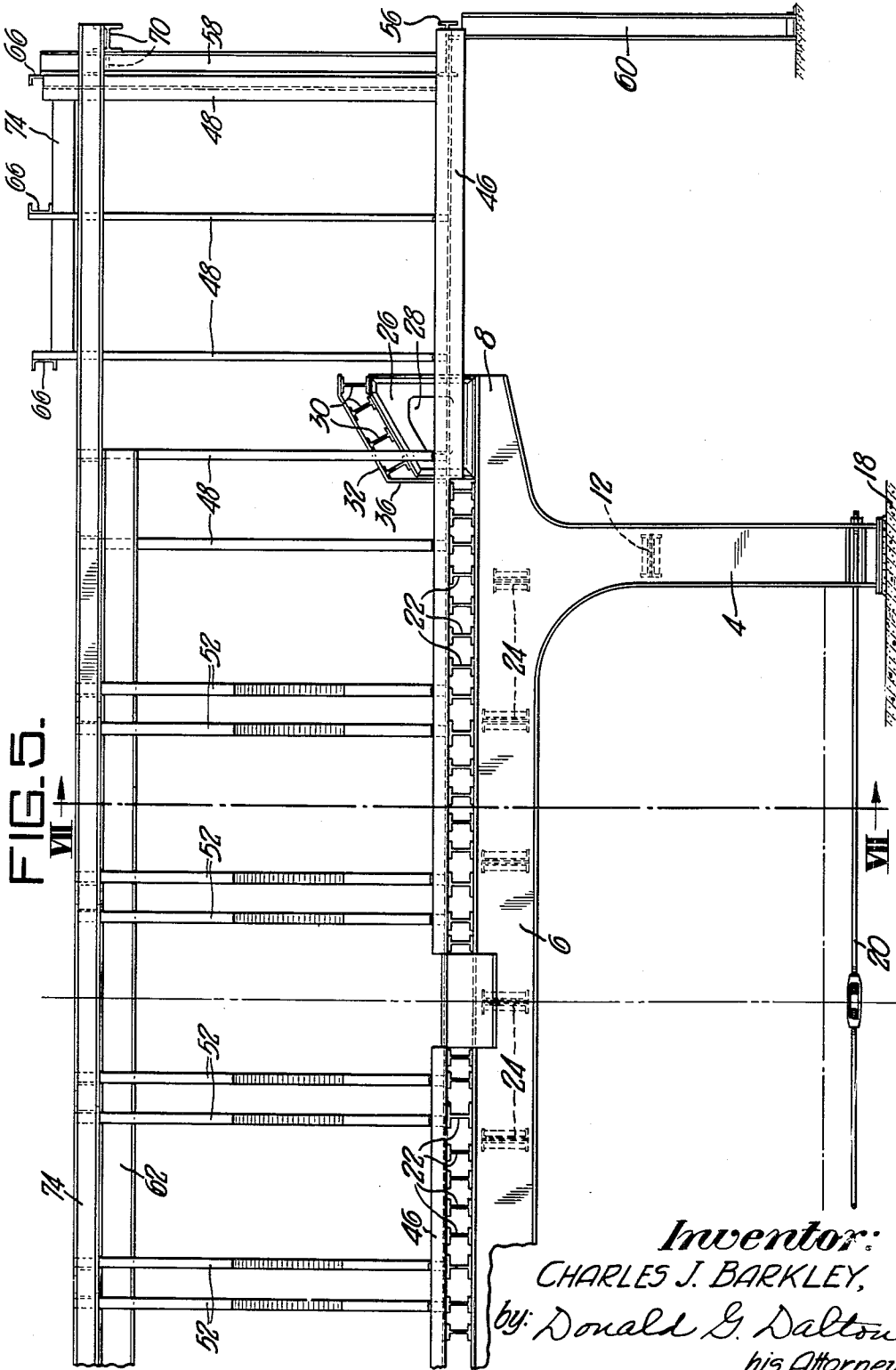
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SUPPORTING STRUCTURE FOR AN OPEN HEARTH FURNACE

Filed Jan. 27, 1953

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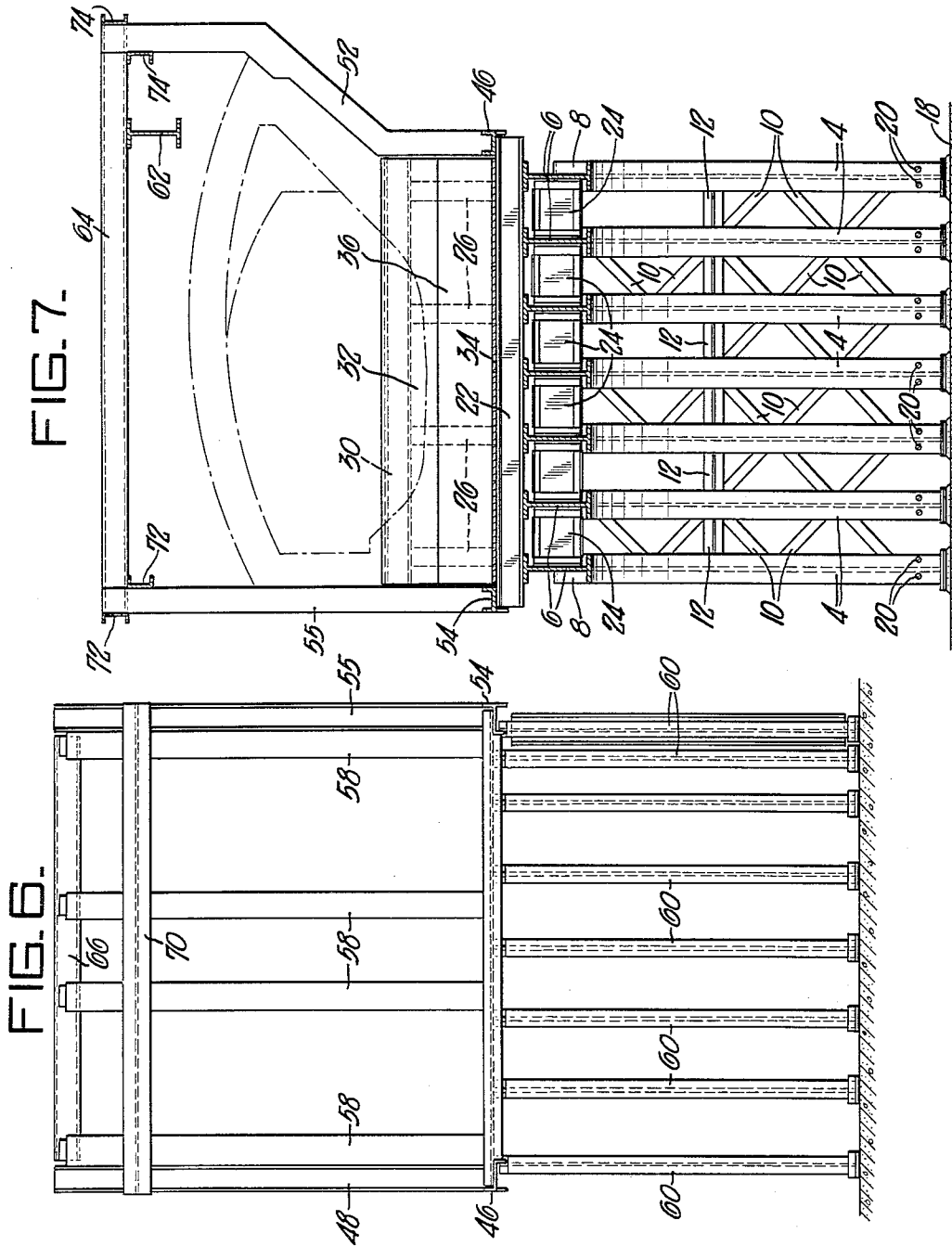
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SUPPORTING STRUCTURE FOR AN OPEN HEARTH FURNACE

Filed Jan. 27, 1953

7 Sheets-Sheet 5



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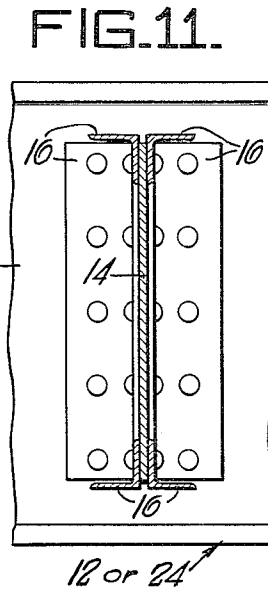
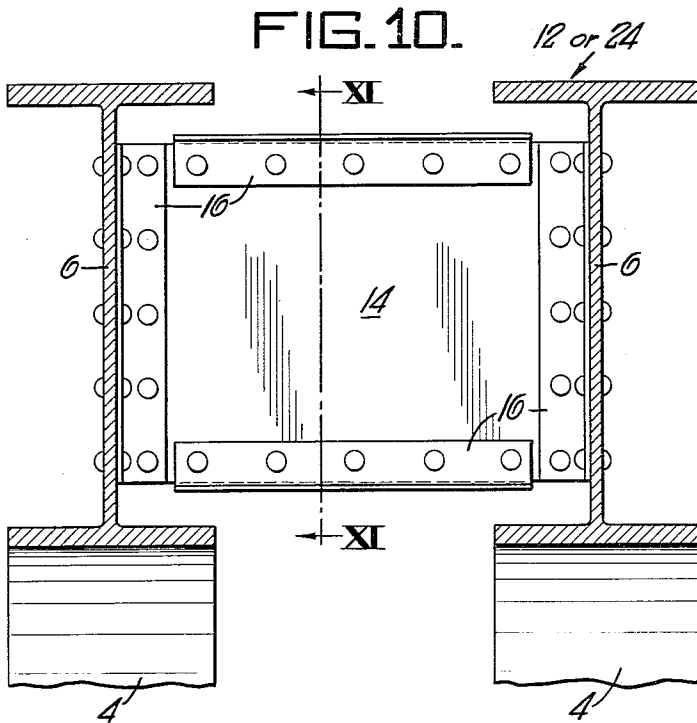
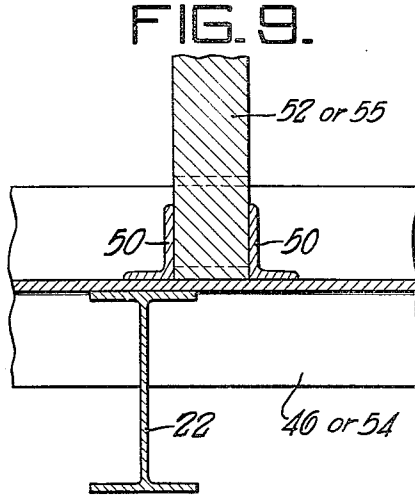
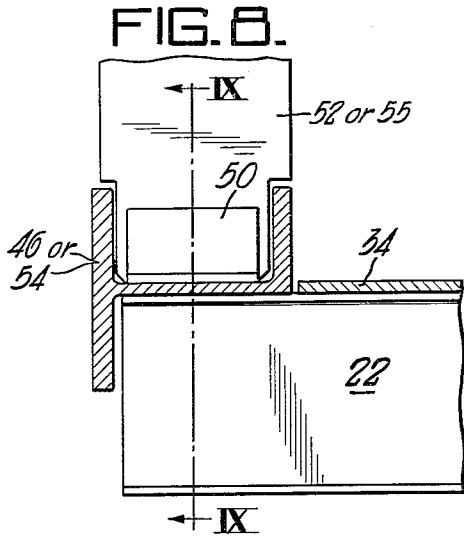
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SUPPORTING STRUCTURE FOR AN OPEN HEARTH FURNACE

Filed Jan. 27, 1953

7 Sheets-Sheet 6



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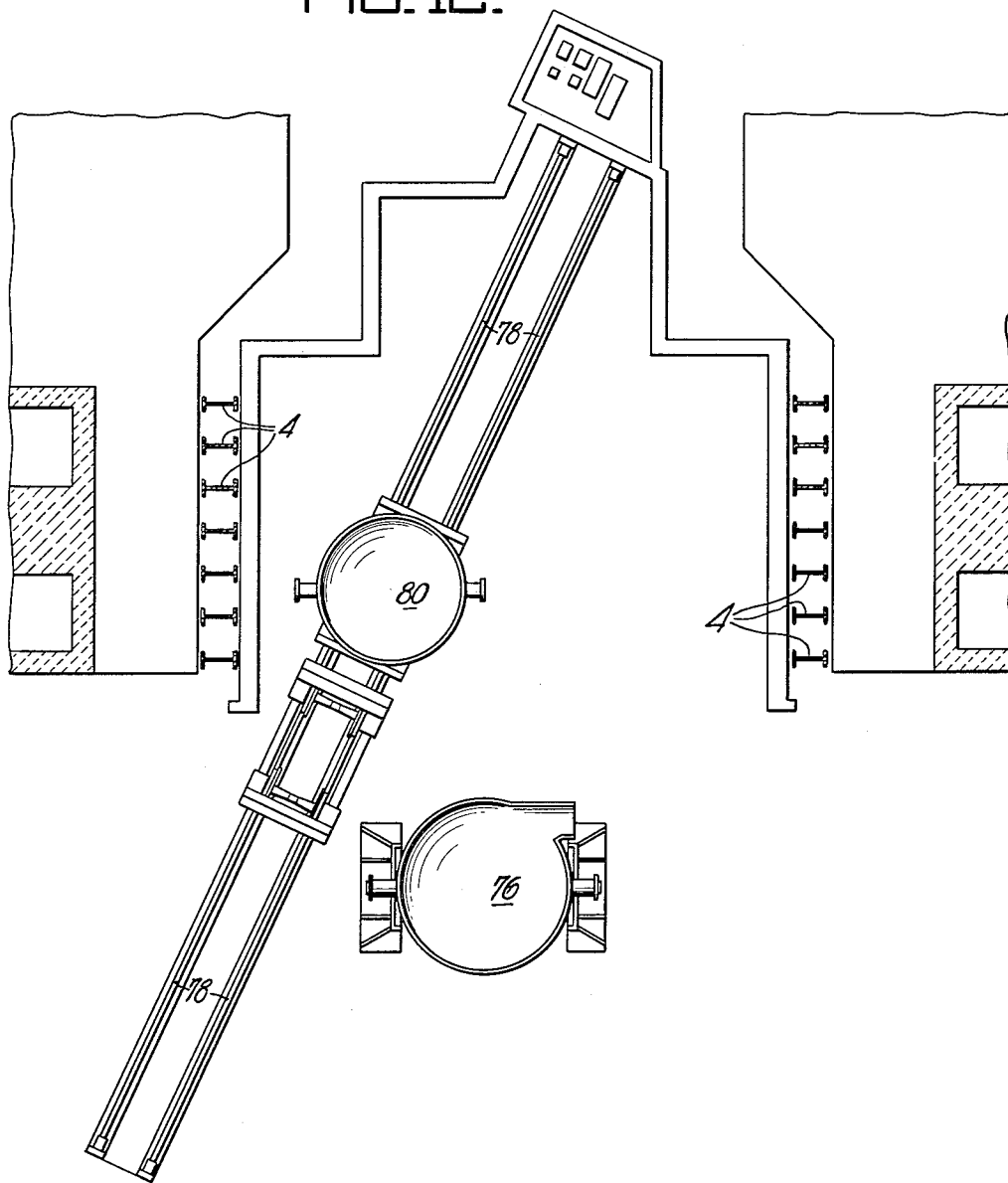
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SUPPORTING STRUCTURE FOR AN OPEN HEARTH FURNACE

Filed Jan. 27, 1953

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FIG. 12.



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## SUPPORTING STRUCTURE FOR AN OPEN HEARTH FURNACE

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Application January 27, 1953, Serial No. 333,500

12 Claims. (Cl. 263—46)

This invention relates to a supporting structure for an open hearth furnace. In the conventional supporting structure for an open hearth furnace the arrangement of the structural support for the main laboratory portion of the furnace is such that the working area beneath the furnace is restricted by the structural work. This made it necessary to position the dragout of the slag pot under the tapping hole of the furnace. This is objectionable because of the normal spills and drippings of molten slag and steel that usually occur after the tapping of the heat. In many instances the dragout tracks were damaged and had to be repaired before the slag pot could be removed. Also it is necessary to place the ladle for the steel in the path of the dragout. The steel ladle had to be removed by the crane each time the slag pot was removed. The conventional supporting structure is such that any breakthrough of metal from the bottom of the furnace greatly endangered the supporting structure of the furnace. Also it is difficult to repair the damage done to the structure work due to the breakthrough. The conventional supporting structure at the chill sections is such that it is almost impossible to repair or seal the brickwork against air infiltration.

It is therefore an object of my invention to provide a supporting structure for an open hearth furnace in which the working area beneath the main laboratory section of the furnace is much larger and unobstructed than in the usual furnace supporting structure.

Another object is to provide such a supporting structure in which means are provided for carrying the load when breakthroughs occur.

Still another object is to provide such a supporting structure which permits easy accessibility to the chill sections of the furnace.

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

Figure 1 is a top plan view of the structural work of an open hearth furnace;

Figure 2 is a sectional view taken on the line II—II of Figure 1 showing some of the brickwork of the furnace;

Figure 3 is a horizontal sectional view of one end of the furnace taken above the main support of the furnace with the refractory brickwork omitted;

Figure 4 is a horizontal sectional view of one end of the furnace showing the top of the rigid arched frames;

Figure 5 is a rear elevation of one end of the furnace showing the supporting structure;

Figure 6 is an end elevation of the structural work of the furnace;

Figure 7 is a view taken on the line VII—VII of Figure 5 and showing the structural work of the furnace;

Figure 8 is an enlarged vertical sectional view showing the support for the buckstays;

Figure 9 is a sectional view taken on the line IX—IX of Figure 8;

Figure 10 is an enlarged view showing the construction of the diaphragms used with the rigid arched frames;

Figure 11 is a sectional view taken on the line XI—XI of Figure 10; and

Figure 12 is a schematic plan view of the furnace beneath the rigid arched frame.

Referring more particularly to the drawings, the reference numeral 2 indicates a plurality of spaced apart rigid arched frames which serve as the main supporting structure for the furnace. As best shown in Figures 2, 4, 5 and 7, each of the rigid arched frames consists of spaced apart columns 4 and a horizontal beam section 6. Both the columns 4 and the beam section 6 are in the form of an I-beam but it should be understood that they may be formed from plates welded or riveted together. The beam section 6 includes a cantilever section 8 at each end thereof. Suitable bracing 10 is provided between the arched frames. A horizontal diaphragm 12 extends between adjacent columns 4. As shown in Figures 10 and 11 each of the diaphragms consists of a plate 14 having angles 16 arranged around the periphery thereof on each side of the plate with two angles being riveted or otherwise fastened to the webs of the columns. The rigid arched frames 2 are spaced apart a sufficient distance to permit a workman to easily pass therebetween. The bottoms of the arched beams 2 are imbedded in concrete 18 and are connected by tensile members 20 to prevent the bottoms thereof from separating. As shown in Figures 2, 3, 5 and 7 a plurality of transverse I-beams 22 are fastened to the longitudinal beams 6 and extend the full width of the furnace with certain of the beams extending beyond the back end of the furnace to serve as a support for a series of platforms (not shown). A plurality of diaphragms 24, similar to the diaphragms 12, extend between adjacent beams 6 under certain of the transverse beams 22 and are fastened to the beams 22. A plurality of vertical diaphragms 26 are fastened to and extend upwardly from the cantilever section 8 at each end of the beam 6. Each diaphragm 26 is provided with an opening 28 of sufficient size to permit a workman to pass therethrough. A plurality of spaced apart beams 30 are fastened to and extend between the diaphragms 26. A hearth supporting plate 32 is fastened to the beams 30. A hearth supporting plate 34 is also fastened to the top of beams 22. The plates 32 and 34 are connected by means of a plate 36 at each end of the plate 34. A vertical refractory wall 38 extends upwardly along the columns 4 at each end of the rigid arched frames 2. A refractory arch 40 is suspended from the bottom of the cantilever sections 8 at each end of the frames 2. A refractory wall 42 extends upwardly from the end of each of the suspended arches 40. A refractory furnace bottom 44 is supported on the plates 32 and 34.

As shown in Figures 3, 4, 5, 6, 7, 8 and 9 a horizontal H-beam 46 is fastened to the beams 22 at the back end of the furnace. As shown in Figures 8 and 9 the lower flange of the H-beam adjacent the interior of the furnace is cut off so that the web of the beam can rest on the top flanges of the beams 22. The web of the beam 46 is fastened to the top flange of beams 22 in any suitable manner. Spaced apart vertical buckstays 48 are fastened to the H-beam 46 by means of an angle 50 fastened to the bottom end thereof. In a similar manner angular buckstays 52 are fastened to the H-beam 46 on each side of the center line through the main laboratory of the furnace. An H-beam 54, similar to the beam 46, is fastened to the front end of the beams 22. Vertical buckstays 55 are fastened to the beam 54 in the same manner as the buckstays at the rear of the furnace are fastened to the beam 46. The ends of the beams 46 and 54 are connected by means of similar beams 56, one at each end of the furnace. Buckstays 58 are fastened to the beams 56. The outer and intermediate portions of the beams 56 are supported by vertical beams or columns 60.



As shown in Figures 1, 2, 5 and 7 and I-beam 62 is fastened to the buckstays 48 a short distance below the top thereof and extends between the buckstays 48 on each side of the buckstays 52. The top of buckstays 52 and the top of the center front buckstays 55 are connected by channels 64. The tops of buckstays 48 and front buckstays 55 are connected by means of channels 66 in a similar manner. Two H-beams 70 (Figures 1, 2, 5 and 6) are fastened to the buckstays 58 near the top thereof at each end of the furnace. Two channels 72 are fastened to and extend between the ends of the beams 70 at the front end of the furnace. Two channels 74 are fastened to the top of buckstays 48 and 52 and extend between the beams 70 and are fastened thereto.

As shown in Figure 12 a steel ladle 76 for receiving the molten metal is arranged at the back end of the furnace adjacent the central portion thereof. Tracks 78 arranged at the angle extend from the back end of the furnace to the front end thereof and are provided for dragging out the slag pot 80.

The construction described above enables the workman to get into the space above the suspended arch 40 so that he can seal the refractory in the suspended arch 40 and the wall 42 from infiltration of air. In case of a burn through any of the interior beams 6 the furnace will not burn through because the load will be carried to adjacent beams by means of the diaphragms 24. In case the rear beam 6 should burn out the load will be transferred to the beam 62 through the beams 22 and 46, buckstays 48 and 52, and the channels 64. The beams 46, 54 and 56 together form a lower binder for the furnace. The buckstays, the channels 64, 66, 72 and 74 and the H-beams 70 complete the box-like structure enclosing the furnace.

While one embodiment of my 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.

I claim:

1. A supporting structure for an open hearth furnace comprising a series of spaced apart arch-like members, each of said arch-like members including a vertical column under each end of the main bath portion of the furnace and a horizontal beam extending between and rigidly supported by said columns, each of said beams having a cantilever portion at each end extending beneath the chill sections of the furnace, a vertical diaphragm fastened to and extending upwardly from at least part of said cantilever portions at each side of the columns, a plurality of diaphragms fastened to and extending between adjacent pairs of said beams, and a plurality of parallel transverse beams spaced apart along the length of the horizontal beams between the vertical columns, said transverse beams being fastened to the top of and extending between the beams or said arch-like members.

2. A supporting structure for an open hearth furnace comprising a series of spaced apart arch-like members, each of said arch-like members including a vertical column under each end of the main bath portion of the furnace and a horizontal beam extending between and rigidly supported by said columns, each of said beams having a cantilever portion at each end extending beneath the chill sections of the furnace, a vertical diaphragm fastened to and extending upwardly from at least part of said cantilever portions at each side of the columns, means for suspending a refractory arch from said cantilever portions, a plurality of diaphragms fastened to and extending between adjacent pairs of said beams, means for holding the bottom of said columns from spreading, and a plurality of parallel transverse beams spaced apart along the length of the horizontal beams between the vertical columns, said transverse beams being fastened to the top of and extending between the beams of said arch-like members.

3. A supporting structure for an open hearth furnace comprising a series of spaced apart arch-like members, each of said arch-like members including a vertical column under each end of the main bath portion of the furnace and a horizontal beam extending between and rigidly supported by said columns, a plurality of diaphragms fastened to and extending between adjacent pairs of said beams, a plurality of parallel transverse beams spaced apart along the length of the horizontal beams between the vertical columns, said transverse beams being fastened to the top of and extending between the beams of said arch-like members, and a box-like structure surrounding said furnace and supported by the front and back ends of said transverse beams.

4. A supporting structure for an open hearth furnace comprising a series of spaced apart arch-like members, each of said arch-like members including a vertical column under each end of the main bath portion of the furnace and a horizontal beam extending between and rigidly supported by said columns, a plurality of diaphragms fastened to and extending between adjacent pairs of said beams, a plurality of parallel transverse beams spaced apart along the length of the horizontal beams between the vertical columns, said transverse beams being fastened to the top of and extending between the beams of said arch-like members, a beam fastened to the back end of said transverse beams and extending substantially the length of the furnace, angular buckstays fastened to and extending upwardly from the last named beam at the main bath portion of the furnace, said angular beams extending rearwardly from said furnace, vertical buckstays fastened to and extending upwardly from said last named beam to each side of the main bath portion of the furnace, and a horizontal beam extending the length of the main bath portion of the furnace and fastened to at least part of said last named buckstays intermediate their height.

5. A supporting structure for an open hearth furnace comprising a series of spaced apart arch-like members, each of said arch-like members including a vertical column under each end of the main bath portion of the furnace and a horizontal beam extending between and rigidly supported by said columns, each of said beams having a cantilever portion at each end extending beneath the chill sections of the furnace, a vertical diaphragm fastened to and extending upwardly from at least part of said cantilever portions at each side of the columns, a plurality of diaphragms fastened to and extending between adjacent pairs of said beams, a plurality of parallel transverse beams spaced apart along the length of the horizontal beams between the vertical columns, said transverse beams being fastened to the top of and extending between the beams of said arch-like members, a beam fastened to the back end of said transverse beams and extending substantially the length of the furnace, angular buckstays fastened to and extending upwardly from the last named beam at the main bath portion of the furnace, said angular beams extending rearwardly from said furnace, vertical buckstays fastened to and extending upwardly from said last named beam to each side of the main bath portion of the furnace, and a horizontal beam extending the length of the main bath portion of the furnace and fastened to at least part of said last named buckstays intermediate their height.

6. A supporting structure for an open hearth furnace comprising a series of spaced apart arch-like members, each of said arch-like members including a vertical column under each end of the main bath portion of the furnace and a horizontal beam extending between and rigidly supported by said columns, each of said beams having a cantilever portion at each end extending beneath the chill sections of the furnace, a vertical diaphragm fastened to and extending upwardly from at least part of said cantilever portions at each side of the

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columns, means for suspending a refractory arch from said cantilever portions, a plurality of diaphragms fastened to and extending between adjacent pairs of said beams, means for holding the bottom of said columns in said arch-like members from spreading, a plurality of parallel transverse beams spaced apart along the length of the horizontal beams between the vertical columns, said transverse beams being fastened to the top of and extending between the beams of said arch-like members, a beam fastened to the back end of said transverse beams and extending substantially the length of the furnace, angular buckstays fastened to and extending upwardly from the last named beam at the main bath portion of the furnace, said angular beams extending rearwardly from said furnace, vertical buckstays fastened to and extending upwardly from said last named beam to each side of the main bath portion of the furnace, and a horizontal beam extending the length of the main bath portion of the furnace and fastened to at least part of said last named buckstays intermediate their height.

7. A supporting structure for an open hearth furnace comprising a series of spaced apart arch-like members, each of said arch-like members including a vertical column under each end of the main bath portion of the furnace and a horizontal beam extending between and rigidly supported by said columns, each of said beams having a cantilever portion at each end extending beneath the chill sections of the furnace, a vertical diaphragm fastened to and extending upwardly from at least part of said cantilever portions at each side of the columns, a plurality of diaphragms fastened to and extending between adjacent pairs of said beams, a plurality of parallel transverse beams spaced apart along the length of the horizontal beams between the vertical columns, said transverse beams being fastened to the top of and extending between the beams of said arch-like members, a pair of beams having their flanges arranged vertically and extending the length of said furnace with one being fastened to each end of said transverse beams, a pair of beams one at each end of the furnace having their flanges arranged vertically, means connecting one of the last named pair of beams to one end of said first named pair of beams, means connecting the other of the last named pair of beams to the other end of said first named pair of beams, vertical buckstays fastened to and extending upwardly from the front beam of said first named pair of beams and from each of the second named pair of beams, angular buckstays fastened to and extending upwardly from the rear beam of said first named pair of beams at the main bath portion of the furnace, said angular beams extending rearwardly from said furnace, vertical buckstays fastened to and extending upwardly from the rear beam of said first named pair of beams to each side of the main bath portion of the furnace, and a horizontal beam extending the length of the main bath portion of the furnace and fastened to at least part of said last named buckstays intermediate their height.

8. A supporting structure according to claim 7 having a frame fastened to the front, side and rear buckstays adjacent the top thereof, and means extending across the top of said furnace connecting the front and rear buckstays.

9. A supporting structure for an open hearth furnace comprising a series of spaced apart arch-like members, each of said arch-like members including a vertical column under each end of the main bath portion of the furnace and a horizontal beam extending between and rigidly supported by said columns, each of said beams having a cantilever portion at each end extending beneath the chill sections of the furnace, a vertical diaphragm fastened to and extending upwardly from at least part of said cantilever portions at each side of the columns, means for suspending a refractory arch from

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said cantilever portions, a plurality of diaphragms fastened to and extending between adjacent pairs of said beams, means for holding the bottom of said columns in said arch-like members from spreading, a plurality of parallel transverse beams spaced apart along the length of the horizontal beams between the vertical columns, said transverse beams being fastened to the top of and extending between the beams of said arch-like members, a pair of beams having their flanges arranged vertically and extending the length of said furnace with one being fastened to each end of said transverse beams, a pair of beams one at each end of the furnace having their flanges arranged vertically, means connecting one of the last named pair of beams to one end of said first named pair of beams, means connecting the other of the last named pair of beams to the other end of said first named pair of beams, vertical buckstays fastened to and extending upwardly from the front beam of said first named pair of beams and from each of the second named pair of beams, angular buckstays fastened to and extending upwardly from the rear beam of said first named pair of beams at the main bath portion of the furnace, said angular beams extending rearwardly from said furnace, vertical buckstays fastened to and extending upwardly from the rear beam of said first named pair of beams to each side of the main bath portion of the furnace, and a horizontal beam extending the length of the main bath portion of the furnace and fastened to at least part of said last named buckstays intermediate their height.

10. A supporting structure according to claim 9 having a frame fastened to the front, side and rear buckstays adjacent the top thereof, and means extending across the top of said furnace and connecting the front and rear buckstays.

11. A supporting structure for an open hearth furnace comprising a series of spaced apart arch-like members, each of said arch-like members including a vertical column under each end of the main bath portion of the furnace and a horizontal beam extending between and rigidly supported by said columns, each of said beams having a cantilever portion at each end extending beneath the chill sections of the furnace, a vertical diaphragm fastened to and extending upwardly from at least part of said cantilever portions at each side of the columns, means for suspending a refractory arch from said cantilever portions, a plurality of diaphragms fastened to and extending between adjacent pairs of said beams, means for holding the bottom of said columns in said arch-like members from spreading, a plurality of parallel transverse beams spaced apart along the length of the horizontal beams between the vertical columns, said transverse beams being fastened to the top of and extending between the beams of said arch-like members, a pair of beams having their flanges arranged vertically and extending the length of said furnace with one being fastened to each end of said transverse beams, a pair of beams one at each end of the furnace having their flanges arranged vertically, means connecting one of the last named pair of beams to one end of said first named pair of beams, means connecting the other of the last named pair of beams to the other end of said first named pair of beams, vertical buckstays fastened to and extending upwardly from the front beam of said first named pair of beams and from each of the second named pair of beams, angular buckstays fastened to and extending upwardly from the rear beam of said first named pair of beams at the main bath portion of the furnace, said angular beams extending rearwardly from said furnace, and vertical buckstays fastened to and extending upwardly from the rear beam of said first named pair of beams to each side of the main bath portion of the furnace.

12. A supporting structure according to claim 11 hav-

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ing a frame fastened to the front, side and rear buckstays adjacent the top thereof, and means extending across the top of said furnace and connecting the front and rear buckstays.

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