

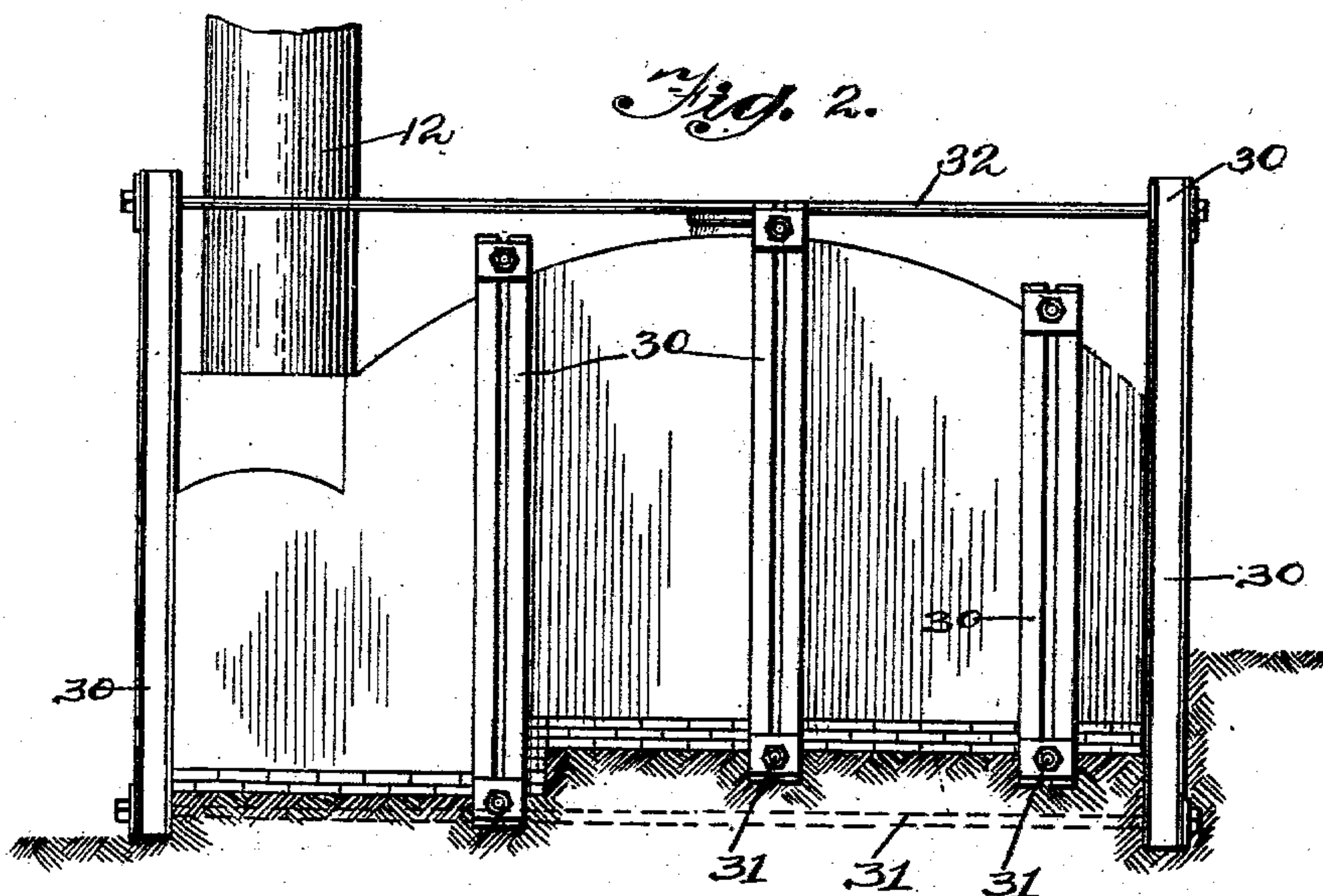
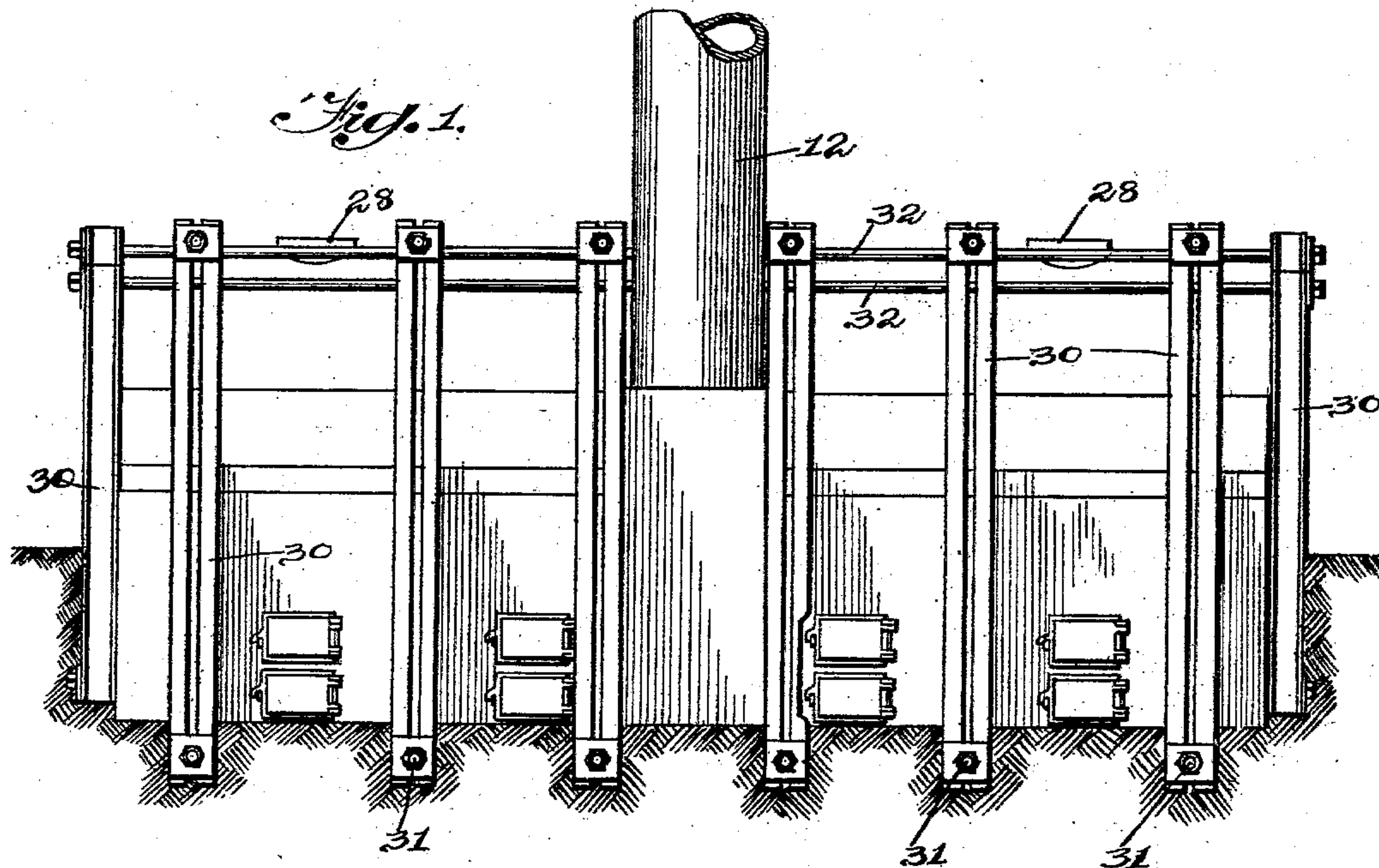
No. 716,893.

Patented Dec. 30, 1902.

A. M. HEWLETT.
ANNEALING FURNACE.
(Application filed Jan. 13, 1902.)

(No Model.)

4 Sheets—Sheet 1.



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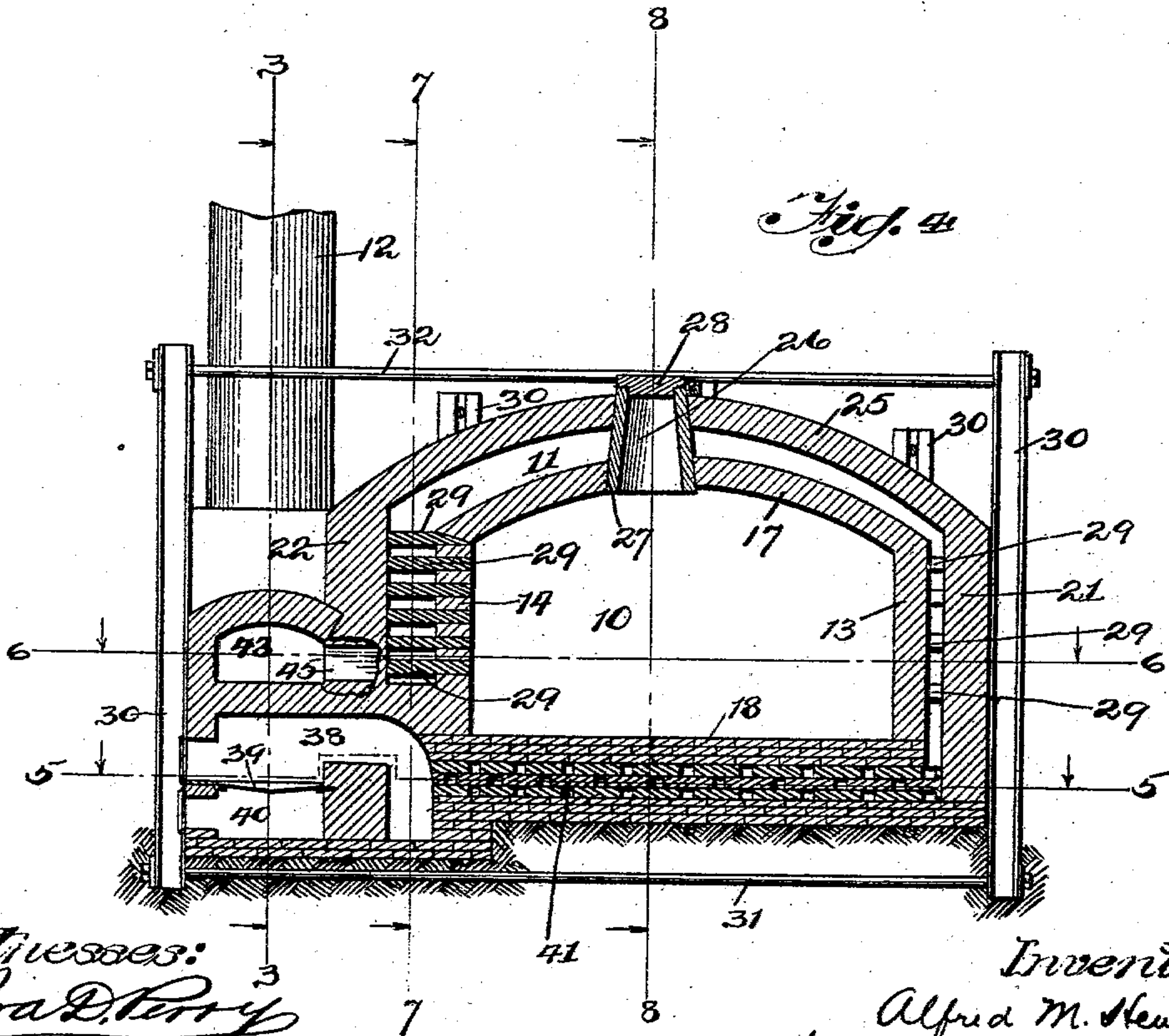
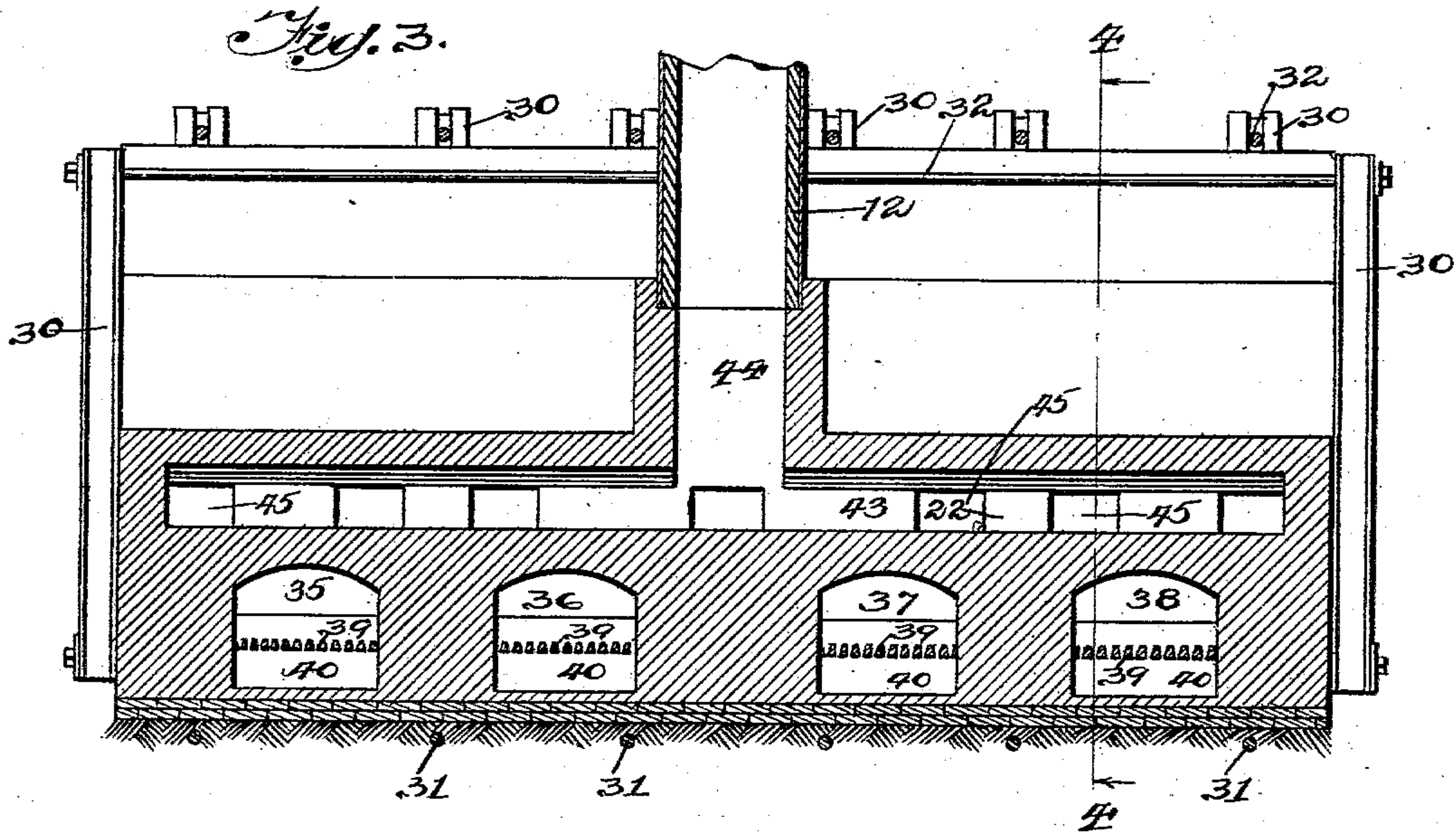
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4 Sheets—Sheet 2.



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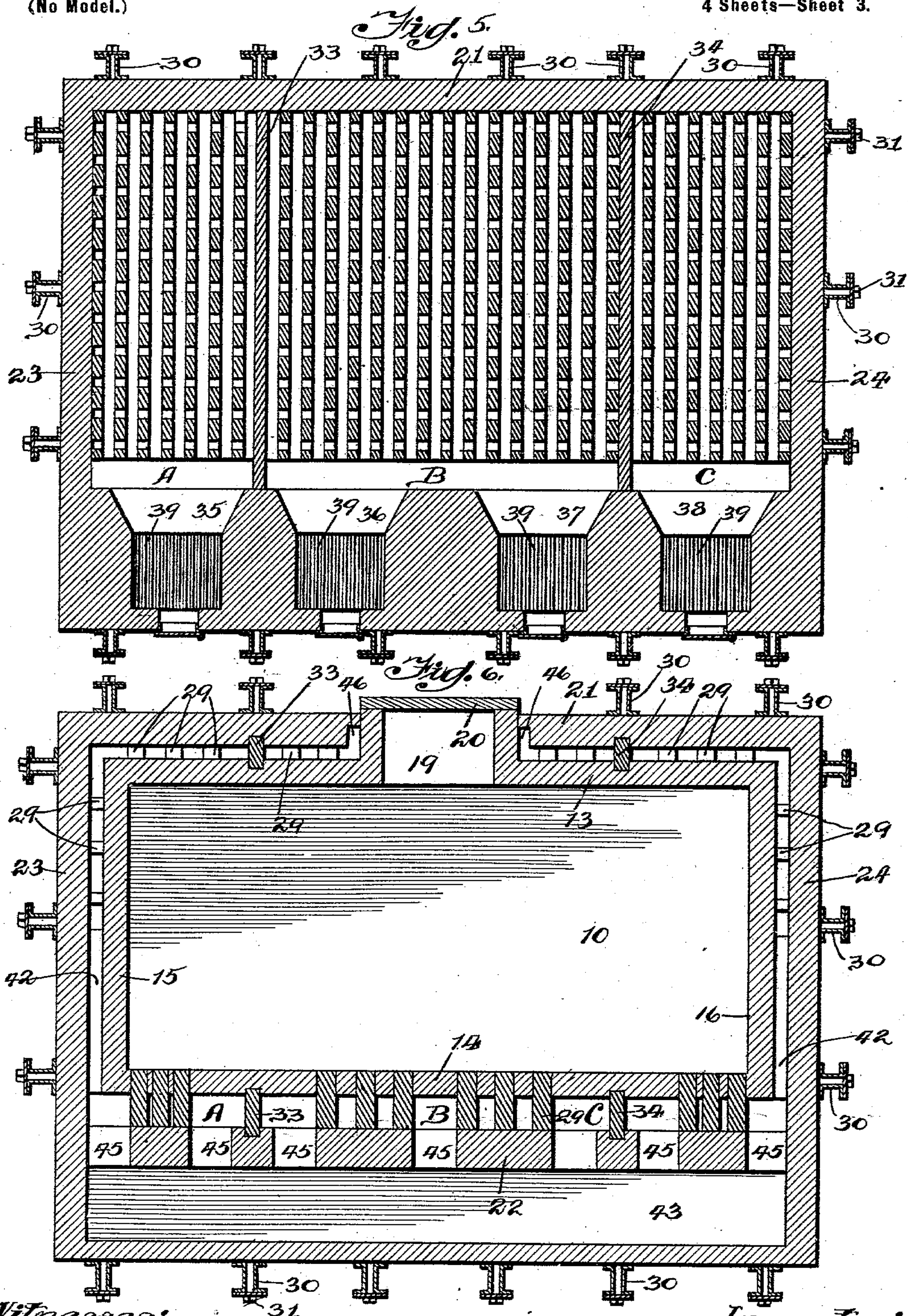
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4 Sheets—Sheet 3.



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4 Sheets—Sheet 4.

Fig. 7.

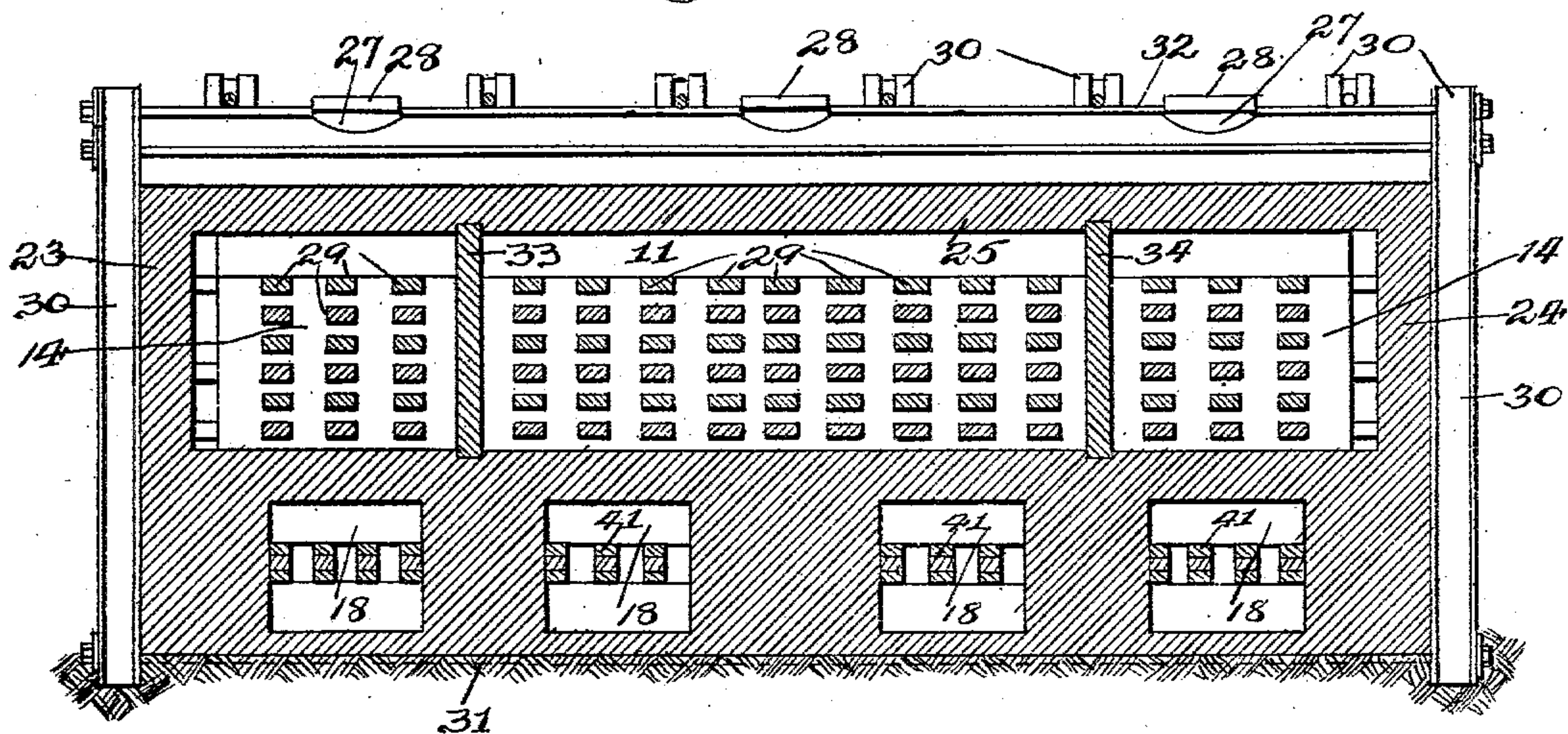
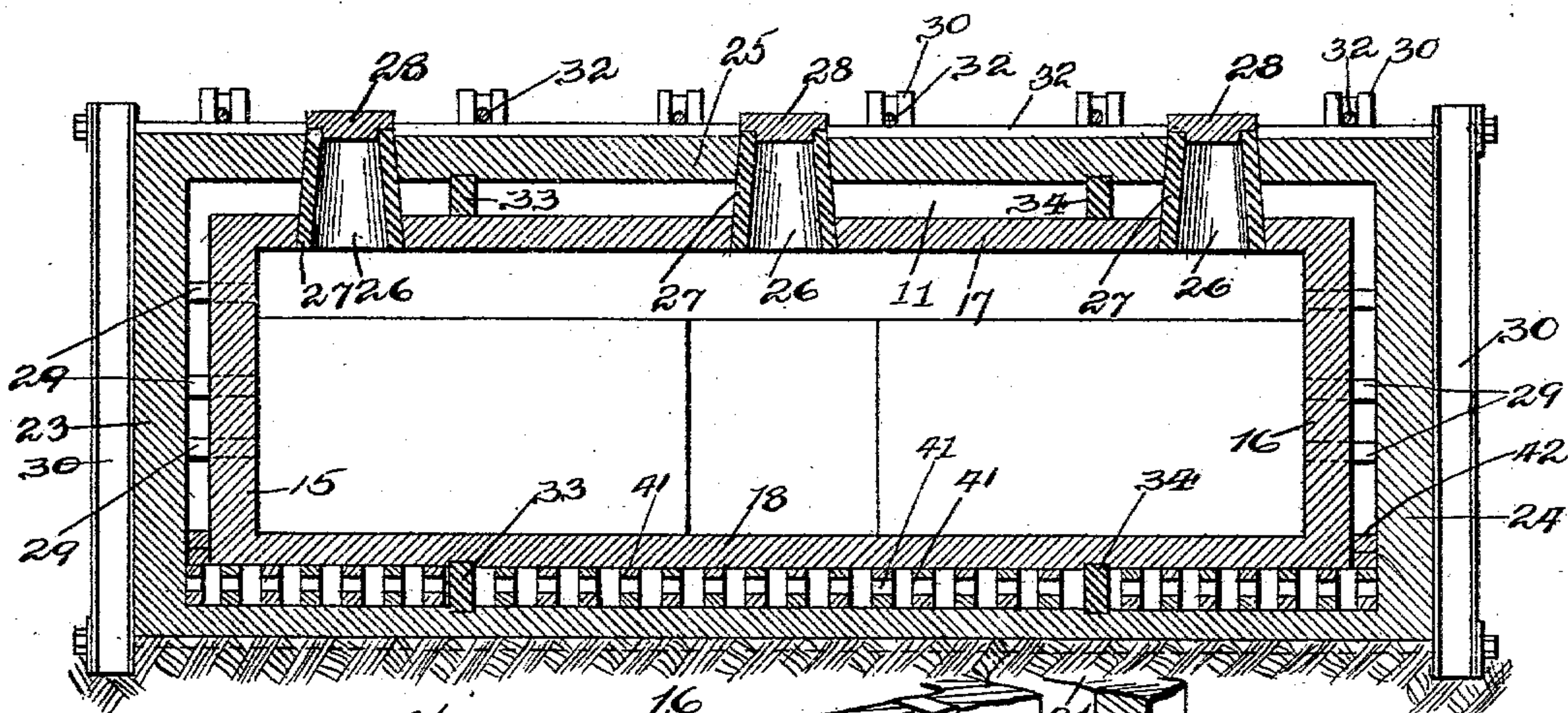


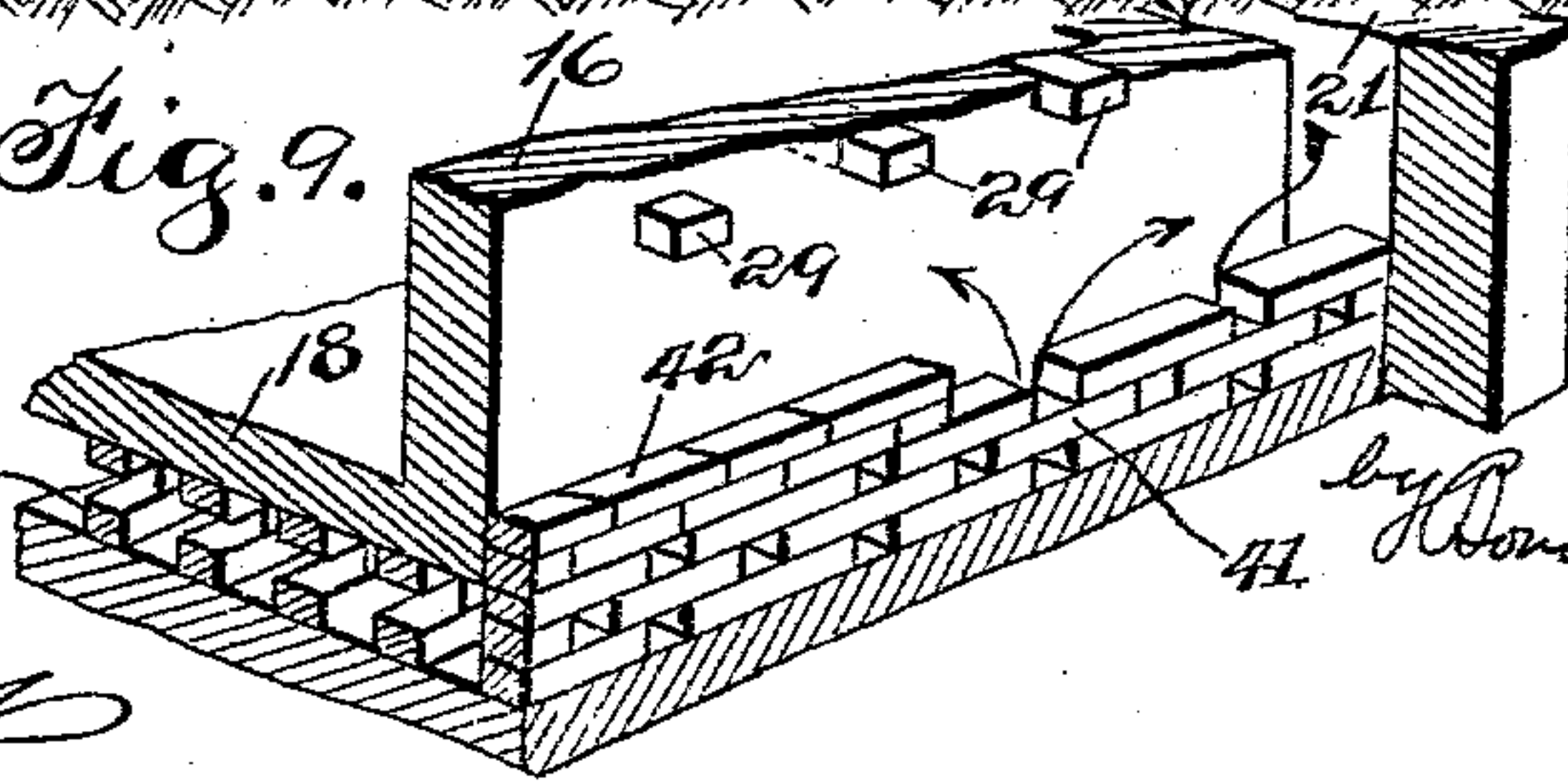
Fig. 8.



Witnesses: Fig. 9.

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UNITED STATES PATENT OFFICE.

ALFRED M. HEWLETT, OF KEWANEE, ILLINOIS.

ANNEALING-FURNACE.

SPECIFICATION forming part of Letters Patent No. 716,893, dated December 30, 1902.

Application filed January 13, 1902. Serial No. 89,595. (No model.)

To all whom it may concern:

Be it known that I, ALFRED M. HEWLETT, a citizen of the United States, residing at Kewanee, in the county of Henry and State of Illinois, have invented certain new and useful Improvements in Annealing-Furnaces, of which the following is a specification, reference being had to the accompanying drawings.

10 My invention relates to furnaces for annealing iron castings and other objects.

It has for its object to provide certain improvements in furnaces adapted to employ coal, gas, or coke by which the heat may be more evenly distributed throughout the furnace than in constructions heretofore employed, by which furnaces of much larger capacity can be efficiently employed, by which the distribution of the heat can be accurately controlled and regulated for different parts of the furnace, and by which the greatest efficiency can be secured from the fuel consumed.

25 In annealing-furnaces as heretofore commonly constructed it has been found necessary to build the furnaces of small size, owing to the fact that it has been impracticable to heat large furnaces uniformly. The life of an annealing-furnace is dependent to a large extent upon the number of heats, the heating and cooling ordinarily serving to destroy it or at least injure it to such an extent that its destruction is necessary after about fifty heats. Besides, the heating and cooling of the furnace occupy a considerable period of time. Consequently it is desirable that an annealing-furnace be made of as great capacity as possible, so that time, as well as labor and materials, may be economized. 35 While this has long been well understood by those familiar with the art, it has heretofore been found impracticable to construct large furnaces, owing to the fact that the constructions employed have not been such as to provide effectively for distributing the heat uniformly throughout all parts of the furnace, and particularly the end portions thereof.

50 In annealing-furnaces as heretofore commonly constructed the heating apparatus has been arranged to apply the heat first to the upper portion of the furnace, and owing to the natural tendency of the heated air to rise

it has been quite difficult, if not impossible, to heat the lower portion of the furnace satisfactorily. Furthermore, the heat has been so applied that it was not equally distributed throughout the furnace, the result being that some of the castings would be heated too hot, while others would not heat hot enough, in both cases imperfect annealing being effected. 55 60

By my improvements I provide for heating all parts of the furnace uniformly, the heat being applied first at the bottom of the furnace, provision, however, being made for maintaining a constant application of heat on all sides thereof, so that the castings in all parts of the furnace are equally heated and the temperature at all points is substantially uniform. I further provide for increasing or reducing the temperature in certain parts of the furnace without materially varying the temperature in other parts thereof, and this without regard to the size of the furnace, so that the question of size is practically eliminated and it is practicable to employ furnaces of great length. I further provide a much stronger construction of furnace than heretofore has been produced. 65 70 75

In addition to the foregoing my invention involves certain other improvements, which will be hereinafter pointed out. What I regard as new is set forth in the claims. 80

In the drawings, Figure 1 is a front view of a furnace. Fig. 2 is an end elevation thereof. Fig. 3 is a longitudinal vertical section on line 3 3 of Fig. 4. Fig. 4 is a vertical cross-section on line 4 4 of Fig. 3. Fig. 5 is a horizontal section on line 5 5 of Fig. 4. Fig. 6 is a horizontal section on line 6 6 of Fig. 4. Fig. 7 is a longitudinal vertical section on line 7 7 of Fig. 4. Fig. 8 is a longitudinal vertical section on line 8 8 of Fig. 4; and Fig. 9 is a perspective view illustrating one end of the furnace, the outer walls being broken away and certain parts being in section. 85 90 95

In my improved furnace there are two chambers—an inner chamber 10, which is adapted to contain the castings or other articles to be annealed, and an outer chamber 11, through which the combustible gases from the furnace are conducted on their way to the smoke-stack 12. For convenience of description the inner chamber 10 will be referred to as the “annealing-chamber” and the outer 100

chamber 11 as the "heating-chamber." As shown in Figs. 4 and 6, the annealing-chamber 10 is inclosed by front and rear walls 13 14, respectively, end walls 15 16, and a roof 17, which is preferably arched, as shown in Fig. 4. The floor 18 of the annealing-chamber 10 is a solid fire-brick floor, as shown in Fig. 4. A doorway 19 is provided in the front wall 13, preferably at the center, as shown in Fig. 6, and is closed by a door 20. The heating-chamber 11 is inclosed by front and rear walls 21 22, respectively, end walls 23 24, and a roof 25, preferably arched, as shown in Fig. 4. As best shown in Fig. 4, the walls of the heating-chamber are spaced apart from the walls of the annealing-chamber a sufficient distance to provide space for the gases from the furnace to pass, and, as shown, greater space is provided at the rear than at the front, so that although the gases may have cooled to some extent by the time they reach the rear of the furnace the heat applied to the rear of the furnace is not reduced. As shown in Fig. 6, the doorway 19 extends through both walls 13 and 21, so that access may readily be had to the annealing-chamber for charging or emptying the furnace.

26 indicates a number of apertures which extend through the roofs 17 and 25 of the annealing and heating chambers, as shown in Figs. 4 and 8. Said apertures are designed for charging the furnace, and they are formed by inseting tiles 27, said tiles extending through the roofs of both chambers. Covers 28 are provided for said tiles, so that they may be hermetically sealed.

The side and end walls of the annealing-chamber 10 are supported by a series of tiles 29, which are fitted in the walls and project far enough out to engage the inner surfaces of the walls of the heating-chamber. The arrangement of said tiles is best shown in Figs. 4 and 6. The outward pressure on the walls of the annealing-chamber is considerable, since said chamber is entirely filled with castings; but such outward pressure is effectually resisted by the tiles 29, which transmit the pressure to the walls of the heating-chamber. The latter are supported and braced by I-beams 30 or railroad-rails, the lower ends of which are embedded in the foundation of the furnace and are connected by tie-rods 31, which extend under the furnace, as shown in Fig. 4. The upper ends of the beams 30 are connected by tie-rods 32, which extend over the furnace. As shown in Figs. 2 and 4, I-beams 30 are provided at the ends as well as the sides of the furnace, and the tie-rods 31 32 extend across the furnace longitudinally as well as transversely. By this construction all the outer walls of the furnace are thoroughly supported, thereby also firmly supporting the inner walls. 33 34 indicate partitions which extend around the annealing-chamber transversely of the furnace, as best shown in Figs. 5, 6, and 8. One of said partitions is placed between the doorway 19 and

the end wall 23 and the other between the doorway 19 and the end wall 24, as shown, thus dividing the heating-chamber into three separate compartments A, B, and C, respectively. The object of this construction is to assist in directing the heat to different vertical zones of the furnace and to insure its proper distribution, as will be hereinafter more fully explained.

35 36 37 38 indicate a number of fire-boxes having grate-bars 39 and ash-pits 40. As best shown in Figs. 3, 4, and 5, the fire-boxes 35 36 37 38 are placed in a row along the rear side of the furnace, extending under the smoke-stack 12. The fire-box 35 communicates with compartment A, the fire-boxes 36 37 with compartment B, and the fire-box 39 with compartment C, as best shown in Fig. 5. While this specific arrangement is preferred, it is not essential. A greater or less number of compartments may be provided, and a greater or less number of fire-boxes may also be employed, the feature which the drawings are designed to illustrate being the provision of a plurality of compartments with separate means for furnishing heat to such compartments, whereby the heat is compelled to pass in a predetermined direction. The hot gases from the different fire-boxes are conducted from the fire-boxes at the rear of the furnace under the floor of the annealing-chamber to the lower portion of the heating-chamber at the front of the furnace—that is to say, that portion of the heating-chamber between the front walls 13 and 21 of the annealing and heating chambers. At the same time it is also conducted to the lower portions of the heating-chamber at the ends of the furnace. For thus distributing the heat a checker-brick construction 41 is provided under the floor 18 of the annealing-chamber, as shown in Figs. 4 and 5. By this construction the heat can pass both transversely and longitudinally of the furnace, and as the floor 18 of the annealing-chamber is subjected to the heat the bottom of the annealing-chamber is heated first, the heat afterward being applied to the sides, ends, and roof of the annealing-chamber as the hot gases pass up in the heating-chamber. In order to prevent the heat which passes from the end fire-boxes 35 38 into the end portions of the heating-chamber from rising immediately upon passing from said fire-boxes, the rear portion of the checker-brick at the ends of the furnace is overlaid with fire-brick 42 for about half the width of the annealing-chamber, as best shown in Fig. 9, thereby compelling the hot gases to pass through the checker-brick passage to a point beyond the transverse center of the furnace before they can rise. They are thus forced to the front portion of the heating-chamber and are thereby made effective for heating all parts of the annealing-chamber properly.

43 indicates a flue or tunnel which extends longitudinally of the furnace over the fire-boxes 35 36 37 38, as best shown in Figs. 4

and 6. Said flue communicates directly with the smoke-stack 12 by a passage 44. (Best shown in Fig. 3.) It also communicates with the lower rear portion of the heating-chamber 11 by a series of passages 45, placed at intervals longitudinally of the rear wall 22 of the heating-chamber. By this construction the hot gases and other products of combustion pass from the heating-chamber 11 down through the passages 45 into the flue 43 and thence up and out through the stack 12.

The operation is as follows: The annealing-chamber 10 is filled with castings, usually at first through both the door 20 and the passages 26 in the roof, afterward through said passages only. When the annealing-chamber has been filled, the door 20 and passages 26 are tightly closed, and the fires are started in the fire-boxes 35 36 37 38. The hot gases and other products of combustion pass through the fire-boxes into the checker-brick passages under the floor 18 of the annealing-chamber, heating said floor. The heat from the fire-boxes 36 37 passes directly across the furnace, rising into the heating-chamber between the front walls 13 and 21. The heat from the end fire-boxes 35 38 in part passes directly across to the front of the furnace and in part up at the ends of the furnace; but, as above stated, it cannot rise until it has passed beyond the fire-brick covering 22, the heat in the different compartments then passing over the roof 17 of the annealing-chamber and down through passages 45 to the flue 43, from which it escapes into the stack 12. It will thus be seen that the heated gases pass entirely around the annealing-chamber, so that all parts of it are effectually heated. It will further be seen that by providing a plurality of fire-boxes should it be desired to increase or diminish the heat at any part of the furnace it may readily be accomplished by properly regulating the appropriate fire-boxes.

When the castings or other articles have been heated sufficiently, the furnace is allowed to cool and the castings removed. The cooling is expedited by removing the covers 28 and opening the door 20.

An important feature of my improved construction consists in arranging the fire-boxes at the side of the furnace and extending the heat-passages transversely thereof, so that the heat passes around the furnace the narrow way. Consequently the temperature of the gases and other products of combustion at all points in the heating-chamber is substantially the same, the temperature of the gases at the outlet portion of the heating-chamber being only slightly less than at the inlet end thereof, and this variation is compensated for by increasing the area of the heating-chamber near the outlet, as above stated. As shown in Fig. 6, the heating-chamber 11 is provided with an offset portion or enlargement 46 around the doorway 19, the object of which is to compensate for the loss

of space in the heating-chamber caused by the presence of the doorway, and this further insures a uniform heating at all points. It should be noted that by my construction the articles under treatment are entirely protected from the products of combustion, so that there is no danger of their being damaged in that way.

I wish it to be understood that various modifications may be made without departing from my invention, since, although I have described specifically the construction illustrated, my invention is not restricted to such details except in so far as they are particularly claimed.

That which I claim as my invention, and desire to secure by Letters Patent, is—

1. In an annealing-furnace, the combination of an annealing-chamber, a fire-box at one side thereof and a conduit for conducting the heat from said fire-box under and in proximity to the floor of said annealing-chamber and thence into contact with all sides of said chamber, substantially as described.

2. In an annealing-furnace, the combination of an annealing-chamber, a fire-box, and a conduit for conducting the heat from said fire-box under and in proximity to the floor of said annealing-chamber, thence upward adjacent to the end walls and a side wall of said chamber and then over said chamber, and down adjacent to the other side wall thereof, substantially as described.

3. In an annealing-furnace, the combination of an annealing-chamber, a fire-box at one side of said furnace, and means for heating said annealing-chamber on all sides by heat from said fire-box, substantially as described.

4. In an annealing-furnace, the combination of an annealing-chamber, a plurality of heating-compartments adjacent to the outside of the walls of the said annealing-chamber and arranged to heat separate vertical zones of the annealing-chamber, and means for supplying heat to said compartments, substantially as described.

5. In an annealing-furnace, the combination of an annealing-chamber, a fire-box at one side thereof, a conduit extending under the floor of said annealing-chamber, a heating-chamber surrounding all sides of said annealing-chamber, said conduit being separated from said heating-chamber except near and at the side of the furnace opposite that at which the fire-box is placed, and a stack communicating with said heating-chamber, substantially as described.

6. In an annealing-furnace, the combination of an annealing-chamber, a plurality of fire-boxes on one side of said furnace and means for heating said annealing-chamber on all sides by heat from said fire-boxes, substantially as described.

7. In an annealing-furnace, the combination of an annealing-chamber, a plurality of heating-compartments adjacent to and outside of the walls of said annealing-chamber

for conducting heat to different parts of the wall of said annealing-chamber, and a plurality of fire-boxes for supplying heat to said compartments, substantially as described.

5 8. In an annealing-furnace, the combination of an annealing-chamber, a heating-chamber around said annealing-chamber, a conduit below the floor of said annealing-chamber, partitions in said conduit and heating-
10 chamber, dividing said conduit and heating-chamber into compartments, and a plurality of fire-boxes for supplying heat to said compartments, substantially as described.

9. In an annealing-furnace, the combination of an annealing-chamber, a heating-chamber around said annealing-chamber, a conduit below the floor of said annealing-chamber, partitions in said conduit and heating-chamber, dividing said conduit and heating-chamber into compartments, a plurality of fire-
20 boxes for supplying heat to said compartments, a flue with which said compartments communicate, and a stack communicating with said flue, substantially as described.

25 10. In an annealing-furnace, the combination of an annealing-chamber, a checker-brick conduit under the floor of said chamber, a fire-box with which said conduit communicates, and a heating-chamber surrounding all sides
30 of said annealing-chamber and receiving heat from said conduit, substantially as described.

11. In an annealing-furnace, the combination of an annealing-chamber, means surrounding all sides of said annealing-chamber
35 for applying heat to the outer surface of the walls thereof for heating the same, and means for regulating the distribution of heat to different vertical zones of the wall of said annealing-chamber, substantially as described.

40 12. In an annealing-furnace, the combination of an annealing-chamber, a heating-chamber surrounding all sides of said annealing-chamber, a door for said annealing-chamber, and a passage through the roofs of said chambers, substantially as described.
45

13. In an annealing-furnace, the combination of an annealing-chamber, a heating-chamber inclosing said annealing-chamber, a door for said annealing-chamber, and a tube extending through the roofs of said chambers,
50 substantially as described.

14. In an annealing-furnace, the combination of an annealing-chamber, a heating-cham-

ber inclosing said annealing-chamber, a doorway for said annealing-chamber, said heating-chamber being enlarged around said doorway, and means for supplying heat to said heating-chamber; substantially as described. 55

15. In an annealing-furnace, the combination of an annealing-chamber, a heating-chamber surrounding all sides of said annealing-chamber, a fire-box at one side of said furnace, and a conduit extending under the floor of said annealing-chamber and communicating with said heating-chamber adjacent to
60 and at the opposite side thereof, said conduit being closed at the side of the furnace adjacent to the fire-box, whereby the heat is conducted to near the opposite side of the furnace before it passes into said heating-chamber, substantially as described. 65 70

16. In an annealing-furnace, the combination of a substantially rectangular annealing-chamber, means for applying heat to the bottom thereof, and means for conducting the
75 heat from under the bottom up around three sides thereof, thence over the top, and then down on the fourth side thereof, substantially as described.

17. In an annealing-furnace, the combination of a substantially rectangular annealing-chamber, a fire-box at one side thereof, and means for conducting heat from said fire-box to the bottom of said annealing-chamber, thence up around three sides thereof, thence
80 over the top, and then down over the fourth side thereof, substantially as described. 85

18. In an annealing-furnace, the combination of an elongated annealing-chamber, a plurality of fire-boxes arranged at one of the
90 sides of said furnace, and means for conducting heat from said fire-boxes transversely around said annealing-chamber and up over the end portions thereof, substantially as described. 95

19. In an annealing-furnace, the combination of an annealing-chamber, a plurality of heating-compartments adjacent to the outside walls of said annealing-chamber and arranged to heat separate vertical zones of the annealing-chamber, and means for varying the heat-supply in the said zone. 100

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