H. E. SMYTHE.

CONTINUOUS HEATING FURNACE.

APPLICATION FILED DEC. 4, 1908.

924,009. **Patented June 8, 1909.**

5 SHEETS—SHEET 1.

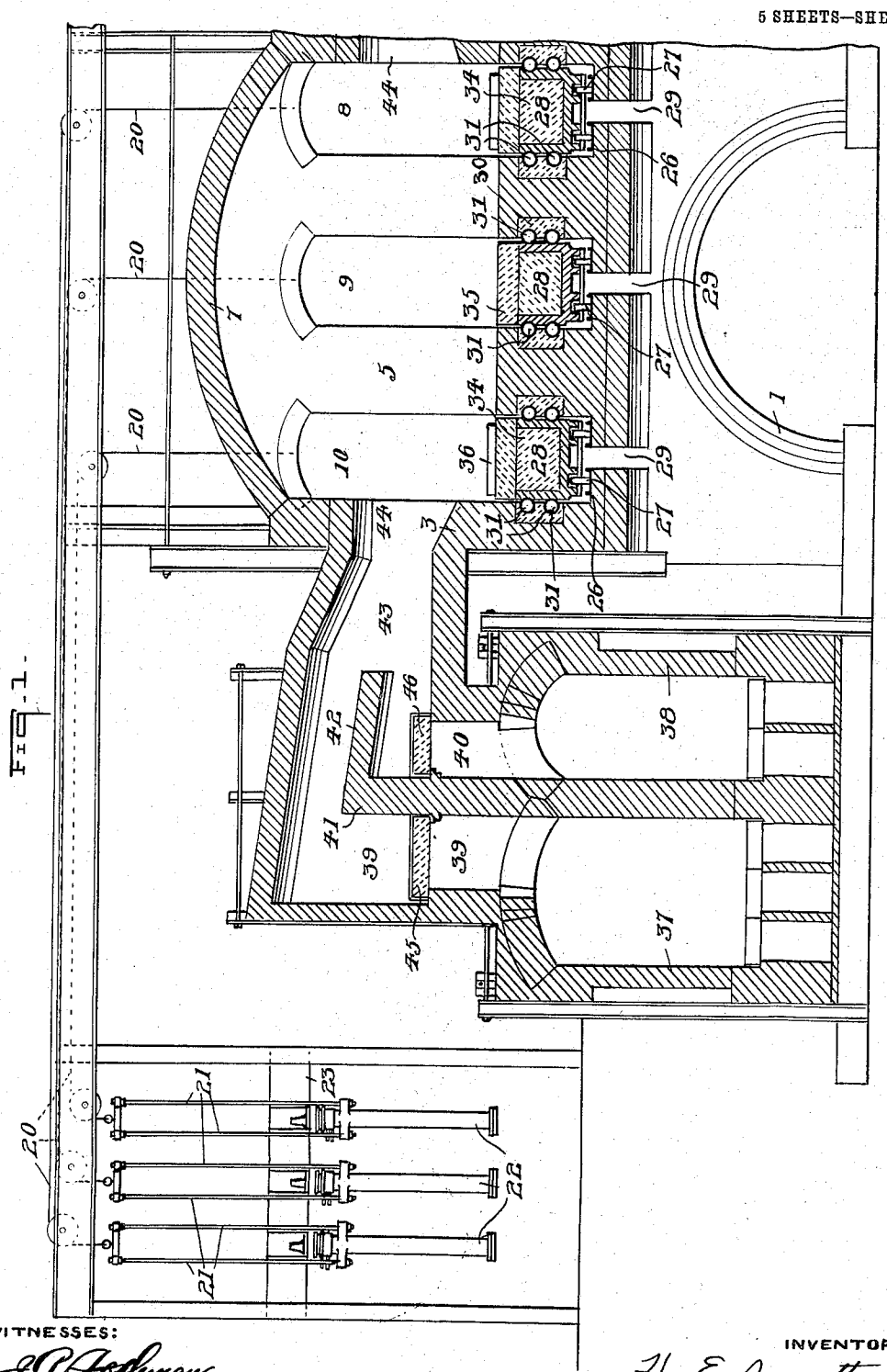


Fig. 1.

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5 SHEETS—SHEET 2.

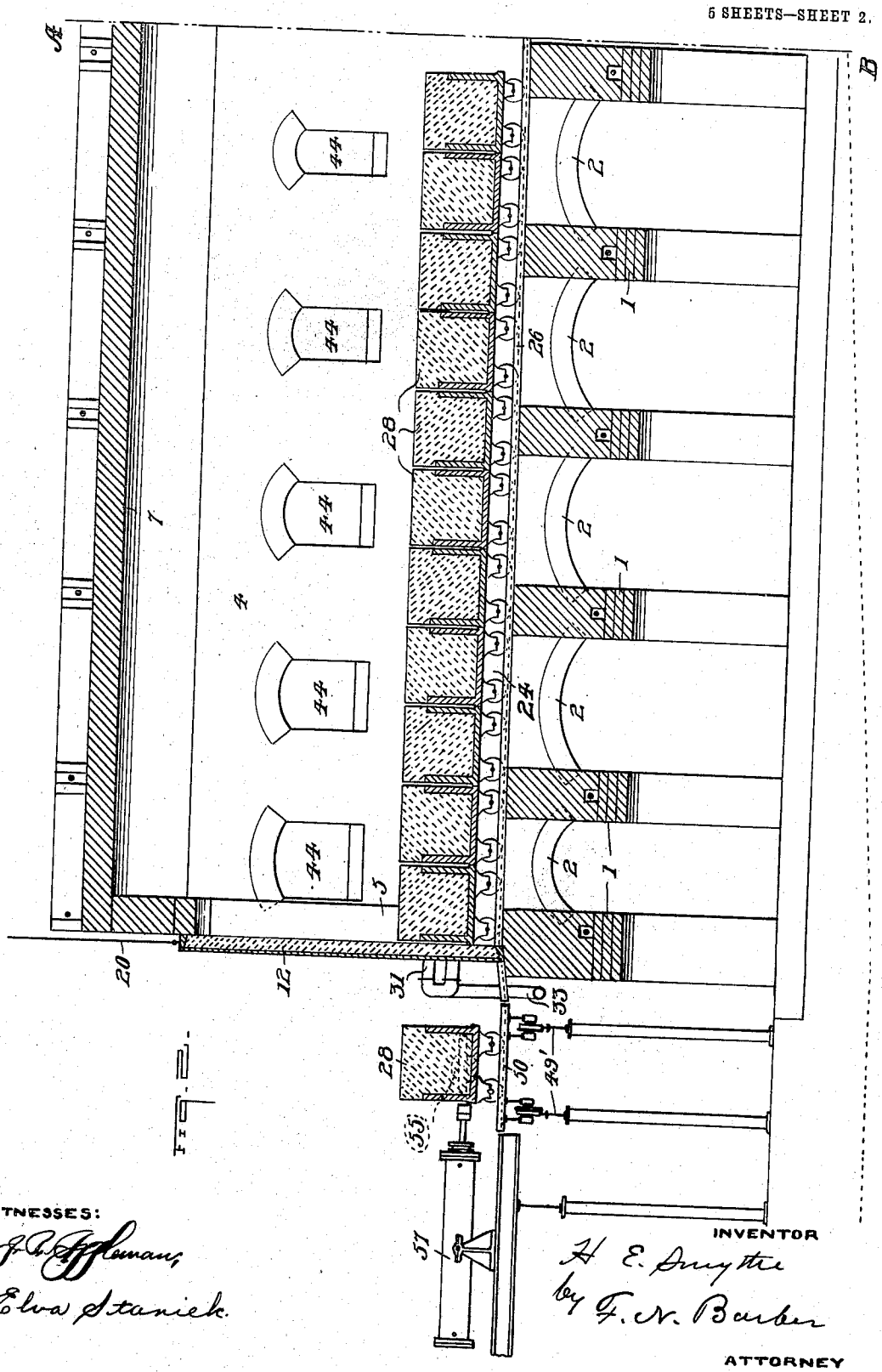


FIG. 2.

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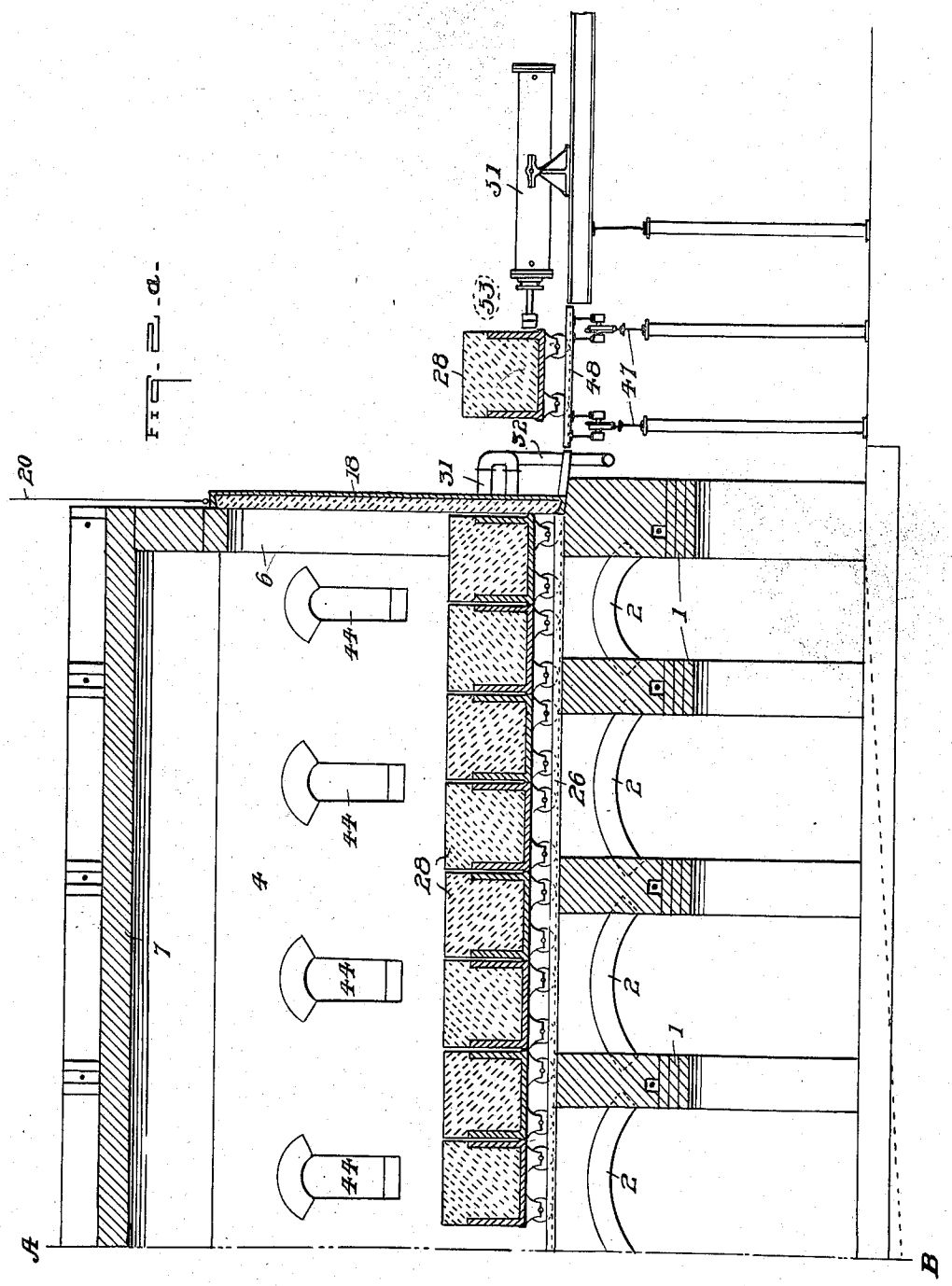
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5 SHEETS—SHEET 3.

Fig. 2.a.



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6 SHEETS—SHEET 4.

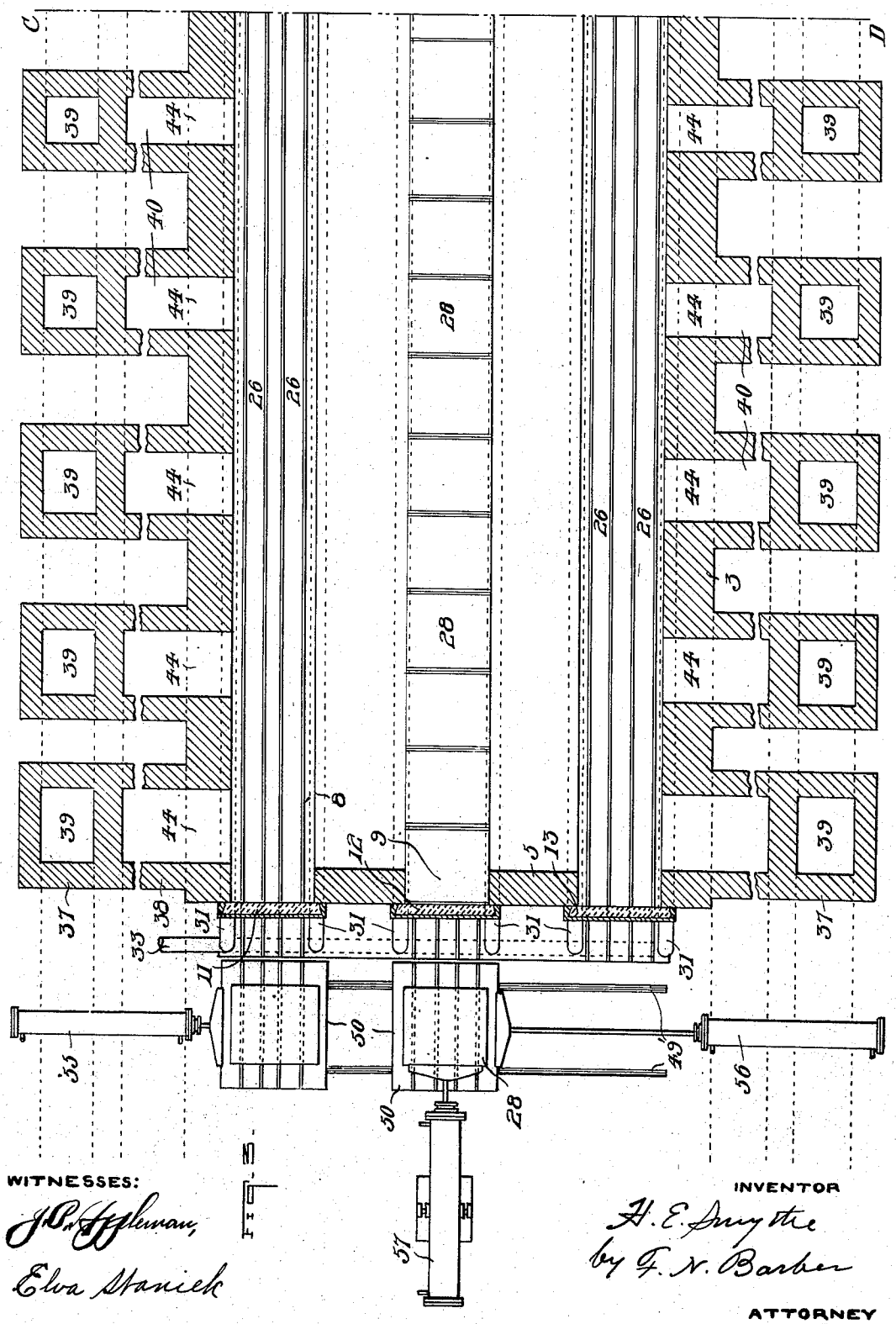


FIG. 5.

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5 SHEETS—SHEET 5.

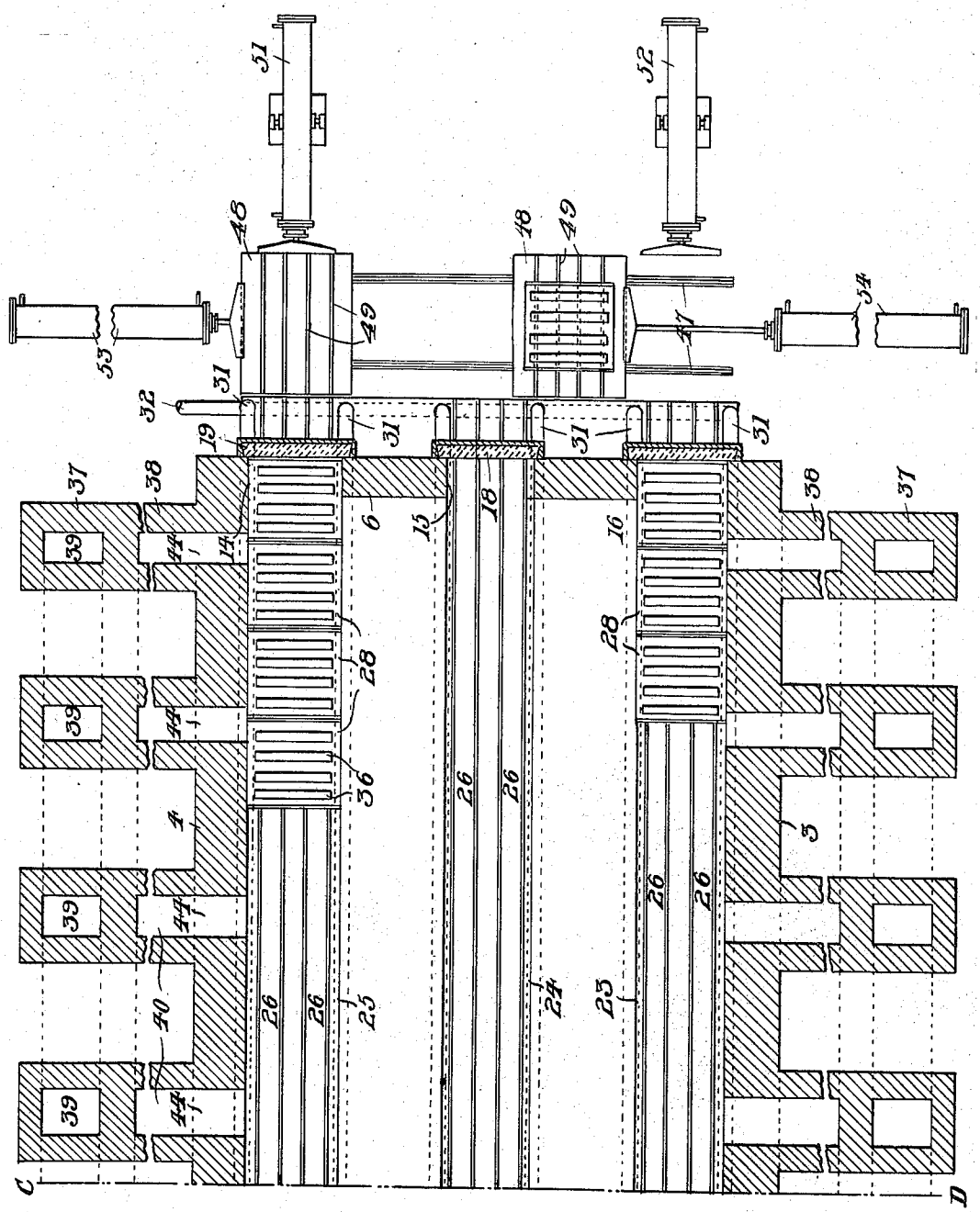


FIG. 5.

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UNITED STATES PATENT OFFICE.

HORACE E. SMYTHE, OF OAKMONT, PENNSYLVANIA, ASSIGNOR TO THE S. R. SMYTHE COMPANY, OF PITTSBURG, PENNSYLVANIA, A CORPORATION OF WEST VIRGINIA.

CONTINUOUS-HEATING FURNACE.

No. 924,009. Specification of Letters Patent. Patented June 8, 1909.

Application filed December 4, 1908. Serial No. 465,918.

To all whom it may concern:

Be it known that I, HORACE E. SMYTHE, a citizen of the United States, residing at Oakmont, in the county of Allegheny and State of Pennsylvania, have invented or discovered new and useful Improvements in Continuous-Heating Furnaces, of which the following is a specification.

My invention relates to continuous heating furnaces. Its object is to provide a furnace of this character which, in connection with its accessories, is capable of heating to the required degree any class of articles, as billets, slabs, ingots, annealing boxes, crucibles, glass melting or annealing pots and the like.

Another object is to provide a furnace having a large capacity, so that a large number of articles may be simultaneously treated.

Another object is to provide a novel means for keeping the article-carrying devices hot on their return to the feeding-in end of the furnace.

Other objects are to cause the article carrying devices, preferably cars, to seal the bottom of the furnace chamber; to provide means for cooling the said article-carrying devices below a destructive temperature; and to provide for their transfer from one part of the furnace to another and their entrance into and discharge from the furnace.

Other minor objects will appear in the description following.

Referring to the accompanying drawings, Figure 1 is a vertical cross-section through one form of my invention. Figs. 2 and 2ª, mutually supplemental views showing my invention in longitudinal vertical section; and Figs. 3 and 3ª, mutually supplemental views showing a horizontal section.

On the drawings, 1 represents a series of parallel arches standing transversely of the length of the furnace, and 2, a series of arches, standing at right angles to the arches 1, the two sets of arches forming a foundation or base for the furnace floor.

3 and 4 represent the side walls, 5 and 6 the ends, and 7 the roof of the furnace. The front end 3 has the three doorways 8, 9, and 10, closed and opened by the vertically slidable gates or doors 11, 12, and 13, respectively, and the rear wall 4 has the three doorways 14, 15, and 16, arranged respectively directly opposite the doorways 8, 9, and 10, and closed and opened by the vertically slidable gates or doors 17, 18, and 19. The doors are connected by individual cables 20 to the separate hydraulic cylinders 21, by which the doors may be raised and lowered, in a manner well understood. The pistons 22 of the cylinders are stationary, being secured to the cross-bar 23.

There are three depressed track-ways 23, 24, and 25 in the bottom of the furnace, the track-way 23 being in line with the doorways 10 and 16; the track-way 24 being in line with the doorways 9 and 15; and the track-way 25 being in line with the doorways 8 and 14. The track-ways each have a pair of parallel tracks 26 preferably in the shape of a channel-bar, in which the wheels 27 of the article-carrying cars 28 run. The arches 2 are provided with the slots 29 which extend from the spaces between the tracks 26 to the spaces between the arches 1. In the sides of the track-ways are brick or metallic blocks 30 each having two groove. one above the other to receive the pipes 31, against which the sides of the cars 28 contact as they run on the tracks. The pipes are connected at one end to the inlet pipe 32 and at the other end to the outlet pipe 33. The pipes convey water, air, or other cooling fluid for keeping down the temperature of the cars, so that the extreme heat in the furnace will not injure the cars. Furthermore, the pipes 31 in conjunction with the cars constitute a seal for the bottom of the furnace. The cars are of the box-type, having the four side-walls and bottom made of steel or other suitable metal, the cars being filled with fire brick or other refractory material, 34, capped with chrome brick, sand, or coke dust 35, on which the articles, as the ingots 36, to be heated are set.

37 represents regenerative chambers there being one on each side of the furnace, and 38 represents gas chambers leading from a gas producer or other source of combustible gas. From the chambers 37 there arise a series of vertical gas passages 39, parallel with the furnace, the passages 39 being also parallel with a series of vertical passages 40 leading up from the chambers 38. The passages 39 and 40 are turned at their top toward the furnace, being kept separated by the vertical partition 41 and the baffle 42 which extends downwardly slightly and also toward the

furnace. At the end of the baffle 42 the air and gas intermingle in the mixing chambers 43 from which the flames enter the furnace chamber through the side ports 44. The volume of gas blowing in each passage 39 is regulated by the slidable valve 45 and the volume of air flowing in each passage 40 is regulated by the slidable valve 46. It will be noticed that the ports 44 are progressively wider or higher from front to rear along the furnace walls, so that the heat may be progressively increased as the cars move through the furnace and so that the heat at the early stages will not be so intense as to cause the cars or the material treated to be injured before they emerge from the rear of the furnace.

Extending parallel with the front of the furnace is the depressed track 47, on which the transfer cars 48 run. The top of the cars 48 has the channel tracks 49 like the channels 26 to receive the wheels of the cars 28. When the cars 48 stand in front of the doors 14, 15, and 16, the channels 26 and 49 register so that cars 28 can be run from the furnace upon the transfer cars 48 or vice versa. The ends of the channels 26 are inclined downwardly slightly so that the cars 28 will run by gravity to the transfer cars as the cars 48 are discharged from the furnace. At the rear of the furnace is the depressed track 49′ and the transfer cars 50, arranged as the track 47 and the car 48 are at the front end of the furnace. At the front of the furnace and at the side of the track 47 opposite the furnace are the two rams 51 and 52, preferably hydraulic, arranged in line with the two lateral trackways 23 and 25 for pushing the cars 28 from the transfer cars 48 or their equivalent, into the furnace until the cars 28 clear the gates of the doorways 14 and 16. At the ends of the track 47 are the two rams 53 and 54 arranged to move the transfer cars back and forth along the said track. At the ends of the track 49′ are the two rams 55 and 56 to move the transfer cars 50 back and forth on the track. The ram 57 is arranged at the rear end of the furnace in line with the track-way 24 so as to push the cars 28 through the door-way 12 toward the front of the furnace.

The cars 28 being previously heated in the central track-way as hereinafter described, they are run onto the transfer cars 48 which are at once run by the rams 53 and 54 so as to bring the cars 28 in line with the lateral track-ways 23 and 25. The articles to be heated are immediately placed on the cars 28 by overhead cranes or by other means. The doors 17 and 19 are raised and the rams 51 and 52 are actuated to push the cars into the furnace. The doors are closed and the transfer cars again receive more cars 28 from the middle track-way. These cars are pushed into the furnace as the first cars were, the last cars to be pushed into the furnace engage the last car previously pushed in, so that the cars are pushed through the furnace step by step. I have shown four cars pushed in on one side and three on the other with another car on the transfer car 48 on its way on the transfer car 28 to the trackway 23 which contains the said three cars. When the track-ways 23 and 25 are full, the doors at the rear end of these track-ways must be opened when other cars are pushed into the front ends thereof, so that the foremost car in each trackway may be pushed out therefrom onto a transfer car 50 previously placed by the rams 55 and 56 to receive the same. The heated articles are removed from the cars 28 and transferred to suitable apparatus for further treatment. One of the transfer cars is then pushed by the proper ram 55 or 56 to as to bring one of the cars 28 in line with the central track-way 25; the door 12 is raised; and the ram 57 is actuated to push the car from the transfer car into the furnace. The other car 28 on the remaining transfer car is next pushed into the furnace, which advances the other car along the trackway 24. When the track-way is full the door 18 will have to be lifted to allow the leading car 28 to roll down onto one of the transfer cars 48. It will be seen that the cars will move twice as often in the middle or return trackway as in the side track-ways so that they will not remain long enough thereon to cause them to be injured. Their liability to be burned in all the track-ways is further provided for by the provision of the refractory materials 34 and 35, the air or water cooled pipes 31, and the air cooling of the bottom of the cars through the passages 29 and the space in the passageways not occupied by the cars.

I have not deemed it necessary to illustrate or describe fully the regenerative furnaces or the usual valves and devices for causing the burning gases to enter alternately opposite rows of ports 44 in the sides of the furnace.

The doors at the ends of the track-ways will be kept closed except when cars are passing, this being readily accomplished by the actuation of the proper cylinders 21, which are duplicated at both ends of the furnace. As these door opening and closing devices form no part of the novelty of the present invention, I have not deemed it necessary to show and describe their manner of control. The manner of control of the rams is not shown and described as it is a matter easily provided by competent mechanics.

My invention does not in all its aspects require cars 28 as other article-carrying devices may be substituted therefor. The track-ways may be placed closer together if desired and the cooling arrangements may be considerably modified and possibly omitted for some purposes. The cars 28 or their equivalent may be transferred in va-

rious ways. The number of track-ways may be varied to suit the exigencies of each particular installation.

I claim—

1. In a continuous heating furnace, a plurality of tracks therein extending from end to end in the same horizontal plane, article-carrying devices arranged to travel on said tracks, and means to cause the said devices to travel in one direction on some of said tracks and to cause the said devices to travel in the opposite direction on other of said tracks.

2. In a continuous heating furnace, a plurality of tracks located in the furnace chamber and extending from end to end, article-carrying devices arranged to travel on said tracks, means at one end of the furnace to cause the said devices to travel in one direction on some of said tracks, and means at the other end of the furnace to cause the said devices to travel in the opposite direction on other said tracks.

3. In a continuous heating furnace, a plurality of tracks located in the furnace chamber and extending from end to end, article-carrying devices arranged to travel on said tracks, means to cause the said devices to travel in one direction on some of said tracks and to cause the said devices to travel in the opposite direction on other of the tracks, and means for transferring the said devices from one track to another.

4. In a continuous heating furnace, a plurality of tracks therein extending from end to end in the same horizontal plane, article-carrying devices arranged to travel on said tracks, means to cause the said devices to travel in one direction on some of said tracks and to cause the said devices to travel in the opposite direction on other of said tracks, a transfer device having travel across the end of the furnace and arranged to receive said article carrying devices from some of said tracks and to deliver them to other of said tracks, and means for moving said devices from the transfer device to a track-way.

5. In a continuous heating furnace, a series of article-carrying devices, means for moving them through the furnace chamber, and separate gas burners having their ports in the walls of the furnace, the ports increasing in size from the article charging end to the other end of the furnace, whereby the articles become subjected to greater heat as they move through the furnace.

6. In a continuous heating furnace, a series of article-carrying devices, means for moving them through the furnace chamber, separate gas burners having their ports in the walls of the furnace, the ports increasing in size from the article charging end to the other end of the furnace, whereby the articles become subjected to greater heat as they move through the furnace.

7. In a continuous heating furnace, a track extending through the furnace, article-carrying devices arranged to travel on the track extending beyond the furnace chamber, and an incline at the end of the track whereby an article carrying device on said incline will run down the same by gravity beyond the end of the furnace.

8. In a continuous heating furnace, two lateral tracks and a central track extending from end to end of the furnace chamber, a transfer track at each end of the furnace parallel with the ends of the furnace, transfer cars on each end track, article-carrying cars adapted to the first three tracks named, means at the front of the furnace for pushing article-carrying cars from the front transfer cars along the lateral tracks and upon the transfer cars on the rear transfer tracks, means for shifting the transfer cars from the lateral tracks to the central track and vice versa, means for pushing the article-carrying cars from the rear transfer cars along the central track and upon transfer cars on the front transfer track, and means for shifting the front transfer cars from the central to the lateral tracks and vice versa.

9. In a continuous heating furnace, a series of article-carrying devices, means for moving them through the furnace chamber and independent burners having their ports in the walls of the furnace, the ports increasing in size from the article-charging end to the other end of the furnace, whereby the articles become subjected to greater heat as they travel through the furnace.

10. In a continuous heating furnace, article carrying devices to support articles while in the furnace, means for moving the article carrying devices through the furnace and for returning them to the charging end of the furnace, and means for heating the article-carrying devices during their return to the charging end of the furnace.

Signed at Pittsburg, Pa., this 30th day of November, 1908.

HORACE E. SMYTHE.

Witnesses:
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ANNA R. BEATTY.