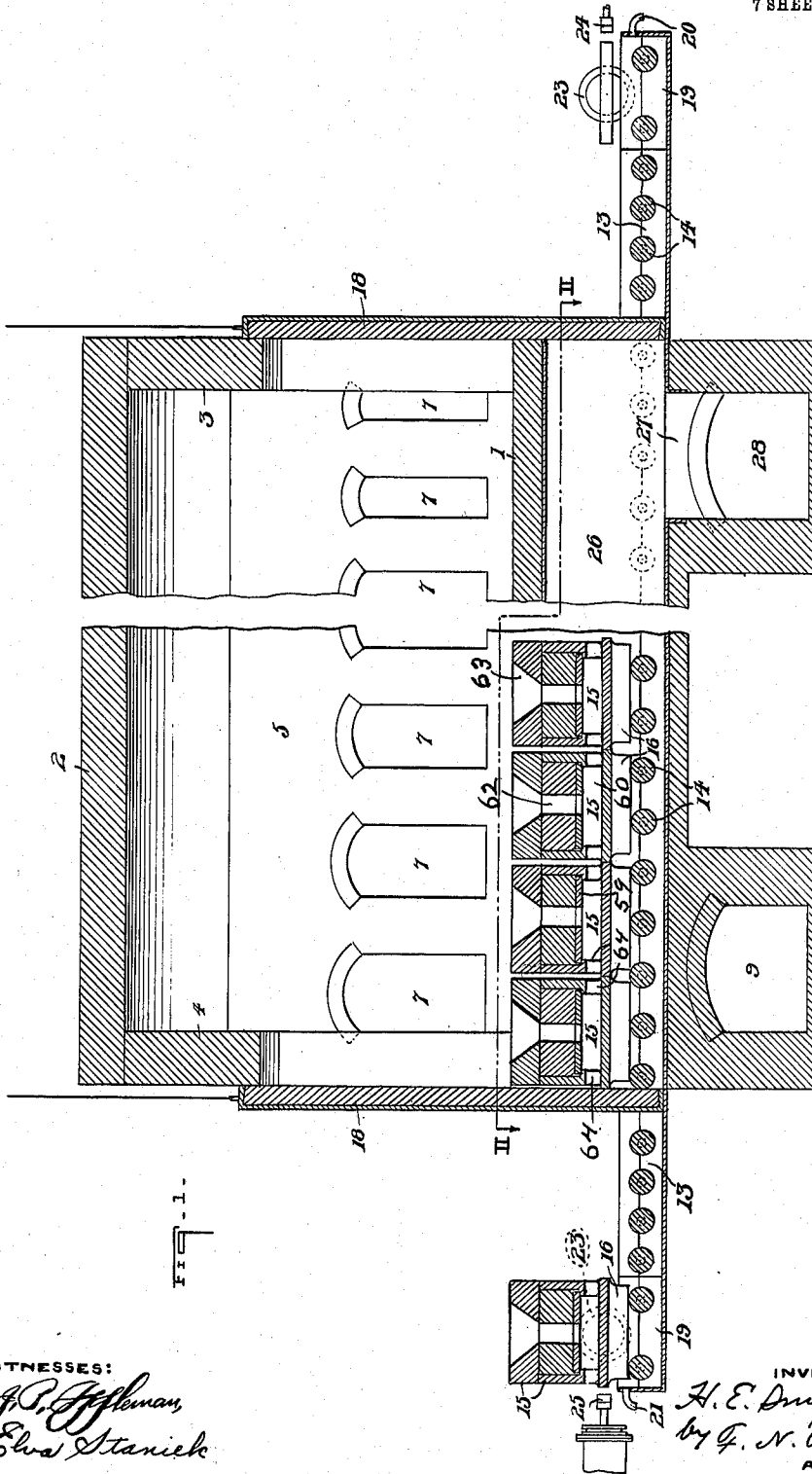


H. E. SMYTHE.
SEAL FOR CONTINUOUS HEATING FURNACES.
APPLICATION FILED DEC. 4, 1908.

930,811.

Patented Aug. 10, 1909.

7 SHEETS—SHEET 1.



WITNESSES:

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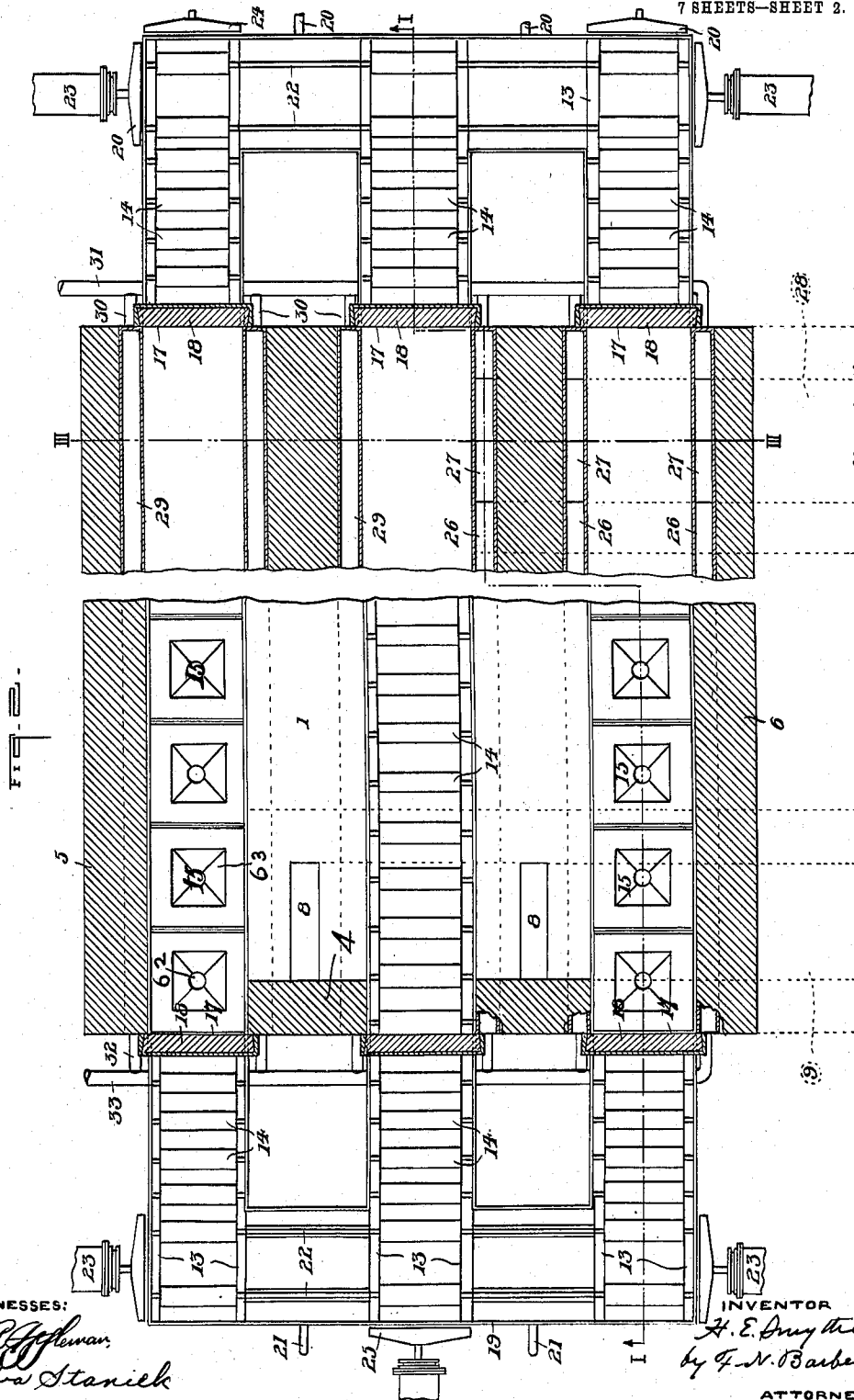
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7 SHEETS—SHEET 2.



WITNESSES:

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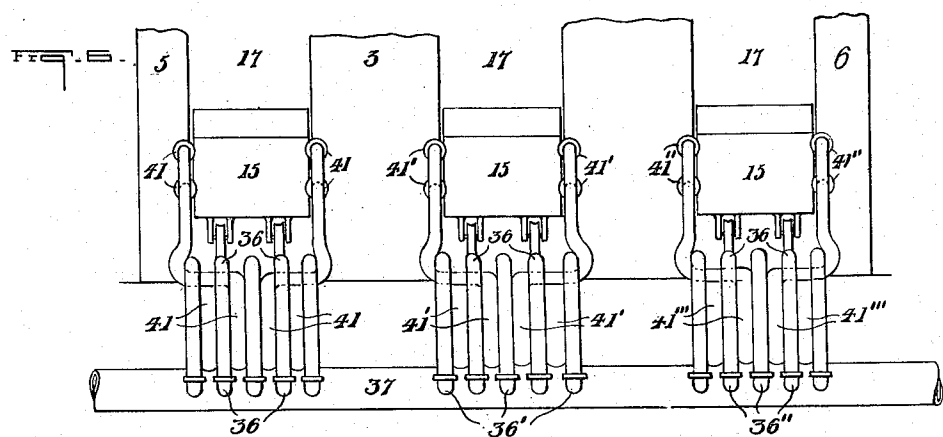
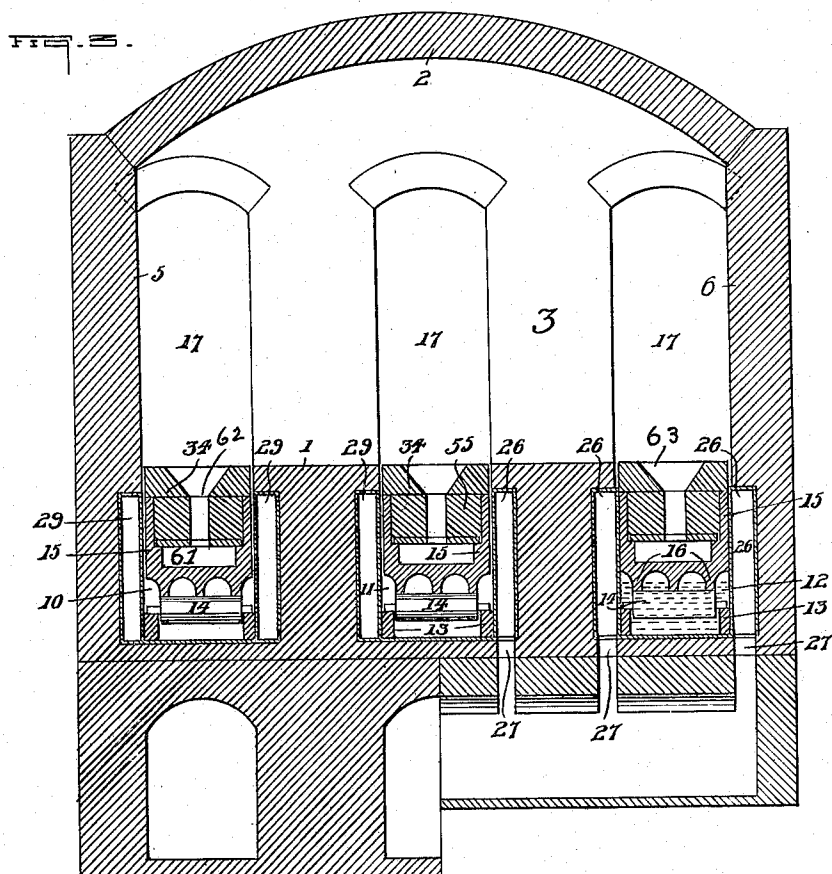
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 7 SHEETS—SHEET 3.



WITNESSES:
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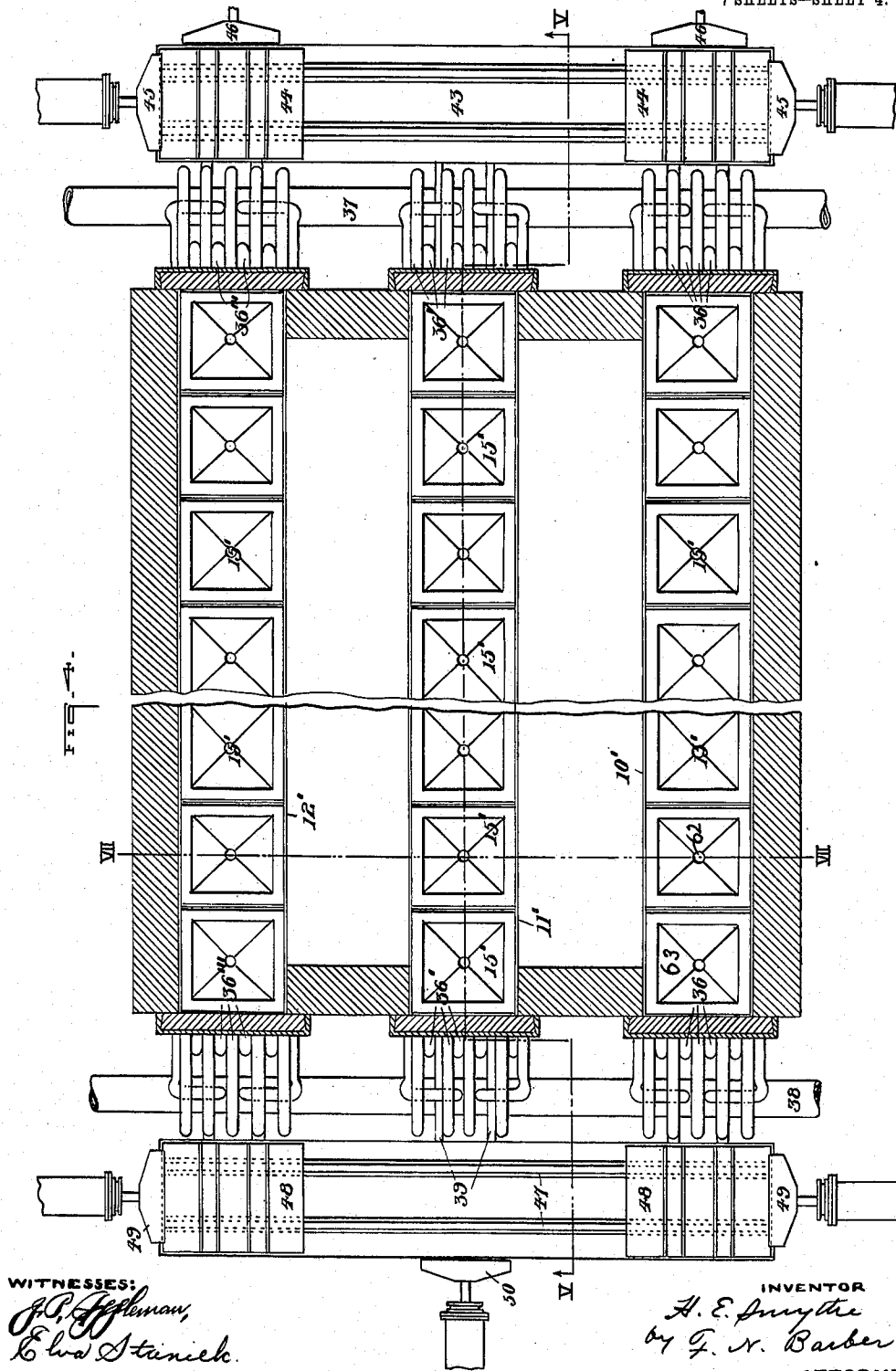
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7 SHEETS—SHEET 4.

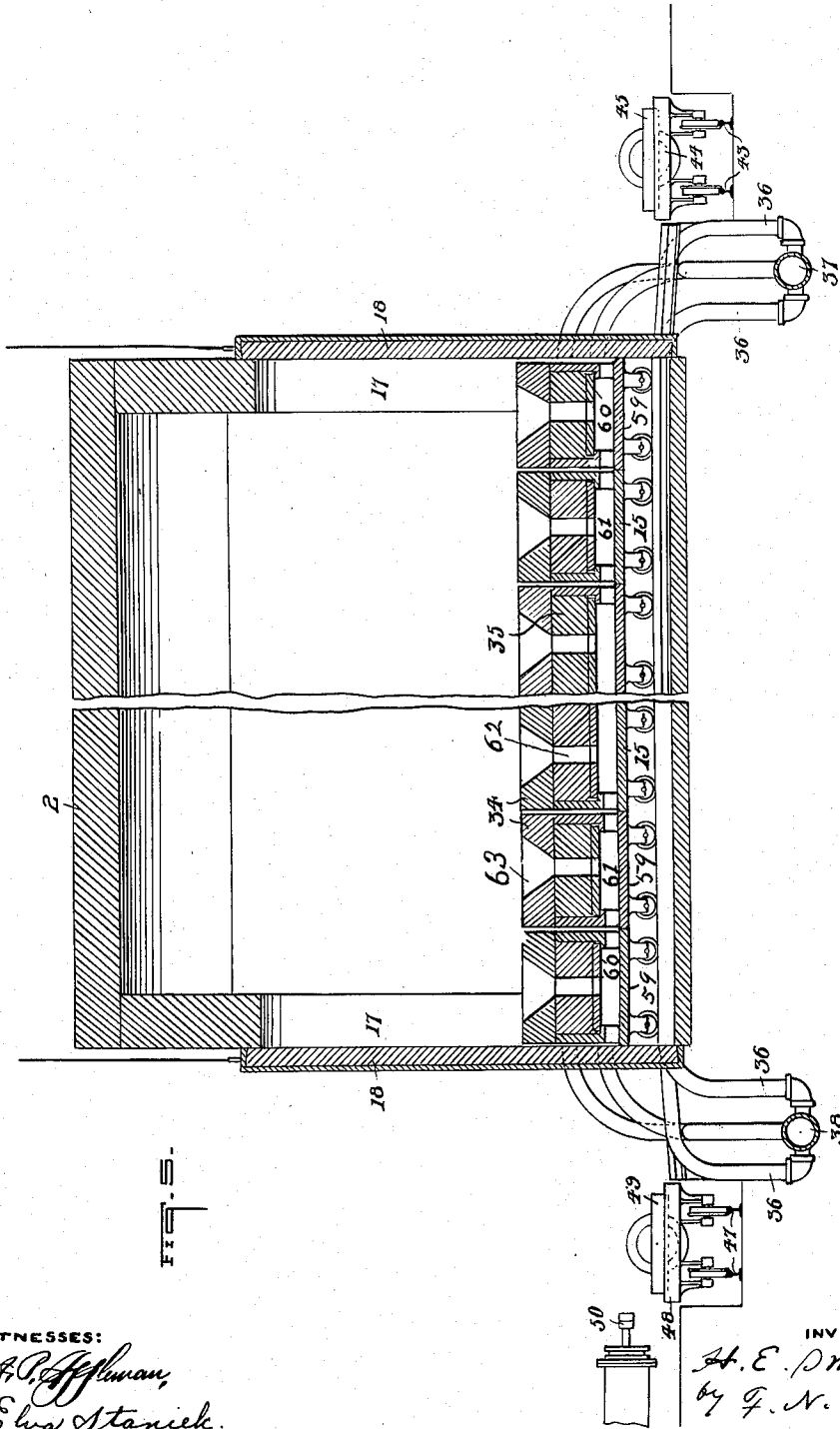


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7 SHEETS—SHEET 5.



WITNESSES:

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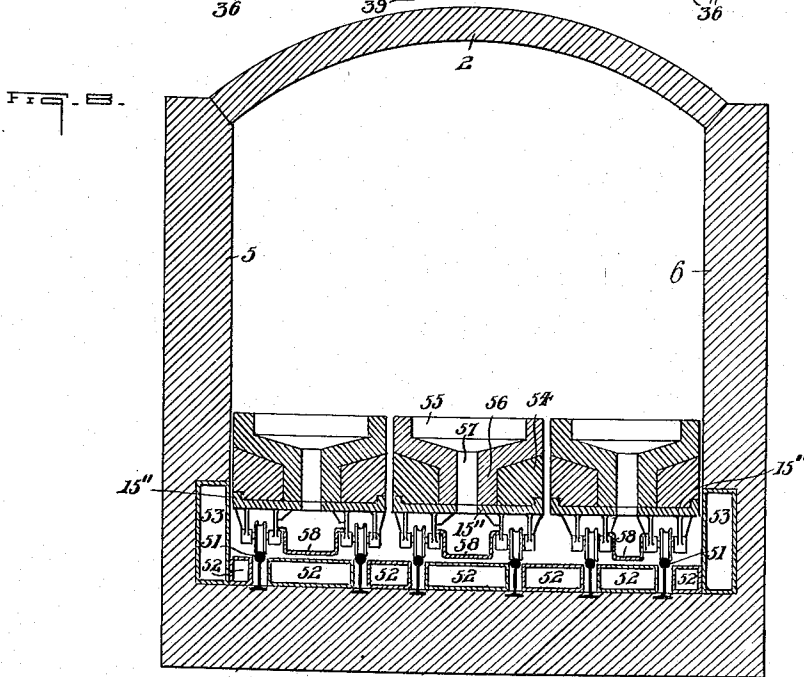
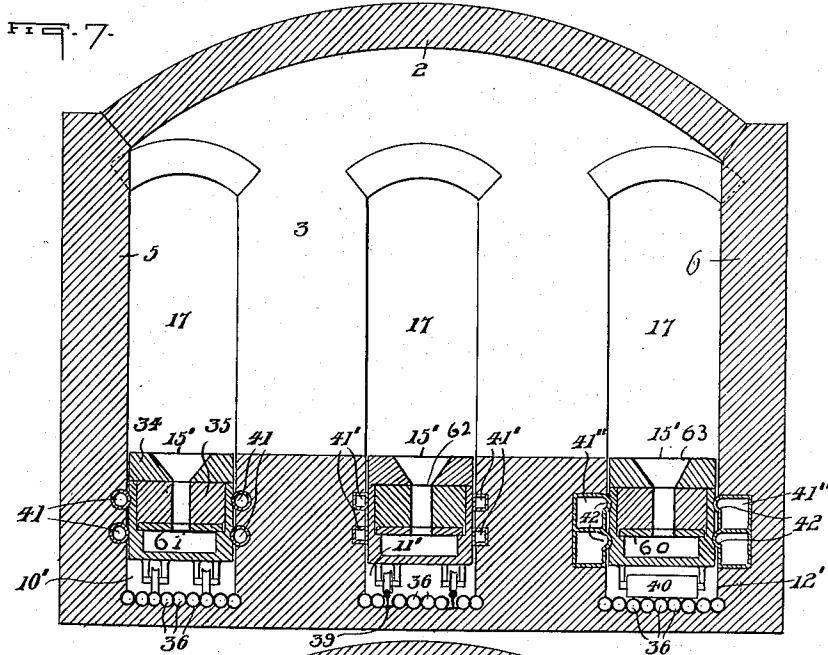
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Patented Aug. 10, 1909.

7 SHEETS—SHEET 6.



WITNESSES:

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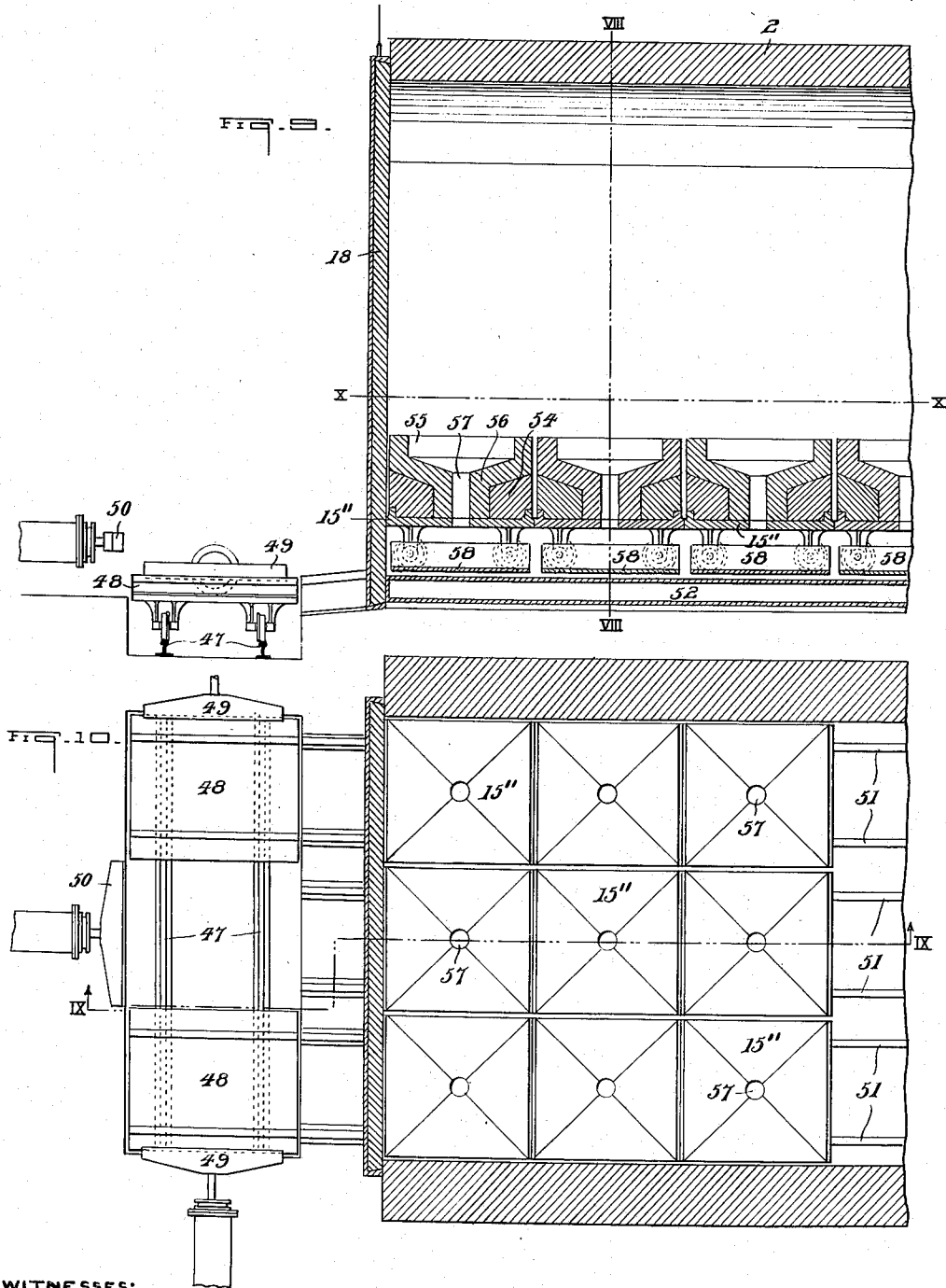
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7 SHEETS—SHEET 7.



WITNESSES:

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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.

SEAL FOR CONTINUOUS HEATING-FURNACES.

No. 930,811.

Specification of Letters Patent.

Patented Aug. 10, 1909.

Application filed December 4, 1908. Serial No. 465,919.

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 Seals for Continuous Heating-Furnaces, of which the following is a specification.

My invention relates to continuous furnaces in combination with article-carrying devices adapted for travel therein and constructed for coöperation with the furnace structure so as to seal the interior of the furnace from the external atmosphere, and prevent the escape of the internal products of combustion.

In addition to the above-named novel purpose, I may provide means for cooling the article-carrying devices below temperature which might injure. Incidentally I may cause air to abstract heat from the furnace bottom and from the article-carrying devices and lead the heated air to a recuperator or combustion chamber by natural means or under pressure.

Referring to the accompanying drawings, Figure 1 is a vertical longitudinal section on the line I—I of Fig. 2; Fig. 2, a horizontal section on the line II—II, Fig. 1; Fig. 3, a vertical cross-section on the line III—III, Fig. 2; Fig. 4, a horizontal section of a modified form of my invention; Fig. 5, a vertical longitudinal section thereof; Fig. 6, an end elevation of the same; Fig. 7, a vertical section of a third form of my invention; Fig. 8, a vertical cross-section of a fourth form of my invention; Fig. 9, a vertical longitudinal section taken through one end of the furnace shown in Fig. 8; and Fig. 10, a horizontal section of Fig. 9, above the article-carrying cars.

Referring to Figs. 1 to 4, 1 represents the bottom; 2, the roof; 3 and 4, the ends; and 5 and 6, the sides of a continuous furnace equipped with one form of my invention. The inlets for the heated gases are indicated by the ports 7 in the sides 5 and 6, the ports being gradually larger from the front of the furnace toward the rear.

8 is the outlet for the spent gases which enter the conduit 9 leading to the stack not shown.

In the bottom 1 of the furnace are the three or more parallel depressed track-ways 10, 11 and 12, each having parallel bars 13,

lying on or near the bottom of the runway and at the outer sides thereof to serve as bearings for the ends of the idle rollers 14 which form an anti-friction bed or track on which the article-carrying cars or plates 15 ride. The rollers extend transversely of the runways and the cars 15 have the downwardly extending flanges 16 extending lengthwise of the runway, these flanges riding directly on the rollers. Preferably the ends of the rollers are reduced, the reduced ends resting on the bars 13. The rollers can be replaced by slide bars, if preferred, to accomplish the same purpose.

The track-ways extend longitudinally of the furnace between the doorways 17 at the ends of the furnace, which doorways are closed and opened by means of the doors 18 operated in any desired manner. From each doorway the track-ways or supporting bars extend outwardly beyond the furnace, the height being preferably somewhat above the tops of the rollers 14. The outer ends of the track-way extensions are connected to transverse track-ways 19, having their sides as high as the track-way extensions. The track-ways 10, 11, and 12, with their said extensions and the track-ways 19 form a set of connected troughs, in which water may circulate, the inlets being indicated at 20 and the outlets at 21. The bars 13 and the rollers 14 are continued along the track-way extensions and into the transverse track-ways 19 as shown on Figs. 1 and 2. The rails 22 in the track-ways connect the three longitudinal track-ways so that the cars delivered from any of the longitudinal runways into a transverse runway may be pushed by the proper ram 23 into line with another runway. The rams 23 may be of any desired construction. I have not intended to indicate more than the presence of a ram standing at each end of each runway 19. The rams may pull or push or do both.

At the front end of the furnace and in line with the outer track-ways 10 and 12 are the two rams 24 arranged to push cars delivered from the central track-way 11 along the track-ways 19 by the rams 23, into the furnace when the doors 18 have been raised. At the rear of the furnace and in line with the central runway 11 is the ram 25 arranged to push cars delivered from the track-ways 10 and 12 along the rear track-way 19 into the furnace. Each side of the track-ways 10, 11

11, and 12 is faced for nearly its whole height with the metallic boxes running from one end of the track-way to the other. Three of these boxes marked 26 have their rear ends open to the atmosphere and have their forward ends open at the bottom as shown at 27, the openings 27 communicating with the passage 28 leading to a recuperator or combustion chamber (not shown) where the heat imparted to the air in its passage through the boxes 26 may be utilized in an obvious manner at the same time cooling or reducing the temperature of the cars or plates 15. The remaining three boxes marked 29 are inclosed and have the inlet pipes 30 connected to the feeder 31, and the outlet pipes 32 connected to the waste pipe 33, so that water may pass from end to end in the boxes 29 and reduce the temperature of the cars 15, which may be in contact therewith as shown in connection with the boxes 29 or slightly spaced therefrom as shown in connection with the boxes 26. In case water be not used in the bottoms of the track-ways 10, 11, and 12 to seal the furnace bottom from the atmosphere or gases beneath, the sides of the car should engage the sides of the cooling boxes.

The circulation of air through the boxes 26, down the openings 27, and along the passage 28 may be induced in various ways not necessary to illustrate, as by means of a fan or the stack or natural draft.

Supposing the track-ways 10 and 12 to be full of cars carrying articles to be heated, such as billets, slabs, ingots, annealing boxes, crucible, glass pots, or the like; the track-way 11 to be full of empty cars; the temperature of the furnace being such as to heat the articles properly while they pass from the rear to the front of the track-ways; and the circulation of water or air in the cooling boxes and of water or air in the track-ways to be set up, the rams 24 push cars, loaded in any desired manner, into the rear end of the furnace, which causes the leading cars, which are supposed to have their load sufficiently heated for further treatment, to be shoved out of the front of the furnace into the rear-track-way 19; the cars are then unloaded; the rams 23 push the cars along the track-way 19 into line with the track-way 11; the ram 25, which necessarily works twice as fast as each ram 23, pushes the empty cars into the track-way 11, each introduced car causing a car or its equivalent at the front of the furnace to be delivered to the front track-way 19. The rams 23 then bring the empty cars or their equivalent into line with the track-ways 10 and 12, where they are loaded and shoved into the furnace, the operation detailed being repeated as long as desired. The doors 18 will be opened and closed so as to keep the doorways open for as short periods as possible.

The cars 15 are of steel, cast iron or other metal and are filled and capped with refractory material 34 and 35.

Referring now to Figs. 4 to 7, the longitudinal track-ways 10', 11' and 12' are provided with stationary tracks on which cars provided with wheels or rollers run. The track-ways do not carry water for the entire or partial submerging of the cars and making a furnace seal as in the form of my invention already described. I have shown each track-way provided with a different kind of track or a different kind of a car. I have also shown each track-way with a slightly different form of seal. In the track-ways I place a series of parallel pipes 36 on the bottom thereof all extending the entire length of the furnace and extending somewhat beyond each end thereof. The pipes 36 are connected at the front of the furnace alternately to opposite sides of the inlet or feeding pipe 37 which runs transversely along the front of the furnace and somewhat below the same. At the rear of the furnace the pipes 36 are connected alternately to opposite sides of the waste or outlet pipe 38. In the track-way 10', the wheels of the cars run on some of the pipes 36 which serve as rails. In the track-way 11', the car wheels run on rails 39 which have been substituted for the third pipe 36 at each side of the track-way. In the track-way 12' the pipes are as in the track-way 10' but the cars are provided with the rollers 40 which bear on the central pipes 36, the rollers taking the place of the wheels of the car shown in the track-ways 10' and 11'. In the track-way 10', I place in grooves in each side thereof, a pair or more of pipes 41, shown to be round in cross-section. One end of these pipes is connected to the top side of the inlet pipe 37 and the other end thereof to the outlet pipe 38. These pipes 41 in order to keep out of the way of the cars pass laterally beneath the pipes 36 which are connected to that side of the pipes 37 and 38 farthest from the furnace and then upwardly to the aforesaid grooves in the sides of the track-ways. The cars may have grooves to fit the pipes 36 as shown on Fig. 7. The pipes and the cars form a seal at the sides of the track-way. The cars being in contact, form seals between the cars. In the track-way 11', the pipes 41' are shown rectangular in cross-section and not in grooves in the cars. In the track-way 12', the pipes 41'' are shown as a double conduit with lateral rounded ribs 42 extending into grooves in the sides of the cars. The ends of the double conduit are connected by the pipes 41''' to the inlet and outlet pipes 37 and 38, as the ends of the pipes 41 are connected to the said inlet and outlet pipes.

At the front of the furnace is the depressed track 43 extending transversely of

the furnace. The transfer cars 44 run on this track and are moved back and forth thereon by the rams 45. 46 are rams arranged to push cars 15' from the transfer cars 44 into the track-ways 10' and 12'. At the rear of the furnace is the depressed track 47 extending crosswise of the furnace and having thereon the two transfer cars 48 moved back and forth by the rams 49. The ram 50 is arranged to push cars 15' from the transfer cars 48 into the central track-way 11'. The track-ways outside the furnace are inclined downwardly so that the cars will run down by gravity into the transfer cars. The tracks 39 extend to the edge of the runway for the transfer cars.

The operation is substantially as that given for Figs. 1 to 3. Empty cars 15' on the cars 44 are loaded and shoved into the track-ways 10' and 11' by the rams 46, the leading cars being pushed out onto the cars 48. After being unloaded the cars 48 are pushed by the rams 49 in line with the ram 50, which pushes the cars 15' into the central track-way 11', the leading cars being pushed out onto the transfer cars 44. The latter are then pulled or pushed by the rams or motors 45 into line with the track-ways 10' and 11' where the cars 15' thereon are again loaded. This operation is continued indefinitely.

In Figs. 4 to 7, the sides of the car are kept cool by means of a cooling fluid as air or water flowing through the pipes or boxes in the sides of the track-ways. These pipes or boxes in conjunction with the cars, seal the furnace chamber from the underside of the cars, the ends of the cars 15' being in contact constitute seals.

Referring now to Figs. 8 to 10, it will be seen that I dispense with the sunken track-ways in the furnace chamber and provide a series of rails 51 for the article-carrying cars 15''. Between consecutive rails and at the outer side of the lateral rails I place cooling boxes or pipes 52, shown as rectangular in cross-section. These are intended to carry currents of water or other cooling fluids, the inlet and outlet connections being omitted to save confusion on the drawings, the principle of their connection being illustrated in the figures already described. At the sides of the furnace opposite the lower portion of the cars, I place the conduits or pipes 53 running parallel with the tracks and close to or in contact with the outer rows of cars. The cars 15'' are placed almost in contact thus saving a great deal of space between the cars shown in the first two forms of my invention. The bodies of the cars 15'' have much lower sides than the cars 15 and 15' have, while the height of the cars may be all substantially the same. The heat cannot get at the metallic body of the cars 15'' as it is so far from the top thereof and as the space

between the cars is so narrow. The circulation of the cooling fluids in the pipes 52 and 53 will cool the car bodies sufficiently to prevent their destruction or injury by the furnace heat. The cars 15'' have on the top of their metal bodies the refractory brick bases 54 and on top of the bases 54 the chrome-brick caps provided with the hopper-like top depressions 55, the tubular bottom extensions 56, and the central holes 57. The openings 57 in the extensions 56 are continued down through the metal car bodies. The cinder dropping from ingots, slabs, other metal forms, or glass pots, will run down through the holes 57 upon the pans 58 which are metallic channels with horizontal flanges resting on the axle-boxes or suspended from the lower part of the cars, as shown in Fig. 8. The pan 58 can readily be withdrawn by workmen when the cars are out of the furnace and fresh ones replaced, thus readily disposing of these accumulations of cinder, slab, steel or glass.

In Figs. 1 to 5, and 7, the cars are shown with the bottoms 59 closed. Each car supports at a short distance above its bottom the horizontal steel plate 60, on which the refractory material 35 sits. The refractory material 34 rests on the material 35. These materials and the plate 60 have a central vertical passage 62 leading to the space 61 between the bottom 59 and the plate 60, which space constitutes a place of deposit for cinder or other molten substances running from the articles, pots, etc. resting on the cars. The material collected in the space 61 is extracted or pushed from the end openings 64 in the cars. The material 34 has its upper face with a hopper-like depression 63 to direct the cinder or equivalent toward the center of the car.

The invention shown on Figs. 8 to 10, employs the sunken tracks, the transfer cars and the rams made use of in the invention shown on Figs. 4 to 7.

The operation of the invention shown in Figs. 8 to 10 is substantially like that of the invention shown in Figs. 4 to 7 and similar to that of the invention shown in Figs. 1 to 3, and consequently need not be repeated here.

Though I have described and shown my several inventions with considerable minuteness, I do not limit myself to the precise details and combinations thereof. The use of the word car does not limit the object designed thereby to the use of wheels, since the cars may be of any form or construction to carry the aforesaid articles, or their equivalents whether the cars have wheels or slide on rails or their equivalent or are otherwise supported during their travel.

I claim—

1. In a continuous heating furnace, article-carrying devices, means for moving the same

through the furnace, air-conveying conduits in engagement with the sides of the said devices to prevent the furnace heat from injuring the said devices, and forming seals to prevent ingress or egress of air, gases or both from or to the interior of the furnace.

2. In a continuous heating furnace, at least two trough-like trackways containing a cooling liquid and extending longitudinally of the furnace, article-carrying devices adapted to travel on the trackways, and means for causing the said devices to travel one way on one trackway and in the opposite direction on the other trackway, the said devices being submerged in said liquid so as to constitute a substantial cooling means for the same.

3. In a continuous heating furnace, at least two trough-like trackways containing a cooling liquid and extending longitudinally of the furnace, article-carrying devices adapted to travel on the trackways, and means for causing the said devices to travel one way on one trackway and in the opposite direction on the other trackway, the said devices being submerged in said liquid so as to constitute a substantial cooling means for the same, and the said trough-like trackways being continued so as to connect their ends, whereby the said devices remain constantly more or less submerged.

4. In a continuous heating furnace, at least two trough-like trackways therein connected at their ends by trough-like trackways, a cooling liquid in the trackways, article-carrying devices adapted to travel in a circuit on the trackways, and means for causing the said devices so to travel.

5. In a continuous heating furnace, an article-conveyer adapted to be passed

through the same, said conveyer having an open-ended receptacle, and a conduit leading molten material therefrom to the said receptacle.

6. In a continuous heating furnace, an article-conveyer adapted to be passed through the same, and an open-ended collecting pan suspended beneath the conveyer, the conveyer having therein a conduit to lead molten material therefrom to the said pan.

7. In a continuous heating furnace, an article-conveyer adapted to be passed through the same, and a pan having flanges for suspending it beneath the conveyer, the conveyer having therein a conduit to lead molten material therefrom to the said pan.

8. In a continuous heating furnace, a car adapted to be passed through the same, and a pan having flanges for suspending it on the axle-boxes of the car, the car having therein a conduit to lead molten material therefrom to the said pan.

9. In a continuous heating furnace, article-carrying devices, means for moving the same through the furnace, air-conveying conduits at the sides of the conveyer for cooling or sealing the same, an off-take conduit to receive the heated air from the said air-conveying conduit and transfer the same to a suitable apparatus for economically using the heat abstracted by the conduits from the furnace.

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

HORACE E. SMYTHE.

Witnesses:

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