

No. 680,726.

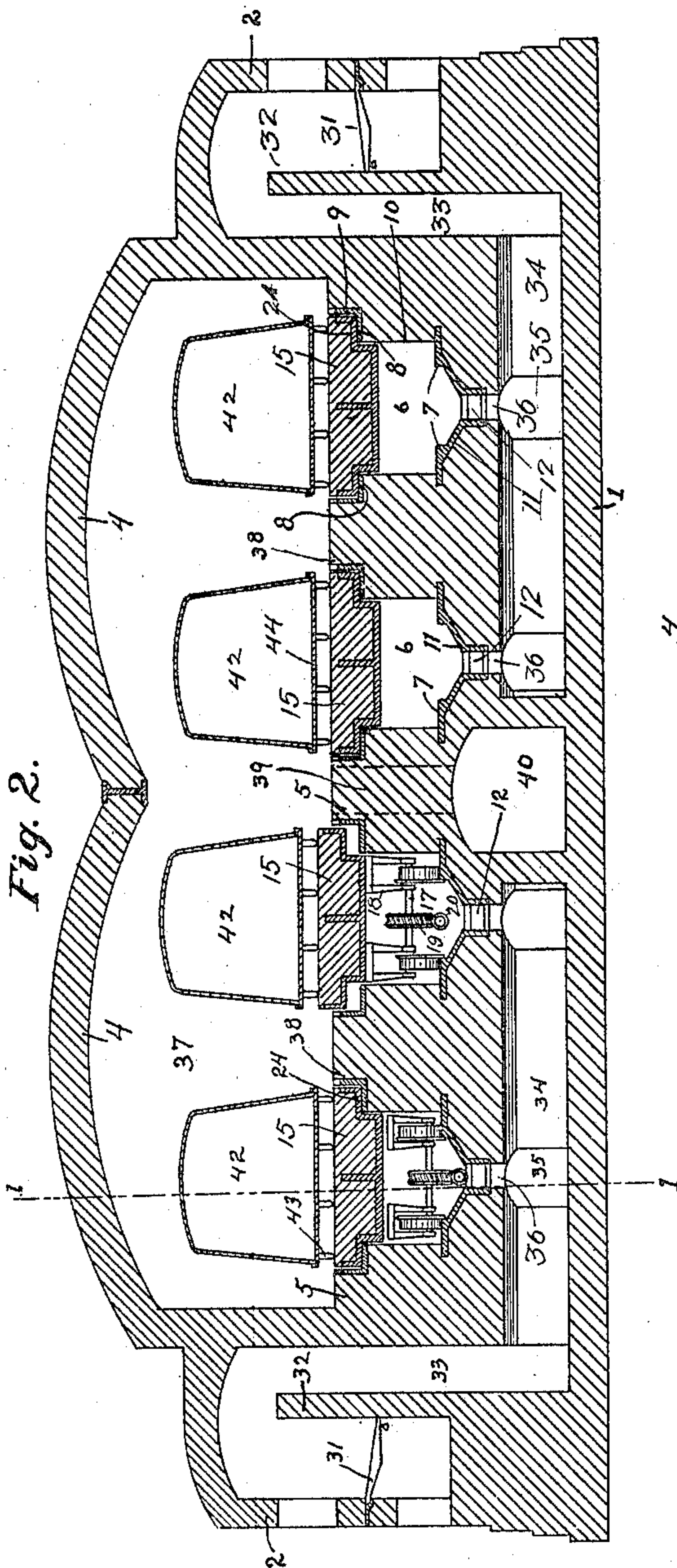
Patented Aug. 20, 1901.

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HEATING FURNACE.

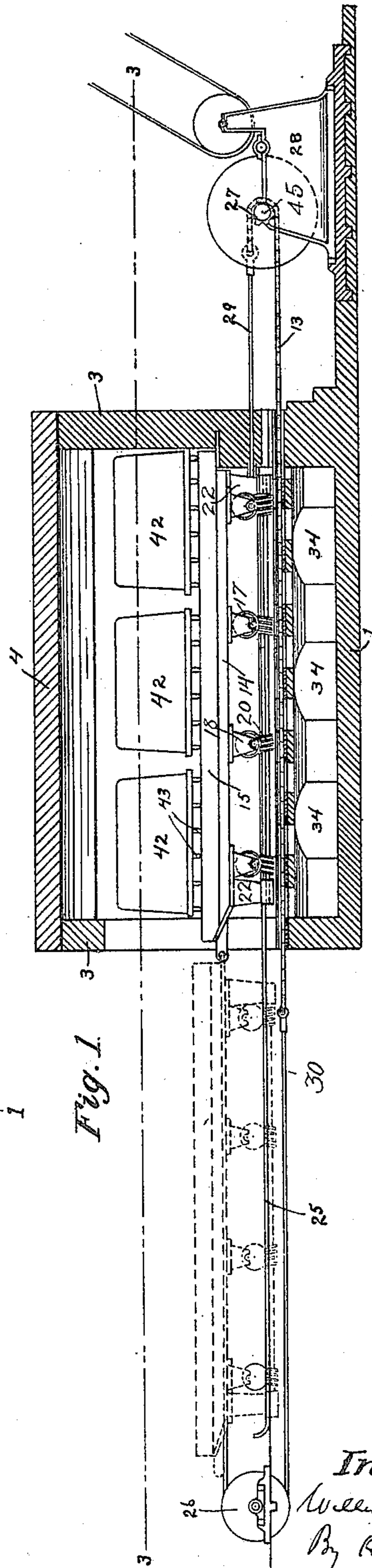
(Application filed Apr. 13, 1901.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses.  
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No. 680,726.

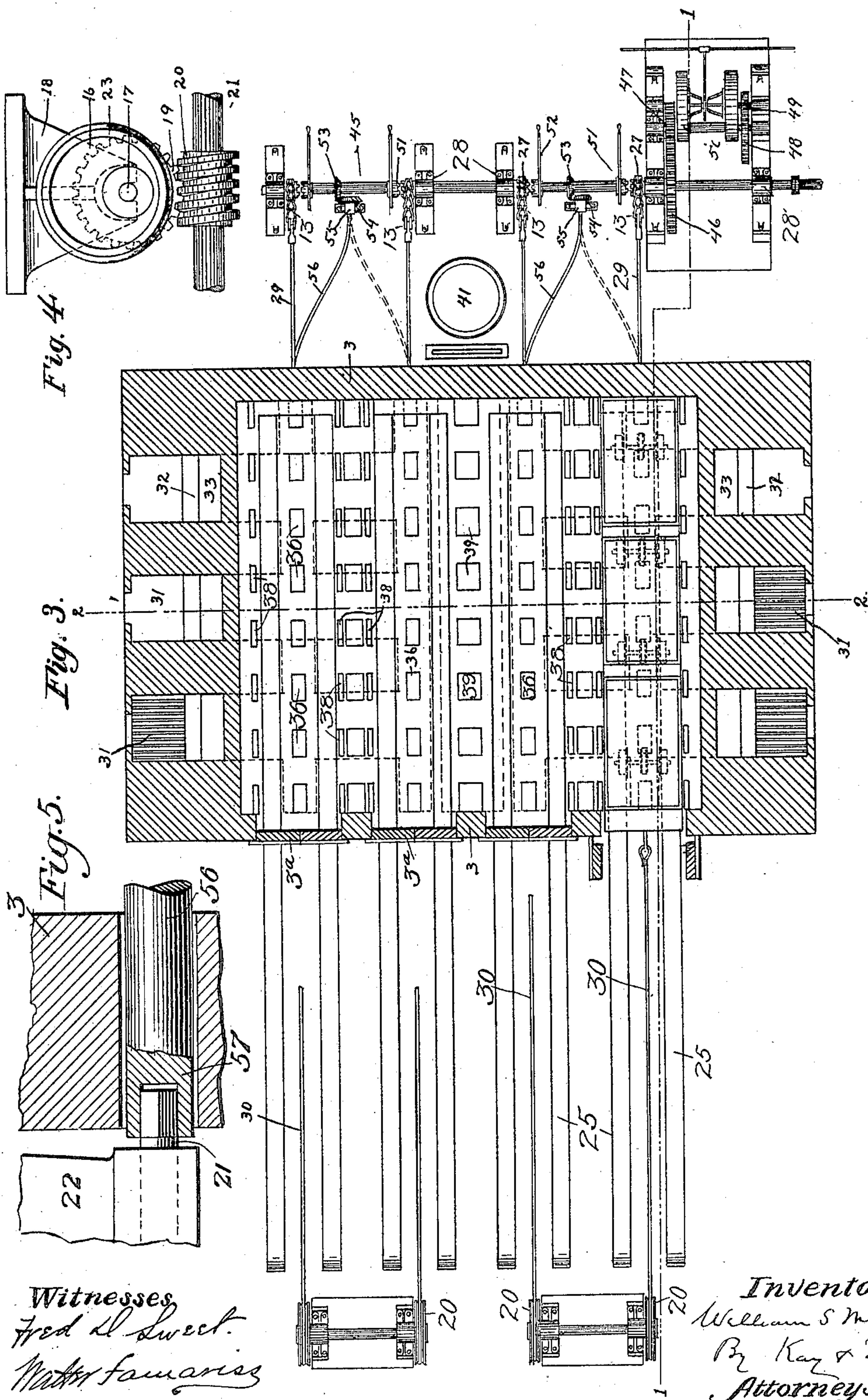
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(Application filed Apr. 13, 1901.)

(No Model.)

2 Sheets—Sheet 2.





# UNITED STATES PATENT OFFICE.

WILLIAM S. MCKENNA, OF MINERALRIDGE, OHIO, ASSIGNOR OF ONE-HALF  
TO HENRY WHITELEY, OF WILMINGTON, DELAWARE.

## HEATING-FURNACE.

SPECIFICATION forming part of Letters Patent No. 680,726, dated August 20, 1901.

Application filed April 13, 1901. Serial No. 55,662. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM S. MCKENNA, a resident of Mineralridge, in the county of Trumbull and State of Ohio, have invented a new and useful Improvement in Heating-Furnaces; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to heating-furnaces, including any class of furnace, whether for metallurgical, glass, crockery-ware, or any other purposes to which it is applicable. Its object is to provide a furnace by means of which annealing-boxes, muffles, pots, such as glass-melting pots, and other like receptacles or inclosures for objects to be treated in any way within the furnace can be easily and quickly moved into and out of the furnace, while the mechanism for accomplishing this result will be protected from the heat of the furnace and therefore will not be liable to injury such as would occur to it when exposed to the high heat of such furnaces.

The invention comprises, generally stated, a heating-furnace having a recess extending along its hearth provided with a track and a ledge or seat between the track and the top of the hearth, a truck to enter the recess of the furnace, and a movable furnace-bottom carried by the truck and vertically adjustable thereon and having a seat or projection for engagement with the seat or ledge of the furnace. It also comprises other improvements, both in the furnace itself and in the means for moving the truck, all of which will be hereinafter described and claimed.

To enable others skilled in the art to make and use my invention, I will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a longitudinal section on the line 1 1, Fig. 2, of a furnace embodying the invention. Fig. 2 is a cross-section on the line 2 2, Fig. 3. Fig. 3 is a horizontal section on the line 3 3, Fig. 1. Fig. 4 is a detail showing the mechanism for adjusting the furnace-bottom vertically, and Fig. 5 is a sectional detail showing the connection of the flexible shaft to the worm-shaft.

The invention is illustrated in connection with an annealing-furnace for annealing sheet

metal, the invention being particularly applicable to such work, and the furnace shown being arranged to be heated with solid fuel, though it is evident that it can as well be heated with gaseous fuel. The furnace-chamber has the bed 1, above which extend the side walls 2 2 and end walls 3 3, the furnace having the double-arched roof 4 and hearth 5. Extending down into the hearth are longitudinal recesses or depressions 6 therein, such recesses being formed with tracks 7, on which run the wheels of the trucks hereinafter referred to, while the recesses have the ledges or seats 8 formed between such tracks and the top of the hearth. It is to be noted that these ledges 8 are formed between the vertical walls 9 10 of the recesses and that the ledges are made practically horizontal, this being considered the best form of ledge, though it is evident that the ledge may be made on an incline if it is considered desirable. It will be noticed that the tracks 7 are formed as part of castings 11, which extend for the full length of the recesses 6, forming the entire bottoms of the same and having depressions formed centrally therein, this construction being employed to give space for the worm-wheel shafts of the trucks. It is also to be noticed that these castings 11 have centrally thereof the inclosed passages 12, which extend for their full length and form protecting-chambers for the lower reaches of the chains 13, by which the trucks are moved. Moving in these recesses 6 are the trucks 14, which can be of any desired construction suitable for carrying the movable furnace-bottoms 15 and giving vertical adjustment to the same, as found necessary. A very simple form of truck for this purpose, and the one which is illustrated in the drawings, is shown in patent to Victor Chartener, No. 572,104, of December 1, 1896, being composed of a series of disks 16, secured eccentrically upon cross-shafts or axles 17, which are mounted in the bearings 18 of the truck, said axles 17 carrying the worm-wheels 19, engaging with worms 20 on the worm-shaft 21, mounted in hangers 22, attached to the bottom of the truck, and so providing for the turning of the eccentrics 16. Fitting around these eccentrics are the



wheels 23, which are formed as rings mounted upon the eccentrics, it being preferred that antifriction-rollers between the eccentrics and rings shall be employed, and in the use of the apparatus the wheels 23 rotate on the eccentrics 16 when the truck is moved longitudinally, while in order to raise or lower the truck and with it the furnace-bottom 15 the worm-shaft 21 is rotated, which rotates the different worm-wheels, and thereby turns the axles carrying the same and the eccentrics secured to those axles, so that in this way the truck 14 is raised or lowered, as may be desired. The furnace-bottoms 15 are loosely carried upon these trucks, and, as shown in the drawings, they correspond substantially in shape to the upper part of the recesses 6, being of slightly less width than said recesses, so as to fit freely therein, and having seats or projections 24, extending over the seats or ledges 8, so that when the movable bottoms 15 are lowered said projections 24 will rest on the ledges 8, thereby supporting said bottoms in place and permitting the trucks to be withdrawn from the furnace. To prevent the escape of heat, the front ends of the recesses 6 are closed by suitable doors 3<sup>a</sup> after the trucks are withdrawn, as will more fully hereinafter appear. The tracks 7 are carried out beyond one end of the furnace, as at 25, and at the ends of the same are pulleys or sheaves 26. At the other end of the furnace are sprocket-wheels 27, mounted loosely on a shaft journaled in suitable bearings 28, and the operating-chains 13 pass around said sprocket-wheels and connect to wire ropes 29, which are connected to one end of the trucks, while the sprocket-chains themselves pass through the chain chambers or passages 12 of the castings 11 and extend back toward the sheaves 26, other wire ropes 30 being connected to the sprocket-chains and passing around said sheaves and being connected to the other end of the trucks. In this way in the operation of the movable bottoms of the furnace when said bottoms are raised by turning the shafts 21 by means of the sprocket-wheels 27 the trucks can be drawn out of the furnace into the position shown in dotted lines, and they can subsequently be drawn back into the furnace on reversal of the movement of the sprocket-wheels 27 and upon the turning of the worm-shafts 21 can be lowered down into their fixed or permanent positions, resting upon the ledges 8, as above stated.

For the purpose of an annealing-furnace and practically for all furnaces requiring high heat the furnace preferably employed is that shown in the drawings, in which the furnace-chamber has a series of grates 31 on both sides thereof, having the bridge-walls 32, over which the flame and heat pass into the downtake-flues 33, leading to the cross-flues 34, communicating with the longitudinal flues 35, located underneath the recesses 6 and communicating therewith through the ports 36.

The recesses 6 are in communication with the furnace-chamber 37 through the ports 38, extending through the masonry around the seats or ledges 8. To carry off the heated products of combustion, I provide the central downtake-flues 39, extending through the hearth down into the tunnel 40, which leads to the stack 41. In order to distribute the heat evenly in the furnace, which is the great desideratum in annealing-furnaces, the two outside recesses 6 are provided with ports 38 on each side thereof, while the two central recesses 6 are provided with ports 38 on only one side and that opposite the central downtake-flues 39, leading to the stack, and the cross-flues 34 on the two sides of the furnace do not communicate with each other. In this way an even distribution of the heat can be made over the hearth and a proper and even distribution of the heat in the furnace is obtained. The furnace as illustrated contains twelve annealing-boxes of the ordinary construction, as at 42, these boxes being supported on a series of pins 43 on the bottom plates 44, so that there is a full opportunity for passage of the heat entirely around the bottom plates. In the usual arrangement of these annealing-furnaces in large plants the custom has been to have a number of them located together, and in order to provide for the operation of these several furnaces by power and to do away with practically all the hand labor required to introduce and withdraw the annealing-boxes I provide extending along between the different furnaces the driving-shaft 45, carrying the gear-wheel 46, meshing with the pinion 47, which is driven by any suitable power connections, such as by the gearing 48 49, from the reversing-clutch 50. Fitting loosely around the power-shaft 45 are the sprockets 27, above referred to, around which pass the chains for moving the trucks longitudinally, and sliding upon the driving-shaft 45, having clutch-faces engaging with clutch-faces on said sprocket-wheels, are the clutches 51, operated by hand-levers 52. By such construction it is evident that a single operator can through the clutch mechanism reverse the driving-shaft and through the clutches connect the sprockets 27 to such driving-shaft, and thus move the trucks into and out of the different furnaces, doing away entirely with hand labor for the purpose, it only being necessary to place the several clutches in proper position, according to the furnace which is to be drawn. In order to do away with heavy hand labor, such as would be found in the rotating of the worm-shaft 21, I mount upon the driving-shaft 45 the bevel-gears 53, meshing with the bevel-gears 54, mounted in the bearings 55 and carrying the flexible shafts 56, these flexible shafts being provided with sockets 57 in their ends to connect to the angular end of the worm-shafts 21, and the flexible shafts being arranged so that they each turn the worm-shafts of either of two trucks, it being pos-



sible to swing said flexible shafts around into either position desired.

In the use of the furnace constructed as above described the furnace is heated in the usual way, it being necessary, however, in raising the furnace to a high heat that the ends of the recesses 6 be closed. When it is desired to charge the furnace with muffles, annealing-boxes, pots, or other such objects to be heated, the trucks are operated to raise the movable bottoms 15, and such movable bottoms when carried upon the trucks in raised position are drawn out of the furnace into the position shown in dotted lines. The annealing-boxes or like objects are then carried by overhead cranes and lowered into position upon the movable bottom-sections 15, and when the truck is full it, with its bottom and the load thereon, is drawn into the furnace by the reversal of the movement of the driving-chain, and when brought into proper position by operating the mechanism for vertically adjusting the furnace-bottom, such as by turning the worm-shaft 21 and through it turning the positions of the eccentrics 16, the bottom is lowered until its projections or seats 24 contact with the seats or ledges 8 in the recess 6, which support the bottom and permit the truck being withdrawn. The front ends of the recess 6 is closed, and the furnace is then operated to heat the annealing-boxes, muffles, pots, &c., and their contents, as may be desired, this being continued until the annealing or other operation is completed and it is desired to withdraw the same, when the truck is again drawn into the recess 6 and the removable bottom is raised and is withdrawn from the furnace, as above described, and the annealing-boxes or other like objects can be quickly removed therefrom and others to be treated placed on such removable bottoms, so that the furnace operations are practically continuous. To accomplish such work, except for the handling of the boxes carried on the trucks, it requires only the services of one workman, who can attend to the many different furnaces, the laborious and dangerous work especially required in operating annealing and like furnaces being overcome. Another very important advantage found in the use of the invention in the annealing of sheet metal arises from the fact that the movable furnace-bottoms are necessarily at a very high heat, which acts upon the annealing-boxes as soon as they are placed thereon and results in causing the heating of the lower sheets of the packs within the annealing-boxes more quickly than the heating of the upper sheets thereof, because of the high heat of the furnace-bottom on which they rest directly, while provision is made for the passage of the heat and flame between the bottoms of the annealing-boxes and the furnace-bottom itself. It is found in practice that the lower sheets contained in the annealing-boxes have formed over their surfaces a peculiar oxid in waved lines, known as a

"snaky" surface. This arises from the deposit of the moisture in the plates in the box which gathers around these lower sheets and is liable to mar them. When, however, the boxes are placed upon the highly-heated movable furnace-bottoms, the heat commences to pass through the bottoms of the boxes and tends to drive this moisture to the upper part of the box and toward the waste sheets put therein to protect the main body of sheets from the heat of the furnace, and this results in driving away such moisture as would lead to the forming of the snaky appearance or surface of the sheets, resulting in the production of a larger proportion of perfect sheets and doing away with a second pickling of sheets in many cases.

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

1. A heating-furnace having a recess extending along its hearth provided with an immovable track and with a ledge or seat at each side above the track but below the hearth, in combination with a truck moving on said track, a movable furnace-bottom adapted to be supported on said truck, the upper portion of which projects laterally over said ledges or seats, and means for vertically adjusting said bottom, substantially as set forth.

2. A heating-furnace having a recess extending along its hearth provided at each side with a horizontal ledge or seat below the hearth-face, in combination with a movable furnace-bottom adapted to enter said recess, the upper portion of which projects laterally over said ledges or seats, means for raising said furnace-bottom from its seats and means for moving it longitudinally, substantially as set forth.

3. A heating-furnace having a recess extending along its hearth provided with an immovable track, a horizontal ledge or seat at each side above the track and below the hearth-face, in combination with a truck traveling on said track, a movable furnace-bottom adapted to be carried by the truck and projecting laterally over said ledges or seats, means for adjusting said furnace-bottom vertically on the truck and means for moving the truck longitudinally, substantially as set forth.

4. A heating-furnace having a recess extending along its hearth and provided with a horizontal ledge or seat at each side below the hearth-face, in combination with a movable furnace-bottom narrower than said recess and projecting laterally over said ledges or seats, means for adjusting said furnace-bottom vertically, and means for moving said furnace-bottom longitudinally, substantially as set forth.

5. A heating-furnace having a recess extending along its hearth provided with a track, a track extending in line therewith beyond the furnace, a truck traveling on said track, a pulley and a sprocket or driving wheel at



opposite ends of the furnace and track, endless chain or rope connections passing around said pulley and wheel and connected to opposite ends of the track, power connections  
5 for driving such sprocket, a movable furnace-bottom adapted to be carried by the truck and means for vertically adjusting said furnace-bottom thereon, substantially as set forth.

6. A heating-furnace having a recess extending along its hearth and provided with  
10 a track that extends beyond the furnace at one end, a furnace-bottom fitting into said recess, a truck on said track provided with means for lowering the furnace-bottom into  
15 the recess and raising it therefrom, a pulley and a sprocket or driving wheel journaled adjacent to the respective ends of the track, endless chain or rope connections passing around said pulley and wheel and connected  
20 to opposite ends of the truck, power connections for driving such sprocket or driving wheel, and an inclosed passage extending through the furnace below the furnace-recess for the passage of the chain, substantially  
25 as set forth.

7. A heating-furnace having a recess extending along its hearth provided with a track, a track extending in line therewith beyond the furnace, a truck traveling on said track,  
30 a pulley and a sprocket or driving wheel at opposite ends of the furnace and track, endless chain or rope connections passing around said pulley and wheel and connected to opposite ends of the truck, power connections  
35 for driving such sprocket, a movable furnace-bottom adapted to be carried by the truck, means for vertically adjusting it thereon, and ledges or seats in the furnace-recess upon which the furnace-bottom is adapted  
40 to rest, substantially as set forth.

8. A heating-furnace having a recess extending along its hearth, a casting forming the bottom of said recess and having a track thereon, and provided with a hollow passage  
45 below the recess, a truck traveling on said track and adapted to carry a movable furnace-bottom, a track in line with the furnace-track at one end thereof, a pulley and sprocket or driving wheel at opposite ends of such  
50 track and furnace respectively and a chain connected to both ends of the truck and passing around such pulley and driving-wheel and through the passage in said casting, substantially as set forth.

9. A heating-furnace having a recess extending along its hearth provided with a track, in combination with a truck and a movable furnace-bottom adapted to be carried thereon, means on the truck for adjusting the bottom  
55 vertically, a longitudinal shaft engaging with said adjusting means, a power-driven shaft at one end of the furnace and a flexible shaft driven thereby and adapted to engage with  
60 said longitudinal shaft, substantially as and for the purpose set forth.

10. A heating-furnace having a recess extending along its hearth provided with a track, a truck traveling on said track and a movable furnace-bottom adapted to be carried  
65 by the truck, a track in line with the furnace-track, a pulley and driving-wheel at the respective ends of the furnace and said track, and a rope connected to the truck and passing around said pulley and driving-wheel and  
70 under said truck, a power-driven shaft on which the driving-wheel is mounted, means for reversing said shaft and a clutch connection between the driving-wheel and said  
75 shaft, substantially as set forth.

11. A heating-furnace having two or more  
80 recesses extending along its hearth provided with tracks having trucks moving on said tracks, furnace-bottom sections adapted to be carried on the trucks and means for vertically adjusting said sections, said furnace  
85 having fire-chambers at the sides thereof, a tunnel thereunder and central downtake-flues between said recesses and communicating with said tunnel, substantially as set forth.

12. A heating-furnace having two or more recesses extending along its hearth provided with tracks having trucks moving on said tracks, furnace-bottom sections adapted to be carried on the trucks and means for vertically adjusting said sections, said furnace  
95 having fire-chambers at the sides thereof, a tunnel thereunder, flues leading from the same to the recesses and ports leading from the recesses through the hearth, and central  
100 downtake-flues between said recesses and communicating with said tunnel.

In testimony whereof I, the said WILLIAM S. MCKENNA, have hereunto set my hand.

W. S. MCKENNA.

Witnesses:

THOMAS J. MOORE,  
P. C. MAURER.