No. 859,413. PATENTED JULY 9, 1907.

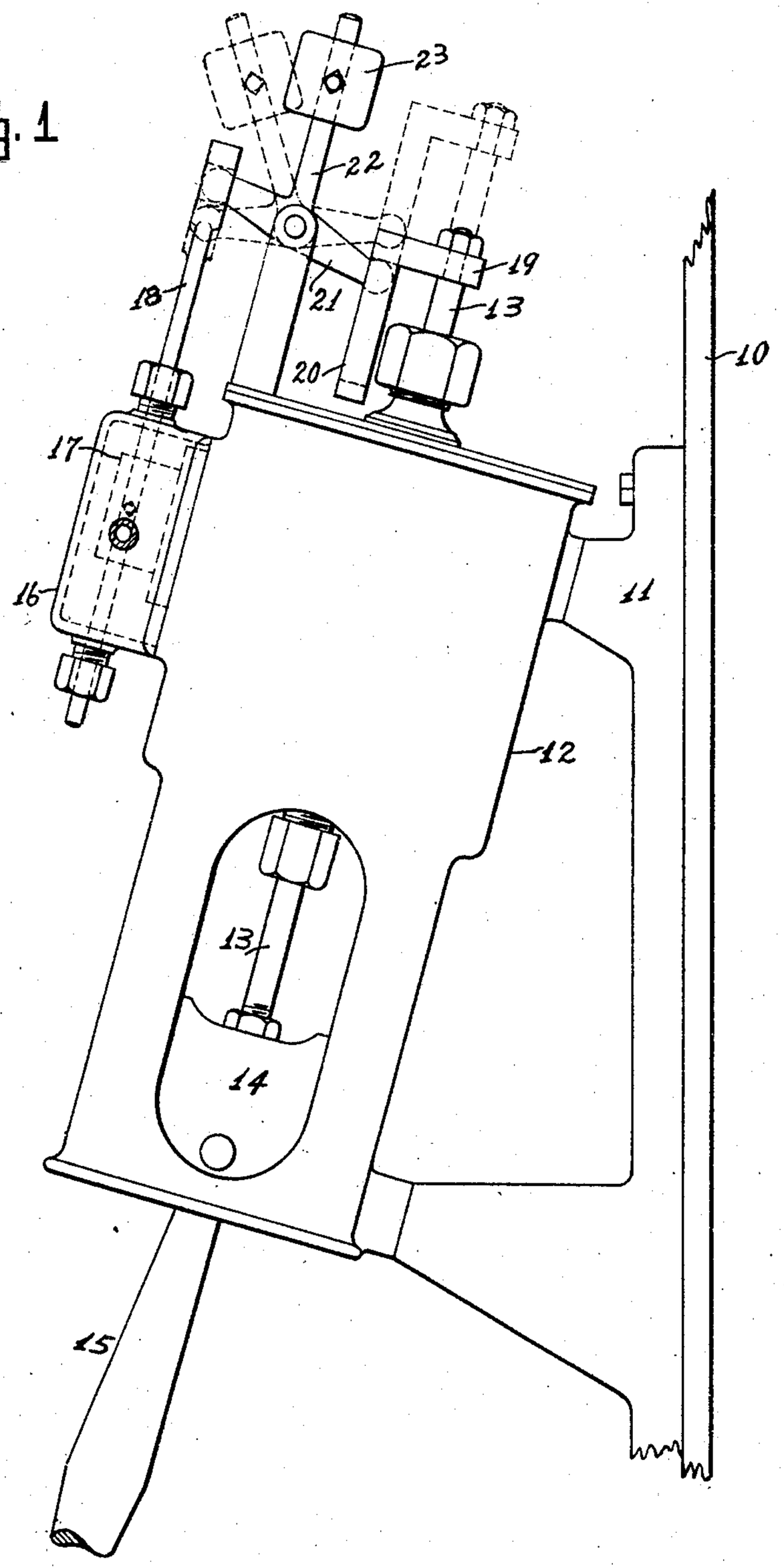
F. E. SMALL.

STOKER FURNACE.

APPLICATION FILED JUNE 1, 1906.

3 SHEETS—SHEET 1.

Fig. 1



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Inventor
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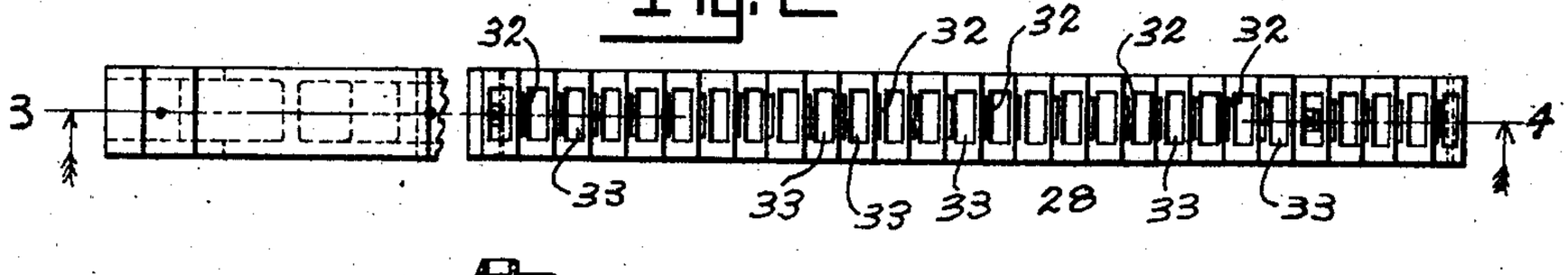
3 SHEETS—SHEET 2.

Fig. 2



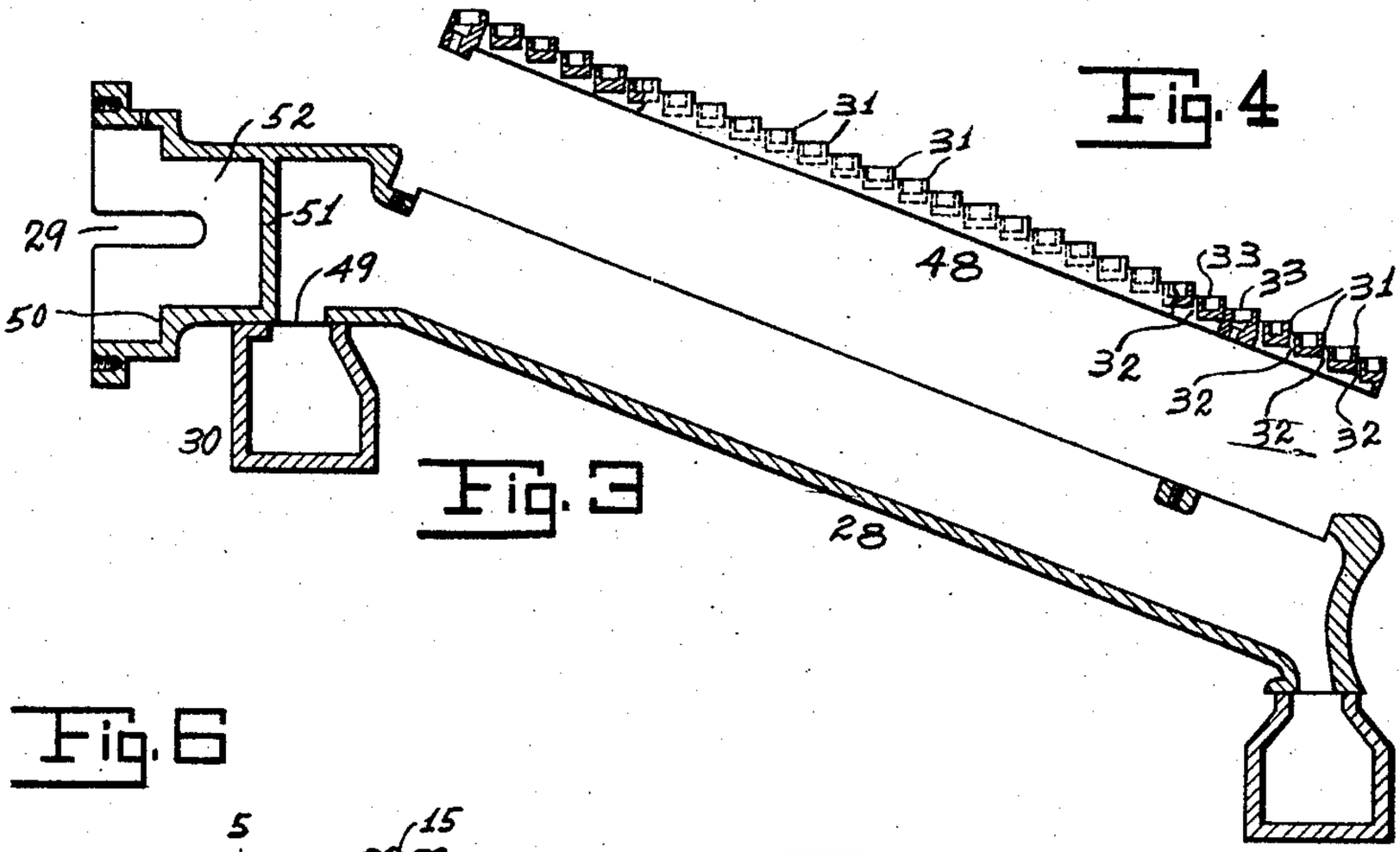


Fig. 3

Fig. 4

Fig. 6

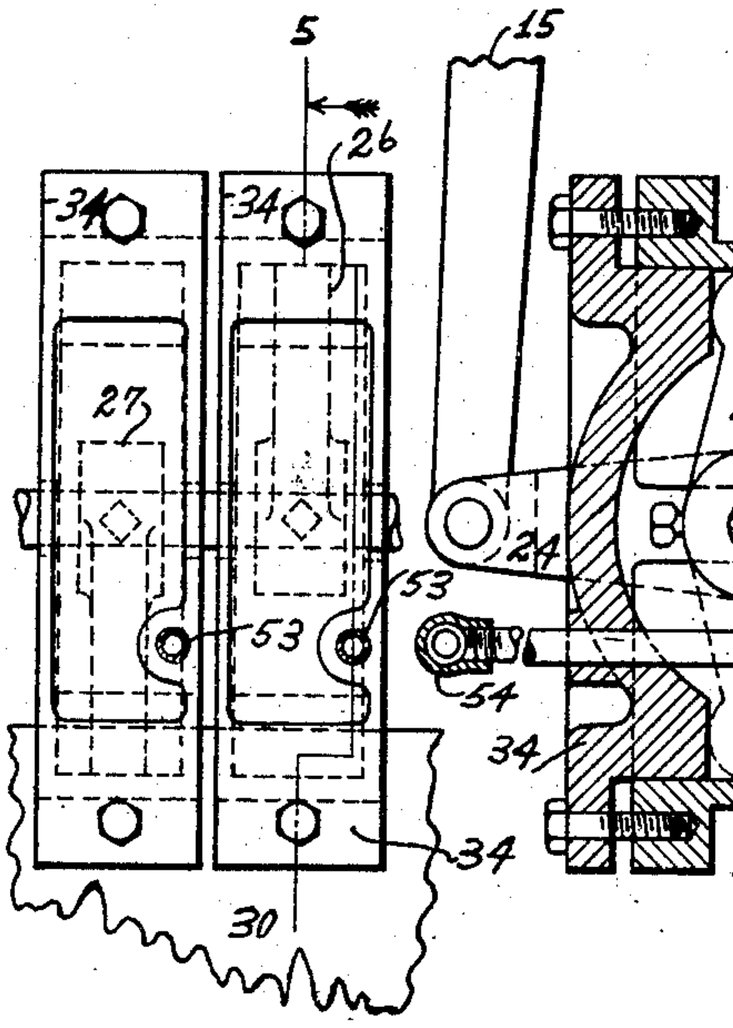
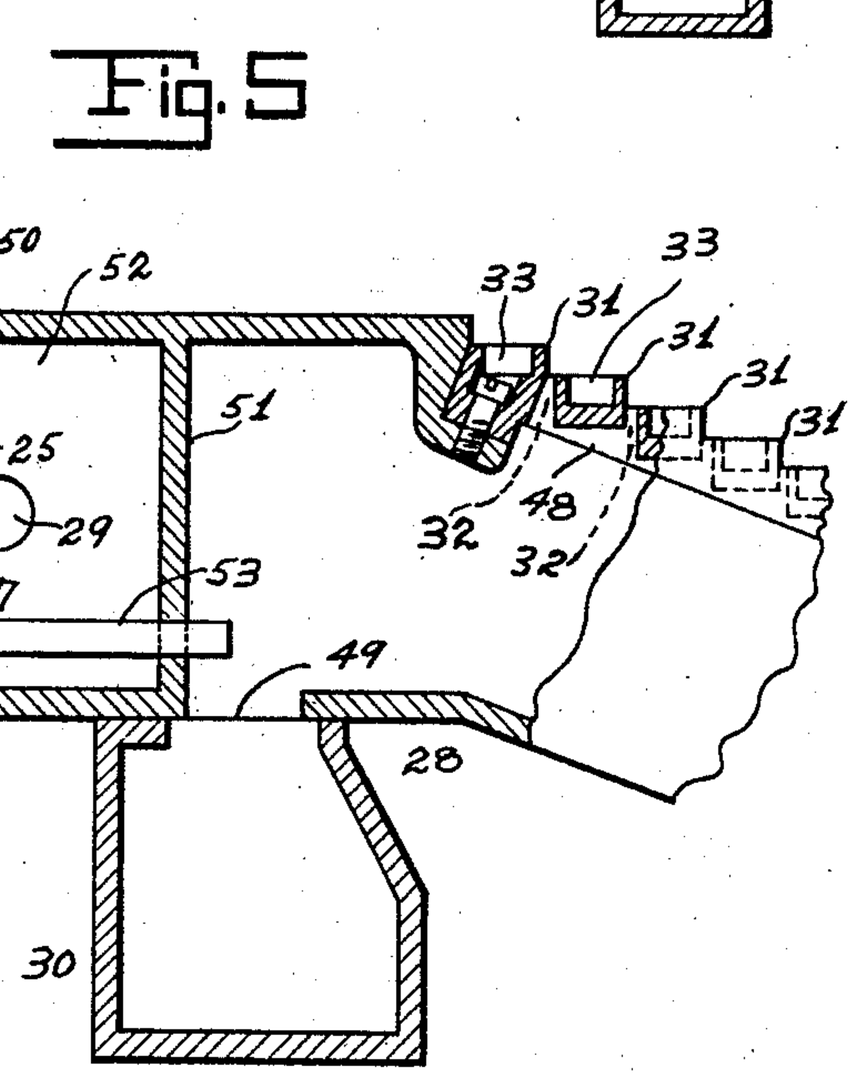


Fig. 5



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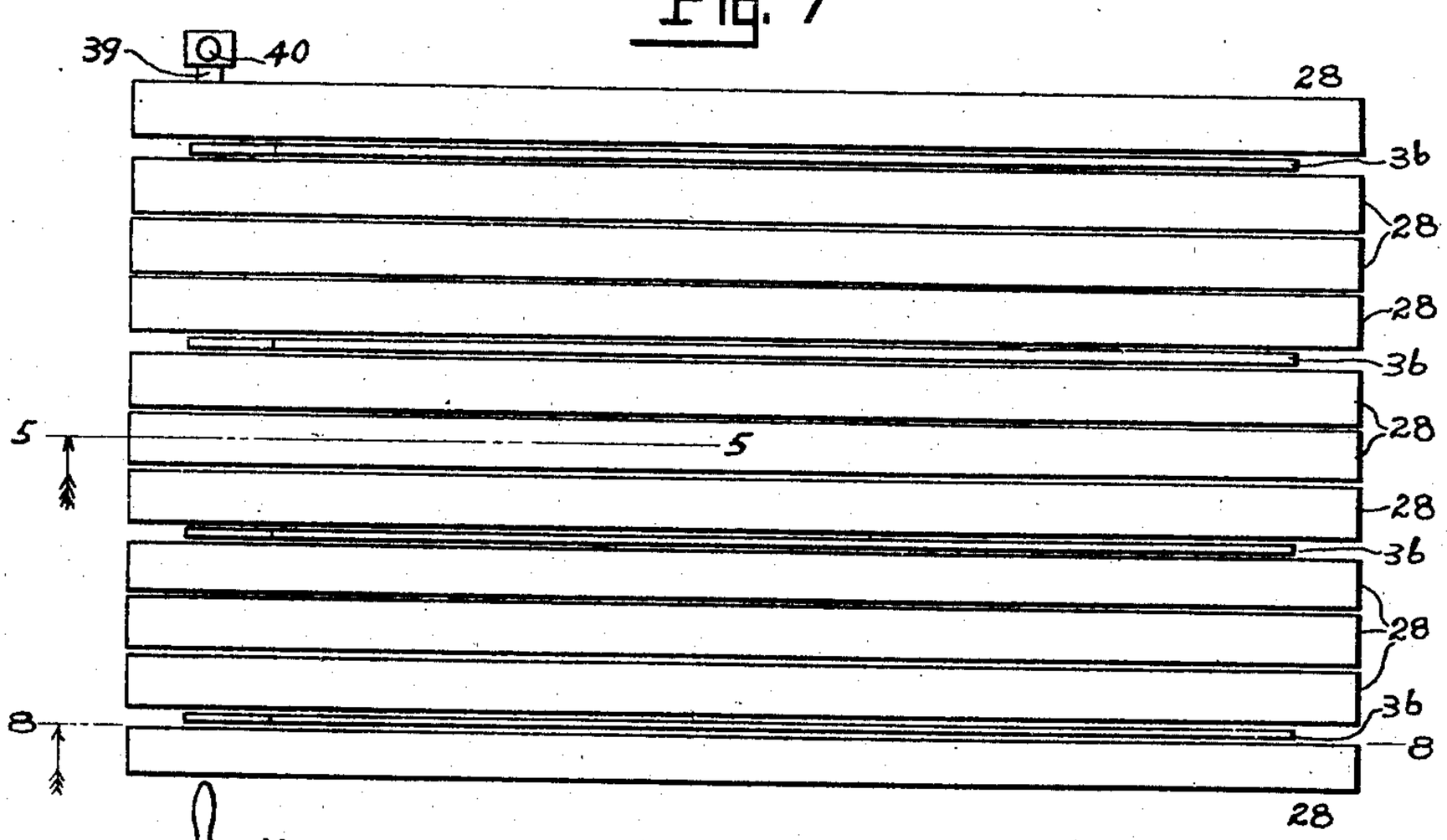
3 SHEETS—SHEET 3.

Fig. 7



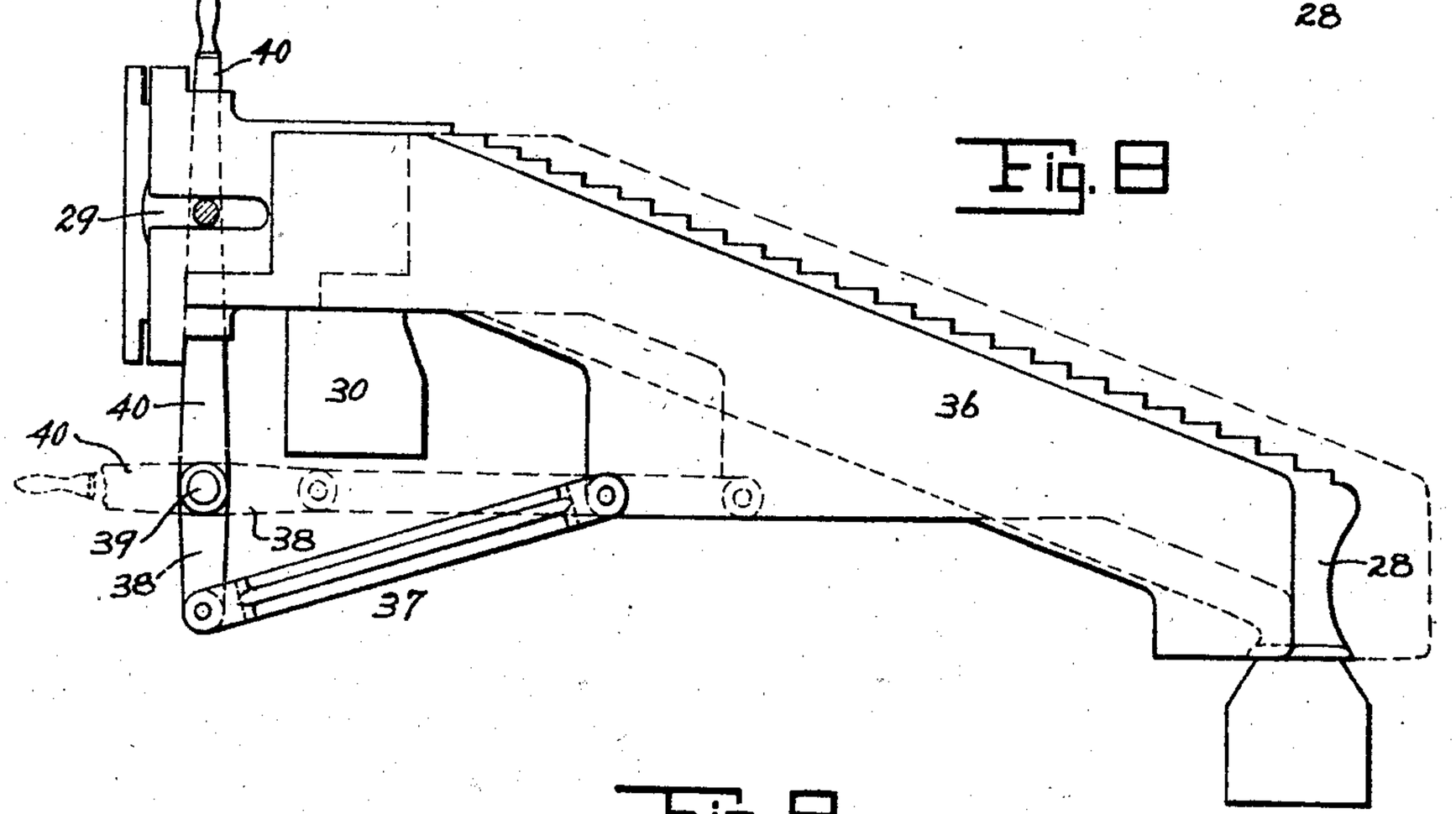
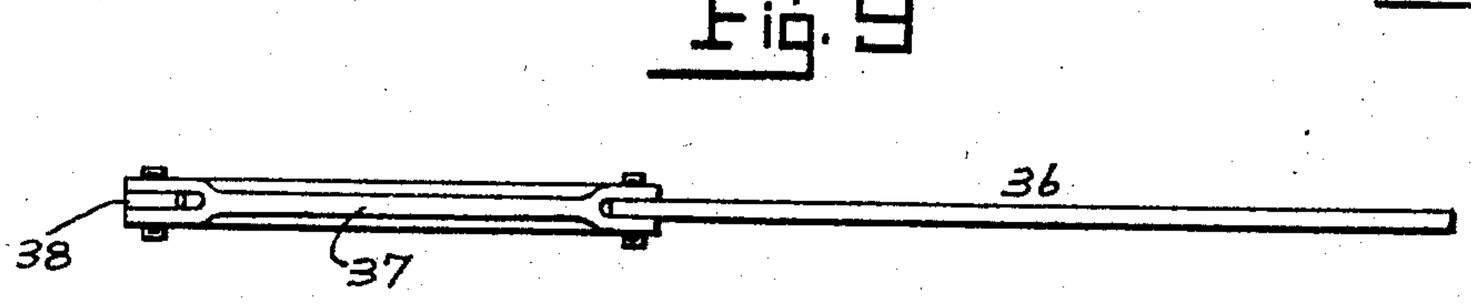


Fig. 8

Fig. 9



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UNITED STATES PATENT OFFICE.

FRANK E. SMALL, OF BROOKLYN, NEW YORK.

STOKER-FURNACE.

No. 859,413. Specification of Letters Patent. Patented July 9, 1907.

Application filed June 1, 1906. Serial No. 319,690.

To all whom it may concern:

Be it known that I, FRANK E. SMALL, a citizen of the United States, and a resident of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Stoker-Furnaces, of which the following is a specification.

The invention relates to improvements in stoker furnaces; and consists in the novel features and combinations of parts hereinafter described and particularly pointed out in the claims.

The object of my invention is to provide a reliable, efficient and easily operated and conveniently maintained stoker-furnace and one in which a complexity of parts and operative mechanism is avoided.

My invention resides more particularly in the novel inclined stepped reciprocatory grate-bar sections hereinafter described, breaking-up plates interposed between said sections, or sets of them, novel means for imparting reverse reciprocatory movements to alternate grate-bar sections, or sets of them, and means for operating said breaking-up plates.

My invention also embodies novel details of construction and arrangement pertaining to the main features of my invention.

The invention will be fully understood from the detailed description hereinafter presented, reference being had to the accompanying drawings, in which:

Figure 1 is a side elevation of a portion of the furnace and shows the motor for reversely moving alternate grate bar sections; Fig. 2 is a detached top view, partly broken away, of one of the grate bar sections; Fig. 3 is a vertical longitudinal section through the same, the upper surface section of the bar section being omitted, and shows the supports for the ends of the grate bar sections; Fig. 4 is a detached side elevation, partly in section, of the upper surface section of the grate-bar sections; Fig. 5 is an enlarged section through the upper portion of one of the grate bar sections and illustrates a part of the means for alternately moving said sections, said means deriving its action from the motor shown in Fig. 1; Fig. 6 is an end view, partly broken away, looking at two of the grate bar sections and taken from the left hand end of Fig. 5; Fig. 7 is a top view of a series of the grate bar sections shown in diagram, with lifting or breaking up plates arranged between the several sets of said sections; Fig. 8 is a side elevation of same, partly in section, looking at the lower end of Fig. 7, with one of the grate bar sections removed so as to show the lifting plate by full lines, with the means for operating said plate, the said lifting or breaking up plate being shown in a receded position by full lines and in its outer position by dotted lines, and Fig. 9 is a bottom view of the lifting plate shown in Fig. 8.

In the drawings, (Fig. 1), 10 indicates the front portion of the furnace structure upon which is secured a bracket 11 which supports the cylinder 12 of the motor. This cylinder 12 receives the usual piston secured upon a piston rod 13, whose lower end is connected with a cross head 14 which has connected with it the pitman rod 15, through which power is transmitted for operating the grate bar sections. Upon the side of the cylinder 12 is secured a valve chest 16 containing a D-valve 17 and supplied with the usual inlet on one side for water and an outlet on the other side for the exhaust. The valve 17, according to its position admits the water either above or below the piston in the cylinder 12, for actuating the piston rod 13. The valve 17 is secured upon a rod 18, and upon the upper end of the piston rod 13 is secured an angle-plate 19 having a slotted member 20 in parallelism with the valve rod 18. Intermediate the member 20 and rod 18 is pivoted the two ended lever 21, one arm of which is confined loosely within the slot of the member 20 and the other arm of which is confined in a head on the rod 18. The lever 21 is formed with an upwardly extending arm 22 carrying a weight 23.

In the position of the parts shown in Fig. 1 the piston in the cylinder 12 is in its lower position and the valve 17 is in position to admit water at the lower side of said piston and allow the water then above said piston to exhaust from the cylinder. As the water fills in below the piston in the cylinder 12 the rod 13 will ascend without moving the lever 21 until said rod nearly reaches its upper position, upon reaching which the member 20 of the plate 19 will strike the lever 21 and turn the same so that the weight 23 will pass beyond a vertical central line and tilt to the position shown in Fig. 1 by dotted lines, this having the effect of shifting the valve 17 so that the water below the piston in the cylinder 12 may exhaust and the water under pressure pass to the other side of said piston, for returning the rod 13 to its lower position and the weight 23 to the position shown by full lines in Fig. 1. I utilize the movement of the rod 13 to actuate the pitman rod 15 and then utilize the movement of this rod 15 to effect the movement of the grate bar sections. The point of novelty connected with the motor is the means provided by me for shifting the valve 17, these means comprising the lever 21, angle plate 19 and weight 23.

The motor as constructed by me is very simple and effective and dispenses with the complications of parts which motors heretofore used for this purpose have possessed.

My motor operates with only one valve 17, whereas other motors used in this particular art have required several valves.

The pitman rod 15 is pivotally connected with a crank arm 24 (Fig. 5) which is secured on a shaft 25, upon which I secure arms 26, 27 for alternately actuating the grate bar sections 28. The shaft 25 is a rock shaft and extends through slots 29 formed in the upper

end portions of the body of the grate bar sections, which upper portions are horizontally disposed and preferably rest upon a transverse box 30. The movement of the rod 15 rocks the shaft 25, and the movement of the latter causes the crank members 26, 27 to move the alternate grate bar sections 28, the arm 26 moving its section in one direction while the arm 27 moves its grate bar section in the opposite direction. The shaft 25 will be provided with as many arms 26, 27 as there are grate bar sections.

The grate bar sections 28 are hollow and provided with upper surface-bars 48 (Fig. 4) formed with steps 31 between which are formed vertical air spaces 32 and in the upper surfaces of which are formed recesses 33, these latter being to receive and hold ashes whereby the upper surfaces of the steps 31 are prevented from being burned out. The air spaces 32 direct the air along the vertical sides of the steps 31 and thereby the fuel is properly supplied with air and the grate bars are prevented from being burned out.

I direct particular attention to the fact that the air spaces 32 are not horizontally disposed, nor do they extend vertically through the middle portions of the horizontal faces of the steps 31, but on the contrary are in the form of vertical slots in line with the vertical faces of said steps, the adjacent vertical walls of adjacent steps below the general upper surface of the grate-bar sections forming the walls of said slots, as shown in Fig. 5, whereby the air is directed upwardly directly along and against the vertical faces of said steps, it being my purpose to prevent the air from taking a horizontal course through the grate-bar sections and to confine the air as far as possible directly along and against the vertical faces of the steps 31. I insert in the upper outer end of the grate bar sections a block or head 34 which, with the adjacent portions of the said sections, affords a bearing for the ends of the crank arms 26, 27. At the lower side of the upper end of the grate bar sections are formed openings 49 to register with openings in the box 30 into which, by means of a fan, not shown, I drive the air, which air passes through the hollow interior of the grate bar sections and escapes through the passages 32 formed therein. I may admit the air in several other ways than through the box 30. I give the grate bar sections 28 about an inch movement, and as above described this movement is secured from the rod 15 and motor connected therewith.

The grate bar sections 28 are novel in form and construction and the means shown for alternately actuating them are also novel. I particularly claim the hollow grate bar sections having the steps 31, ash recesses 33 and air passages 32. The surface bars 48 of the grate-bar sections are, for convenience, separately cast and bolted or otherwise properly secured to the body of said sections.

Intermediate the grate-bar sections 28 or intermediate sets of said sections, I provide, as shown in Figs. 7 and 8, lifting or breaking-up plates 36 which have the same inclination as the grate bar sections and are connected by links 37 and crank-arms 38 with a rock-shaft 39 operable by a lever 40 secured to one end of same. In Fig. 8 I show the lever 40, by solid lines, in its normal upright position with the plates 36 receded between the grate bar sections 28. When it is desired to break up the fire or crust on the grate bar sections, the lever 40 will be pulled downwardly to the position in which it is shown, partly broken away, by dotted lines in Fig. 8, whereby the plates 36 will be projected forwardly as shown by the dotted lines and serve to break up the fire-bed after it has become properly coked. I regard the plates 36 as novel in stoking furnaces and as forming a part of my invention.

There are three elements which coöperate in making my invention desirable, one being the motor shown in Fig. 1 connected with the grate bar sections, another being the special construction of grate bar sections shown, and the third being the lifting or breaking up plates 36.

The furnaces employing my invention will burn culm or the refuse of hard coal, when mixed with about twenty per cent. of bituminous coal, and this is a very important matter.

In carrying out my invention the cylinder 12 may be placed below the rock shaft 25 instead of above the same, which is its position indicated in the drawings, and I will arrange and dispose of the cylinder 12 and its parts in any way the occasion may seem to render most convenient.

There are several details of construction presented which are of value in carrying out the general purposes of my invention efficiently and conveniently and in the convenient construction and assemblage of the parts of the furnace. For illustration, the slots 29 extend through the end of the body of the grate bar sections, and hence when the heads or caps 34 are removed, the shaft 25 may be conveniently withdrawn from the said sections and carry the crank-arms 26, 27 with it. The heads 34 at their inner sides enter the upper outer ends of the grate-bar sections, as shown in Fig. 5, and not only impart great strength and rigidity to said ends but coöperate with shoulders 50 on said ends to form bearing surfaces or sockets for the rounded outer ends of the crank-arms 26, 27. Within the upper outer end portions of the hollow grate-bar sections are formed partitions 51, which prevent the heated air and ashes from passing into the chambers 52 occupied by the crank-arms 26, 27 and compel the air from the flue-box 30 to travel through the hollow interior of the said sections and find its escape through the vertical ports 32. Each grate-bar section 28 is equipped with a branch pipe 53 leading from a transverse pipe or header 54, through which steam may be supplied and directed by the pipes 53 into the grate-bar sections, whereby I am enabled to supply a mixture of steam and air to the bed of fuel on the grate-bars. The pipes 53 are stationary and the grate-bar sections reciprocate upon them. The surface bars 48 may be conveniently formed separately from the main body of the grate-bar sections, and a resultant advantage of this is that if one of said bars should become burned out it may be replaced at small expense and without discarding the entire section.

The novel features disclosed in this application in illustrating and describing the best means known to me for utilizing my invention and not permissible of being claimed herein are to be made the subject of a separate application for Letters Patent.

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

1. In a furnace, the hollow inclined grate-bar sections whose upper surfaces are stepped and formed with vertical

air-passages 32 in line with the vertical faces of said steps, the adjacent vertical walls of adjacent steps below the general upper surfaces of the grate-bar sections forming the walls of said passages, whereby the air is directed upwardly directly along and against the vertical faces of said steps, combined with means for conducting air to said sections; substantially as set forth.

2. In a furnace, the hollow inclined grate-bar sections whose upper surfaces are stepped and formed with vertical air passages at the vertical sides of said steps and with ash receiving recesses in the upper surfaces of said steps, combined with means for conducting air to said sections; substantially as set forth.

3. In a furnace, the hollow inclined grate-bar sections each comprising a body portion and a separate surface bar portion, the latter being stepped and formed with vertical air passages at the vertical sides of said steps and with ash receiving recesses in the upper surfaces of said steps, combined with means for conducting air to said sections, and means for reciprocating alternate sections in reverse directions; substantially as set forth.

4. In a furnace, the hollow inclined grate-bar sections whose upper surfaces are stepped and formed with air passages and in the top of the steps with ash receiving recesses, combined with means for conducting air to said sections, and means for reciprocating alternate sections in reverse directions; substantially as set forth.

5. In a furnace, the hollow inclined grate-bar sections whose upper surfaces are stepped and formed with air-passages, combined with means for conducting air to said sections, means for horizontally reciprocating alternate sections in reverse directions, breaking-up plates 36 interposed between said grate-bar sections and having upper edges inclined correspondingly therewith, and means for imparting a horizontal inward and outward movement to said plates, whereby when said plates are moved inwardly their upper inclined edges will be carried uniformly forwardly of and above said sections; substantially as set forth.

6. In a furnace, the hollow inclined grate-bar sections whose upper surfaces are stepped and formed with air passages and whose upper end portions are substantially horizontal and each formed with a chamber 52 separated by a partition 51 from the main body of the section, a rock-shaft extending through the chambers 52 of said sections, crank-arms on said shaft within said chambers and engaging said sections, and means exterior to said sections for actuating said shaft and crank-arms and thereby reciprocating alternate sections in reverse directions, combined with means for conducting air to said sections; substantially as set forth.

7. In a furnace, the hollow inclined grate-bar sections whose upper surfaces are stepped and formed with air passages and whose upper end portions are substantially horizontal and each formed with a chamber 52 separated by a partition 51 from the main body of the section, a rock-shaft extending through the chambers 52 of said sections, crank-arms on said shaft within said chambers and engaging said sections, and means exterior to said sections for actuating said shaft and crank-arms and thereby reciprocating alternate sections in reverse directions, combined with means for conducting air to said sections; a header-pipe for steam exterior to said sections, and branch pipes extending therefrom through said chambers and partitions for directing steam into the hollow interiors of said sections; substantially as set forth.

8. In a furnace, the hollow inclined grate-bar sections whose upper surfaces are stepped and formed with air passages and whose upper end portions are substantially horizontal and each formed with a chamber 52, a bearing shoulder 50 and side slots 29, a rock-shaft extending through the slots 29 and chambers 52 of said sections, crank-arms on said shaft within said chambers and engaging said shoulders 50, heads secured within the outer ends of said chambers and affording bearing surfaces for said crank-arms, and a motor for actuating said shaft and crank-arms and thereby reciprocating alternate sections in reverse directions, combined with means for conducting air to said sections; substantially as set forth.

Signed at New York city, in the county of New York and State of New York this 31st day of May A. D. 1906.

FRANK E. SMALL.

Witnesses:
CHAS. C. GILL,
ARTHUR MARION.