

(No Model.)

2 Sheets—Sheet 1.

F. H. RICHARDS.
TRAVELING GRATE FURNACE.

No. 527,450.

Patented Oct. 16, 1894.

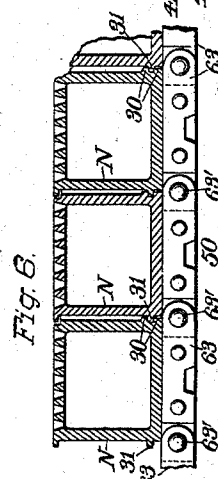
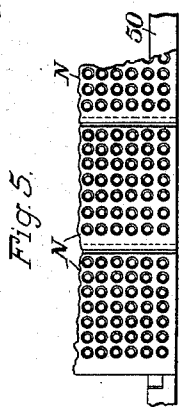
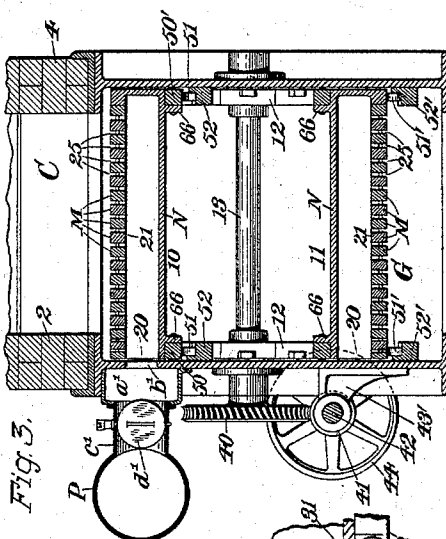
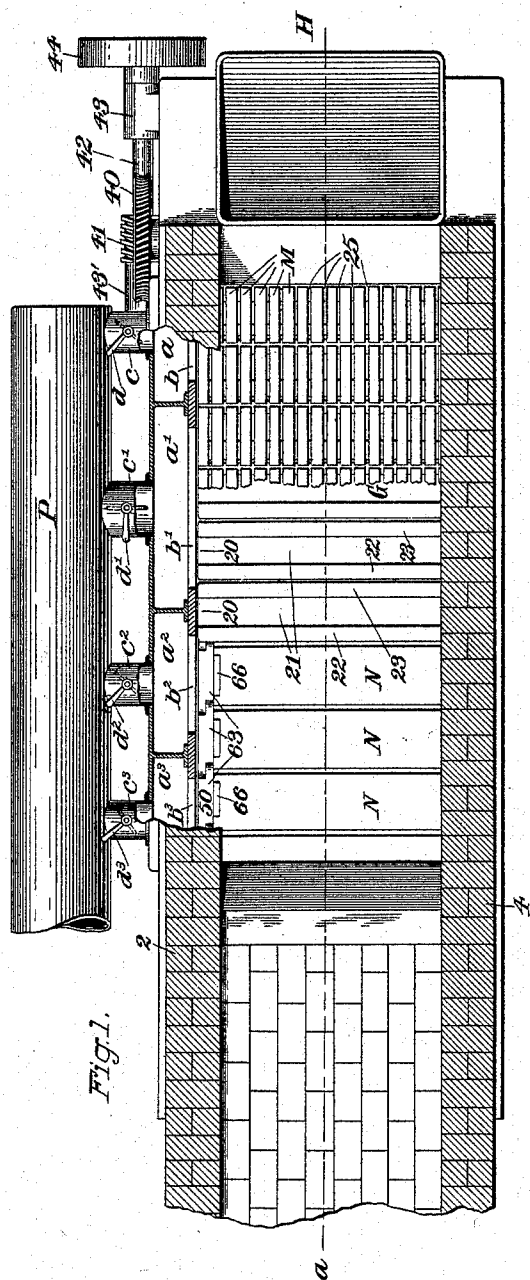


Fig. 7.



Fig. 8.

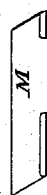


Fig. 9.



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TRAVELING-GRATE FURNACE.

SPECIFICATION forming part of Letters Patent No. 527,450, dated October 16, 1894.

Application filed June 25, 1894. Serial No. 515,600. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS H. RICHARDS, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Traveling-Grate Furnaces, of which the following is a specification.

This invention relates to furnaces of that class employing a traveling grate or furnace floor, and in which the fuel, ignited while spread in a layer upon the grate, is subjected to successive air-blasts of successively varying pressures during the successive stages of the combustion period, as described, for instance, in United States Letters Patent No. 499,716, granted to Eckley B. Coxe, June 20, 1893.

In traveling-grate or traveling-floor furnaces of this class as heretofore constructed, it has been customary to supply air to the upper or fuel-carrying run of the traveling floor from fixed air-chambers located between the upper and lower runs of said grate, said chambers being open at the ends thereof adjacent to the upper run of said grate; and, owing to the location of said chambers, more or less coal-dust or small fragments of coal would, during the traveling movement of the grate, fall into said chambers through the upper run of said grate, thus necessitating a cleaning-out of the chambers from time to time.

The object of my present invention is to provide in connection with a furnace a traveling furnace-floor comprising a series of successive and independent floor-beam air-boxes each having an inlet opening at one end thereof, means for imparting a traveling movement to said furnace-floor, and means in position and adapted for supplying air to the series of floor-beam air-boxes through the inlet openings at the ends thereof; also to so construct and organize said furnace-floor that the floor-beam air-boxes thereof will be protected, in a great measure, from the warping influences of the heat and will also, in a practical degree, be self-cleaning, or, in other words, will, during the traveling movement thereof, discharge any fragments of coal or analogous material which may have fallen into them.

In the drawings accompanying and forming a part of this specification, Figure 1 is a sectional plan view of a traveling-grate furnace embodying my invention, portions thereof being broken away to more clearly show the construction of certain details thereof. Fig. 2 is a vertical longitudinal section of the same, taken in line *a-a*, Fig. 1. Fig. 3 is a vertical cross-section of the same, taken in line *b-b*, looking toward the right-hand in said figure. Fig. 4 is an enlarged longitudinal section of a portion of the traveling grate, showing the construction and arrangement of the air-chambers and grate-bars or floor-plates. Fig. 5 is a plan view, on an enlarged scale, of a portion of a grate of modified construction. Fig. 6 is a vertical longitudinal section of the same. Figs. 7, 8 and 9 are plan, side, and end views, respectively, of one of the grate-bars shown in Figs. 1, 2, 3 and 4.

Similar characters designate like parts in all the figures.

In the preferred form thereof herein shown and described, my invention resides in the combination, in a furnace, of a traveling furnace-floor comprising a series of successive and independent floor-beams each embodying an inclosed air-chamber (which air-chamber and floor-beam together will be hereinafter termed the "floor-beam air-box") each air-chamber having an inlet opening at one end thereof, means for imparting a traveling movement to the furnace-floor, and an air-supply apparatus in position and adapted for supplying air to the air-chambers through the inlet openings thereof, all of which will be hereinafter more fully described.

For illustrating the application and utility of my present improvement, I have shown the same applied to a furnace whose general construction is similar to that of the furnace shown and described in the aforesaid Letters Patent No. 499,716. In the present instance, however, the furnace-chamber C is shown covered for a considerable portion of its length by a reverberatory roof, A. The furnace-chamber C is inclosed at the sides and ends thereof by the usual side-walls, 2 and 4, front end-wall, 3, and the rear wall or bridge-wall, 7. A space is shown at the rear end of the roof A for the reception of a boiler or

other thing to be heated. In the front end-wall 3 is a passageway, 5, through which the fuel is supplied to the grate.

The floor of the furnace consists of the upper run, 10, of an endless traveling grate, designated in a general way by G, and which is carried upon suitable grate-carrying wheels or chain-wheels, 12 and 14, that are supported upon shafts, 13 and 15, journaled in suitable bearings in the side-walls 2 and 4 of the furnace. As a means for actuating said shafts for imparting the required traveling movement to the furnace-floor, the shaft 13 is shown furnished with a worm-wheel, 40, that meshes with a worm, 41, on a driving-shaft, 42, journaled in bearings, 43 and 43' (shown in full lines in Fig. 1, and in dotted lines in Fig. 2) upon the side-wall 2 of the furnace, said shaft 42 being provided with a pulley, 44, whereby it may be driven from any suitable source of power.

For supplying fuel to the endless grate G, a hopper, H, is shown placed at the forward end of the furnace with its delivering-end contiguous to the passage-way 5 in the front end-wall 3.

The upper and lower runs, 10 and 11, respectively, of the traveling grate G will preferably be supported by rollers, 51 and 51', revolvably supported by roller-beams, 52 and 52', secured to the side-walls 2 and 4 of the furnace. For the purpose of protecting the side-edges of the furnace-floor, and also for preventing fine fuel passing over the side-edges thereof, the side-walls of the furnace are extended inward over the side-edges of the furnace-floor, as most clearly shown in Fig. 3 of the drawings.

The traveling grate or furnace floor, in the form thereof herein shown, consists of a series of transverse chambered or box-like grate-bar-supporting beams or floor-beam air boxes, N, carrying the floor-plates M, or grate-bars proper of the furnace-floor, which beams are preferably carried by a pair of endless chains, 50 and 50', consisting, in the form thereof herein shown, of a series of links, 63, (see Figs. 1, 2, 3, 4 and 6,) connected together by pivot-pins or rivets, 63', preferably as shown in Fig. 4. In this preferred form, the floor-beam air boxes N have depending lugs at opposite ends at their under side, as shown at 66, which lugs are riveted to the side-faces of opposite links of the two chains, as most clearly shown in Fig. 3.

In the form thereof shown in Figs. 1, 2, 3 and 4 of the drawings, each floor-beam air box is open at one end and one side thereof, as shown at 20 and 21, respectively, and is adapted for removably carrying a series of grate-bars, M. The open side of said floor-beam air box is shown having oppositely-disposed inwardly-projecting grate-bar-engaging flanges, 22 and 23, and the grate-bars M are shown having central depending flanges, 24, which are preferably dovetailed, as most clearly shown in Fig. 4, and extend between

and are engaged by the flanges 22 and 23 of the floor-beam air box N.

As a means for providing air-spaces between grate-bars to allow air to pass from the interior of the floor-beam air-box (which floor-beam air-box constitutes an air-supply chamber for supplying air to the fuel carried by the grate-bars or furnace-floor), each grate-bar is provided with remotely-disposed laterally-projecting lugs at one side thereof adapted to bear against the side-faces of the next adjacent grate-bar, thus leaving air-spaces, 25, between grate-bars, which may be of greater or less area as required.

In some cases, instead of providing the floor-beam air boxes N with removable grate-bars M as shown in Fig. 4, it may be desirable to employ a grate-beam having four side-walls, as shown in Figs. 5 and 6, and to perforate the outer wall to form air-spaces; therefore it is not desired to limit this invention to the particular construction of floor-beam air box shown in Fig. 4 of the drawings, although the construction therein shown is preferable, as it permits the grate-bars to be readily removed and replaced, in case of accident thereto, without the necessity of replacing an entire floor-beam air box; it being simply necessary, when it is desired to remove and replace the grate-bars, in the organization shown in Fig. 4, to slip said bars off the grate-beam at the open end of said beam and replace them in a like manner, as will be readily understood by reference to Figs. 3 and 4 of the drawings.

By the construction and organization herein shown and described it will be seen that, owing to the chambered construction of the grate-beams, the floor is made up of a series of traveling air-chambers having open ends in close proximity to the inner face of one of the side-walls of the furnace.

As a means for supplying air to the traveling air-chambers or to the interior of the chambered beams N at successive points in, and during the traveling movement thereof, and to regulate the pressure of the air-blast supplied thereto at the required points in the length of the furnace-chamber to secure the best practical results in the combustion of the fuel carried by the traveling furnace-floor or grate, I have provided an air-supply apparatus which, in the form thereof herein shown, consists of a series of fixed separated compartments, a, a', a^2, a^3 , preferably of different areas, located at one side of the upper run, 10, of the traveling grate contiguous to the open ends of the floor-beam air boxes and communicating with the interior of said floor-beam air boxes through inlet openings, b, b', b^2 , and b^3 , which register with the open ends of said floor-beam air boxes, as clearly shown in Figs. 1, 2 and 3 of the drawings. Said fixed air-supply compartments may be two or more in number, four of them being shown in the present instance. In general I prefer to use not less than three such chambers. For sup-

plying air to these fixed compartments a , a' , a^2 and a^3 , each compartment has a separate pipe, c , c' , c^2 and c^3 , which communicates with and terminates in a large supply-pipe, P , which will be connected with any suitable air-supply, as, for instance, an air-pump or blower. (Not shown.) In some cases, it is preferable to connect said air-supply pipe P with the second fixed compartment a' of the series so that the high pressure of the air-blast will be supplied to the air-chambers of the hollow beams N at a point approximately midway of the length of the furnace-chamber, which point corresponds to the middle of the combustion-period of the fuel. Therefore said compartment a' and the pipe c' communicating there with will preferably be of greater area than the compartments a , a^2 and a^3 and their communicating pipes.

In practice, the best possible results in the combustion of the fuel are obtained by regulating the air-supply to the fuel so that at the ignition-period, or when the fuel is at that point adjacent to the receiving-end of the traveling grate, a low-pressure air-blast of only sufficient pressure to gently blow the ignited fuel is supplied thereto at this point; and after the fuel has passed the ignition-point, an air-blast of high-pressure is supplied thereto, which pressure is gradually reduced thereafter at successive points in the length of the furnace-chamber, as fully described in connection with other means in the patent aforesaid; and to accomplish this result I have provided each supply-pipe c , c' , c^2 and c^3 , with regulating-valves, d , d' , d^2 and d^3 , respectively, by means of which the influx of air at successive points in the length of the furnace-chamber may be properly regulated to secure the requisite results at these points.

To prevent leakage of air at points between the chambered beams N , each beam is provided at opposite sides with flanges, 30 and 31, adapted for interlocking or overlapping with the flanges of the next adjacent beam, which flanges form a cut-off for any air which may enter between the beams, and prevent the egress of said air to the space between the upper and lower runs of the grate.

The mode of operation of my invention is as follows: The fuel is supplied to the furnace-floor or grate at a point adjacent to the first air-supply compartment a upon the grate-bars carried by the beams whose open ends are in communication with said compartment, and is then carried along past this compartment and the succeeding compartments a' , a^2 and a^3 with a slow traveling movement.

During this period the combustible material of the fuel is consumed, and the resultant cinder or ash is afterward carried under the bridge-plate 7 and finally delivered over the rearward end of the grate into the ash-pit.

In practice, the combustion goes on at one stage or another throughout the entire length of the furnace-chamber, the ignition taking

place within a short distance of the point where the fuel falls upon the grate, and the fuel being completely reduced to cinder by the time it reaches a point adjacent to the bridge-plate 7. During the traveling movement of the grate, the successive traveling floor-beam air boxes receive a supply of air successively from the successive compartments a , a' , a^2 and a^3 at the requisite varying pressures, whence the air is delivered through the discharge-openings or spaces between grate-bars to the fuel, which is maintained upon the furnace-floor substantially in *statu quo* during the successive stages of the combustion thereof.

By the construction and organization of mechanism as herein shown and described, I am enabled to secure the best practical results in the combustion of the fuel, and at the same time dispense with air-supply apparatus between the upper and lower runs of the traveling grate.

During operation, should dirt, cinders or fragments of coal fall through the air-spaces into the chambered grate or floor-beam air-boxes, they will be again discharged owing to the inverting of the beams when they arrive at their lower-run positions, thus maintaining the cleanliness highly desirable in furnaces of this class.

It will be obvious that any suitable means for supplying air to the inlet- or supply-openings b , b' , b^2 and b^3 , in the side wall of the furnace-chamber, and that any means for regulating the said supply of air, might be employed without departure from my invention.

By the term "air-chambers" used in connection with the description of the furnace-floor, it will be understood, is meant the space inclosed by the side and bottom walls of the floor-beams or floor-beam air boxes N , said chambers being independent of each other and being connected together to form the endless traveling furnace-floor.

Having thus described my invention, I claim—

1. In a furnace of the class specified, the combination with the furnace-chamber and its inclosing walls, of a traveling furnace-floor comprising a series of successive and independent floor-beam air-boxes each having an inlet opening at one end thereof, means for imparting a traveling movement to the series of floor-beam air-boxes, and an air-supply apparatus adjacent to the inlet openings of and adapted for supplying air to said floor-beam air-boxes, substantially as described.

2. In a furnace of the class specified, the combination with the furnace-chamber and its inclosing walls, of an endless traveling furnace-floor or grate having an upper and a lower run and consisting of a series of successive and independent floor-beam air-boxes each having an inlet opening at one end thereof and having outlet openings through

the fuel-supporting portions thereof, means for imparting a traveling movement to the furnace-floor, and an air-supply apparatus located adjacent to one edge of the upper run of said floor and adapted for supplying air to the air-boxes comprising said floor, substantially as described and for the purpose set forth.

3. In a furnace of the class specified, the combination with the furnace-chamber and its inclosing walls, of a traveling furnace-floor comprising a series of successive and independent floor-beam air-boxes each having an inlet opening at one end thereof and having outlet openings through the fuel-supporting portions thereof, means for imparting a traveling movement to the furnace-floor, and a variable-pressure air-supply apparatus located adjacent to one edge of said furnace-floor and adapted for supplying air to the floor-beam air-boxes through the end inlets at varying pressures at successive points in the traveling movement thereof, substantially as described and for the purpose set forth.

4. In a furnace of the class specified, the combination with the furnace-chamber and its inclosing walls, of a traveling furnace-floor comprising a series of successive and independent floor-beam air-boxes pivotally connected together and open at the fuel-supporting sides thereof and each having an inlet opening at one end thereof and a series of grate-bars secured to the open sides of each floor-beam air-box, means for imparting a traveling movement to the furnace-floor, and an air-supply apparatus in communication with the inlet openings in the ends of and adapted for supplying air to the series of floor-beam air-boxes, substantially as described and for the purpose set forth.

5. In a furnace of the class specified, in combination, a series of transversely-disposed box-like or chambered grate-beams provided with fuel-supporting floor-plates or grate-bars and pivotally connected together to form an endless traveling grate, means for imparting a traveling movement to said grate, and means for supplying air to the interior of successive grate-beams at successive points in and during the traveling movement of said grate-beams, substantially as described and for the purpose set forth.

6. In a furnace of the class specified, in combination, a series of pivotally-connected box-like or chambered grate-beams open at one side and one end thereof and carrying fuel-supporting grate-bars having intermediate air-spaces, means for imparting a traveling movement to the grate-beams, and an air-supply apparatus adjacent to the open ends of said beams and adapted for supplying air thereto during the traveling movement of said beams, substantially as described and for the purpose set forth.

7. In a furnace of the class specified, an endless traveling grate supported by revoluble carriers and comprising a series of pivotally-

connected hollow beams open at one end thereof and having fuel-supporting plates or bars with air-spaces in communication with the interiors of said beams, in combination with an air-supply located adjacent to the open ends of said beams and in communication therewith and adapted for supplying air to the interiors of said beams at different pressures at successive points in and during the travel thereof, means in connection with said air-supply for regulating the supply of air to the successive grate-beams, and means for rotating the carriers for imparting a traveling movement to the grate, substantially as described and for the purpose set forth.

8. In a furnace of the class specified, a series of pivotally-connected chambered grate-beams each open at one side and at one end thereof and having grate-bar-engaging flanges at the open side thereof, in combination with a series of grate-bars removably engaging the flanges of said grate-beams, substantially as described.

9. In a furnace of the class specified, the combination with the furnace-chamber, of a traveling furnace-floor consisting of a series of independent grate-sections connected together, and each section comprising a rectangular beam having an inclosed air-chamber and a series of grate-bars or floor-plates removably connected with said beam, substantially as described.

10. In a furnace of the class specified, the combination with the furnace-chamber having an air supply opening, of a series of independent inclosed traveling air-chambers having fuel-supporting portions with air-spaces therein and having inlet openings adapted for successively registering with the air-supply opening in the furnace-chamber during the traveling movement of said chambers, substantially as described.

11. In a furnace of the class specified, a grate-section consisting of a rectangular chambered beam open at the end and at one side thereof and having oppositely-disposed inwardly-projecting flanges at the open side thereof, in combination with a series of grate-bars having, each, a depending flange in movable engagement with the flanges of said beams and having abutments at one side thereof adapted to bear against the side-face of the next adjacent grate-bar to form an air-space between adjacent bars, substantially as described.

12. In a furnace of the class specified, the combination with the furnace-chamber having a series of air-supply openings at one side thereof adjacent to the path of travel of the furnace-floor, of a series of fixed compartments communicating with said supply-openings, air-supply pipes communicating with said compartments and having regulating-valves, a traveling furnace-floor comprising a series of independent inclosed air-chambers connected together and supported in position to register successively with the air-supply open-

ings of the furnace-chamber, and means for imparting a traveling movement to said furnace-floor, substantially as described and for the purpose set forth.

5 13. In a furnace of the class specified, the combination with the furnace-chamber having an air-supply opening through one of the side-walls thereof, of a traveling furnace-floor having a fuel-supporting run supported in
10 horizontal alignment with said air-supply opening in the furnace-chamber and consisting of a series of floor-beam air-boxes each having fuel-supporting portions with air-spaces or outlet openings therein and each
15 having an inlet opening at one end thereof adapted for registering with the air-supply opening in the furnace-chamber during the traveling movement of said floor-beam air-boxes, and means in position and adapted for
20 supplying air through the air-supply opening in the furnace-chamber to the interior of said floor-beam air-boxes, substantially as described and for the purpose set forth.

14. The herein-described floor-section for
25 traveling furnace-floors for furnaces of the class specified, it consisting of a combined

floor-beam and air-box having an inlet opening at one end thereof and having outlet openings extending through the fuel-supporting
30 sides thereof, substantially as described.

15. The herein-described floor-section for traveling furnace-floors for furnaces of the class specified, it consisting of a floor-beam air-box open at one end and at one side thereof, and a series of transversely-disposed grate-
35 bars removably secured to the open side of said floor-beam air-box, substantially as described.

16. The herein-described floor-section for traveling furnace-floors for furnaces of the
40 class specified, it consisting of a cross-sectionally rectangular floor-beam longitudinally recessed to form an air-box open at one side and at one end and having longitudinal flanges at
45 opposite sides thereof adapted for overlapping similar flanges upon adjacent floor-beams, substantially as described.

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