

(No Model.)

3 Sheets—Sheet 1.

F. H. RICHARDS.
TRAVELING GRATE FURNACE.

No. 527,452.

Patented Oct. 16, 1894.

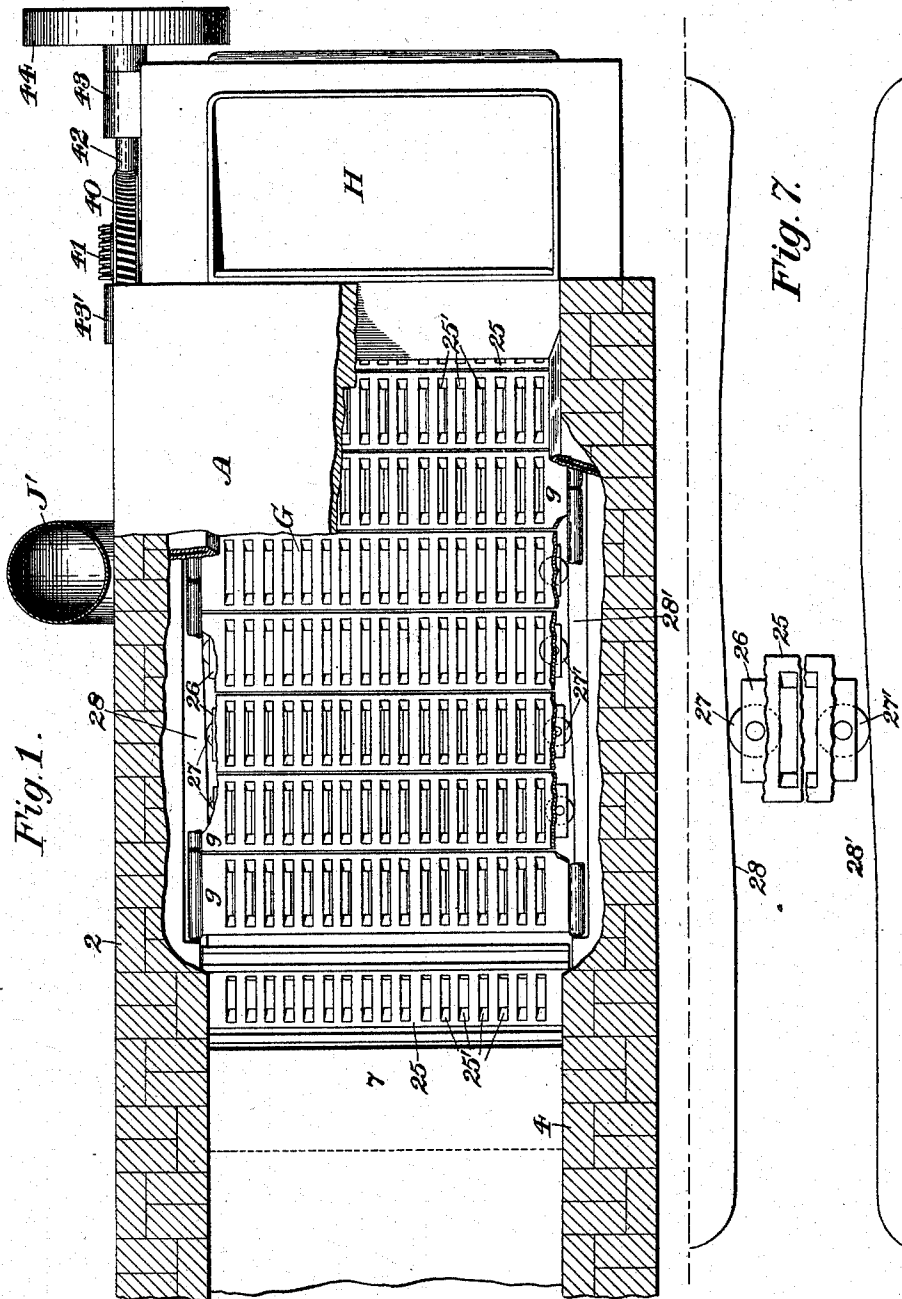


Fig. 1.

Fig. 7.

Witnesses:
G. L. Edwards Jr.
Fred J. Dole.

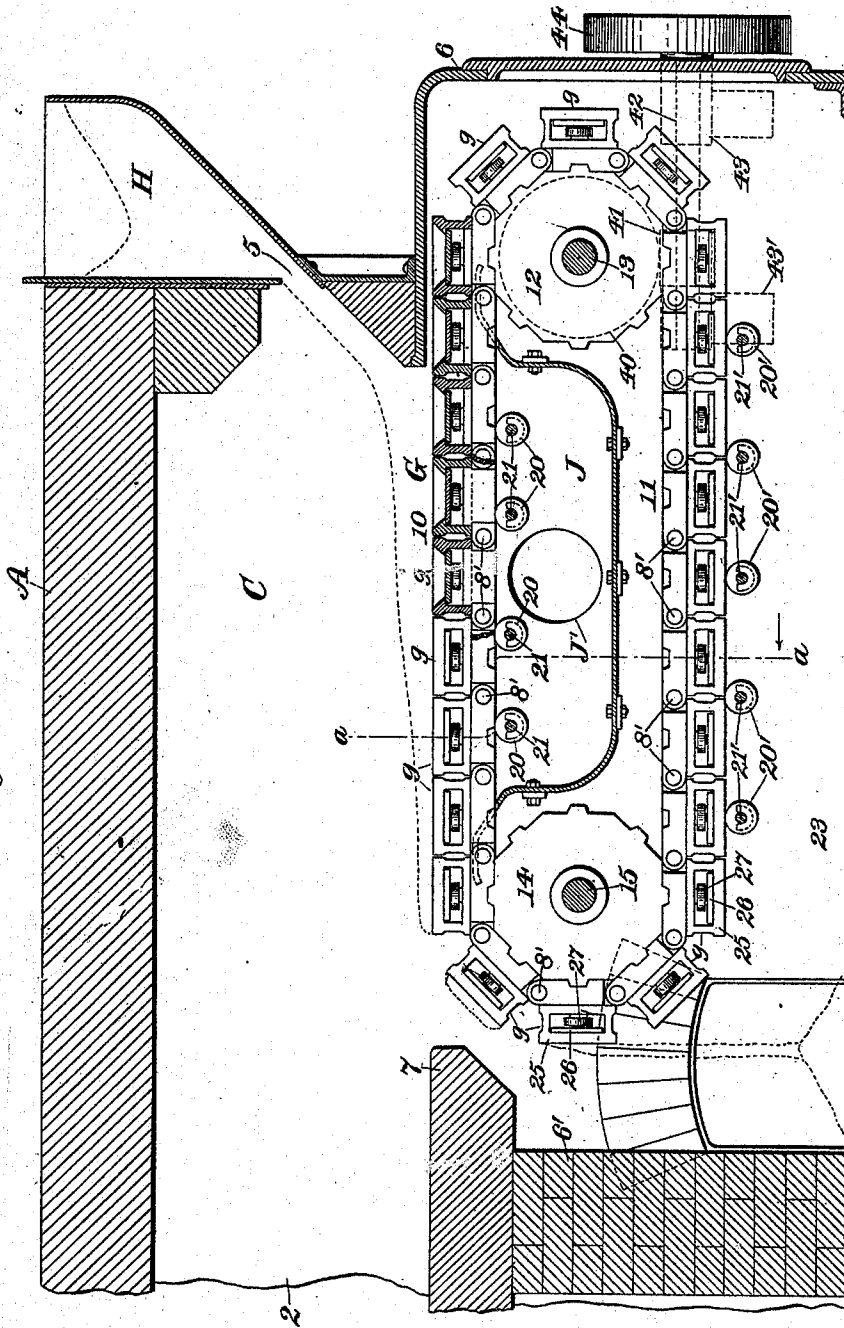
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Fig. 2.



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(No Model.)

3 Sheets—Sheet 3.

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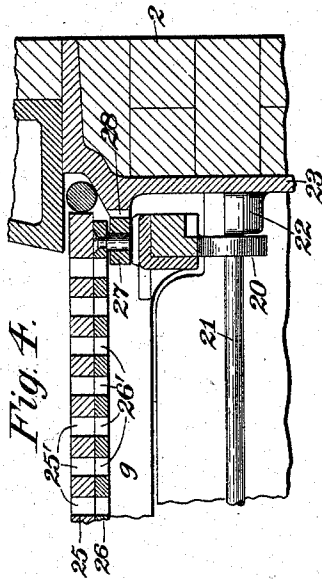


Fig. 4.

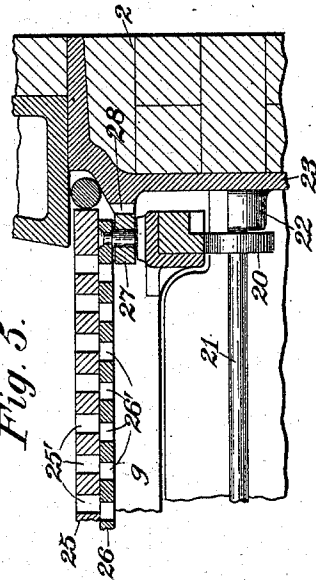


Fig. 5.

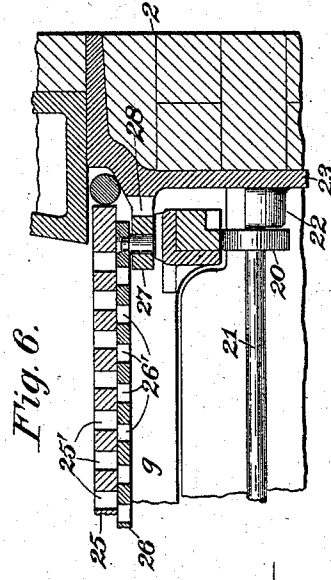


Fig. 6.

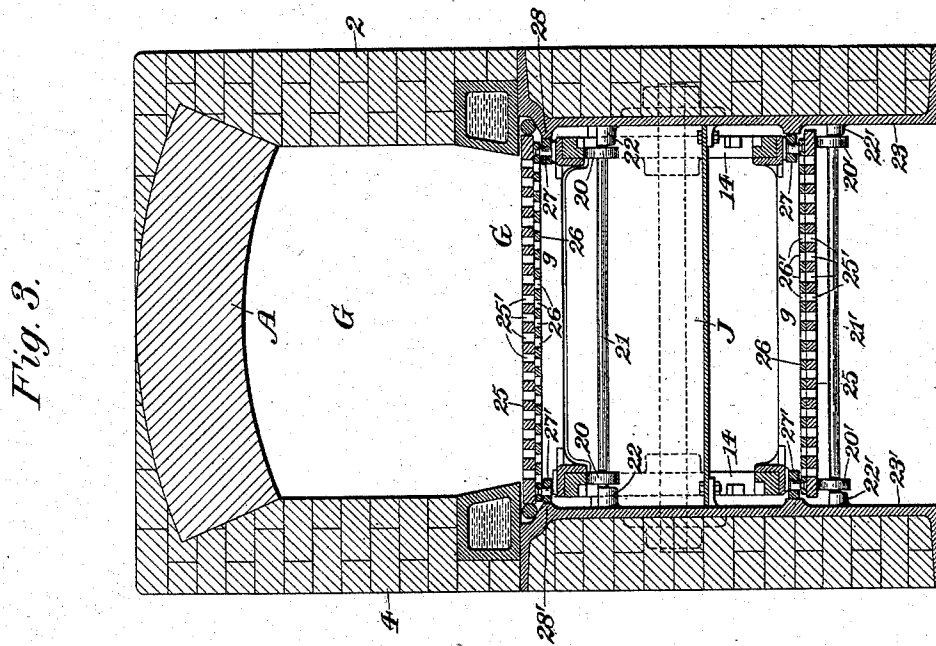


Fig. 3.

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UNITED STATES PATENT OFFICE,

FRANCIS H. RICHARDS, OF HARTFORD, CONNECTICUT, ASSIGNOR TO ECKLEY
B. COXE, OF DRIFTON, PENNSYLVANIA.

TRAVELING-GRATE FURNACE.

SPECIFICATION forming part of Letters Patent No. 527,452, dated October 16, 1894.

Application filed July 14, 1894. Serial No. 517,552. (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 traveling-grate furnaces, and has special reference to that class of furnaces in which an endless traveling grate or traveling furnace-floor is employed for supporting and imparting a continuous traveling movement to the fuel, and means are employed for supplying air to the fuel during its traveling movement at varying pressures at successive points in its course of travel.

In furnaces of this class as heretofore organized, it has been customary to provide a series of successive air-blast chambers intermediate to the upper and lower runs of the traveling grate, and to provide means for supplying air to the successive chambers at varying pressures, as described, for instance, in Letters Patent of the United States, No. 499,716, granted to Eckley B. Coxe, June 20, 1893, to which reference may be had.

The object of my present invention is to provide, in connection with a furnace of this class, an endless traveling furnace-floor or grate comprising a series of transversely-disposed floor-sections or beams each having a series of air-spaces or air-supply openings; also to provide an air-supply chamber having an outlet contiguous to several of said sections, and to provide, in connection with the floor-sections comprising the furnace-floor or grate, slide-valves or gates having air-spaces or openings therein adapted for registering with the air-spaces or openings of the floor-sections; also to provide means for automatically shifting the slide-valves or gates of the floor-sections for independently regulating the effective area of the openings through each section during the traveling movement of the furnace-floor, to increase or decrease the supply of air to the fuel at successive points in the traveling movement thereof as required to properly regulate combustion.

In the drawings accompanying and forming part of this specification, Figure 1 is a sectional plan view of a furnace embodying my present improvements, parts thereof being broken away to more clearly illustrate the construction and arrangement of certain details thereof. Fig. 2 is a sectional side elevation of said furnace, a portion of the traveling furnace-floor being shown in end elevation, while other portions thereof are shown in longitudinal section. Fig. 3 is a vertical cross-section of the furnace, taken in line *a-a*, Fig. 2, looking toward the left hand in said figure; and Figs. 4, 5, and 6 are cross-sectional views of a portion of one side of the furnace, on an enlarged scale, illustrating the operation of one of the regulating-valves in connection with one of the floor-sections, said figures showing three successive positions of said valve with relation to the floor-section, which positions are assumed by said valve at successive points in the traveling movement of the grate. Fig. 7 is a diagrammatic view of the two valve-operating cam-tracks, showing their relative relation to a straight line coinciding with the line of travel of the furnace-floor.

Similar characters designate like parts in all the figures.

The framework for carrying the operative parts of the furnace mechanism and also for protecting said mechanism and preventing the efflux of the air-blast, is shown having the usual inclosing walls at the sides and ends thereof, which may be of the construction shown and described in the Patent No. 499,716 hereinbefore referred to. The side-walls are designated in a general way by 2 and 4, respectively, and the furnace-chamber, designated by C, is shown covered by a reverberatory arch or roof, A, at the rear end of which the boiler (if one is used) will be located. A portion only of the rear end of the furnace is shown. The front- and back-walls are designated by 6 and 6', respectively, and the usual bridge-wall is designated by 7. At the forward end of the furnace this is provided with a fuel-supply hopper, H, from which fuel is supplied to the furnace-chamber through the inclined chute or opening 5, in a well-known manner.

The furnace is shown provided with an endless traveling furnace-floor, or grate, designated in a general way by G, the upper run of which constitutes the fuel-supporting run.

5 This furnace-floor is shown supported on and driven by chain-wheels, 12 and 14, at opposite ends of the furnace-chamber, which wheels are carried by shafts, 13 and 15, respectively, supported in any suitable bearings carried
10 by the framework of the furnace structure.

As a means for imparting a traveling movement to the furnace-floor, the shaft 13 is shown provided at one end thereof with a worm-wheel, 40, which meshes with a worm, 41, carried by a driving-shaft, 42, supported in bearings, 43 and 43', which shaft is provided with a pulley, 44, by means of which the same may be rotated by means of a belt (not shown) driven from any suitable source of power.

20 In the preferred form thereof herein shown, the traveling furnace-floor consists of a series of transversely-disposed floor-sections, designated in a general way by g, pivotally-connected together as at 8' to form, practically,
25 an endless chain or chain-grate, which is carried, as before stated, by the forward and rearward chain-wheels 12 and 14, respectively; the upper and lower runs, 10 and 11, respectively, of the furnace-floor or grate being herein
30 shown supported upon rollers, 20 and 20', respectively, which rollers are preferably carried upon transverse shafts, 21 and 21', supported for rotation in bearings or sockets, 22 and 22', herein shown formed upon the two
35 plates 23 and 23', which will preferably constitute the inner faces of the side-walls of the furnace-chamber.

Each floor-section of the series of floor-sections which comprise the furnace-floor is
40 herein shown consisting of two parts, or members connected together preferably for sliding movement the one relatively to the other, one of which parts constitutes the main body-portion, or, as it will be hereinafter
45 termed, the "floor-beam," 25, and the other of which constitutes a valve, 26. The floor-beam 25, which is of oblong construction and supported transversely of the furnace-chamber, is shown having a series of air-supply
50 openings, 25', therethrough, through which air may be admitted to the fuel supported upon said floor-beam; and the slide-valve 26 has a series of air-supply openings, 26', therethrough, in position and adapted for registering with the openings in the beam 25. The
55 floor-beam is shown having two side-walls and a fuel-supporting wall, and the slide-valve is shown supported for sliding movement between the two side-walls of the floor-beam in close proximity to the fuel-supporting
60 wall of said beam, and is of a length approximately equal to the length of said beam. At opposite ends of the slide-valve are friction-rollers, 27 and 27', respectively, which, at the
65 upper run of the fuel-carrying floor, bear against oppositely-inclined valve-operating tracks, or cams 28 and 28', respectively, pref-

erably formed integral with the two side-plates 23 and 23', as most clearly illustrated in Figs. 1, 3, 4, 5 and 6 of the drawings. The
70 working-faces of these cams will, in practice, be parallel to each other and will be of such inclination at different portions thereof and will bear such relation to a straight line coinciding with the line of travel of the furnace-floor as to cause a variation in the position
75 of the slide-valves with relation to the floor-beams at different points in the length of the furnace-chamber during the traveling movement of the furnace-floor, to thereby increase
80 the effective areas of the air-supply openings of some of the floor-beams and decrease in proper proportions the effective areas of the air-spaces of others of said floor-beams, thus
85 regulating the effective supply of air to the fuel supported upon the floor at successive points as required in the traveling movement thereof. In the drawings each floor-section is shown independently carried at its opposite ends by links, one at each end, of an
90 endless chain somewhat after the manner of chain-grates heretofore made.

As a means for supplying air to the fuel supported upon the upper run of the furnace-floor, I have provided an air-chamber, J,
95 which is located below the upper run of said floor and has an open end contiguous to said upper run, said chamber having its walls preferably constructed of sheet-metal bent to proper form and secured in any suitable
100 manner to the side-plates 23 and 23', said chamber being most clearly shown in Figs. 2 and 3 of the drawings. This chamber is supplied with air from an air-supply pipe, J', which, in turn, may be supplied by a blower,
105 or air-pump, (not shown,) in the usual manner.

In practice, an air-pressure will be maintained in the air-supply chamber J somewhat in excess of the maximum pressure required for the fuel at any given point in the length
110 of the furnace-chamber, and this pressure is regulated at successive points in the length of the fuel-carrying run of the furnace-floor by increasing or decreasing the effective areas of the air-supply openings through the
115 floor-sections, permitting thereby of greater or lesser volumes of air to pass through said air-supply openings, and consequently varying the effective pressures at these points.

Having thus described my invention, I
120 claim—

1. In a furnace of the class specified, a traveling grate having one or more fuel-supporting grate-sections with air-spaces therein, a valve in connection with said grate-sections
125 and adapted for varying the area of said air-spaces, and means for automatically operating said valve during the traveling movement of the grate to bring the air-spaces to predetermined areas at given points in the
130 furnace-chamber, substantially as described.

2. In a furnace of the class specified, in combination, a traveling grate comprising successive fuel-supporting grate-sections,

each of which has a series of air-spaces or outlet-openings, a valve connected with each grate-section in position for closing the air-spaces, means for supplying air to the fuel supported upon said grate-sections, means for imparting a traveling movement to the grate, and means for operating the successive valves of the grate-sections during the traveling movement thereof to open or close the air-spaces of each section and bring them to predetermined areas at given points in the travel of the grate, 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 having air-supply openings therein and carrying valves contiguous to and adapted for varying the effective areas of said openings, means for supplying air to said openings, means for imparting a traveling movement to the furnace-floor, and means in position and adapted for operating the valves during the traveling movement of the furnace-floor to bring the outlet-openings of said furnace-floor to predetermined areas at given points in the travel thereof, substantially as described.

4. In a furnace of the class specified, an endless traveling furnace-floor comprising a multiplicity of perforated floor-sections connected together to form substantially an endless chain-grate, slide-valves carried by said floor-sections and having perforations adapted for registering with the perforations of said floor-sections, and means for automatically imparting a sliding movement to said valves, substantially as described and for the purpose set forth.

5. In a furnace of the class specified, the combination with the furnace-chamber and its inclosing walls, of a perforated endless traveling furnace-floor carrying valves contiguous to the perforations thereof, means for imparting a traveling movement to said furnace-floor, and fixed cams or inclines for operating said valves during the traveling movement of the furnace-floor to bring the perforations to predetermined areas at given points in the travel of said furnace-floor, substantially as described.

6. 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 transversely-disposed connected floor-sections having air-supply openings therethrough, a valve carried by each of said sections in position for closing the openings therethrough, means for imparting a traveling movement to the furnace-floor, and fixed cams adjacent to and adapted for operating the several valves of the several floor-sections during the traveling movement of the furnace-floor to bring the air-supply openings in said sections to predetermined areas at given points in the travel of the furnace-floor, substantially as described.

7. In a furnace of the class specified, the combination with the furnace-chamber and its inclosing walls, of an endless traveling furnace-floor supported at opposite ends of said chamber upon rollers and comprising a series of transversely-disposed floor-sections having each a series of air-supply openings, means for imparting a traveling movement to the furnace-floor, a slide-valve carried by each of said sections and having rollers at opposite ends thereof, a fixed cam adjacent to each end of said sections in position to be engaged by the rollers of the valves and adapted during the traveling movement of the furnace-floor to slide said valves longitudinally of their respective sections to increase or decrease the area of the air-supply openings at predetermined points in the travel of the furnace-floor, substantially as described and for the purpose set forth.

8. In a furnace of the class specified, the combination with the furnace-chamber and its inclosing walls, of an endless fuel-supporting traveling furnace-floor having air-supply openings therein and carrying valves contiguous to and adapted for varying the areas of said supply-openings, means for imparting a traveling movement to said furnace-floor, and means for automatically operating said valves during the traveling movement of said furnace-floor to bring the air-supply openings to predetermined areas at given points in the travel of said furnace-floor, substantially as described.

9. In a furnace of the class specified, the combination with the furnace-chamber and its inclosing walls, of an endless traveling furnace-floor carried upon rollers substantially as described, and having air-supply openings therein, and carrying valves in position and adapted for varying the effective areas of said openings, an air-supply chamber located intermediate to the upper and lower runs of said furnace-floor and having an open end contiguous to the air-supply openings, means for supplying air to said air-chamber at the maximum pressure required, means for imparting a traveling movement to the furnace-floor, and means for automatically operating said valves during the traveling movement of the furnace-floor to vary the areas of the air-supply openings at predetermined points in the travel of said furnace-floor to thereby reduce the effective air-supply at certain points in the length of the furnace-chamber, substantially as described.

10. In a furnace of the class specified, the combination with the furnace-chamber and its inclosing walls, of an endless traveling furnace-floor carried upon rollers substantially as described, and having air-supply openings therein, and carrying valves in position and adapted for varying the effective areas of said openings, an air-supply chamber located intermediate to the upper and lower runs of said furnace-floor and having

an open end contiguous to the air-supply openings, means for supplying air to said chamber at the maximum pressure required, means for imparting a traveling movement to the furnace-floor, fixed cams supported adjacent to and in the path of travel of the upper run of said furnace-floor and adapted for automatically operating the valves during the traveling movement of the furnace-floor to bring the air-supply openings to predetermined areas at given points in the travel of said furnace-floor to reduce the effective pressures of air-supply contiguous to the fuel supported upon said furnace-floor at the requisite points in the length of the furnace-chamber, substantially as described.

11. In a furnace of the class specified, the combination with the furnace-chamber and its inclosing walls, of a perforated endless traveling furnace-floor carrying valves contiguous to the perforations thereof, means for imparting a traveling movement to said furnace-floor, two fixed oppositely-disposed cams located one at each side of the furnace-floor in the path of travel of the valves and having oppositely-inclined tracks adapted for automatically changing the positions of the valves relatively to the perforations of the furnace-floor to increase or decrease the effective areas of the perforations at predetermined points in the travel of said furnace-floor, substantially as described.

12. In a furnace of the class specified, the combination with the furnace-chamber and its inclosing walls, of two side-plates located one at each side of the furnace-chamber, and having inwardly-projecting oppositely-disposed valve-operating tracks, a perforated endless traveling furnace-floor carried upon rollers at opposite ends of the furnace-chamber and having the upper and lower runs thereof supported by rollers carried upon shafts supported in bearings or sockets formed in the side-plates, valves carried by said furnace-floor contiguous to and adapted for closing said perforations and carrying rollers at opposite ends thereof in position for engagement with the valve-operating tracks, means for supplying air below the upper run of the furnace-floor, and means for imparting a traveling movement to said furnace-floor, substantially as described and for the purpose set forth.

13. 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 connected floor-sections or transversely-disposed floor-beams each having two side-walls and a perforated fuel-supporting wall, a sliding valve located between the side-walls of each floor-section contiguous to the perforated fuel-supporting wall, means for imparting a traveling movement to said furnace-floor, means for supplying air below the valves of said furnace-floor, and valve-actuating cams adjacent to each end of and adapted for operating said valves

during the traveling movement of the furnace-floor to vary the effective air-pressure at predetermined points in the travel of said furnace-floor, substantially as described and for the purpose set forth.

14. In a furnace of the class specified, the combination with the furnace-chamber and its inclosing walls, of valve-operating tracks fixed at opposite sides of said furnace-chamber, and a perforated furnace-floor supported for traveling movement between said tracks and having slide-valves in bearing engagement with said tracks, substantially as described.

15. In a furnace of the class specified, the combination with the furnace-chamber and its inclosing walls, of two oppositely-disposed valve-operating tracks having inclined adjacent faces in parallel lines, a traveling furnace-floor located between said tracks and comprising a series of transversely-disposed floor-sections having air-supply openings, slide-valves carried by said sections contiguous to said supply-openings and having rollers at opposite ends thereof in bearing-contact with the valve-operating tracks, and means for imparting a traveling movement to said furnace-floor whereby the valves, through the medium of the tracks, are operated to vary the areas of the air-supply openings of successive sections to vary the effective air-supply to the fuel carried by said furnace-floor, at successive points in the travel thereof, substantially as described.

16. In a furnace of the class specified, a traveling furnace-floor having air-supply openings therein, in combination with oppositely-inclined valve-operating cam-tracks located one at each side of said furnace-floor in a plane corresponding to the plane of travel thereof, valves in sliding engagement with said furnace-floor and located between, and in bearing-contact at opposite ends with, the said cam-tracks, an air-blast apparatus located below, and in communication with, said furnace-floor, and means for imparting a traveling movement to said furnace-floor and, through the medium of the cam-tracks, to simultaneously operate successive valves in varying degrees to bring the air-supply openings of the furnace-floor to varying areas at predetermined points in the travel thereof, substantially as described.

17. In a furnace of the class specified, the combination with the furnace-chamber and its side-walls, of two opposite horizontally-disposed valve-operating tracks secured one to each side-wall of the furnace and having oppositely-inclined working-faces, a perforated furnace-floor supported for traveling movement intermediate to said tracks and carrying a plurality of slide-valves whose opposite ends are, in certain positions of the furnace-floor, contiguous to, and in bearing-contact with, said tracks, means for supplying air below said valves, and means for imparting a traveling movement to the furnace-

floor and at the same time imparting a sliding movement to said valves, substantially as described and for the purpose set forth.

18. 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 floor-sections each section consisting of two longitudinally-disposed perforated members connected together for sliding movement one relatively to the other, means for imparting a traveling movement to said furnace-floor, and means for automatically imparting a sliding movement to one member of each floor-section relatively to the other member of each floor-section, substantially as described.

19. In a furnace of the class specified, a traveling furnace-floor mechanism comprising a series of connected floor-sections, each section of which consists of two members connected together for sliding movement one relatively to the other and each having air-supply openings adapted for registering one with the other, means for imparting a traveling movement to said furnace-floor, and cams in position and adapted for imparting a sliding movement to one member of each floor-section relatively to the other member thereof, substantially as described.

20. In a furnace of the class specified, the

combination with the furnace-chamber and its inclosing walls, of a series of transversely-disposed connected floor-sections comprising together a traveling furnace-floor, each section consisting of two members in sliding engagement having registering air-supply openings, fixed horizontal cam-tracks adjacent to the ends of the sliding members and adapted for imparting a sliding movement successively to one member of each floor-section at predetermined points in the traveling movement thereof, and means for imparting a traveling movement to said sections simultaneously, substantially as described and for the purpose set forth.

21. In a traveling furnace-floor, a series of perforated floor-sections having openings in the ends thereof and each having a perforated slide-valve adjacent to the perforations of said floor-section, the ends of which slide-valve extend through said end-openings of the floor-section and bear against the valve-operating inclines or cams, and the inclines or cams for operating said valves, substantially as described.

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