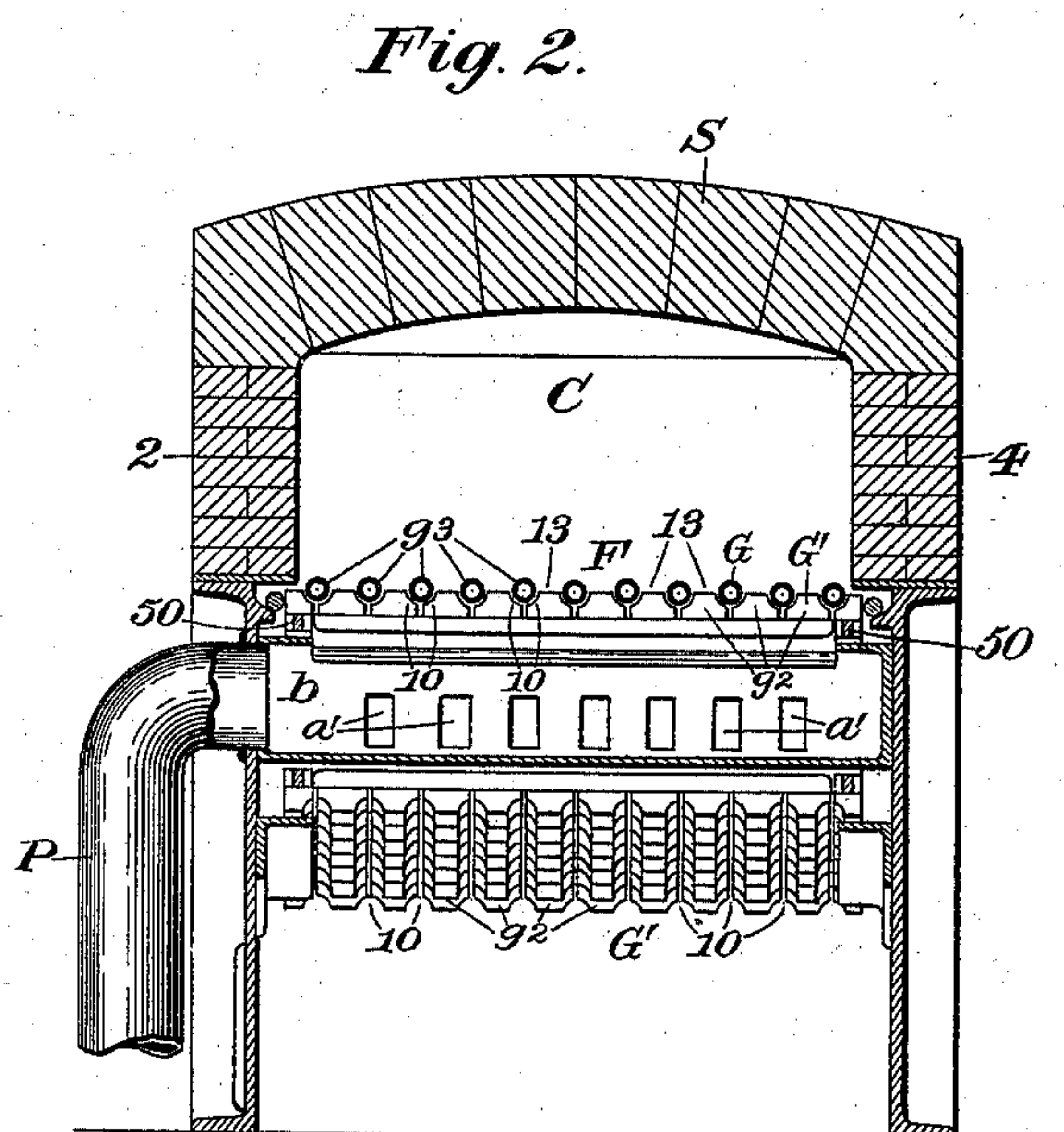
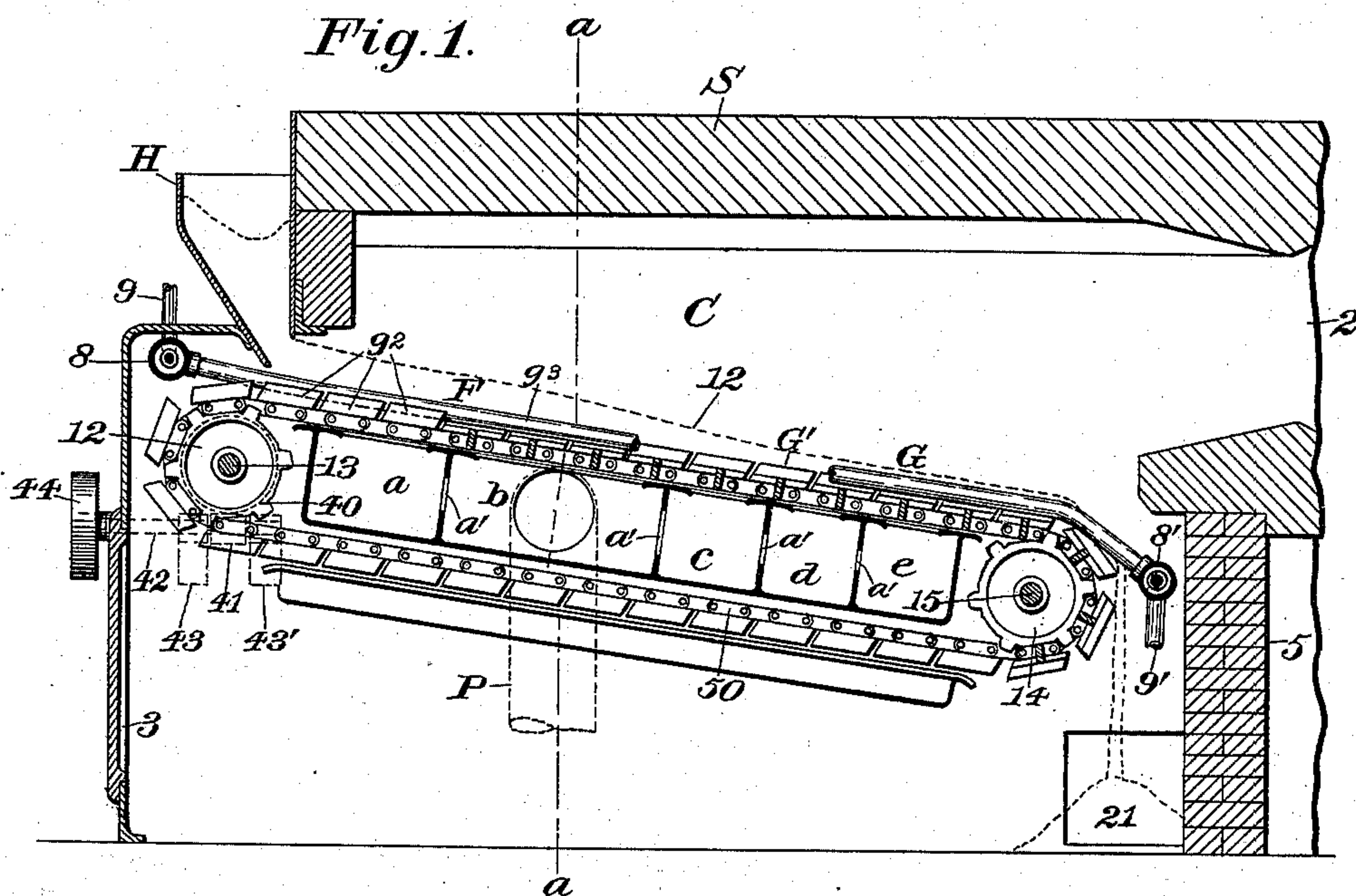


(No Model.)

F. H. RICHARDS.  
TRAVELING GRATE FURNACE.

No. 535,405.

Patented Mar. 12, 1895.



Witnesses:

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# UNITED STATES PATENT OFFICE.

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## TRAVELING-GRATE FURNACE.

SPECIFICATION forming part of Letters Patent No. 535,405, dated March 12, 1895.

Application filed September 27, 1894. Serial No. 524,233. (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 in which a fuel-traveling furnace floor is employed for carrying the fuel in the furnace-chamber and in which means are provided whereby the fuel supported upon said floor is subjected to air-blasts of varying pressures at successive points in the length of the furnace-chamber, as described, for instance in Letters Patent of the United States No. 499,715, granted to Eckley B. Coxe June 20, 1893, to which reference may be had.

In furnaces adapted for carrying out the process described in the aforesaid Letters Patent, it has been customary as fully set out in said patent, to first ignite the layer of fuel supported upon the ignition area of the fuel-traveling furnace floor, and aerate the same at the ignition-area by a moderate blast from a relatively low-pressure air-blast chamber, and next carry the fuel forward over a relatively high-pressure air-blast chamber where it is here raised to a high state of combustion by the relatively high pressure blast, and, after this carrying the layer forward over successive air blast chambers and subjecting the same to successive air-blasts of gradually reduced pressures, respectively. Thus it will be seen that at the area next adjacent to the ignition-area the temperature of the fuel-carrying furnace-floor will, owing to the increased air-blast and the relatively high state of combustion of the fuel at this point, be relatively high as compared with the temperature of those portions of said floor in advance and in the rear of this high-combustion area. This unevenness in temperature of successive portions of the furnace-floor is, as can be readily appreciated, detrimental to the life and efficiency of the traveling furnace-floor.

Therefore, the object of my present invention is, primarily, to provide, in connection with a furnace of the class specified, an im-

proved fuel-traveling furnace-floor, and to provide means in connection with said floor whereby the otherwise high temperature of the high-combustion area of said floor will be modified or reduced to approximate the temperature of the adjacent portions or areas of said floor, as will also said adjacent portions be modified in temperature to bring the entire area of the floor to an approximate uniform temperature.

In the drawings accompanying and forming part of this specification, Figure 1 is a sectional side elevation of a portion of a furnace embodying my present invention, and Fig. 2 is a transverse vertical section of the same taken in line *a-a*, Fig. 1, looking toward the right hand in said figure.

Similar characters designate like parts in both of the figures.

In the preferred construction and organization thereof herein shown and described my improved furnace has a fuel-traveling furnace-floor, comprising an upper and a lower fuel-supporting grate, the upper grate of which floor comprises a series of remotely disposed hollow grate-members fixedly supported in longitudinal disposition relatively to the furnace-chamber, and the lower grate of which floor comprises a series of grate-members supported for traveling-movement longitudinally of the furnace-chamber and longitudinally of said fixed grate-members, means in connection with, and adapted for actuating, the lower grate of the furnace-floor, to impart a traveling-movement to the fuel supported thereon, and means in connection with, and adapted for circulating water through, the hollow members comprising the upper-grate, to modify or regulate the temperature of successive portions of the lower-grate, all of which will be hereinafter more fully described.

For convenience in illustrating the application and utility of my present improvements, I have shown the same in connection with a furnace similar to the one described in the Patent No. 499,715, hereinbefore referred to. It will be understood, however, that my improvements are applicable to various forms of furnaces.



The furnace herein described is shown having a fuel-traveling furnace-floor designated in a general way by F, which is located within the furnace-chamber, C, which furnace-chamber has the usual inclosing walls at the sides and ends thereof and is shown provided with the ordinary roof, S. The side-walls are designated by 2 and 4 respectively; and the front and rear end-walls by 3 and 5, respectively. At the forward end of the furnace this is shown provided with the usual fuel-hopper H, through which fuel is supplied to the forward end or ignition area of the fuel-traveling furnace-floor.

In a form thereof herein shown and described the fuel-traveling furnace-floor comprises the fixed upper fuel-supporting grate, designated in a general way by G, and a lower movable grate, designated in a general way by G'.

The lower movable-grate, G', will preferably be of the endless chain variety, and is shown of a construction somewhat similar to the endless-chain grate described in the patent hereinbefore referred to, said endless grate comprising a series of grate-sections  $g^2$ , which grate sections are carried by chains 50, which run over and are actuated by chain-wheels 12 and 14, which are carried upon shafts 13 and 15, after the manner described in the aforesaid Letters Patent. Said shafts and chains are or may be actuated by means of a worm-wheel, 40, fixed to one of said shafts, and meshing with the worm, 41, on the driving-shaft, 42, supported in bearings 43, and 34', (shown in dotted lines in Fig. 1 of the drawings) which shaft 42, is provided with pulley 44, which may be driven from any suitable source of power (not shown).

I do not desire to limit my present invention to the particular form of lower traveling-grate shown in the drawings as other forms of grate adapted for imparting a traveling movement to the fuel might be employed in connection with the fixed upper grate herein shown and described for attaining the objects of my present invention, although the traveling-grate G', shown in the drawings is preferable.

The fixed grate, G, in the form thereof herein shown comprises a series of longitudinally and remotely disposed hollow members,  $g^3$ , (preferably tubes,) which are supported in parallelism with and in close proximity to the fuel-supporting face of the movable grate G'. These hollow members are shown as forming a conveying means, adjacent to the fuel-supporting portions of the fixed and movable grates, for circulating a cooling medium, and thereby modifying the normally high temperature of said grates. In practice the opposite ends of the hollow members,  $g^3$ , will communicate with headers, or transversely disposed pipes, 8 and 8', supported at their ends in the side-walls at the forward and rearward ends respectively, of the furnace chamber as

most clearly illustrated in Fig. 1, of the drawings.

As a means for supplying a cooling medium to, and maintaining a circulation thereof through, the hollow members,  $g^3$ , of the fixed grate, the headers, 8 and 8', will communicate by means of pipes, 9 and 9', with the interior of the furnace-boiler, (not shown,) above and below the major axis thereof, respectively, thus maintaining a continuous circulation of water through said hollow members.

In practice it is preferable, with the furnace-floor such as herein described, that the lower faces of the members shall depend below the upper face of the lower movable-grate comprising the upper fixed-grate and to accomplish this the fuel-supporting surface of the lower movable-grate is shown having a series of grooves or recesses 10, therein extending longitudinally of the furnace-chamber and in vertical alignment with and adapted for receiving the longitudinal members of the upper fixed grate. By this construction and organization just described it will be seen that the fuel, represented by the dotted line 12 in Fig. 1, will rest, the major portion thereof, upon the movable-grate and between the hollow-members comprising the fixed-grate. The spaces, 13, between, and in connection with the side-walls of, the remotely and longitudinally disposed members comprising the fixed-grate constitute fuel guides adapted for guiding the fuel in its traveling movement.

Located below the furnace-floor is an air-supply apparatus adapted for supplying air to the fuel at varying pressures at successive points in the length of the furnace-floor which air-supply apparatus may be, substantially, of the same general construction and organization as the air-supply apparatus described in the patent hereinbefore referred to.

In the form thereof herein shown and described the air-supply apparatus comprises a series of air-blast-chambers, *a*, *b*, *c*, *d* and *e*, respectively, having outlet openings respectively contiguous to successive fuel-supporting areas of the furnace-floor.

For supplying air to the several air-blast chambers *a*, *b*, *c*, *d* and *e*, respectively, I have shown an air-supply pipe, P in connection with one of the air-blast chambers, herein shown as the high-pressure air-blast chamber *b*, the chambers *a*, *c*, *d* and *e*, receiving their supply of air from the chamber *b*, through the opening *a'*, in the walls of said chambers as will be readily understood by reference to said drawings. If desired the communicating openings *a'* between adjacent air-blast chambers may be provided with valves or gates, to limit or regulate the flow of air from one chamber to another. This air-blast apparatus will be adapted for supplying air to the fuel supported upon the furnace floor at varying pressures at successive points in the length of said floor for the purpose of effecting the combus-



tion of the fuel according to the process described in the Letters Patent No. 499,715, hereinbefore referred to, which process, is fully described and claimed in said patent and need  
5 not be herein described in detail.

The fuel is fed to the furnace floor at a point adjacent to the first air-blast apparatus, each section of the furnace floor, speaking particularly of the lower traveling grate thereof receiving its supply of fuel at or before the  
10 time it reaches the first air-blast chambers, being then carried along over the chamber, by the traveling movement of the lower grate and successively over the succeeding chambers *b, c, d* and *e*. During this period the combustible material of the fuel is consumed and the resulting cinder, or ash, is finally delivered over the rearward end of the lower grate into the ash-pit 21. During the successive stages of the combustion period the successive fuel-supporting areas of the furnace floor are maintained at a relatively low and substantially uniform temperature owing to the constant circulation of water through the  
20 hollow members comprising the upper grate. This method of reducing the temperature of the grate will, in no material degree, injuriously affect the temperature of the combustion chambers.

30 Having thus described my invention, I claim—

1. In a furnace, the combination with the furnace-chamber and its inclosing walls, of a fuel-traveling furnace-floor comprising a fixed  
35 fuel-supporting grate and a progressively-movable fuel-supporting grate supported substantially in parallelism and one above the other, means for progressively actuating the movable grate, conveying means adjacent to the fuel-supporting portions of said grates  
40 and in position and adapted for circulating a cooling medium and thereby modifying the normally high temperature of said fuel-supporting portions of said grates, and means  
45 connected with said conveying means for supplying a cooling medium thereto, substantially as described and for the purpose set forth.

2. In a furnace, the combination with the  
50 furnace-chamber and its inclosing walls of a fuel-traveling furnace-floor comprising a fixed fuel-supporting-grate and a progressively-movable fuel-supporting grate supported substantially in parallelism and one above the  
55 other, and means connected with the movable grate for progressively actuating the same, substantially as described.

3. In a furnace, the combination with the furnace-chamber and its inclosing walls, of a  
60 movable-grate supported within and adapted for movement longitudinally of the furnace-chamber, a fixed grate located above and having longitudinal fuel-guides contiguous to said movable grate, and means in connection  
65 with and adapted for actuating the movable-

grate, substantially as described and for the purpose set forth.

4. In a furnace, the combination with the furnace-chamber and its inclosing walls, of a  
70 movable-grate supported within and adapted for movement longitudinally of the furnace chamber, a fixed grate comprising a series of longitudinally and remotely disposed members having longitudinal fuel-guides or passage ways intermediate thereto, and means in  
75 connection with and adapted for actuating the movable-grate, substantially as described and for the purpose set forth.

5. In a furnace, the combination with the furnace-chamber and its inclosing walls, of a  
80 movable-grate supported within and adapted for movement longitudinally of the furnace chamber, a fixed-grate comprising a series of longitudinally disposed internally-recessed members, having longitudinal fuel-guides or  
85 passage ways intermediate thereto, and means in connection with and adapted for actuating the movable-grate, and means in connection with and adapted for circulating water through the recessed members of the fixed-  
90 grate, substantially as described and for the purpose set forth.

6. In a furnace, the combination with the furnace-chamber and its inclosing walls, of a  
95 fuel-traveling furnace-floor comprising an upper and lower fuel-supporting grate, the upper grate of which comprises a series of remotely disposed hollow grate-members fixedly supported in longitudinal disposition relatively to the furnace-chamber, and the lower  
100 grate of which comprises a series of grate-members supported for traveling movement longitudinally of the furnace-chamber and longitudinally of the fixed grate-members, means in connection with and adapted for  
105 actuating the lower grate of the furnace-floor to impart a traveling-movement to the fuel supported thereon, and means in connection with and adapted for circulating water through the fixed hollow-members of the up-  
110 per-grate, to regulate the temperature of the lower grate, substantially as described and for the purpose set forth.

7. In a furnace, the combination with the furnace-chamber and its inclosing walls of a  
115 fuel-traveling furnace-floor, comprising an upper and lower fuel-supporting grate, the upper grate of which comprises a series of remotely disposed hollow grate-members, fixedly supported in longitudinal disposition  
120 relatively to the furnace-chamber, and the lower grate of which comprises a series of transversely disposed pivotally-connected grate members, supported for traveling-movement longitudinally of the upper grate-mem-  
125 bers, means in connection with and adapted for imparting a traveling-movement longitudinally of the furnace-chamber, with the lower grate-members, and means in connection with and adapted for circulating water  
130



through the fixed hollow-members of the upper grate, substantially as described and for the purpose set forth.

8. In a furnace, the combination with the  
5 furnace-chamber and its inclosing walls, of a movable-grate supported within and adapted for movement longitudinally of the furnace chamber, means for actuating the movable grate, a fixed grate located above and having  
10 fuel-guides contiguous to said movable grate, and a series of air-supply chambers of varying pressures having outlets contiguous to said grates, substantially as described and for the purpose set forth.

15 9. In a furnace, the combination with the furnace-chamber and its inclosing walls, of a fuel-traveling furnace-floor comprising a movable-grate supported within and adapted for movement longitudinally of the furnace-  
20 chamber, means for actuating said movable grate, a fixed-grate comprising a series of longitudinally disposed hollow grate-members, an air-supply apparatus located below the furnace-floor and comprising a series of air-blast  
25 chambers of varying pressures, means for supplying air to said chambers, and means for

circulating water through the hollow members comprising the fixed-grate, substantially as described and for the purpose set forth.

10. In a furnace, the combination with the  
30 furnace-chamber and its inclosing walls, of an endless-grate supported for traveling-movement within and longitudinally of the furnace-chamber, means for imparting a traveling-movement to said grate, a series of re-  
35 motely-disposed hollow grate-members fixedly supported in longitudinal disposition relatively to the furnace-chamber with their under faces depending below the upper face of the fuel-supporting portions of the travel-  
40 ing-grate, a series of varying-pressure air-blast chambers having outlets contiguous to the fuel-supporting portions of said grate, means for supplying air to said chambers,  
45 and means for circulating water through the fixed hollow-grate members, substantially as described and for the purpose set forth.

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