

(No Model.)

2 Sheets—Sheet 1.

E. B. COXE.
TRAVELING GRATE FURNACE.

No. 510,566.

Patented Dec. 12, 1893.

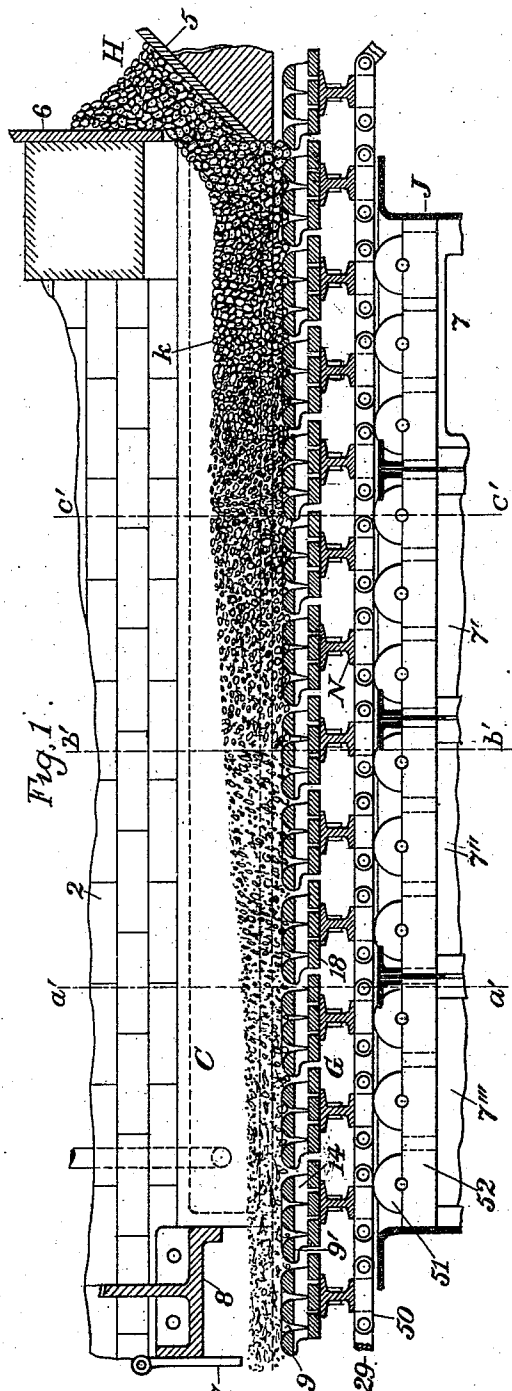


Fig. 1.

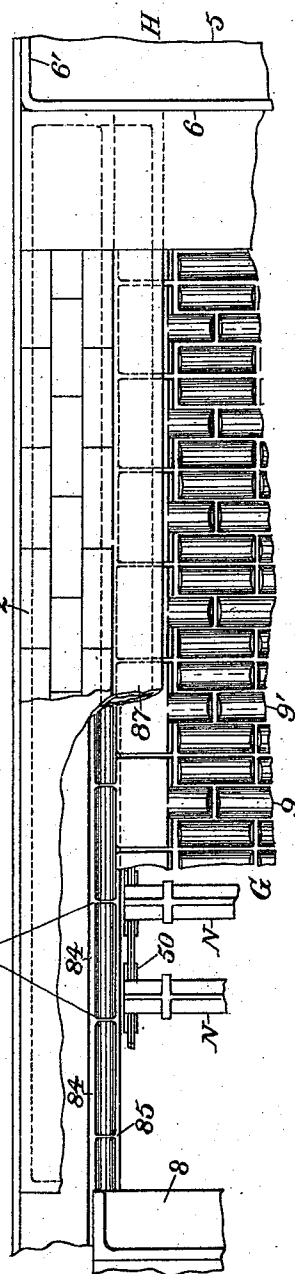


Fig. 2.

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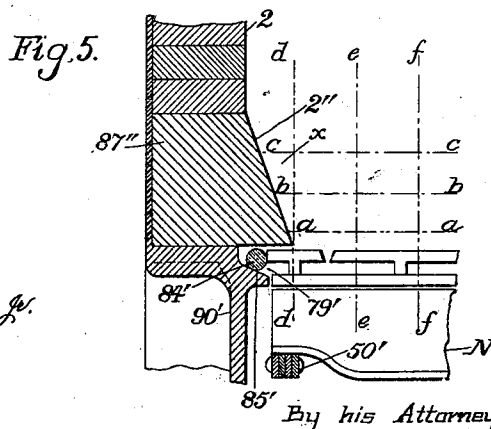
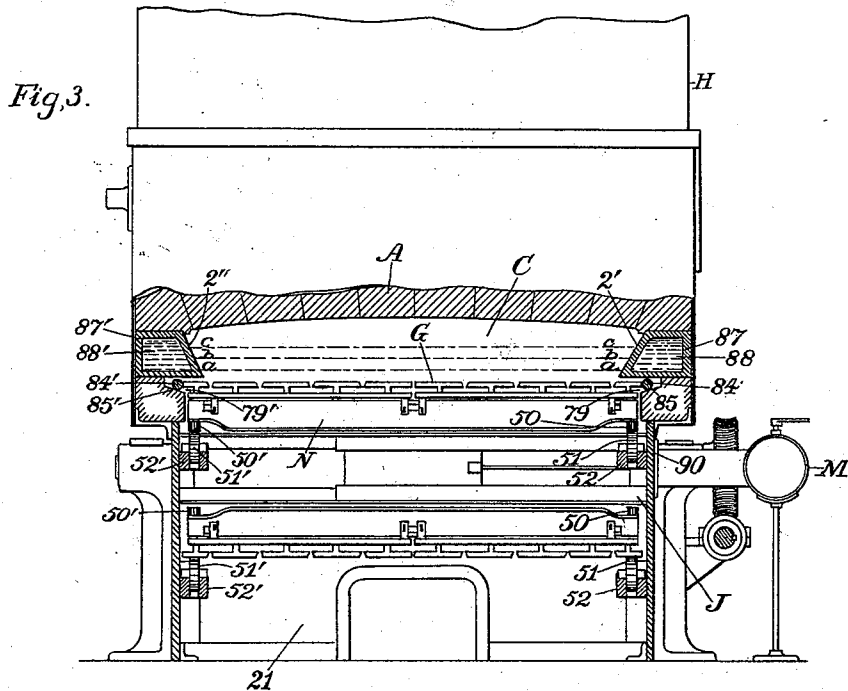
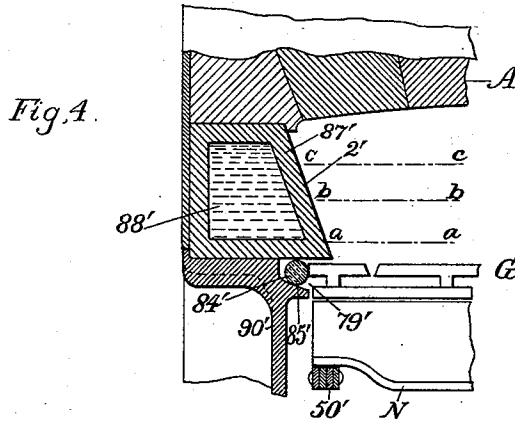
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THE NATIONAL LITHOGRAPHING COMPANY,
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UNITED STATES PATENT OFFICE.

ECKLEY B. COXE, OF DRIFTON, PENNSYLVANIA.

TRAVELING-GRATE FURNACE.

SPECIFICATION forming part of Letters Patent No. 510,566, dated December 12, 1893.

Application filed May 13, 1893. Serial No. 474,053. (No model.)

To all whom it may concern:

Be it known that I, ECKLEY B. COXE, a citizen of the United States, residing at Drifton, in the county of Luzerne and State of Pennsylvania, 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 for its object to provide means for controlling combustion and maintaining the mass of fuel and cinder along the edges of the grate or furnace-floor.

My present improvements are shown applied to a furnace of the kind described in Letters Patent of the United States No. 499,716, granted to me June 20, 1893, but in this application I have shown only a portion of said furnace, as required for properly illustrating the nature and mode of operation of my present invention.

In the drawings accompanying and forming a part of this specification, Figure 1 is a sectional side elevation of a portion of a furnace of the class specified, furnished with my present improvements. Fig. 2 is a plan view of the apparatus shown in Fig. 1, some parts being broken away to show the air-seal at the edge of the grate. Fig. 3 is a sectional end elevation, on a reduced scale, of the complete furnace as seen from the right hand in Figs. 1 and 2. Fig. 4 is an enlarged view of a portion of Fig. 3, for more clearly illustrating the principal features of my invention. Fig. 5 is a view corresponding to Fig. 4, and illustrates a modification of the preferred form of the improvements.

Similar characters designate like parts in all the figures.

The furnace partially shown in the drawings has the usual side-walls, (the one shown herein being designated by 2,) and the furnace-chamber, indicated by C in Fig. 2, and shown covered by the roof or arch A. The furnace-floor consists of the traveling-grate, designated in a general way by G, which is shown formed of successive floor-sections or grate-bars 9 and 9', carried by suitable beams as N, upon a chain 50. Said chain is or may be driven by suitable feed-mechanism, and has its advancing movement on the upper run thereof toward the left hand in Figs. 1 and 2. Said upper run 29 of the floor-carry-

ing chain 50 is shown supported on a series of rollers, 51, which are journaled on a roller-beam, 52, that is supported in a fixed position in the furnace structure. As a means for operating the traveling furnace-floor, the carrying chain or chains therefor are or may be driven by sprocket-wheels having teeth for engaging in said chain, as set forth in said Letters Patent No. 499,716.

The grate-mechanism is supposed to be inclosed by walls after the manner described in my aforesaid patent, but as these features are not a part of my present invention, the same do not require a particular description herein.

The particular kind of grate-bars, 9, shown in the drawings, have their upper bars of a segmental or oval form and set over the spaces between the flat bars 18; this arrangement allows a free exit of air from beneath and prevents the fine coal falling through. The upper bars 9 are supported by connections with the lower bars by intermediate supports 14, thereby forming an integral grate-section. This grate-bar, or furnace-floor, is not claimed herein, but constitutes the subject-matter of a separate application, Serial No. 481,527, filed July 26, 1893.

As a convenient means for storing a supply of fuel adjacent to the furnace, this is shown provided with a fuel-hopper, designated in a general way by H, which hopper is only partially shown in this application. Said hopper consists of the inclined lower wall 5, the forward wall 6, the usual end-walls, one of which, 6', is herein shown. The hopper is also usually provided with a suitable gate for regulating the discharge of fuel from the hopper.

The air-supply for successive portions of the grate is regulated by means of the air-box J, which is sub-divided by partitions into a series of air-chambers, 7, 7', 7'' and 7''', through which air under varying degrees of pressure is supplied to the grate; the regulation being obtained by means of valves in the entrance pipe or pipes, or between each adjacent chamber. The supply-pipe M, is to be connected with some source of air-supply, as a blower, air-compressor, or other apparatus.

The fuel is fed to the grate adjacent to the first air-supply chamber J, each section of the

grate receiving its evenly distributed fuel at or before the time it reaches the first air-chamber 7. The fuel is carried by the traveling-grate over said first chamber 7, and then over the succeeding chambers 7', 7'' and 7'''; during this period the combustible of the fuel is consumed and the resultant cinder or ash is afterward carried under the bridge-plate 8, and valve-plate 17, and finally delivered over the rearward end of the grate into the ash-pit 21. The thickness of the cinder as it passes under the bridge-plate 8 is generally much less than the original height of the fuel, as illustrated in Fig. 1.

The particular amount of air-pressure required in the successive chambers to properly regulate the combustion, depends upon the precise nature of the fuel and is controlled by means of the valves in the air-supply pipe and passages. By properly regulating these valves, the combustion may be regulated to burn the fuel with the greatest degree of economy.

During the forward motion of the burning fuel, and because of a slight opening along the sides of the traveling-grate, an extra quantity of air is supplied to the fuel on the edges of the grate, which naturally hastens the combustion at these points in excess of that over the middle portions of the grate. This difficulty is overcome by use of the air-check or packing devices, hereinafter next described.

The floor-sections, or grate-bars, which lie side by side transversely of the furnace, are, in practice, substantial duplicates; but owing to the unavoidable warping incident to continued use, and from the variable expansion of said sections or bars due to unavoidable variations of material and different degrees of temperature, the ends of said sections are in approximate alignment only; so that the narrow spaces at 79 normally existing between the floor-sections and the fixed side-wall 2' of the furnace-structure, will vary in thickness at different points alongside of the furnace-floor. As a means for substantially closing said side-space against the air-blast underneath the furnace-floor, an air-check apparatus is provided, which apparatus is located alongside of the grate, and in the preferred form thereof herein shown consists of an inclined track or ledge 85, alongside of the grate, in position for supporting a series of rolling air-check rods, 84 and 84', against the ends of the floor-sections, as will be understood by comparison of Figs. 2, 3, 4 and 5. Said rods 84 should, in practice, be of but moderate length, as indicated, for instance, in Fig. 2, so as to conform more accurately to the varying positions of the ends of the grate-bars as these travel along in the furnace. Said air-check bars are shown round in section, (see Figs. 3, 4 and 5,) so as to roll freely down the inclined surface of their supporting track and bear against the edge of the grate. In practice, the extreme ends of the

air-check rods 84 are rounded, as indicated, for instance, at 84'', Fig. 2, so as to pass over the slightly-projecting corners of the grate-bars. It will, of course, be understood that the described air-check apparatus is not intended to absolutely close the side-passages 79 along the edge of the grate against the air-blast, but to substantially close the same against any excess of such air-blast and thus reduce the air-supply at the edge of the grate to or below that of the other and more central portions of the grate. The fuel being spread in a mass upon the grate, usually about to the height of the lines *c c*, and being carried forward by the traveling-grate alongside of the stationary side-wall 2' of the furnace, partakes of the action of a stream, the extreme edge portion of the mass bearing against said side-wall being held back by the friction, while those portions of the mass at a greater distance from the side-wall move forward with a greater velocity; and at a considerable distance from said wall, as, for instance, at the line *e e*, Fig. 5, move forward with the full velocity of the grate itself. It is obvious that by reason of the described retardation of the fuel adjacent to the side-wall of the furnace, this portion of the fuel, if blown equally with that upon the more central portions of the grate, will be subjected for a longer period to the air-blast, and thereby naturally become more quickly burned out; that is, burned out at a point less distant from the fuel-supply of the furnace. This is the action which would normally take place, (especially with the fine fuels for the burning of which this furnace is especially designed,) if the side-walls of the furnace were, as in the usual practice heretofore, set vertically to the plane of the grate.

It is one of the principal objects of my present improvements to furnish means for supplying an excess of fuel to the edge of the grate, and for controlling the combustion of such excess of fuel so as to retard the burning of the same and thus cause the fuel along the edges of the grate to be consumed at substantially the same rate as that along the middle portions of the furnace. For securing the required excess of fuel, I set the side-wall 2' of the furnace longitudinally of the line of travel of the grate and immediately over the edge thereof, and construct the same to have an outward and upward inclination from the grate. By this means the fuel contained, for instance, within the triangular space —X—, Fig. 5, gradually descends, as it is consumed, downward upon the grate immediately adjacent to the line *d d*, thereby adding by so much to the fuel and the cinder therefrom lying upon the grate between the vertical lines *d d, e e*. This excess of fuel not only furnishes supply for counteracting the effect of the retardation of the forward movement of the fuel which is adjacent to the side-wall of the furnace, but serves to pile upon the grate-space *d d* an extra quantity of ash and cin-

der for properly covering that portion of the grate during the later stages of the combustion; for it will be understood that my present improvements are particularly designed for use in connection with successive air-blasts of successively-reduced pressure, after the manner described in Letters Patent No. 499,715, granted to me June 20, 1893, for an improved process of burning fuel.

As a further means of retarding the combustion of the slowly moving fuel adjacent to the side-walls of the furnace, and in connection with the inclined side-walls for securing the proper excess of fuel along said walls, I provide means for supplying a cooling-circulation to said side-walls, whereby the combustion of the fuel is retarded and controlled so as to be completed simultaneously, or substantially so, with that of the fuel carried upon the more central portions of the grate. In Fig. 5, I have shown the inclined side-wall 2'', consisting of the inner side of a solid block, 87'', set upon the top-flange of the side-plate 90 of the furnace structure. In Fig. 4, the corresponding block, 87', is shown formed hollow, the interior space 88' being filled with a cooling fluid, usually with water, as indicated by the conventional dotted lines; the interior side-wall of said hollow block constitutes the inclined side-wall of the furnace-chamber, and corresponds to the inner surface 2'' of the block 87'', Fig. 5. In practice, and since for securing the best results it is desirable to keep said side-wall at a relatively low temperature, said wall is preferably made of metal, as, for instance, cast-iron; and the heat conveyed through the same is absorbed by the water-supply to the interior of the side-bar 87'; this being afterward utilized as feed-water for steam-generators.

The inclined side-wall of the furnace extends lengthwise of the furnace, over the series of air-chambers 7, 7', 7'' and 7''', which chambers are, as hereinbefore mentioned, provided with means for varying the air-pressure therein so as to properly control the combustion of the fuel at the corresponding successive points in the length of the furnace. By means of this combination of the described features, the rate of combustion over each of the successive air-chambers may be independently controlled and so regulated as to prevent the lifting (by the air-pressure) of the mass of partially burned fuel during the later stages of the combustion, which, of course, should be completed over the last air-chamber 7''' of the series, as indicated at the left hand in Fig. 1, by the representation in light shading of the ash and cinder.

The horizontal dotted lines *a a*, *b b*, and *c c*, which are drawn at successive heights, respectively, relative to the grate and to the inclined side-wall, in Figs. 3, 4 and 5, are intended to correspond substantially with the normal height, relative to said side-wall, of the upper surface of the fuel at the successive points in the length of the furnace indicated

by the vertical lines *a' a'*, *b' b'* and *c' c'*, Fig. 1. When the fuel is supplied to the furnace at a suitable depth, indicated, for instance, at *k*, Fig. 1, it is, in practice, first ignited and brought into a high state of combustion over the first air-chamber 7; from thence it is carried along over the second air-chamber 7', where it is further consumed and therefore somewhat reduced in depth, as indicated at the line *b' b'*; from thence it is carried forward and very much reduced in thickness as the combustion approaches completion, as indicated by the line *a' a'*; after this it is carried forward over the last air-chamber 7''' where the combustion is fully completed, and is then carried on to be finally disposed of. At the first point *c' c'*, the fuel lies against the inclined side-walls for a considerable portion of their height, as indicated by the lines *c c*, Figs. 3, 4 and 5. At the point *b' b'*, Fig. 1, the fuel is lowered to about the line *b b*, Figs. 3, 4 and 5; and at the point *a' a'*, Fig. 1, is further lowered to about the line *a a*, in said Figs. 3, 4 and 5. As the described lowering of the mass goes on, the portion of fuel in the triangular space between the inclined side-wall and the line *d d*, Fig. 5, slides down said inclined wall and is deposited upon the grate between the lines *d d* and *e e*, Fig. 5, thereby accumulating upon this edge-portion of the grate an excess of cinder over that naturally formed upon the more central portions of the grate.

The traveling-grate, or furnace-floor, consists, as hereinbefore mentioned, of a series of connected floor-sections located side by side crosswise, or transversely, of the furnace, in which they are carried forward by means of supporting and driving appliances more fully described in a separate application, Serial No. 477,264, filed June 12, 1893, to which reference may be had. These appliances consist, as herein partially shown, of the beams *N*, the chains 50, and means for supporting and driving said chains. But it is to be understood that any other suitable and well-known kind of traveling-grate may be substituted for the one herein described, without departing from the spirit and scope of my invention.

Having thus described my invention, I claim—

1. In a furnace, the combination with a traveling grate, and with means for supplying the grate with fuel spread in a layer thereon, of a side-wall over the edge of the grate and in close proximity thereto and in substantial alignment with the line of movement thereof, and set inclined upwardly and outwardly therefrom, whereby an excess of fuel is supplied to the grate along the edge thereof, substantially as described and for the purpose specified.

2. In a furnace, the combination with a traveling grate, and with means for supplying the grate with fuel spread in a layer thereon, of a hollow side-bar over the edge

of the grate in close proximity thereto and in substantial alignment with the line of travel thereof, and having its inner side set at an inclination upwardly and outwardly from the surface of the grate, and means for supplying a cooling-circulation against said inclined wall, whereby an excess of fuel is supplied to the grate along the edge thereof, and whereby the combustion of such excess of fuel is controlled, substantially as described and for the purpose specified.

3. In a traveling-grate furnace, the combination with the traveling-grate, or furnace-floor, comprising a series of connected floor-sections located side by side crosswise of the furnace and having their ends in approximate alignment, of a side-wall standing slightly above the ends of the floor-sections and longitudinally of the grate, and a series of rolling air-checks alongside of the grate, and means for supporting the air-checks normally in position against the ends of the floor-sections, substantially as described.

4. In a traveling-grate furnace, the combination with the traveling-grate comprising a series of bars transversely thereof and having their ends in approximate alignment, of the inclined track or ledge alongside of the grate, and a series of rolling air-check rods supported on said track or ledge in position for normally bearing against the ends of the floor-sections, substantially as described.

5. In a furnace, the combination with the traveling-grate, or furnace-floor, and with an air-supply below said furnace-floor, of a fixed side-wall alongside of and adjacent to the edge

of the furnace-floor, there being the air-space between said side-wall and said furnace-floor edge, an inclined side-wall and said furnace-floor edge, an inclined side-wall immediately over and alongside of the edge of the furnace-floor and having an inclination upward and outward as set forth, and the air-check rods intermediate to and bearing against the edge of the grate and the side-wall alongside of said grate-edge, whereby the excess of fuel supplied to the grate along the edge thereof is protected from an excess of air-blast, substantially as described.

6. In a furnace, the combination with a traveling-grate, or furnace-floor, of a series of air-supply chambers located under the furnace-floor at successive points longitudinally of the furnace, means for supplying air to said chambers at varying pressures, a feed-supply for supplying fuel to the grate over the first of said air-chambers, and a side-wall located in substantial alignment with the line of travel of the grate and extending lengthwise of the furnace over the series of air-chambers and having an outward and upward inclination from the surface of the furnace-floor, whereby an excess of fuel is supplied to the grate along the edge thereof, and whereby the combustion of such excess of fuel is controlled at successive points along the length of said inclined side-wall, substantially as described.

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