(No Model.) 2 Sheets—Sheet 1.

E. B. COXE.

TRAVELING GRATE.

No. 515,656. Patented Feb. 27, 1894.

Fig: 1.

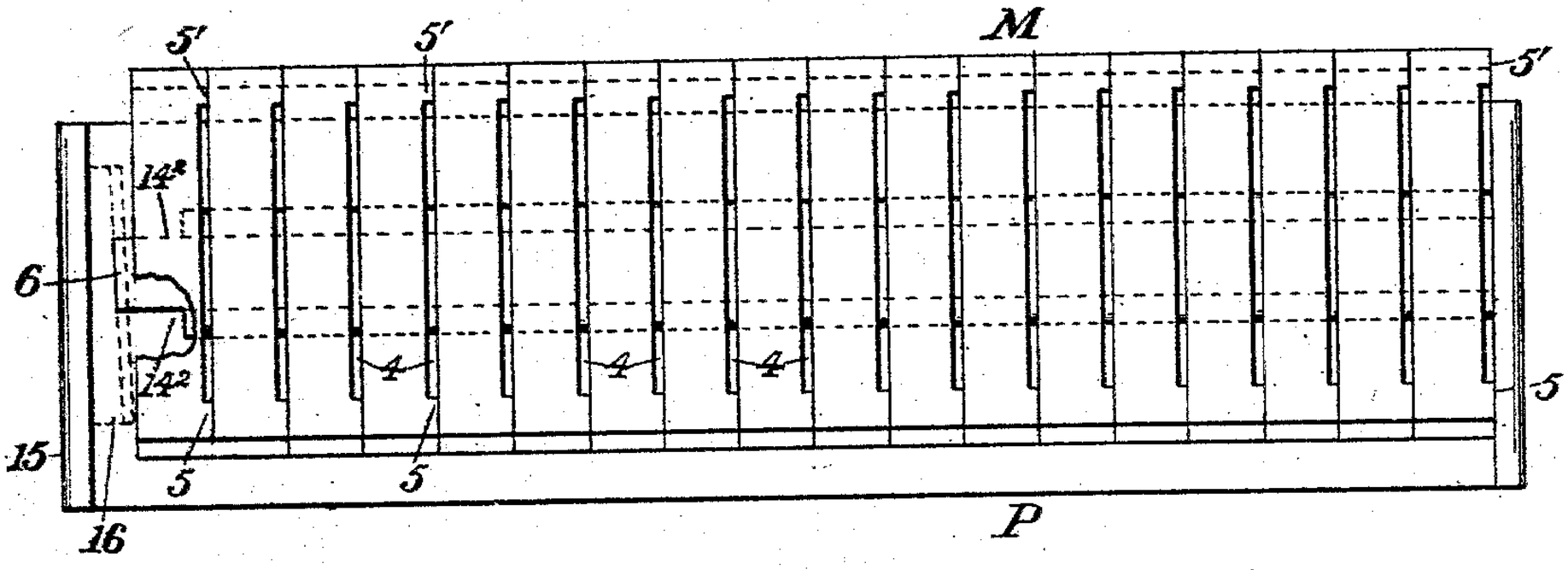


Fig: 2.

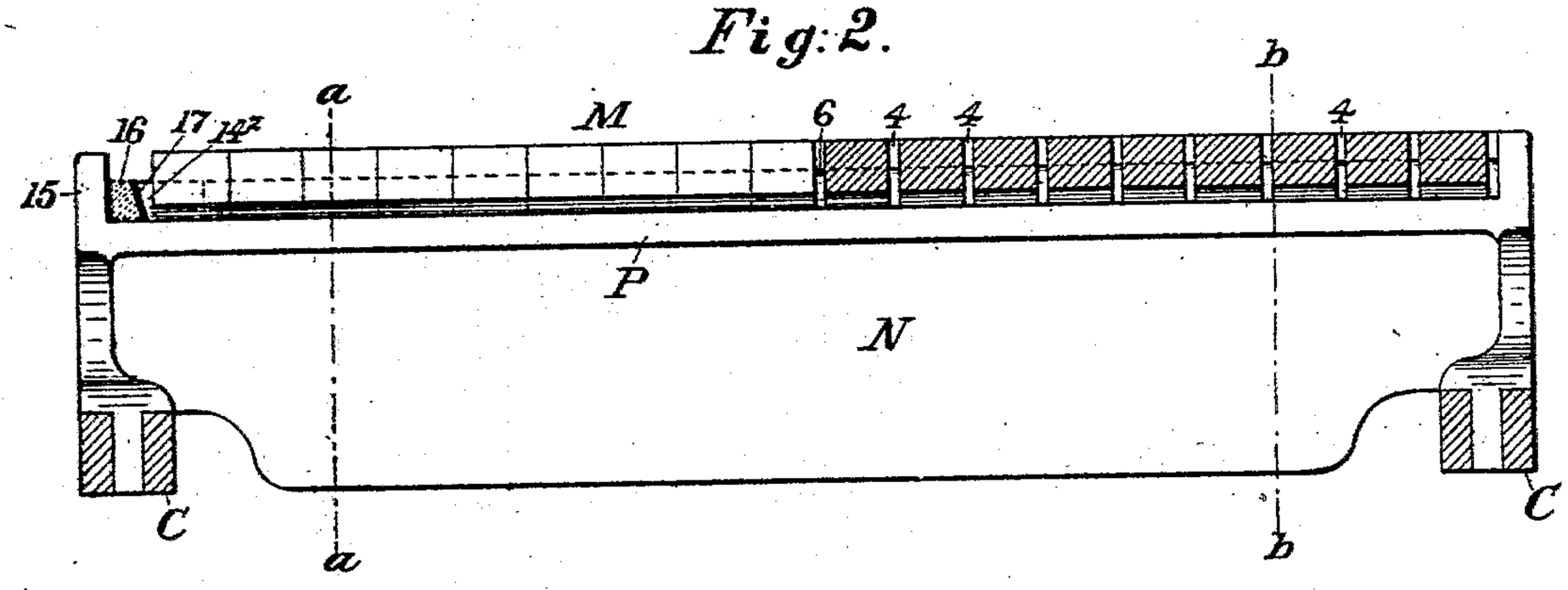


Fig: 3.

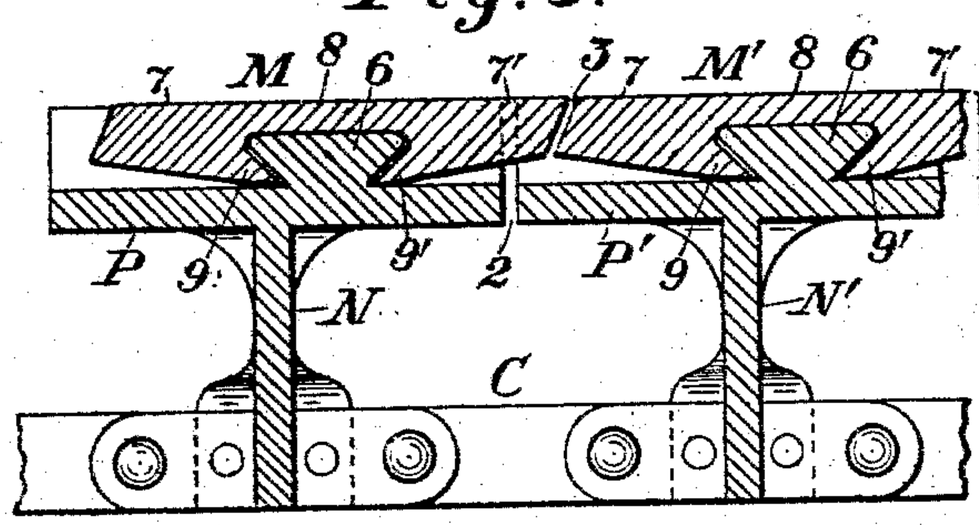
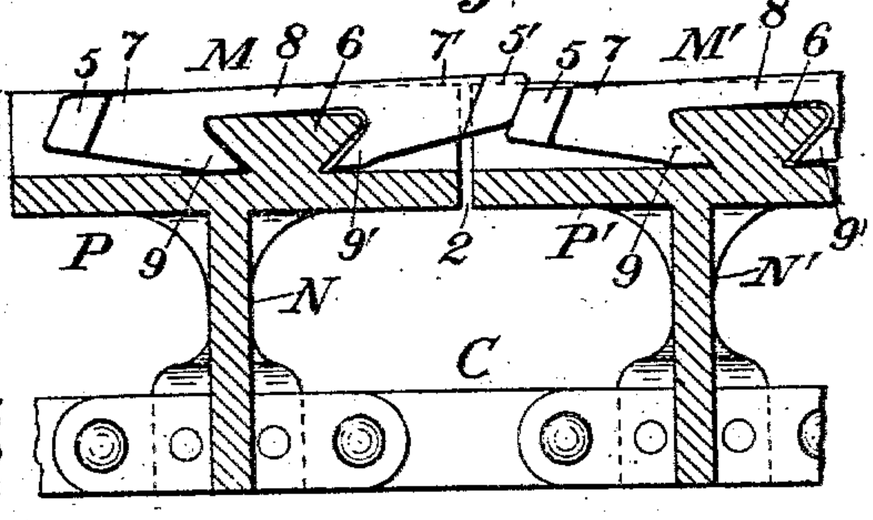


Fig: 4.



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(No Model.) 2 Sheets—Sheet 2.

E. B. COXE.

TRAVELING GRATE.

No. 515,656. Patented Feb. 27, 1894.

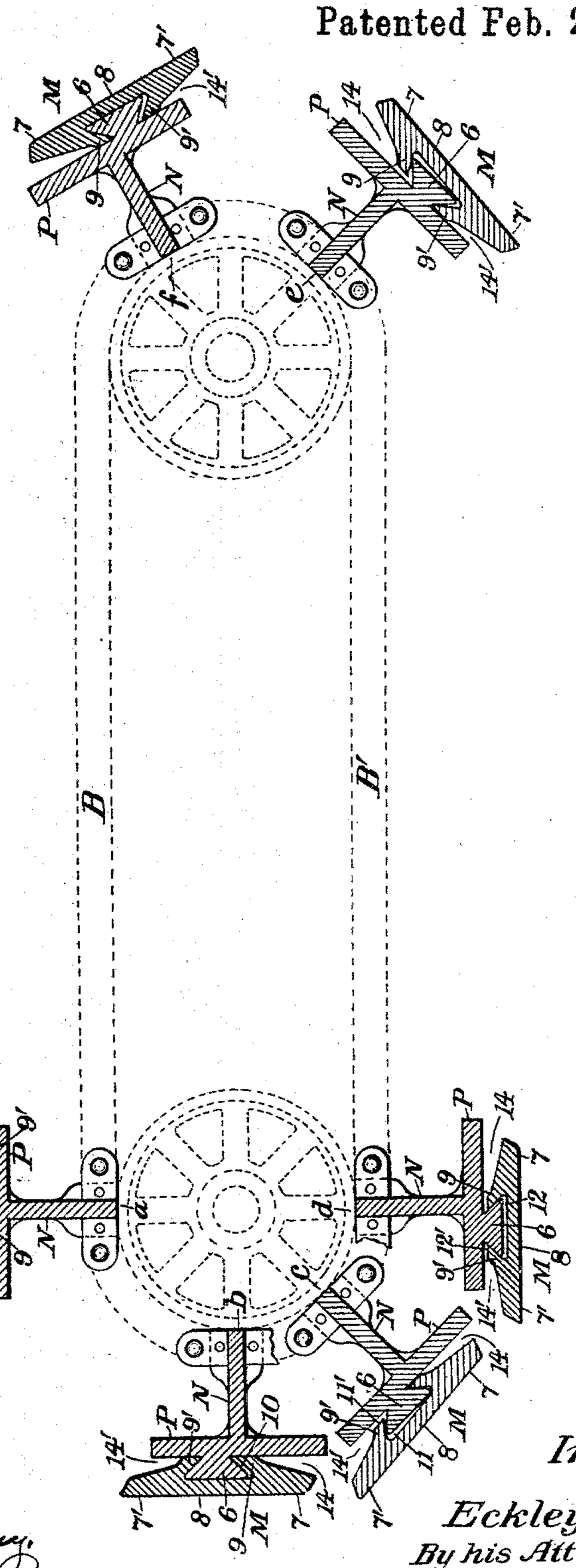

Fig. 5.

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UNITED STATES PATENT OFFICE.

ECKLEY B. COXE, OF DRIFTON, PENNSYLVANIA.

TRAVELING GRATE.

SPECIFICATION forming part of Letters Patent No. 515,656, dated February 27, 1894.

Application filed December 26, 1893. Serial No. 494,618. (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 Furnace-Floors for Traveling-Grate Furnaces, of which the following is a specification.

This invention relates to furnace-floors for traveling-grate furnaces; the object being to provide an improved furnace-floor consisting of supporting beams and grate-bars, in which the grate-bars may be readily renewed and shall be adapted, by reason of the construction and combinations of the same, for keeping the furnace-floor normally free of obstruction by ash and cinder.

In the drawings accompanying and forming a part of this specification, Figure 1 is a plan view of a furnace-floor beam provided with a series of grate-bars made according to my present invention. Fig. 2 is an elevation, partially in section, of the furnace-floor beam shown in Fig. 1. Fig. 3 is a sectional view, corresponding to line *a*—*a*, Fig. 2, through two successive floor-beams, which are here shown supported by a portion of the endless chain of the traveling-grate mechanism. Fig. 4 is a view similar to Fig. 3, corresponding to line *b*, *b*, Fig. 2, for illustrating certain features of the operation of the invention. Fig. 5 is a diagrammatic view illustrating certain further features of the operation of the invention.

Similar characters designate like parts in all the figures.

My present invention is in the nature of an improvement upon certain of the features shown and described in Letters Patent of the United States No. 510,569, and upon the furnace-floor shown and described in United States Letters Patent No. 510,580, both of which patents were granted to me December 12, 1893.

The traveling-grate mechanism, as also shown in my Patent No. 510,569, will consist of the usual carrying-chains C (see Figs. 2, 3 and 4), a series of transverse floor-beams or grate-bar-carrying beams, N, and a series of floor-plates, M—M′, (or grate-bars proper) carried upon said beams and together constituting the real floor of the furnace.

According to my present invention, the beam-sections will ordinarily consist of a lower-floor plate, P or P′, the edges of which plate on one beam stand adjacent to the edges of the corresponding plate of the adjacent beams, these plates together constituting the nearly continuous lower-floor or plate of the "double-plate" furnace-floor. In the present instance, the space at 2 (Figs. 3 and 4) admits air to the under side of the upper-floor plates or grate-bars M—M′ carried upon the beams. The space at 3 between the ends of the successive sets of grate-bars M—M′ (which space, of course, extends transversely of the furnace-floor) forms, in practice, one of the air-spaces, and the space 4, between adjacent sides of the successive grate-bars of each set (which spaces extend longitudinally of the furnace-floor, or at right angles to the spaces 3) constitute the main air-spaces for supplying air to the fuel of the grate. It is well known that where two such narrow air-spaces cross, there will be, at the point of intersection, an extra amount of air supplied to the fuel, and that with forced air-blasts such as intended to be used with this furnace-floor such extra air-blast is undesirable. As a means for obviating the foregoing objection, the grate-bars are made to bear against each other at the extreme ends thereof, the intermediate air-spaces 4 being cut off by the thickness-projections 5 and 5′ formed on one side and at opposite ends of said bars. These projections serve to hold the bars apart by a distance equal to the thickness of the slots 4 between the bars. Also, the grate-bars M—M′ are proportioned and located upon the beams to bring the aforesaid joint, or transverse space, 3, at some distance one side of the space 2 between the lower plates P—P′ of the furnace-floor. By this means, the direct action of the air-blast through said lower space 2 is broken up, and the air furnished more evenly to the several air-spaces of the upper-floor.

The grate-bars M—M′, the successive series or sets of which constitute a furnace-floor, are held in place on the grate-beams N—N′ by means of a locking engagement with the rib 6′, formed on the beams N, N′, respectively, and, for reasons hereinbefore referred to, usually located at one side of the lower

plate P or P′; otherwise, in order to bring said transverse space 3 at one side of said lower space 2, the two ends 7 and 7′ of the grate-bar would have to be made of different lengths, instead of being made, as herein shown, of nearly the same length.

The middle portion 8 of the grate-bar M (and the grate-bar M′) is made relatively thin in a vertical direction, and by reason of its position on the rib 6 is protected by said rib from the direct action of the air-blast. The result of this particular feature is that, in practice, the middle portion 8 of said bar is heated entirely through the same to nearly the same degree of temperature, thereby reducing very materially the tendency to warp by continued use, and very materially prolonging the durability, or life, of the bar. When the grate is in use, the several grate-bars are carried gradually along the furnace-floor, so that the heating of the bars is done very slowly, as also the cooling of the same; and this action is, of course, favorable to the durability of the bars. The bars are held in place by the lips 9 and 9′ thereof engaging under the edges of the dovetailed or undercut rib 6, and the bars are fitted loosely upon said rib so as to be capable of a considerable tilting movement thereon,—and this for several reasons.

In Fig. 4 is illustrated a case in which the grate-bars are crowded one upon the other, the left-hand bar M being elevated at its right-hand end by engagement with the inclined left-hand end of another grate-bar, M′. This relation of the parts may arise from warping of the grate-bars, or the expansion of the same by continued heating and also by the irregular action of the successive beams of the grate-mechanism as these beams travel along the relatively irregular ways or tracks upon which the grate-mechanism runs. For the purpose here described, the ends of the grate-bars are inclined in the same direction, so that one acts as a wedge (under the circumstances described) for elevating the corresponding bar of the adjacent set of bars.

The grate-bars being fitted very loosely on the beam as set forth, and the beam being given a complete rotation during each movement of the same through the circuit of the chains, (said circuit being indicated by dotted lines at B—B′, Fig. 5,) each of the bars is thereby adapted to have a complete series of variable shifting movements on the beam during the rotation thereof, whereby the bars are kept free of obstruction by means of ashes and cinder. This action of the described parts will be understood by comparison of the successive positions of the floor-section shown in Fig. 5. When the floor-section is upon the upper run of the traveling grate, as at *a*, (see Fig. 5) the grate-bar lies horizontally on the lower-plate P of the floor-beam N, with the middle portion 8 of the bar upon the upper side of the dovetailed rib 6 of the beam. On the beam passing over the end of the circuit, as at *b*, the grate-bar slides down upon the rib and rests on the upper edge thereof, as there indicated, with the space 10 at the lower edge of the rib. Passing still farther around the lower end of the circuit, the grate-bar naturally falls to the position shown at *c*, where the upper end 7′ of the bar is thrown out from the plate P, forming a space at 11 between the middle portion of the bar, and the rib 6, and leaving a space, 11′, between the plate P and the lip 9′ of the bar. Passing still farther along the circuit, the grate-bar assumes a different position, as shown at *d*, it here dropping away from the plate P and being held in place entirely by the lips 9 and 9′ of the bar engaging the inclined edges of said rib 6, leaving a space, as at 12, between the middle portion of the bar and face of the rib, and a space, as 13, between the lips 9—9′ and plate P. When the floor-section reaches the other end of the circuit and the positions shown at *e* and *f*, the grate-bar falls into a position substantially opposite to that illustrated at *c* and *b* respectively; and on again reaching the upper run of the circuit, falls back to the original position shown at *a*. In this manner, the several bars have a variable shifting movement on the beam, which, in practice, is somewhat different in amount with the different bars, and also is modified by the amount of ashes or cinder on or between the same; so that, in practice, the entire system of bars is thoroughly agitated, the one bar against the other, at some time during the traveling movement of the same in the circuit. And the action here described is found to be very effective for the purpose of freeing the bar of the usual accumulation of ashes and cinder, and for keeping the same in proper working position. It will, of course, be noted in this connection that the movement of the floor-sections is such that in passing down, at the left-hand of Fig. 5, the space 14 between the bars and floor-plate will be emptied of any accummulation of ashes; and that when passing upward over the right-hand end of the circuit, the opposite space 14′ will be similarly emptied.

To provide for the ready attachment of the grate-bars to the beam, the floor-beam has the side edges of its rib cut away for a short distance from the end thereof, (as shown at 14^2 in Figs. 1 and 2,) sufficiently to permit the grate-bars to be placed successively upon the rib with their lips 9, 9′, at either end of said rib and then slid along said rib into proper position, the lips 9 and 9′ of the grate-bars, when in position as hereinbefore described, engaging beneath the projecting side-edges of the rib 6.

In practice, the floor-beam N will have an upwardly-projecting flange at one end thereof as shown at 15; and as a means for retaining the grate-bars in position upon the floor-beam, a wedge, 16, will be interposed between said flange 15 and the side-face of the end grate-bar, as clearly shown in Figs. 1 and 2.

The reduced portion of the rib 6 of the floor-beam, as shown at 14^2, is preferably cut away horizontally in tapering lines about flush with the upper face of the floor-plate P at its end or adjacent to the flange 15; in this instance the wedge being driven between the end of the rib 6 and flange 15. As shown in the drawings most clearly in Fig. 2, the end of the rib 6 is under-cut or tapered as shown at 17, which prevents the wedge from dropping out as the positions of the floor-beam and grate change during their traveling movement through the circuit of the chains C.

According to my present invention, in the preferred form thereof herein shown, each upper-floor section M or M′ consists of a multiplicity of relatively narrow grate-bars, each bar of which is cut away at one side vertically from a point near one end to a point near the opposite end, as shown at 4, to form an air-space between each two adjacent bars. In some cases, it is desirable to construct the upper-floor section of approximately square plates, each plate of which has a series of perforations, and to dispense with the lower-floor plate P. This feature of construction, however, is described and claimed in a separate application, Serial No. 494,619, filed December 26, 1893.

To remove a defective grate-bar from its supporting beam, it is customary to break said bar by striking the same a blow at one end thereof, and it is necessary that said bar should be broken at its point of connection with the supporting beam. To accomplish this, the central portion 8 of said bar is made considerably thinner than the outer end thereof, as shown in the drawings. This thin portion 8, therefore, has two functions: one, to insure uniform longitudinal expansion and contraction and obviate "warping" of the bar; and the other, to insure the breaking of the bar at its point of connection with its supporting beam when struck a blow as set forth.

In practice, the grate-bars M, M′ will each preferably be cast with a dovetailed groove in the lower face thereof transversely and centrally thereof, and extending from side to side of the bar, the lower faces of said bars being tapered or inclined from a point near the said transverse groove to the outer ends of said bars, as shown in the drawings, to form an air-space as before described, between the under face of the said bar and the upper face of the lower floor-plate P.

To insure a sliding or over-riding contact between the ends of the adjacent grate-bars of adjacent sections, which contact may be caused by expansion, warping, or unevenness of the grate-bars themselves, or by an irregular action of the grate-mechanism as a whole, the adjacent ends of the grate-bars M and M′ are beveled or inclined in parallel lines, so that when the ends contact they will act in the manner of a wedge forcing the end of one bar upward and the end of the other bar downward, as clearly illustrated in Fig. 4, thus obviating strain transversely of the floor-beams, and preventing the distortion of the heated grate-bars from such strain.

The grate-bar herein described constitutes a separate article of manufacture and sale, and is adapted to be made and supplied to the makers or users of the furnaces, and by them to be used in new furnaces, or for replacing broken or defective grate-bars.

Having thus described my invention, I claim—

1. In a traveling grate or furnace-floor, the combination with a grate-bar-supporting plate or beam, of a grate-bar or a series of grate-bars removably secured thereto and adapted for longitudinal, and also for transverse shifting movement thereon, substantially as described.

2. In a traveling grate or furnace-floor of the class specified, the combination with a grate-bar or floor-plate-supporting beam carried in a circuit, of a grate-bar or floor-plate loosely and removably fitted thereto and adapted to have a series of variable shifting movements transversely thereon, substantially as described, during the revolution of the beams while passing through the circuit, substantially as and for the purpose set forth.

3. In a traveling grate or furnace-floor of the class specified, the combination with an endless chain or chains, of a series of grate-bar or floor-plate-supporting beams carried thereby, and a series of grate-bars or floor-plates shiftably secured to said beams and adapted for transverse movement with relation to said beams during the traveling movement of the chain, substantially as and for the purpose set forth.

4. In a traveling grate or furnace-floor of the class specified, the combination with the grate-bar or floor-plate-supporting beam having a longitudinal flange or rib, of a grate-bar or floor-plate having projections or lips loosely engaging said rib, substantially as described and for the purpose set forth.

5. In a traveling grate or furnace-floor of the class specified, a floor-plate or grate-bar-supporting beam having a longitudinal dovetailed rib or projection, in combination with a floor-plate or grate-bar having inclined lips loosely engaging said dovetailed rib, said floor-plate or grate-bar being adapted for transverse and longitudinally shiftable movements with relation to said beam, substantially as and for the purpose described.

6. In a traveling grate or furnace-floor of the class specified, the combination of a lower floor-plate or grate-bar-supporting beam having a longitudinal dovetailed rib and one or more grate-bars grooved transversely and loosely fitted to said dovetailed rib, whereby it is capable of variable shifting movements longitudinally and transversely of the lower floor-plate or supporting-beam, substantially as described and for the purpose set forth.

7. In a traveling grate or furnace-floor of the

class specified, the combination with a lower floor-plate, or beam, of a series of relatively narrow upper floor-plate or grate-bars removably and loosely secured to said lower floor-plate or beam and each having remotely-disposed projections on one side-face thereof to form air-spaces between adjacent floor-plates or grate-bars, substantially as described.

8. In a traveling grate or furnace-floor of the class specified, the combination with the lower floor-plate having the longitudinal dovetailed rib, of a series of grate-bars or upper floor-plates having oppositely-disposed lips or projections having inclined faces which loosely engage the inclined faces of the rib, and each of said grate-bars having remotely-disposed side projections at one side thereof, one at each end, which bear against the side-face of the next adjacent grate-bar, substantially as described and for the purpose set forth.

9. In a traveling grate or furnace-floor of the class specified, the combination with the endless revoluble chains, of a series of floor-sections consisting of a series of transversely-disposed lower-floor plates secured to said chains with their adjacent side edges in close proximity to one another, and a series of grate-bars or upper floor-plates shiftably secured, substantially as described, to said lower floor-plates with their ends terminating at one side of the side edges of the lower floor-plate, substantially as described and for the purpose set forth.

10. In a traveling grate or furnace-floor of the class specified, two or more floor-sections consisting of the transverse grate-bar-supporting beams N, N′ so disposed with relation to each other as to leave an air-space between their upper adjacent side edges and a series of upper floor plates or grate-bars shiftably secured to said lower floor-plates and so disposed with relation to each other that the adjacent ends of each series of grate-bars are in close proximity but out of vertical alignment with the ends of the lower floor-plates, and each of said bars having remotely-disposed side projections to bear against the side of the next adjacent grate-bar of the same series, substantially as described and for the purpose set forth.

11. In a traveling grate or furnace-floor of the class specified, a grate-bar-supporting beam N flanged at its upper end to form a lower floor-plate and having a longitudinal dovetailed vertical projection or rib located at one side the center thereof substantially as described, in combination with an upper floor-plate or grate-bar M having oppositely-disposed lips or flanges bearing upon the lower floor-plate and loosely engaging the dovetailed rib thereof and having its ends terminating at one side of the side edges of the lower floor-plate, substantially as described and for the purpose set forth.

12. A traveling grate-bar or floor-plate herein described, it consisting of a bar having depending inclined projections upon its lower face adapted for locking engagement with a grate-bar-supporting beam at a point midway of the length of the bar, substantially as described.

13. The herein-described grate-bar for traveling grates of the class specified, consisting of the oblong bar M having remotely-disposed projections upon one side-face thereof, and having downwardly and inwardly projecting lips at its under side adapted for engagement with a dovetailed projection upon a grate-bar-supporting beam, substantially as described.

14. The herein-described grate-bar for traveling grates of the class specified, consisting of the bar M inclined in parallelism at its opposite ends, having remotely-disposed projections upon one of its side faces, and having depending projections at its lower face adapted for loose locking-engagement with a projection upon a grate-bar-supporting beam, substantially as described.

15. The herein-described grate-bar for traveling grates of the class specified, it consisting of the bar M the central portion of which is of less thickness than its ends and having depending projections upon its lower face adapted for loose or shiftable engagement with a grate-bar-supporting beam, substantially as described and for the purpose set forth.

16. The herein-described grate-bar for traving grates, it consisting in a bar having, midway of its length, a breakable portion of reduced size, combined with holding-lips at the opposite ends of said breakable portion, whereby the bar is adapted to be removed from the furnace-floor by the breaking thereof in said reduced portion, substantially as described.

17. In a traveling grate the combination with the lower-plate having the elevated grate-bar-carrying rib about midway of its width, and grate-bars, substantially as described, in locking engagement with said rib, and each consisting in a bar located transversely of the lower-plate and having the middle portion of its length of reduced thickness and bearing upon said rib, whereby said middle portion is protected from the air-blast, the end-portions of said bar having a clear space between them and said lower-plate, whereby said end-portions are subjected to the cooling effect of the air-blast, whereby the said middle portion will be heated through its entire thickness for reduction of the warping effect of the heat upon the bar, substantially as described and for the purpose specified.

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