July 21, 1936. H. B. HOLT 2,048,383

FURNACE GRATE

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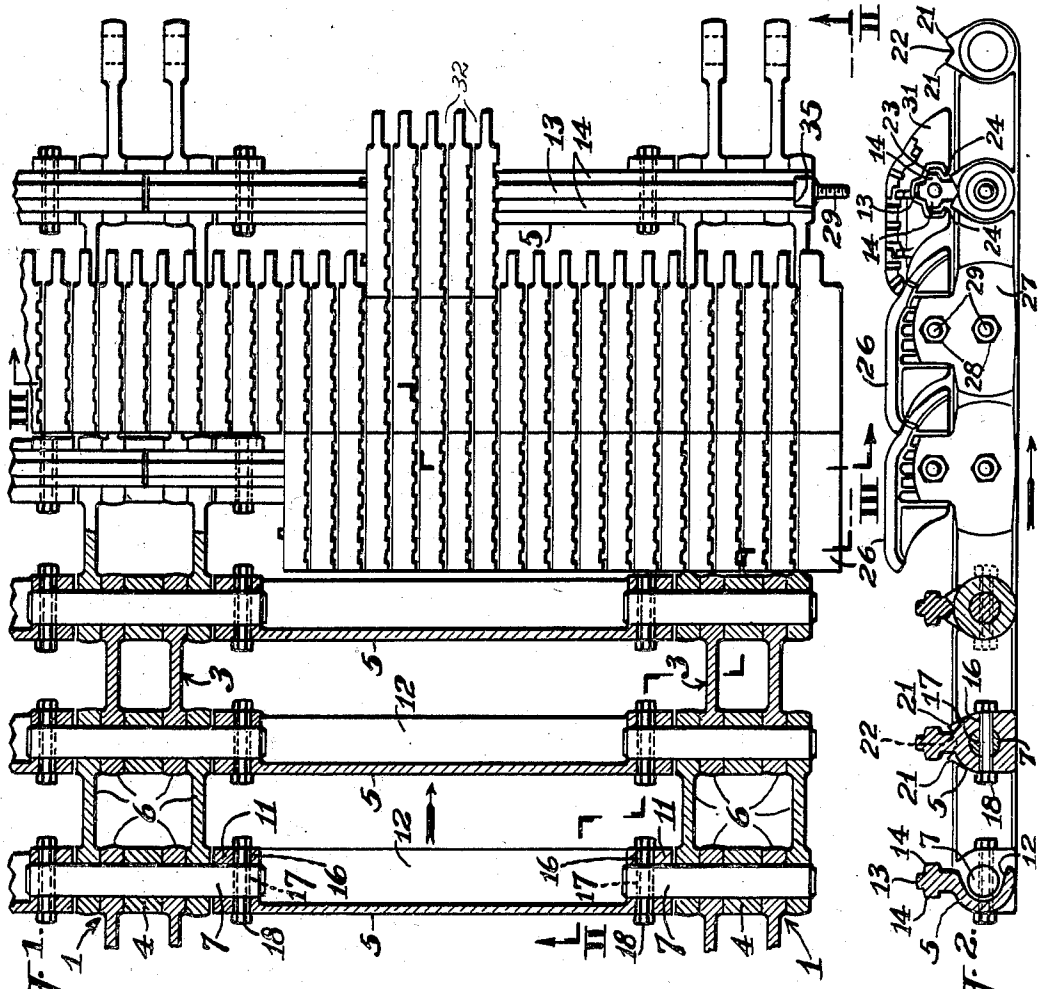

Fig. 1.

Fig. 2.

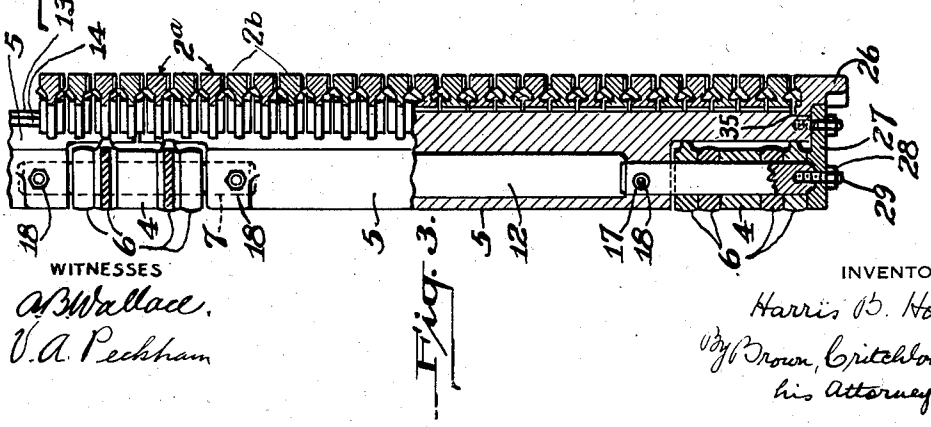

Fig. 3.

WITNESSES

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Fig. 4.

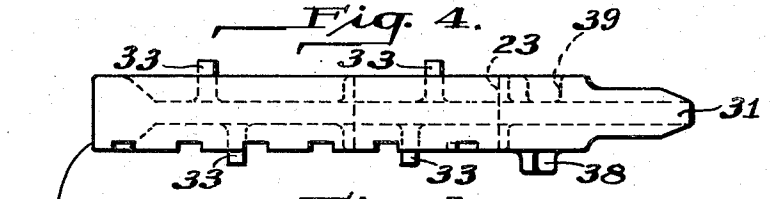


Fig. 5.

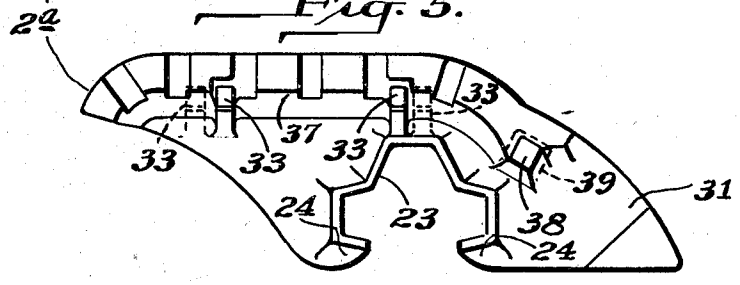


Fig. 6.

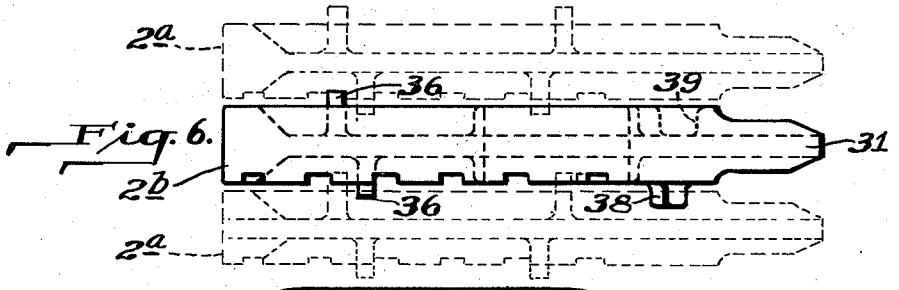


Fig. 7.

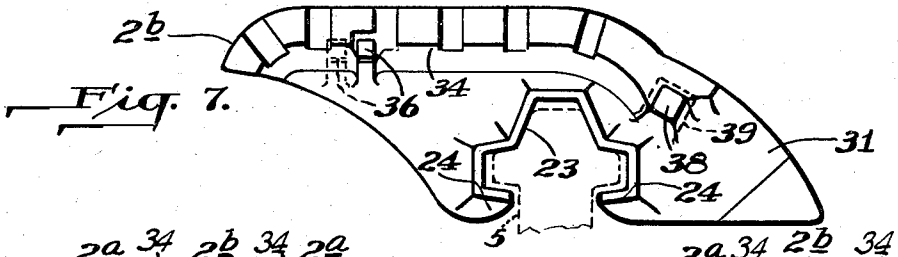


Fig. 8.

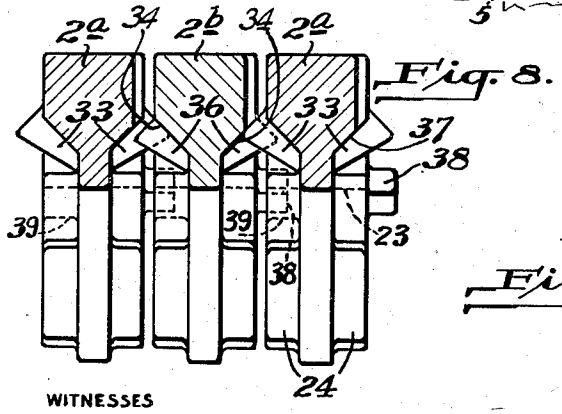
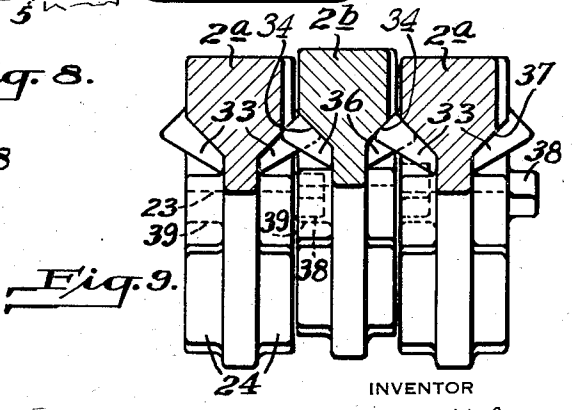


Fig. 9.



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Patented July 21, 1936 2,048,383

UNITED STATES PATENT OFFICE

2,048,383

FURNACE GRATE

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Application October 23, 1934, Serial No. 749,588

12 Claims. (Cl. 110—40)

This invention relates to furnace grates, and more particularly to traveling grates of the endless chain or belt type which, by their movements, carry into furnaces new supplies of fuel or other material to be burned, and carry away the ashes remaining after combustion.

As chain grates become heated, their lateral expansion is relatively great because of the large width of such grates. Therefore, the grate or furnace, or both, must be so constructed as to provide for this expansion without leaving openings through the grate or between the grate and the furnace wall through which fuel can escape when the grate is not fully expanded. Various means have been suggested for this purpose, but they have generally been unsatisfactory, or expensive and difficult to construct, and to reach for repairs.

It is among the objects of this invention to provide a grate the width of which remains substantially constant whether the grate is hot or cold, and through which fuel can not fall. Another object is to provide an expansible grate in which the grate bars remain uniformly spaced apart laterally under all temperature conditions. Further objects are to provide such a grate which is relatively simple and inexpensive to construct, strong, dependable, very unlikely to get out of order, and has means for maintaining broken grate bars in place.

In accordance with this invention there is provided a grate including a support with a plurality of grate bar supports extending transversely thereof. A plurality of grate bars is mounted side by side in rows on the grate bar supports, and means is connected to alternate bars in each row for spacing the intermediate bars uniform distances therefrom. The intermediate bars are loosely mounted on the grate bar supports, and the spacing means and the portions of the intermediate bars which engage the spacing means are formed for elevating the intermediate bars when the bars expand toward one another. When the bars contract, the elevated bars are permitted to drop back to their original positions and the spacing means again maintain all of the bars equal distances apart. The bars are also provided with means for interlocking them in such manner that broken bars are maintained in place until removed.

The preferred embodiment of the invention is illustrated in the accompanying drawings in which Fig. 1 is a fragmentary plan view of an unexpanded endless chain grate shown partly in section and with some of the grate bars removed; Figs. 2 and 3 are views taken on the irregular lines II—II and III—III respectively of Fig. 1; Fig. 4 is a plan view of one type of grate bar used with the grate; Fig. 5 is a side view thereof; Fig. 6 is a plan view of a second type of grate bar used with the grate; Fig. 7 is a side view thereof; Fig. 8 is a rear view, partly in section, of three grate bars in the positions they occupy when the grate is cold; and Fig. 9 is a view, similar to Fig. 8, showing the grate bars in the positions they occupy when they have expanded.

Referring to the drawings, a traveling chain grate is shown as being formed of two general parts, an endless chain or belt 1 and fuel-supporting grate bars mounted thereon. The preferred construction of this belt is best illustrated in Fig. 1 where the belt is shown as comprising a plurality of parallel chains 3 retained in spaced relation by means of cylindrical spacing members 4 and grate bar supports 5. The chains are preferably of the double strand type adapted to travel over sprockets (not shown) at the ends of a furnace and formed from a plurality of links 6 pivotally connected at their ends by pivot pins 7, both strands of each chain being connected by the same pins to bring their corresponding pivot axes into alignment. A plurality of the spacing members 4 and grate bar supports 5 serve to retain the chains and their strands of links in predetermined spaced parallel relation, thereby completing the belt.

The cylindrical spacing members 4 are disposed between the strands of each chain with the pivot pins 7 extending therethrough, and the grate bar supports 5 have tubular end portions 11 into which the ends of pivot pins in adjacent chains project. One side of the body portion between the tubular ends of each grate bar support is open, as at 12, to give access to the pivot pins projecting into it so that they may be readily driven out or replaced should the belt require repairing, and also to eliminate unnecessary weight.

As shown in Fig. 2, each of the grate bar supports is provided with an integral radial rib 13 projecting outwardly from the belt and having oppositely disposed side flanges 14 extending therefrom. The rib and flanges project across the pivoted ends of the adjoining links to within a short distance of the other grate bar supports in line therewith and thereby form transverse parallel rows with each row taking the form of a substantially continuous grate bar support. The tubular end portions 11 of the grate bar supports are provided with radial bores 16 register-

ing with radial bores 17 through the ends of pivot pins 7 (Fig. 1). Extending through these bores are suitable fastening members such as bolts 18 which connect the pins and grate bar supports together. It should be apparent from this construction that the pivot axes of each chain are maintained in alignment with the corresponding pivot axes of the other chains, all of the pins and links thus being arranged in parallel rows transversely of the belt.

While the belt may travel in either direction, the preferred direction of travel is that indicated by the arrows in Figs. 1 and 2. The front end of each link 6 is provided with a pair of upwardly tapered lugs 21 forming between them a V-shaped recess 22, as shown in Fig. 2. The portions of the grate bar supports which project across the links are formed for engaging the lugs in recesses 22, whereby the grate bar supports are rigidly positioned with relation to the row of links whose lugs 21 they engage.

A plurality of fuel-supporting grate bars 2*a* and 2*b* is slidably mounted on each row of grate bar supports, the lower portion of each bar being provided with a recess 23 (Figs. 2 and 5) for receiving radial rib 13 and its flanges 14, and with inwardly projecting lugs 24 for engaging the under surface of the flanges to retain the grate bar on its support. The grate bars are prevented from sliding off the ends of their supports by end bars 26 (Figs. 2 and 3) that are slidably mounted on the grate bar supports in the same manner as the other bars. Bars 26 are held in place by plates 27 which engage their outer sides and are detachably connected to belt 1 by means of nuts 28 threaded on pins 29 whose inner ends are threaded in openings in the ends of adjoining pivot pins and in ribs 13 of adjoining grate bar supports, the outer ends of pins 29 projecting through plates 27. The fuel-engaging surfaces of the outermost grate bars 26 are wider than the fuel-engaging surfaces of the other bars, and the bars 26 project laterally from the belt beyond the grate elements below them and travel in close proximity to the furnace walls, not shown.

The outer surface of each grate bar is preferably of the form shown in Fig. 2 with the outer surface of its nose 31 formed as an arcuate portion of an imaginary cylindrical surface coaxial with the pivot pins supporting the grate bar support on which the bar is mounted, so that when the grate rounds the curved ends of its path in a furnace the rows of grate bars do not spread apart and open up the fuel-supporting surface. The noses of the grate bars are also preferably narrowed in width to form ash-receiving recesses 32 between them for receiving ash at one end of the grate and discharging it at the opposite end.

It is a feature of this invention that the grate is so constructed that its parts can fully expand and contract with temperature changes without changing in overall width to any appreciable extent and without forming openings through its fuel-supporting surface through which fuel can fall. Accordingly, the diameters of the bores 16 and 17 through the grate bar supports and the pivot pins are somewhat greater than the diameter of the bolts disposed therein, and the length of the supports is less than the distance between the sprocket-positioned chains 3 when the grate is cold. Consequently, when the grate becomes heated and the members constituting the belt expand transversely thereof, the grate bar supports and the pivot pins are permitted to telescope relative to each other, whereby, although the constituent members of the belt expand, the overall width of the belt is not noticeably increased.

As the grate bars also expand with the heat, it is necessary to make provision for such expansion. A former way of doing this was to put a fewer number of bars in each row than the row would accommodate and to then spread out the bars to provide substantially uniform spaces between them into which they could expand. However, it is obvious that as there was nothing to maintain this uniform spacing of grate bars the vibration of the moving grate caused them to work together in groups or towards one side of the grate, thereby leaving relatively large open spaces in the fuel-supporting surface of the grate through which fuel could fall.

Applicant has eliminated this difficulty by providing some of the grate bars in each row, preferably alternate bars 2*a*, with laterally projecting lugs 33 (Figs. 4, 5 and 8) which engage the sides of adjoining or intermediate grate bars 2*b* and space them therefrom, all of such spacing being uniform. Either the surfaces 34 of intermediate bars 2*b* that engage lugs 33 or the lugs' upper surfaces which engage the intermediate bars, preferably both as shown in Figs. 8 and 9, are inclined upwardly toward the adjoining bars 2*a*. The grate bars are slidably mounted on their supports, and recesses 23 are large enough to provide sufficient play between the bars and supports to permit bars 2*b* to move outwardly relative to the supports within predetermined limits.

When the bars in any given row become heated and expand laterally there is a tendency for the inclined surfaces 34 of intermediate bars 2*b* and the inclined upper surfaces of lugs 33 to move toward each other in a plane parallel to belt 1, but movement in such a plane is impossible because these surfaces are already in engagement with each other. Consequently, intermediate bars 2*b* ride up the inclined surfaces of lugs 33 as the bars approach one another, the loose play between bars 2*b* and their supports permitting their elevation in this manner. Thus, although the grate bars are originally spaced apart by positive means (lugs 33), such means do not prevent the spaces between the bars from being closed up when the bars expand, as shown in Fig. 9, whereby lateral expansion of the grate bars is permitted without increase in the length of the rows of bars.

When the grate cools, the surfaces of the grate bars in effect move away from each other and, as any given alternate bars 2*a* contract, the intermediate bar 2*b* supported between them on their lugs 33 is permitted to settle back to its original position on a grate bar support 5. In thus settling back, the intermediate bar can not crowd over against an adjacent bar 2*a* and thereby leave a space between itself and the bar adjacent its opposite side which is double the width it would be if the intermediate bar were equally spaced from adjacent bars 2*a* on both sides of it, because the force of gravity causes it to slide down lugs 33 to a point midway between the adjacent bars 2*a*.

End bars 26 are neither provided with elevating lugs nor elevated when the remaining grate bars expand, but the end portions of grate bar supports 5 on which the end bars are mounted are recessed slightly to form shoulders 35, as shown in Fig. 3, for limiting the distance that the end bars can move inwardly away from the sides of the grate.

To prevent the loosely mounted grate bars 2*b* from rocking to a harmful degree on grate bar supports 5 and tilting up at their rear ends, the rear portions of those bars are provided with laterally projecting lugs 36 adapted to strike against the lower faces of shoulders 37 on bars 2*a* when bars 2*b* attempt to tilt or are elevated by expansion. Lugs 36 are disposed farther down from the fuel-supporting surface of a grate bar than are lugs 33 so that they will not interfere with the desired elevation of bars 2*b*. Rear lugs 33 on grate bars 2*a* prevent those bars from tilting and also prevent the rear ends of bars 2*b* from tilting downwardly.

The rear ends of the grate bars are so interlocked by lugs 33 and 36 that if one of them happens to break, the rear broken portion is supported either by lugs 36 or rear lugs 33 and thereby prevented from falling away and jamming or breaking the grate. To maintain the forward broken portion in place, one side of the nose of each grate bar is provided with a laterally projecting lug 38 and the opposite side is provided with a lug-receiving socket 39, these lugs and sockets registering throughout the length of each row. Thus, the front portion of a broken grate bar is supported by the lug 38 which projects into the socket 39 of the broken bar. As soon as a broken grate bar is discovered it can be removed by sliding the bars off one end of their support and sliding on a new bar. Sockets 39 are of such depth and breadth relative to the length and breadth of lugs 38 as not to interfere with the expansion of the grate bars and the raising of bars 2*b*.

A furnace grate constructed in accordance with this invention can be placed in any furnace without having to construct the furnace to allow for expansion of the grate. The grate takes care of its own expansion so that it does not increase in width a noticeable amount. The grate bars forming the surface of such an expansible grate remain uniformly spaced apart laterally so that openings are not formed in the fuel-supporting surface through which fuel could fall and jam the grate or be wasted. The expansion compensating means are simple and inexpensive and practically certain not to get out of order. Furthermore, in case a grate bar breaks in this grate the broken pieces are held in place until discovered and removed.

According to the provisions of the patent statutes, I have explained the principle and mode of operation of my invention, and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. A grate comprising a support, a plurality of grate bar supports connected thereto, and a plurality of grate bars mounted side by side in a row on each grate bar support, alternate bars in each row being provided with means engaging and spacing the intermediate bars therefrom, the intermediate bars being loosely mounted for free vertical movement on each grate bar support, and said means and the portions of said intermediate bars engaging said means being formed for elevating the intermediate bars when the bars expand toward one another, whereby said spacing means do not interfere with lateral expansion of the grate bars.

2. A grate comprising a support, a plurality of grate bar supports connected thereto, and a plurality of grate bars mounted side by side in a row on each grate bar support, alternate bars in each row being provided with means engaging and spacing the intermediate bars therefrom, the intermediate bars being loosely mounted for free vertical movement on each grate bar support, the engaging surfaces of said means and the portions of said intermediate bars engaging said means being inclined for elevating the intermediate bars when the bars expand laterally toward one another.

3. A grate comprising a support, a plurality of grate bar supports connected thereto, and a plurality of grate bars mounted side by side in a row on each grate bar support, alternate bars in each row being provided with means engaging and spacing the intermediate bars therefrom, said intermediate bars being provided with shoulders projecting laterally therefrom, said bar-spacing means projecting below said shoulders on the sides of the intermediate bars, the latter being loosely mounted for free vertical movement on each grate bar support, and the shoulder-engaging surfaces of said means being inclined downwardly and outwardly, whereby the intermediate bars are elevated by said means when the grate bars expand laterally.

4. A grate comprising a support, a plurality of grate bar supports connected thereto, and a plurality of grate bars mounted side by side in a row on each grate bar support, alternate bars in each row being provided with means engaging and spacing the intermediate bars therefrom, said intermediate bars being provided with shoulders projecting laterally therefrom, said bar-spacing means projecting below said shoulders on the sides of the intermediate bars, the latter being loosely mounted for free vertical movement on each grate bar support, and the spacing means engaging surfaces of said shoulders being inclined upwardly and outwardly, whereby the intermediate bars are elevated by said means when the grate bars expand laterally.

5. A grate comprising a support, a plurality of grate bar supports extending transversely thereof and supported thereby, a plurality of grate bars mounted side by side in rows on the grate bar supports, and lugs projecting laterally from the sides of alternate bars in each row and engaging the intermediate bars for spacing all of the bars substantially equal distances apart, the intermediate bars being loosely mounted on the grate bar supports for free vertical movement thereon, the lugs and the portions of said intermediate bars engaging the lugs being formed for elevating the intermediate bars when the bars expand laterally toward one another.

6. A grate comprising a support, a plurality of grate bar supports extending transversely thereof and supported thereby, a plurality of grate bars mounted side by side in rows on the grate bar supports, and lugs projecting laterally from the sides of alternate bars in each row and engaging the intermediate bars for spacing all of the bars substantially equal distances apart, the intermediate bars being loosely mounted on the grate bar supports, the engaging surfaces of the lugs and the portions of the intermediate bars engaging the lugs being inclined for elevating the intermediate bars when the bars expand laterally toward one another.

7. A grate comprising a support, a plurality of grate bar supports extending transversely there-

of and supported thereby, a plurality of grate bars mounted side by side in rows on the grate bar supports, and lugs projecting laterally from the sides of alternate bars in each row and engaging the intermediate bars for spacing all of the bars substantially equal distances apart, the intermediate bars being loosely mounted on the grate bar supports, the portions of the intermediate bars engaging the lugs being formed as shoulders, the shoulder-engaging faces of the lugs being inclined downwardly and outwardly and the lug-engaging faces of the shoulders being inclined upwardly and outwardly, whereby the intermediate bars are elevated by the lugs when the bars expand laterally toward one another.

8. An endless traveling chain grate comprising a plurality of endless chains advancing in parallel paths and formed of links pivotally connected at their ends by pivot pins aligned in parallel rows, a plurality of grate bar supports provided at their ends with axial bores for slidably receiving the ends of said pivot pins whereby axial movements of the grate bar supports and the pivot pins relative to each other are permitted as the grate expands and contracts with temperature changes, means for limiting said axial movements, and a plurality of grate bars mounted side by side in rows on the grate bar supports, alternate bars in each row being provided with means engaging and spacing the intermediate bars therefrom, the intermediate bars being loosely mounted on the grate bar supports for free vertical movement thereon, and said means and the portions of said intermediate bars engaging said means being formed for elevating the intermediate bars when the bars expand laterally toward one another.

9. A grate comprising a support, a plurality of grate bar supports extending transversely thereof and supported thereby, and a plurality of grate bars mounted side by side in rows on the grate bar supports, alternate bars in each row being provided with means engaging and spacing the intermediate bars therefrom, the intermediate bars being loosely mounted on the grate bar supports for free vertical movement thereon, said means and the portions of said intermediate bars engaging said means being formed for elevating the intermediate bars when the bars expand laterally toward one another, and means connected to the bars for limiting longitudinal rocking of the intermediate bars on said grate bar supports relative to said alternate bars.

10. A grate comprising a support, a plurality of grate bar supports extending transversely thereof and supported thereby, a plurality of grate bars mounted side by side in rows on the grate bar supports, and lugs projecting laterally from the sides of alternate bars in each row and engaging the intermediate bars for spacing all of the bars substantially equal distances apart, the intermediate bars being loosely mounted on the grate bar supports, the lugs and the portions of said intermediate bars engaging the lugs being formed for elevating the intermediate bars when the bars expand laterally toward one another, said alternate bars being provided with side shoulders, and lugs on the sides of the intermediate bars projecting beneath said shoulders, whereby rocking of the intermediate bars on said grate bar supports relative to said alternate bars is materially limited.

11. A grate comprising a support, a plurality of grate bar supports extending transversely thereof and supported thereby, a plurality of grate bars mounted on each grate bar support and including a plurality of grate bars loosely mounted for free vertical movement on said grate bar support, said loosely mounted bars being adapted to be elevated relative to the remaining bars on said grate bar support and all of said bars being disposed side by side in rows, and lugs projecting laterally from the sides of the grate bars adjacent said loosely mounted bars for engaging and spacing the latter therefrom, the engaging surfaces of said lugs and the portions of said loosely mounted bars engaging the lugs being inclined for elevating said loosely mounted bars when the bars expand laterally toward one another.

12. A grate comprising a support, grate bar supports connected thereto, and a plurality of grate bars mounted on each grate bar support and including a plurality of grate bars loosely mounted for free vertical movement on said grate bar support, said loosely mounted bars being adapted to be elevated relative to the remaining bars on said grate bar support and all of said bars being disposed side by side in rows, the grate bars adjacent said loosely mounted bars being provided with means for engaging and spacing the latter bars therefrom, and said means and the portions of said loosely mounted bars engaging said means being formed for elevating the loosely mounted bars when the bars expand toward one another, whereby said spacing means do not interfere with lateral expansion of the grate bars.

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