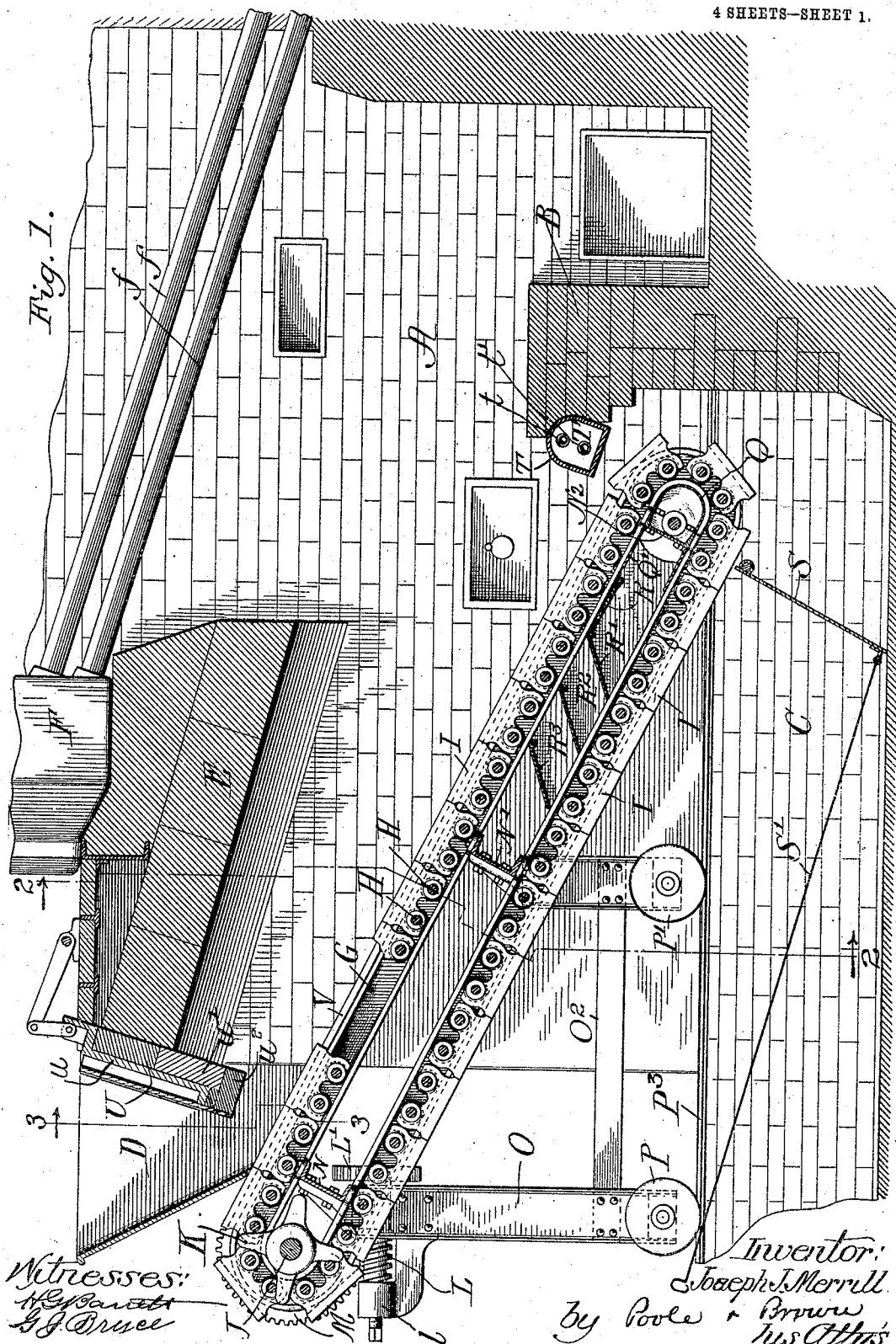


J. J. MERRILL.
FURNACE GRATE.

APPLICATION FILED JULY 21, 1904.

4 SHEETS-SHEET 1.

Fig. 1.



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4 SHEETS—SHEET 2.

Fig. 2

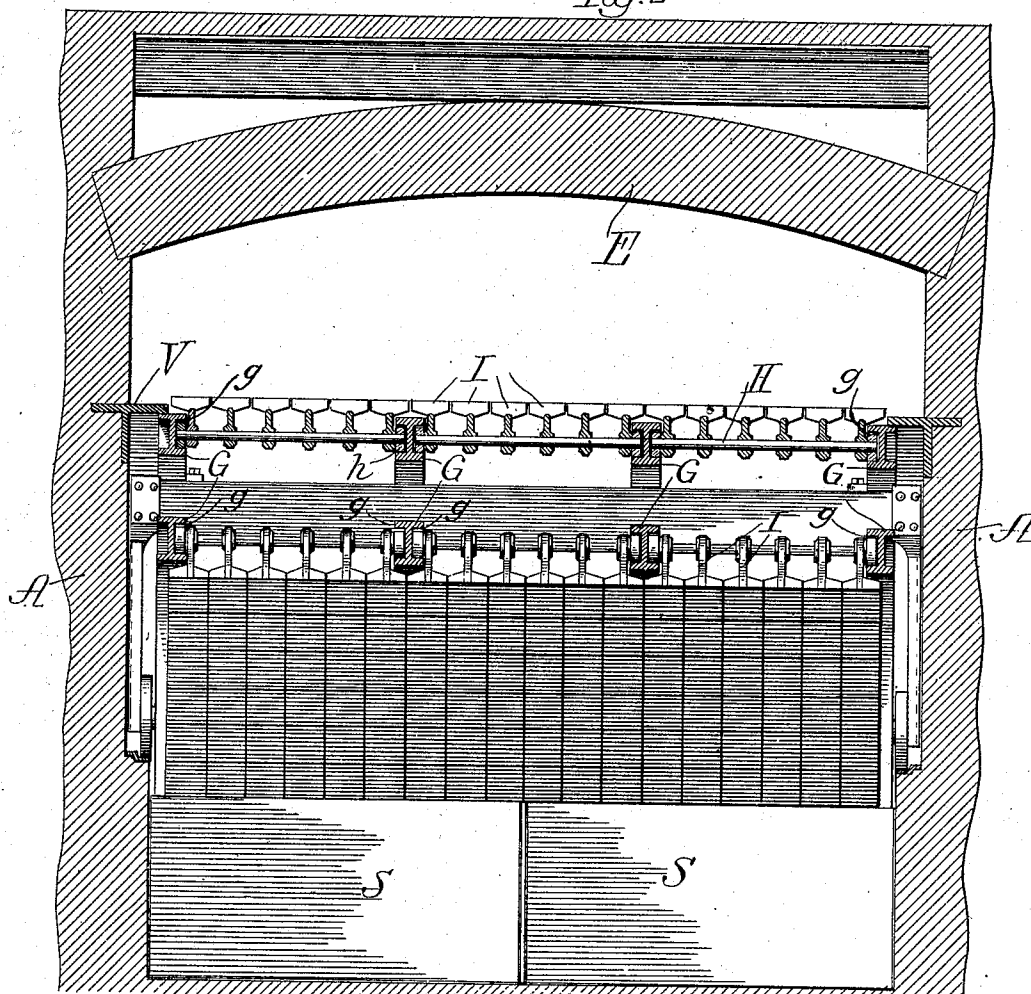
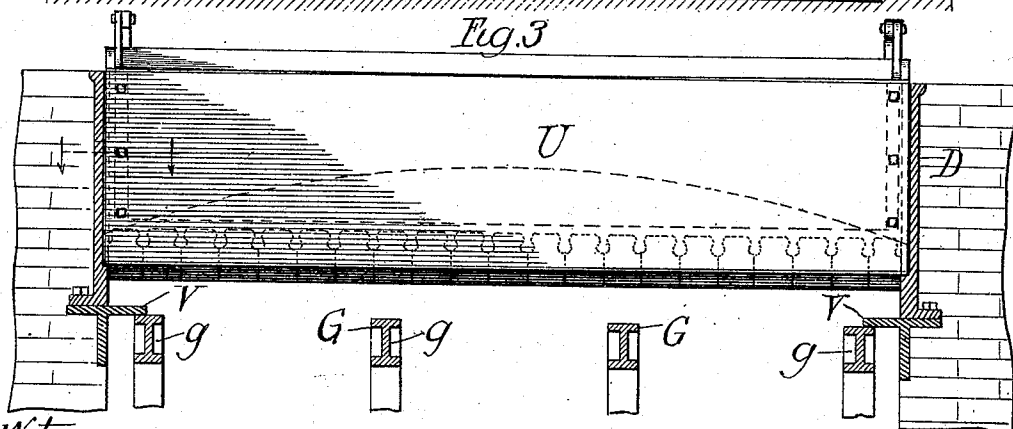


Fig. 3



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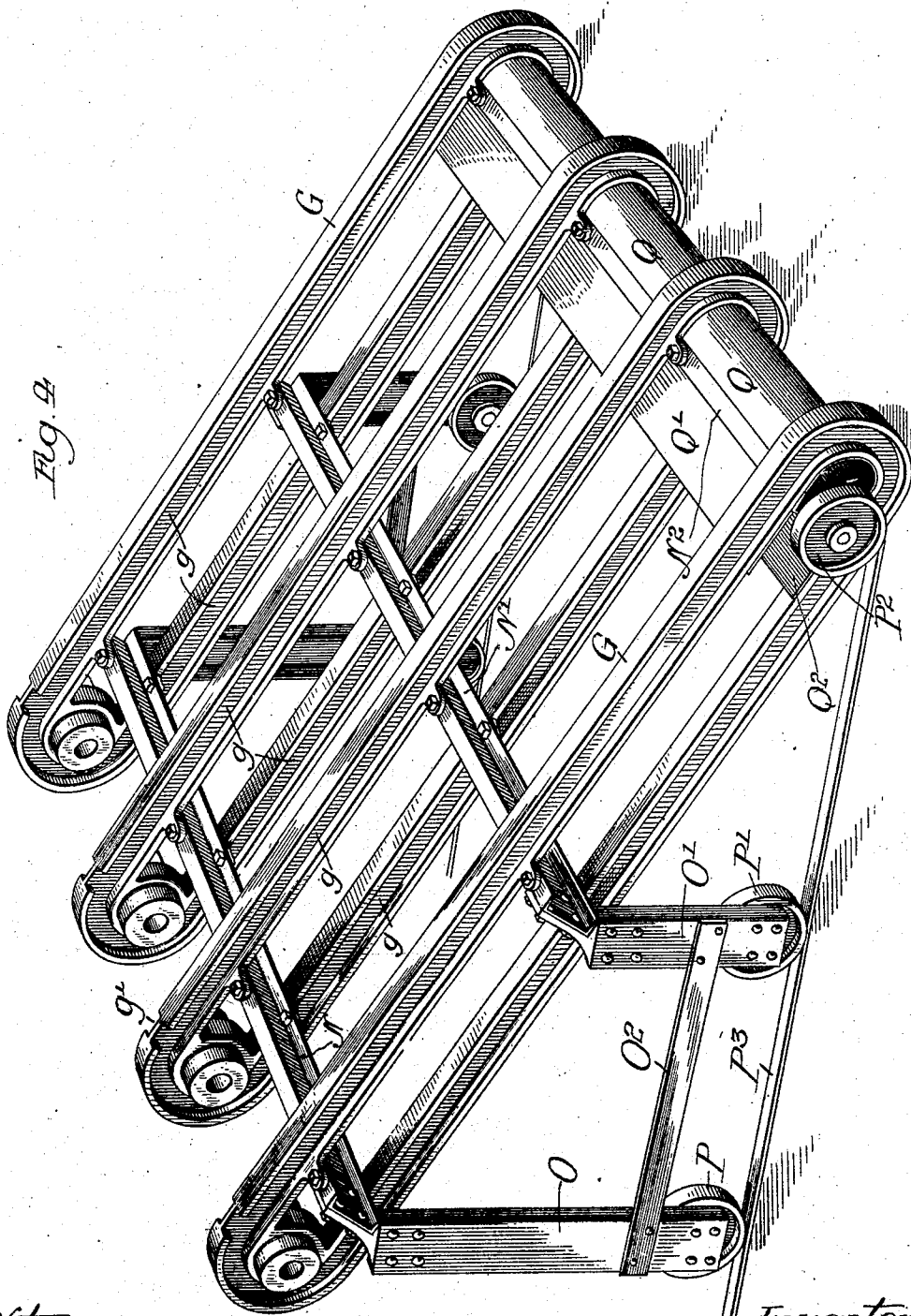
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J. J. MERRILL.
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4 SHEETS—SHEET 3.



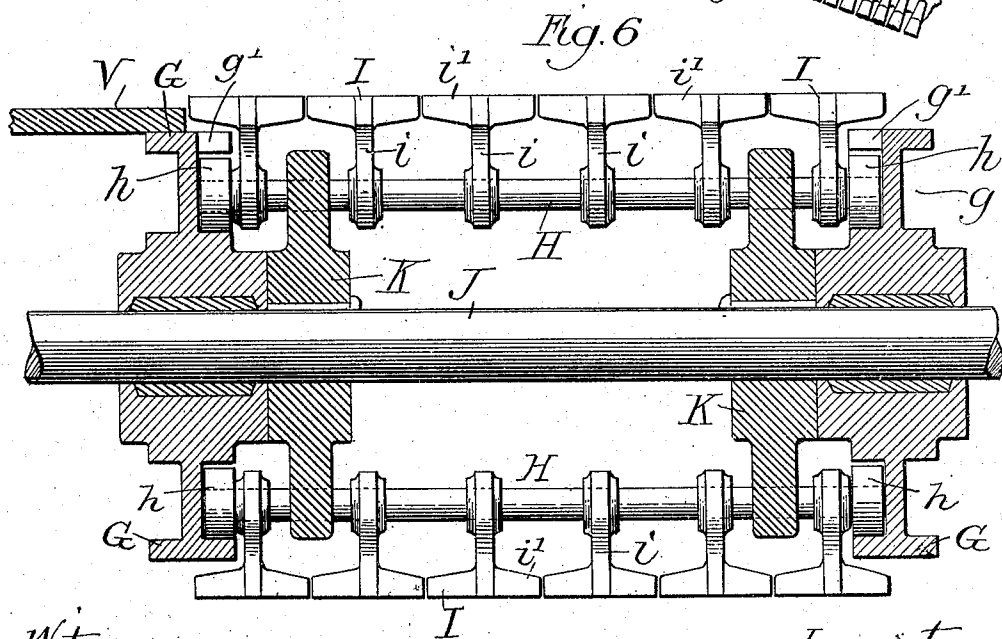
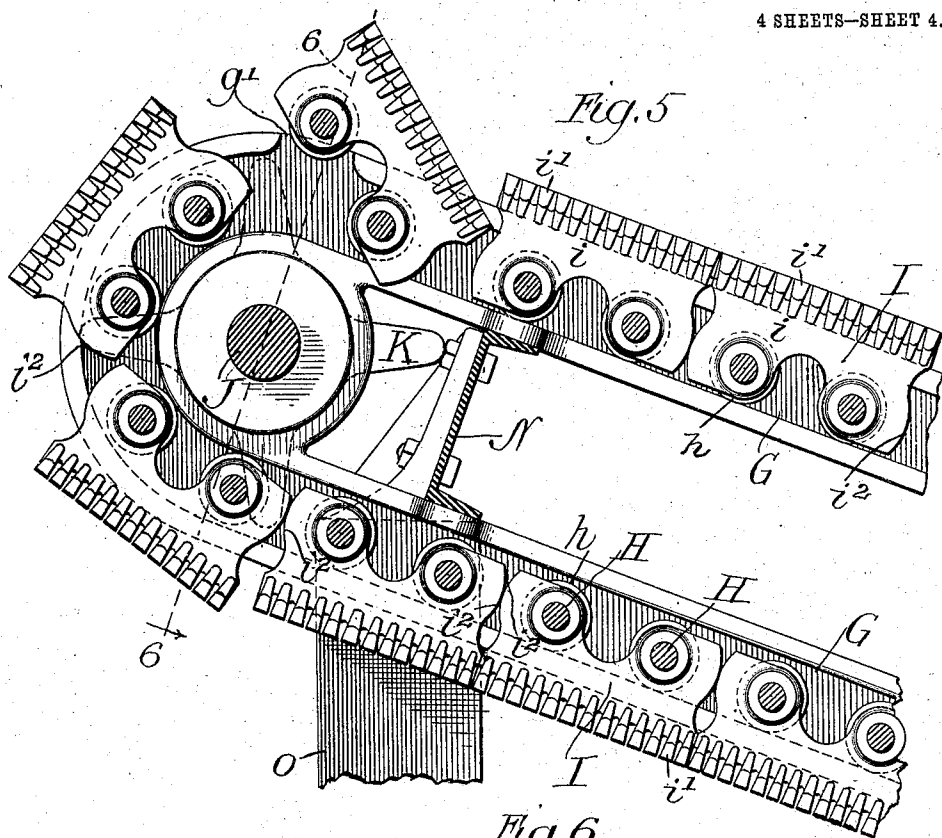
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4 SHEETS—SHEET 4.



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UNITED STATES PATENT OFFICE.

JOSEPH J. MERRILL, OF CHICAGO, ILLINOIS.

FURNACE-GRATE.

No. 806,422.

Specification of Letters Patent.

Patented Dec. 5, 1905.

Application filed July 21, 1904. Serial No. 217,532.

To all whom it may concern:

Be it known that I, JOSEPH J. MERRILL, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Furnace-Grates; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in furnace-grates of the kind known generally as "endless traveling grates," or those in which the grate-bars on which the fuel is supported move or travel inwardly from the feed-opening of the furnace toward the interior thereof and afford support for the layer of fuel which is continuously fed to the forward or outer end of the grate and is moved inwardly by and upon the same during progress of combustion.

The invention consists in the matters hereinafter described, and pointed out in the appended claims.

In the accompanying drawings, Figure 1 is a view in central longitudinal vertical section of a steam-boiler furnace provided with a grate embodying my invention. Fig. 2 is a view thereof in cross-section, taken upon line 2 2 of Fig. 1. Fig. 3 is a detail section taken upon line 3 3 of Fig. 1 with parts of the grate omitted. Fig. 4 is a perspective view of the supporting-frame of the grate separate from the other parts. Fig. 5 is an enlarged detail section through the upper end of the grate. Fig. 6 is an enlarged detail section taken transversely through the supporting-frame on line 6 6 of Fig. 5, showing two of the grate-bar sections in elevation.

As illustrated in said drawings, A A indicate the side walls of the furnace; B, the bridge-wall thereof; C, the ash-pit; D, the feed-hopper at the front of the furnace; E, the fire-arch located over the front part of the fire-box; F, the front header of a water-tube boiler which is located over said fire-arch, and *f f* two of the water-tubes in said boiler.

The grate illustrated as embodying my invention embraces a plurality of guide-bars G G of continuous ring or loop form and transversely-arranged grate-bar sections, which move or travel on said guide-bars and which are disconnected or unattached to each other, but are in contact with each other,

so as to form a continuous loop or ring the upper part or lap of which constitutes the fuel-supporting part of the grate. Each grate-bar section according to the details of construction illustrated consists of two parallel supporting-rods H H, which extend transversely of the furnace between the said guide-bars, and grate-bars I I, which extend longitudinally of the furnace and which extend between and are attached to said rods H H. Said grate-bars I are spaced upon the supporting-bars H H at regular intervals along the length of the same. Each grate-bar I consists of a vertically-arranged web portion *i*, having at its upper edge a plurality of laterally-extending fingers *i'*, which are arranged transversely of the furnace and the upper edges of which constitute the fuel-supporting surface of the grate. The supporting-rods H H are shown as engaged with grate-bars I by being inserted through apertures in the webs *i* of said grate-bars, said supporting-bars H H being preferably made of round or cylindric rods and the said webs *i* of the grate-bars being provided with thickened parts or hubs through which said bars extend, as clearly shown in the drawings.

The grate-bar sections, consisting of the parallel supporting-bars H H and the grate-bars I, which are attached to and connect said supporting-bars, as above described, are engaged at their ends with the guide-bars G by having the ends of the said rods H H extended into lateral guide-grooves *g*, formed by means of flanges on said guide-bars, and to lessen friction in the movement of the said rods H H in said guide-grooves said rods are provided on their ends with antifricition-rollers *h h*, which are free to turn upon the said rods H H and travel upon the upper or lower flanges of the said guide-bars. Said guide-bars G G are arranged in vertical planes parallel with each other and embrace upper and lower straight parts joined at their ends by curved connecting portions. As preferably constructed said upper and lower parts of the guide-bars are parallel with each other and are joined at their ends by semicircular curved portions, as clearly seen in the drawings.

Any desired number of the guide-bars G, with associated intermediate grate-bar sections, may be employed; but in the particular construction illustrated four of said guide-bars are used in connection with three sets of grate-bar sections. These grate-bar sections, as hereinbefore stated, are not pivotally joined or

connected with each other, as in chain grates heretofore used, but the sections are arranged on the guide-bars in contact with each other. In the particular construction shown the ends of the webs i of the individual link-bars are arranged to meet end to end or in abutting relation, said webs having at their ends bearing-surfaces i^2 , which are convexly curved, so that they will remain in contact with each other during the movement of the sections around the curved parts of the guide-bars G at the front and rear ends of the grate.

Provision is made for driving the grate-bar sections or moving them continuously in an inward direction on the upper parts of the guide-bars and in an outward direction on the lower parts of said guide-bars, consisting of a rotative driving-shaft J, arranged concentrically with the forward curved ends of the guide-bars G and provided with sprocket-wheels K, of which preferably two are used for each set of grate-bar sections and the teeth or spurs of which are adapted to engage the supporting-bars H of the grate-bar sections as the sprocket-wheels are turned, so as to move or carry the grate-bar sections upwardly around the curved parts of the guide-bars and to deliver them to the upper parts of said guide-bars. As the grate-bar sections are thus forced or carried one by one into the forward ends of the upper guide-bars the sections preceding them are pushed or thrust rearwardly, and thereby caused to travel continuously inward along said upper parts of the guide-bars. When the grate-bar sections reach the rear ends of the guide-bars, they will be forced around the curved connecting portions of the guide-bars there located and thence forwardly around the lower parts of the guide-bars, so that the rearward pressure imparted to the upper line of the sections by the sprocket-wheels K K serves to move the entire series of bars continuously in a path determined by the shape of the guide-bars. The grate herein shown is rearwardly and downwardly inclined, with its lower end near the level of the bottom of the furnace. Such inclined arrangement of the grate is not, however, necessary, and it may be otherwise arranged, if desired or preferred.

As preferably constructed the several guide-bars G G are joined to each other by means of transverse girders N N' N², which extend between the upper and lower parts of the bars and are bolted to the upper and lower edges of the same. The girders N and N' are attached at their ends to standards O O', which are joined at their lower ends by connecting-bars O² and are provided at such lower ends with supporting-rollers P P'. Like rollers P² are mounted on the ends of the rear girder N². Said rollers P, P', and P² rest and are adapted to travel on rails P³, supported on ledges formed on the side walls of the furnace. A rigid grate-supporting frame is thus

formed which may be moved in and out of the furnace on said track-rails P³.

Any suitable driving or actuating device may be employed for giving rotary motion to the driving-shaft J, that herein shown consisting of a horizontally-disposed worm L, mounted in a bracket L', attached to one of the front standards O and adapted to engage a spur-wheel M on the end of the shaft J. The shaft of the worm-wheel L is provided with a rigidly-attached gear-wheel L', by which motion may be given to the said worm L.

Attached to and extending between the guide-bars G G at the rear end of the grate are curved plates Q Q, which extend along the inner edges of said guide-bars from the upper to the lower margin of the girder N². In front of said girder N² are located similar flat plates Q' Q², which are also secured to and extend between said guide-bars adjacent to and forward of their upper and lower margins of said girder N², the said plates Q' and Q² being likewise attached to the inner edges of said guide-bars. Said plates Q, Q', and Q² serve to prevent ashes dropping through or between the grate-bar sections at the rear part of the grate upon the upper surfaces of the lower grate-bars when said grate-bar sections are separated from each other as they begin to move around the curved parts of the guide-bars at such rear end of the grate. Such plates also serve to prevent the upward passage of air through the grate-bars at the extreme rear end of the grate.

As a means of controlling the upward passage of air through the rear part of the grate I have shown in Fig. 1 damper-plates R R' R² R³ as hinged to the lower surfaces of the upper parts of the guide-bars G in such manner that when opened their free edges may be dropped toward or upon the lower parts of said guide-bars and when elevated the free edge of each metal plate will meet the upper or hinged edge of the one in advance of it. The rearmost damper-plate R is shown as having its pivot located adjacent to the front edge of the stationary plate Q', and said plate is shown in said Fig. 1 as elevated or closed with its rear edge in contact, or nearly so, with the pivoted edge of the plate R', while the other plates R', R², and R³ are shown as in their lowermost or open position.

By raising or lowering one or more of the damper-plates described air may be admitted to the layer of fuel resting on the grate near to or farther from the rear end of the grate, as required, according to the condition under which the furnace is operating. It is well understood that when combustion of the layer of fuel on the grate takes place so rapidly that the fuel is entirely or largely consumed before it reaches the rear end of the grate and the latter is covered by a thin layer of cinders and ashes only then it is desirable that the air-supply to that part of the grate should be

shut off, as otherwise a large portion of the air would pass through such thin layer of cinders and ashes, and the air-supply to the burning fuel would be correspondingly lessened.

5 S indicates a damper-plate which is pivotally supported at its upper margin at a point near the lower lap of the grate adjacent to the rear end of the furnace and adapted to extend downwardly into contact with the bottom
10 of the ash-pit. Said damper S is shown as provided with an actuating-rod S', attached at its lower edge and extending to the front of the furnace, by which it may be moved or actuated. Said damper-plate S serves to prevent
15 the passage of air from the ash-pit around the rear end of the grate and is pivotally supported, as shown, in order that its free end may be lifted to permit the ashes to be removed from the rear part of the ash-pit
20 behind the same.

T indicates a water-cooled bridge-piece which extends along the front margin of the bridge-wall B in contact with the latter and just above the rear end of the grate and
25 which serves to prevent the passage of air upwardly around the rear end of the grate and forwardly over the latter. Said bridge-piece is arranged with its bottom surface at a distance above the grate-bar sections sufficient
30 only to permit the passage beneath it of the layer of clinkers and ashes from the burned-out fuel and is preferably made in the form of a metal shell provided with water supply and return pipes, the ends of which are indicated
35 by t t' in Fig. 1, this construction being employed to enable the bridge-piece to withstand the intense heat to which it is subjected.

U indicates a sliding fuel-door located over the feed-opening of the furnace with its lower
40 edge a short distance above the fuel-supporting surface of the grate and which is made adjustable to control the thickness of the layer. Said door U is shown as consisting of a metal plate u , provided on its inner surface
45 with a lining of fire-brick u' and on its lower edge with protective fire-bricks u'' , which fire-bricks are held in engagement with the plate u by means of transverse-headed depending flanges on the said plate, with which said fire-
50 bricks u'' are interlocked, as clearly seen in dotted lines in Fig. 3.

The grate illustrated is inclined downwardly and rearwardly from its front to its rear end, this construction being employed to facilitate
55 the inward travel or feed of the layer of fuel on said fuel-supporting surface. In connection with the grate, which is thus inclined, I provide upon the side walls of the furnace inwardly-projecting joint-plates V, which are
60 inclined to correspond with the inclination of the upper parts of the guide-bars G and which extend over and overlap the outer margins of the upper surfaces of said guide-bars. Said joint-plates V are preferably stiffened by vertical
65 flanges and have outwardly-extending

parts which are embedded in the masonry side walls A A of the furnace.

By the employment of the inwardly-extending plate-joints V V, arranged as described, tight joints may be maintained between the
70 exterior guide-bars and the side walls of the furnace, it being manifest that when the grate-frame as a whole is thrust into the furnace by reason of the inclination of said bars and of the upper surfaces of exterior guide-bars
75 the latter may be brought into close contact with the lower surfaces of said plates V V. The presence of any spaces or openings for the upward passage of air around the sides of the grate or between the side walls of the furnace and ends of the grate-bar sections is thus
80 avoided, it being, of course, understood, as clearly seen in Fig. 2, that the external grate-bars of said sections are located close to the external guide-bars G G, so that the outwardly-extending fingers on said grate-bars
85 extend or project over the said guide-bars and come close to the inner margins of said plates V V.

In order to enable the several grate-bar sections to be separately disconnected from and
90 engaged with the guide-bars G, said guide-bars, as shown in the drawings Figs. 4, 5, and 6, are provided near their forward ends in the upper flanges thereof with notches g'
95 of sufficient width to permit the passage therethrough of the rollers h on the supporting-rods H H of said grate-bar sections. The presence of said notches g' g' enables the grate-bars to be introduced into their places within
100 or between the guide-bars after the guide-bars have been joined or assembled to form the frame shown in Fig. 4 and to be removed from their engagement with said guide-bars at any time without taking apart or separating
105 the parts of said frame. The separate removal of the grate-bar sections without disturbing other parts of the apparatus is desirable for the purpose of repairs or replacing parts, it being obvious that if any of the
110 grate-bars become injured by excessive heat or burned out the section to which it belongs may be readily removed from its place in the guide-bars, the separate grate-bars removed from the supporting-rods, new grate-bars introduced where necessary, and the repaired
115 section readily and quickly introduced into its place in the guides.

I claim as my invention—

1. An endless traveling grate comprising transversely-arranged grate-bar sections which are disconnected or separate from each other, each grate-bar section consisting of two parallel supporting-rods and grate-bars which extend between and are attached to said rods,
125 and guide-bars for the said sections provided with guide-grooves with which the ends of said rods are engaged.

2. An endless traveling grate comprising a plurality of transversely-arranged grate-
130

bar sections each consisting of two parallel supporting-rods and a plurality of grate-bars which extend between and are attached to the said rods, guide-bars of loop form for the said sections provided with lateral guide-grooves, and rollers mounted on the ends of said rods and engaging the said guide-grooves.

3. An endless traveling grate comprising a plurality of transversely-arranged grate-bar sections which are disconnected or separate from each other, a plurality of guide-bars with which the ends of said sections are engaged, said bars each consisting of straight parallel upper and lower parts joined at their ends by curved portions and transverse girders extending between the upper and lower parallel parts of said bars and attached at their upper and lower margins to the same, said guide-bars and girders constituting a rigid supporting-frame for the grate.

4. An endless traveling grate comprising a plurality of transversely-arranged grate-sections which are disconnected or separate from each other, guide-bars provided with grooves for engagement with projections on the ends of the sections, said guide-bars each

consisting of straight parallel upper and lower parts connected at their ends by curved portions, transverse girders extending between the upper and lower parallel parts of said bars and attached at their upper and lower margins to the same, and curved plates extending transversely and attached to the inner surfaces of the curved parts of the guide-bars at the rear end of the grate.

5. An endless traveling grate comprising a plurality of grate-bar sections which are disconnected or separate from each other, each section embracing two supporting-rods and a plurality of longitudinally-arranged grate-bars mounted side by side on said rods, the grate-bars of each of the sections being adapted for endwise contact with corresponding grate-bars of other sections.

In testimony that I claim the foregoing as my invention I affix my signature, in presence of two witnesses, this 18th day of July, A. D. 1904.

JOSEPH J. MERRILL.

Witnesses:

C. CLARENCE POOLE,
GERTRUDE BRYCE.