

J. HARRINGTON.

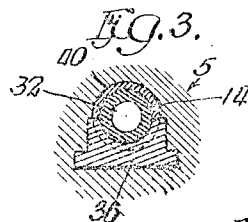
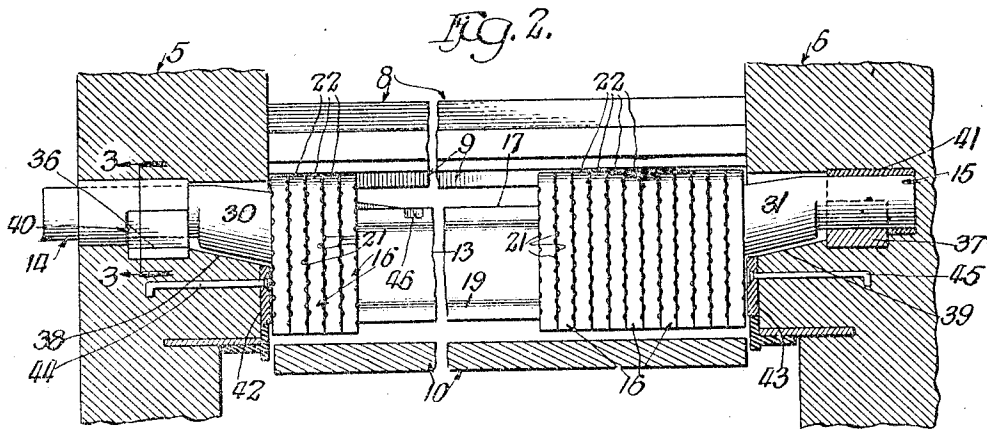
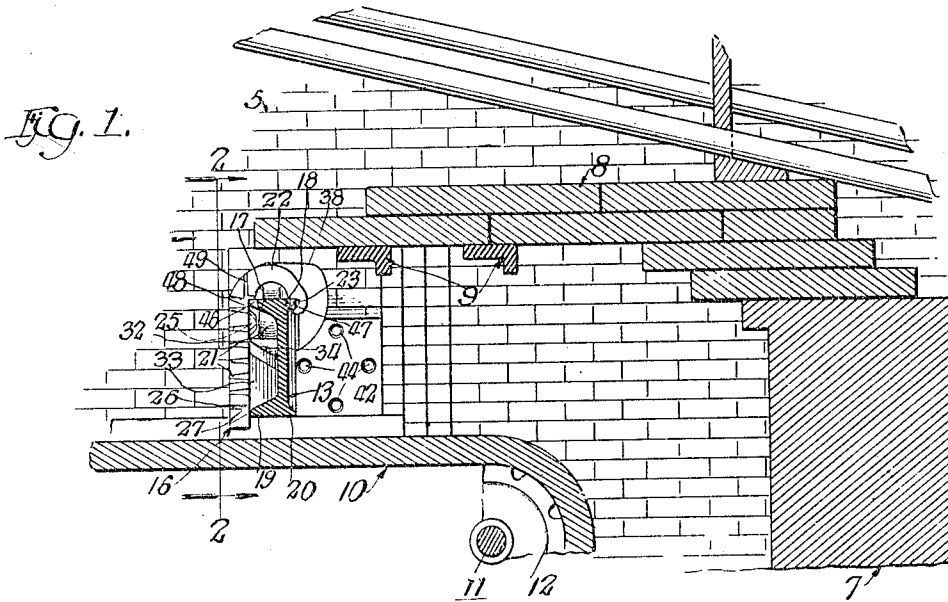
FURNACE.

APPLICATION FILED MAY 15, 1911.

1,058,365.

Patented Apr. 8, 1913.

2 SHEETS—SHEET 1.



Witnesses:
J. H. Alfreds
A. R. Wilkins

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by *Paul J. Brown* Attys

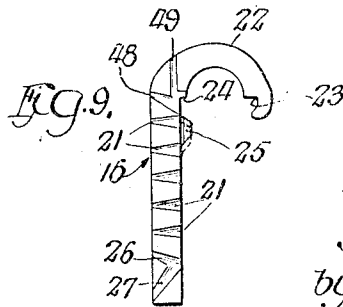
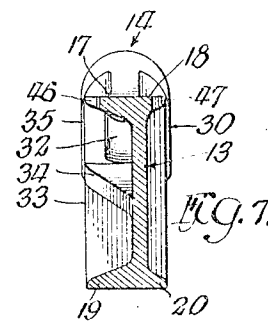
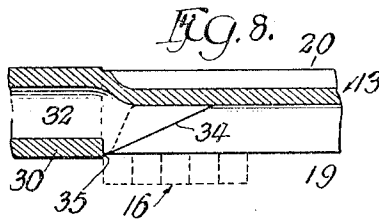
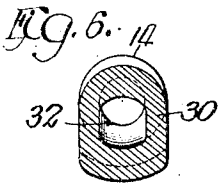
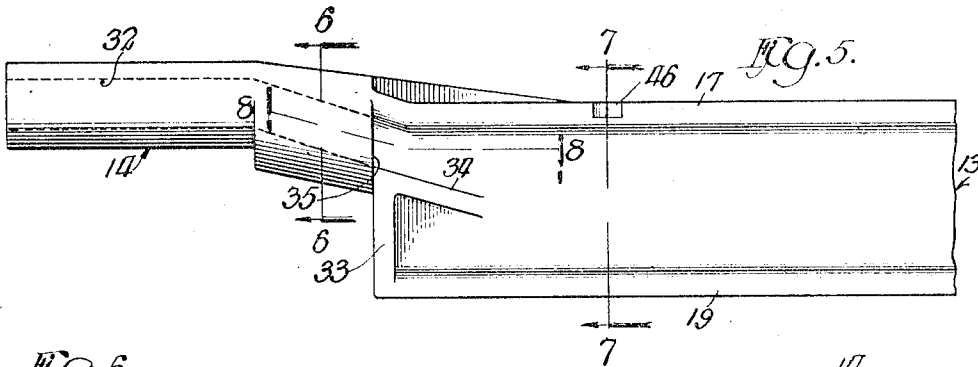
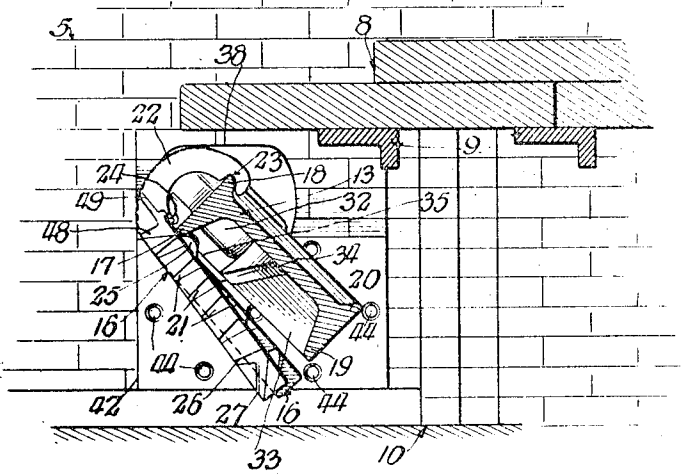
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2 SHEETS-SHEET 2.

Fig. 4.



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UNITED STATES PATENT OFFICE.

JOSEPH HARRINGTON, OF RIVERSIDE, ILLINOIS.

FURNACE.

1,058,365.

Specification of Letters Patent.

Patented Apr. 8, 1913.

Application filed May 15, 1911. Serial No. 627,186.

To all whom it may concern:

Be it known that I, JOSEPH HARRINGTON, a citizen of the United States, and a resident of Riverside, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Furnaces; 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 an improved construction in furnaces of that kind having an endless traveling or chain grate, acting to carry the fuel rearwardly within the furnace during the progress of combustion, and a device in the nature of a metal closure or gate which extends across the furnace above the rear end of the grate and beneath a forward extension of the bridge wall that overhangs said rear part of the grate, with its lower edge in position for contact with the layer of ashes or burned out fuel which passes beneath it on the rearward travel of the grate, and which serves the purpose of preventing the entrance of air to the furnace through the space between the rear part of the grate and the said bridge wall.

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

A closure or gate embodying my invention is made of metal and embraces as its main features a beam or girder which is supported at its ends by the side walls of the furnace and extends across the same above the rear end of the traveling grate, together with a plurality of separate metal bars, sections or protecting members, generally resembling grate bars, that are hung or sustained upon the said girder at the front face of the same, and which extend vertically or transversely to the girder, and are arranged side by side, in such manner as to cover the front surface of said girder. Said protecting bars, thus arranged, serve to prevent contact with the girder itself or any part of the layer of hot ashes, or partially consumed fuel, which moves rearwardly with the grate, and to also prevent the girder from being unduly heated by the action of the heat within the furnace. The girder and protecting bars are, moreover, so constructed as to afford a longitudinally extending air space or duct between

the front face of the girder and said protecting bars and provision is made for the admission of air to such air space or duct at one or both ends of the gate, and said bars are so shaped or arranged as to afford spaces between them for the passage of air, so that air will pass constantly from said space or duct outwardly or forwardly through or between the projecting bars with the effect of preventing the same from becoming injuriously heated, in the same manner that the grate bars of an ordinary grate are kept cool by the passage of air through the spaces between the same. A continuous flow of the air through the air space or duct referred to, and forwardly between the protecting bars, is produced by the draft of the furnace, supplemented, in cases where found necessary, by a blower or air forcing device arranged to deliver the entering air to said space or duct.

As a further feature of my invention, the gate, constructed as described, is pivotally supported in a manner to permit the same to turn or swing on a horizontal axis located near its upper edge, and the gate is so arranged that it will normally hang in a vertical position, while its lower edge will be free to swing rearwardly from its normal position; this construction enabling the gate to yield rearwardly for the purpose of permitting the passage beneath it of large pieces of unburned fuel or clinker, carried rearwardly on the grate, and to insure that the lower edge of the gate shall always be in contact with the surface of the layer of ashes or burned fuel; it being understood that the lower edge of the gate, when the same is in its vertical position, will be at such distance above the top surface of the grate as to provide for the passage beneath it of a layer of ashes of minimum thickness, while the rearward yielding of the device permits the free passage of a thicker layer of ashes and clinkers, so that the gate is adapted to prevent any passage of air between its lower edge and the grate, under varying conditions with respect to the thickness of the layer of ashes on the grate.

A device embodying my invention also includes other details of construction and arrangement of the parts, as will be hereinafter fully pointed out.

As shown in the accompanying drawings—Figure 1 is a view of vertical section

of the rear part of the furnace showing a portion of the bridge wall, a portion of the rear end of the traveling grate and a gate embodying my invention in connection therewith. Fig. 2 is a sectional view taken on line 2—2 of Fig. 1 showing the gate embodying my invention partially in elevation and partially in section. Fig. 3 is a detail section, taken on line 3—3 of Fig. 2. Fig. 4 is a sectional view, corresponding generally with Fig. 1, but showing the gate in changed position. Fig. 5 is a detail view showing one end of the metal beam or girder of the gate in side elevation. Fig. 6 is a detail section taken upon line 6—6 of Fig. 5. Fig. 7 is a detail cross section, taken upon line 7—7 of Fig. 5. Fig. 8 is a detail longitudinal section, taken upon line 8—8 of Fig. 5. Fig. 9 is a detail view of one of the detachable protecting bars or sections constituting the side of the gate that is exposed to the heat within the furnace.

As shown in the accompanying drawings, 5 and 6 indicate the side walls and 7 the bridge wall, of a steam boiler furnace. The bridge wall is provided with a forwardly extending overhanging part 8 which, as shown in the drawings, consists of horizontally disposed fire brick or tiles supported in part by the bridge wall itself and in part by transversely extending metal supporting members 9, 9 inserted at their ends in and supported by the side walls 5 and 6.

10 indicates the rear part of the traveling grate, and 11 the rear shaft on which are mounted the rear supporting wheels or pulleys for the grate, one of which is indicated at 12, in Fig. 1.

13 indicates the beam or girder which constitutes the supporting member or body of the gate, and which is provided at its ends with supporting extensions, shown as having the form of journals or trunnions 14, 15, by means of which the said beam or girder is supported on the said side walls 5 and 6. 16, 16, 16 indicate metal protecting bars or sections which are hung on the girder in such a manner as to extend transversely of the front face of the same. These protecting bars are arranged side by side throughout the entire length of that part of the girder between the inner faces of the side walls 5 and 6 of the furnace. Said girder 13 is recessed on its forward face so as to form a longitudinal channel extending the entire length of the same. In the particular construction shown, the girder consists of an upright web portion, having at its upper margin, forwardly and rearwardly extending flanges 17 and 18, and at its lower margin like forwardly and rearwardly extending flanges 19 and 20, said flanges giving to the girder the general form of an I-beam. The flanges at the forward face of the girder are made of considerably greater

width than those at the rear face thereof. The protecting bars rest against the forward edges of the upper and lower forward flanges 17 and 19 of the said girder 13, so that the several bars, together with the web and said upper and lower flanges of the girder, constitute the walls of a longitudinal air duct or passage. The said protecting bars are, moreover, so constructed so as to permit the passage of air between the same, and for this purpose they are so constructed that, while portions of their side faces are in contact, in a manner to keep the bars properly spaced, openings or air passages are formed between the bars. In the particular construction illustrated, the bars are severally provided in both side faces of each bar, with transverse notches 21, 21, 21, such notches forming spaces or channels between the bars, while enabling the bars to be arranged with parts of the side face of each bar in contact with that of an adjacent bar, while at the same time affording spaces for the passage of air from the air duct forwardly between said bars. The said air duct communicates at one or both ends with an air inlet passage or passages, through which air enters said duct, either through the influence of the draft of the furnace or by the action of a fan or blower.

As shown in the accompanying drawings, each of the protecting bars or sections 16 is so shaped or constructed at its upper end as to embrace or engage the margins of the flanges 17 and 18, on the upper edge of the girder 13, and for this purpose said bars are provided each with a rearwardly extending arm 22 (Figs. 1, 4 and 9) adapted to extend rearwardly from the upper end of the bar over the top of the girder to the rear margin of the flange 18, and having at its rear end or extremity a notch 23 to receive the rearwardly extending upper flange 18 of the girder. A corresponding notch 24, adapted to receive the forward edge of said upper flange 17 of the girder, is formed in the rear face of the bar 16 at its upper end; said notch being formed by means of a lug 25 projecting from the said inner face of the bar just below its upper end, as clearly seen in Fig. 9. The arm 22 is shown as made of upwardly curved and approximately semi-circular form, so that when the gate, as a whole, is adapted to swing or rotate on its trunnions 14, 15, the curved top margins of the several bars will remain at a uniform distance from the overhanging part 8 of the bridge wall, thereby maintaining a close joint between the upper edge of the gate, as a whole, and said overhanging part of the bridge wall. The curved construction in the arm 22, moreover, affords, when the arms are assembled on the girder, a longitudinal air space or channel between the several arms and the top surface of the girder, so

as to decrease the amount of heat that will be transmitted from the upper ends of the bars to the said girder.

In the construction shown in the drawings, the journals or trunnions 14, 15 are integral with the girder 13; and are made tubular in order to provide air inlet passages for the admission of air to the ends of the longitudinal air duct formed between the girder and the protecting bars, as described. When the gate is pivotally supported, as shown, it is desirable that the pivotal axis thereof should be located near the top of the gate, and, for this purpose, the trunnions are arranged with their central axes approximately in line with the top edge of the girder 13, and said trunnions are formed on, or constitute outward extensions of hubs 30 and 31, on the ends of the girder. Said hubs are inclined upwardly and outwardly from the ends of the girder and have their bottom surfaces transversely curved, on arcs concentric with the central axes of the trunnions, as clearly seen in Fig. 6. The hubs 30 and 31 are made hollow or tubular; the passages within the same forming inward extensions of the passages in the trunnions, and communicating at their inner ends with the ends of the air duct or channel formed between the web of the girder and the protecting bars 16, 16, as hereinbefore described. In the construction shown, provision is made for admission of air through the left-hand trunnion 14, only, although both trunnions are preferably made alike, and air may be admitted through both trunnions, if desired. As more particularly shown in Figs. 5, 6, 7 and 8, the girder is provided at its end with an upright, forwardly extending flange 33, which is joined to the lower flange 19 and extends upwardly to the bottom wall of the hub 30, thereby leaving a space or notch between the upper end of said flange 33 and the end of the upper flange 17, and the air passage extending through the trunnion 14 and hub 30, indicated as a whole by 32, opens at its inner end through said space or notch, into the longitudinal air duct formed between the girder and the protecting bars, as clearly shown in Fig. 8, and by dotted lines in Fig. 5. In order to afford a suitably strong connection of the hub 30 with the body of the girder, an obliquely arranged flange 34 is shown as extending from the upper edge of the flange 33 inwardly for a short distance along the web of the girder. That one of the protecting bars 16, which is located adjacent to the end of the girder, is as indicated by dotted lines in Fig. 8, arranged to overlap and rest in contact with the forward edge of the upright flange 33, and as the several protecting bars extend over or across the space between the top of said flange 33 and the upper flange 17, and rest in contact

with the upper and lower flanges 17 and 19, it will be apparent that the several protecting bars that are located adjacent to the end of the girder will, in effect, form the outer wall of the air duct at this point, where said air duct is in communication with the passage 32 of the hub and trunnion, as clearly shown in Fig. 8, wherein such bars are indicated in cross section, by dotted lines. The hub 30 is, moreover, arranged to extend somewhat forward of the plane of the front edges of the top and bottom flanges and end flange 33 of the girder, so as to form an inwardly facing shoulder 35, as clearly seen in Fig. 8. The adjacent or end protecting bar rests against the said shoulder 35 which forms a stop by which said end bar is held from lateral, outward movement. Said shoulder 35 is, moreover, arranged in the same plane with the end face of the girder so that the outer face of the end protecting bar will be held by said shoulder flush with said end face of the girder.

The trunnions 14 and 15 are mounted to turn in seats formed in bearing blocks 36, 37 that are embedded in the side walls 5 and 6 of the furnace. Said bearing blocks are located at points between the inner and outer faces of said side walls, this arrangement bringing said blocks at a considerable distance outwardly from the inner face of said side walls in order that they will not be injuriously affected by the heat of the furnace. Open spaces or recesses 38, 39 are formed in the masonry side walls, extending from the bearing blocks 36, 37 inwardly to the inner faces of the said walls; said recesses being made of a size and shape required to permit free movement of the hubs 30 and 31 when the same are swung or oscillated in the swinging movement of the gate. Said bearing blocks 36 and 37 are preferably made with semi-circular bearing recesses, in their upper faces, adapted to receive the lower parts of the trunnions, as clearly shown in connection with the trunnion 14 in Fig. 3 of the drawings. In connection with the bearing blocks thus made, metal protecting sleeves 40 and 41 (Figs. 2 and 3) are applied to cover the parts of the trunnions above and exterior to said bearing blocks, said sleeves being of cylindrical form in their parts outside of the bearing blocks, but being cut away at their lower portions, at their inner ends, so as to fit over and against the top and end faces of said blocks. Such sleeves are made of such internal diameter as to permit the trunnions to turn freely in the same. The bearing blocks will be seated in the side walls, and the sleeves will be placed in position and the wall built around them in the process of constructing the walls.

42, 43 are face plates, which are secured by means of bolts 44, 45 to the inner faces of

the side walls, in position to cover the parts of the same over which the ends of the gate swing or move. The said plates, as clearly seen in Fig. 4, have their forward edges substantially in line with the front face of the gate when the latter stands in its vertical position, so that the plates will not be exposed to the heat within the furnace when the gate is in its normal position, as shown in Fig. 1, and only to a slight extent when swung rearwardly, as shown in Fig. 4.

In order to permit the protecting bars to be placed on the girder in interlocked relation with the top flanges of said girder, as hereinbefore described, the said top flanges are provided, at one point in the length of the latter, with opposite notches 46, 47 (Figs. 5 and 7); said notches being of suitable size for the passage of the end portion of the arm 22 below the notch 23 therein, through the rear notch 47 of the girder and for the passage of the inwardly projecting lugs 25 through the forward notch 46 of said girder. It will be understood that in placing the several bars upon the girder, each bar will be so applied to the girder at the point where the notches 46 and 47 are located and then slipped endwise along the girder until all of the bars have been properly placed thereon.

As hereinbefore stated, the bars 16 are, in order to provide for the passage of air between the same, provided with transverse grooves or notches 21, 21, formed in the side edges of the bars at intervals along said side edges from the top to the bottom thereof. These notches, as clearly shown in Fig. 2 are arranged in alternate or staggered relation in the case of the notches in the opposite sides of each bar, so that when the bars are placed together, or side by side, the notches in one bar will come opposite the spaces between the notches in the other bar, thereby affording a large number of closely spaced openings for the passage of air between each pair of adjacent bars. I have, moreover, provided a special construction in notches or air channels at points adjacent to the upper and lower flanges of the girder, in order to provide for the cooling of the upper and lower end portions of the bars, that rest in contact with said flanges. For this purpose, as clearly shown in Fig. 9, intersecting grooves 48 and 49 are formed in each side face of each bar near the upper end thereof, the grooves 48 being inclined upwardly and forwardly and the groove 49 being vertically disposed, and the said grooves being arranged to intersect each other near the rear face of the bar and form an open space opposite the upper forward flange of the girder. In like manner each bar is provided in each of its side faces, near its lower end, with two obliquely arranged, intersecting grooves 26, 27, that meet or in-

tersect each other at the point adjacent to, but just above, the lower forward flange of the girder, this construction permitting the passage of air between the lower parts of adjacent bars to aid in the cooling of the same. The bars, made generally in the manner described, are provided with a further special feature of construction, by which, when the gate, as a whole, is pivotally supported and adapted to swing or yield rearwardly, as hereinbefore described, every alternate bar will have slight swinging movement at its lower end relatively to the bars at either side of the same. This construction is employed in order to prevent the spaces between the bars from being closed by adherence to the side faces thereof, of fusible parts of the fuel that may accumulate in the form of clinker on said bars. In other words, by hanging the bars loosely on the girder, and in such manner that they may have movement relatively to each other, adherence of clinker to the side faces of adjacent bars, in a manner to cause one bar to adhere to another, or to result in the spaces between the bars being filled or closed by accumulated clinker material, is thereby avoided. Such movement of the bars relatively to each other is secured by providing a loose connection between the upper ends of a part or all of the bars and the top of the girder, and by so constructing the parts that a greater amount of movement between the bars and the girder is afforded in the case of the first, third, fifth and other bars than in the case of the second, fourth, sixth and other bars. In the construction illustrated, the rear flange 18 of the girder is arranged to fit closely within the notch 23 of each bar, while, in the case of the forward notch 24 the same is made of greater width vertically than the thickness of the forward edge of the flange 17 that enters said notch. By this construction, a certain amount of lost motion or play of each bar relatively to said forward flange, is permitted, the bar turning or swinging about the rear flange as its lower end moves relatively to the girder. This lost motion or play is preferably provided for to some extent in all of the bars, but in the case of every alternate bar the lug 25 will be located at a lower point on the bar, as indicated by dotted lines in Fig. 9, so as to give a greater amount of play or movement to said alternate bars. As a result of this construction, as shown in Fig. 4, when the girder, as a whole, is thrown into a rearwardly inclined position, the lower ends of one set of the bars will swing or drop away from the lower margins of the girder for a short distance, while the other set of intermediate bars will swing to a greater distance at their lower ends away from the girder, and this relative movement of the bars will take place every time that

the gate is swung rearwardly by the contact therewith of pieces of clinker, or the like, carried rearwardly on the grate. The lower ends of the several protecting bars are preferably extended a short distance below the lower edge or flange of the girder, in order that the ashes or burned out parts of the fuel, which are still at a high temperature when they reach the gate, may not come in direct contact with the lower part of the girder.

It is to be observed that the protecting bars, extending over the forward face of the girder, as described, are subject not only to the heat within the furnace, but also to the heat from the layer of ashes and nearly burned out fuel, on the rear part of the grate, which is carried against and beneath the gate, the lower edge of which is always in contact with the top surface of such layer, in order to prevent the passage of air, beneath the gate forwardly from the space at the rear of the gate into the furnace. The top portion of such layer of ashes and burned out fuel will, to some extent, at least, accumulate or become banked up against the lower ends of the protecting bars, but any injurious heating of the heat from this cause as well as from the heat radiated thereon from the burning fuel and gases in the furnace, is prevented by the cooling effect of the air which passes through or between said bars. In other words, the said protecting bars are cooled by the passage of air between them, in the same manner that the grate bars of a fuel supporting grate are similarly cooled. An ample supply of air to effect the cooling of the protecting bars will usually be afforded by the effect of the furnace draft, which will produce an inward flow of air through the admission passage or passages at one or both ends of the air duct behind the protecting bars, and forwardly between the bars. In cases where the air supply thus produced is insufficient, air may be supplied to the air duct from a fan, blower or air compressing device.

It is to be understood that the general features of my invention may be applied to a gate which is supported in the furnace otherwise than as herein illustrated; it being manifest that so far as the use of air-cooled protecting bars is concerned, the same may be applied to a gate which is supported in the furnace, by either of the several means heretofore employed in connection with gates used for the same purpose or in any other desired or preferred manner.

Gates embracing the several features, herebefore described may be variously constructed with respect to the details of construction thereof, and I do not, therefore, desire to be limited to the particular features of construction, illustrated in the ac-

companying drawings and hereinbefore set forth, except so far as the same may be herein claimed as parts of my invention.

I claim as my invention—

1. In a furnace, the combination with an endless traveling grate, of a movably mounted metal closure or gate located above the rear end of the grate and comprising a girder, a plurality of metal protecting bars supported upon and arranged side by side transversely of said girder, said girder and the protecting bars being constructed to provide between them a longitudinal air duct; said bars being adapted for the outward passage of air from said air duct, and means providing an air supply passage communicating with said air duct.

2. In a furnace, the combination with an endless traveling grate, of a movably-mounted metal closure or gate located above the rear end of the grate, and comprising a girder provided in one of its side faces with a longitudinal channel, a plurality of metal protecting bars supported upon the girder and arranged side by side transversely over the channeled side of the same, said girder and the protecting bars forming between them a longitudinal air duct; said bars being adapted for the outward passage of air from said air duct between their side faces, and means providing an air supply passage communicating with said air duct at the end of the gate.

3. In a furnace, the combination with an endless traveling grate, of a movably mounted metal closure or gate located over the rear end of the grate, and comprising a metal girder provided at its ends with supporting extensions, and a plurality of metal protecting bars supported upon and arranged side by side transversely of said girder, said girder and the protecting bars being constructed to provide between them a longitudinal air duct, said bars being adapted for the outward passage of air from said air duct between their side faces, and at least one of said supporting extensions being provided with an air supply communicating with said air duct.

4. In a furnace, the combination with an endless traveling grate, of a movably mounted metal closure or gate located over the rear end of the grate and comprising a girder provided at its ends with supporting extensions, and a plurality of metal protecting bars supported on and arranged side by side transversely of the said girder; said girder and the protecting bars being constructed to provide between them a longitudinal air duct and at least one of said supporting extensions being provided with an air inlet passage communicating with the exterior of the furnace and with the air duct formed by the girder and protecting bars.

5. In a furnace, the combination with an

endless traveling grate, of a movably mounted metal closure or gate located above the rear end of the grate and comprising a girder provided at its ends with supporting extensions, and a plurality of metal protecting bars supported upon and arranged side by side transversely of said girder, said girder and the protecting bars being constructed to provide between them a longitudinal air duct, and at least one of said supporting extensions being provided with a longitudinal air inlet passage communicating with the exterior of the furnace and with said air duct, and the said bars having in their side faces transverse notches for the passage of air from said air duct between said bars, the notches in opposite sides of the bars being arranged in alternate or staggered relation.

6. In a furnace, the combination with an endless traveling grate, of a movably mounted metal closure or gate located above the rear end of the grate, and comprising a girder provided at its ends with supporting extensions, a plurality of metal protecting bars arranged side by side and extending transversely over one of the side faces of the girder, said bars being provided at their upper ends with arms adapted to engage the upper edge of said girder, and said girder and the protecting bars being constructed to provide between them a longitudinal air duct, and at least one of said supporting extensions being provided with an air supply passage communicating with said air duct.

7. In a furnace, the combination with an endless traveling grate, of a movably mounted metal closure or gate located over the rear end of the grate, and comprising a girder having a web portion and forwardly extending longitudinal flanges at its upper and lower edges and provided at its ends with supporting extensions, and a plurality of metal protecting bars arranged side by side transversely of the front face of the girder and resting against the said flanges; said bars being provided at their upper ends with arms which extend over and embrace the top edge of the girder, and at least one of said supporting extensions being provided with an air supply passage communicating with the space between the web of the girder and said protecting bars.

8. In a furnace, the combination with an endless traveling grate, of a movably mounted metal closure or gate located over the rear end of the grate, and comprising a metal girder provided at its ends with supporting extensions, and a plurality of metal protecting bars supported upon and arranged side by side transversely of said girder, said girder and the protecting bars being constructed to provide between them a longitudinal air duct, and the girder being provided at its ends with inwardly facing

shoulders forming stops against which rest the protecting bars at the ends of the girder and at least one of said longitudinal extensions being provided with an air inlet passage communicating with said air duct.

9. In a furnace, the combination with an endless traveling grate, of a movably mounted metal closure or gate located over the rear end of the grate, and comprising a girder, provided with a longitudinal channel in its side face and with trunnions at its ends, and a plurality of metal bars supported on and arranged side by side transversely over the channeled side of said girder and forming with the girder a longitudinal air duct; said girder being provided at its ends with inwardly facing shoulders arranged in the same planes with the end faces of the girder, and forming stops to hold the protecting bars at the ends of the girder with their outer side faces flush with said end faces of the girder, and at least one of said trunnions being made of tubular form to provide an air inlet passage communicating with the said air duct.

10. In a furnace, the combination with an endless traveling grate, and a bridge wall provided with a part overhanging the rear end of said grate, a movably mounted metal closure or gate located above the rear end of the grate and beneath the overhanging part of said bridge wall, said gate comprising a longitudinally flanged girder provided at its ends with supporting extensions, and a plurality of protecting bars arranged side by side and extending transversely over one of the side faces of the girder and forming with the girder a longitudinal air duct, said bars being provided at their upper ends with arms adapted to engage the upper edge of said girder, said arms being upwardly curved to form an air space between the same and the top surface of the girder, and at least one of said longitudinal extensions being provided with an air supply passage communicating with said air duct.

11. In a furnace, the combination with an endless traveling grate, of a metal closure or gate located above the rear end of the grate and comprising a girder provided at its ends with trunnions by which it is pivotally supported, and a plurality of metal protecting bars supported upon and extending transversely of said girder, said girder and protecting bars being constructed to provide between them an air duct, and at least one of said trunnions being provided with an air inlet passage in communication with said air duct.

12. In a furnace, the combination with an endless traveling grate, of a metal closure or gate located above the rear end of the grate, and comprising a girder provided in one of its side faces with a longitudinal channel and at its ends with trunnions, and a plurality

of metal protecting bars supported upon the girder and arranged side by side transversely over the channeled side of the same, and forming with the girder an air duct, at least one of said trunnions having a longitudinal inlet passage opening at its inner end into the adjacent end of the channel of the girder.

13. In a furnace, the combination with an endless traveling grate, of a pivotally supported metal closure or gate located over the rear end of the grate, and comprising a girder, and a plurality of protecting bars arranged side by side transversely of the front face of the girder, said bars being hung at their upper ends on the girder, and the alternate bars having loose connection with the girder, permitting swinging movement of their lower ends relatively to the girder and the intermediate bars.

14. In a furnace, the combination, with an endless traveling grate, of a pivotally supported metal closure or gate located over the rear end of the grate, and comprising a girder, and a plurality of protecting bars arranged side by side transversely of the front side of the girder; said bars being hung at their upper ends on the girder, by loose connections affording limited swinging movement of the lower ends of all of the bars relatively to the girder, and a greater extent of swinging movement in the lower ends of the alternate bars than in the lower ends of the bars intermediate thereto.

15. In a furnace, the combination with the masonry side walls thereof and an endless traveling grate, of a metal closure or gate located above the rear end of the grate, comprising a girder provided at its ends with trunnions by which it is pivotally supported, and a plurality of metal protecting bars supported upon and extending transversely of said girder, said girder and protecting bars being constructed to provide between them an air duct, and at least one of said trunnions being provided with an air inlet passage in connection with said air duct, and metal bearing blocks for said trunnions, mounted in said side walls at a distance outwardly from the inner faces thereof.

16. In a furnace, the combination with an endless traveling grate, of a metal closure or gate pivotally mounted over the rear end of the grate and comprising a girder and a plurality of metal protecting bars, said girder and bars being constructed to provide between them a longitudinal air duct.

In testimony, that I claim the foregoing as my invention I affix my signature in the presence of two witnesses, this 9th day of May A. D. 1911.

JOSEPH HARRINGTON.

Witnesses:

C. CLARENCE POOLE,
GEORGE R. WILKINS.