

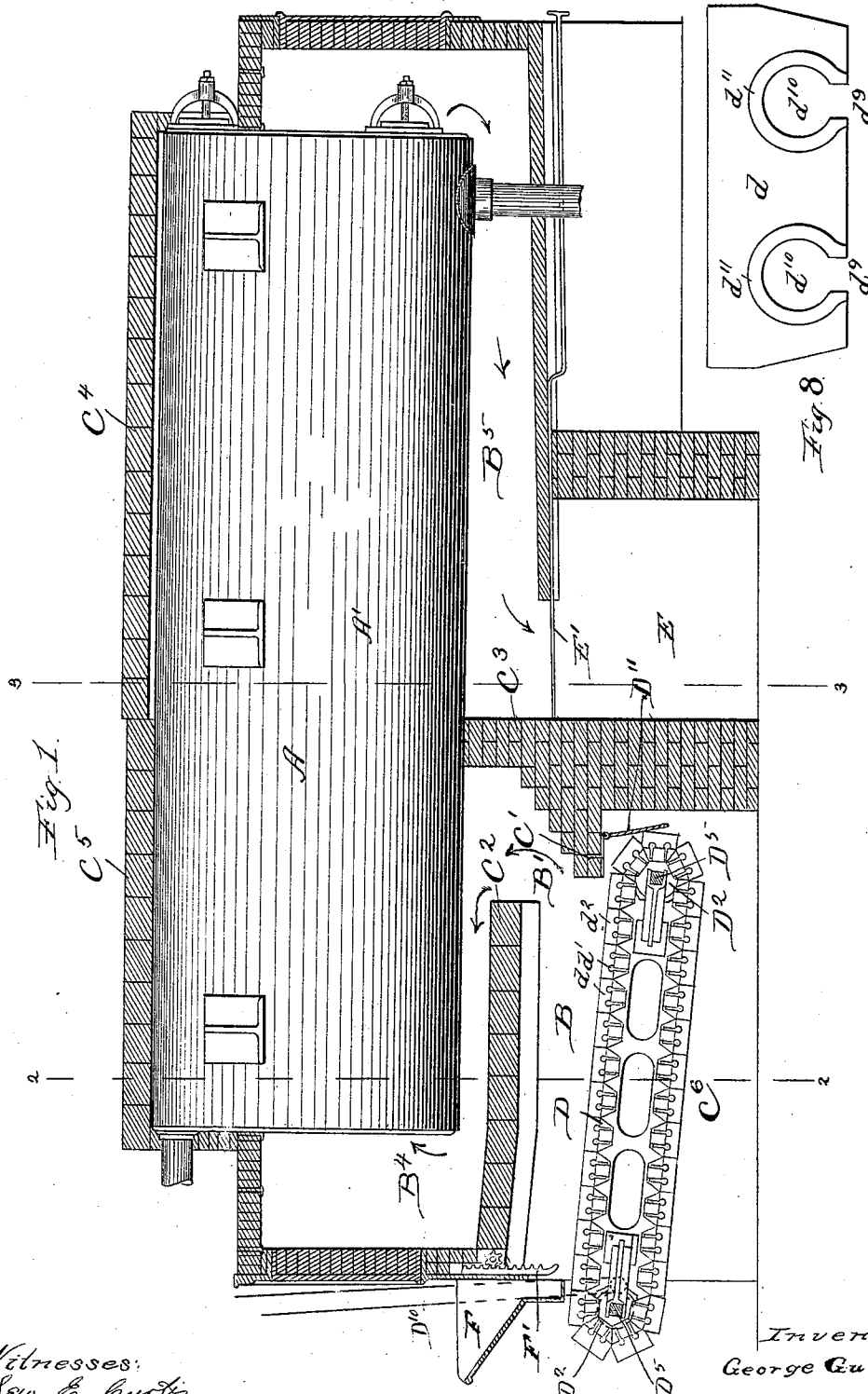
(No Model.)

4 Sheets—Sheet 1.

G. GULICKSON.
SELF FEEDING SMOKELESS FURNACE.

No. 520,986.

Patented June 5, 1894.



Witnesses:
Sew. E. Curtis
Emmanuel Stark

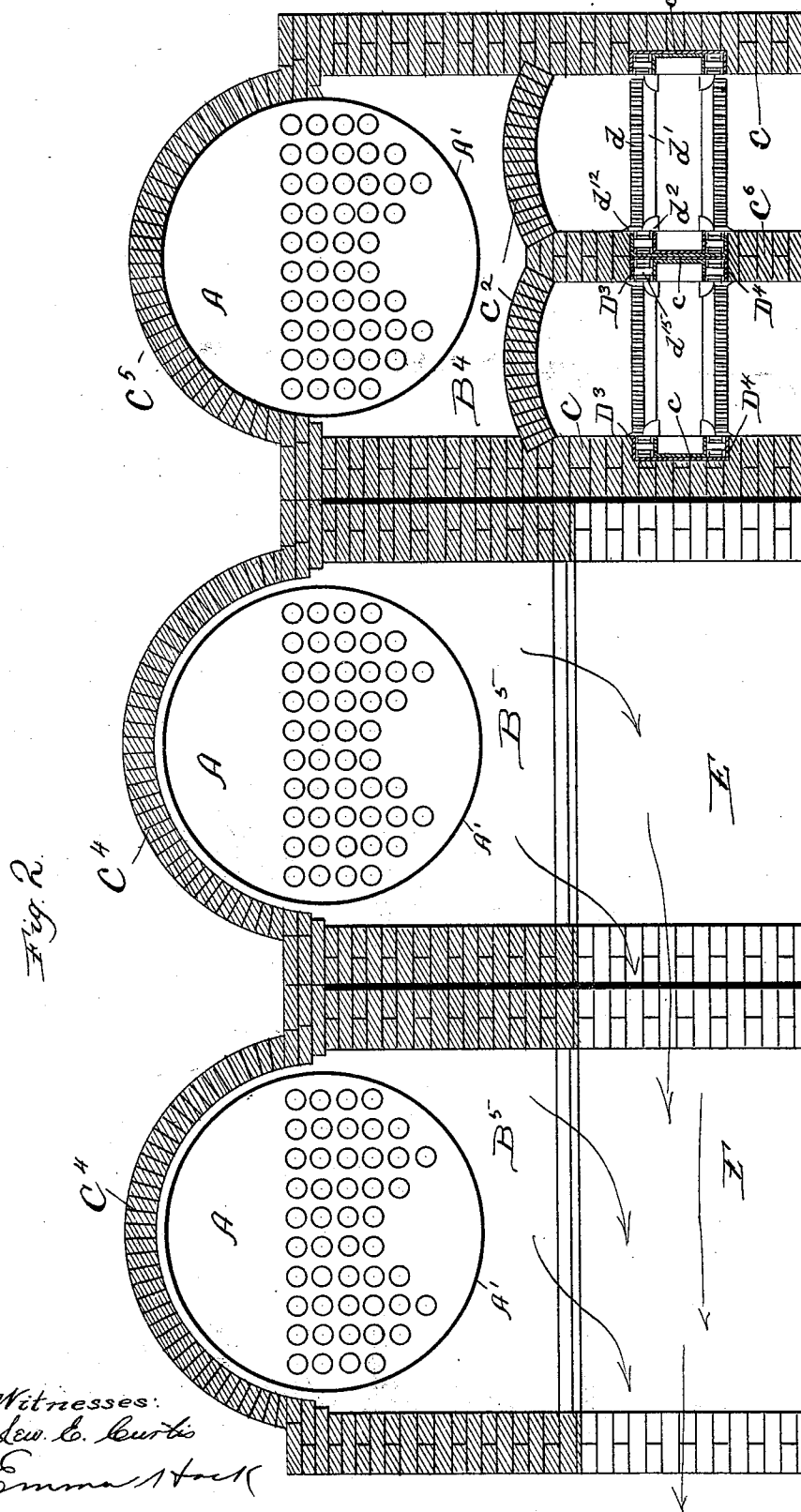
Inventor:
George Gulickson.

By Munday, Watts & Holcomb
His Attorneys

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Witnesses:
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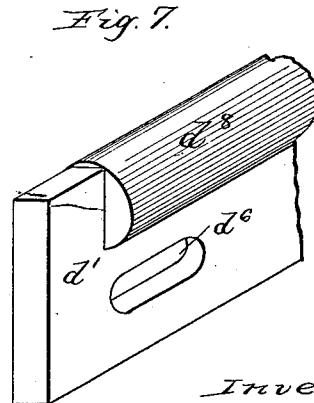
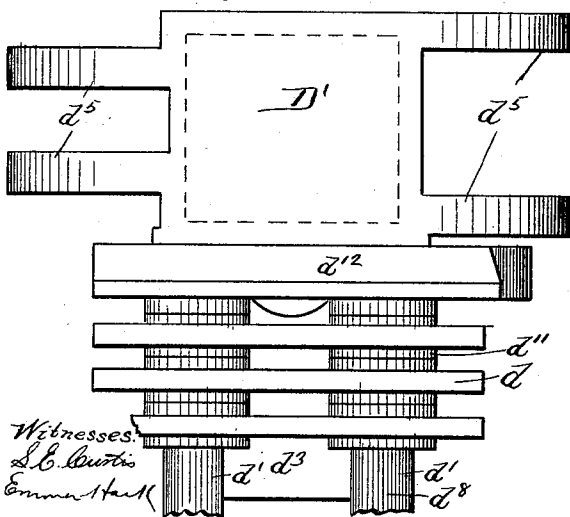
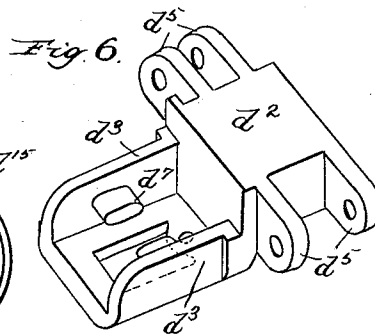
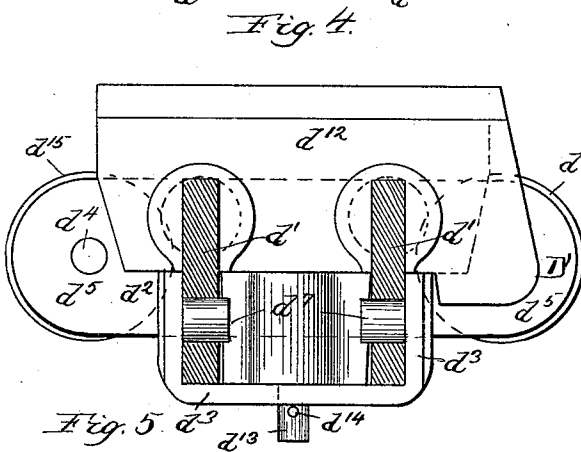
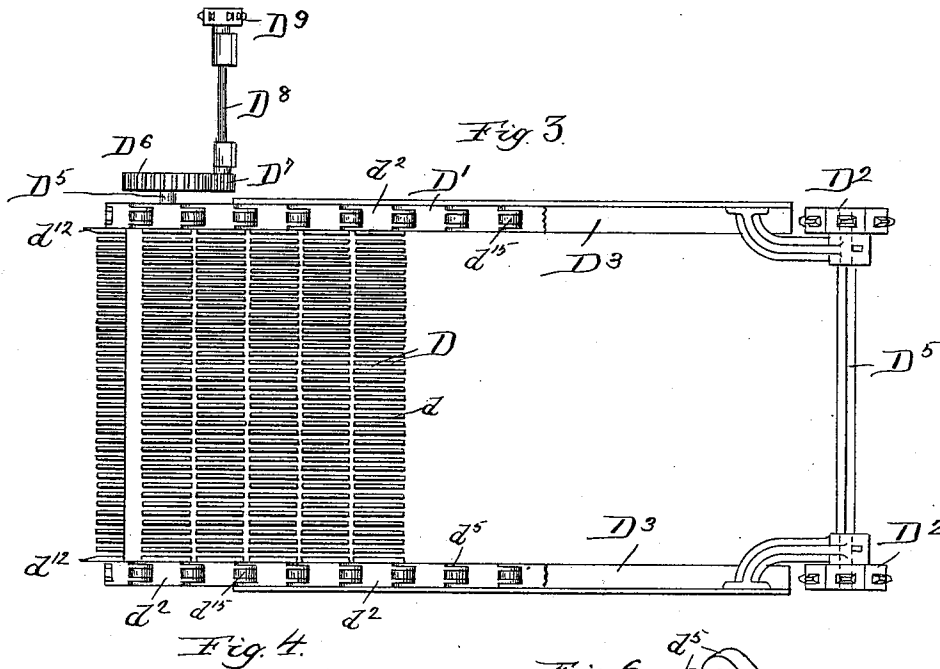
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G. GULICKSON.
SELF FEEDING SMOKELESS FURNACE.

No. 520,986.

Patented June 5, 1894.



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(No Model.)

4 Sheets—Sheet 4.

G. GULICKSON.
SELF FEEDING SMOKELESS FURNACE.

No. 520,986.

Patented June 5, 1894.

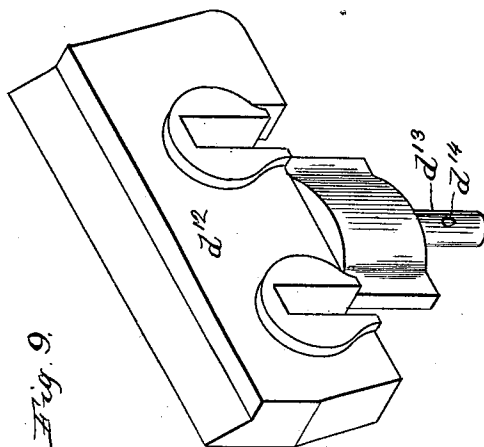


Fig. 9.

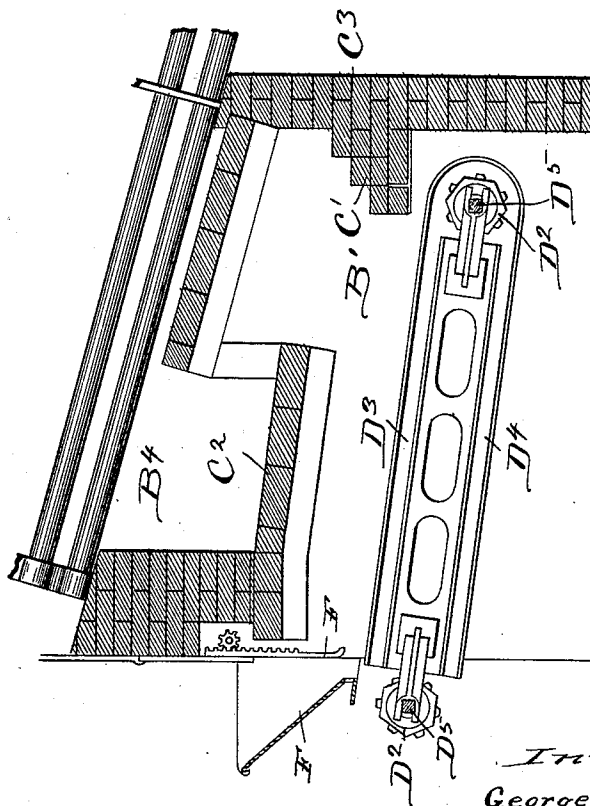


Fig. 10.

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UNITED STATES PATENT OFFICE.

GEORGE GULICKSON, OF CHICAGO, ILLINOIS.

SELF-FEEDING SMOKELESS FURNACE.

SPECIFICATION forming part of Letters Patent No. 520,986, dated June 5, 1894.

Application filed February 23, 1892. Serial No. 422,375. (No model.)

To all whom it may concern:

Be it known that I, GEORGE GULICKSON, a citizen of the United States, residing in Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Self-Feeding Smokeless Furnaces, of which the following is a specification.

My invention relates to furnaces for steam boilers.

10 The object of my invention is to provide a steam boiler furnace of a simple and economical construction, by means of which a uniform and complete combustion of the fuel may be secured and the heat utilized in the
15 production of steam without the production of smoke.

My invention consists in the novel devices and novel combinations of parts and devices herein shown and described.

20 In the accompanying drawings I have illustrated a device embodying my invention, and which I believe to be the best mode now known to me for practicing the same.

In said drawings, which form a part of
25 this specification, Figure 1 is a vertical central sectional view of said device. Fig. 2 is a cross sectional view taken in part on the line 2—2 of Fig. 1 and in part on the line 3—3 of Fig. 1. Fig. 3 is a partial plan view of
30 one of the traveling grates. Fig. 4 is an enlarged detail sectional view of the grate. Fig. 5 is an enlarged plan view of one of the links of the grate. Fig. 6 is a perspective view of one of the hinge links. Fig. 7 is a perspective
35 view of one of the cross bars which support the grate bars. Figs. 8 and 9 are detail views of one of the end grate bars of each link, and Fig. 10 illustrates a modification in which the invention is applied to a water
40 tube boiler, as contradistinguished from a tubular boiler, as illustrated in the other figures.

The same reference letters are employed to indicate the same parts in all the figures.

45 In said drawings A represents the boiler, A' its shell, B the furnace, C the furnace walls, D the grate, E the exit or smoke flue and F the fuel hopper or feed device.

In the drawings a battery of three boilers
50 and furnaces are represented as being arranged parallel to each other, but any greater

or less number may be employed as desired, or as occasion may require.

The grate D is a traveling grate, composed of a number of separate links D', connected
55 together and mounted upon sprocket wheels or rollers D² and traveling upon suitable tracks or guide ways D³ D⁴, which extend between the sprocket wheels or rollers. The guide ways or tracks D³ D⁴, one for the upper
60 and one for the lower loop of the link chain grate are fixed in suitable recesses c in the furnace walls C. Each link D' of the link chain grate is composed of a series of parallel short grate bars d, supported upon a pair
65 of cross bars d' d', which are connected at each end and supported by the hinge links d² of the chain. The hinge links d² have projections or brackets d³ to receive the cross bars d'. The hinge links d² are hinged or
70 pivoted together by pivot bolts d⁴ which pass through the ears d⁵ of said hinge links. The cross bars d' are furnished with openings d⁶ to receive the lugs d⁷ which are cast upon the brackets d³ on the hinge links, whereby
75 the cross bars d' are held in place in connection with the grate bars d supported on the cross bars d'. The cross bars d' consist of vertical webs furnished with a thickened bearing rib d⁸ at its upper edge, preferably of
80 a round, or substantially round form. This thickened rib d⁸ extends nearly to the end of the bar d', but not quite, space being left at the end to permit the insertion of the grate bars d in place through the slot d⁹, leading to
85 the eye or bearing hole d¹⁰ in each of said grate bars d. In addition to the eyes d¹⁰ and slot d⁹ the grate bars are each furnished with bosses d¹¹, one on each side of each eye, the purpose of which is to keep the grate bars d
90 a proper distance apart on their supporting cross bars d'. It will be observed that in putting the links of the grate bars together the two cross bars d' d' of each link are first put in place on the brackets d³ of the hinge links
95 d², and then the series of grate bars d inserted at the end on the cross bars d' and slipped endwise along the same in place. The grate bars d thus serve to lock or hold the cross bars d' in place on the lugs d⁷ of the brackets d³. Each link D' of the grate is also furnished with two side or extreme grate bars

d^{12} d^{12} which are wider or deeper than the other grate bars and thus serve as side flanges for the grate as a whole, thereby keeping the fuel off the hinge links. The side flange grate bars d^{12} also serve to fill up the space at the extreme ends of the cross bars d' . These side flange grate bars d^{12} are each furnished with a projecting pin or lug d^{13} which projects through the bracket d^3 on the hinge link and is secured in place by a key d^{14} which passes through the same. The sprocket wheels D^2 upon which the hinge links d^2 travel, are secured to shafts D^5 which are journaled in suitable bearings supported in the furnace walls C , and a slow traveling movement is imparted to the grate bars from any suitable countershaft or source of power through the intermeshing gears D^6 D^7 , shaft D^8 , sprocket wheel D^9 and belt or chain D^{10} . Or a slow traveling movement may be imparted to the grate by any other suitable means. This slow traveling movement of the grate, in connection with the feed hopper F which is furnished with an adjustable gate or slide F' , serves to feed or supply the fuel to the grate or furnace in a uniform and regular manner, so that the fuel at the extreme front end of the furnace may always be in a state of gradual and slow ignition, while that at the middle and back portions of the grate may be at a high heat and in a state of rapid combustion, while that at the extreme back end of the grate may be simply in the form of residue or ash. By this means not only is the fuel fed uniformly and evenly and at a proper rate to the furnace to produce the required amount of heat or power, and the grate is also caused to keep itself clean and in the best condition for proper combustion of the fuel, but also any smoke which may be caused by the uniform slow and regular ignition of fresh fuel near the front end of the grate is caused to pass over the high heated fuel at the rearward portions of the grate and thus be completely consumed and utilized.

D^{11} is a hinged gate or guard supported from an arch C' which projects over the rear end of the traveling grate. This guard or gate serves to prevent the too free passage of air around the end of the grate or to regulate the quantity of air that may be here admitted to insure a more thorough and complete combustion of the products in their further passage through the furnace and boiler.

C^2 is an arch projecting over the grate D and extending to near the rear end of the same, a passage B' being left between the end of the arch C^2 and the opposing arch C' . The arch C' is lower than the arch C^2 and the former arch is furnished with an inclined or shelving upper surface, preferably about as shown in Fig. 1.

C^3 is a cross or division wall of the furnace at the rear end of the grate D and from which the arch C' projects. This cross wall C^3 extends up to the boiler and divides the fur-

nace space surrounding the boiler into two compartments B^4 and B^5 . The space B^4 at the front end of the boiler communicates directly with the furnace space proper B , between the grate D and arch C^2 through the passage B' . And the furnace space B^5 communicates with the furnace space B^4 of the boiler. The exit flue E extends preferably out horizontally and transversely below the boiler and at about the middle of the furnace, as is clearly indicated at Figs. 1 and 2. A damper or slide E' regulates the opening between the exit flue E and the rear compartment B^5 of the furnace space. The non-conducting wall or covering arch C^4 at the top of the boiler is somewhat raised above the boiler shell at the rear compartment B^5 , so that the heat space B^5 may completely surround the boiler at its rear end, as is clearly indicated in Fig. 1 and in Fig. 2 at the left hand boilers. But the covering wall or arch C^5 at the front end of the boiler should be set snug against the boiler shell, as is clearly indicated in Fig. 1 and also in Fig. 2, at the right hand boiler. Under each boiler I provide, or prefer to provide, two traveling grates D , the two being separated by a divisional wall C^6 .

The operation will be readily understood by those skilled in the art. The arrows at Fig. 1 indicate the directions the products of combustion pass in their way through the furnace and boiler. By reason of the arches C^2 around the ends of which the products of combustion pass, and by reason of the cross wall C^3 , it will be observed that the heat and products of combustion are deflected or projected directly against the boiler shell at or near its middle portion, then lapping around the front end of the boiler shell they pass through the tubes of the boiler and thence into the rear furnace space or compartment B^5 and lap around the rear end of the boiler shell, and thence pass out through the exit flue. By this means, in connection with the slow uniform and regular manner in which the fuel is fed or supplied the furnace and the grate kept always in a clean and proper condition for the admission of air or oxygen to the bed of fuel in process of combustion by reason of the automatically traveling grate, in combination with the feed hopper, I secure a most thorough and complete combustion of the fuel, and also a complete absorption or utilization of the heat units developed, and this too without the production or escape of smoke in the exit flue, and the waste of fuel incident thereto.

The hinge links d^2 are each furnished with friction wheels or rollers d^{15} that travel upon the guide ways or tracks D^3 D^4 .

I claim—

1. The combination with a feed hopper of a traveling grate, a furnace B having forward and rear compartments B^4 and B^5 surrounding the boiler and separated by a cross wall near the middle portion of the boiler, said

furnace being also furnished with an arch projecting between the grate and the boiler, and having a passage B' for the products of combustion around the rear end of said arch, and an exit flue connecting with the rear compartment of said furnace, substantially as specified.

2. The combination with a feed hopper of traveling grate, a furnace B having forward and rear compartments B⁴ and B⁵ surrounding the boiler and separated by a cross wall near the middle portion of the boiler, said furnace being also furnished with an arch projecting between the grate and the boiler, and having a passage B' for the products of combustion around the rear end of said arch and an exit flue connecting with the rear compartment of said furnace, said transverse division wall having an arch projecting over the rear end of the grate, substantially as specified.

3. The combination with a feed hopper of a traveling grate, a furnace B having forward and rear compartments B⁴ and B⁵ surrounding the boiler and separated by a cross wall near the middle portion of the boiler, said furnace being also furnished with an arch projecting between the grate and the boiler, and having a passage B' for the products of combustion around the rear end of said arch and an exit flue connecting with the rear compartment of said furnace, said exit flue extending out transversely and horizontally beneath said rear compartment of the boiler, substantially as specified.

4. The combination with a feed hopper of a traveling grate, a furnace B having forward and rear compartments B⁴ and B⁵ surrounding the boiler and separated by a cross wall near the middle portion of the boiler, said furnace being also furnished with an arch projecting between the grate and the boiler, and having a passage B' for the products of combustion around the rear end of said arch, and an exit flue connecting with the rear compartment of said furnace, and means for automatically and uniformly propelling said traveling grate, substantially as specified.

5. A traveling grate, comprising a series of links each composed of a number of short parallel bars *d* supported on a pair of cross bars *d'* connected to a series of hinge links *d²*, substantially as specified.

6. A link chain grate, each link of which comprises a series of short parallel grate bars *d*, cross bars *d'* for supporting said grate bars *d*, and hinge links *d²* furnished with brackets *d³* for supporting said cross bars *d'*, substantially as specified.

7. A link chain grate, each link of which comprises a series of short parallel grate bars *d*, cross bars *d'* for supporting said grate bars *d*, and hinge links *d²* furnished with brackets *d³* for supporting said cross bars *d'*, said cross bars *d'* having rounded or thickened bearing ribs *d⁸*, and said grate bars having slotted eyes *d⁹* *d¹⁰*, substantially as specified.

8. A link chain grate, each link of which comprises a series of short parallel grate bars *d*, cross bars *d'* for supporting said grate bars *d*, and hinge links *d²* furnished with brackets *d³* for supporting said cross bars *d'*, said bars *d'* having openings *d⁶*, and said brackets *d³* having lugs *d⁷* entering said openings *d⁶*, substantially as specified.

9. A link chain grate, each link of which comprises a series of short parallel grate bars *d*, cross bars *d'* for supporting said grate bars *d*, and hinge links *d²* furnished with brackets *d³* for supporting said cross bars *d'*, said cross bars *d'* having rounded or thickened bearing ribs *d⁸*, and said links having slotted eyes *d⁹* *d¹⁰*, said cross bars *d'* having openings *d⁶*, and said brackets *d³* having lugs *d⁷*, entering said openings *d⁶*, substantially as specified.

10. The combination with the sprocket wheels D² and guide ways or tracks D³ D⁴, of a link chain grate D comprising a series of links D', each consisting of a number of short parallel grate bars *d*, cross bars *d'* and hinge links *d²*, substantially as specified.

11. The combination with the sprocket wheels D² and guideways or tracks D³ D⁴, of a link chain grate D comprising a series of links D', each consisting of a number of short parallel grate bars *d*, cross bars *d'* and hinge links *d²*, and a feed hopper F furnished with a gate or slide F', substantially as specified.

12. The combination with the sprocket wheels D² and guide ways or tracks D³ D⁴, of a link chain grate D comprising a series of links D', each consisting of a number of short parallel grate bars *d*, cross bars *d'*, hinge links *d²*, a feed hopper F, boiler A, furnace B having forward and rear compartments B⁴ B⁵ separated by a transverse division wall C³, said furnace also having opposing arches C' C², substantially as specified.

13. The combination with the sprocket wheels D² and guide ways or tracks D³ D⁴, of a link chain grate D comprising a series of links D', each consisting of a number of short parallel grate bars *d*, cross bars *d'*, hinge links *d²*, a feed hopper F, boiler A, furnace B having forward and rear compartments B⁴ B⁵ separated by a transverse division wall C³, said furnace also having opposing arches C' C², the heat space B⁵ of said rear compartment surrounding the boiler at the top, substantially as specified.

14. The combination of the boiler A with the furnace B having forward and rear compartments B⁴ B⁵, separated by a transverse division wall C³, and provided with an arch C² projecting over the grate to near the rear end of the same and around which arch the flame and products of combustion pass, said compartment B⁵ being below the rear end of the boiler and communicating with the front compartment B⁴ through the boiler substantially as specified.

15. The combination of the boiler A with the furnace B having forward and rear compartments B⁴ B⁵, separated by a transverse

division wall C³, and provided with an arch C² projecting over the grate to near the rear end of the same and around which arch the flame and products of combustion pass, and
5 an opposite and lower arch C' projecting from said transverse wall C³ over the rear end of the grate, substantially as specified.

16. The combination of the boiler A with the furnace B having forward and rear compartments B⁴ B⁵, separated by a transverse division wall C³, and provided with an arch C² projecting over the grate to near the rear end of the same and around which arch the flame and products of combustion pass, an
15 opposite and lower arch C' projecting from said transverse wall C³ over the rear end of the grate, and an exit flue E furnished with a slide or damper E' and extending beneath said rear compartment B⁵, substantially as
20 specified.

17. The combination of the boiler A with

the furnace B having forward and rear compartments B⁴ B⁵, separated by a transverse division wall C³, and provided with an arch C² projecting over the grate to near the rear
25 end of the same and around which arch the flame and products of combustion pass, an opposite and lower arch C' projecting from said transverse wall C³ over the rear end of the grate, and a gate or guard D¹, substantially
30 as specified.

18. A traveling grate comprising a series of links each composed of a number of short parallel bars *d* supported on a pair of cross bars *d'* connected to a series of hinged links
35 *d*², said links being provided with rollers or wheels, in combination with a track, substantially as specified.

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Witnesses:

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