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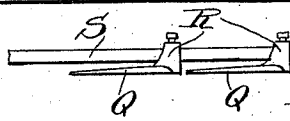
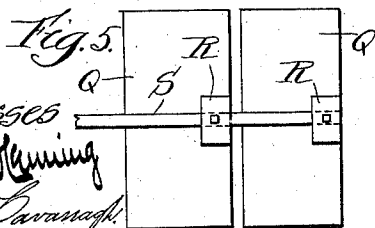
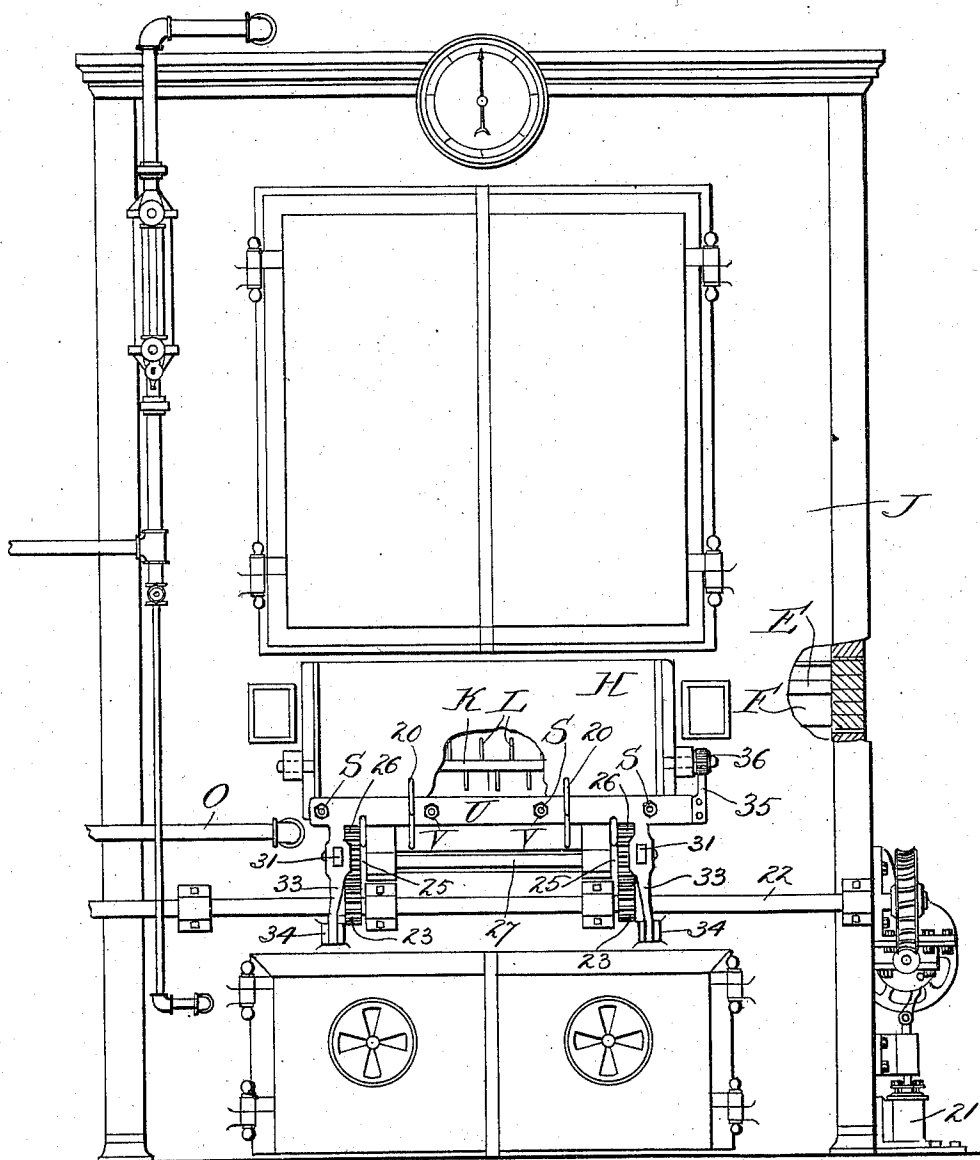
2 Sheets—Sheet 1.

W. H. PEARCE.
BOILER FURNACE.

No. 576,470.

Patented Feb. 2, 1897.

Fig. 1.



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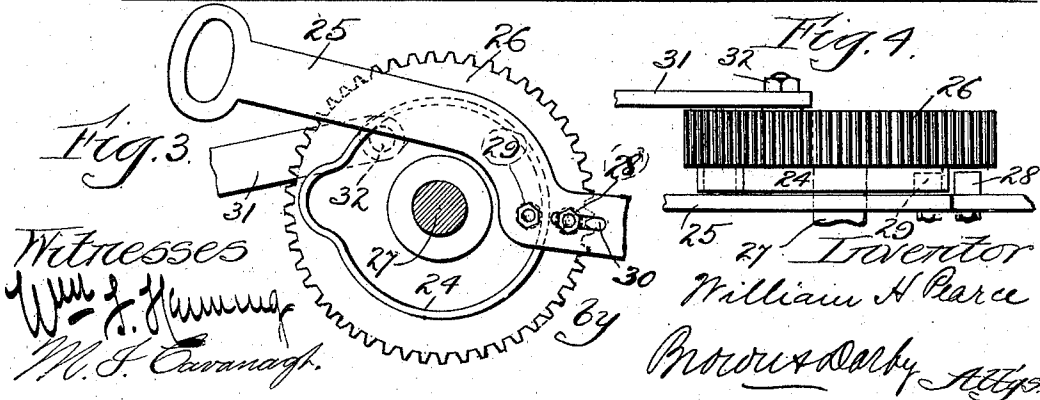
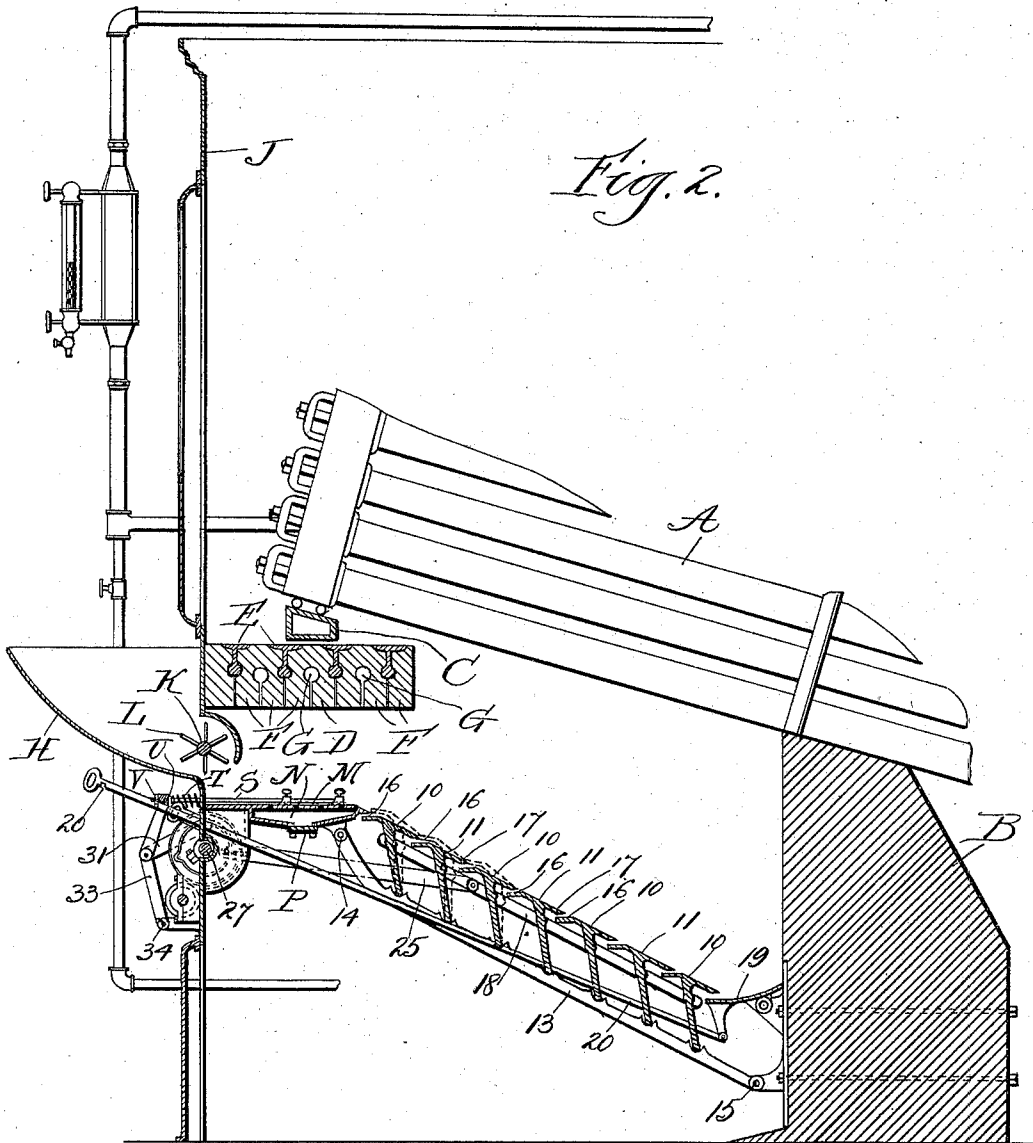
(No Model.)

2 Sheets—Sheet 2.

W. H. PEARCE.
BOILER FURNACE.

No. 576,470.

Patented Feb. 2, 1897.



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UNITED STATES PATENT OFFICE.

WILLIAM H. PEARCE, OF CHICAGO, ILLINOIS.

BOILER-FURNACE.

SPECIFICATION forming part of Letters Patent No. 576,470, dated February 2, 1897.

Application filed May 23, 1896. Serial No. 592,722. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. PEARCE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Boiler-Furnace, of which the following is a specification.

This invention relates to furnaces for steam-boilers.

10 The object of the invention is to provide a furnace for steam-boilers which is simple in construction and thoroughly efficient in operation.

15 A further object of the invention is to provide a furnace for steam-boilers wherein the products of the combustion of the coal is thoroughly consumed, thereby rendering the furnace practically smokeless.

20 A further object of the invention is to provide a furnace wherein the feed of the fuel is positive and automatic.

25 A further object of the invention is to provide an arrangement wherein the bed of fuel occupies a position close to the boiler, whereby the greatest amount of heat is utilized and made more effective in the production of steam.

30 A further object of the invention is to provide a construction wherein the renewal of the arch is facilitated.

35 A further object of the invention is to provide a grate arranged to present practically a plane surface to the bed of coal, thereby avoiding projecting surfaces, which are rapidly burned off.

A further object of the invention is to provide a construction wherein sifting of unconsumed portions or particles is avoided.

40 Other objects of the invention will appear more fully hereinafter.

45 With these objects in view the invention consists substantially in the construction, combination, location, and relative arrangement of parts, all as will be more fully hereinafter set forth, as shown in the accompanying drawings, and finally pointed out in the appended claims.

Referring to the accompanying drawings and to the various views and reference-signs appearing thereon, Figure 1 is a view in front elevation of a steam-boiler furnace, parts being broken out, embodying the principles of

my invention. Fig. 2 is a vertical longitudinal sectional view of the same. Fig. 3 is a detached detail view, in side elevation, illustrating a form of apparatus for effecting a positive and automatic feed of the fuel. Fig. 4 is a plan view of the same. Fig. 5 is a plan view of the fuel-feeding shovels. Fig. 6 is a side view of the same.

The same part is designated by the same reference-sign wherever it occurs throughout the several views of the drawings.

In the accompanying drawings, reference-sign A designates the steam-boiler, which may be of water-tube or tubular form, as shown, or of any other convenient or well-known form, and suitably supported in any convenient manner, as the usual brick or masonry work B and the supporting-beam C.

60 Adjacent to the front end of the boiler A and in proximity to the front wall of the furnace-chamber I arrange the fire-arch D. This fire-arch is peculiarly constructed with special reference to securing economy in the consumption of coal, efficiency in effecting a consumption of the products of combustion, and facility in feeding the fuel to the furnace and in the arrangement of the bed of fuel in close proximity to the surface to be heated and to the facility of renewal and repairs. In order to secure these desirable ends, I removably mount in the side walls of the furnace-chamber the straight parallel flanged rails or bars E, and I string thereon the fire-bricks F, shaped to fill the spaces between the webs and flanges of adjacent rails E, by which said fire-bricks are supported. The fire-bricks F are provided with channels or passages G for the circulation of air-currents. By this construction it will be seen that the under surface of the arch lies in a single horizontal plane, and hence I am enabled to effect a feeding of the fuel to the furnace-chamber at a point nearer to the boiler to be heated than would be possible otherwise. It will also be seen that in case the fire-bricks burn out on account of the intense heat to which they are subjected an easy renewal thereof may be readily effected by withdrawing endwise one or more of the supporting-rails E through the opening provided for that purpose in the side walls of the furnace, as indicated in Fig. 2, and stringing new fire-brick upon such sup-

porting-rails, as will be readily seen and understood.

I will now describe the construction for feeding the coal to the furnace-chamber.

5 Suitably supported upon the front of the furnace-chamber is a hopper H, adapted to receive the coal to be fed to the furnace-chamber and having its outer wall curved downwardly and inwardly toward the aperture or
10 opening in the front wall J of the furnace, through which the coal passes into the furnace-chamber. It frequently occurs when the receiving-hopper H is filled that the coal clogs itself therein and is thereby prevented from
15 feeding freely into the furnace-chamber. The coal thus clogged may be loosened by a blow upon the outside of the hopper; but it may occur that through the inattention of the fireman the clog is not observed. It is therefore
20 of importance to provide some means by which the clogging of the coal is automatically prevented. I accomplish this result by mounting in the aperture forming the communication between the hopper H and the furnace-chamber a revoluble shaft, cylinder, or drum K,
25 having a series of radiating arms L mounted thereon. Now by imparting to the shaft or cylinder K an intermittent or periodic rotation the arms L effect such an agitation of
30 the coal at the base of the pile contained in the hopper as to prevent the coal from clogging up the passage, thereby permitting a constant and free feed of the coal into the furnace-chamber.

35 I will presently describe more fully the construction and arrangement of apparatus for actuating the shaft or drum K intermittently or periodically.

It will be observed that the curvature of
40 the outer wall of the hopper downwardly and inwardly toward the furnace-chamber assists in destroying the tendency of the coal to clog up and also coöperates with the agitating-drum to the same effect.

45 From the hopper H the coal is delivered upon a flat platform M within the furnace-chamber, where it piles up and from which it is fed to the grate-bars, as will be presently more fully explained.

50 From the foregoing description it will be seen that in my peculiar construction and arrangement I am enabled to provide the platform or receiving-table H with a flat horizontal surface the entire length thereof, and by constructing the fire-arch D with the fire-bricks
55 F thereof presenting an under surface, which also lies in a horizontal plane, a uniform distance between the platform M and the fire-brick is maintained throughout, thereby enabling me to bring the pile of coal in closer
60 proximity to the boiler to be heated than would be possible otherwise.

Immediately underneath the coal-receiving platform M is arranged an air box or chamber
65 N, into which a draft of air may be forced from any suitable source and in any suitable manner, as through pipe O, and the top wall

of such chamber, which is the coal-receiving platform M, is suitably perforated, as shown, to permit the air to be forced into and through
70 the pile or bed of coal supported upon the platform M. Any ashes, dirt, or dust which may fall into the air-chamber N may be readily removed therefrom by removing the plate P from the bottom thereof, as will be readily
75 understood.

From the foregoing description it will be seen and understood that the greatest amount of heat of the coal supported upon the receiving-platform M is at the top of the pile or heap
80 which is in closest proximity to the under surface of the fire-bricks F, and, as will be understood by persons familiar with the art, these bricks are maintained at a very high temperature. Now the fresh or green coal supplied to
85 the furnace is introduced at a point forming the base of the heap or pile, and hence the smoke and unburned particles of carbon rising therefrom is of necessity compelled to pass through or over the entire bed of the fuel superimposed thereon and which, as above explained, increases in the degree of heat generated thereby toward the top of such pile or
90 heap, the said smoke and unburned particles of carbon being supplied with oxygen to effect its complete combustion and consequent consumption from the air introduced from or
95 through the air box or chamber N. If such smoke and unburned carbon is not consumed and destroyed while passing through the constantly-increasing heat of the pile as it rises through such pile, it is completely and effectively consumed when it comes into contact with the intensely-heated fire wall or brick F in the presence of the air admitted through
105 perforations G.

It is important to provide means for positively feeding the coal from the platform or receiving-table M to and upon the grate-bars. I therefore mount a series of shovel-shaped
110 plates Q upon such platform to slide or reciprocate thereon and having the thinner edge thereof presented toward the outer or front wall J of the furnace-chamber. These plates or shovels Q, more clearly shown in Fig. 6,
115 are provided with bosses or thimbles R, by which they are held upon a rod S. By reciprocating or moving the rods S toward the front wall J of the furnace-chamber the plates slide underneath the pile or stream of increasing
120 fresh or green coal, and upon the movement of said rods in the opposite direction said coal is carried or fed forward onto the grate-bars. In the form shown, to which, however, I do not desire to be limited or restricted, I provide four such rods S, (see Fig. 1,) and I
125 mount two shovels or plates Q upon each rod S. In order to prevent breakage of the parts in case lumps or particles of coal should fall between the outer edge of the plates Q and
130 the inner surface of the wall J, I mount the rods S to be reciprocated outwardly through a yielding resistance secured through a suitable spring T, interposed between a collar

carried by said rod and the bar or plate V, by which said rods are reciprocated. The nuts V serve to adjust the tension of said spring. I will presently describe more fully the arrangement of gearing for imparting to said rods S their reciprocating movements.

I will now describe the construction, function, and mode of operation of the grate-bars.

From the platform or table M the coal is delivered upon the top surface of the grate-bars 10 11. In order to facilitate the feed of the coal down the surface formed by the grate-bars, I preferably arrange the top surface of such grate-bars upon a downward incline from the delivery end or edge of the platform. I therefore mount a supporting-bracket 13, with its front end arranged to be supported upon a convenient part of the framing, say the casing forming the air box or chamber N, as indicated at 14, and arrange such box or support on a downward incline therefrom and support the opposite end thereof in a convenient part of the masonry or brickwork B, as at 15. Upon the supporting-bars 13 the grate-bars 10 11 are pivotally supported. Each grate-bar is provided with a portion 16, presenting a flat surface, and a portion 17, presenting a rearwardly-inclined surface when the grate-bar is in its normal position, as clearly shown in the drawings. A bar 18 is arranged to pivotally connect two or more of the grate-bars. In the form shown, to which, however, I do not desire to be limited or restricted, each alternate grate-bar is coupled to rock in unison through the bar 18. By reciprocating the bar 18 endwise it will be seen that these grate-bars, which are connected to said bar 18, are rocked about their pivots and in the direction of the incline upon which the top or supporting surfaces of such grate-bars are arranged, as indicated in lines in Fig. 2. By reason of the fact that the extreme lower end of the portion 17 of the grate-bar moves on a shorter radius about the pivot of the grate-bar than the upper portion 16 of such bar, it will be observed that the top surface of the grate-bar or at least that inclined portion 17 thereof imparts a pushing effect to the bed of coal supported thereby, and hence urges or positively feeds the coal down the inclined surface of the grate. It will also be seen that the toe or extreme lower tip of the inclined portion 17 of the grate-bar when said grate-bar is rocked effects a scraping of the flat portion 16 of the grate-bar immediately below it, thereby clearing out any particles of coal, clinker, or ashes that may accumulate upon such flat portion, and hence maintaining a free air-space between adjacent grate-bars.

Suitably pivoted at the extreme lower end of the grate-surface upon the adjacent brick or masonry work B is the ash-dump 19. A rod 20 is connected to such dump 19, and extending forwardly with its outer end projecting through the front wall J of the furnace-chamber affords means for dropping said

dump to remove the ashes collected therein. The rods 20 pass through suitable openings in the wall J and are notched at suitable points, whereby they may be maintained in position to hold the ash-dump 19 in elevated position, as shown in Fig. 2, or in the lowered or tilted position, as will be readily understood.

I will now describe an illustrative form of means for actuating positively and automatically the several movable parts, as above indicated.

Any suitable form of motor 21 is arranged to effect a continuous rotation of a shaft 22 through suitable gearing, as shown in Fig. 1. Upon shaft 22 is mounted gears 23, arranged to mesh with and drive gears 26 upon a shaft 27. Upon the face of the gears 26 is formed a cam-flange 24, as clearly shown in Fig. 3. A bar or link 25 is pivotally connected at its inner end to bar 18 and is arranged to engage the cam-flange 24. A convenient arrangement of such engagement is to provide said link 25 with rollers 28 29, arranged to receive the cam-flange 24 therebetween. From this construction it will be seen that when said gear 26 is rotated the cam-flange 24 thereon effects a reciprocation of link 25, which in turn imparts a reciprocating movement to bars 18, and hence effects a periodic rocking of the grate-bars, as above explained. By providing one or more pairs of such links 25 and bars 18 and relatively timing the action and operation of the cams 24, I thus secure a rocking or pushing movement of the entire grate-surface, and hence an efficient feed of the coal. The degree to which the grate-bars are rocked may be rigidly adjusted by adjusting the rollers 28 29 relative to each other, as by mounting one of said rollers in a slot 30 in said link 25.

To the opposite face of the gears 26, and eccentrically with reference to the axis of rotation thereof, I pivotally connect, as at 32, one end of an arm or link 31 and I connect the outer end of such link to a lever 33, which is pivotally mounted, as at 34, upon a convenient portion of the framework. The levers 33 are connected to or form part of the bar or plate V, above mentioned. Therefore when the gears 26 are rotated a lateral vibration or movement is imparted to said bar or plate V, and hence therethrough a reciprocation is imparted to rods S, upon which the shoes or plates Q are carried, as above explained.

The plate or bar V is provided with an arm or pawl 35, arranged to engage a ratchet-wheel 36 upon the end of the shaft or cylinder K, whereby a periodic or intermittent rotation is imparted to said shaft to effect an agitation of the coal at the base of the hopper H.

Many variations and alterations in the details of construction and arrangement of parts would readily suggest themselves to persons skilled in the art and still fall within the spirit and scope of my invention. I do not desire, therefore, to be limited or restricted to the exact details shown and described; but,

Having now explained the nature and object of my invention and an operative embodiment thereof, and having explained the construction, function, and mode of operation thereof, what I claim as new and useful and of my own invention, and desire to secure by Letters Patent, is—

1. In a boiler-furnace, a furnace-chamber, a series of suspended supporting-rails arranged within said chamber and in the same horizontal plane and in advance of the front ends of the grate-surface, and removable bricks arranged to be supported by said rails, said bricks presenting a flat under surface; as and for the purpose set forth.

2. In a fire-arch for boiler-furnaces, a furnace-chamber, grate-bars arranged therein, a receiving-platform for the coal arranged in said chamber and in advance of the grate-bars, supporting-rails arranged within said chamber and above said platform and in advance of the grate-bars, and fire-bricks removably supported on said rails and arranged to present a flat under surface parallel with the supporting-surface of said platform; as and for the purpose set forth.

3. In a fire-arch for boiler-furnaces, a furnace-chamber, grate-bars arranged therein, a receiving-platform for the coal arranged in said chamber and in advance of the grate-bars, supporting-rails arranged above said platform parallel with each other and in a plane parallel with the supporting-surface of said platform, and fire-bricks removably supported on said rails and presenting an under surface parallel with the supporting-surface of said platform, said bricks provided with air-passages; as and for the purpose set forth.

4. In a boiler-furnace, the combination with grate-bars, a perforated platform arranged within the furnace-chamber and adapted to receive thereon the fresh or green coal, said grate-bars having their front ends arranged adjacent to the delivery edge of said platform and extending rearwardly therefrom upon a downward incline, an air-passage arranged adjacent to said platform and adapted to deliver air to the coal supported on said platform through said perforations; as and for the purpose set forth.

5. In a boiler-furnace, the combination with the grate-bars, a perforated platform arranged within the furnace-chamber and adapted to receive thereon the fresh or green coal, said grate-bars having their front ends arranged adjacent to the delivery edge of said receiving-platform and extending rearwardly therefrom upon a downward incline, an air-chamber arranged adjacent to said platform and adapted to deliver air to the coal supported on said platform through said perforations, said air-chamber provided with a removable plate; as and for the purpose set forth.

6. In a boiler-furnace, the combination with grate-bars, of a platform arranged within the furnace-chamber and in advance of the grate-

bars, said platform adapted to receive thereon the fresh or green coal supplied to said chamber, pushers arranged to reciprocate on said platform to positively feed the fresh or green coal from said platform to said grate-bars, a lever pivotally mounted at one end upon the front of the furnace-chamber and connected at the opposite end thereof to said pushers, and means, connected intermediate the ends of said lever, for rocking the same and actuating said pushers; as and for the purpose set forth.

7. In a boiler-furnace, the combination with the grate-bars, of a platform arranged in the furnace-chamber to receive thereon the fresh or green coal supply to said chamber, reciprocatory plates mounted on said platform to feed said coal, and means for actuating said plates; as and for the purpose set forth.

8. In a boiler-furnace, a platform arranged within the furnace-chamber, to receive thereon the fresh or green coal, shovel-shaped plates having their thin edges presented outwardly arranged to slide back and forth upon said platform to positively feed the coal to the grate-surface of the furnace, and means for reciprocating said plates against a yielding resistance; as and for the purpose set forth.

9. In a boiler-furnace, a series of pivotally-mounted grate-bars, each grate-bar provided with a flat portion and with a rearwardly-inclined portion, and means for rocking said grate-bars; as and for the purpose set forth.

10. In a boiler-furnace, a series of pivotally-mounted grate-bars arranged to present a continuously rearwardly-inclined grate-surface, and means for simultaneously rocking one or more of said grate-bars; as and for the purpose set forth.

11. In a boiler-furnace, a series of pivotally-mounted grate-bars, arranged with reference to each other to form air-spaces therebetween, and means for intermittently rocking one or more of said grate-bars; as and for the purpose set forth.

12. In a boiler-furnace, a series of pivotally-mounted grate-bars, each provided with a grate-surface having a flat horizontal portion and a rearwardly-inclined portion, bars connecting two or more of such grate-bars, and means for intermittently and positively reciprocating said connecting-bars endwise; as and for the purpose set forth.

13. In a boiler-furnace, a shaft, means for rotating said shaft, cams mounted on said shafts, a series of pivotally-mounted grate-bars arranged to present a flat rearwardly-inclined surface, and means actuated by said cams for rocking said grate-bars about their pivots; as and for the purpose set forth.

14. In a boiler-furnace, a shaft having gears thereon, means for rotating said shaft, cam-flanges formed on said gears, a series of pivotally-mounted grate-bars, means for positively rocking said grate-bars about their

pivots, comprising a bar arranged to engage said cam-flanges; as and for the purpose set forth.

15. In a boiler-furnace, a shaft, means for
5 continuously rotating the same, gears mounted on said shaft and provided with cam-flanges, a series of pivotally-mounted grate-bars, bars connected to rock said grate-bars and carrying rollers arranged to embrace said
10 cam-flange; as and for the purpose set forth.

16. In a boiler-furnace, a shaft, means for continuously rotating said shaft, gears mounted on said shaft having crank-arms, a pivotally-mounted lever, connected to be rocked

by said crank, a bar carrying a pawl arranged 15 to be actuated by said lever, a hopper, a shaft or drum mounted therein and having arms projecting therefrom, a ratchet-wheel mounted on said shaft and arranged to be engaged and intermittently rotated by said pawl; as 20 and for the purpose set forth.

In witness whereof I have hereunto set my hand this 20th day of May, 1896, in the presence of the subscribing witnesses.

WILLIAM H. PEARCE.

Witnesses:

MICHAEL I. CAVANAGH,
E. C. MORGAN.