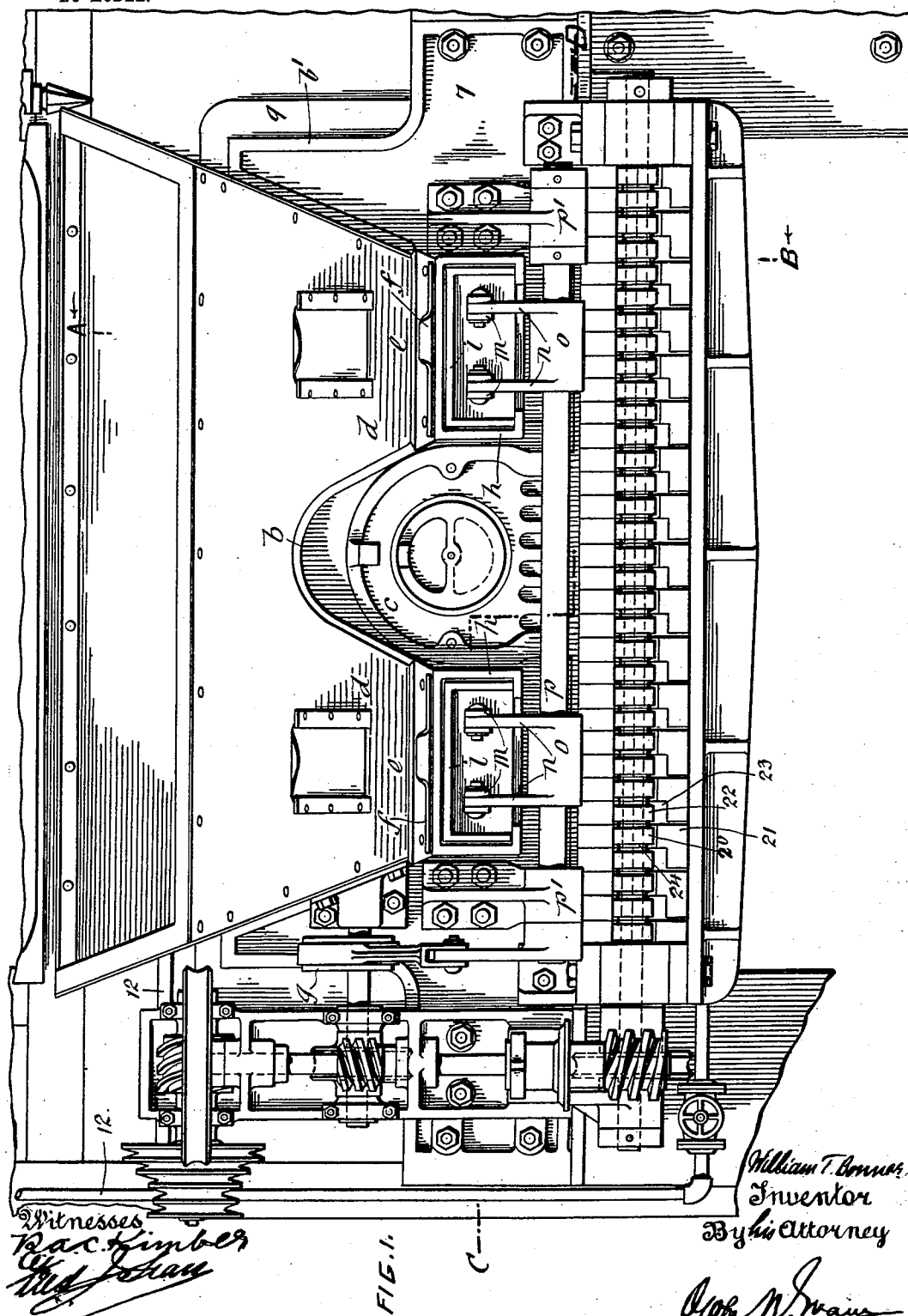


W. T. BONNER.  
MECHANICAL STOKER.  
APPLICATION FILED APR. 3, 1901.

NO MODEL.

4 SHEETS—SHEET 1.



No. 742,826.

PATENTED NOV. 3, 1903.

W. T. BONNER.  
MECHANICAL STOKER.  
APPLICATION FILED APR. 3, 1901.

4 SHEETS—SHEET 2.

NO MODEL.

FIG. 2

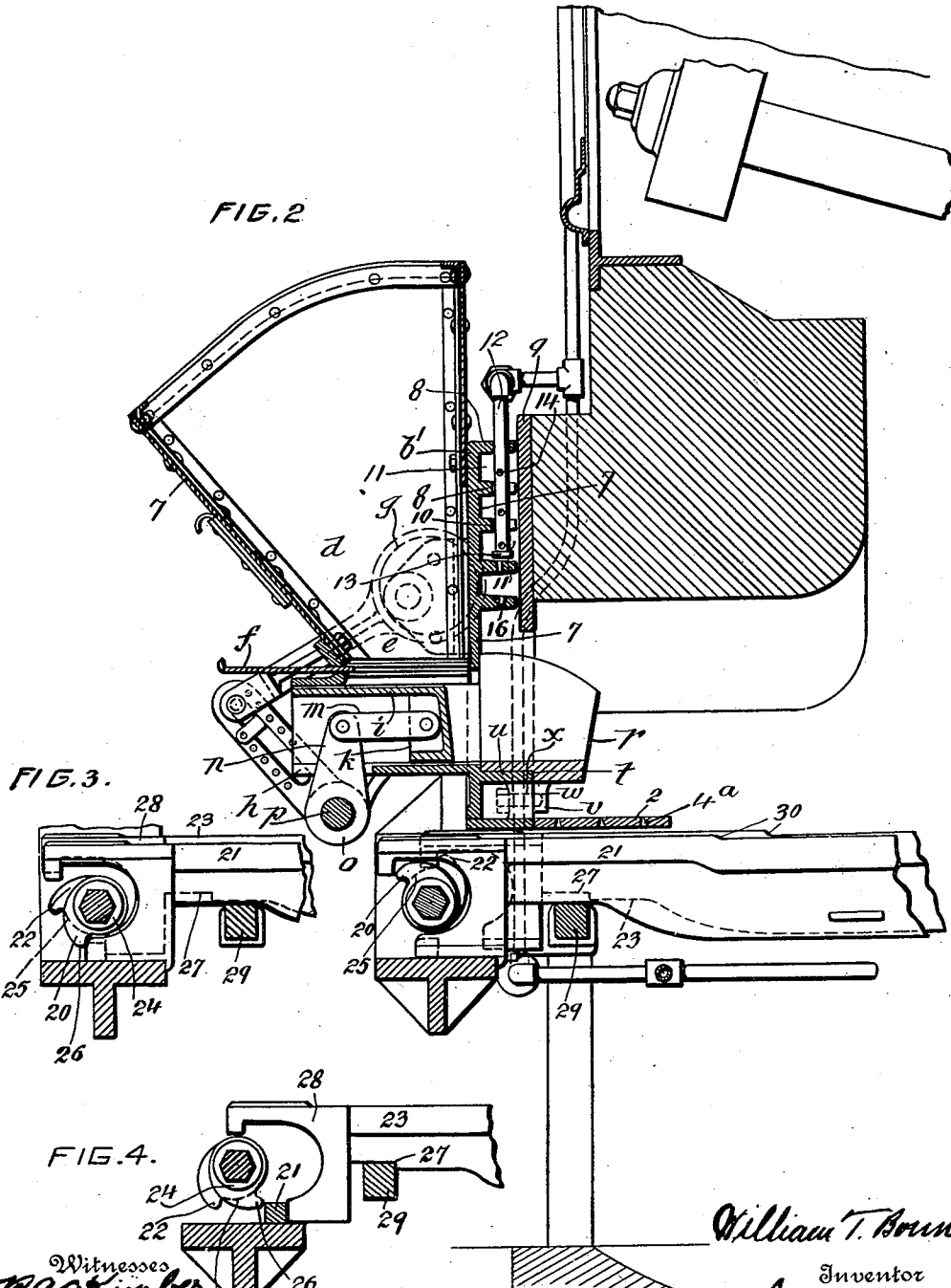


FIG. 3.

FIG. 4.

Witnesses  
*W. T. Bonner*  
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*William T. Bonner*  
 Inventor  
 By *his* Attorney  
*W. T. Bonner*

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4 SHEETS—SHEET 3.

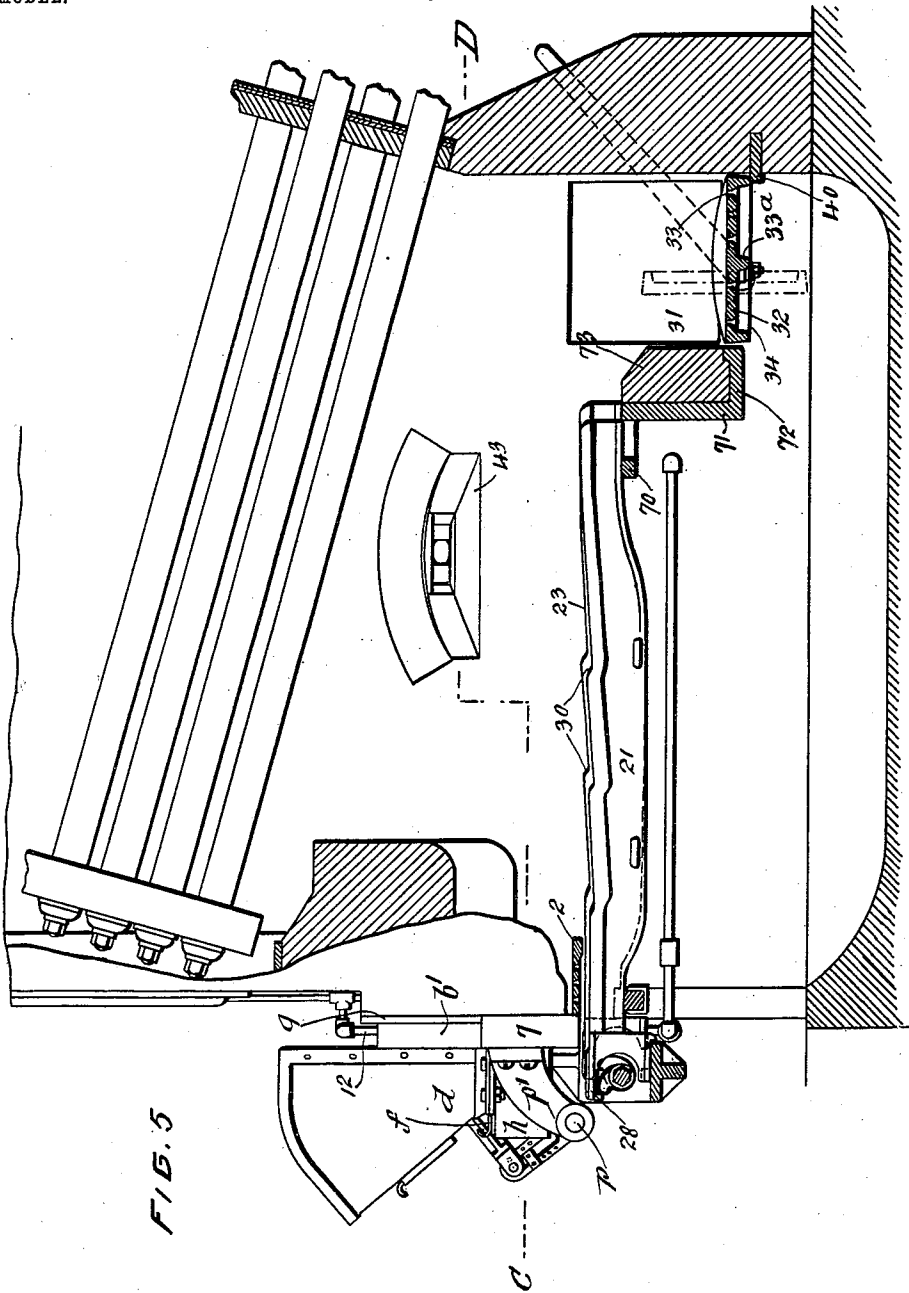


FIG. 5

Witnesses  
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APPLICATION FILED APR. 3, 1901.

NO MODEL.

4 SHEETS—SHEET 4.

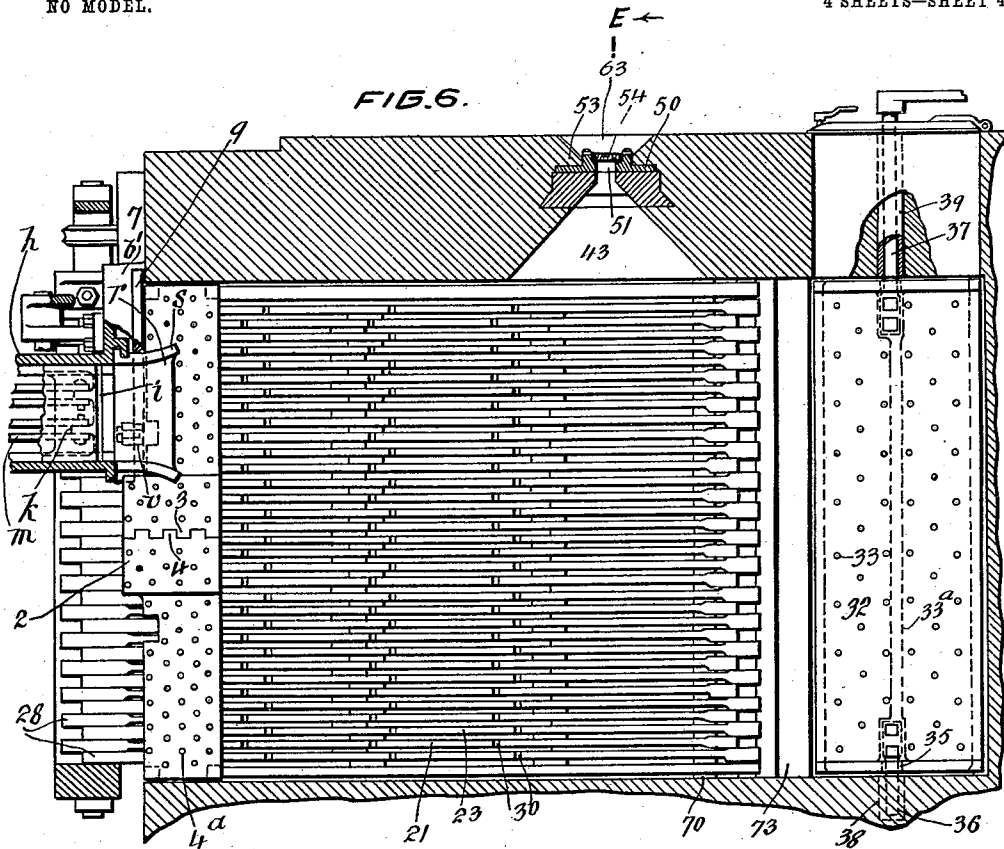


FIG. 7.

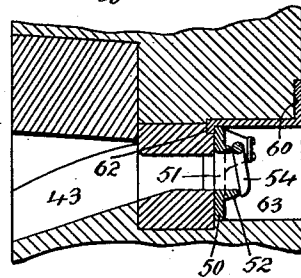
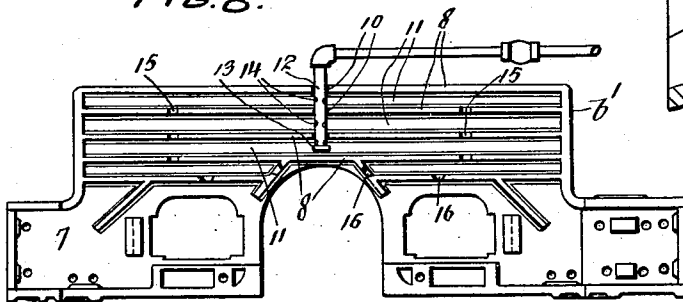


FIG. 8.



Witnesses  
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*William T. Bonner*  
Inventor  
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# UNITED STATES PATENT OFFICE.

WILLIAM THOMPSON BONNER, OF MONTREAL, CANADA.

## MECHANICAL STOKER.

SPECIFICATION forming part of Letters Patent No. 742,826, dated November 3, 1903.

Application filed April 3, 1901. Serial No. 54,216. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM THOMPSON BONNER, of the city of Montreal, Province of Quebec, Canada, have invented certain new and useful Improvements in Mechanical Stokers; and I do hereby declare that the following is a full, clear, and exact description of the same.

My invention has for its object to increase the capacity of the coal-hopper and render same more easily accessible for charging and with a view to facilitate the examination of the interior and for permitting the better inspection and adjustment of adjacent machine parts of same without dismantling any part thereof, also to increase the volume of feed and the distribution of the coal fed over the grate, also to secure greater fuel economy by the more complete combustion of the coal and to facilitate the removal of the rise due thereof, furthermore to obviate undesirable dampening-drafts and increase the powers of combustion, and, speaking generally, to provide a mechanical stoker of greater durability and of greater efficiency than mechanical stokers heretofore known.

The invention may be said, briefly, to consist in constructing the coal-hopper to feed directly and freely into the ram-guides, the flow to each ram-guide being independently controlled, the rams themselves acting in conjunction with coking-boxes, according to my invention, to distribute the coal over a greater transverse area of the grate-surface, and the coking-plates are adapted to facilitate the combustion, of the more volatile combustible gases, which escape from the coal in the vicinity of the coking-boxes and incidentally to prolong the life of the coking-plates, while the grate-bars and their actuating-cams are constructed and adapted to move the bars collectively forward from the rams, one half of their number alternating with the other half in their return movement and moving at a different time thereto and meantime being elevated above the level thereof, the rear end of bars resting on an L-beam of novel construction, so arranged as to receive a course of fire-brick or other refractory material for the purpose of preventing the passage of cold air from ash-pit into interior of furnace.

The fire-front of stoker, which also forms

the rear wall of coal-hopper, is constructed with a series of horizontal chambers, to each of which steam and air are supplied and through all of which said steam and air circulate and in a mixed condition are projected into the fire-chamber at the outer end thereof. A dumping fuel-supporting section is located at the inner end of the grate-bars and is provided with a series of draft-apertures, and an integral peep-hole frame or brick of novel construction is set in the wall of the stoking-chamber in a position to enable the interior thereof to be viewed.

For full comprehension, however, of my invention reference must be had to the accompanying drawings, forming a part of this specification, wherein like symbols indicate the same parts, and in which—

Figure 1 is a front elevation of a mechanical stoker constructed according to my invention. Fig. 2 is a longitudinal vertical sectional view of the front portion of the furnaces, taken on line A B, Fig. 1. Figs. 3 and 4 are detail views illustrating the action of the cams in their operation of my improved grate-bars. Fig. 5 is a longitudinal sectional view of my complete stoking-chamber. Fig. 6 is a horizontal sectional view taken on line C D, Figs. 1 and 5. Fig. 7 is a transverse vertical sectional view taken on line E, Fig. 6, and illustrating particularly my improved peep-door and my improved lining and lintel; and Fig. 8 is a rear side elevation of the front plate, the upper portion of which constitutes a portion of the rear wall of my improved hopper.

I have illustrated my invention as applied to a boiler of the water-tube type, although it is applicable to almost any type of boiler, retort, or other heating-furnace, and as the subject to be heated does not enter into my invention I will not further allude to same.

My improved hopper is oblong in front elevation, with a rise *b* in the middle of its bottom to bridge the fire-door *c* and at the same time provide two subhoppers *d*, the bottoms or exit ends *e* whereof are of extended frontal width and provided with horizontal sliding plates *f*, abutting, when closed, against the lower edge of the rear wall of the hopper. The ram-guides *h* are located immediately below and in direct communication with said

exit ends *e* of the subhoppers and are of extended width, while the rams *i* are each formed on the interior of their fronts with a pair of webs *k*. A pair of links *m* are pivotally connected at one end to each of these webs and at their other ends to the upper end of an arm *n*, of which there are a pair for each ram, each pair being formed integral with a sleeve *o* rigidly upon the usual ram-shaft *p*, mounted rotatably in bearings *p'*, and this ram-shaft is oscillated, as formerly, by an eccentric *g*.

The coking-boxes *r* are of oblong cross-section and have their inner ends or mouths horizontally flared, as at *s*, to distribute the coal transversely of the grate as it is pushed therefrom by the action of the rams. The under side of each of these coking-boxes is transversely recessed, as at *t*, to set snugly upon the inwardly-projecting downwardly-offset sill *u* of the particular ram-guide to which it forms an extension, and a downwardly-projecting lug *v* integral with the under side of each coking-box serves as a means for rigidly securing it in place, these lugs being each formed with a tapped boring *w*, extending almost but not completely there-through, into which the retaining-bolt *x* is threaded from the outside of the stoking-chamber.

An independent coking or dead plate 2 is provided to receive the fuel from each coking-box, and these plates are formed, respectively, with teeth 3 and 4 on their abutting edges, the teeth of one plate being in staggered relation to the teeth of the other plate to engage therewith and be interlocked to prevent horizontal lateral displacement of the plates relatively to one another. These coking or dead plates are provided with upwardly-tapering holes 4<sup>a</sup>, preferably equidistant from one another and distributed throughout the area of each plate. These holes admit a constant supply of pure air at a comparatively low temperature to serve the double purpose of, first, facilitating the initial combustion of the more volatile combustible gases as they are given off from the fuel in the coking-boxes and upon these coking or dead plates, and, secondly, maintaining these plates at a constantly comparatively low temperature, thereby prolonging the life thereof without the necessity of asbestos or other heat-proof coverings, while the upwardly-tapered nature of these holes imparts a twyer action thereto in their admission of air and prevents the lodging of clinkers therein.

The top portion *b'* of the front plate 7 of the stoker constitutes the rear wall of my improved coal-hopper and is cast with a series of horizontal flanges 8 of less width than the distance between said rear wall and the usual protection-plate 9. The three uppermost of said flanges are drilled or notched, as at 10, to accommodate a steam-supply pipe 12, which extends downwardly therethrough to within a short distance of the fourth flange,

the lower end of said pipe being capped, as at 13, and the portions thereof extending through the chambers 11 between the flanges are perforated, as at 14, to spray steam into each of said chambers, while the spaces between the edges of the flanges and the protection-plate admit cool air to said chambers, and a series of perforations or notches 15 allow the passage of the steam and air mixed from chamber to chamber and finally to the front end of the combustion-chamber through twyer-like perforations 16 in the lowermost flange.

The grate-bars according to my invention have besides a collective movement rearwardly and a forward movement in two groups, one following the other, a lifting movement of one of the groups to cause a grinding action between the bars of one group and the bars of the other, and thereby prevent the formation of clinkers. To this end and to improve the general working of the grate, I construct the cams 20 and 22 almost of as great width as the bars 21 and 23 and with distance-hubs 24 to locate them relatively to one another and the bars, while the cams 22 are formed with a peripheral rise 25 besides the usual dogs 26, with which the cams of each series are formed. The bars 23 are recessed, as at 27, at the forward ends of their under sides immediately contiguous to their actuating-heads 28 to when in their extreme back position fit over a rectangular cross-bar 29 and be held against forward movement with the group of bars 21 when the latter move forwardly. This rearward movement of the bars collectively shifts the body of coal there-upon toward the rear of the fire-chamber a distance equal to said rearward movement, while the forward movement of but half of the bars at a time, together with the form of the teeth 30, prevents the return of the body of coal, thus causing the coal to be intermittently fed toward the rear of the fire-chamber, and the lifting of the group of bars 23 besides preventing the formation of clinkers slightly agitates the fire and keeps it constantly free of ash.

I have discovered that when the fuel reaches the rear end of the fire-grate a large percentage of it is still undergoing combustion and owing to the constant agitation of the fire by the lifting of the alternate grate-bars is very much broken up. To obviate the loss of the heat energy contained in this fuel as it drops over the end of the feeding-grate and at the same time prevent an undesirable cooling back draft from the ash-pit 31 around the rear end of the fire to the combustion-chamber, I provide a combined damper and dumping auxiliary fuel-support having, comparatively speaking, diminutive draft-apertures to receive the fuel as it drops from the grate and when said fuel is completely consumed dump it into the ash-pit. The device I prefer to use for this purpose consists of an oblong plate 32, having a series of upwardly-

tapered perforations 33, distributed throughout the area thereof at points preferably equidistant from one another, said plate being formed on its under side with a longitudinal rib or ribs 33<sup>a</sup> and a pair of transverse end ribs 34, the end ribs being each divided midway of its length to form a space 35 to accommodate trunnions 36 and 37, respectively, bolted to the under side of the plate. The trunnion 36 projects into a tubular bearing 38, set in one of the side walls of the furnace, and the other trunnion, 37, is elongated and projects through a tubular bearing 39 in the opposite wall and has its end squared to receive a lever whereby the plate is dumped. The plate when in its horizontal position rests at one side edge upon a ledge 40.

In order that the interior of the combustion-chamber may be viewed, a peep-door is provided, and to facilitate the construction thereof I provide an integral peep-door and frame with a fire-brick lining consisting, preferably, of a brick of rectangular cross-section with parallel horizontal faces and ends keyed to secure brick when built in place, while its middle portion is cored out to form an inwardly-flared opening 43. This brick constitutes a protective lining for the peep-door and is built into the wall of the furnace with its inner face flush with the surface of the interior of the wall, while a metallic plate 50, with a central opening 51 inclosed by an elliptical annular flange 52, is held by bricks 53 of the wall against the outer face of my improved peep-door brick. The function of this metallic plate is to afford a support for a door 54, through which when it is open the fire-chamber may be viewed when desired from the exterior of the furnace.

I use in conjunction with my improved lining just described a lintel of novel construction, the function whereof is to serve as a roof for the outer end or mouth of the peep-door opening and at the same time afford a bearing for the upper edge of the peep-door frame. This lintel consists of an angular plate, the vertical portion 60 whereof is embedded in the outer surface of the wall of the stoking-chamber, while the horizontal portion 61 thereof is downwardly offset at its end, as at 62, said horizontal portion being embedded in the bricks which overhang the outer end or mouth 63 of the peep-door opening 43 in the wall, and the offset portion 62 is embedded in the upper end of the face surrounding said mouth to constitute a seat against which the peep-door frame rests.

A hanging bridge-wall cuts off the combustion-chamber proper from the main bridge-wall and forms one of the walls of the auxiliary combustion-chamber, of which the dumping-plate forms the bottom. This hanging bridge-wall consists of an angle-plate comprising an upper horizontal portion 70, constituting a sill upon which the inner ends of the grate-bars are supported, a vertical portion 71 extending from said sill to the level

of the plate 32, while a lower horizontal portion 72 supports fire-bricks 73, the whole being built into the walls of the stoking-chamber and, as before mentioned, constituting a hanging bridge-wall.

A mechanical stoker constructed according to the foregoing will have greater efficiency than mechanical stokers heretofore known owing to its increased coal-carrying capacity, the facilitated combustion of the more volatile gases which are given off from the fuel at the front end of the combustion-chamber by the mingling therewith of air and steam admitted both above and below the body of fuel, the prevention of the formation of clinkers, the freeing of the fire from ash, the checking of the cooling-draft at the rear end of the fire-chamber, and, finally, insuring the complete combustion of the semi-consumed fuel dropped over the rear end of the grate and augmenting the main fire by utilizing, in conjunction therewith, the heat energy contained in said semiconsumed fuel, while the durability of mechanical stokers of this type is increased by maintaining the coking or dead plates and the rear wall of the coal-hopper constantly at a comparatively low temperature by my improved method, the durability being also increased by my novel construction of the cams and bars, and, furthermore, by closing off the ram-guides from the coal-hopper the accidental ignition of the coal in the hopper is obviated.

What I claim is as follows:

1. In a mechanical stoker the combination with the protection-plate, and a pair of ram-guides set a short distance from one another, a coal-hopper extending completely across the tops of the said ram-guides, the portion of the bottom of said hopper between said ram-guides being closed and elevated, and the portions of the bottom of said hopper on each side of said elevated portion being open and communicating with the ram-guides, means for independently controlling said open portions of the bottom, a plate constituting the rear wall of said hopper and located adjacent to said protection-plate, a series of horizontal flanges extending between said rear wall and protection-plate and an independent steam-supply to each of the chambers between said flanges, substantially as described and for the purpose set forth.

2. In a mechanical stoker the combination with the protection-plate and a pair of ram-guides set a short distance from one another, of a coal-hopper extending completely across the top of said ram-guides, the portion of the bottom of said hopper between said ram-guides being closed and elevated, and the portions of the bottom of said hopper on each side of said elevated portion being open and communicating with the ram-guides, a pair of sliding gates for independently controlling said open portions of the bottom, a plate constituting the rear wall of said hopper and located adjacent to said protection-plate, a

series of horizontal flanges extending between said rear wall and protection-plate and an independent steam-supply to each of the chambers between said flanges, substantially as described and for the purpose set forth.

3. In a mechanical stoker the combination with the protection-plate of an oblong coal-hopper consisting of a front wall, a rear wall, a pair of end walls, and an elevated bottom extending from the front to the rear walls of the hopper and of less length than the lower end of said hopper and located midway of the length thereof to leave the portions of the bottom adjacent to the end walls open, a pair of ram-guides each having the upper edges of its side walls connected directly to the side edges of one of said bottom openings, a pair of sliding gates for closing said open portions of the bottom, a plate constituting the rear wall of said hopper and located adjacent to said protection-plate, a series of horizontal flanges upon said rear wall and extending from said rear wall to within a short distance of said protection-plate, said flanges having vertical openings therethrough, and a steam-pipe extending downwardly through said flanges except the lowermost and to within a short distance of said lowermost, a cap closing the lower end of said pipe, and the portions of said pipe between said flanges being perforated, substantially as described and for the purpose set forth.

4. The combination with the coal-hopper and the protection-plate of a mechanical stoker, of a plate constituting the rear wall of said hopper and located adjacent to said protection-plate, a series of horizontal flanges extending between said rear wall and protection-plate and an independent steam-supply to each of the chambers between said flanges, substantially as described and for the purpose set forth.

5. The combination with the coal-hopper and the protection-plate of a mechanical stoker, of a plate constituting the rear wall of said hopper and located adjacent to said protection-plate, a series of horizontal flanges extending between said rear wall and protection-plate, an independent steam-supply to each of the chambers between said flanges, and an air-supply to said chambers, substantially as described and for the purpose set forth.

6. The combination with the coal-hopper and the protection-plate of a mechanical stoker, of a plate constituting the rear wall of said hopper and located adjacent to said protection-plate, a series of horizontal flanges upon said rear wall and extending from said

rear wall to within a short distance of said protection-plate, said flanges having vertical openings therethrough, and a steam-pipe extending downwardly through said flanges except the lowermost and to within a short distance of said lowermost, a cap closing the lower end of said pipe, and the portions of said pipe between said flanges being perforated, substantially as described and for the purpose set forth.

7. In a mechanical stoker comprising a feeding-grate, the combination with said feeding-grate of a dumping-plate having upwardly-tapered perforations, and means for supporting said dumping-plate transversely and beneath the level of the rear end of said feeding-grate, substantially as described and for the purpose set forth.

8. In a mechanical stoker comprising a feeding-grate, the combination with said feeding-grate of a dumping-plate having upwardly-tapered perforations distributed throughout the area thereof at points equidistant from one another, and means for supporting said dumping-plate transversely and beneath the level of the rear end of said feeding-grate, substantially as described and for the purpose set forth.

9. In a mechanical stoker comprising a feeding-grate the combination with said feeding-grate of a dumping fuel-support consisting of an oblong plate having a series of upwardly-tapered perforations distributed throughout the area thereof at points equidistant from one another, a rib extending longitudinally of said plate midway of the width of the underside thereof, a transverse rib at each end of the under side thereof, a trunnion projecting longitudinally from one end of said plate, an elongated trunnion projecting longitudinally from the other end thereof, and having its end squared and means for rotatably supporting said trunnions, substantially as described and for the purpose set forth.

10. In a mechanical stoker the combination with a peep-door and frame of a lining consisting of an oblong fire-brick having the rear portions of its ends longitudinally extended and beveled, and said brick having an inwardly-flared interior opening, substantially as described and for the purpose set forth.

In testimony whereof I have affixed my signature in presence of two witnesses.

WILLIAM THOMPSON BONNER.

In presence of—

FRED J. SEARS,

FRANK H. DENMAN.