L. F. TORREY.

MECHANICAL STOKER.

APPLICATION FILED OCT. 18, 1906.

986,877. Patented Mar. 14, 1911.

2 SHEETS—SHEET 1.

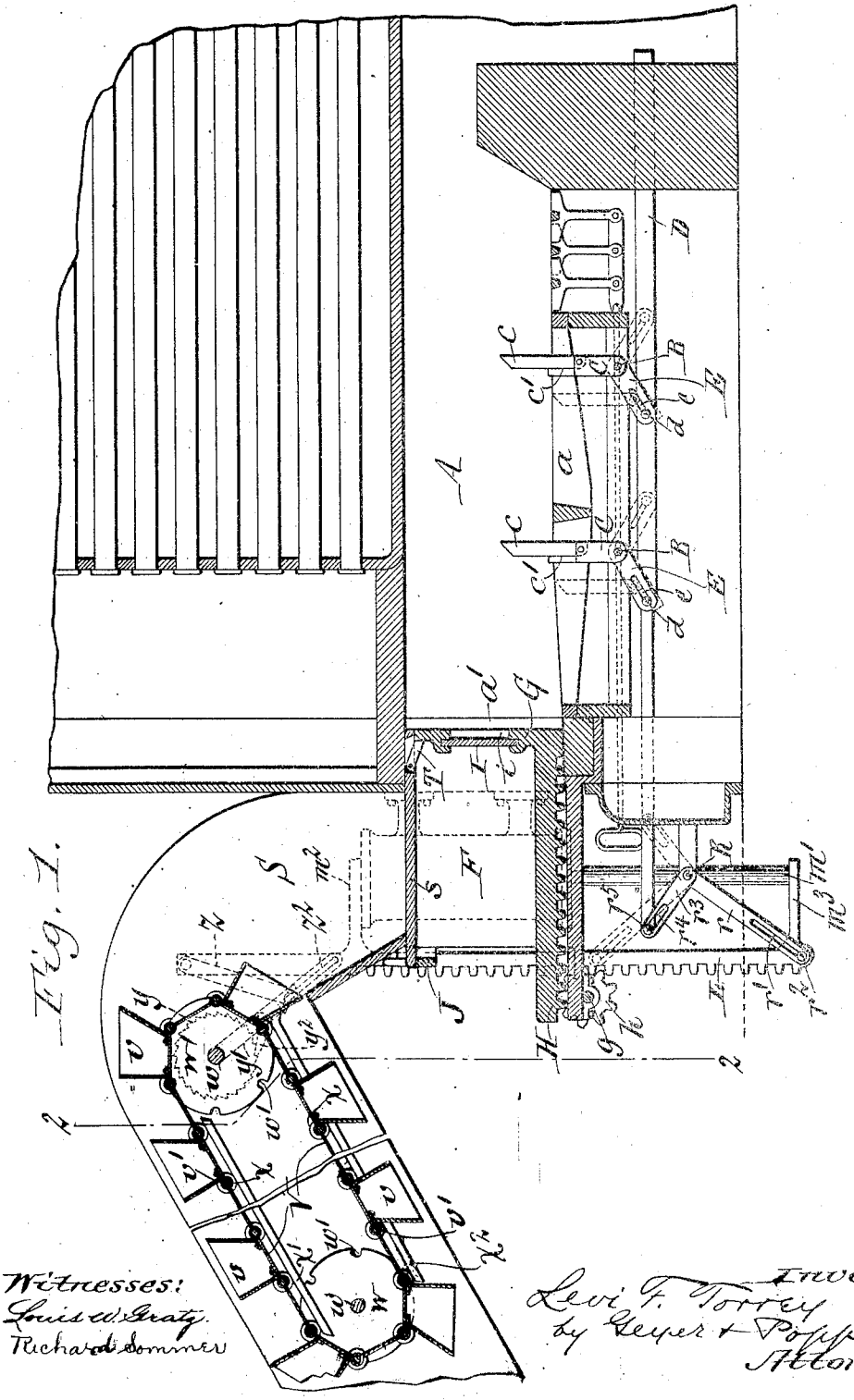

Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

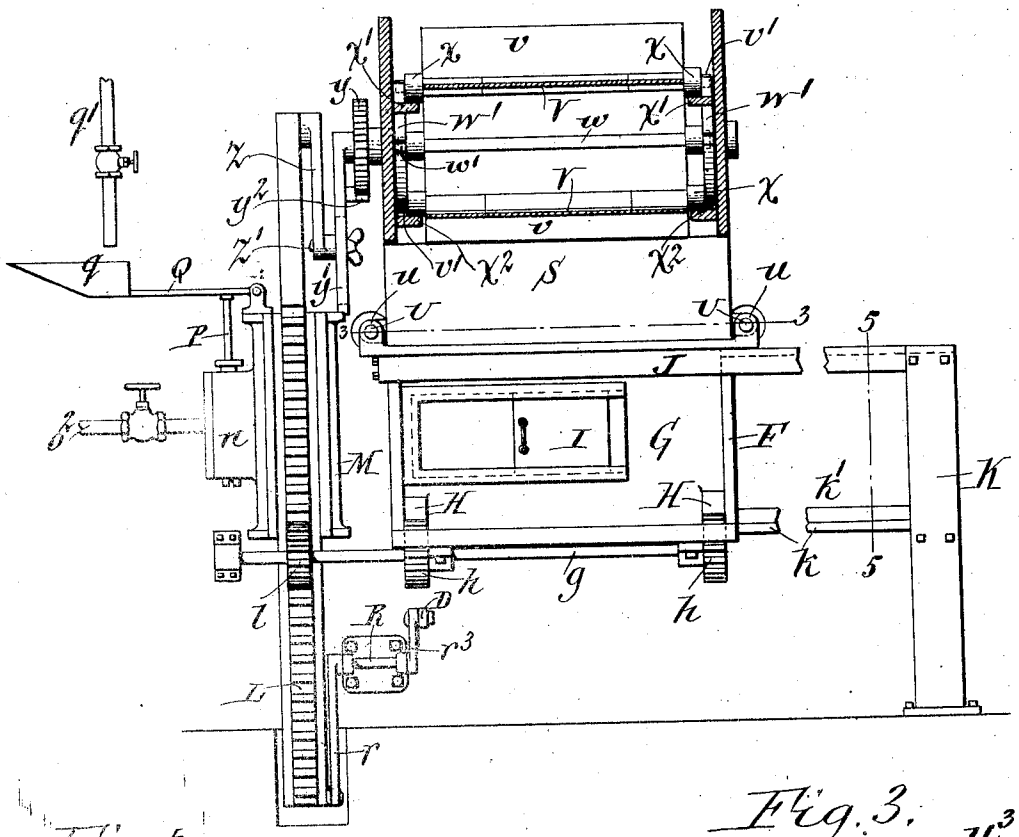


Fig. 5.

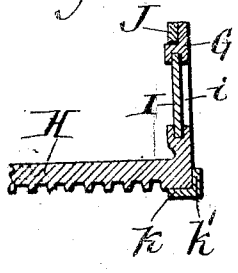


Fig. 3.

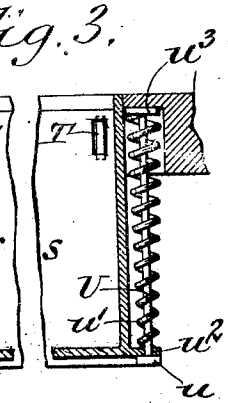
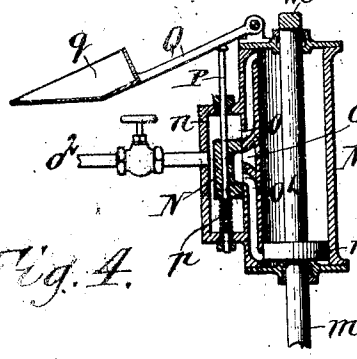


Fig. 4.



Witnesses

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MECHANICAL STOKER.

986,877. Specification of Letters Patent. Patented Mar. 14, 1911.

Application filed October 18, 1906. Serial No. 339,433.

To all whom it may concern:

Be it known that I, LEVI F. TORREY, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented a new and useful Improvement in Mechanical Stokers, of which the following is a specification.

This invention relates to a mechanical stoker for furnaces and has the object to produce a device for this purpose which is simple and compact in construction, efficient in operation and which manipulates the fuel in such a manner that the greatest heating effect is obtained therefrom.

In the accompanying drawings consisting of 2 sheets: Figure 1 is a vertical longitudinal section of my improved stoker applied to a furnace. Fig. 2 is a cross section thereof in line 2—2 Fig. 1. Fig. 3 is a fragmentary horizontal section in line 3—3, Fig. 2. Fig. 4 is a vertical section of the motor for operating the stoker. Fig. 5 is a vertical section in line 5—5, Fig. 2, showing the manner of supporting the fuel feeding plunger when the same is removed from the feed box.

Similar letters of reference indicate corresponding parts throughout the several views.

A represents a furnace provided with the usual horizontal grate bars *a* and feed opening a^1 through which the fuel is delivered upon the grate. Below the grate bars one or more transverse rock shafts B are arranged each of which carries a plurality of stoking members which are adapted to move forwardly and backwardly through the spaces between the grate bars. Each of these stoking members preferably consists of an upwardly projecting rock arm C secured to one of the rock shafts, a stoking finger *c* pivoted on the free end of the stoking arm, and a stop or shoulder c^1 arranged on the arm in such a position that it arrests the backward movement of the finger relatively to the arm when in a straightened position but permits said finger to fold forwardly relatively to said arm. During the forward movement of the stoking member its finger passes upwardly and forwardly above the grate surface and is shifted into its straightened position by engagement with the coal, as shown by full lines in Fig. 1, whereby the latter is pushed forwardly on the grate. During the backward movement of the stoking member its finger is folded forwardly on the arm by engagement with the coal and remains in this position until the end of its backward stroke as shown by dotted lines in Fig. 1, whereby the finger is prevented from pushing the coal backwardly.

The several rock shafts B are operated simultaneously by means of a horizontal reciprocating bar D guided lengthwise below the grate and provided with pins *d* which enter slots *e* formed in depending shifting arms E secured to the rock shaft. Upon pushing this bar forwardly, the stoking members are retracted or moved rearwardly while upon moving the bar backwardly the stoking members are caused to move forwardly and produce a forward feed of the coal over the grate.

F represents a fuel feeding box arranged horizontally in front of the furnace and opening at its front end into the furnace feed opening.

G represents a horizontally reciprocating plunger whereby the fuel delivered into the fed box is pushed forwardly out of the same and into the furnace over the grates. The means for effecting the reciprocating movement of the plunger shown in the drawings, consists of a horizontal shaft *g* journaled transversely at the outer end of the bottom of the feed box and provided with one or more gear wheels or pinions *h* which engage with outwardly projecting gear racks H connected with the lower part of the plunger. Upon rotating the shaft alternately in opposite directions the plunger is moved forwardly and backwardly in the feed box. For the purpose of enabling the fireman to observe the condition of the fire in the furnace without removing the plunger, the latter is provided with an opening *i* which is normally closed by a sliding shutter I. Free access to the interior of the furnace is afforded for cleaning or repairing the same by wholly withdrawing the plunger rearwardly from the feed box and then moving the same laterally so as to clear the

feed box. During this lateral movement of the plunger the same slides on a guideway or track which preferably consists of an upper horizontal flat rail or bar J extending across the upper part of the feed box at the outer or rear end thereof and projecting from one side thereof and a lower rail or bar extending laterally from the bottom of the box at the outer or rear end thereof and on the same side at the upper rail and having a horizontal lower web or flange k which is flush with the top of the bottom of the feed box and a front vertical flange or web k^1 extending upwardly from the front edge of the horizontal flange, as shown in Figs. 2 and 5. The outer ends of the two rails may be supported by posts or standards K or otherwise. When it is desired to remove the plunger from the feed box of the same is first drawn outwardly until its upper edge engages with the upper rail J. The plunger is then slid laterally so that its lower end or edge is transferred from the bottom of the feed box to the lower angular rail of the guideway, as shown in Fig. 5. In this position the plunger may be moved on the guideway so as to entirely clear the feed box, the guideway being made sufficiently long for this purpose. While the plunger is thus supported by the guideway, the outwardly overhanging gear racks on the same tend to tilt the plunger but this is prevented by engagement of the plunger on its outer side adjacent to its upper end with the upper rail J and at its inner side adjacent to its lower end with the vertical flange k^1 of the lower rail.

The rotation of the shaft g in opposite directions may be effected by various means but preferably by the means shown in the drawings which are constructed as follows: L represents a vertically reciprocating gear rack which meshes with a gear pinion l on the shaft g. M represents a power cylinder arranged vertically adjacent to one side of the feed box and containing a piston m which is mounted on the piston rod m^1. The latter slides through the upper and lower heads of the cylinder and is connected at its upper and lower ends by horizontal arms m^2 m^3 with the gear racks L. Steam or other pressure medium is admitted alternately into opposite ends of the power cylinder for raising and lowering the piston therein by means of a slide valve N arranged in a valve chest n and adapted to connect the ports o, o^1 leading to opposite ends of the cylinder alternately with the steam supply pipe o^2 and with an exhaust port o^3 in a manner well known in steam engines. The slide valve is secured to a vertically sliding rod P guided in the valve chest and normally held in an elevated position by means of a spring p surrounding the valve rod and interposed between the lower ends of the valve and the valve chest. While thus elevated the slide valve admits steam into the lower end of the cylinder thereby raising the piston therein and moving the plunger, which is operatively connected therewith, outwardly. The downward movement of the valve is effected by means of a trip arm or lever Q resting upon the upper end of the valve rod and pivoted at one end while its opposite end is provided with a trip pan q which is adapted to be filled slowly and intermittently by water supplied from the pipe q^1. When sufficient water has been delivered into the pan to overcome the tension of the spring p the trip arm or lever will be depressed together with the slide valve operatively connected therewith as shown in Fig. 4, thereby admitting steam to the upper end of the cylinder and causing the piston to be depressed and the plunger to be moved forwardly or inwardly through the feed box, as shown in Fig. 1. As the trip arm is depressed by the weight of the water in the trip pan the latter is shifted into an inclined position in which the contents thereof are discharged quickly. The instant the trip pan is emptied of water the spring p immediately raises the same and the slide valve into its uppermost position when the filling of the trip pan again proceeds slowly and the steam is admitted into the lower end of the cylinder for moving the plunger backwardly. The movement of the piston is also transmitted to the bar D for actuating the stoking members. The means shown in the drawings suitable for this purpose consists of a short rock shaft R provided at one end with a depending rock arm r having a slot r^1 which receives a pin r^2 on the gear rack L and a rearwardly projecting rock arm r^3 at its opposite end having a slot r^4 which receives a pin r^5 at the outer end of the shifting bar D. The rock shaft R and its arms r, r^3 thus form an elbow lever which operates to move the stoking members forwardly and backwardly simultaneously with the corresponding movements of the plunger.

S represents a feed hopper arranged above the feed box and opening at its lower end into the top of the box.

s represents a horizontally and longitudinally reciprocating slide valve or shutter which is guided between the hopper and box and operates to open or close communication between the same. When the slide is in its forward position, as shown in Fig. 1, the bottom of the hopper is closed and in a condition to receive a charge of fuel and upon moving the slide backwardly so as to open the bottom of the hopper the charge of fuel therein is delivered into the feed box at which time the plunger is in its outermost position so that the fuel enters

the feed box in front of the plunger. The slide is closed and the filling of the hopper with coal is effected while the plunger is in its foremost position. In order to automatically open the slide, as the plunger moves backwardly and thereby cause the fuel to be discharged from the hopper into the feed box in front of the plunger, means are provided for coupling the slide and plunger which preferably consists of one or more latches, pawls or dogs T which are pivoted on the slide at the front end thereof and are adapted to assume an inclined position while their front ends engage with the rear side of the plunger, as shown in Fig. 1. Upon moving the plunger outwardly or backwardly while the dogs are in this position the slide is caused to move in the same direction and thereby open the bottom of the hopper. During the last portion of this backward or outward movement, the inclined dogs engage with a stationary abutment and are lifted out of engagement with the plunger leaving the slide free to be again pushed forwardly into its closed position independently of the plunger. That part of the upper guide rail or bar J across the upper rear part of the feed box serves as the abutment for thus lifting the dogs of the slide out of engagement from the plunger.

In order to automatically move the slide forwardly and close the hopper the instant the plunger and slide reach their rearmost position and the slide is disconnected from the plunger, a spring operated closing device is provided which preferably consists of two horizontal slide rods U arranged on the opposite outer sides of the feed box and connected at their rear ends with laterally and upwardly projecting lugs u arranged at the rear end of the slide and springs u^1 each of which surrounds one of the slide rods and bears at its rear end against a lug or shoulder u^2 on the adjacent part of the feed box and a head or shoulder u^3 at the front end of the respective slide rod. During the backward movement of the slide with the plunger the springs u^1 are compressed and when the slide is released from the plunger at the rear end of the backward movement of these parts the springs u^1 immediately draw the slide forwardly into its closed position, thereby preventing air from entering the furnace through the hopper during the time that the plunger is in its retracted position. The plunger remains at rest in this retracted position a considerable time but its forward and backward movement are effected quickly without an interval of rest while in its foremost position, thereby avoiding exposure of the plunger to the heat of the furnace for any considerable time and interposing a new charge of fuel in the feed box between the plunger and the furnace and thus gradually rendering this new charge better suited for perfect consumption in the furnace. After the slide has been closed, the plunger remains in its rearward position until the trip pan has been again filled with water sufficient to depress the slide valve when the motor will be operated to move the plunger forwardly and push the charge of coal in the feed box into the furnace. During the last part of the forward movement of the plunger its upper edge engages with the inclined dogs and lifts the same until the rear side of the plunger has passed the shoulder or front side of the dogs when the latter drop by gravity in rear of the plunger, thereby coupling the slide and plunger and compelling these parts to move backwardly together during the subsequent return stroke.

Any suitable means may be provided for elevating or conveying the coal or other fuel into the hopper, the means shown in the drawings, as an example, being constructed as follows: V represents an endless carrying or conveyer belt having alternate links constructed to form outwardly opening buckets v. At its receiving and delivery ends this carrying belt passes around pairs of sprocket wheels W, W^1, each pair being mounted upon a shaft w and provided with notches w^1 in their peripheries which are engaged by the ends of the pintles or rods V^1 which pivotally connect adjacent links of the carrying belt. Adjacent to its ends each pintle of the carrying belt is provided with rollers x which run over upper and lower supporting rails x^1, x^2 adjacent to the operative part and the lower inoperative part of the carrying belt. One end of the shaft which is connected with the delivery sprocket wheels W^1 is provided with a ratchet wheel y and adjacent to the same a ratchet arm y^1 is mounted loosely on the respective shaft and provided with a pawl y^2 which engages with the ratchet wheel. This ratchet arm is rocked or oscillated by means of a link z which is pivotally connected at one end with an upward extension of the gear rack L while its opposite end is adjustably connected with the ratchet arm by an adjusting bolt or screw z^1 passing through a longitudinal slot z^2 in the ratchet arm. As the buckets of the conveyer pass from the lower inoperative to the upper operative part of the belt the fireman fills the buckets with coal or other fuel. The piston during each reciprocating movement moves the conveyer forwardly step by step through the medium of the intermediate mechanism which operatively connects the conveyer with the piston, thereby discharging the contents of the buckets intermittently and successively into the top of the hopper. The operating mechanism of the conveyer is so constructed that the conveyer moves for-

ward one step and delivers the contents of one of the buckets into the hopper while the same is closed by the slide and the plunger is effecting its forward movement.

My improved stoker contains no delicate parts which are liable to get out of order, its operation is reliable, comparatively little power is required for operating the same and the coal is manipulated in a manner calculated to produce the greatest amount of heat and the least amount of smoke.

I claim as my invention:

1. A stoker comprising a feed box having an outlet, a plunger reciprocating in said box and operating to push the fuel from the box through its outlet, and means for actuating said plunger comprising a gear rack connected with the plunger, a gear pinion meshing with said rack, a shaft carrying said pinion, a power cylinder, a piston arranged in the cylinder, a gear rack connected with said piston, and a pinion connected with said shaft and meshing with said last mentioned gear rack, substantially as set forth.

2. A stoker comprising a feed box having an outlet, a plunger reciprocating in said box and operating to push the fuel from the box through its outlet, a power cylinder having a piston operatively connected with said plunger, a valve constructed to admit a pressure medium alternately into opposite ends of said cylinder, a movable trip pan adapted to be filled with water and operatively connected with said valve for shifting the same in one direction, and means for shifting the valve in the opposite direction, substantially as set forth.

3. A stoker comprising a feed box having an outlet, a plunger reciprocating in said box and operating to push the fuel from the box through its outlet, a power cylinder having a piston operatively connected with said plunger, a vertically sliding valve constructed to admit a pressure medium alternately into opposite ends of said cylinder, a slide rod connected with said valve, a trip lever bearing against said rod, a trip pan arranged on said lever and adapted to be filled with water thereby depressing said rod and shifting the valve in one direction, and a spring operating to shift said valve in the opposite direction, substantially as set forth.

4. A stoker comprising a feed box having an outlet, a feed hopper opening into the top of the feed box, a plunger reciprocating in the feed box and operating to push the fuel from the feed box through its outlet, a slide operating to open and close communication between said hopper and box, and movable in the same direction as the plunger and a coupling dog pivoted on the slide and adapted to engage with said plunger for compelling the same to move backwardly together but permit the plunger to move forwardly independently of the slide, substantially as set forth.

5. A stoker comprising a feed box having an outlet, a feed hopper opening into the top of the feed box, a plunger reciprocating in the feed box and operating to push the fuel from the feed box through its outlet, a slide operating to open and close communication between said hopper and box, and movable in the same direction as the plunger, a forwardly inclined coupling dog pivoted on the slide and adapted to engage with the plunger for compelling the slide and plunger to move backwardly together, and an abutment arranged to be engaged by said dog during the last part of the backward movement of the slide and disengage the same from the plunger, substantially as set forth.

6. A stoker comprising a feed box having an outlet, a plunger reciprocating in the box and operating to push the fuel from the same through its outlet, a supply hopper opening into the box, a slide adapted to open and close communication between the hopper and box, and movable in the same direction as the plunger and means operating to automatically close said slide independently of said plunger, substantially as set forth.

7. A stoker comprising a feed box having an outlet, a plunger reciprocating in the box and operating to push the fuel from the same through its outlet, a supply hopper opening into the box, a slide adapted to open and close communication between the hopper and box, a dog operating to couple said plunger and slide and compel them to move backwardly together, an abutment arranged to shift said dog at the end of the backward movement of the plunger and slide so as to disconnect the same, and means for automatically moving said slide forwardly when released from said plunger consisting of slide rods arranged lengthwise on opposite outer sides of the feed box and connected at their rear ends with the slides, and springs arranged between shoulders on the box at the rear ends of the rods, substantially as set forth.

8. A stoker comprising a feed box having an outlet, a plunger reciprocating in the box and adapted to push the fuel from the box through its outlet and movable laterally independently of the feed box, and a guide way or track which extends laterally from the rear end of the box and is mounted thereon and upon which the plunger may be moved when withdrawn from the rear end of the box, substantially as set forth.

9. A stoker comprising a feed box having an outlet, a plunger reciprocating in the box and adapted to push the fuel from the box through its outlet and movable laterally in-

dependently of the feed box, and a guide-way or track upon which the plunger may be moved laterally upon being withdrawn rearwardly from the box and which is mounted on the feed box and consists of an upper rail arranged across the upper part of the box at the rear end thereof and extending laterally therefrom and a lower rail extending laterally from the lower part of the side of the box at its rear end, substantially as set forth.

Witness my hand this 28th day of September, 1906.

LEVI F. TORREY.

Witnesses:
THEO. L. POPP,
E. M. GRAHAM.