No. 733,657. PATENTED JULY 14, 1903.

J. W. KINCAID.

MECHANICAL STOKER.

APPLICATION FILED JUNE 23, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

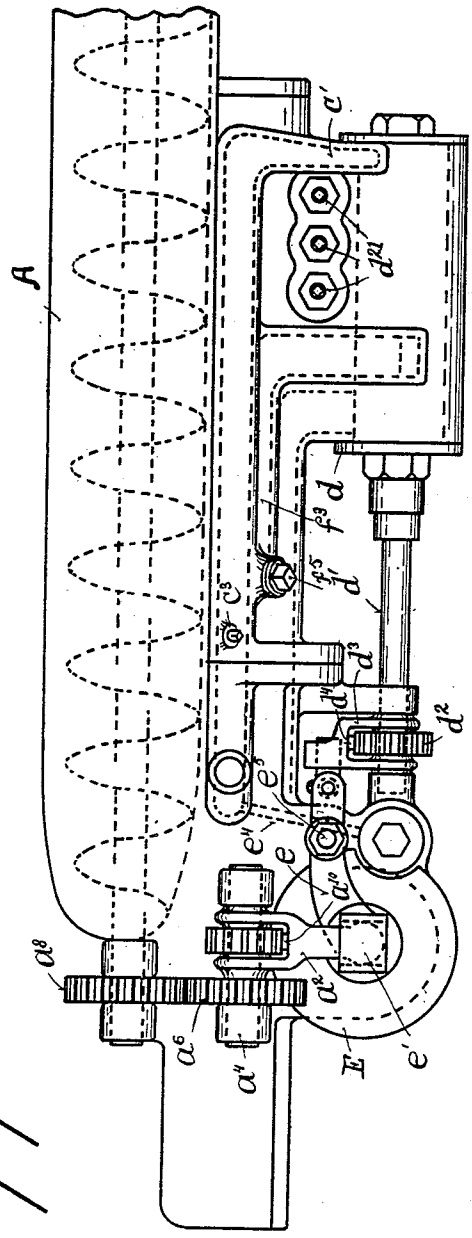

Fig. 1.

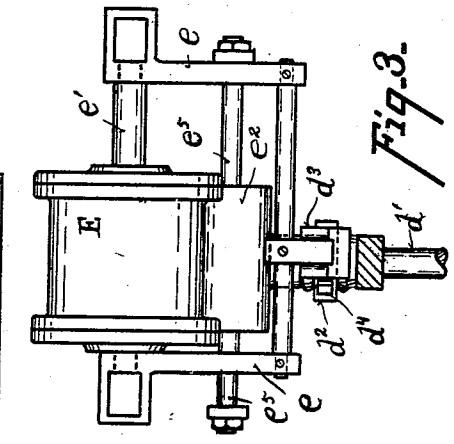

Fig. 3.

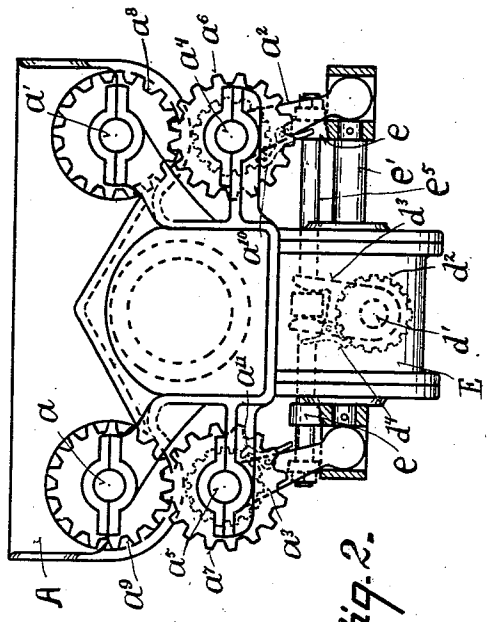

Fig. 2.

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NO MODEL. 3 SHEETS—SHEET 2.

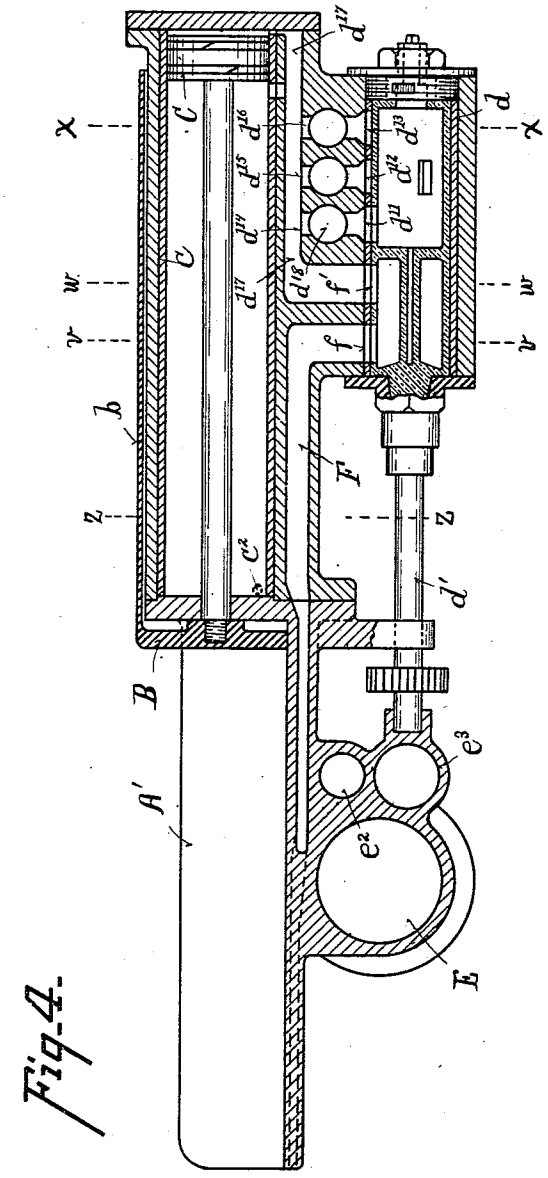

Fig. 4.

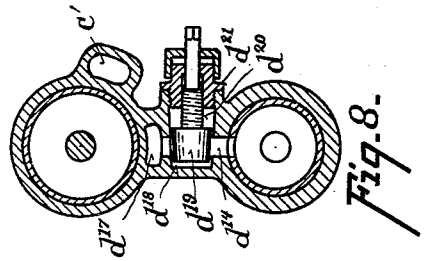

Fig. 8.

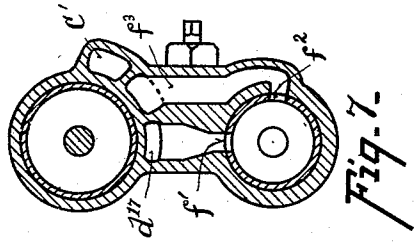

Fig. 7.

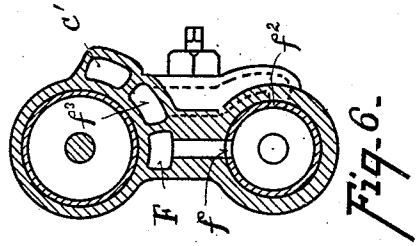

Fig. 6.

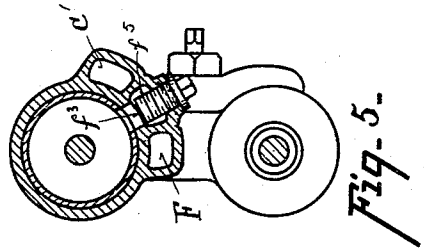

Fig. 5.

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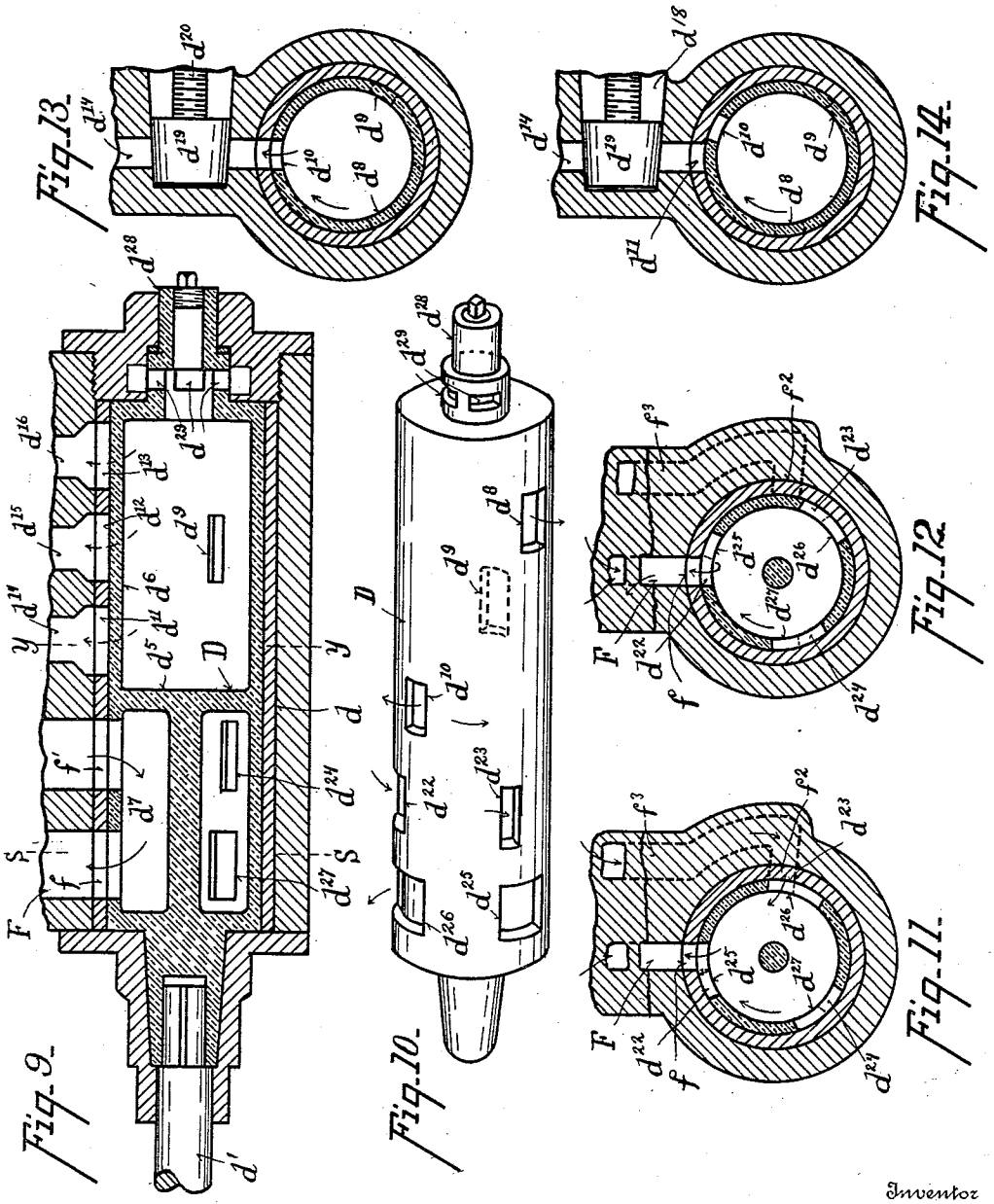
APPLICATION FILED JUNE 23, 1902.

NO MODEL. 3 SHEETS—SHEET 3.



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No. 733,657. Patented July 14, 1903.

UNITED STATES PATENT OFFICE.

JOHN W. KINCAID, OF COVINGTON, KENTUCKY.

MECHANICAL STOKER.

SPECIFICATION forming part of Letters Patent No. 733,657, dated July 14, 1903.

Application filed June 23, 1902. Serial No. 112,740. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. KINCAID, a citizen of the United States of America, and a resident of Covington, county of Kenton, State of Kentucky, have invented certain new and useful Improvements in Mechanical Stokers, of which the following is a specification.

My invention relates to mechanical stokers in which fuel is fed above the grate-bars by a plunger reciprocating within a trough into which the fuel is fed from a hopper when the plunger is retracted and in which the plunger is advanced at varying rates of speed.

The object of my invention is a mechanical stoker of the aforesaid character which has an improved arrangement of the secondary engine for operating the feeder in the hopper and regulating the valve for varying the strokes of the plunger, in which the means for connecting the main valve and the means for operating it are simplified and the machine rendered more compact and the hopper capacity increased, and in which the valve for regulating the forward strokes is simplified and cheapened in construction, improved in operation, and rendered capable of more delicate adjustments. This object is attained by the means described in the specification, specifically pointed out in the claims, and illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of the mechanical stoker embodying my invention. Fig. 2 is a front view of the same. Fig. 3 is a detail plan view of the secondary engine for operating the spiral conveyers in the hopper and for rotating the main valve. Fig. 4 is a longitudinal central sectional view of the stoker embodying my invention. Fig. 5 is a transverse sectional view taken upon line $z\,z$ of Fig. 4. Fig. 6, Fig. 7, and Fig. 8 are similar views taken upon line $v\,v$, $w\,w$, and $x\,x$, respectively, of Fig. 4. Fig. 9 is a detail longitudinal central sectional view of the main valve and its casing upon an enlarged scale. Fig. 10 is a perspective view of the main valve. Fig. 11 is a transverse sectional view of the main valve, taken upon line $s\,s$ of Fig. 9, showing the position of the valve when the plunger is advancing. Fig. 12 is a similar view of the valve in the position it occupies when the plunger is being retracted. Fig. 13 is a transverse sectional view taken upon line $y\,y$ of Fig. 9, showing the same position of the valve as shown in Fig. 11. Fig. 14 is a similar view showing the same position of the valve as shown in Fig. 12.

Referring to the parts, fuel placed in hopper A is fed toward the front of the hopper by spiral conveyers whose shafts a and a' are journaled in the ends of the hopper. From the front of the hopper the fuel falls into the channel or trough A′ when the plunger B is retracted, the opening in the bottom of the hopper being closed when the plunger is advanced by an apron b, attached to the plunger. The plunger is actuated by a piston C, reciprocating within a cylinder c.

The admission of steam to and from cylinder c is regulated by a cylindrical valve D within casing d. Valve D has a horizontal valve-stem d' projecting forward and having a ratchet-wheel d^2 upon its forward end and an arm d^3 swiveled upon the end of the valve-stem and coupled at its other end to an arm e, which projects rearward from the piston-rod e' of the secondary engine E. Arm d^3 carries a pawl d^4, which engages ratchet-wheel d^2 and imparts an intermittent rotation to the same as the piston-rod e' reciprocates. Secondary engine E is placed beneath the channel a'. Steam is admitted to the engine E by means of tappet and floating valves e^2 and e^3, steam being admitted to the tappet-valve by a channel e^4, leading down from the main steam-channel c'. The tappet-valve stem e^5 is reciprocated by arm e, secured upon the end of the piston-rod e' of the secondary engine.

Upon the ends of the piston-rod e' arms a^2 and a^3 are swiveled, the opposite ends of the arms being journaled upon the short shafts a^4 and a^5, journaled upon the sides of hopper A, said shafts carrying gear-wheels a^6 and a^7, which engage gear-wheels a^8 and a^9 upon the ends of conveyer-shafts a and a'. Arms a^2 and a^3 carry pawls a^{10} and a^{11}, which rotate gear-wheels a^6 and a^7 when the piston-rod e' reciprocates, and thereby impart an intermittent rotation to the conveyers to carry the fuel to the forward end of the hopper.

It is seen that the valve for controlling the admission of steam to the plunger and the conveyers for carrying fuel in front of the

plunger are regulated by the same engine, so that the amount of fuel fed to the plunger is increased in the same ratio as the reciprocation of the plunger, so that the rate at which the plunger reciprocates and the rate at which fuel is fed in front of it are kept in proportion to each other. Moreover, by placing the secondary engine beneath the trough the space that can be occupied by the hopper is increased, thereby enlarging the capacity of the hopper, and, moreover, the means of coupling the main valve and the secondary engine is rendered direct and simple.

Main valve D consists of a cylindrical shell closed at both ends and having an internal transverse wall d^5, which divides the valve into a live-steam chamber d^6 and an exhaust-chamber d^7. Live-steam chamber d^6 has three ports d^8, d^9, and d^{10}, which are situated at one hundred and twenty degrees apart and out of vertical alinement with each other. Valve-casing d has in its top three ports d^{11}, d^{12}, and d^{13}, each of which has its own individual channel d^{14}, d^{15}, and d^{16} leading up into a common channel d^{17}, which communicates with cylinder c at its rear end. Each of channels d^{14}, d^{15}, and d^{16} is crossed by tapered bores d^{18} of somewhat larger diameter than the channel and in which are seated tapered plugs d^{19}, which have screw-threaded stems d^{20} extending out through stuffing-boxes d^{21} and having square ends to receive keys. By means of these plugs d^{19} the size of the channels d^{14}, d^{15}, and d^{16} can be regulated to a nicety, so that the rapidity of the forward strokes of the plunger can be varied so as to make a change of a few inches in the distance which the plunger will throw the coal.

Upon the exhaust end of the valve the valve-casing has two ports f and f' in longitudinal alinement with ports d^{11}, d^{12}, and d^{13} and a third port f^2 upon the side of the valve-casing and situated at a distance of ninety degrees from port f' and in the same transverse plane therewith. Port f communicates with the main exhaust-channel F, which extends longitudinally forward centrally beneath the main cylinder c and the trough a' to a point leading into the fire-box. From the port f^2 an exhaust-channel f^3 leads to the forward end of cylinder c. Valve D upon the exhaust side has three ports d^{22}, d^{23}, and d^{24} to register with ports f' and f^2 in the casing and ports d^{25}, d^{26}, and d^{27} to register with port f in the casing. Ports d^{25}, d^{26}, and d^{27} are made of a width equal to twice that of ports d^{22}, d^{23}, and d^{24} and are placed with their front edges in longitudinal alinement with the ports d^{25}, d^{26}, and d^{27}, so that when one of the series of ports d^{22}, d^{23}, and d^{24} reaches port f' at the same time one of the series of ports d^{25}, d^{26}, and d^{27} reaches port f in the casing and that when the said port of the series d^{22}, d^{23}, and d^{24} has passed f' another one of the ports of said series has reached f^2, so that immediately after the rear end of the cylinder has exhausted out through port f' into port f port f' is closed, leaving port f open, and port f^2 is opened to allow the forward end of the cylinder to exhaust therethrough. Ports d^{22}, d^{23}, and d^{24} are placed out of longitudinal alinement with ports d^8, d^9, and d^{10}, so that while steam is being admitted to the rear end of the cylinder to advance the plunger port f' is closed and that after each forward stroke of the plunger one of the ports d^{22}, d^{23}, and d^{24} registers with port f' to put the rear end of the cylinder c in communication with the exhaust-chamber.

Cylinder c has a reduced port c^2 at its forward end which communicates with the live-steam channel c'. After the plunger has been advanced and port f^3 is closed this steam returns the piston to the rear end of its cylinder c. When port f^3 is opened, the steam in the forward end of the cylinder exhausts out through channel f^3 until the piston passes the point where the said channel enters the cylinder. The steam then remaining in the cylinder acts as a cushion to the piston to protect the front head of the cylinder, the degree of cushioning being regulated by an adjustable plug f^5 in channel f^3. Port c^2 has a choke-plug c^3 to regulate the size of the opening leading into the cylinder c, so that the rapidity with which the piston C is returned to the rear end of its cylinder may be regulated. Main cylindrical valve D has a rearwardly-projecting stem d^{28}, which extends through the rear head of valve-casing d and which has a series of radial holes d^{29}, through which live steam from channel c' enters the valve. It is thus seen that the stem upon the interior of valve D is balanced and that the pressure of the atmosphere at the end of the valve balances that upon the other end of the valve, so that the valve is a perfectly-balanced valve.

What I claim is—

1. In a mechanical stoker the combination of a reciprocating piston for actuating a plunger for throwing fuel upon the fire, the plunger, a channel for conveying steam back of the piston to actuate it, a series of channels leading into said channel, a cylindrical valve for controlling the admission of steam to each of the series of channels, and means for rotating the valve, substantially as shown and described.

2. In a mechanical stoker the combination of a reciprocating piston for actuating the plunger for feeding fuel to a fire, the plunger, a channel for conveying steam to the piston to actuate it, a series of channels leading into the said channel, a cylindrical valve having ports to register with said series of channels to admit steam thereto, and means for rotating the valve, substantially as shown and described.

3. A valve for controlling the admission of steam to an engine for actuating a feeder consisting of a valve-casing, having a series of

channels in alinement with one another leading into the valve-casing, a cylindrical valve within the casing having a series of ports to register with the channels, and means for rotating the cylindrical valve, substantially as shown and described.

4. A valve for controlling the admission and exhaust of steam to the forward and rear ends of a cylinder to reciprocate a piston therein, consisting of a valve-casing, a valve therein consisting of a cylindrical shell, divided by a transverse partition into an exhaust and a live steam chamber, channels leading from the exhaust side into the front and rear ends of the cylinder, channels leading from the live-steam side of the valve into the cylinder, ports in the shell upon the live-steam side and upon the exhaust side to register with the channels, substantially as shown and described.

5. In a mechanical stoker a cylinder, a reciprocating piston therein for actuating a plunger for feeding fuel into a furnace, the plunger, a valve-casing, a valve therein consisting of a cylindrical shell, divided by a partition into a live-steam and an exhaust chamber, channels leading from the exhaust side to both ends of the cylinder, channels leading from the live-steam side into the cylinder to convey steam to the cylinder to actuate the piston, ports in the cylindrical shell to register with the live-steam channels and with the exhaust-channels, substantially as shown and described.

6. In a mechanical stoker, a reciprocating plunger for conveying fuel to the fire, a piston reciprocating within a cylinder to actuate the plunger, the cylinder, channels leading into one end of the cylinder to actuate the piston, tapered bores crossing the channels, tapered plug-valves seated in the bores, and means for regulating the position of the plugs in the bores to vary the size of the channels to regulate the amount of steam admitted to the cylinder, substantially as shown and described.

7. In a mechanical stoker a piston-cylinder, a piston reciprocating within the cylinder, channels leading into one end of the cylinder for the admission and the exhaust of steam therefrom, an exhaust-channel leading into the other end of the cylinder at a distance therefrom greater than the thickness of the piston, a valve for controlling the passage of steam to and from the channels, a reduced channel leading into the said end of the cylinder placing it in continuous communication with the live steam, whereby the steam acts as a cushion for the stroke of the piston and when the exhaust-port is covered returns the piston to the rear end of the cylinder, substantially as shown and described.

8. In a mechanical stoker the combination of a hopper, conveyers in the hopper for feeding the fuel toward its forward end, a channel beneath the hopper leading into a furnace, a plunger reciprocating in the channel, a cylinder beneath the hopper, a piston within the cylinder for reciprocating the plunger, a valve beneath the cylinder for controlling the admission of steam to the cylinder, a secondary engine beneath the channel, and means for coupling the secondary engine to the conveyers and to the valve, substantially as shown and described.

9. In a mechanical stoker the combination of a piston-cylinder, a piston reciprocating in the cylinder, a channel leading into a furnace, a plunger in the channel, a hopper above the cylinder and the channel, conveyers in the hopper for feeding fuel into the channel, a cylindrical valve beneath the cylinder for regulating the admission of steam thereto for advancing the plunger, and means for coupling the engine and the conveyers and the engine and the cylindrical valve, substantially as shown and described.

10. In a mechanical stoker the combination of a piston-cylinder, a piston reciprocating within the cylinder, a channel leading from the cylinder into a furnace, a plunger reciprocating within the channel, means for feeding fuel in front of the plunger, a valve-casing, a valve within the casing consisting of a cylindrical shell having an exhaust-chamber in one end of it and a live-steam chamber in the other end, a series of ports in the live-steam end of the valve, and a series of ports in the exhaust-steam end of the valve, channels leading from the live-steam end of the valve into the rear end of the cylinder and registering with the ports in the live-steam end of the cylinder, a channel placing the rear end of the cylinder in communication with the exhaust side of the valve, a channel leading from the front end of the cylinder at a distance therefrom greater than the thickness of the piston into the exhaust end of the valve, and a reduced channel leading from the live-steam channel to the forward end of the piston-cylinder, substantially as shown and described.

11. In a mechanical stoker a piston-cylinder, a piston reciprocating within the cylinder, channels leading into one end of the cylinder for the admission and the exhaust of steam therefrom, an exhaust-channel leading into the other end of the cylinder at a distance therefrom greater than the thickness of the piston, a valve for controlling the passage of steam to and from the channels, a reduced channel leading into the said end of the cylinder placing it in continuous communication with the live steam, whereby the steam acts as a cushion for the stroke of the piston and when the exhaust-port is covered returns the piston to the rear end of the cylinder, and a plug for regulating the size of the reduced channel, substantially as shown and described.

12. In a mechanical stoker the combination of a piston-cylinder, a piston within the cylin-

der, a plunger actuated by the piston, means for admitting and exhausting steam from the rear end of the cylinder to advance the piston, a reduced channel leading into the front end of the cylinder to admit steam thereto, an exhaust-channel leading into the front end of the cylinder at a distance therefrom greater than the thickness of the piston and a plug for regulating the size of the exhaust-channel, substantially as shown and described.

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Witnesses:
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