A. G. ELVIN.

LOCOMOTIVE GRATE SHAKER.

APPLICATION FILED NOV. 29, 1909.

998,882.

Patented July 25, 1911.

4 SHEETS—SHEET 1.

FIG. 2.

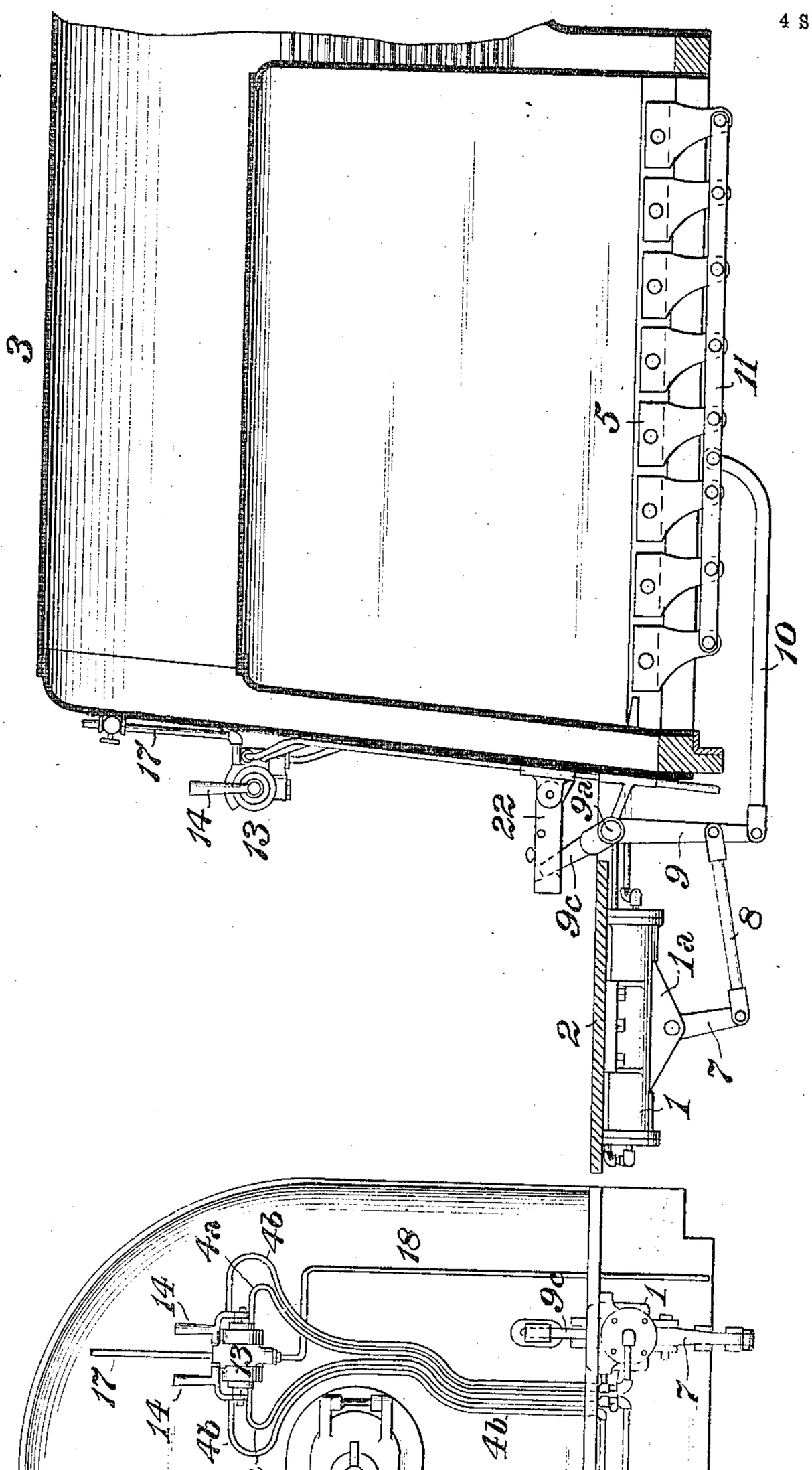
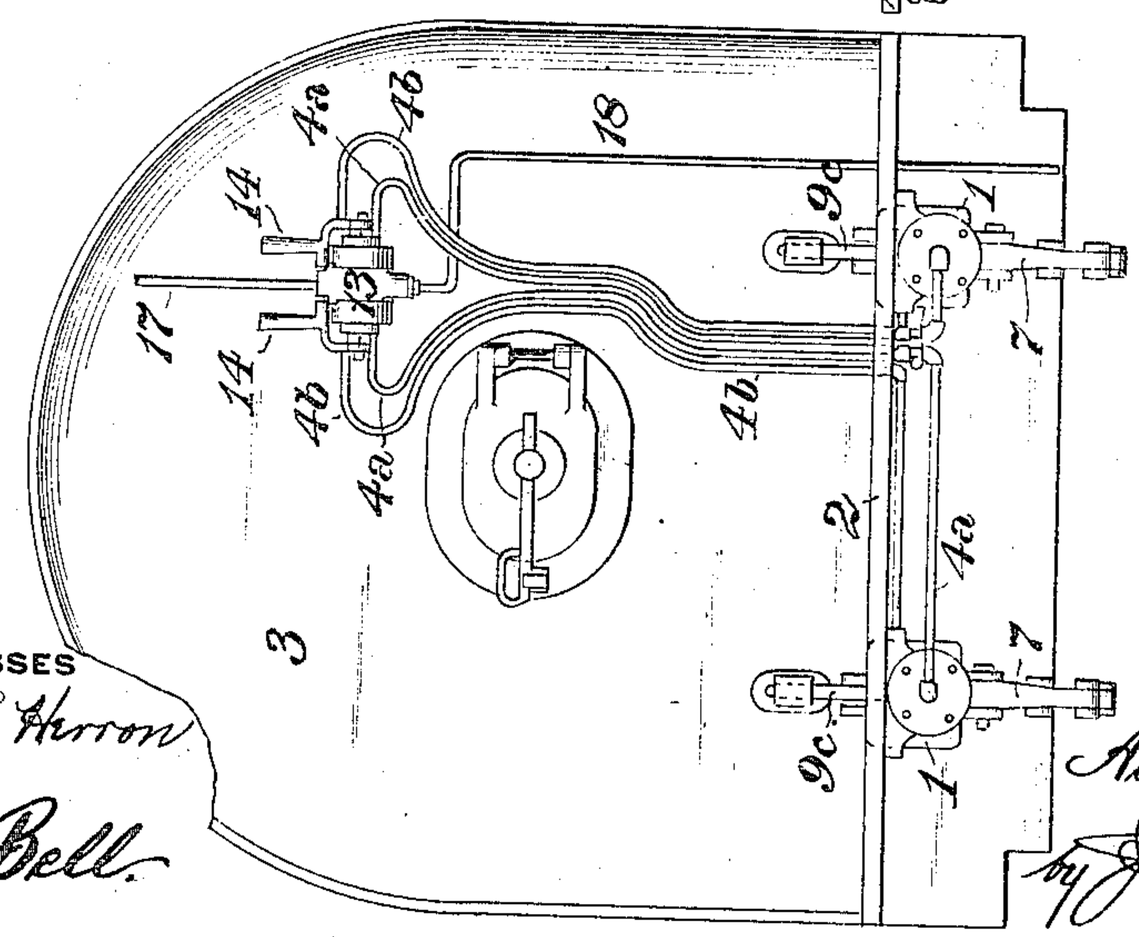


FIG. 1.



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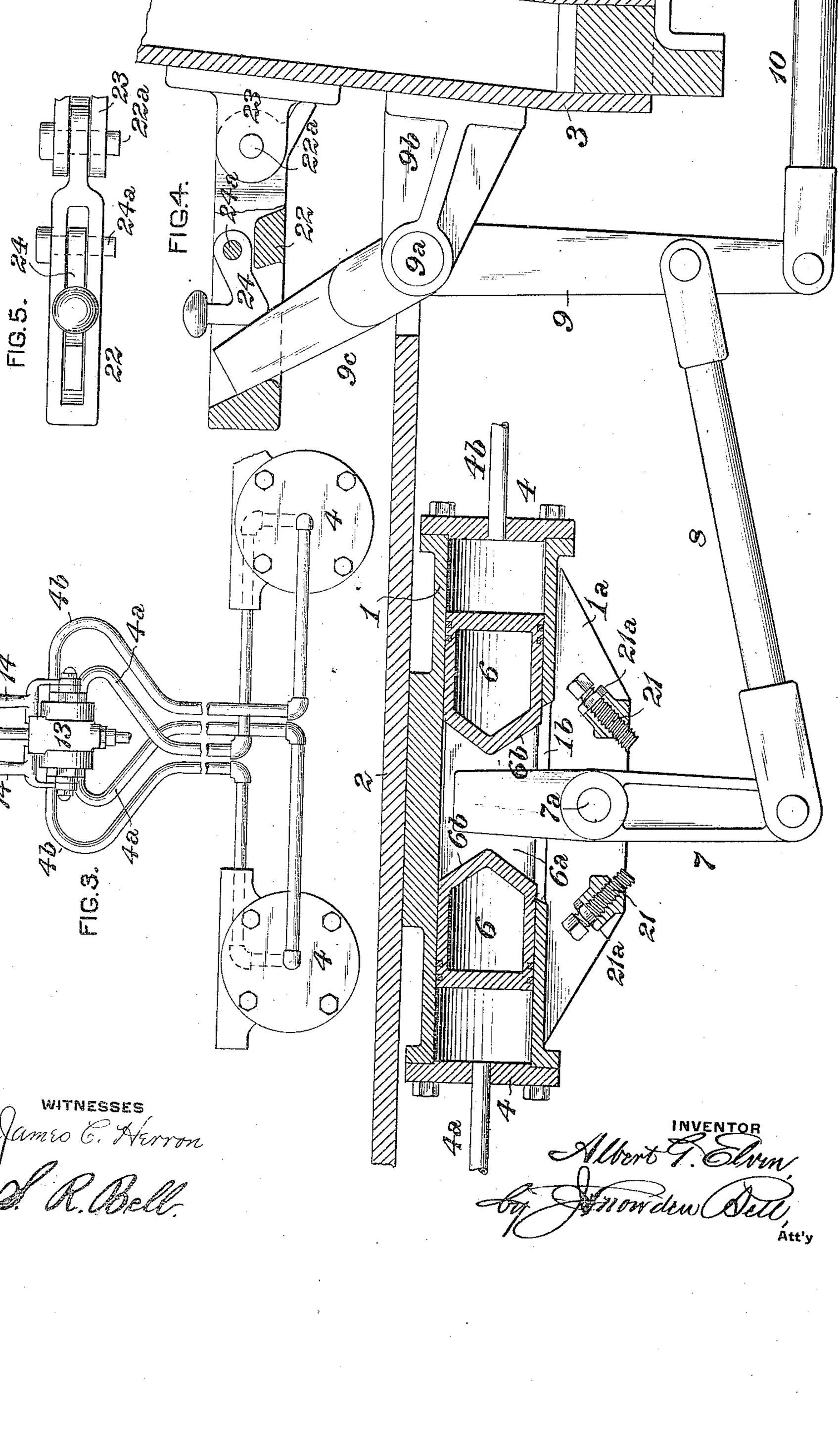
4 SHEETS—SHEET 2.



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4 SHEETS—SHEET 3.

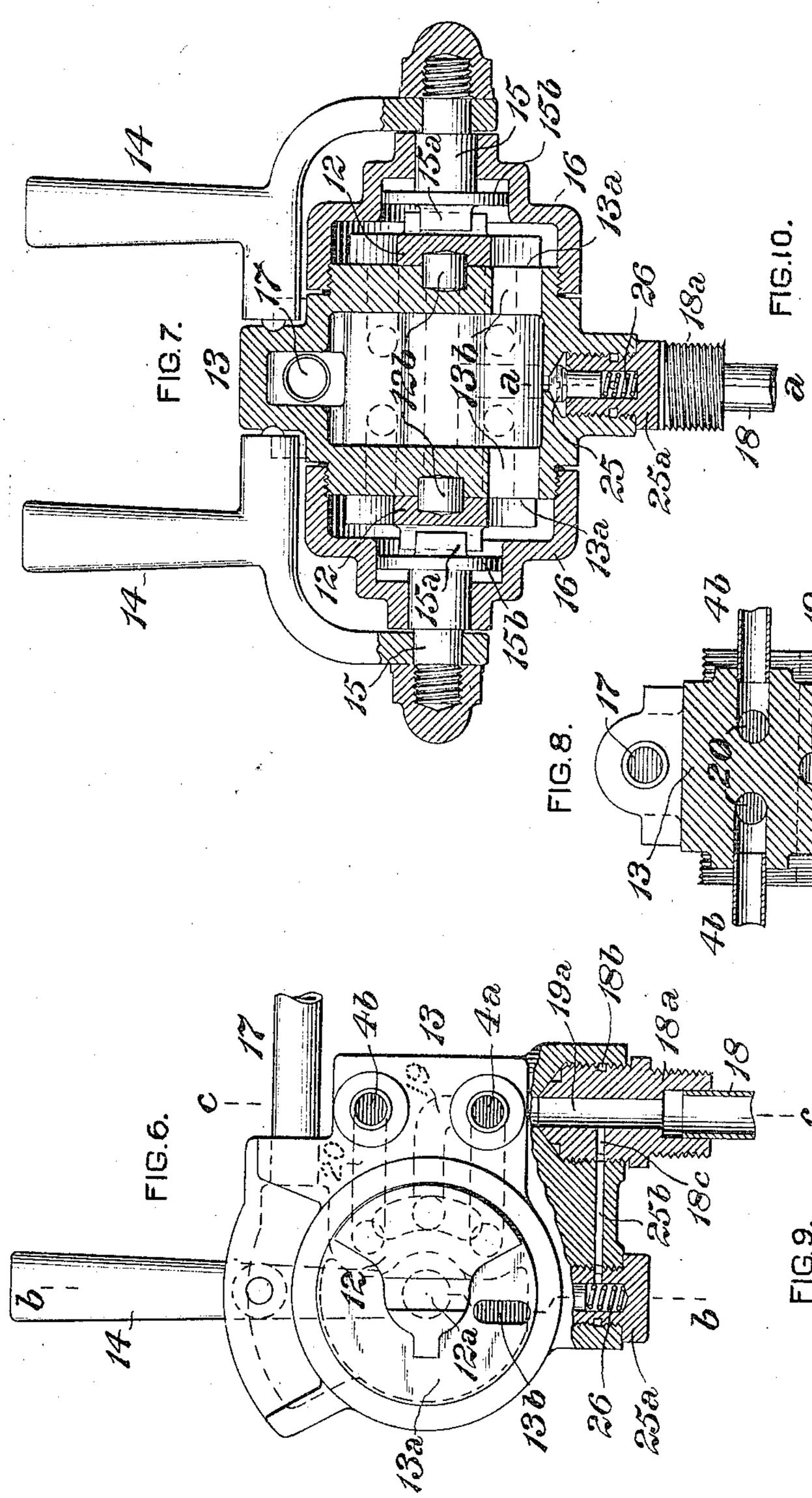

FIG. 7.

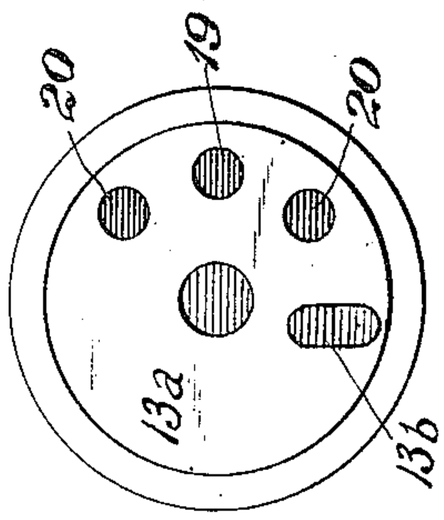

FIG. 10.

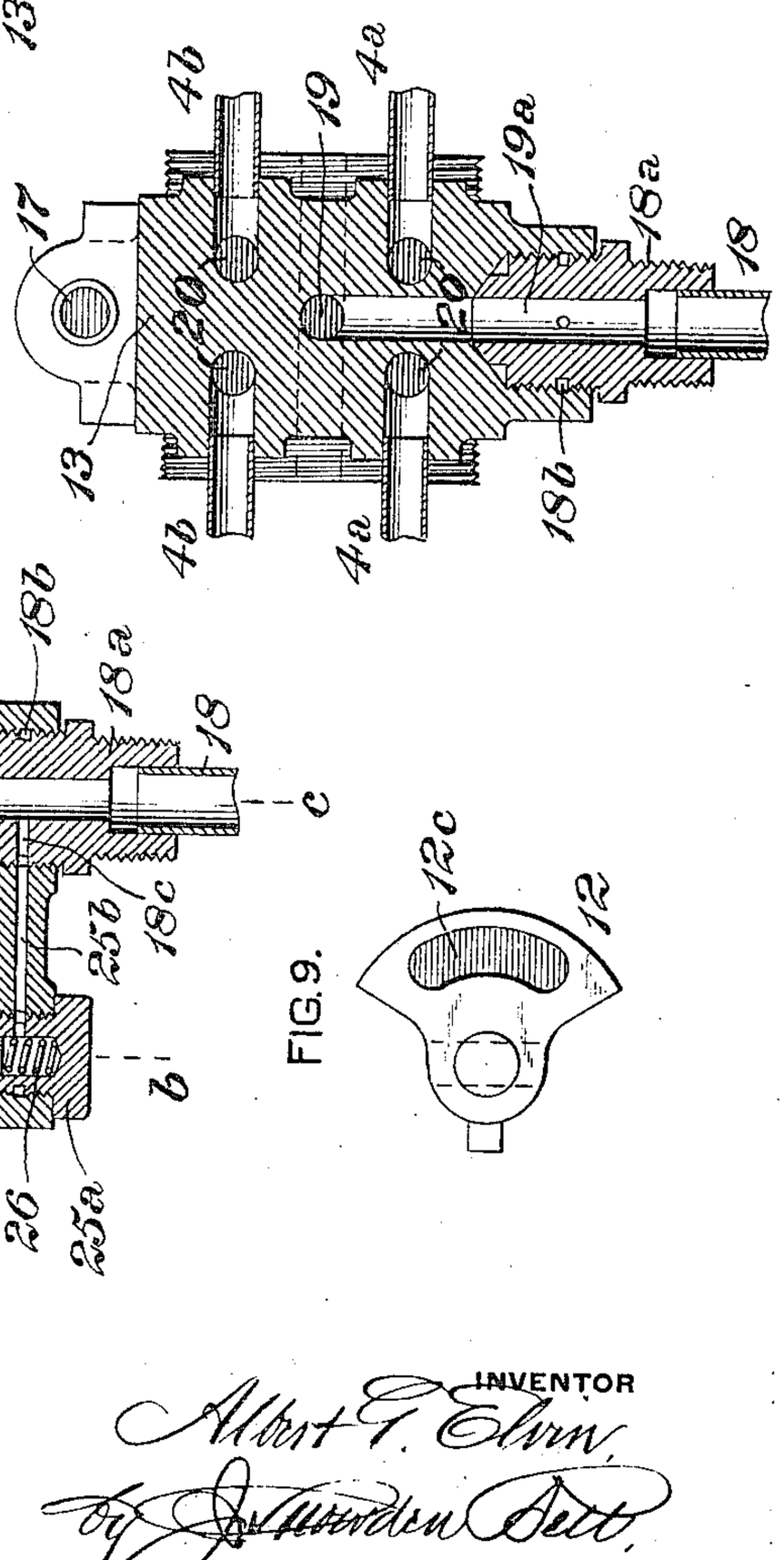

FIG. 8.

FIG. 6.

FIG. 9.

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4 SHEETS—SHEET 4.

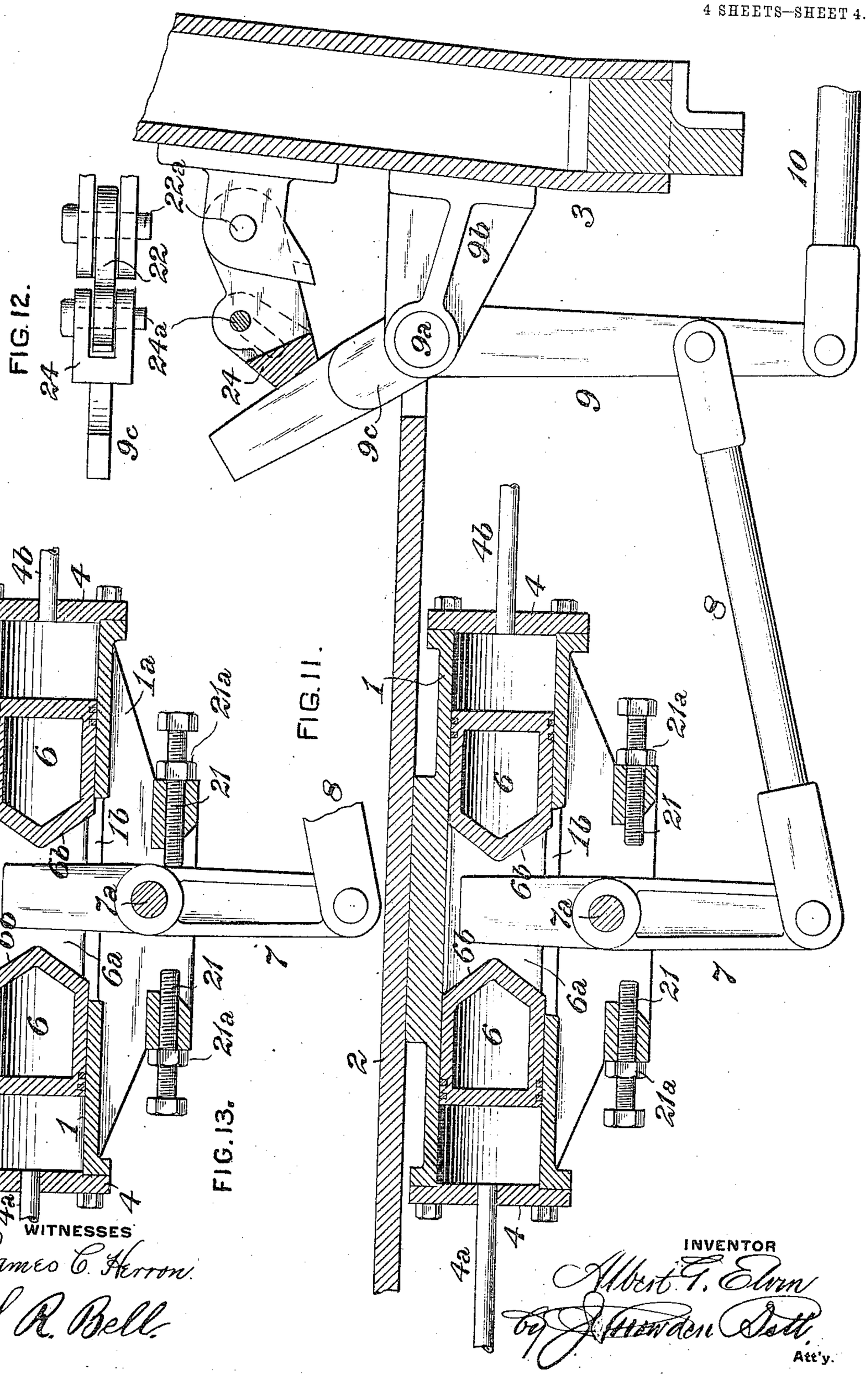

FIG. 12.

FIG. 13.

FIG. 11.

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UNITED STATES PATENT OFFICE.

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LOCOMOTIVE-GRATE SHAKER.

998,882. Specification of Letters Patent. Patented July 25, 1911.

Application filed November 29, 1909. Serial No. 530,323.

To all whom it may concern:

Be it known that I, ALBERT G. ELVIN, of East Orange, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Locomotive-Grate Shakers, of which improvement the following is a specification.

The object of my invention is to provide an appliance, of simple and inexpensive construction and ready applicability in locomotive engines of the various constructions now in service, whereby different portions or sections of locomotive grates of the rocking type may be shaken or rocked, either independently or simultaneously, as from time to time required to clear them of clinkers and cinders and permit free access of air to the fuel, this operation being performed either by the action of fluid pressure or manually by an operator standing in the cab or on the foot plate or deck of the locomotive or tender, as circumstances may render more advisable.

The improvement claimed is hereinafter fully set forth.

In the accompanying drawings: Figure 1 is a rear view, in elevation, of a locomotive firebox, illustrating an embodiment of my invention; Fig. 2, a vertical-longitudinal section through the same; Fig. 3, a rear view, in elevation and on an enlarged scale, of the motor cylinders, the valve casing, and the pipe connections; Fig. 4, a vertical longitudinal central section, on a further enlarged scale, through one of the motor cylinders and through the rear portion of the firebox; Fig. 5, a plan view of the lever locking mechanism of Fig. 4; Fig. 6, a view in elevation, as seen from the right, of the operating valve casing and one of the operating valves, the lower portion of the figure being in section on the line *a a* of Fig. 7; Fig. 7, a longitudinal section through the operating valve casing and valves, on the line *b b* of Fig. 6; Fig. 8, a similar section, on the line *c c* of Fig. 6; Fig. 9, a bottom view of an operating valve; Fig. 10, a plan view of a valve face; Fig. 11, a view similar to Fig. 4, but showing structural modifications of the lever locking mechanism and of the disposition of the actuating lever stops; Fig. 12, a plan view of the lever locking mechanism of Fig. 11; and, Fig. 13, a longitudinal central section through a motor cylinder showing a different adjustment of one of the stops.

My invention is specially designed for use in connection with rocking grates of locomotive boilers, and is herein exemplified as applied to a boiler of such type, on which it has been, for some time past, and is now, regularly and satisfactorily operated in practical railroad service. It will, however, be obvious that its application is not, in any wise, limited to locomotive boilers, and that it may be employed, without variation of structural or operative principle, on stationary and marine boilers which are provided with rocking grates.

In the practice of my invention, a horizontal motor cylinder, 1, either one or a pair of which may be used as conditions may require, is secured below the main foot plate, 2, of a locomotive engine, a short distance in rear of the firebox, 3, or, equivalently, below one or both of the running boards, so as to be out of the way of the engineer and fireman, and its opposite ends are closed by heads, 4, to which are connected supply and exhaust pipes, 4^a, 4^b, leading to the casing of an operating valve hereinafter described. The firebox, 3, is provided with a grate, 5, which may be of any suitable and preferred form of the rocking type, and which, as it does not, in and of itself, form part of my present invention, will not be herein at length set forth. In the instance exemplified, and as is deemed preferable in connection with grates of comparatively large areas, which are now generally in use, two motor cylinders, located adjacent to opposite sides of the firebox, are applied, one of said cylinders serving to actuate the set of grate bars on one side of the longitudinal central plane of the firebox, and the other cylinder to independently actuate the set of grate bars on the opposite side of the longitudinal central plane. The two motor cylinders, and the connecting actuated mechanisms are, however, substantially similar in construction and operation, as will be understood from the following description of either system of the pair.

Each of the motor cylinders, 1, is fitted with a properly packed piston, 6, in the middle portion of which is formed a longitudinal slot, 6^a, having, at its ends, bearing faces, 6^b, which are inclined toward the ends of the cylinder, upwardly and downwardly from its horizontal axial plane, as clearly shown in Figs. 4, 11, and 13. A double armed actuating lever, 7, is pivoted

in flanges, 1^a, cast on the cylinder, 1, by a transverse pin, 7^a, formed on or fixed in it, and working in suitable bearings in the flanges, the upper arm of said lever passing freely through a longitudinal slot, 1^b, formed in the middle and lower portion of the cylinder, and through the slot, 6^a, of the piston, and extending above the apexes of the double inclined bearing faces at the ends of the slot. The lower arm of the actuating lever is coupled, by a link or connecting rod, 8, to an arm, 9, fixed on a rock shaft, 9^a, which is journaled to vibrate in bearings, 9^b, secured to the rear head of the firebox, 3. An arm, 9^c, fixed upon the rock shaft, projects upwardly therefrom, and is adapted to enter a socket in, and be moved by, a hand lever worked by the fireman, when the rocking of the grates is desired to be manually effected. The lower end of the arm, 9, is coupled by a link or connecting rod, 10, to a bar, 11, coupled to downwardly depending arms of the grate bars, 5, which are comprehended in the set on the side of the longitudinal central plane of the firebox on which the motor cylinder is located.

Under the above construction, it will be seen that when the piston, 6, is reciprocated, rocking or vibratory movement will be imparted to the actuating lever, 7, and the connected grate bars, and the same will be the case when the rock shaft, 9^a, is swung in its bearings by the application of manual power to the arm, 9^c, fixed thereon.

Each piston, 6, is reciprocated in its cylinder, 1, by the action upon it of fluid pressure, as compressed air or steam, the admission and exhaust of pressure to and from the cylinder being effected by a manually actuated operating valve, 12, controlling passages in a valve casing, 13, which communicate with the supply and exhaust pipes, 4^a, 4^b, leading into the opposite ends of the cylinder. In cases where two cylinders and actuating means are applied, as in the instance shown, two operating valves are also applied, each of said valves working on a valve face, 13^a, on one end of the valve casing. The valve, 12, is vibrated about a central bearing pin, 12^b, seated in a recess in the valve face, by a hand lever, 14, fixed upon a stem, 15, which is journaled in a cap, 16, secured on the end of the valve casing and covering the valve, said stem having a transverse tenon or projection, 15^a, on its inner end, which engages a corresponding mortise, 12^a, on the top of the valve. A disk, 15^b, on the stem, provided with a gasket, fits truly in a cylindrical bore in the cap, to prevent leakage of fluid from the casing. Fluid under pressure is admitted to a chamber in the valve casing, interposed between the valve faces thereof, through a supply pipe, 17, connected to the upper portion of the casing, and is discharged from the motor cylinders through an exhaust pipe, 18, connected to a nipple, 18^a, screwed into the lower portion of the casing. Ports, 13^b, one in each valve face, establish continuous communication between the supply pipe, 17, and the spaces between the valve faces and the caps, 16, and each of the operating valves is provided, on its face, with an exhaust cavity or recess, 12^c (see Fig. 9). A port, or passage, 19, in each valve face, communicates continuously with the exhaust pipe, 18, through a central passage, 19^a, in the nipple, 18^a, to which said pipe is connected, and one or the other of two ports or passages, 20, on opposite sides of the port, 19, establishes, (see Fig. 10) when uncovered by the valve, 12, working on said valve faces, communication between the supply pipe, 17, and one of the supply and exhaust pipes, 4^a, 4^b, of the motor cylinder controlled by said valve. By vibrating either of the hand levers, 14, about the axis of its stem, 15, the supply and exhaust pipes of the opposite ends of the motor cylinder controlled by the valve to which said hand lever is connected, will alternately be brought into communication with one of the ports, 20, and the communicating supply pipe, 17, when said port is uncovered by the valve, and with the port, 19, and the communicating exhaust pipe, 18, when the port, 19, and the other port, 20, are brought into communication through the exhaust cavity, 12^c, of the valve. The piston of each motor cylinder will consequently be reciprocated therein, coincidently with the movements of its operating valve and with corresponding speed and force.

To admit of the automatic discharge of water of condensation from the interior of the valve casing, 13, a drain valve, 25, of the puppet type, is fitted in a plug, 25^a, screwed into the bottom of the valve casing, said valve controlling communication between the fluid supply chamber of the casing and a passage, 25^b, leading to an annular groove, 18^b, in the periphery of the connecting nipple, 18^a, of the exhaust pipe, from which groove a passage, 18^c, leads into the central passage, 19^a, of said nipple. So long as motive fluid is cut off from the supply chamber, the drain valve is held unseated by a spring, 26, and any water that may collect in the supply chamber will escape by gravity therefrom, through the passages, 25^b and 18^c, into the exhaust pipe. Upon the admission of pressure to the supply chamber, the drain valve is seated by said pressure, and remains seated until the pressure is again cut off from the chamber.

The traverse of the actuating lever in either direction, and, consequently the range of movement which will be imparted to the grate bars, is regulated as desired by adjustable stops, 21, which are preferably, as shown, set screws, engaging lugs on the

flanges, 1ª, of the motor cylinders, in position to be contacted with by opposite sides of the actuating levers, 7, at short distances from the center of oscillation of said levers. The set screws, 21, are provided with lock nuts, 21ª, to hold them in adjusted position, and as shown in Fig. 4, are inclined relatively to the adjusting levers when the latter are in central position, while in Figs. 11 and 13, they are at right angles to said levers when in said position. As shown in Fig. 13, one of the stops is adjusted to abut against the adjusting lever when in central position, and consequently the lower arm of said lever cannot be further moved in the direction of said stop. This adjustment is made in cases where it is desired that the grate bars shall be rocked on one side only of their central planes transverse to the firebox.

In order to either lock the grate bars in normal position or to permit a limited range of movement to be imparted to them when desired, a double latch mechanism is provided for each actuating lever and its connections, the same consisting of a main latch, 22, pivoted at one end by a pin 22ª, to a bearing, 23, fixed to the rear head of the firebox, and a supplemental latch, 24, pivoted to the main latch by a pin, 24ª, in position to normally abut against the upwardly projecting arm, 9ᶜ, of the rock shaft, 9ª. As shown in Figs. 4 and 5, the main latch is longitudinally slotted and the arm, 9ᶜ, is normally held in locked position between the outer end of its slot and the supplemental latch, 24. When the latter is swung upwardly around its pivot in the main latch, a limited degree of traverse of the arm, 9ᶜ, and its connections is permitted, and when the main latch is swung upwardly upon its pivot, 22ª, the arm, 9ᶜ, and its connections may be moved freely through their entire range of traverse. In the structural modification shown in Figs. 11 and 12, the main latch, 22, is a flat plate and the supplemental latch, 24, is slotted to embrace it, the outer end of the supplemental latch normally forming the bearing for the arm, 9ᶜ. The arm, 9ᶜ, may therefore be moved in one direction, *i. e.*, outwardly, but cannot be moved in the opposite direction, so long as the latches are in the position shown in the drawings. It may, however, be either moved partially or fully in the opposite direction, accordingly as either the supplemental latch only, or both the main and the supplemental latch, is or are swung upwardly, as in the form shown in Figs. 4 and 5.

The mechanism above described is of simple and comparatively inexpensive construction, and as the motor cylinders, actuating levers, and grate bar connections are all located below the main foot plate or deck of the locomotive, or below the foot boards or running boards, which extend forwardly therefrom, it is not in position to interfere with the movements of the engineer and fireman or to obstruct the cab. The grate sections may be separately or conjointly actuated as desired, either by power or manually, and the traverse of the grate bars be limited to whatever degree may from time to time be found to be best adapted to the conditions of fuel and service.

I claim as my invention and desire to secure by Letters Patent:

1. The combination, in a grate shaking appliance, for locomotives provided with a foot plate, of a horizontal motor cylinder secured under said foot plate and in rear of the firebox of the locomotive, a piston working therein, an operating valve controlling the admission and exhaust of fluid to and from said cylinder, a double armed actuating lever pivoted adjacent to and projecting into said cylinder and adapted to move in substantially a vertical plane and having one of its arms located in position to be oscillated by the piston, and connections for coupling the opposite arm of said lever to a rocking grate.

2. The combination, in a grate shaking appliance, for locomotives provided with a foot plate, of a horizontal motor cylinder secured under said foot plate and in rear of the firebox of the locomotive, a piston working therein, an operating valve controlling the admission and exhaust of fluid to and from said cylinder, a double armed actuating lever pivoted adjacent to and projecting into said cylinder and adapted to move in substantially a vertical plane and having one of its arms located in position to be oscillated by the piston, connections for coupling the opposite arm of said lever to a rocking grate, and an arm coupled to the actuating lever for the application of manual power to effect its movement.

3. The combination, in a grate shaking appliance, for locomotives provided with a foot plate, of a horizontal motor cylinder secured under said foot plate and in rear of the firebox of the locomotive, a piston working therein, an operating valve controlling the admission and exhaust of fluid to and from said cylinder, a double armed actuating lever pivoted adjacent to and projecting into said cylinder and adapted to move in substantially a vertical plane and having one of its arms located in position to be oscillated by the piston, connections for coupling the opposite arm of said lever to a rocking grate, and an adjustable stop for regulating the traverse of the actuating lever.

4. The combination, in a grate shaking appliance, for locomotives provided with a foot plate, of a horizontal motor cylinder secured under said foot plate and in rear of the firebox of the locomotive, a piston working therein, an operating valve controlling

the admission and exhaust of fluid to and from said cylinder, a double armed actuating lever pivoted adjacent to and projecting into said cylinder and adapted to move in substantially a vertical plane and having one of its arms located in position to be oscillated by the piston, connections for coupling the opposite arm of said lever to a rocking grate, and a pivoted locking latch mechanism acting to oppose movement of the actuating lever and its connections.

5. The combination, in a grate shaking appliance, for locomotives provided with a foot plate, of a horizontal motor cylinder having a longitudinal slot in its middle portion secured under said foot plate and in rear of the firebox of the locomotive, heads closing the ends of said cylinder, supply and exhaust pipes opening into the ends of said cylinder, a piston fitting said cylinder and having a longitudinal slot in its middle portion, an operating valve controlling the supply and exhaust pipes, a double armed actuating lever pivoted adjacent to the motor cylinder and having one of its arms extending through the longitudinal slot thereof and into the longitudinal slot of the piston, connections for coupling the opposite arm of said lever to a rocking grate and stops for limiting the movement of said lever.

6. The combination, with a steam boiler firebox, of a rocking grate, a foot plate, a horizontal motor cylinder located below said foot plate and in rear of the firebox, a piston working in said cylinder, a double armed actuating lever having one of its arms projecting into and operated by said piston, a rock shaft journaled adjacent to the firebox, an arm projecting downwardly from said shaft, a link coupling said arm to the actuating shaft, connections coupling said arm to the rocking grate, and an arm projecting upwardly from the rock shaft for the application of manual power.

7. The combination, with a steam boiler firebox, of a rocking grate, a foot plate, a horizontal motor cylinder located below said foot plate and in rear of the firebox, a piston working in said cylinder, a double armed actuating lever moving in a vertical plane and having one of its arms operated by said piston, a rock shaft journaled adjacent the firebox, an arm projecting downwardly from said shaft, a link coupling said arm to the actuating shaft, connections coupling said arm to the rocking grate, an arm projecting upwardly from the rock shaft for the application of manual power, and a locking latch mechanism pivoted to the firebox and abutting against said upwardly projecting arm.

8. The combination, with a steam boiler firebox, of a rocking grate, a motor cylinder, a piston working therein, connections from said piston to the rocking grate, an operating valve working in a valve casing and controlling the admission and exhaust of fluid to and from the motor cylinder, a drain valve controlling a discharge passage from the valve casing and fitted to be seated by pressure therein, and a spring bearing on said valve and acting to unseat it upon and during the release of pressure from the valve casing.

9. The combination, in a grate shaking appliance, of a pivoted actuating lever, fluid pressure operating means for oscillating said lever about its pivotal axis, connections for coupling said lever to a rocking grate, means for manually oscillating said lever, a pivoted main latch for preventing movement of said lever in one direction, and a supplemental latch pivoted to the main latch for permitting a limited degree of movement of said lever.

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