C. H. WILLIAMS.

STOKER FOR LOCOMOTIVES.

APPLICATION FILED JULY 19, 1910.

1,043,987.

Patented Nov. 12, 1912.

2 SHEETS—SHEET 1.

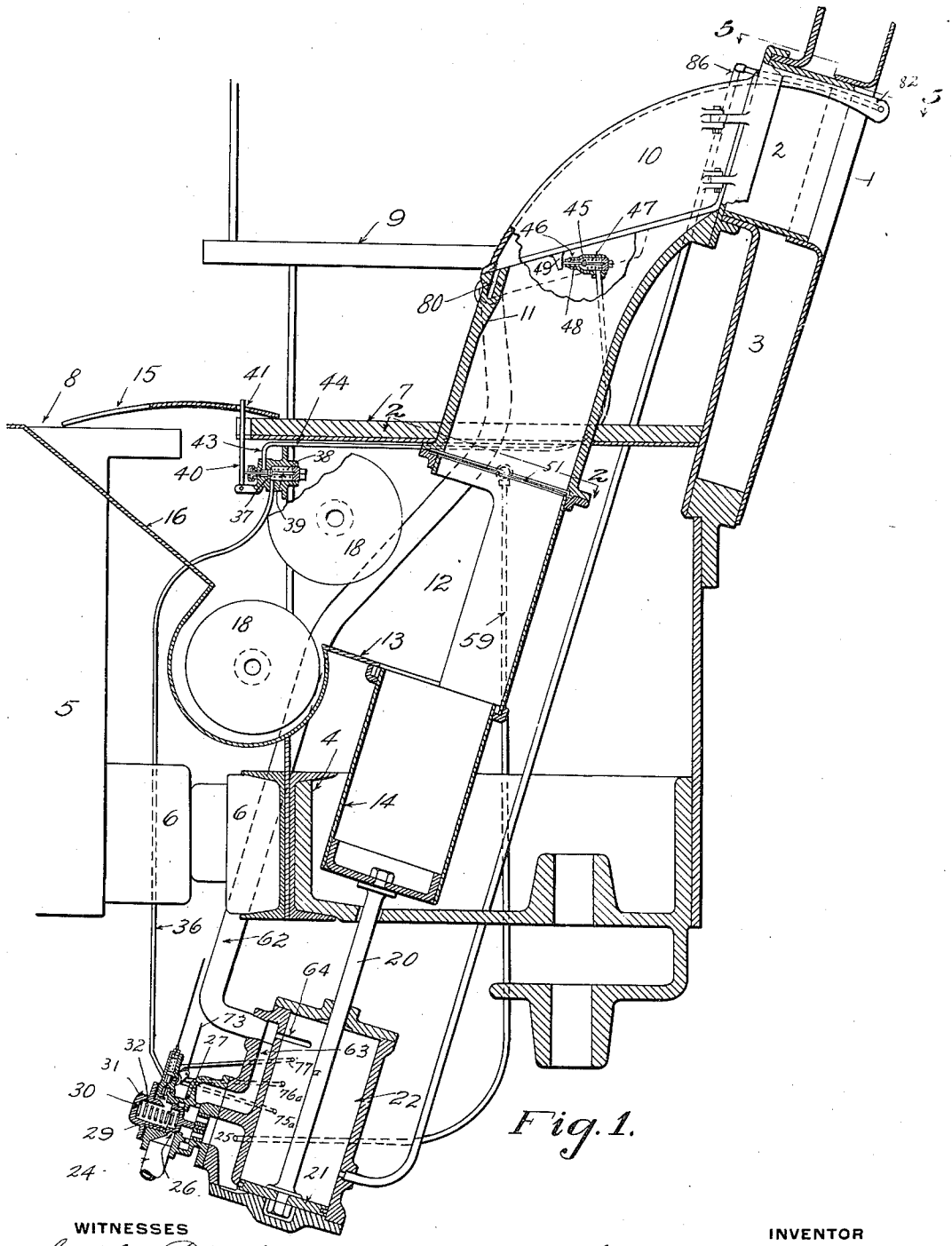

Fig. 1.

WITNESSES

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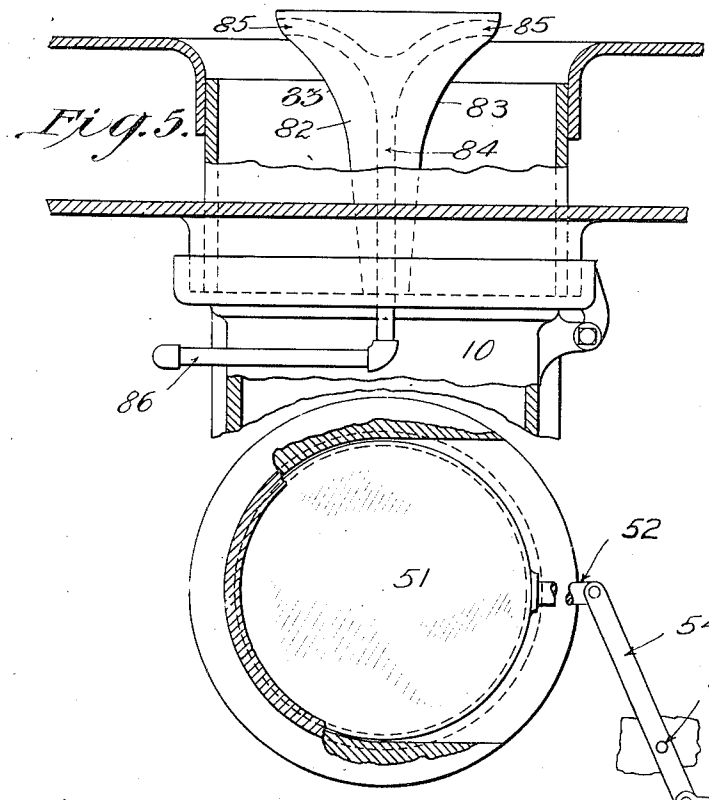

Fig. 5.

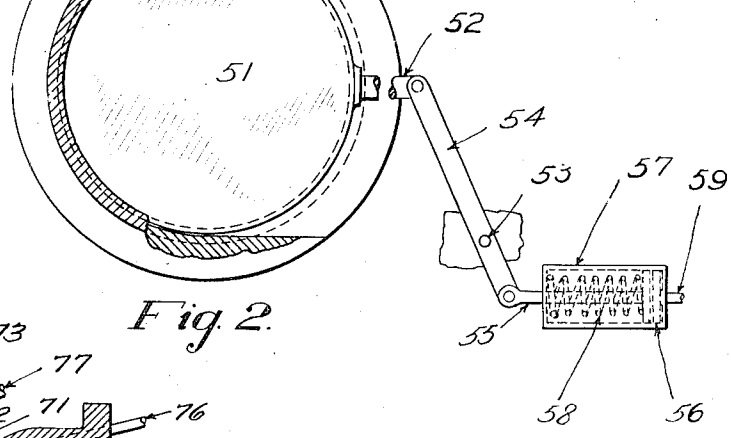

Fig. 2.

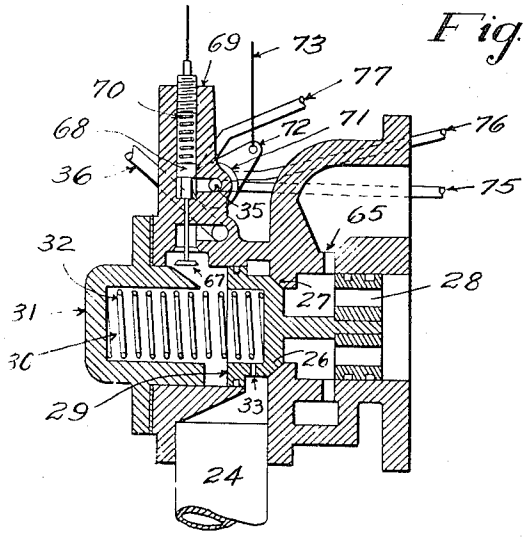

Fig. 3.

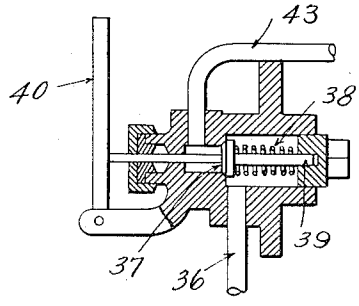

Fig. 4.

WITNESSES

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STOKER FOR LOCOMOTIVES.

1,043,987. Specification of Letters Patent. Patented Nov. 12, 1912.

Application filed July 19, 1910. Serial No. 572,685.

To all whom it may concern:

Be it known that I, CHARLES H. WILLIAMS, a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Stokers for Locomotives, of which the following is a specification.

This invention relates to stoking or coal feeding devices for locomotives.

The object of the invention is to provide apparatus for this purpose which occupies a minimum amount of space on the locomotive, and particularly in the cab, which is so arranged that the locomotive can be fired by hand in case the automatic feeding apparatus becomes disabled, and which is of comparatively simple construction and not likely to get out of order.

The invention comprises the construction, location and arrangement of parts hereinafter described and claimed.

In the accompanying drawings Figure 1 is a vertical section through the fuel feeding apparatus and showing a portion of the locomotive and tender; Fig. 2 is a cross sectional view through the feeding tube or conduit taken on the line 2—2, Fig. 1; Figs. 3 and 4 are enlarged views respectively of the admission valve and the exhaust valve; and Fig. 5 is a horizontal sectional view taken on the line 5—5, Fig. 1, and showing the vane for spreading the coal in plan.

In the drawings a portion of the locomotive fire box is indicated at 1 this being provided with the usual firing door opening 2 in the water leg 3 of the fire box.

The end of the locomotive frame is indicated at 4 and the end of the tender frame at 5, these being provided with the usual bumpers 6.

The floor of the locomotive cab is indicated at 7 and the floor of the tender at 8.

The fireman's seat is shown at 9.

The firing door opening of the fire box is provided with a specially shaped door 10 which may be formed either in two parts divided vertically at the center with the two parts swinging in opposite directions, or in a single part hinged at one side. The latter construction is shown in the drawing. This door is of a curved or hood shape, curving backwardly and downwardly and being hollow underneath. It is adapted to be swung to one side to expose the firing opening 2 for the purpose of breaking up or cleaning the fire or for hand firing. The lower edge of the door has a close fit with the upper end of a tube or conduit 11 which projects diagonally downwardly and slightly rearwardly through the floor of the locomotive cab, and below said floor is provided with the fuel receiving opening 12. This tube or conduit is closed at its lower end 13, said closure being provided with an opening through which reciprocates the fuel feeding bucket 14. The tender floor near the front is provided with an opening 15 from which a plate or chute 16 leads to the opening 12 in the fuel feeding tube or conduit 11. Preferably coal crushing devices are placed in the passage for the coal so as to crush the same before reaching the bucket 14. The drawings show crushing rollers 18, which may be driven by a small engine supplied with steam from the boiler. Any other form of crusher, however, may be used, or the crusher may be entirely omitted in case the coal supplied to the locomotive runs uniformly small. A conveyer, such as a screw, may be provided on the tender floor to convey the coal to the opening 15.

The bucket 14 is connected to the upper end of piston rod 20, which is carried by piston 21 working in the single acting steam cylinder 22, so that when steam is introduced into said cylinder beneath the piston the latter is forcibly moved upwardly to give a very quick, accelerated movement to the bucket to throw the coal in the bucket up through the tube 11 and through the feeding opening 2 into the fire box.

The cylinder 22 is operated by live steam taken from the locomotive boiler, or from compressed air supplied by a pump or reservoir, which is supplied through pipe 24 to the lower end of cylinder 22 through passage 25. Between the passage 25 and the supply pipe 24 is the admission valve, which comprises a valve 26 adapted to seat on seat 27 and provided with a stem to which is connected a ring piston 28 which is provided with openings to permit the steam or air to pass through the same. The valve 26 is provided with an annular extension forming a piston 29 which works in chamber 30, closed by cap 31. The valve 26 is normally held to its seat by the combined action of a spiral spring 32 in the chamber 30, and the pressure of live steam which leaks past the piston 29 or through a small leak port 33.

As long as the chamber 30 is kept closed the combined action of the spring and live steam overbalances the pressure of steam acting underneath the annular piston 29, and consequently the valve 26 remains on its seat. The valve is opened automatically by the pressure of steam underneath the annular piston 29 when the pressure is vented from chamber 30. To this end there is connected to chamber 30 at 35 a pipe 36 which leads to the exhaust valve 37. This exhaust valve is normally held to its seat by spring 38, and is provided with a stem 39 against which bears the actuating lever 40 which projects slightly above the floor plate 41 in position to be operated by the fireman either by his hand, foot, shovel, or other implement which he may have in his hand. When the valve 37 is opened pressure is released from the chamber 30 so that the valve 26 opens automatically to admit pressure through passage 25 to the lower end of cylinder 22 underneath the piston 21 to project said piston and bucket 14 upwardly.

In order to prevent the accidental actuation of the piston 21 when the fireman has the door 10 open and is poking, cleaning or examining the fire, I provide means to prevent the venting of steam from chamber 30 when the door is open. To this end the exhaust port 43 of exhaust valve 37 has connected thereto a pipe 44 leading to the control valve 45. The latter is normally held to its seat so as to close exhaust 46 by means of spring 47. The valve is provided with a stem 48 projecting through the casing thereof and into position to be engaged by a projection 49 on the door 10, said projection being so shaped that when the door is closed the valve is pushed backwardly against the tension of spring 47 to hold the valve unseated with the exhaust open, so that as long as the door is closed the actuation of lever 40 admits steam to cylinder 22. When the door 10, however, is open, spring 47 seats valve 45 thereby closing the exhaust from valve 37 so that the accidental actuation of lever 40 produces no effect on the fuel feeding device.

To prevent cold air from coming up through the tube or conduit 11 when fuel is not being fed, said conduit is provided with a sliding valve or damper 51, which must be withdrawn to open the tube when a charge of coal is to be fed. To automatically withdraw the damper in time to permit a charge of coal to pass, said damper is provided with an operating rod 52 which is connected to one arm of a lever 54, fulcrumed at 53 and having its other arm connected to the piston rod 55 of a piston 56 working in a cylinder 57, and arranged when steam is admitted behind said piston to withdraw the damper 51, a spring 58 being provided to close the valve when steam pressure is exhausted from the cylinder 57. The cylinder 57 is connected by pipe 59 with the passage 25 in cylinder 22, so that as soon as valve 26 is opened to admit live steam to the lower end of cylinder 22, steam is also admitted to cylinder 57 to withdraw the damper 51. As soon as the steam is exhausted from the lower end of the cylinder 22 the spring 58 automatically closes the damper 51.

The cylinder 22 is exhausted through pipe 62, connected to the passage 63 and to the upper end of the cylinder through port 64. This port is located such a distance from the upper head of cylinder 22, that the piston 21 is cushioned at the extreme end of its upstroke to prevent hammering the upper head of the cylinder and to suddenly arrest the upward movement of bucket 14. The passage 63 is connected with the passage 25 through exhaust port 65, which port is in such position that when valve 26 is seated it is uncovered so as to permit the fluid pressure in passage 25 and lower end of cylinder 22 to pass therethrough, but when valve 26 unseats said port is covered by the ring piston 28 so as to prevent live steam from escaping to the exhaust.

The valve 26 after being opened as heretofore described is seated by closing the exhaust from the chamber 30 through pipe 36. This closure is effected by a small valve 67 controlling the passage between the chamber 30 and the port to which pipe 36 is connected. Said valve is connected to a small piston 68 working in a cylinder 69 and which normally is held by adjustable spring 70 in position to hold the valve 67 open. Valve 67 is closed by admitting steam pressure underneath piston 68. This is effected by means of a three-position rotary valve 71 adapted to be set in any one of three positions by means of arm 72 to which is connected an operating rod 73. The casing of valve 71 is connected to three pipes, 75, 76 and 77, respectively, which open into the cylinder 22 at the points 75^a, 76^a and 77^a, respectively, and which provide for an adjustable cut-off for said cylinder, depending upon the position to which valve 71 is set. For instance, if valve 71 is set in position to connect pipe 75 with the small cylinder 69 then as soon as piston 29 uncovers port 75^a steam is admitted underneath piston 68 and closes valve 67, whereas if the valve 71 is set to either one of the other two positions, valve 67 will not be closed until piston 21 uncovers the port which is connected to the cylinder 69. As soon as the valve 67 is closed fluid pressure entering chamber 30 through leak port 33, with the aid of the tension of spring 32, overbalances the pressure acting against the lower face of the valve 26 and seats said valve, thereby cutting off the flow of fluid pressure to the cylinder 22, and also opening exhaust port 65 so as to exhaust

the pressure from said cylinder. As soon as steam is exhausted from the cylinder the piston 21 descends by gravity.

The exhaust steam or air from cylinder 22 escapes through pipe 62 to a cored out passage 80 in the upper part of the tube 11 near the outer portion thereof and which opens through the upper end of said tube inside of the door 10, in order to blow against the coal and push the same around the curved portion of the conduit formed by the door 10, so that if there is any tendency of the coal to be stopped by hitting against said curved portion of the door the steam or air assists to push it into the fire box.

To prevent the coal entering through the firing opening 2 from dropping in a heap in the middle of the fire box I provide in the upper portion of the door opening a suitable vane or vanes or devices for splitting the coal into two or more streams and directing it toward the sides of the fire box. The vane shown is formed as a casting 82 shaped as shown in Figs. 1 and 5, with spiral or inclined sides 83 shaped to direct the coal in two streams sidewise. To further assist in spreading the coal, and particularly for forcing it into the corners of the fire box and along the side sheets thereof, the vane 82 is provided with a cored out passage 84 having branches 85 leading to the two inner corners thereof. The cored passage is connected by pipe 86 to cylinder 22 so that a portion of the steam or air entering the cylinder passes up through pipe 86 and through the cored passages 84 and 85 and blows or tends to blow a portion of the coal sidewise in both directions.

The operation of the device will be readily understood from the illustration and foregoing description. The fireman shovels the coal upon the plate 16, or it may be fed thereon by a screw or other conveyer, whence the same passes through crusher 18 and into bucket 14. He then operates lever 40 to open valve 37 and exhaust fluid pressure from chamber 30, whereupon valve 26 opens by the overbalancing of pressures on opposite faces thereof. This closes exhaust port 65 and admits live steam underneath piston 21. Steam also passes through pipe 59 into cylinder 57 to withdraw damper 51. The piston 21 and bucket 14 are shot upwardly at a high rate of speed, and said piston and bucket are stopped suddenly but the coal contained in the bucket continues upwardly on account of the momentum imparted thereto and is projected into the fire box, the curved hood acting to scatter the fuel over the surface of the fire. The exhaust steam or air escapes through pipe 62 and flows into the tube or conduit 11 near the curved upper end thereof and assists the coal in passing around said curve. The vane 82 splits the stream of coal into branches and directs the same sidewise toward the side sheets of the fire box and prevents the coal from falling in a heap in the middle of the fire box. The live steam or air or other fluid pressure escaping through ports 85 also acts to blow the coal toward the corners of the fire box and thus helps in distributing the same. The valve 26 seats automatically as soon as the piston 21 has uncovered one of the ports 75^a, 76^a or 77^a, depending upon the position of the three-position cock 71, thereby closing the exhaust from chamber 30, so that pressure again accumulates in said chamber to counterbalance the pressure on the lower face of valve 26.

The tube or conduit 11 is substantially vertical and the coal is thrown up through the same by means of the bucket 14 in a manner largely resembling the shoveling of coal. The bucket 14 does not act merely as a ram or piston to force a column of coal up through the conduit, but the coal contained in the bucket is shot up from the tube or conduit into the furnace, so that the conduit is free from coal at all times except when it is being shot through the same by the bucket. This enables the door 10 to be opened whenever necessary to inspect, poke or clean the fire. By the term "bucket" in the claims hereinafter made is meant a receptacle having sides and a bottom, as distinguished from a mere ram or piston.

The apparatus described is located almost entirely below the floor of the cab, and hence is largely out of the way and does not interfere to any extent with the clear space in the locomotive cab. It can be very easily operated and requires no particular attention except to supply the coal on the plate 16 and actuate the valve lever 40 at the proper time. The feeding mechanism is applied to the usual fire door opening, and in case it should become deranged it is merely necessary to swing the door 10 open and fire by hand, as of old. The fire can be readily poked, cleaned or inspected by opening the door 10, and when this is the case the exhaust port from valve 37 is held closed by valve 45, so that if the lever 40 should be accidentally pushed the apparatus nevertheless would not operate, and throw coal into the face of the fireman or into the locomotive cab.

Various changes may be made in the details of construction of the several parts, and particularly is it possible to use different forms of valves from those illustrated for effecting the several purposes intended.

What I claim is:

1. In a locomotive stoker the combination with a fire box provided with a feeding opening, a door closing said opening, a conduit connected to said opening, a coal feed-

ing member mounted to reciprocate in said conduit, a power cylinder apparatus connected to said member, a valve connecting a source of fluid pressure with said cylinder, and means controlled by the door for preventing actuation of said valve when the door is open.

2. In a locomotive stoker, the combination with a fire box provided with an opening thereinto, a door closing said opening, a conduit connected to said opening, a bucket mounted to reciprocate in said conduit, a power cylinder operatively connected to said bucket, a valve connecting a source of fluid pressure with said cylinder, said valve being held closed by fluid pressure, an actuating valve arranged to exhaust the fluid pressure from said valve and permit it to open, and means controlled by the door for preventing such exhaust when the door is open.

3. In a locomotive stoker, the combination with a fire box provided with a feeding opening, of a substantially vertical conduit connected to said opening, a reciprocating bucket in said conduit arranged to project the coal therethrough, and a vane in the upper part of the feeding opening arranged to spread the stream of coal, said vane being provided with ports therethrough opening on opposite sides and connected to a source of fluid pressure.

4. In a locomotive stoker, the combination with a fire box and feeding opening, of a conduit connected to said opening and curving downwardly, a reciprocating bucket in said conduit, a fluid pressure cylinder operatively connected to said bucket, means for admitting fluid pressure to said cylinder, and connections from the exhaust of the cylinder to the curved upper portion of the conduit and arranged to project the fluid medium into said conduit.

5. In a locomotive stoker, the combination with a fire box provided with a feeding opening, of a substantially vertical conduit connected to said feeding opening, a reciprocating member in said conduit arranged to project the coal up through the same and into the fire box, and a vane in the upper part of the feeding opening arranged to spread the stream of coal, said vane being provided with ports therethrough opening on opposite sides and connected to a source of fluid pressure.

6. In a locomotive stoker, the combination with a fire box provided with a feeding opening thereinto, a conduit connected to said feeding opening, a bucket reciprocating in said conduit, a single-acting power cylinder operatively connected to said bucket, a valve seating by fluid pressure against one face for admitting fluid pressure to said cylinder, a valve controlled passage for exhausting fluid pressure from said valve to permit it to open, and means controlled by the piston in the cylinder for closing said exhaust passage to effect the closing of the main valve.

7. In a locomotive stoker, the combination with a fire box provided with a feeding opening, of a conduit connected to said opening, a reciprocating bucket in said conduit, a power cylinder for actuating said bucket, a damper closing said conduit, a second cylinder for opening said damper, and connections whereby when fluid pressure is admitted into the main cylinder said second cylinder is also actuated.

8. In a locomotive stoker, the combination with a fire box provided with a feeding opening, a hinged door covering said opening and forming part of a fuel supply conduit, a damper closing said conduit, means for forcing fuel through said conduit into said fire box, connections for operating said damper from said means, and connections whereby said means is rendered ineffective upon opening said door.

9. In a locomotive stoker, the combination with a fire box provided with a feeding opening, a door closing said opening and forming a fuel supply conduit, power cylinder apparatus for forcing fuel through said conduit, a fluid pressure connection for said apparatus, a valve controlling the supply of motive fluid through said connection, and a connection between said valve and said door so arranged as to prevent the supply of fluid through said connection when said door is open.

10. In a locomotive stoker, the combination with a fire box provided with a feeding opening, a substantially vertical conduit connected to said opening, fuel feeding means movable in said conduit for feeding fuel into said fire box, a single acting fluid pressure cylinder for operating said means, a vane in the upper part of the feeding opening arranged to spread the stream of fuel and provided with ports therethrough, a connection from the pressure end of said cylinder to said vane, and a connection from the other end of cylinder for leading the exhaust motive fluid to said conduit.

In testimony whereof I have hereunto set my hand.

CHARLES H. WILLIAMS.

Witnesses:
F. W. WINTER,
JAS. L. WELDON.