W. C. A. HENRY.

AUTOMATIC STOKER.

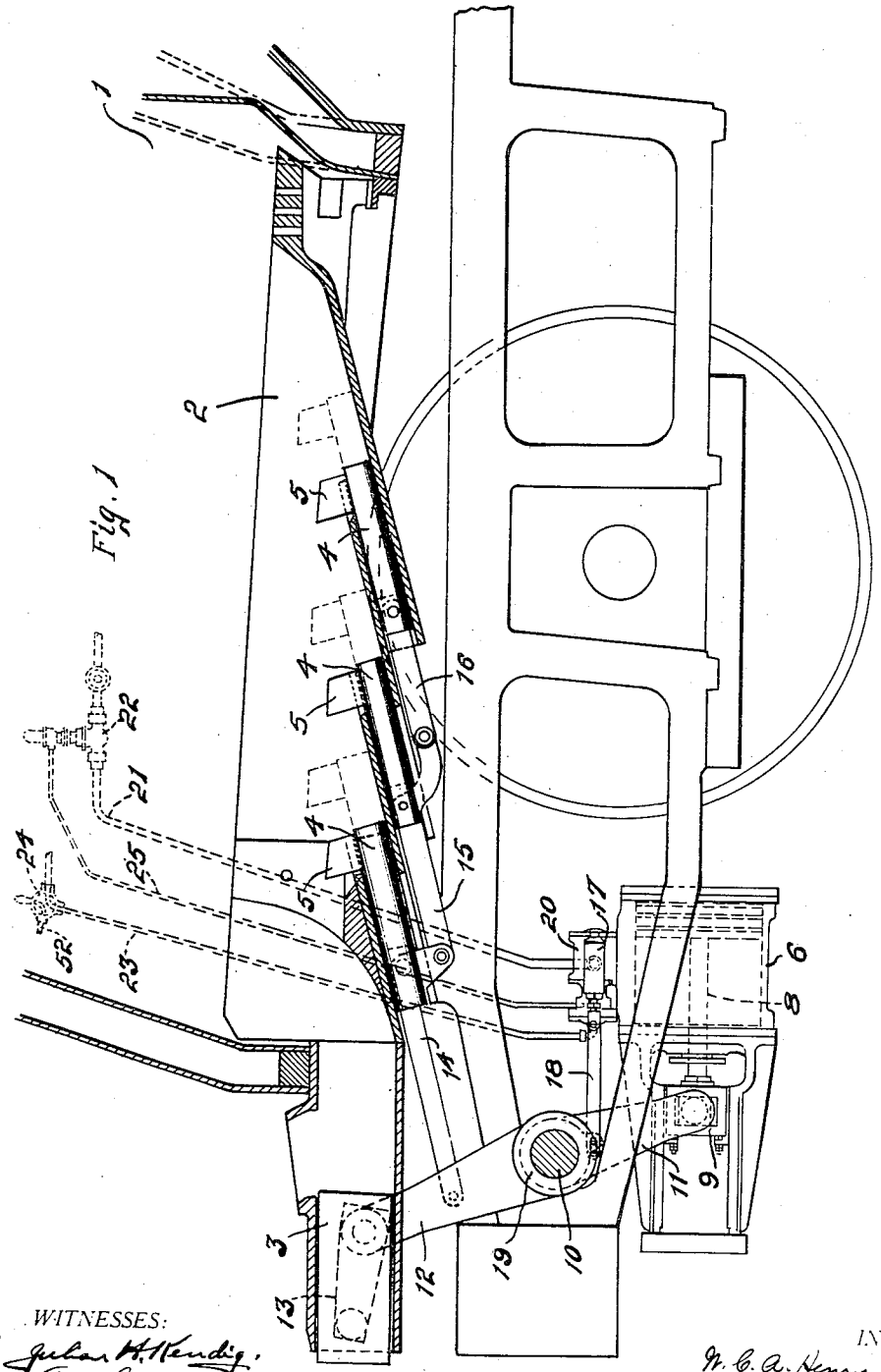
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3 SHEETS—SHEET 1.

Fig. 1



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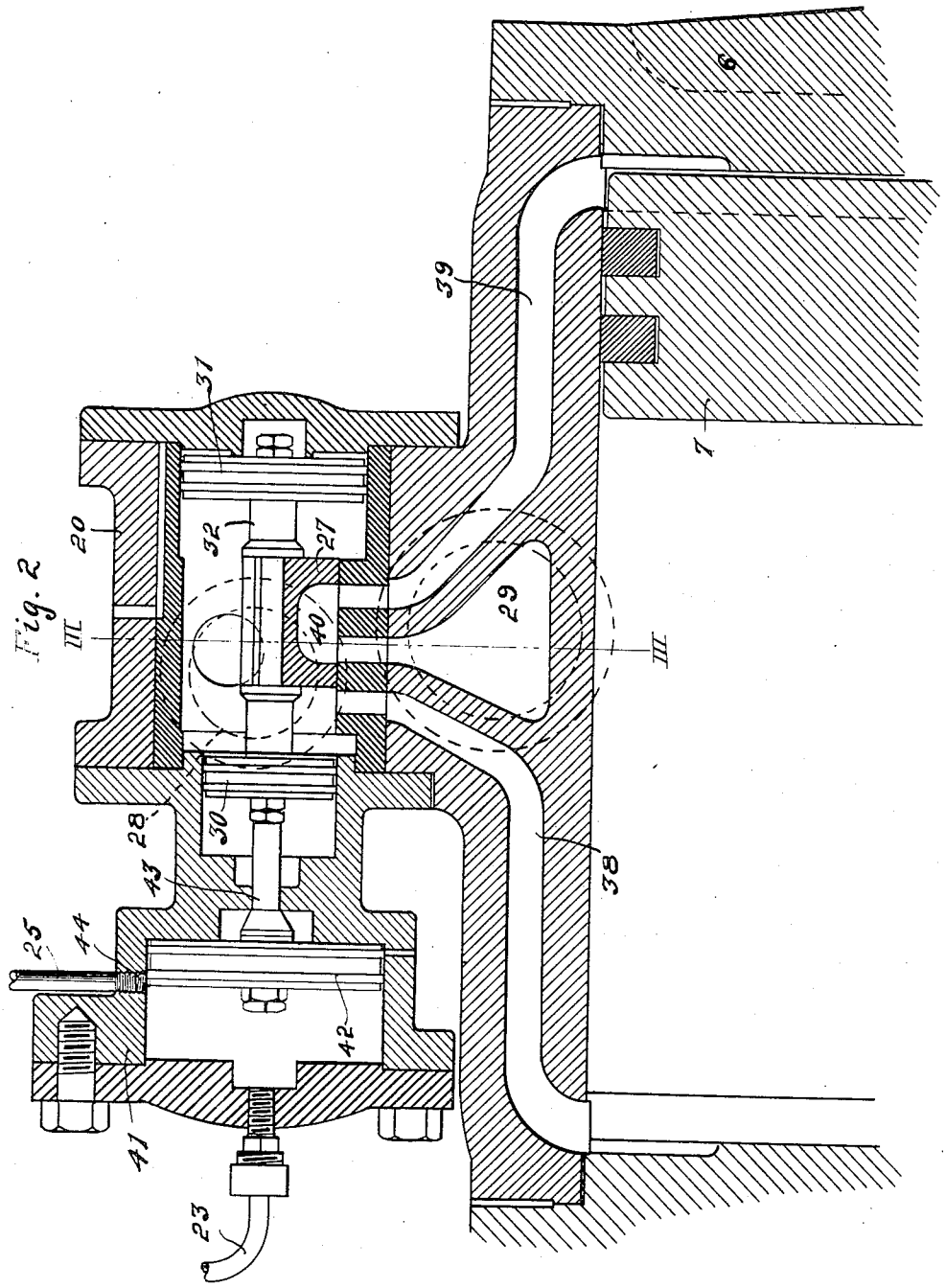


Fig. 2

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3 SHEETS—SHEET 3.

Fig. 4

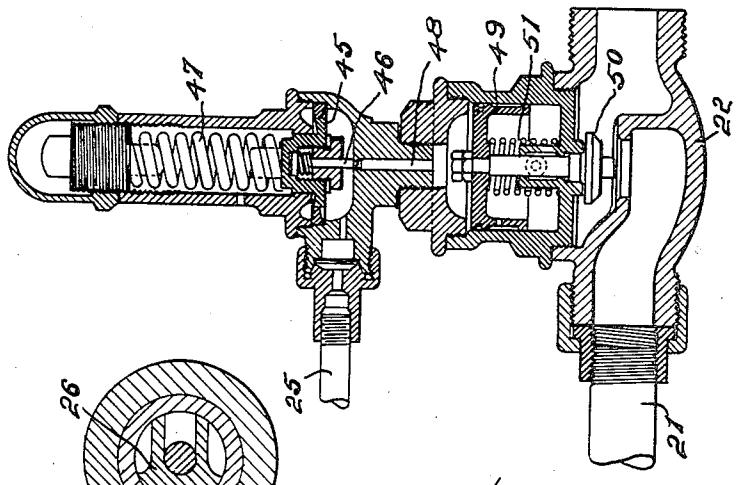
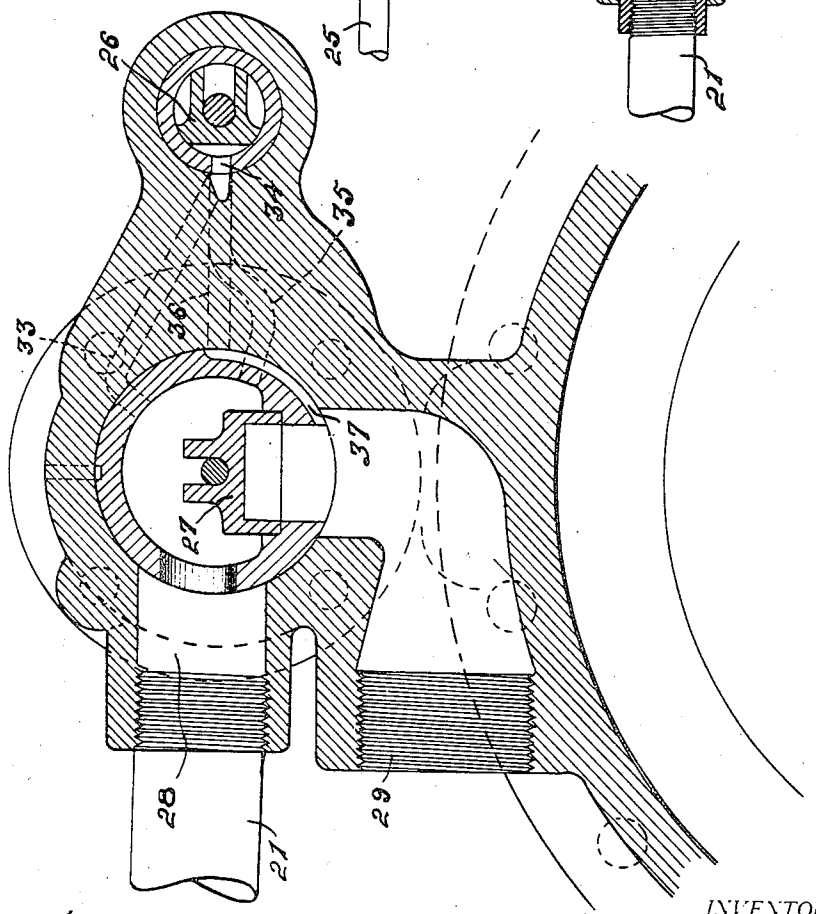


Fig. 3



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AUTOMATIC STOKER.

1,096,106. Specification of Letters Patent. Patented May 12, 1914.

Application filed August 7, 1912. Serial No. 713,924.

To all whom it may concern:

Be it known that I, WILLIAM C. A. HENRY, a citizen of the United States, residing at Columbus, in the county of Franklin and State of Ohio, have invented certain new and useful Improvements in Automatic Stokers, of which the following is a specification.

The invention relates to automatic stokers of the underfeed type, and has for its primary objects; the provision of a stoker mechanism wherein the agitators on the auxiliary feed plungers and the plungers themselves, are protected and a maximum length of life for such parts insured; and the provision of an automatically operating controlling means whereby the movement of the feed plungers is stopped when the plungers are at their greatest distance from the surface of the fuel in the feed trough. One embodiment of the invention is illustrated in the accompanying drawings, wherein—

Figure 1 is a longitudinal section through a locomotive firebox provided with a stoker and showing in side elevation an assembled view of the controlling mechanism embodying the invention, Fig. 2 is a longitudinal section through the valve mechanism employed and the controlling means therefor, Fig. 3 is a transverse section on the line III—III of Fig. 2, and Fig. 4 is a vertical section through the steam admission valve and the operating means therefor.

The invention is applicable primarily to underfeed stokers employing feed troughs and auxiliary pistons or plungers therein for giving the fuel a forward feed through the troughs. In this type of apparatus as commonly employed, the auxiliary pistons are provided adjacent their front ends with upward projections called agitators, and the pistons work upwardly and forwardly through the bottom of the trough, so that in their front positions the ends of the pistons and the agitators carried thereby approach the surface of the fuel in the trough while in their rear positions such parts are buried a greater distance beneath the surface of the fuel. When the stoker is stopped with the auxiliary feed pistons in their forward positions it often happens that the front end of the pistons and their agitators are so close to the surface of the fuel that they are exposed to a heat sufficiently intense to injure these parts, and particularly the agitators, such agitators by reason of this exposure to the heat when the apparatus is stopped with the plungers in their forward positions, requiring frequent replacement. The purpose of the present invention is to provide a controlling mechanism whereby the auxiliary pistons always occupy their rear positions when the apparatus is brought to a stop, at which time the plungers and their agitators are buried at a maximum distance beneath the surface of the fuel in the trough and are so protected from the heat. This result is accomplished by providing a controlling means for the valves of the engine which operates the stoker, such controlling mechanism being so arranged that the valve is always forced to occupy a certain position when the supply of steam is cut off. This of course insures that the piston of the engine shall always occupy the same position upon the stoppage of the apparatus, and this position of the piston of the engine is such that the plungers in the feed trough occupy their rear positions. The position of the engine valve is controlled by means of air pressure supplied from the main reservoir used in connection with the braking apparatus of the train, although steam pressure may be employed if desired.

Referring first to the general arrangement of parts as indicated in Fig. 1, the principal parts may be enumerated as follows; 1 is the firebox of the locomotive, which may be of any approved type; 2 is an underfeed trough, on either side of which are the usual side grates (not shown); 3 is the main feed plunger at the rear end of the trough; 4—4—4 are auxiliary plungers or pistons working through the bottom of the trough and each provided adjacent its front end with the upwardly projecting agitators 5—5—5, the forward positions of which are indicated in dotted lines; 6 is the steam-engine for operating the apparatus, such engine being provided with the piston 7, piston rod 8, and cross head 9; 10 is the rock shaft extending transversely of the locomotive, and oscillated from the cross head 9 by means of the rocker arm 11; 12 is another rocker arm carried by the shaft 10 and connected to the main piston 3 by the connecting rod 13; 14, 15, and 16 are connecting rods whereby the supplemental pistons 4—4—4 are operated from the rocker arm 12; 17 is the casing of the main positively-actuated valve for controlling the

movement of the piston 7; 18 is a connecting rod for operating the valve in the casing 17, such connecting rod being secured at its outer end to a crank 19 carried by the rock shaft 10; 20 is the casing of a secondary differential valve whose movement is controlled by the main valve in the casing 17; 21 is the steam supply pipe for furnishing steam to the engine 6; 22 is the casing of the cutoff valve governing the supply of steam to the engine; 23 is an air pipe for conducting air under pressure from the main reservoir of the brake system to an actuating means at the end of the casing 20, for controlling the operation of the secondary valve in such casing; 24 is a three-way valve governing the supply of air passing through the pipe 23, and also governing the exhaust from such pipe 23; and 25 is an air pipe leading from the casing at the end of the casing 20 to the operating mechanism in the casing 22.

The engine shown in Figs. 2 and 3, is aside from the addition to be hereinafter later described, substantially the same as that always employed with the Westinghouse air brake pump, and the valve mechanism comprises the usual main positively operated valve, and a second differential valve controlled by the actuation of the main valve and itself adapted to govern the admission to the cylinder of the engine. The main valve just referred to is shown only in cross section in Fig. 3 and is indicated by the reference numeral 26. This valve is reciprocated by the connecting rod 18 (Fig. 1), and controls the supply of steam for operating the differential valve 27 shown in Fig. 2. As shown in Figs. 2 and 3, 28 is the steam admission passage to which is connected the supply pipe 21 (Fig. 1) and 29 is the exhaust. Steam admitted through the passage 28 exerts pressure upon both of the heads 30 and 31 to which the valve 27 is connected by means of the stem 32, so that if these heads are unacted upon by some other force the valve 27 occupies the position shown in Fig. 2. The movement of the valve 27 to the left to its other position is secured through the operation of the main valve 26. This valve 26 governs the admission of steam to the right hand end of the head 31, and when this occurs the valve 27 is moved to the left. This admission of steam to the right hand end of the head 31 is secured via the passages 33, 34, and 35, the passage 35 leading to the end of the head 31 from the main valve chamber when the main valve 26 is in one of its extreme positions. When the valve 26 reaches its other extreme of position the chamber to the right of the head 31 is connected to the exhaust 29 by means of the passages 36 and 37, and when exhaust occurs from this end of the head 31 the parts move back again to the position shown in Fig. 2, by reason of the differential pressures upon the inner faces of the heads 30 and 31. It will be seen that when the valve 27 occupies the position shown in Fig. 2 admission is occurring to the left of the piston 7 via the passage 38, and exhaust occurring from the right of such piston 7 via the passages 39, 40, and 29. Also that when the valve 27 is moved to its extreme position to the left admission occurs to the right of the piston 7 via the passage 39, and exhaust occurs from the left of the piston via the passages 38, 40 and 29. The foregoing engine mechanism as described and illustrated is very old and well known in the art, no claim being made to any of such structure, and only a very brief description of such structure being given because of its well known character.

From a consideration of the foregoing description of the operation of the valve mechanism it will be seen that the secondary valve 27 is steam-operated, and that if the piston valve 27 is positively held in the position shown in Fig. 2, the engine will be stopped with the piston 7 occupying its extreme right hand position as indicated in Figs. 1 and 2, and when the piston 7 occupies this position, the auxiliary pistons 4—4—4 will occupy their rearmost positions as indicated in Fig. 1, and the front ends of these pistons or plungers with their agitators will be located a maximum distance below the surface of the fuel in the trough. It will be understood therefore that the purpose of the controlling mechanism, about to be described, is to secure the movement of the valve 27 to the position shown in Fig. 2 and its maintenance in such position whenever the engine is stopped. To this end the air cylinder 41 at the left hand end of the secondary valve casing 20 is provided, and such chamber carries a piston 42 provided with a stem 43 which abuts the end of the stem 32, but is not secured thereto. Air is supplied to the left hand end of the piston 42 by means of the air pipe 23 (Fig. 1). When it is desired to stop the engine and maintain the valve 27 in its extreme right hand position as indicated in Fig. 2, the three-way valve 24 is moved to the position indicated in Fig. 1, thus admitting a supply of air through the pipe 23 and into the cylinder 41. This causes the plunger 42 to move to the right, and its stem 43 engaging with the end of the stem 32 causes the movement of the valve 27 to the position shown in Fig. 2. The area of the piston 42 is such that the differential steam pressures applied to the heads 30 and 31 tending to move the valve 27 to the left is insufficient to cause such movement, so that when air is supplied to the left hand end of the piston 42 the valve 27 is not only moved to the right, but is also maintained in such position

as long as the air pressure is maintained upon the piston 42. The engine is thus stopped with the piston in the position shown in Figs. 1 and 2 and with the auxiliary plungers in the position shown in such figure. It is obviously desirable to also cut off the supply of steam to the engine when this stoppage occurs, and to this end the pipe 25 and controlling mechanism in the casing 22 illustrated in cross section in Fig. 4 are provided. The pipe 25 leads from a small passage 44 in the cylinder 41 so positioned that when the piston 42 reaches its extreme right hand position a flow of air is permitted from the chamber to the left of the piston 42 to the pipe 25. The pipe 25 leads to the controlling mechanism in the casing 22, such controlling mechanism constituting the ordinary governor employed with the Westinghouse air brake system. By reference to Fig. 3 it will be seen that the mechanism carried in the casing 22 comprises a diaphragm 45, a valve 46 carried thereby, an adjustable spring 47 above the diaphragm 45, passage 48 below the valve 46, a plunger 49, a valve 50, and a spring 51 normally holding the plunger 49 in its upper position. When the plunger 42 (Fig. 2) passes the opening 44 and admits air to the passage 25, the air under pressure flowing into the chamber beneath the diaphragm 45 (Fig. 4) causes the opening of the valve 46, thus permitting air pressure to be applied to the upper end of the plunger 49, and such plunger moves down closing the valve 50 and shutting off the supply of steam to the engine.

The operation incident to the stoppage of the engine and the movement of the auxiliary pistons in the position indicated in Fig. 1 is as follows:

The handle of the three-way valve 24 being moved to the position indicated in Fig. 1, air is admitted through the pipe 23 to the left hand end of the cylinder or casing 41. This causes the movement of the plunger 42 to the right, and the engagement of the stem 43 with the stem 32 secures the movement of the valve 27 to the right and its maintenance in the position indicated in Fig. 2. With the valve 27 in this position, steam is supplied from the valve chamber to the left hand side of the piston 7 via the passage 38, exhaust being permitted through the passages 39, 40, and 29. The engine and the auxiliary plungers are thus stopped in the position illustrated. The movement of the plunger to the right also uncovers the passage 44, permitting a flow of air from the cylinder 41 through the pipe 25 and to the lower side of the diaphragm 45 (Fig. 4). This causes the opening of the valve 46, admitting pressure to the upper side of the plunger 49 and causing the closing of the cut off valve 50, so that the supply of steam to the engine is cut off. When it is desired to again start the mechanism, the handle of the three-way valve is moved in a clockwise direction 90 degrees, thus cutting off the supply of air through the pipe 23, and putting such pipe 23 into communication with the exhaust pipe 52. This permits an exhaust of air from the upper side of the plunger 49 (Fig. 4), the air passing back through the pipe 25 to the cylinder 41 and thence through the pipe 23 to the exhaust. The plunger 49 immediately moves upward under the influence of the spring 51, opening the valve 50 and supplying steam to the engine. There is now no interference with the operation of the valve 27, since the pressure to the left of the plunger 42 has been relieved, so that such plunger is free to be pushed to the left by the differential pressure upon the heads 30 and 31.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent, is the following:

1. The combination with an underfeed stoker having a feed trough and an auxiliary feed member working in the trough and during its forward movement approaching the surface of the fuel in the trough and during its rearward movement receding therefrom, of a steam engine having a piston connected for operating the feed means, a positively operated main valve, a steam actuated secondary valve controlling the movement of the piston and itself controlled from the main valve, and manually controlled means for stopping the secondary valve in such position that the piston will be stopped with the feed member in its rear position.

2. The combination with an underfeed stoker having a feed trough and an auxiliary feed member working in the trough and during its forward movement approaching the surface of the fuel in the trough and during its rearward movement receding therefrom, of a steam engine having a piston connected for operating the feed means, a positively operated main valve, a steam actuated secondary valve controlling the movement of the piston and itself controlled from the main valve, a cut off valve for controlling the supply of steam to the engine, and manually controlled means for stopping the secondary valve in one extreme of movement and securing the closure of the cut off valve, whereby the piston is stopped in one extreme of movement, and the feed member stopped in its rear position.

3. The combination with an underfeed stoker having a feed trough and an auxiliary feed member working in the trough and during its forward movement approaching the surface of the fuel in the trough

and during its rearward movement receding therefrom, of a steam engine having a piston connected for operating the feed means, a positively operated main valve, a steam actuated secondary valve controlling the movement of the piston and itself controlled from the main valve, fluid pressure actuated means for stopping the secondary valve in position to secure the stoppage of the feed means in its rear position, and a hand operated means for controlling the supply of fluid to said fluid pressure actuated means.

4. The combination with an underfeed stoker having a feed trough and an auxiliary feed member working in the trough and during its forward movement approaching the surface of the fuel in the trough and during its rearward movement receding therefrom, of a steam engine having a piston connected for operating the feed means, a positively operated main valve, a steam actuated secondary valve controlling the movement of the piston and itself controlled from the main valve, fluid pressure actuated means for stopping the secondary valve in position to secure the stoppage of the feed means in its rear position, a cut off valve for controlling the supply of steam to the engine, fluid pressure actuated means for operating such cut off valve, and a hand operated means for controlling the supply of fluid to both of said fluid pressure actuated means.

In testimony whereof I have hereunto signed my name in the presence of the two subscribed witnesses.

WILLIAM C. A. HENRY.

Witnesses:
GEO. W. DAVIDSON,
W. L. SCOTT.