N. M. LOWER ET AL

STOKER

Filed May 26, 1924 4 Sheets-Sheet 1

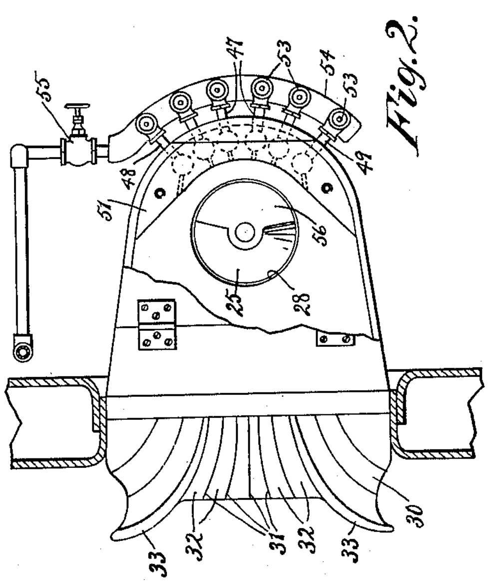


Fig. 2.

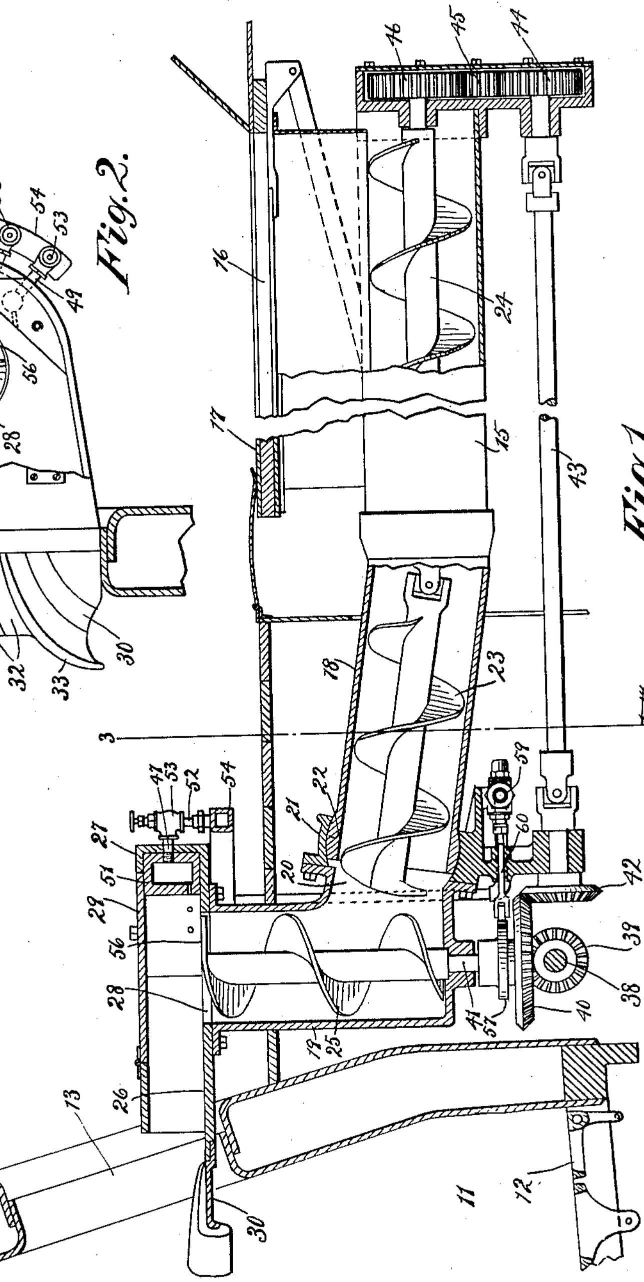


Fig. 1.

Inventors:
Nathan M. Lower
Paul A Ketchpel
By [signature]
Attys.

Feb. 7, 1928. 1,658,246

N. M. LOWER ET AL

STOKER

Filed May 26. 1924 4 Sheets-Sheet 2

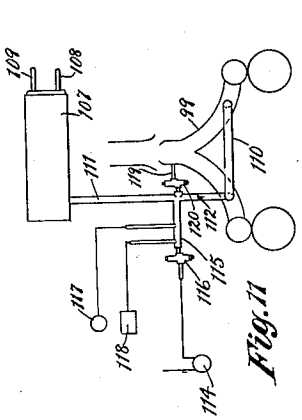


Fig. 1.

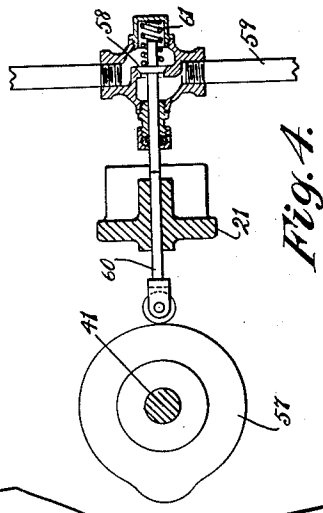
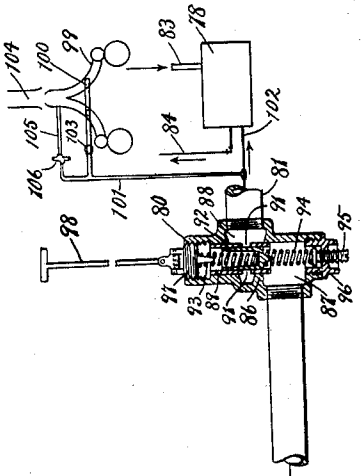


Fig. 4.



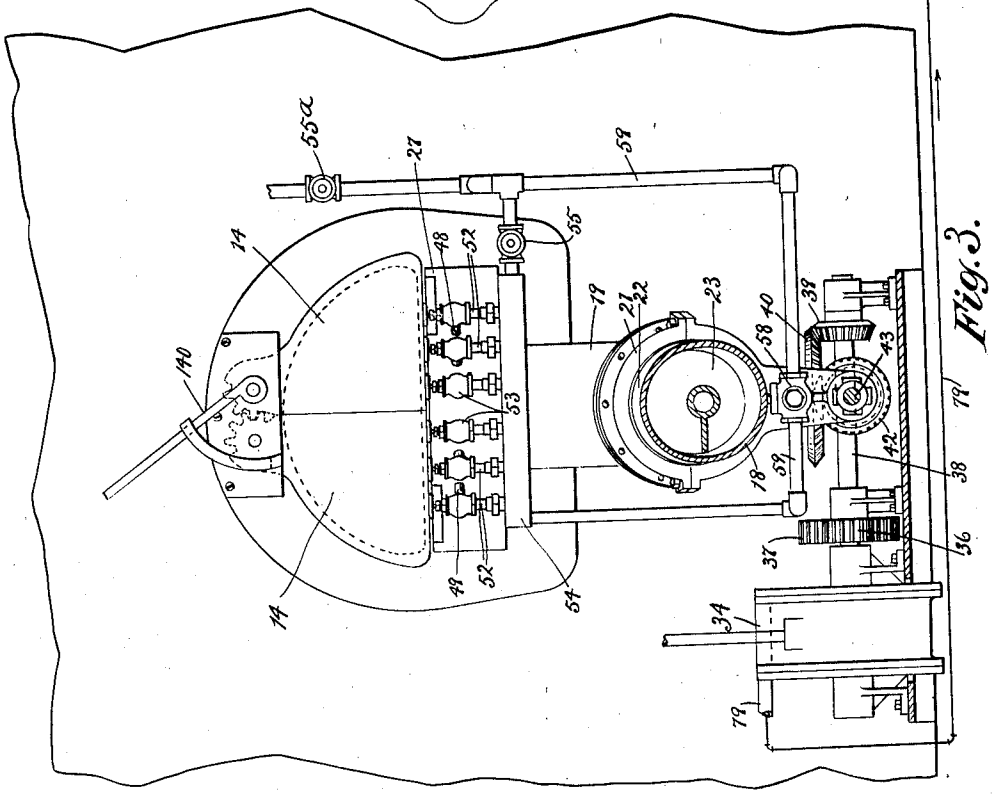


Fig. 3.

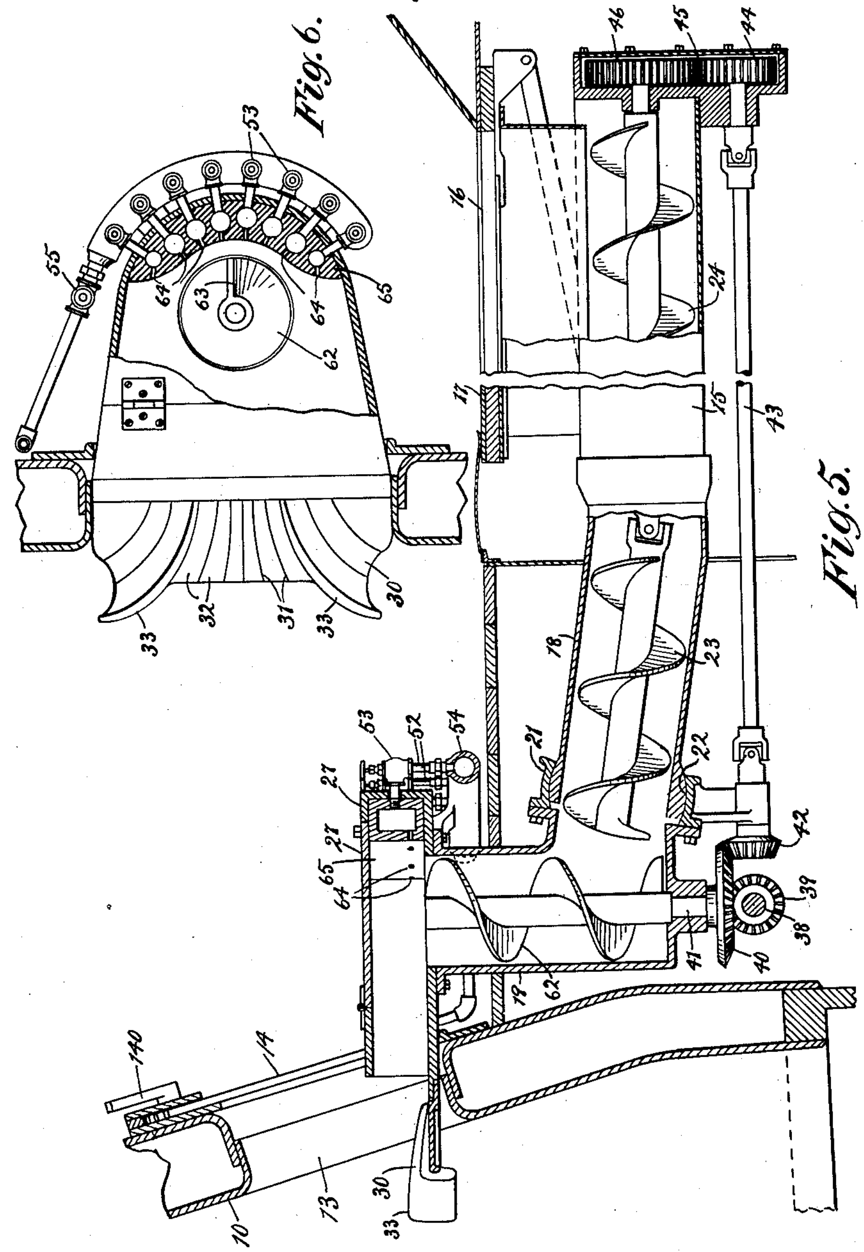
Inventors:
Nathan M. Lower
Paul A. Ketchpel
By Fillow Mann
Attys.

Feb. 7, 1928. 1,658,246

N. M. LOWER ET AL

STOKER

Filed May 26, 1924 4 Sheets-Sheet 3



Inventors:
Nathan M. Lower
Paul A. Ketchpel

By Gilson Moore & Cox
Attys.

Feb. 7, 1928. 1,658,246

N. M. LOWER ET AL

STOKER

Filed May 26, 1924 4 Sheets-Sheet 4

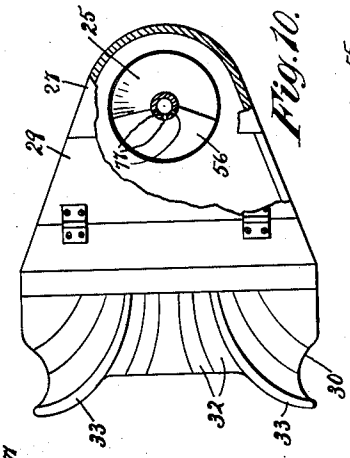


Fig. 10.

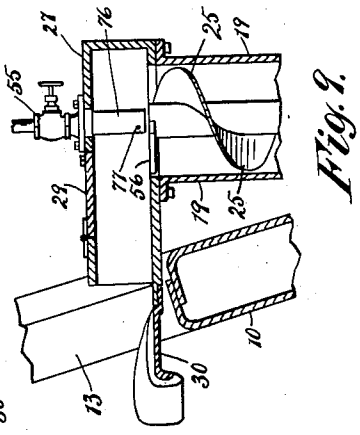


Fig. 9.

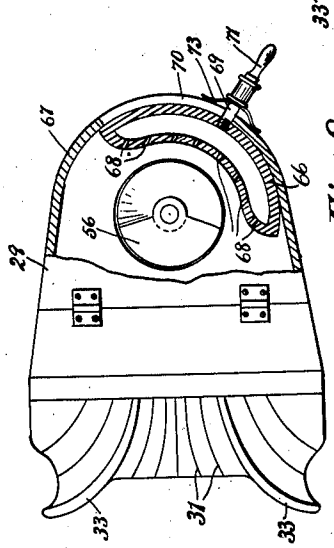


Fig. 8.

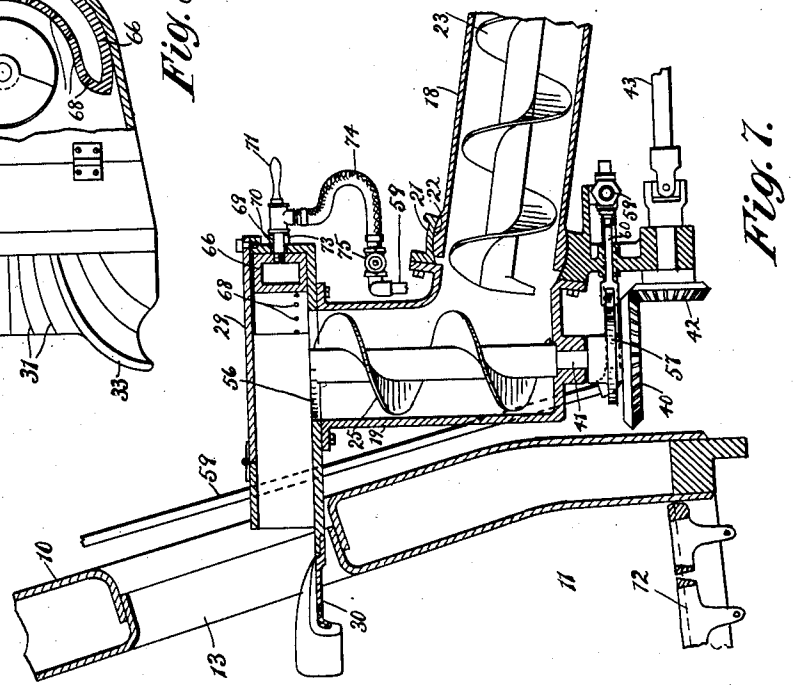


Fig. 7.

Inventors:
Nathan M. Lower
Paul A. Ketchpel
By Gibbon Mac
Attys.

Patented Feb. 7, 1928. 1,658,246

UNITED STATES PATENT OFFICE.

NATHAN M. LOWER AND PAUL ALLISON KETCHPEL, OF PITTSBURGH, PENNSYLVANIA, ASSIGNORS TO LOCOMOTIVE STOKER COMPANY, A CORPORATION OF PENNSYLVANIA.

STOKER.

Application filed May 26, 1924. Serial No. 715,811.

This invention relates to locomotive stokers, and more particularly to that type wherein the fuel is introduced through an opening in the rear wall of the fire box.

The principal objects of the invention are the provision of a new and improved stoking mechanism that is cheap to manufacture, easily assembled, simple in construction, efficient in operation, composed of few moving parts and that is not likely to get out of order.

Other objects of the invention are the provision of new and improved mechanism whereby the exhaust from some or all of the accessory motors may be utilized in heating the water prior to its introduction into the boiler of the locomotive.

Other and further objects and advantages of the invention will appear from the following description taken in connection with the accompanying drawings, in which

Fig. 1 is a diagrammatic view of a portion of a locomotive showing the invention in position thereon, with parts in vertical section and parts broken away;

Fig. 2 is a plan view of a portion of the structure shown in Fig. 1;

Fig. 3 is a section on line 3—3 of Fig. 1, and in addition, showing a vertical section of a back pressure valve arranged in a system for preheating water supplied to the boiler, the heater and connections being shown diagrammatically;

Fig. 4 is a detail plan view showing the valve operating mechanism, with parts in section;

Fig. 5 is a view similar to Fig. 1, but showing a modified form of the device;

Fig. 6 is a plan view of the forward portion of the stoker, with parts broken away and parts in section;

Fig. 7 is a vertical section showing a further modified form of the device;

Fig. 8 is a plan view thereof, with parts in section and parts broken away;

Fig. 9 is a vertical section of a portion of a still further modified form of the device;

Fig. 10 is a plan view thereof, with parts in section and parts broken away; and

Fig. 11 is a diagrammatic view of a slightly modified form of construction for preheating the water supplied to the boiler.

On the drawing, the reference character 10 designates the back head of a locomotive firebox 11 of the usual or well known construction. The firebox 11 is provided with the customary grates 12, and has an opening 13 in the rear wall thereof which permits the introduction of fuel into said firebox. The opening 13 is closed by doors 14 provided with suitable operating mechanism 140, all of which are of the usual or well known construction.

Suitable means are provided for automatically supplying fuel to the firebox and for distributing the same on the grates. In the device chosen to illustrate one embodiment of the invention the reference character 15 designates a fuel conveyor trough located beneath a slot 16 in the deck 17 of the tender, in the usual manner, as conventionally shown in Fig. 1. A conveyor tube 18 which may be arranged at an angle to the trough has its rear end connected to the trough 15 and its forward end flexibly connected to the elevator casing 19 in alinement with an opening 20 in the side wall of said casing in any suitable manner as by means of the sleeve 21 which may form a socket to engage a corresponding spherical projection 22 formed over the forward end of the tube 18 as is usual in such constructions. A screw conveyor which may be in two sections 23 and 24 connected together by a universal pivot (see Figs. 1 and 6) is provided for transferring the fuel from the locomotive tender to the elevator casing 19 from which, or through which, it is elevated by means of the elevator or screw conveyor 25 for suppplying the same to a distributor plate 26 the rear portion of which may be, and preferably is, in the form of a fuel receptacle 27.

Since the invention relates to improvements of stokers of known construction, it is not thought necessary to illustrate and further describe the details of construction of this mechanism. The stoker mechanism is suitably mounted upon and attached to the locomotive.

The fuel receptacle is open at its forward end and is provided with a circular opening 28 in its bottom wall through which the fuel is supplied from the elevator 25. A lid 29 hinged to the top wall of the receptacle 27 provides means of access to the interior of said receptacle.

A plate 30 which may be considered as the distributor plate proper, constituting the forward portion of the distributor plate 26 is detachably secured to the bottom wall of the receptacle 27 and extends forwardly through the opening 13 for distributing the lower stratum of fuel in the firebox. The plate 30 is provided with ribs 31 forming channels 32, those near the center of the plate being straight and those at the sides being curved laterally, for directing the fuel to all portions of the firebox. Certain of the ribs 33 at each side of the plate are made higher than the others and are extended beyond the plate to form curved directing members for supplying fuel to the rear portion of the firebox.

The elevator or screw conveyor 25 is operated from the motor 34 (see Fig. 3) as by means of, or through, the intermeshing gears 36 and 37, the power shaft 38 and the bevel gears 39 on said shaft and 40 on the lower end of the shaft 41 of the elevator screw 25, as clearly shown in Figs. 1 and 3. The conveyor screw 23, 24 is likewise operated from the motor 34. This is accomplished by driving the same from the gear 40 through the gear 42, shaft 43 and intermeshing gears 44, 45 and 46 at the rear of the trough 15, in the usual manner.

Suitable means are provided for directing a fluid under pressure against the fuel supplied to said receptacle for delivering the same to the firebox. A plurality of jets 47 located at the rear of the opening 28 and preferably arranged on a curve, are employed for this purpose. As shown, they are arranged substantially radially on the arc of a circle which is concentric with the circular opening 28, although it is understood that the arrangement may be otherwise, or on a different curve. By arranging the jets radially on a curve their combined action will result in a forwardly directed blast and by closing the valves at one side the jets on the other side will direct a blast to move the fuel to the opposite side of the firebox. In other words, each jet is directing its blast substantially against the center of the fuel mass and hence tends to move the fuel along the radial line on which the jet is located, thus making it possible to direct the fuel to either side of the firebox, or to vary the feed to different parts of the same in any manner desired. By partially or entirely closing certain valves and leaving others open or partially open an innumerable number of different distributing effects may be produced. One or more of the jets at each side of the fuel receptacle may be directed forwardly as shown at 48 and 49, thereby preventing accumulation of coal at each side of the fuel receptacle.

The jets may be contained in a single block forming the nozzle 51 which may be located in the reduced rear portion of the receptacle 27. The jets are independent and each is adapted to be supplied with steam or other fluid under pressure by a separate pipe 52 having an individual valve 53 for independent control. The pipes 52 are connected to a header 54 which is adapted to supply steam from the boiler or other fluid under pressure to said pipes. The header is provided with a valve 55 for controlling the supply of steam to the pipes 52.

The upper flight of the elevator screw 25 may be arranged horizontally to form a plate 56 on which the fuel may collect as it is elevated by the spiral portion of the screw.

The distribution of the fuel will obviously be more uniform if the mechanism is so timed that there will be a blast across the plate 56 only when the same is adjacent to or directly opposite the block 51. Suitable mechanism is accordingly provided for intermittently directing the blast across the plate in timed relation to its rotation. It is desirable that the plate 56 be adjacent to the jets (Fig. 2) during the operation of the blast in order that the resistance to the initial movement of the fuel may be the more easily overcome. The mechanism for accomplishing this purpose comprises a cam 57 (see Figs. 1 and 4) fixed to the shaft 41 of the elevator screw 25, which is adapted to open the valve 58 in the pipe 59 that supplies steam from the boiler to the header 54. The valve 58 is provided with an elongated stem which is engaged by a tappet 60 in which is journaled an anti-friction roller for engaging said cam for opening the valve in timed relation with the rotation of the plate 56. A spring 61 normally maintains the valve in closed position.

In the operation of the device the fuel is supplied from the tender to the receptacle 27 by the conveyors 23, 24 and 25. By means of the intermittent blast or blasts from the nozzle 51 the fuel is forcibly ejected forwardly along the floor of the receptacle at each rotation of the elevator screw 25 and is distributed by the blast and the ribs of the plate over the grates to all parts of the firebox.

The intensity of the blasts are controlled by the valve 55^a in the steam supply pipe 59 operated in any suitable manner while the directional effect of the blasts may be controlled by the valves 53. The blast may be made continuous by opening the valve 55.

The form of the device shown in Figs. 5 and 6 differs from that shown in Figs. 1 to 4, inclusive, in that the upper flight of the elevator screw 62 does not terminate in a horizontal plate and the means for providing intermittent blasts is omitted. As shown, the blast is continuous and thus forcibly

ejects the fuel into the firebox as fast as it emerges from the casing 19. The fuel emerges from the casing 19 only in front of the upper portion of the flight 63 as the same rotates, thus resulting in an oscillating delivery of the fuel to the fuel receptacle 27, which, being acted upon by the forwardly directed jets 64 in the nozzle block 65, causes an oscillating distribution of the fuel from side to side of the firebox.

The intensity of each of the individual jets is controlled by its individual valve 53 or by the valve 55, both of which are arranged substantially the same as in the form shown in Figs 1 to 4. The remaining structure is substantially the same as that previously described, and the parts are designated by the same reference characters.

In the form of the device shown in Figs. 7 and 8, the nozzle block 66 is curved and is movable in the correspondingly curved rear end of the receptacle 67. The block 66 is hollow and nozzle openings 68 are provided in its front wall. While these openings are shown as being parallel, it is understood that they may be convergently or otherwise arranged.

Steam is delivered to the chamber of the block 66 through a pipe 69, which extends through a slot 70 in the rear wall of the casing 27, and is provided with a handle 71 whereby the block may be shifted to direct the blasts to either side or to an intermediate point in said firebox for trimming the fire therein. A spring 73, on the pipe 69, engages the rear wall of the fuel receptacle 67, and resiliently holds the block 66 against the inner side of said wall. The pipe 69 is connected to the steam supply pipe 59 by a flexible hose 74. A valve 75 in the supply pipe 59 is adapted to regulate the supply of steam to the block 66.

The elevator screw 25 is substantially the same as that shown in Figs. 1 to 4, and has its upper flight terminating in a horizontal plate 56, as in said figures.

Means are provided whereby the blasts from the nozzle block will be intermittently directed against the fuel for distributing the same. The means shown are substantially the same as that shown in Figs. 1 to 4, and comprise the cam member 57, mounted on the elevator screw shaft 41, which engages the valve stem 60 for operating the valve, as in said figures. The arrangement of the cam may be the same as in Figs. 1 to 4, or it may be so arranged that the plate 56 will be opposite the block 66 when the valve is opened, as shown in Fig. 7.

The form of the device shown in Figs. 9 and 10 differs from that shown in Figs. 7 and 8 in that the movable nozzle block is replaced by a nozzle member or block 76 in the form of a pipe, having its lower end closed and supported above the elevator screw in axial alinement therewith. The nozzle block or pipe 76 is provided with a plurality of forwardly directed openings 77 therein, for distributing the fuel in the fire-box. No claim is made in this application for the specific form of construction disclosed in Figs. 9 and 10.

The blast may be continuous or intermittent. If the elevator screw be provided with a plate 56 at its upper end, as in Figs. 1 to 4, the blast is preferably intermittent, and is arranged to operate when the plate 56 is in front of the nozzle block 76, as in Figs. 7 and 8.

It is common practice to utilize a portion of the locomotive exhaust to preheat the water used in the boiler of the locomotive. Almost all locomotives as at present constructed are equipped with one or more steam operated accessory motors for operating the air pump, the electric light generator, the stoker, etc. In order to conserve the heat that would otherwise be lost in the exhaust of these accessory motors suitable means are provided for utilizing the heat in the exhaust for assisting in preheating the water for the locomotive boiler. As shown in Fig. 3, the exhaust from the stoker motor is employed to assist in preheating the water supplied to the boiler.

As is usual in such constructions, a portion of the exhaust from the locomotive engine is employed to heat the water in the preheating tank 78. This exhaust is led from the main exhaust passages 99 through the branch exhaust passage formed by the pipes 100, 101 and 102 into the preheating tank 78. A check valve 103 in the passage 100 prevents surging of the pressure back and forth through said passage. In other words, this check valve prevents the pressure in the tank from forcing steam or water back along the passage 100. Water enters the tank 78 through the pipe 83 and is pumped into the locomotive boiler from said tank through the pipe 84 in the usual manner.

The exhaust from the stoker motor 34 is led through the exhaust pipes 79, 81, into the pipe 102, and thence into the heater 78.

The back pressure at the exhaust nozzle 104 will vary considerably due to the different operating conditions of the engine. In order therefore that this back pressure shall not affect the operation of the stoker engine a pressure relief or check valve 80 is employed in the exhaust pipe 79 leading from the stoker motor or engine 34. This valve is so constructed that it will open at a predetermined pressure in the pipe 79. The valve 80 is connected to the end of the exhaust pipe 79 and is in communication with the preheating tank 78 through the pipe 81 and connecting pipe 102 as shown diagrammatically in Fig. 3

The valve 80 comprises a valve housing

divided by the partition 86 into two chambers 87 and 88 which are in communication with the pipes 79 and 81, respectively. A sleeve 89 provided with apertures 91 in its wall opening into the chamber 88 is secured in the partition 86 with its lower end opening into the chamber 87. A plunger 92 is slidably mounted in the sleeve and is held in position between the springs 93 and 94. The tension of the spring 94 is adjusted by means of the stud 95 threaded in the nut 96 and engaging the lower end of the spring 94. The tension of the spring 93 is adjusted by means of the plug 97 threaded in the upper end of the valve housing. The plug 97 may be operated by means of a handle 98 which may extend within convenient reach of the operator.

When the plunger 92 is forced upward by the pressure of the exhaust in the pipe 79, the ports 91 are uncovered to permit the exhaust to enter the water in the tank 78 for heating the same. The tension of the springs 93 and 94 is so adjusted that the ports 91 will not be uncovered until the pressure on the plunger 92 reaches a predetermined amount. By adjusting the springs so that the ports 91 will not be opened until the pressure on the plunger 92 is substantially that of the maximum back pressure developed, the pressure in the pipe 79 will be maintained fairly constant, whereby the speed of the stoker motor 34 will remain substantially uniform.

Suitable means are provided for relieving the back pressure when the same rises above a predetermined amount in the pipe 101. As shown diagrammatically in Fig. 3, a by-pass around the valve 103 is provided for this purpose. The by-pass, as illustrated, comprises a pipe 105 which connects the pipe 101 with the exhaust passage 99 and is provided with a pressure relief valve 106. The valve 106 may be a relief pressure valve similar to the valve 80 or it may be of any other approved type.

When the pressure within the pipe 101 rises above a predetermined amount preferably somewhat below that at which the valve 80 in the pipe 79 is set, the valve 106 will open and relieve the pressure. By this arrangement pressure in the pipe 81 will not interfere with the exhaust from the stoker past the valve 80, and consequently the operation of the stoker will remain fairly constant.

In Fig. 11 is shown diagrammatically a modified form of construction in which the exhaust from all the accessory motors is employed for assisting in heating the water supplied to the boiler of the locomotive. In this construction the heater 107 may be of any approved construction. The water enters the heater at 108 and passes from the heater through the pipe 109 into the boiler. A portion of the exhaust from the locomotive engine is also employed to heat the water in the heater tank. As shown, steam from the exhaust passages 99 is led through pipes 110 and 111 into the heater 107. The pipe 111 is provided with a check valve 112 which in construction and function is similar to the valve 103 in Fig. 3. The exhaust from the stoker motor 114 is led to the heater 107 through the pipe 115 which is connected to the pipe 111. The pipe 115 is provided with a check valve 116 which is preferably of the same construction as the valve 80 shown in Fig. 3. The exhaust from the remaining motors, as the electric light generator, turbine motor 117 and the air pump motor 118 is conducted into the pipe 111 as by being connected to the pipe 115. A by-pass 119 between the pipe 111 and the exhaust passage 99 is provided with a pressure relief valve similar to the valve 80 whereby when the pressure in the pipe 111 exceeds a predetermined amount the valve will automatically open and relieve the pressure.

It is thought from the foregoing, taken in connection with the accompanying drawings, that the construction and operation of our device will be apparent to those skilled in the art, and that various changes in size, shape, proportion and details of construction may be made without departing from the spirit and scope of the appended claims.

We claim as our invention:

1. In a locomotive stoker, a fire-box provided with an opening in the rear wall thereof, a fuel receptacle having a floor extending into said opening, means including an upstanding rotary element for delivering fuel to said receptacle through the floor thereof, said floor extending on opposite sides and at the rear of said opening, and means for delivering a blast of fluid under pressure along the floor of said receptacle and across the discharge end of the delivering means.

2. In a locomotive stoker, in combination, a fire-box having an opening in the rear wall thereof, a distributer plate associated with the opening in said firebox, rotary means for delivering fuel through an opening in the bottom wall of said plate, said plate extending on opposite sides of said rotary means, and means for directing a blast across the upper portion of said rotary means and along said plate.

3. In a locomotive stoker, in combination, a fire-box having an opening therein, a fuel casing associated with said opening, said casing having an opening in the bottom wall thereof, a nozzle movable relatively to said casing, provided with a plurality of jet openings arranged in an arc of a circle about said opening for directing an escaping fluid across the same and along the bottom wall of said casing, and means for supplying fuel to said casing through said opening.

4. In a locomotive stoker, a delivery casing adapted for the discharge of fuel into a fire-box, a screw conveyor for supplying fuel to said casing through its bottom wall, said bottom wall extending all around said opening, and a plurality of individually controlled jets for directing a blast against the fuel as it is delivered to said casing.

5. In combination, a fire box, a fuel receptacle associated therewith and provided with an opening in its bottom wall at a point spaced from the edges thereof, means for supplying fuel to said receptacle through said opening, means for directing a blast across such opening, and means for varying the direction of said blast relative to said receptacle.

6. In combination, a fire-box, a fuel receptacle associated therewith and provided with an opening in its bottom wall spaced from the edges of said wall, means for supplying fuel to said receptacle through said opening, means for directing a blast across such opening, and means for varying the direction of said blast relative to said opening.

7. In a stoker for locomotives, an elevating screw, means for supplying fuel to said elevating screw, the upper portion of the flight of said screw being provided with a flat portion extending at right angles to the axis of said screw, and means for projecting the fuel from said flat portion into the fire-box of said locomotive.

8. In combination, a locomotive fire-box, an elevating screw having a flight terminating in a flat portion extending at right angles to the axis of said screw, means for supplying fuel to said elevating screw, and means for intermittently projecting the fuel from said flat portion into said fire-box.

9. In combination, a locomotive fire-box provided with an opening in the rear wall thereof, a fuel support adjacent to and extending into said opening, means for supplying fuel to said support, means including a movable nozzle block having a plurality of nozzle openings for directing a blast against the fuel on said support, and means for changing the direction of said blast.

10. In combination, a locomotive fire-box having an opening in one wall thereof, a receptacle opening into said fire-box, a screw conveyor for delivering fuel to said receptacle, a nozzle block provided with a plurality of converging nozzles, and means for manually moving said block on a curved line for controlling the direction of the blast from said nozzles

11. In combination, a fire-box having an opening in one wall thereof, a fuel receptacle opening into said fire-box, a conveyor for delivering fuel to said receptacle through the bottom thereof, a nozzle block movably mounted in said receptacle and provided with nozzles directed across the center of said conveyor, and means for moving said block about said conveyor.

12. In combination, a fire-box having an opening in the end wall thereof, a fuel receptacle opening into said fire-box, a conveyor for delivering fuel to said receptacle, and a nozzle block movably mounted in said receptacle and provided with nozzles directed across the center of said conveyor.

13. In combination, a fire-box, a distributor plate, and means for projecting fuel supplied to said plate into said fire-box, said means comprising a laterally adjustable nozzle block having converging openings therein.

NATHAN M. LOWER.
PAUL ALLISON KETCHPEL.