April 16, 1929. T. F. DWYER, JR 1,709,167

SOOT BLOWER

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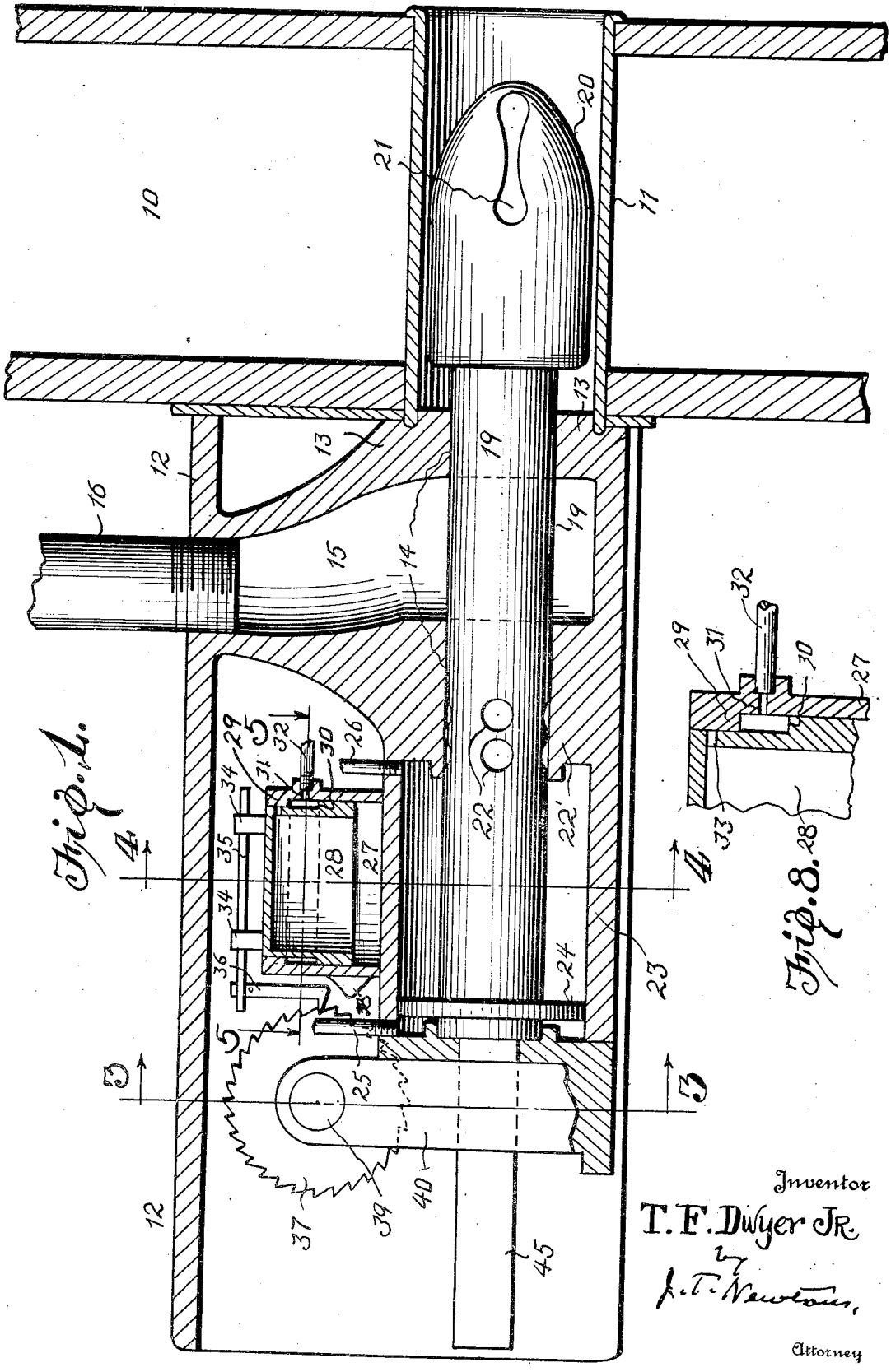


Fig. 1.

Fig. 3.

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SOOT BLOWER

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Fig. 3.

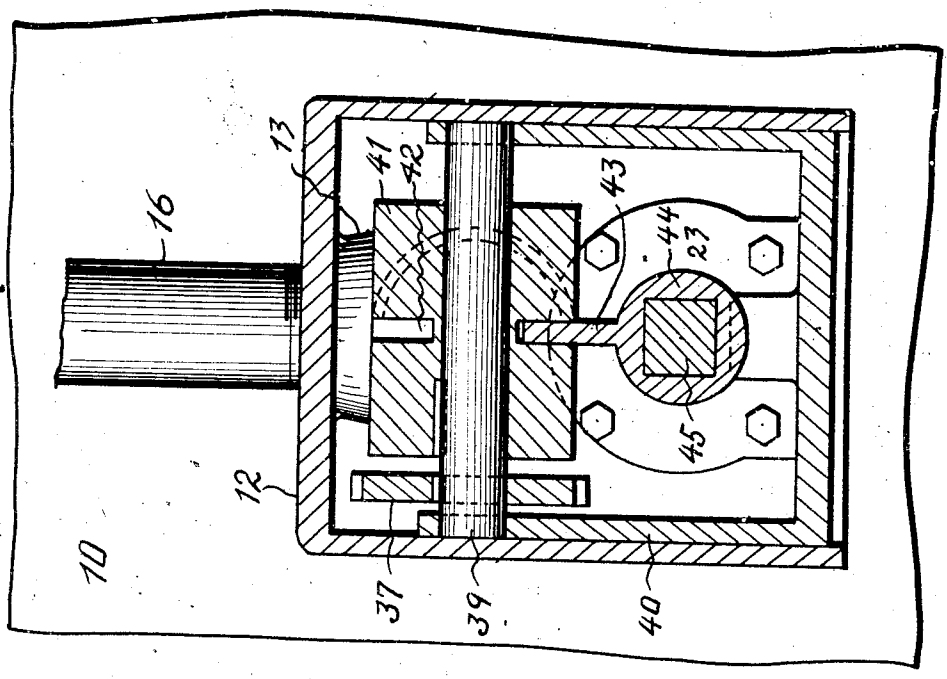
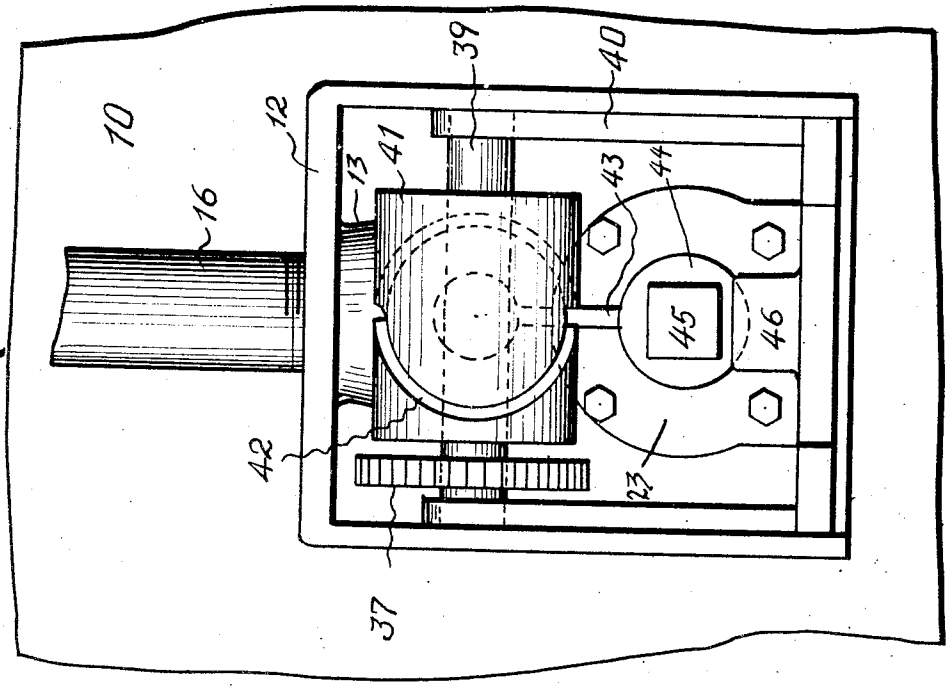


Fig. 2.



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SOOT BLOWER

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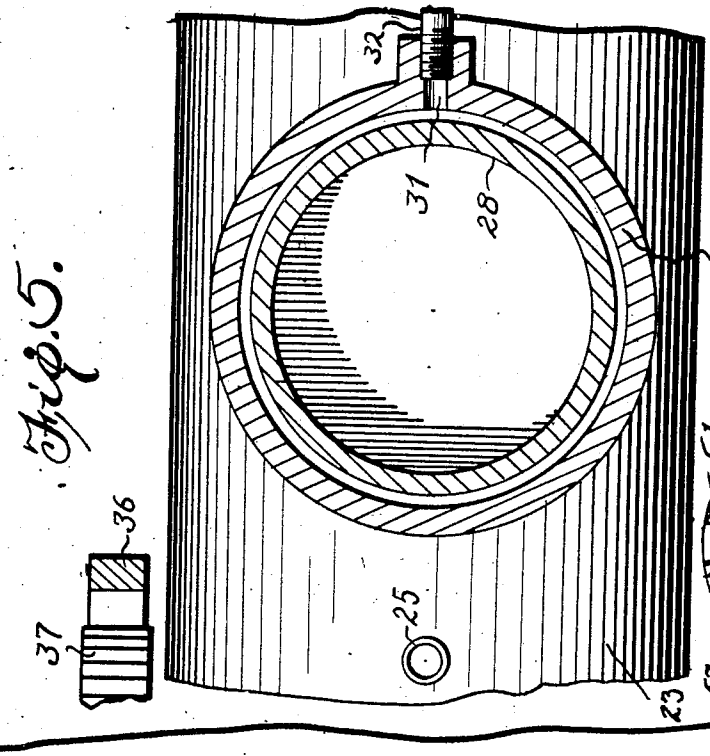


Fig. 5.

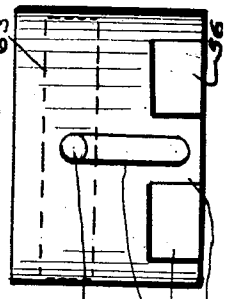


Fig. 10.

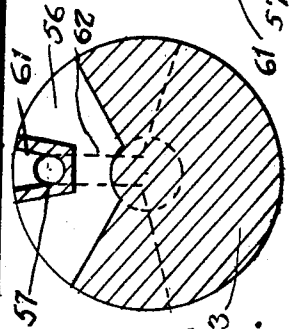


Fig. 9.

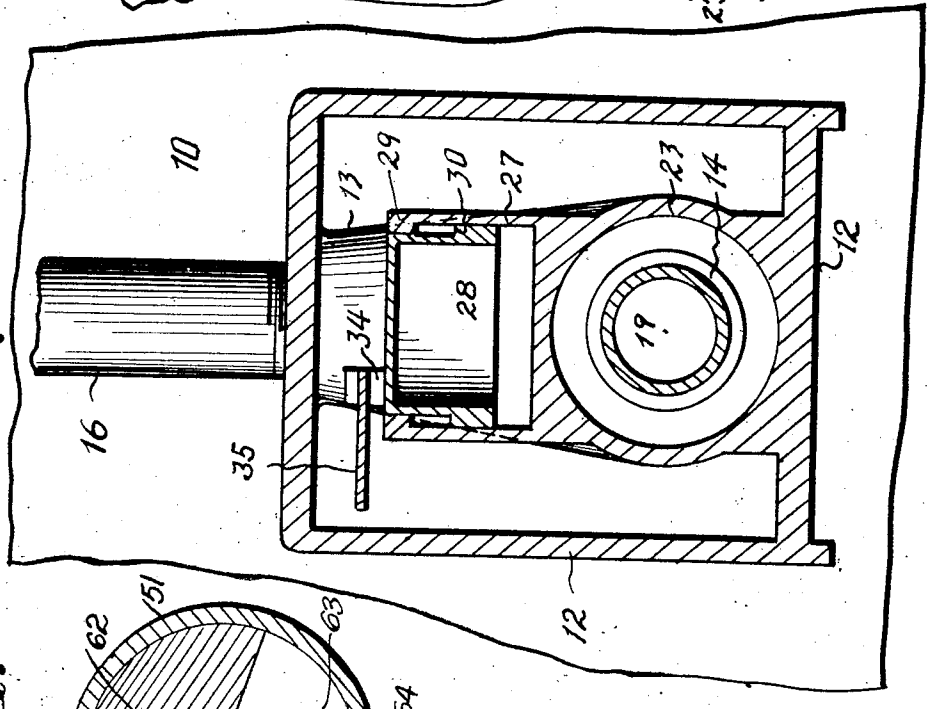


Fig. 4.

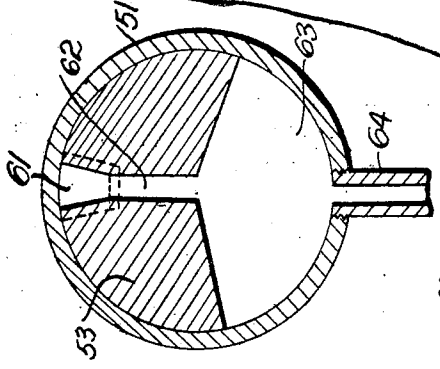


Fig. 11.

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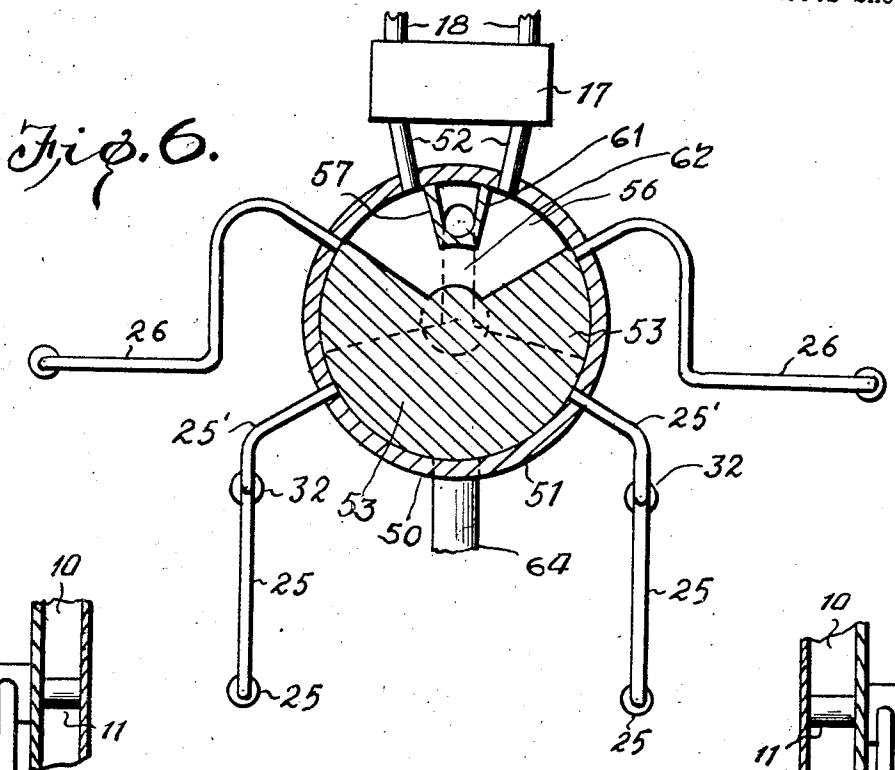
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SOOT BLOWER

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Fig. 6.



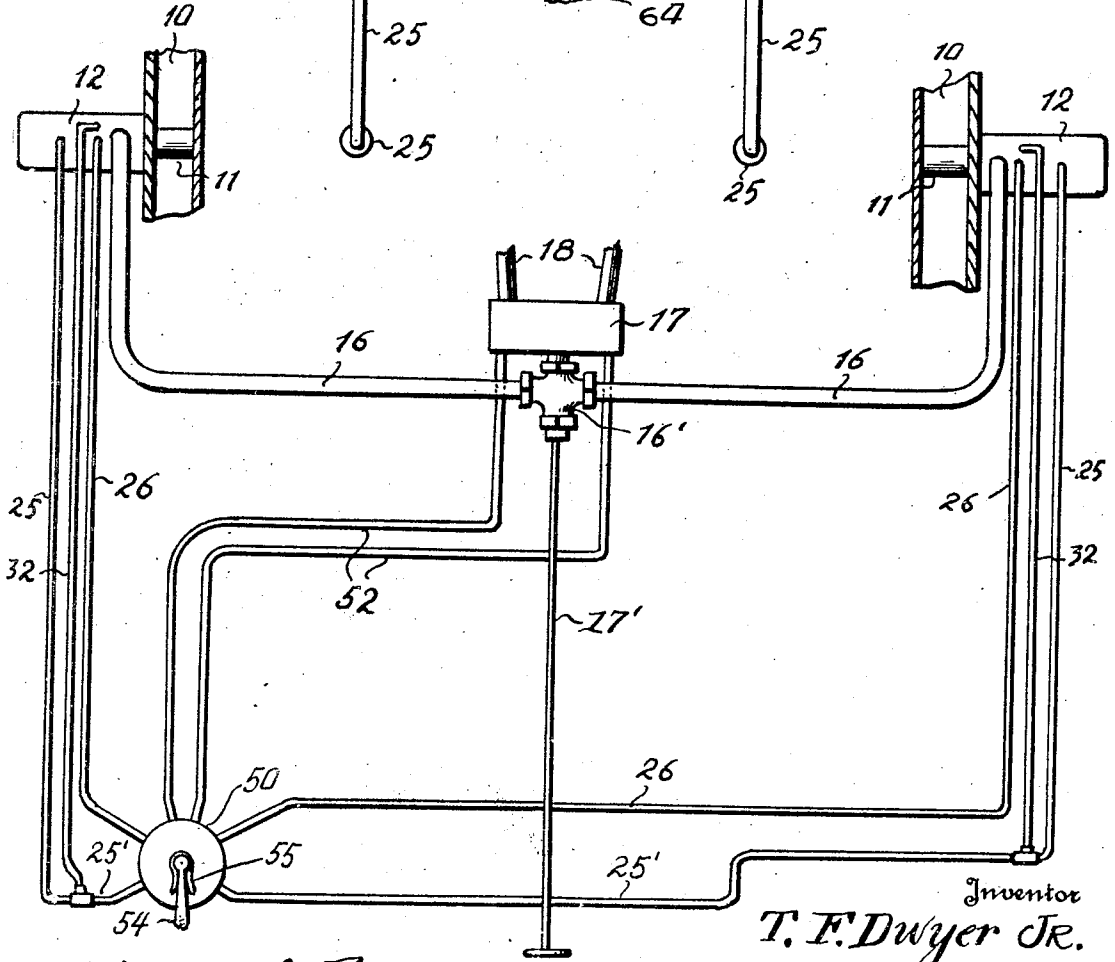


Fig. 7.

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UNITED STATES PATENT OFFICE.

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SOOT BLOWER.

Application filed February 26, 1927. Serial No. 171,250.

This invention relates to improvements in soot-blowers for locomotives in which a nozzle apparatus is employed to sweep a steam jet across the flue-sheet and terminals of the flue tubes to dislodge soot accumulations therefrom. In previous blowers that are in actual use, so far as I am aware, the mechanism for moving the nozzle into and from the fire-box and for turning the nozzle to sweep the jet is actuated by hand.

The principal object of the instant invention is to provide power-driven mechanism, controlled from the cab, for both moving the nozzle into and from the fire-box and turning the nozzle to sweep the jet across the flue-sheet. In a previous application filed by me September 27, 1926, Serial No. 138,080, is disclosed a soot-blower provided with a power-driven motor for turning the nozzle, but in that device the nozzle remains permanently in the fire-box.

In the instant invention, in addition to a power-driven motor for turning the nozzle to effect the sweeping of the jet, a second power-driven motor is employed for projecting the nozzle into and withdrawing it from the fire-box. Both of these motors are driven by steam from the boiler and their connections with the same are controlled by a common valve mechanism mounted in the cab. Also, a soot-blower is mounted on each side of the locomotive and the connections of their respective motors with the boiler are also controlled by the same valve mechanism that controls the connections of the individual motors, so that by the manipulation of a single valve mechanism either one of the blowers can be selected for operation and this same valve mechanism can be actuated to control the operation of both the motors of the selected blower.

In the drawings, which illustrate an embodiment of the invention, and in which similar reference characters designate corresponding parts:

Figure 1 is a longitudinal sectional view of one of the soot-blowers, showing the same mounted on a water-leg of a locomotive boiler with the nozzle housed in a stay-tube seated in the opposite walls of the water-leg.

Fig. 2 is an end view.

Figs. 3 and 4 are cross-sections on the line 3—3 and 4—4, respectively, of Fig. 1.

Fig. 5 is a detail horizontal section on the line 5—5 of Fig. 1.

Fig. 6 is a sectional view through the valve controlling the connections between the motors and the boiler, the view being somewhat diagrammatic.

Fig. 7 is a diagrammatic view showing the connections between the two blowers and the leads from the boiler, parts of the water-legs being shown in section.

Fig. 8 is an enlarged detail view, showing the connection between one of the motors and the steam supply.

Figs. 9, 10 and 11 are detail views, respectively, showing sectional and plan views of the body part of the main controlling valve.

In the practice of the invention two of the blowers are employed, one being mounted on each side of the fire-box so that the nozzle can be projected into the fire-box and turned so that the jet sweeps somewhat more than one-half the area of the flue-sheet and the terminals of flue tubes so that the operation of both blowers will cover the entire surface. As both blowers are alike, a description of one will suffice for both.

Referring to the drawings in detail, 10 designates a portion of one of the water-legs of a locomotive boiler, in the walls of which is seated the stay-tube 11 extending transversely of the same. Abutting the outer wall of the water-leg, adjacent the stay-tube, is the inner end of the casing 12 in which is mounted the nozzle mechanism. The casing has a nipple 13 on its inner end fitting the outer end of the stay-tube. Extending longitudinally through the casing is a bearing 14 concentric with the nipple and the stay-tube, the diameter of the bearing being considerably less than that of the stay-tube. Vertically extending into the casing and across the base of the bearing 14 is the passage 15, connected at its upper end by the steam-supply pipe 16 with the connection box 17, to which lead the pipes 18 from a suitable dry steam space in the boiler (not shown). Both steam-supply pipes 16 are controlled by the valve 16′, the actuating rod 17′ of which extends into the cab (not shown).

Journaled in the bearing 14 is the nozzle-pipe 19, slidable lengthwise therein with its inner end extending into the stay-tube 11 and having the nozzle 20 fixed thereon. In the side and end of the nozzle is the elongated flared orifice 21 adapted to emit a fan-

like jet. In an intermediate part of the nozzle-pipe are the ports 22 to register with the passage 15 when the pipe is moved longitudinally to project the nozzle into the fire-box, the ports being closed by the thickened wall of the casing, as at 22', when the pipe is moved to withdraw the nozzle as shown in Fig. 1.

The motor for reciprocating the nozzle to project it from the stay-tube into the fire-box and to retract it comprises the cylinder 23 with its wall integral with the body of the casing 12 and its bore concentric with the bearing 14 in which is mounted the nozzle-pipe 19 extending into the cylinder. In co-operative relation with the cylinder is the piston 24 fixed on the end of the nozzle-pipe within the cylinder. Communicating with opposite ends of the cylinder are the pipes 25 and 26, respectively, so that steam admitted into the cylinder by the former drives the piston to project the nozzle into the fire-box; steam admitted into the cylinder by the pipe 26 drives the piston in the opposite direction to retract the nozzle from the fire-box.

The motor for oscillating the nozzle to sweep the steam jet across the flue-sheet of the fire-box comprises the vertical cylinder 27 mounted on the horizontal cylinder 23 and the hollow piston 28 in the vertical cylinder. On the inner face of the cylinder 27, at its upper end, is the annular abutment 29, and on the periphery of the hollow piston 28 is the annular shoulder 30 in spaced relation to the annular abutment 29. Between the abutment and shoulder and walls of the cylinder and piston is formed an annular steam chamber. A port 31 leads through the wall of the cylinder, just below the abutment 29, into the annular steam chamber. Communicating with the outer end of the port 31 is the steam pipe 32 leading from a supply source. In the wall of the hollow piston 28 at its upper end is a port 33 extending into the interior of the piston. This port 33 is so positioned that as the piston approaches the limit of its downward stroke the port registers with the annular chamber between the abutment 29 and the shoulder 30, and as the piston approaches the limit of its upward movement the port passes clear of the upper edge of the cylinder and opens the interior of the piston to the exterior air.

In the operation of this motor, with the cylinder and piston in the relative positions shown in Fig. 1, steam is admitted from the pipe 32 through the port 31 into the annular chamber between the abutment 29 and the shoulder 30. The pressure of the steam between the fixed abutment and the shoulder of the piston forces the piston downward until the port 33 registers with the annular chamber below the abutment. When this occurs, steam flows through the port into the interior of the hollow piston. As the area of the interior upper end of the piston is much greater than the area of the shoulder 30, the downward movement of the piston is checked and the greater pressure inside of the piston moves the piston upward until the port 33 passes clear of the cylinder and the steam within the piston escapes. As the pressure on the shoulder 30 remains constant, as soon as the pressure within the piston is relieved, the pressure on the shoulder prevails and the piston is forced downward. In this way a quick reciprocative movement is imparted to the piston and of a very short stroke. This restricted reciprocative movement of the piston is utilized to actuate mechanism to impart an oscillatory movement to the nozzle, previously projected into the fire-box.

Fixed to the top of the hollow piston 28 are the brackets 34 to which is fixed the plate 35 carrying at one end the pivoted pawl 36 in a position to engage the teeth of the ratchet wheel 37. When the pawl descends it is engaged by the cam 38 and moved into engagement with one of the teeth of the ratchet wheel. The ratchet wheel is fast on the shaft 39 journaled in the ends of the U-shaped frame 40 secured between the opposite sides of the casing 12. Fast on the shaft 39 is the cylindrical block or barrel 41 having a circumferential cam-groove 42, with which engages a finger 43 on the hub 44 having a sliding fit on the square rod 45. The rod extends through the outer head of the cylinder 23 and is secured to the closed end of the nozzle-pipe 19 in axial alinement therewith. The hub of the finger is held between the head of the cylinder 23 and the lug 46 (Fig. 2) to prevent movement of the finger longitudinally of the casing 12. The engagement of the hub between the members 23 and 46 permits oscillation of the finger transversely of the casing.

When steam is admitted to the motor formed primarily by the cylinder 27 and piston 28, reciprocatory movement is imparted to the pawl 36 and the latter intermittently engages the teeth of the ratchet wheel 37 and thereby a step-by-step rotary movement is imparted to the cylindrical block or barrel 41. As the cylindrical block rotates, the finger 43 travelling in the cam-groove 42 is given an oscillatory movement, which is imparted to the rod 45 and also the nozzle-pipe 19.

If the nozzle-pipe has been previously moved by the motor 23—24 to project the nozzle into the fire-box, the nozzle will be oscillated to sweep the steam jet across the flue-sheet and the terminals of flue tubes leading therefrom. The sliding connection between the finger and the square rod permits the longitudinal movement of the

nozzle-pipe without interfering with the transmission of the oscillatory movement of the finger to the nozzle.

The steam-supply pipes for both motors are controlled by a common diverting valve 50, (Figs. 6 and 7). This valve is preferably mounted in the fireman's side of the cab so that he can attend to the soot-cleaning operation. This valve comprises a cylindrical casing 51 into which lead the pipes 52 from the connection box 17. Communicating with the interior of the casing 51 at each side thereof are the pipes 25'—25 and 26 leading to the respective motor 23—24 and the pipe 32 leading to the corresponding motor 27—28; the pipes 25 and 32 are branches of the respective single connection 25' with the valve casing. Journalled in the casing 51 is the valve body 53 provided with a handle 54 (Fig. 7). A spring 55 engaging the handle normally holds the valve body in a neutral position, as shown in Fig. 7. The body of the valve is cut away to provide a passage 56 and an abutment 57. With the valve body in a neutral position all the ports of the casing are closed, except those of the pipes 52 leading from the steam supply.

When it is desired to operate one of the blowers, the one to the right for an instance, the valve 53 is turned clock-wise until the port to the pipe 25' is opened to the passage 56. With the valve so turned, communication is established through the passage between the right-hand supply pipe 52 and the pipe 25' and the abutment 57 closes communication between said passages and the port to the pipe 26. Steam then passes through the pipe 25' and the branches 25 and 32. When the abutment 57 closes the passage 56 to the pipe 26, communication is opened between said pipe and the port 61 in the abutment. From this port leads the passage 62 to the exhaust chamber 63 communicating with the exhaust pipe 64. Consequently, any residue steam in the cylinder 23 on the right-hand side of the piston, as shown in Fig. 1, can exhaust to the outside as the piston moves to the right under the influence of steam entering the cylinder through the pipe 25. The steam passing through the pipe 25 enters the outer end of the cylinder 23 and moves the piston 24 to the right, as shown in Fig. 1, and projects the nozzle 20 from the stay-tube 11 into the fire-box. This movement of the nozzle also includes the movement of the nozzle-pipe 19 so that the ports 22 thereof register with the passage 15 of the casing. The valve 16' having been opened, steam passes through the pipe 16, the passage 15, the ports 22, the nozzle-pipe and the nozzle and is emitted in a fan-like jet from the orifice of the nozzle toward the flue-sheet of the fire-box.

Steam passing through the branch pipe 32 enters through the port 31 into the chamber between the abutment 29 and the shoulder 30 of cylinder-piston motor 27—28 and this motor is operated as previously described. Through the intervening mechanism the nozzle is oscillated to sweep the jet up and down the flue-sheet and into the terminals of the flue tubes. When the cleaning operation is completed, the valve is turned counter clock-wise to close the port to the pipe 25' and to open the port to the pipe 26 so that steam is supplied to the inner end of the cylinder 23 to move the piston to the left, as shown in Fig. 1, to withdraw the nozzle from the fire-box into the stay-tube.

When the valve is turned to connect the passage 56 with the pipe 26, exhaust communication is established between the pipe 25' and the exhaust chamber 63 to the exhaust pipe 64, so that the residual pressure medium to the left of the piston, as shown in Fig. 1, can exhaust through the pipes 25, 25', the chamber 63 and the exhaust pipe 64.

It is to be noted that the valve 16' is not essential to control the pipes 16, for under normal conditions the nozzle-pipes 19 of both blowers are withdrawn from the fire-box so that their ports 22 do not register with the passages 15, consequently the pipes remain closed when the blowers are not in operation. However, the valve 16' is an advantage when it is desired to cut-off the steam from the blowers for purposes of repair and inspection.

What I claim is:

1. In a soot-blower, the combination with a casing having a bearing and a cylinder in axial alinement and said casing also having a passage intersecting the bearing and separated from the cylinder, of a pipe reciprocative in the bearing and extending at one end into the cylinder, a nozzle on the other end of the pipe projecting beyond the casing, said pipe having at an intermediate part a port to register with the passage when the pipe is moved to project the nozzle from the casing and said port being closed by the casing when the pipe is moved in the opposite direction, a piston fixed on the pipe within the cylinder, means for supplying pressure-fluid to opposite ends of the cylinder to move the piston in opposite directions to reciprocate the pipe, means for supplying pressure-fluid to the passage, and a common valve mechanism controlling both means for supplying pressure-fluid to the cylinder and to the passage respectively.

2. In a soot-blower, the combination with a casing, of a pipe reciprocative and oscillative in the casing, a nozzle on an end of the pipe projecting beyond the casing, means for supplying pressure fluid to the pipe to be ejected by the nozzle, a prime-mover for reciprocating the pipe, a second prime-mover for oscillating the pipe to sweep back and forth the jet emitted from the nozzle, and

means common to both prime-movers for controlling the operation of the same.

3. In a soot-blower, the combination with a casing, of a pipe reciprocative and oscillative in the casing, a nozzle on an end of the pipe projecting beyond the casing, means for supplying pressure fluid to the pipe to be ejected by the nozzle, a prime-mover for reciprocating the pipe, a second prime-mover including a reciprocative element, and mechanism for translating reciprocative movement into oscillative movement connecting the reciprocative element with the pipe to impart oscillative movement to said pipe.

4. In a soot-blower, the combination with a casing, of a pipe oscillative and reciprocative in the casing, a nozzle on an end of the pipe projecting beyond the casing, means for supplying pressure-fluid to the pipe to be ejected from the nozzle, means including a prime-mover and power-transmitting mechanism for oscillating the pipe, a power-driven motor for reciprocating the pipe in the casing to vary the projection of the nozzle with relation to the casing, and a common control for the prime-mover and the motor.

5. In a soot-blower, the combination with a casing having a bearing and a passage intersecting the bearing, means for supplying pressure-fluid to the passage, a pipe reciprocative and oscillative in the bearing and having a port to register with the passages, a nozzle on an end of the pipe projecting beyond the casing, means including a prime-mover and transmitting mechanisms for oscillating the pipe, a power-driven motor for reciprocating the pipe to vary the projection of the nozzle with relation to the casing and also to move the port into and out of register with the passage, and a common control for the prime-mover and the motor.

6. In a soot-blower, the combination with a casing having a bearing and a cylinder in axial alignment, of a pipe reciprocative and oscillative in the bearing and extending into the cylinder, a nozzle on an end of the pipe projecting beyond the casing, means for supplying pressure-fluid to the pipe to be ejected by the nozzle, a piston on the pipe within the cylinder, means for supplying pressure-fluid to opposite ends of the cylinder to move the piston in opposite directions to reciprocate the pipe to vary the projection of the nozzle with relation to the casing, means for controlling the pressure-fluid supply to the cylinder, a second-pressure-fluid motor operative to oscillate the pipe to sweep the jet emitted by the nozzle, and common means for controlling the supply of pressure-fluid to the cylinder and to the second pressure-fluid motor.

7. In a soot-blower, the combination with a casing having a bearing and a cylinder in axial alinement with the bearing and said casing having a passage intersecting the bearing, of a pipe reciprocative and rotative in the bearing and extending into the cylinder, said pipe having a port to register with said passage, a nozzle on an end of the pipe projecting beyond the casing, a piston on the pipe within the cylinder, means for supplying pressure-fluid to opposite ends of the cylinder to move the piston in opposite directions to reciprocate the pipe to move the port into and out of register with the passage in the casing, the reciprocation of the pipe also operating to vary the projection of the nozzle with relation to the casing, means for supplying pressure-fluid to the passage in the casing, a second pressure-fluid motor for oscillating the pipe to sweep the jet emitted by the nozzle, means for supplying pressure-fluid to the second motor, and a common valve mechanism controlling the pressure-fluid supply to the passage in the casing, to the cylinder and to the second motor.

8. In a soot-blower, the combination with a casing, of a pipe reciprocative and rotative in the casing, a nozzle on an end of the pipe projecting beyond the casing, means for supplying pressure-fluid to the pipe to be ejected by the nozzle, a power-driven motor for reciprocating the pipe to vary the projection of the nozzle with relation to the casing, mechanism for oscillating the pipe to sweep the jet emitted from the nozzle, a second power-driven motor for actuating the mechanism for oscillating the pipe, and means common to both motors for controlling the action of the same.

9. In a soot-blower, the combination with a casing, of a pipe reciprocative and rotative in the casing, a nozzle on an end of the pipe projecting beyond the casing, means for supplying pressure-fluid to the pipe to be ejected by the nozzle, a pressure-fluid motor for reciprocating the pipe to vary the projection of the nozzle with relation to the casing, mechanism for oscillating the pipe to sweep the jet emitted from the nozzle, a second pressure-fluid motor for actuating the mechanism for oscillating the pipe, pressure-fluid supply pipes communicating with both motors, and a common control valve for the supply pipes of both motors.

In testimony whereof I affix my signature.

THOMAS FRANCIS DWYER, JR.