July 17, 1928. 1,677,383

C. A. CLAFLIN

SOOT BLOWER FOR STEAM BOILERS

Filed Oct. 5, 1921 3 Sheets-Sheet 1

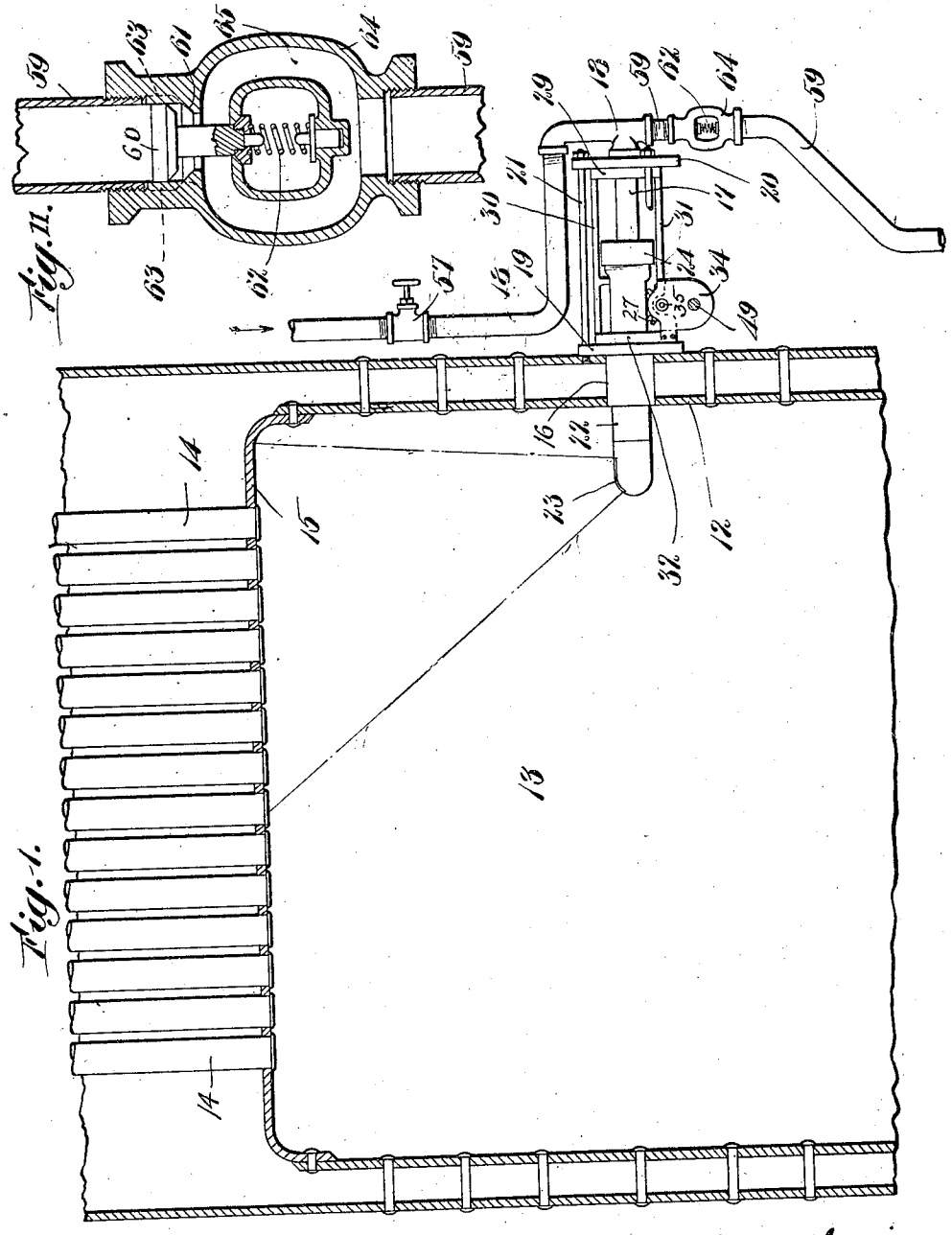


Fig. II.

Fig. 1.

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Fig. 2.

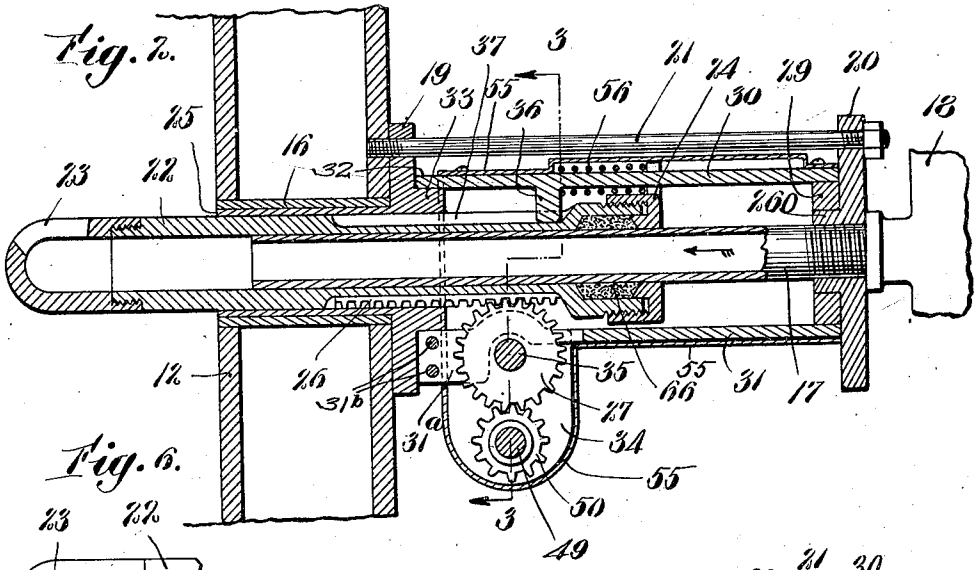


Fig. 6.

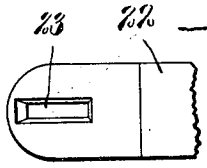
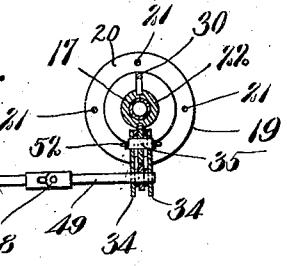


Fig. 4.



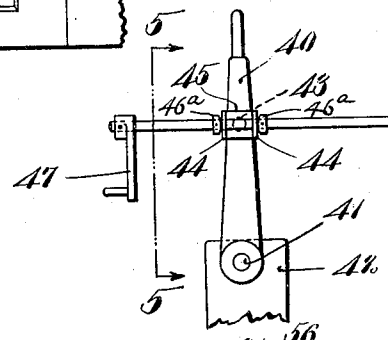
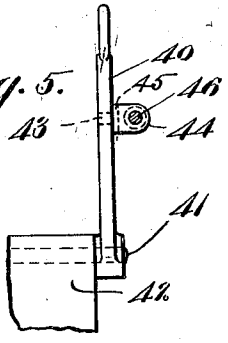


Fig. 5.



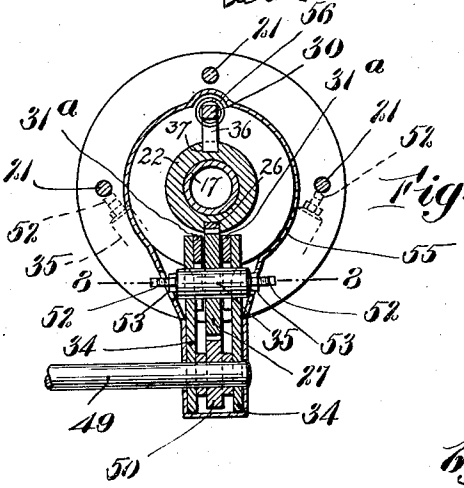


Fig. 3.

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Fig. 7.

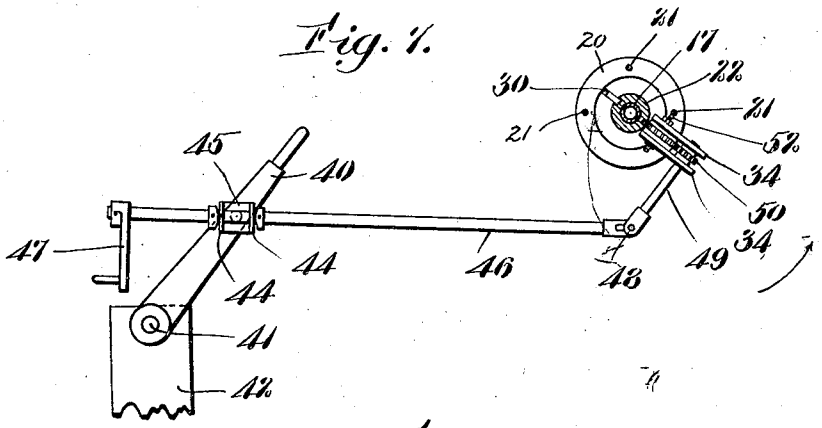


Fig. 8.

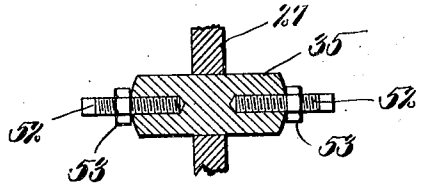


Fig. 9.

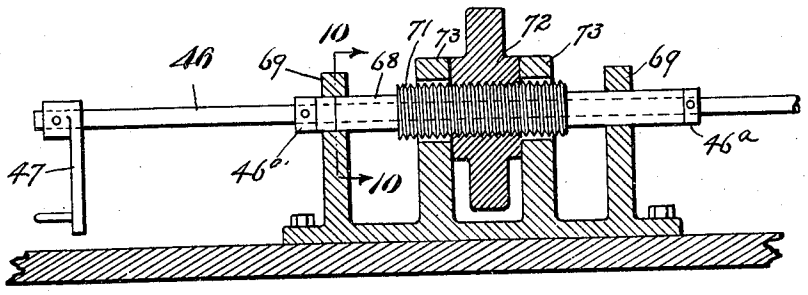
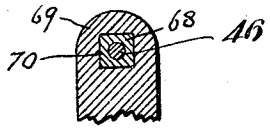


Fig. 10.



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Patented July 17, 1928. 1,677,383

UNITED STATES PATENT OFFICE.

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SOOT BLOWER FOR STEAM BOILERS.

Application filed October 5, 1921. Serial No. 505,505.

This invention relates to soot cleaners for locomotives of that type which comprises a nozzle or jet pipe which is normally received in a pocket formed in the water leg of the boiler at the side of the fire-box, but which may be projected from the pocket into the fire-box while steam is delivered therefrom into and through the flues for cleaning them.

One of the objects of the invention is to provide an improved soot cleaner of this type in which the means for projecting the nozzle or jet pipe from the pocket into the firebox and also the means for turning the jet pipe on its axis, are located in close proximity to each other, so that they can be easily manipulated.

Another object of the invention is to provide a soot cleaner having novel means for turning the nozzle on its axis, by which the movement of the nozzle can be accurately controlled, thus making it possible to thoroughly clean all of the flues.

The invention is embodied in the improvements which I will now proceed to describe and claim.

Of the accompanying drawings forming a part of this specification,—

Figure 1 is a view showing in section portions of the combustion chamber walls of a steam boiler and a tube sheet, a side view of some of the tubes, and a side view of a soot blower embodying the invention, associated with one of the walls.

Figure 2 is a longitudinal section through the blower and a transverse section of a portion of one of the combustion chamber walls.

Figure 3 is a section on line 3—3 of Figure 2.

Figure 4 is a reproduction of a portion of Figure 3, on a smaller scale and shows in elevation portions of the operating mechanism omitted from the preceding figures.

Figure 5 is a section on line 5—5 of Figure 4 and an elevation of parts at the right of said line.

Figure 6 is a fragmentary side view showing a part of the nozzle.

Figure 7 is a view similar to Figure 4 showing a different adjustment.

Figure 8 is a fragmentary section on line 8—8 of Figure 3.

Figure 9 is a fragmentary view partly in section, and partly in elevation, showing a different form of means for turning the nozzle.

Figure 10 is a fragmentary section on line 10—10 of Figure 9.

Fig. 11 is a view showing, on an enlarged scale, the valve controlling the condensate discharge conduit.

The same reference characters indicate the same parts in all of the figures.

In the drawings, 12 represents a steam boiler wall forming one side of a combustion chamber 13, the wall 12 as here shown being hollow and forming a part of a water leg. The usual tubes 14, secured to a tube sheet 15 communicate with the combustion chamber and are adapted to conduct smoke and gases therefrom. The boiler may be of the locomotive or the stationary type. A passage or pocket extends through the wall 12 and, as here shown, is formed by a stay tube 16 joined at its ends to the spaced apart plates or members of the wall. 17 represents a fixed conduit terminal, which is a cylindrical tube having an unobstructed bore and connected with a supply conduit 18, which communicates with a source of steam supply such as the steam space of the boiler. The terminal 17 is rigidly held in alinement with the passage 16 by a frame which is fixed to the wall 12, and is preferably composed of an inner head 19, an outer head 20 and rods or ties 21 connecting said heads and engaged with the wall 12 as indicated by Figures 1 and 2. The conduit terminal 17 has a screw thread or other rigid connection with the outer head 20 and projects therefrom through the inner head and into the passage 16.

22 represents a movable nozzle, which is a tube the bore of which is larger than the bore of the terminal, and projects from the inner end of the latter, the bore of the nozzle constituting an enlarged extension of the bore of the terminal, so that said bores are unobstructed from the receiving end of the terminal, to the outlet end of the nozzle. The nozzle has a sliding fit on the terminal 17, and is provided with a lateral jet-emitting orifice 23 at its outer end preferably formed in an end section detachably secured to the body of the nozzle. The location of the fixed terminal 17 within the nozzle 22, provides an elongated joint between the external surface of the terminal

and the bore of the nozzle. The steam issuing from the terminal expands in the bore of the nozzle, takes the path of least resistance through the outlet 23, and has little or no tendency to pass backward through said joint. The location of the fixed terminal within the nozzle also enables a portion of the external surface of the nozzle to be exposed, and provided as hereinafter described, with an element of nozzle-operating mechanism located wholly outside the steam passage formed by the bores of the terminal and the nozzle. The nozzle may be provided at its inner end with a stuffing box of which 24 is the gland. The stuffing box embraces and is slidable on the terminal 17 between the ends of the latter and tightens the above-mentioned joint. The tube forming the wall passage 16 is preferably of sufficient internal diameter to receive a bushing 25 formed on or rigidly attached to the inner head 19 of the frame, said bushing sustaining the wear due to movements of the nozzle, and preventing wear on the stay tube, and the consequent liability of leakage from the water leg.

A portion of the external surface of the nozzle is exposed within the supporting frame. Fixed in a longitudinal recess in the exposed portion of the nozzle is a rack 26, constituting an element of operating mechanism adapted to move the nozzle endwise to project it into and retract it from the combustion chamber 13, said mechanism including a gear 27 meshing with the rack and manually operable means for rotating the gear in either direction. The said operating mechanism is also adapted to turn the nozzle on the fixed terminal 17 to vary the angular direction of the jet emitted from the nozzle outlet. To this end the operating mechanism includes a holder supported by the frame above described, and adapted to be turned by said manually operable means to turn the nozzle through a predetermined arc of sufficient amplitude to swing the emitted jet and cause it to successively enter different tubes, the arrangement being such that the jet has access to all of the tubes in a given area of the tube sheet.

The said holder, as here shown, includes an outer hub 29 fitted to turn on an annular bearing 260 fixed to the outer frame head 20, bars 30 and 31 fixed to the hub 29, and extending at opposite sides of the conduit terminal 17, and an inner hub 32 (Figure 1) fitted to turn on an annular bearing 33 on the inner frame head 19. The bar 31 is slotted at its inner end to form a fork, the members of which are designated by 31[a] in Figures 2 and 3 and are fixed by fasteners 31[b] (Figure 2) to the inner hub 32, the latter having an opening at one side to receive the fork members. To said members are fixed spaced apart ears 34 projecting outward from the bar 31 and provided with bearings in which are journalled the shaft 35 of the gear 27. The holder bar 30 is provided with a finger 36 projecting into a longitudinal groove 37 in the nozzle and not only causing the nozzle to turn with the holder, but also limiting the endwise movements of the nozzle. It will now be seen that the holder is adapted to be turned with the nozzle and permits an independent endwise movement of the nozzle, the holder being confined against endwise movement. It will also be seen that the gear 27 moves with the holder when the latter is turned, so that the engagement of the gear with the rack is not affected by turning movements of the holder.

I prefer to embody the manually operable means for rotating the gear and turning the holder as follows.

40 represents an oscillatory hand lever pivoted at 41 to a fixed support 42. To said lever is pivoted at 43 a bearing preferably composed of ears 44 connected by a neck 45 with which the pivot 43 is engaged. Journalled in said bearing is a shaft section 46 having a crank 47, and connected by a universal joint at 48 with a shaft section 49 which is journaled in bearings in the holder ears 34. The section 46 is provided with fixed collars 46[a], abutting against the bearing ears 44. The section 49 is so connected with the gear 27 that rotation of the shaft section rotates the gear. Said gear may be attached directly to the section 49, the latter constituting the axis of the gear. I prefer, however, to provide the section 49 with a gear 50, meshing with the gear 27.

When the hand lever 40 is in the position shown by Figure 4, the shaft sections 46 and 49 are in alinement with each other and the sectional shaft may be easily rotated, the operator holding the lever 40 with one hand and rotating the crank 47 with the other. This operation causes an endwise movement of the nozzle. When the nozzle has been suitably projected, the operator swings the lever 40 to an inclined position, and thus causes a turning movement of the holder, as indicated by Figure 7, the shaft sections 46 and 49 being moved endwise, and the section 49 swinging at the joint 48. Provision is thus made for turning the nozzle sufficiently to swing the emitted jet to the desired extent in either direction. It is advisable to project and retract the nozzle when the lever 40 is upright, as shown by Figure 4, the lever being moved to turn the nozzle after the latter has been projected. When all the tubes in the path of the jet have been cleaned, the lever 40 is preferably returned to its upright position before the nozzle is moved endwise to retract it, although the nozzle may be moved endwise if desired, while the lever 40 is inclined.

Two of the frame ties 21 may be utilized

as stops to limit the turning movement of the holder in opposite directions, the ears 34 approaching one of said ties when moved in the direction indicated by the arrow in Figure 7, and being arrested by the tie when the movement has been sufficiently continued. The ears cooperate with the opposite tie 21, when swung in the opposite direction. Figures 3 and 4 show adjustable members, adapted to abut against the ties 21 and vary the limits of the swinging movement, said members being screw-threaded studs 52 engaging tapped sockets in the gear shaft 35, and having lock nuts 53 bearing on the ends of the shaft to lock the studs in their adjusted positions. One stud 52 is arranged to abut against one of the ties 21, and the other against the opposite tie. The studs may be squared at their outer ends, or otherwise adapted to be engaged by an adjusting tool.

The holder may be provided with a sheet metal casing 55 attached to the holder bars and formed to fill the spaces between said bars and enclose the ears 34, as shown by Figures 2 and 3. Said casing excludes dust and dirt from the parts covered thereby.

56 represents a spring interposed between the abutment 36 on the holder bar 30, and an abutment on the nozzle or on the gland 24 of the stuffing-box. Said spring is compressed by the projecting of the nozzle and exerts pressure thereon, acting to retract the nozzle when the supply of steam is shut off by closing a valve 57 in the supply conduit 18.

A discharge conduit 59 is provided for water of condensation, said conduit being connected with the supply conduit 18, at one side of the conduit terminal 17. The discharge conduit is provided with a valve member 60, which is normally held separated from its seat 61 by a spring 62, so that when steam is first admitted, by the opening of the valve 57, some of the steam passes through by-passes 63 across the valve member 60 and through the discharge conduit 59 until the valve member is seated by the steam pressure. It will be seen therefore, that the discharge conduit 59 is always open when the valve 57 is closed, and conducts away any water of condensation which may accumulate in the supply conduit 18, between the valve 57 and the fixed terminal 17. When the valve 57 is opened, the steam pressure first forces through the discharge conduit any water remaining in the conduit 59, and then closes the valve 60, so that the steam passes through the fixed terminal 17 and the nozzle 22, without carrying water of condensation with it. Provision is therefore made for preventing sudden contraction of the highly heated boiler tubes 14, by the impingement thereon of relatively cold water when steam is first admitted. The seat 61 may be formed in a casing 64 having two passages 65 between which the spring 62 is located. It will be seen that the fixed conduit terminal 17 is continuous or uninterrupted from end to end, there being no ports or passages in the periphery of the terminal so that said periphery presents a smooth uninterrupted surface to the packing 66 of the stuffing box, preventing wear or abrasion of the packing by its movements on the terminal.

The bushing 25 sustains the wear caused by the movements of the nozzle, so that the nozzle does not wear the stay tube 16 forming the passage through the boiler wall. There is, therefore, no wear of the stay tube causing leakage of water or steam from the boiler through said tube.

The bushing 25 also ensures the alinement of the fixed terminal 17 and the nozzle 22 with the passage through the boiler wall.

Figures 9 and 10 show a different form of means for moving the shaft section 46 and the companion section 49, endwise to turn the nozzle. In this form the section 46 is journaled to rotate in a longitudinally movable bearing 68, which is movable endwise in fixed guides 69, and is prevented from rotating in said guides by squared portions of the bearing engaged with squared orifices 70 in the guides, as shown by Figure 10. The collars 46ª abut against the opposite ends of the bearing. A screw-threaded portion 71 of the bearing, located between the guides 69, is engaged by the internally threaded hub of a handwheel 72, which is rotatable on the bearing and confined against endwise movement by fixed ears 73. Rotation of the hand-wheel therefore causes a relatively slow endwise movement of the bearing 68, and of the shaft section 46.

It is obvious that the fluid supplied to the nozzle may be compressed air instead of steam.

When my invention is used as a locomotive soot cleaner, the operating element embodied in the crank 47 and the lever 40 (Figure 4), or the said crank and the hand wheel 72 (Figure 9), may be located in the cab. The shaft sections 46 and 49, which may be called a rock-shaft, extend from the cab to the immediate vicinity of the nozzle, the rock-shaft being turnable about an axis extending parallel to the fire-box. The gears 50 and 27 and the rack 26, constitute elements of connections or connecting mechanism between the rock-shaft and the nozzle, whereby turning movement of the nozzle about its axis projects and retracts the nozzle into and from the fire-box, said connecting mechanism being operative in any angular position of the rock-shaft.

The tubular stay-bolt 16 and its bushing 25 constitute a pocket in a water leg at one side of the fire-box, said pocket communicating with the combustion chamber. The said

connecting mechanism in this embodiment of the invention is utilized also, as an element of means for turning the nozzle on its axis.

It will be seen that my invention includes mechanism, of which the rock-shaft is an element, operable from the cab for successively imparting to the nozzle two steps of a compound movement, one of said steps being a rectilinear endwise movement, and another a turning movement about the axis of the nozzle.

It is obvious that an engineer or fireman may leave the nozzle continuously projected and manipulate the nozzle only by turning it in the pocket.

I claim:

1. For use with a boiler having a passage in one of its walls, a soot-blower comprising a supporting frame attached to and projecting from the boiler wall at the outer end of said passage; a fixed internally unobstructed conduit terminal, connected with a source of steam supply, and attached to said frame; a movable nozzle surrounding a portion of said terminal, and adapted to rotate and move endwise on the terminal in said passage, said nozzle having a lateral jet-emitting outlet, and projecting inward from the terminal, the fixed terminal being located within the nozzle, so that a portion of the bore of the nozzle constitutes an enlarged extension of the bore of the fixed terminal, and another portion of the nozzle bore cooperates with the external surface of the terminal in forming a close joint, a portion of the external surface of the nozzle being exposed in said frame; and manually operable nozzle-operating mechanism, associated with the exposed external portion of the nozzle, and including means for moving the nozzle endwise to project and retract it, and means for turning the nozzle on the fixed terminal, to vary the angular direction of the emitted jet.

2. For use with a boiler having a passage in one of its walls, a soot blower comprising a fixed conduit terminal connected with a source of steam supply, a supporting frame attached to and projecting from the boiler wall and attached to the outer end portion of said terminal, said frame supporting the terminal in alinement with said passage, a movable nozzle receiving the fixed terminal and arranged to move endwise and turn thereon in said passage, said nozzle having a lateral jet-emitting outlet, and manually operable nozzle-operating mechanism including a rack fixed to the nozzle, a gear meshing with said rack and means for rotating said gear to impart endwise movements to the nozzle.

3. For use with a boiler having a passage in one of its walls, a soot blower comprising a fixed conduit terminal connected with a source of steam supply, a supporting frame attached to and projecting from the boiler wall and attached to the outer end portion of said terminal, said frame supporting the terminal in alinement with said passage, a movable nozzle adapted to rotate on the fixed terminal and to move endwise and turn thereon in said passage, said nozzle having a lateral jet-emitting outlet, and manually operable nozzle-operating mechanism including a rack fixed to the nozzle, a rocking holder mounted to turn on said supporting frame, a gear journalled in bearings on said holder and meshing with the rack, and operating means having provisions for rotating the gear to move the nozzle endwise and for turning the holder to turn the nozzle on the fixed terminal.

4. For use with a boiler having a passage in one of its walls, a soot blower comprising a fixed conduit terminal connected with a source of steam supply, a supporting frame attached to and projecting from the boiler wall and attached to the outer end portion of said terminal, said frame supporting the terminal in alinement with said passage, a movable nozzle adapted to rotate on the fixed terminal and to move endwise and turn thereon in said passage, said nozzle having a lateral jet-emitting outlet, and manually operable nozzle-operating mechanim including a rack fixed to the nozzle, a rocking holder mounted to turn on said supporting frame, a gear journalled in bearings on said holder and meshing with the rack, an oscillatory operating lever pivoted to a fixed support, a bearing pivoted to said lever, a crank shaft composed of a section journalled in said bearing and a section journalled in said holder and provided with a gear, the said sections being connected by a universal joint, the said gear being connected with the rack through the first-mentioned gear to move the nozzle endwise, the holder being adapted to be turned by said operating lever and to turn the nozzle.

5. A soot blower substantially as specified by claim 3, the said frame including inner and outer heads provided with annular bearings, and means connecting said heads, and the said holder including hubs adapted to turn on said bearings, bars connecting said hubs, and ears projecting from one of said bars and provided with bearings for said gear.

6. A soot blower substantially as specified by claim 3, the said frame including inner and outer heads provided with annular bearings and means connecting said heads, and the said holder including hubs adapted to turn on said bearings, bars connecting said hubs, and ears projecting from one of said bars and provided with bearings for said gear, one of the holder bars being provided with a finger projecting into a longitudinal

groove in the nozzle to limit the endwise movements of the latter and cause the holder and nozzle to turn in unison.

7. A soot blower substantially as specified by claim 3, the said frame including inner and outer heads provided with annular bearings and means connecting said heads, and the said holder including hubs adapted to turn on said bearings, bars connecting said hubs, and ears projecting from one of said bars and provided with bearings for said gear, the holder being provided with a spring adapted to be compressed by the projection of the nozzle and to exert retracting pressure on the latter.

8. A soot blower substantially as specified by claim 3, the said frame including inner and outer heads provided with annular bearings and means connecting said heads, and the said holder including hubs adapted to turn on said bearings, bars connecting said hubs, and ears projecting from one of said bars and provided with bearings for said gear, the holder being provided with a casing filling the spaces between the holder bars and enclosing the holder ears.

9. A soot blower substantially as specified by claim 3, the said frame including inner and outer heads provided with annular bearings and ties connecting said heads, and the said holder including hubs adapted to turn on said bearings, bars connecting said hubs and ears projecting from one of said bars and provided with bearings for said gear, some of said ties being arranged to constitute stops adapted to limit the turning movement of the holder.

10. A soot blower substantially as specified by claim 3, the said frame including inner and outer heads provided with annular bearings and ties connecting said heads, and the said holder including hubs adapted to turn on said bearings, bars connecting said hubs, and ears projecting from one of said bars and provided with bearings for said gear, some of said ties being arranged to constitute a stop, and the holder being provided with adjustable stop members adapted to abut against said ties and adjustably limit the turning movement of the holder.

11. A boiler having a wall forming a water leg, a stay tube forming a passage through said wall, and a fixed bushing in said stay tube; combined with a soot-blower comprising a fixed conduit terminal connected with a source of steam supply; fixed means supporting the terminal in axial alinement with said bushing, a movable nozzle surrounding and adapted to rotate on a portion of the fixed terminal, and adapted to move endwise and turn in said bushing, said nozzle having a lateral jet-emitting outlet at one end, and manually-operable nozzle-operating mechanism, including means for moving the nozzle endwise, to project and retract it, and means for turning the nozzle on the fixed terminal to vary the angular direction of the emitted jet, the bushing sustaining the wear due to the movements of the nozzle, so that the stay tube is not subjected to wear.

12. A soot blower substantially as specified by claim 3, the said frame including inner and outer heads provided with annular bearings and means connecting said heads and the said holder, including hubs adapted to turn on said bearings, bars connecting said hubs, and ears projecting from one of said bars and provided with bearings for said gear, the inner frame head being provided with a bushing for the said passage in the boiler, the said nozzle having a sliding fit in said bushing.

13. In a locomotive soot cleaner for use in a locomotive having a cab, a fire-box provided with a combustion chamber, a water leg at the side of the fire-box provided with a pocket communicating with the combustion chamber, and a flue sheet, the combination with said pocket and cab, of a jet nozzle in the pocket, a rock-shaft mounted in bearings and turnable about an axis extending substantially parallel to the fire-box, said rock-shaft extending into the cab, connecting mechanism connecting the rock-shaft with the nozzle, whereby turning movement of the rock-shaft about its axis projects the nozzle into the fire-box, the rock-shaft being movable in the direction of its axis and jointed between the cab and the said connecting mechanism, and means for moving the rock-shaft in the direction of its axis, by which movement the rock-shaft is caused through said connecting mechanism to turn the nozzle on its axis, said connecting mechanism being operative in any angular position of the rock-shaft.

14. In a locomotive soot cleaner for use in a locomotive fire-box provided with a combustion chamber, a water leg at the side of the fire-box provided with a pocket communicating with the combustion chamber, and a flue sheet, the combination with said pocket, of a jet nozzle therein, a rock-shaft extending parallel to the water leg but situated outside thereof, connections between the rock shaft and the nozzle by which turning of the rock-shaft projects the nozzle from the pocket into the combustion chamber, and means situated in axial alinement with said shaft and operatively connected to the nozzle to turn the latter about its axis.

15. In a locomotive soot cleaner for use in a locomotive fire-box having a combustion chamber, a water leg at the side of the fire-box provided with a pocket communicating with the combustion chamber, and a flue sheet, the combination with said pocket, of a jet nozzle therein having a stem extending through the wall of the fire-box, said stem

being capable of turning about its axis, a rock-shaft extending parallel to the water leg and at right angles to the axial line of the jet nozzle, connections between said rock-shaft and the stem by which turning movement of the rock-shaft moves the stem longitudinally thereby to project the nozzle into the fire-box, and means situated in axial alinement with said rock-shaft and operatively connected to the nozzle stem to turn the latter about its axis.

In testimony whereof I have affixed my signature.

CHARLES A. CLAFLIN.