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SOOT BLOWER HEAD AND VALVE MECHANISM THEREFOR

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This invention aims to provide a new and improved soot blower head designed primarily for soot blowers used in cleaning accumulations of soot from boiler tubes.

Soot blower heads of the types most commonly used have for years been of expensive and complicated construction and have embodied numerous elements not only requiring expensive manufacturing procedure but prone to cause trouble and necessitate frequent repairs and replacements. The present invention, however, aimed to provide a greatly simplified and cheapened construction which nevertheless would be highly efficient and would give maximum service with a minimum of attention, and use of the improved structure has shown that this end has been attained. I have been enabled to dispense with springs, pressure-actuated valves, pilot valves, piston rings, bypasses, cams, cam shafts, rocker arms, etc., whereas such elements have long been considered essentials in the soot blowers most commonly used.

Figure 1 of the accompanying drawings is a side elevation, the valve-actuating parts being shown in valve-open position.

Fig. 2 is a top plan view with the parts positioned as in Fig. 1.

Fig. 3 is a longitudinal sectional view on line 3-3 of Fig. 2, the parts, however, being shown in valve-closed position.

Fig. 4 is a front end view partly in section as indicated by line 4-4 of Fig. 5.

Figs. 5, 6 and 7 are operational diagrams.

A preferred construction has been illustrated and will be rather specifically described, with the understanding, however, that within the scope of the invention as claimed, variations may be made.

A stationary T-shaped body is shown at 8, the head 9 of said body being provided with a removable closure 10 at its front end and with a relatively small stuffing box 11 carried by said closure, while the rear end of said head is provided with a relatively large stuffing box 12. The front end of the head 9 is provided with a bearing lug 13 which may be integral with the head and which projects upwardly and forwardly therefrom, and a flange 14 is formed on the rear end of said head to support rearwardly projecting studs 15 which rigidly support a bearing plate 16.

The shank 17 of the T-shaped body 8 constitutes the steam inlet and is flanged at 18 for connection with a steam supply pipe. Behind this shank, a forwardly facing valve seat 19 is removably mounted in the head 8.

A valve 20 of the disk or poppet type is co-operable with the seat 19 and is provided with a stem 21 which extends forwardly through and beyond the stuffing box 11. The rear stuffing box 12 fluid-tight engages the front section 22 of a conventional soot blowing element 23, said section 22 being mounted in an appropriate bearing 24 carried by the plate 16 and being suitably secured to a gear 25 forming part of the means for rotating the blower element while steam is being discharged from said element through a longitudinal row of jet nozzles (not shown) in said element against a bank of water tubes to blow the soot therefrom in a manner well known in the art. The gear 25 is provided with a suitable flange 26 into which the front end of the rear or main section of the blower element is threaded, said flange 26 having suitable set screws 27 for holding said main section against turning after it has been screwed into the flange.

The above described bearing lug 13 includes an upper portion or bearing ear 28 in which the front end portion of a longitudinal shaft 29 is rotatably mounted, and the rear end of this shaft is mounted in a bearing 30 with which the bearing plate 16 is provided. The rear end of the shaft 29 is equipped with a pinion 31 meshing with the gear 25, and the front end of said shaft 29 has a conventional sprocket 32 for engagement with the usual continuous depending operating chain (not shown). The shaft 29 may be enlarged between its ends and coarsely threaded at 33 to constitute a screw, said screw being engaged with a traveling nut 34. At opposite ends of the screw 33, stop collars 35 and 36 are threaded on the shaft 29 to limit the traveling movement of the nut 34, and said collars 35 and 36 have set screws 37 and 38 by means of which they may be locked after adjustment. The shaft 29 is of course held against longitudinal shifting, and this is preferably accomplished by means of suitable thrust bearings or collars 39 and 40, suitably mounted on said shaft and abutting opposite sides of the portion 28 of the bearing lug 13.

A block 41 is adjustably threaded at 42 on the front end portion of the valve stem 21, said block being provided with oppositely projecting studs 43. A lock nut 44 is threaded on the stem and abuts the front end of the block 41 to hold it in any set position upon said stem, and if desired, a cotter pin or the like 45 may be carried by the stem as a safeguard against loss of the nut 44. The front extremity of the valve stem is preferably squared as shown at 46 for engagement.
with a suitable tool when the valve 20 is to be
ground into its seat 19. Two bell crank levers 41 are disposed at op-5
site sides of the bearing lug 13 and are fulcrumed at their angles to this lug by means of a bolt 48, said bolt being horizontal and transverse to the shaft 29 and the valve stem 21. It will be noted upon reference to Fig. 3 that the screw shaft 29 and the screw 24 are parallel to each other and that the valve 20 and its stem are coaxial with the rotatable blower element 22, 23. Each bell crank 41 has a downwardly projecting arm 49 and a rearwardly projecting arm 50. The lower ends of the arms 48 are formed with slots 51 which pivotally and slidely receive the studs 43 of the block 41, and the rear ends of the arms 50 are pivotally connected by means of a bolt 52 with the lower ends of two links 53, which links are disposed at opposite sides of the traveling nut 34 and are connected at their upper ends to this nut by means of a pivot bolt 54.

These links 53 normally occupy the oblique position shown in Figs. 3 and 5, the valve 20 being then closed. However, upon rotation of the shaft 29 in the direction indicated by the arrows in Figs. 5, 6, and 7, the screw 24 moves the nut 34 rearwardly. As soon as this rearward movement starts, the links 53 operate the bell cranks 41 to start opening the valve 20 and by the time half the rearward travel of said nut has been completed (Fig. 6), said valve occupies its extreme open position. The rest of the rearward travel of the nut 34 again closes the valve 21 as seen in Fig. 7. During these operations, the gear-35 ing 31, 25 rotates the blower element 23 and thus while the blowing steam is being supplied to said element by means of the open valve, it is performing the desired blowing functions upon the boiler tubes. Obviously, the nut 34 may be moved to its forward and rearward extremes as many times as desired and in each instance, travel of the nut in one direction will move the parts from valve-closed position to valve-open positions and to another valve-closed position. Such movement of the valve is due to the relative arrangement of the nut, the links and the bell cranks since during the nut travel in one direction the link pivot 54 on the nut will pass the dead center of the link pivot 52 on the bell crank 41. When the nut 34 is in one valve-closed position, it abuts the collar 35, and said nut abuts the collar 36 when occupying its other valve-closed position. Thus, the valve 20 does not act as a stop for limiting the forward and rearward movements of the nut 34 and is relieved of strain. Obviously the nut will travel in one direction on the threads 33 of shaft 29 when the wheel 32 is turned in one direction and will travel in the opposite direction when the direction of rotation of wheel 32 is reversed. It is a well known practice in operating a scoot blower of this type having an endless operating chain hung from a sprocket wheel on the shaft which actuates the moving parts of a scoot blower, to first pull one side of the chain to rotate the blower element in one direction and then pull the other side of the chain to reverse the direction of rotation of the blower element, and hence no operating chain on wheel 32 has been illustrated in the drawings.

Due to the relation of elements shown, the
valve 20 is opened to an effective degree before any great amount of rotation of the shaft 29 oc-
curs, and the idle rotation which said shaft im-
parts to the blower element 23, prior to said ef-
flective degree of valve opening, is not, therefore, 75 objectionable. The further opening of the valve which occurs as the shaft 29 is further rotated, is simply excess movement, and until said valve has been again closed beyond said effective de-
gree, by the continued rotation of the shaft 29, effective blowing will be accomplished. More-
over, the amount of idle rotation of the blower element 23 which occurs after closing movement of the valve beyond said effective degree, is small and unobjectionable.

When the valve 20 requires grinding, the bell
10 cranks 41 may be easily removed. Then, removal of the closure 10, will remove the valve also. The
grinding compound may then be placed on the valve, the closure 10 again secured in place, and the valve rotated with a suitable tool connected with the squared end 46 of the stem 21. After grinding and cleaning, the parts may be easily re-assembled and the block 41 readjusted on the stem. Removal of the closure 10 and the valve 20 as a single unit is also of advantage for valve
and seat inspection and replacement.

In the construction shown, to facilitate initial engagement of the nut 34 with the screw 23 and any disconnection of said nut from said screw which might later be required, said nut is formed from two sections 34a and 34b, which may be secured together by screws or the like. The upper nut section 34a is formed with two spaced lugs as shown in Figs. 2 and 4. When said nut 34 strikes the stop collar 35 in its movement in one direction, a shoulder on shaft 29 forces a ring or washer as shown in Fig. 3 against the rotatable member of the ball-bearing thrust bearing 40. When said nut 34, in travelling in the opposite direction, strikes stop collar 35, the rearward thrust of shaft 29 is taken up by the movable member of the ball-bearing thrust bearing 39 as said movable member is en-
gaged by an adjustable collar threaded on shaft 29 as shown in Fig. 3. All of the end thrust of the shaft is thus stopped by the heavy lug 28 and there is no likelihood of breaking if excessive force is applied to wheel 32.

Attention is called to the fact that the operat-
ive connections between nut 34 and valve 20 are
such that the valve will be wide open before the nut gets to its center position and stays open while the blower element is turned a full revolu-
tion, thus giving the full steam pressure to the ele-
ment 23 while the latter makes a 360° sweep. The
valve does not start to close until nut 34 moves beyond its center position, so that element 23 will make about two revolutions during the full travel of the nut in one direction or the move-
ment of valve 20 from its closed position, to a full open position and then back to its closed position. It will be further noted that the above de-
scribed arrangement of the parts is such that the valve will be gradually opened so that there will be no danger of the steam cracking the blower element, even though the movement of the valve at the beginning of its open movement and at the end of its stroke, when the part of the blower element which is actuated by the movement of the valve will be accelerated than its movement during the balance of its re-
ciprocation because of the relative positioning of the nut, the links and the bell cranks. In other words the valve will be held relatively stationary in its extreme open position while the pivot 52 passes the dead center of the pivot 52 but the movement of the valve will be accelerated as the nut moves in either direction from such dead cen-
ter position of the pivots. While in a very large percentage of installations it is necessary that the
blower element make a full revolution in order to effectively clean the boiler tubes, in some cases it is only necessary for the element to rotate through a smaller arc. In such cases the stop collars 35 and 36 may be set to start and stop the rotation at the desired points; and it is obvious that the nut 34 may be started from either valve closed position according to whether the blower element is to be turned in a clockwise or counter-clockwise direction.

From the foregoing, taken in connection with the accompanying drawings, it will be seen that novel and advantageous provision has been made for carrying out the object of the invention, and particular attention is invited to the fact that the present construction requires no springs, pressure-actuated valves, pilot valves, bypasses, cams, cam shafts and rocker arms.

Excellent results have been obtained from the construction shown and it is, therefore, preferably followed but attention is invited to the possibility of making variations within the scope of the invention as claimed.

I claim:

1. In a soot blower, a head having a fluid inlet and a fluid outlet, said head having a valve seat between said inlet and outlet, a blower element rotatably connected to said head to receive fluid therefrom, a valve cooperable with said seat and having a slidable stem, said stem being operatively connected to said valve seat, the other arm of said bell crank extending in the direction of the axes of said element and said seat, means between said shaft and said element for rotating the latter when said shaft is rotated, a bell crank fulcrumed at its angle at the exterior of said head and having one of its arms operatively connected to said stem to slide the same, the other arm of said bell crank extending in the direction of the axes of said element and said seat, and a link pivoted at one of its ends to said other arm of the bell crank and pivoted at its other end to said nut, said link normally occupying one valve-closed oblique position, being positively moved said element from said one-valve closed oblique position to valve-open positions and then to a second valve-closed oblique position, said element being continuously rotated in the same direction.

3. In a soot blower, a rotary blower element, a head having a valve for supplying a blowing fluid under pressure to said element, the latter being rotatably connected to said head, said valve having a cycle of movement from closed position to open position and back to closed position, an operating shaft for simultaneously actuating said element and said valve, said valve having screw threads and being mounted for rotation at the exterior of said head with its axis parallel with the axis of said element, means between said valve and said element for rotating the latter when said shaft is rotated, a travelling nut engaged with said screw threads, a bell crank fulcrumed at its angle at the exterior of said head and having an arm operatively connected to said valve to positively move the same, the other arm of said bell crank extending in the direction of the axis of said valve, and a link pivotally connected to said nut to said other arm of said bell crank for positively moving said valve when said nut travels on said threads, the arrangement of the nut, link and bell crank being such that when said shaft is rotated in one direction, the one direction travel of said nut will cause the valve to move through a complete cycle of operation while said element is being rotated through an arc of at least 360°.

4. A structure as specified in claim 3, together with at least one stop longitudinally adjustable on said shaft to limit the travel of said nut in one direction.

5. In a soot blower, a head having a fluid inlet and a fluid outlet, said head having a valve seat between said inlet and outlet, a blower element rotatably connected to said head to receive fluid therefrom, a valve cooperable with said seat and having a slidable stem extending to the exterior of said head, said stem being in alignment with the axis of rotation of said element, an operating shaft for simultaneously actuating said element and said valve, said shaft having screw threads and being rotatably mounted at the exterior of said head with its axis parallel with the axes of said element and said seat, means between said shaft and said element for rotating the latter when said shaft is rotated, a bell crank fulcrumed at its angle at the exterior of said head and having an arm operatively connected to said valve to slide the same, the other arm of said bell crank extending in the direction of the axes of said element and said seat, and a link pivotally connected to said nut to said other arm of said bell crank for positively moving said valve when said nut travels on said threads, the arrangement of the nut, link and bell crank being such that when said shaft is rotated in one direction, the one direction travel of said nut will cause the valve to move through a complete cycle of operation while said element is being rotated through an arc of at least 360°.

6. A structure as specified in claim 5, together with at least one stop longitudinally adjustable on said shaft to limit the travel of the nut in one direction.
7. In a soot blower, a head having a stuffing box and an external apertured bearing ear at its front end, the rear end of said head having a fluid outlet, said head being provided with a fluid inlet behind said stuffing box and with a forwardly-facing valve seat between said fluid inlet and said fluid outlet, a rotary blower element connected with said fluid outlet, a valve cooperating with said seat and having a stem slidable through said stuffing box, an operating shaft mounted for rotation on said head and having one end extending through said apertured bearing ear, said shaft being provided with screw threads and having its axis parallel with the axis of said stem, a bell crank fulcrumed at its angle on said head on an axis transverse to said head and having one of its arms connected to the front end of said valve stem to slide the same and its other arm directed rearwardly, a traveling nut on said threads, a link pivoted at one of its ends to said nut at its other end to said rearwardly directed arm of said bell crank, and thrust collars on shaft on opposite sides of said apertured bearing ear.

8. In a soot blower, a head having a stuffing box and an upwardly projecting bearing lug at its front end, said lug having an apertured bearing ear rising therefrom, the rear end of said head having a fluid outlet, said head being provided with a fluid inlet behind said stuffing box and with a forwardly-facing valve seat between said inlet and said outlet, a rotary blower element connected with said fluid outlet, a valve cooperating with said seat and having a stem slidable through said stuffing box, in operating shaft mounted for rotation on said head and having one end extending through said apertured ear, said shaft being provided with screw threads and having its axis parallel with the axis of said stem, gearing between said shaft and said element for rotating the latter when said shaft is rotated, a pair of bell cranks, one disposed at each side of said bearing lug and fulcrumed on an axis transverse to said head on said lug, one of the arms of each of said bell cranks extending downwardly and being operatively connected to the front end of said valve stem, the other arm of each of said bell cranks being directed rearwardly, a traveling nut on the threads of said shaft, a pair of links disposed on opposite sides of said nut, said links having their upper ends pivoted to said nut and their lower ends pivoted to portions of the rearwardly extending arms of said bell cranks, thrust collars on shaft on opposite sides of said apertured ear, and at least one stop longitudinally adjustable on said shaft to limit the travel of said nut in one direction.

9. In a soot blower, a rotatably mounted blower element, a head for supplying a blower fluid under pressure to said element, a reciprocating control valve for said fluid in said head, an operating shaft rotatably mounted on said head, gearing connecting said shaft with said blower element for rotating the latter as said shaft is operated, and means between said shaft and said valve for positively moving the latter when said shaft is rotated, said means including a nut to travel on screw threads on said shaft, a bell crank fulcrumed on said head and having one of its arms operatively connected to said valve, and a link connecting said nut with the other arm of said bell crank, said other arm extending in generally parallel relation with the axis of said shaft to provide a dead center position for said link.

10. In a soot blower, a rotatably mounted blower element, a head for supplying a blower fluid under pressure to said element, a valve movable to control the supply of fluid to said element, an operating shaft rotatably mounted on said head and having a screw threaded portion, a driving connection between said shaft and said blower element for rotating the latter when said shaft is operated, and means between said shaft and said valve for positively moving the latter when said shaft is rotated, said means including a nut to travel on the screw threads on said shaft, a bell crank fulcrumed on said head and having one of its arms operatively connected to said valve to move the same, and a link pivoted at one of its ends to said nut and pivoted at its other end to the other arm of said bell crank, the last mentioned arm of said bell crank extending in generally parallel relation with the axis of said shaft to cause the link pivot on the nut to pass the dead center of the link pivot on the bell crank when the nut travels in one direction on said shaft.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,413,601</td>
<td>Linaker</td>
<td>Apr. 25, 1922</td>
</tr>
<tr>
<td>1,666,080</td>
<td>Bayer</td>
<td>Apr. 17, 1928</td>
</tr>
<tr>
<td>1,924,550</td>
<td>Hibner et al.</td>
<td>Aug. 29, 1933</td>
</tr>
<tr>
<td>2,303,162</td>
<td>Weeks</td>
<td>Nov. 24, 1942</td>
</tr>
</tbody>
</table>