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P. LIPPERT ET AL

SOOT BLOWER

Filed June 1, 1925

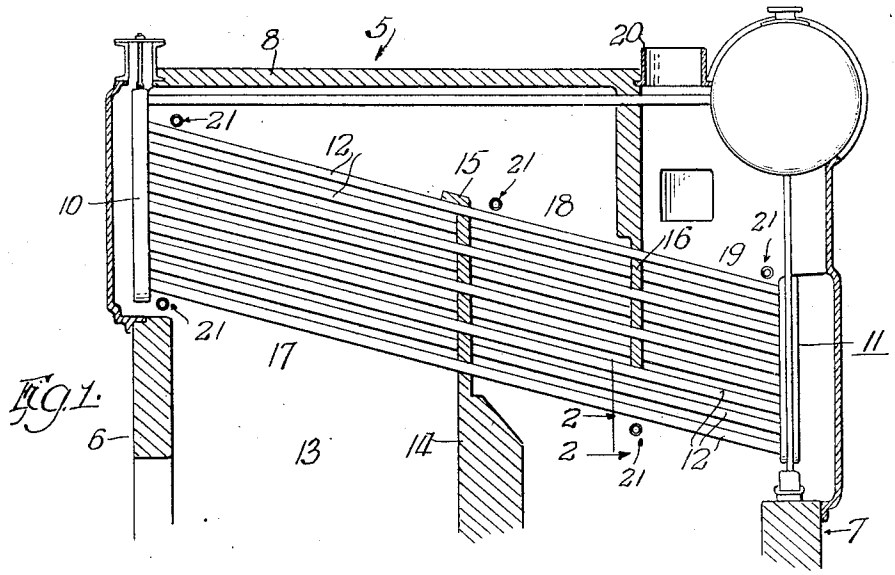


Fig. 1.

Fig. 2.

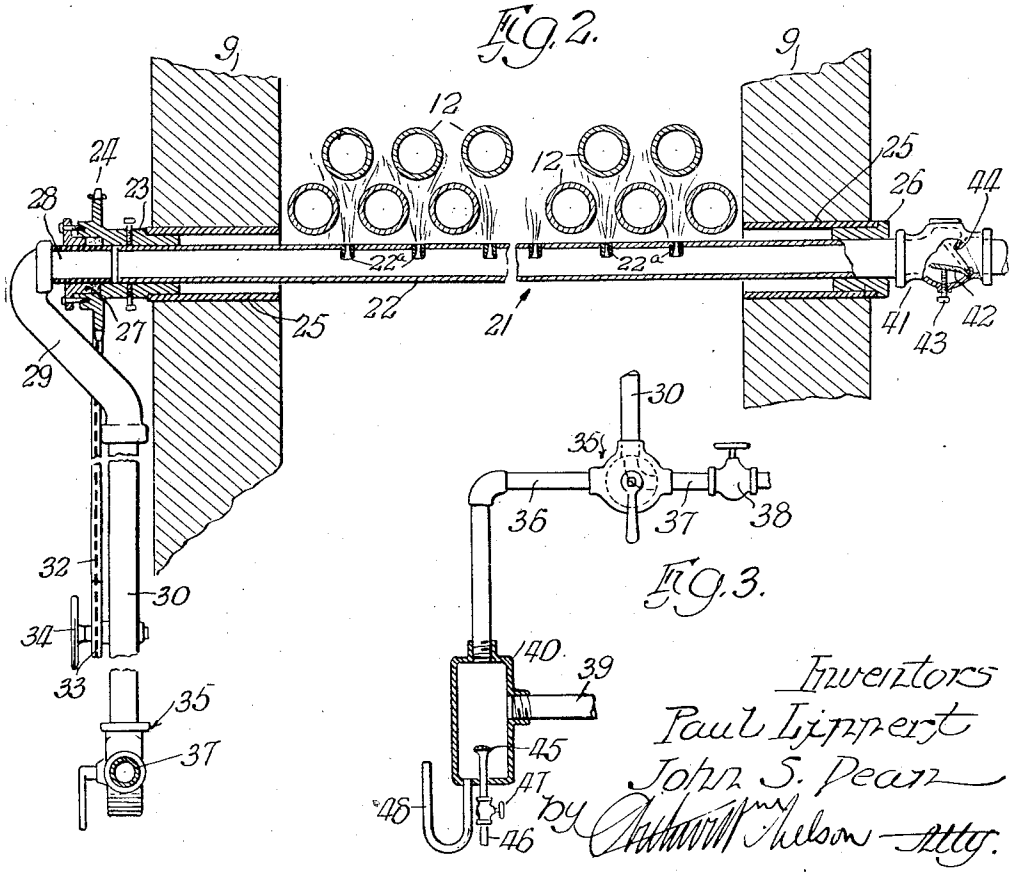


Fig. 3.

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UNITED STATES PATENT OFFICE.

PAUL LIPPERT AND JOHN S. DEAN, OF CHICAGO, ILLINOIS.

SOOT BLOWER.

Application filed June 1, 1925. Serial No. 33,911.

To all whom it may concern:

Be it known that we, PAUL LIPPERT and JOHN S. DEAN, both citizens of the United States, and residents of Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Soot Blowers, of which the following is a specification.

Our invention relates generally to soot blowers but relates more particularly to soot blowers for use in power boiler installations.

In power boiler practice the tubes quickly become covered with soot which must be periodically removed if fuel economy is to be attained. It is common knowledge that soot is a high grade insulator and if permitted to remain on the tubes or boiler surfaces causes an abnormal heat loss up the stack. For this reason it has been common in good boiler practice to utilize devices periodically to remove the soot from the boiler surfaces. Such devices in order to function must be located in close proximity to the tubes or heating surfaces and are therefore subjected to the intense heat of the furnace gases and to the products of combustion which causes them to burn out from time to time. The life of the soot blower elements in the furnace vary widely dependent upon the particular conditions obtaining in the boiler and to the manner of its use. It is quite common to operate boilers at several times above their rated capacity and under such conditions the intense heat is likely quickly to burn out the soot blower elements. Realizing the necessity of increasing the life of the soot blower elements resort has been made to the use of special alloys adapted to withstand higher temperatures but even such constructions do burn out and require replacement from time to time.

With the soot blower construction heretofore devised when a new element is required it is necessary to shut down the boiler and since this may not be convenient at the time the boiler may be operated for some time without the soot blower with the consequent decrease in the boiler efficiency.

Again in the soot blower constructions heretofore devised severe overloads of the boiler were likely to cause such warping, sagging and distortion of the soot blower elements as would make their operation difficult if not impossible.

The general object of our invention is to provide a soot blower construction which shall be better able to withstand the conditions which obtain in service.

It is also an object of our invention to provide a soot blower construction in which the elements can be removed and replaced while the boiler is in operation, thus avoiding the expense and delay which shutting down the boiler entails.

Again we aim to provide a soot blower construction and method of operation in which special and expensive metal alloys can be dispensed with if desired and ordinary iron utilized.

Another object of our invention is to provide a soot blower construction and method of operation whereby a hollow tubular element can be supported in operative position spanning the space between the boiler walls, without the necessity of intermediate support, with the resultant advantages which such a construction embodies.

Our invention consists generally in a device of the form, arrangement, construction, and cooperation of the parts, and in a method of operation thereof, whereby the above named objects together with others that will appear hereinafter are attainable and our invention will be more readily understood by reference to the accompanying drawings which illustrate what we consider at the present time to be the preferred embodiment thereof.

In said drawings:

Fig. 1 is a longitudinal section through a boiler furnace provided with our improved soot blower construction.

Fig. 2 is a transverse section through the same on an enlarged scale as taken on the line 2—2 of Fig. 1.

Fig. 3 is a detail view partly in elevation and partly in section of portions of the piping arrangement of our improved soot blower and will be more specifically referred to later.

Referring now in detail to that embodiment of the invention illustrated in the accompanying drawings and more particularly to Fig. 1 thereof, 5 indicates as a whole the setting of a water tube boiler which includes a front wall 6, a rear wall 7, a top wall 8 and side walls 9—9 respectively. 10 and 11 indicate respectively the front and rear headers which are connected by the

usual inclined water tubes 12. Within the boiler setting and spaced rearwardly from the front wall to provide a combustion chamber 13 is a bridge wall 14 and extending upwardly therefrom is a baffle 15. Between the baffle 15 and rear wall 7 and depending from the top wall is a second baffle 16. The baffles divide the setting into three passes 17, 18 and 19 respectively, the first (17) being in direct communication with the combustion chamber 13 and the third (19) being in communication with the stack lead 20, the other or intermediate pass 18 connecting the first and third passes. The construction above described is typical of a water tube boiler and need not further be described.

Our improved soot blower includes a plurality of tubular members or elements 21 disposed transverely of and in close proximity to the top and bottom water tubes and arranged in the various passes of the furnace. The arrangement of the soot blower elements is, of course, dependent upon the type of furnace in which they are installed and as shown in Fig. 1, we provide two of such elements in the first pass and a single element in each of the second and third passes, with another element between said last mentioned passes and preferably in the plane of the baffle 16. As said elements 21 and the parts associated therewith are alike, a detailed description of one will suffice for all.

Each element is in the form of a tube 22 having longitudinally spaced venturi-like interiorly arranged nozzles 22^a disposed in planes between the adjacent water tubes, as shown in Fig. 2. Each element extends through both side walls 9—9 of the setting and its inlet end is fixed in the tubular hub 23 of a sprocket 24, which hub is journalled in a sleeve 25 set in the associated side wall. The other or discharge end of the element is fixed in a bearing member 26 which is journalled in a similar sleeve 25 set in the associated side wall. The outer end of the sprocket hub 23 carries a stuffing box 27 to receive a non-rotative nipple 28 so that the blower element 22 is capable of being rotated or turned through a predetermined angle with respect to the nipple without leakage at this point. The nipple 28 is carried by a blower head 29 connected to the top end of a vertically disposed blower pipe 30. The sprocket 24 is connected by a chain 32 to a smaller sprocket 33 suitably mounted on the pipe 30, a hand wheel 34 being associated with the last mentioned sprocket to actuate the same. When the hand wheel is operated, it is apparent that the element 22 may be rocked or oscillated through a predetermined angle to provide the necessary sweep of the nozzles, suitable stop means (not shown) being associated with the sprocket 24 to limit the angle of movement thereof.

As best shown in Fig. 3, the pipe 30 is provided with a three-way valve 35 by means of which it may be connected to either an air or other cooling medium pipe 36, or a high pressure steam pipe 37, an auxiliary valve 38 being interposed in said last mentioned pipe for closing off the same should it ever be necessary to remove the three-way valve 35 or the parts associated therewith. The air pipe is connected up to any source of air supply of relatively low pressure by a pipe 39, which when the furnace is equipped with a wind box to promote combustion, may be connected to and secures its air from the wind box. Preferably interposed between said pipes 36 and 39 is a casing 40, the purpose of which will later appear.

The discharge end of the blower element 22 as before described extends through the associated side wall 9 of the setting and in this instance is normally open and is supported at both ends in said side walls, thus eliminating the necessity of the usual hangers depending from the water tubes as is the practice in soot blowers now on the market. Said discharge end is provided outside the associated wall with a check valve 41 of peculiar construction and which normally remains open at low pressure and automatically closes at high pressure within the blower element. Said valve as herein shown includes a normally open flap valve 42 which engages under the action of gravity upon an adjusting screw 43 operable from without the valve casing. When the element is in standby or inoperative position and a substantially low pressure cooling medium or air is supplied to the same, said valve remains normally open but when said element is in its operative or blowing position and high pressure steam is supplied thereto, said valve is lifted upwardly into engagement against a seat 44 and closes said valve.

To increase the heat absorbing qualities of the air used in cooling the element when in stand by or non-soot blowing position, which position means the condition which obtains between soot blowing operations, we provide means for introducing a fine mist or fog-like water vapor into the air from the wind box at a point within the casing 40 by means of a misting nozzle 45 connected to a suitable supply of water under pressure. Said nozzle as shown herein is mounted on the top end of a supply pipe 46 in which is provided a shut-off valve 47. This nozzle is of the kind that reduces the water to a fine mist or fog which is rapidly taken up by the incoming air and passes with said air to the blower element or tube wherein the thermal capacity of the air is increased

so that it will absorb the greatest amount of heat from the walls of the element. Should condensation take place in the pipe 36, the water of condensation will collect or accumulate in the casing 40 which is provided with a sealed automatic discharge or manometer tube 48, the top end of which is located in a plane below that of the nozzle 45.

Assume that the soot blower element 22 is in its standby or normal inoperative position and the three way valve 35 is in a position connecting the pipe 30 with the pipe 36. Air under substantially low pressure will pass up through said pipe 30 into the head 29 and thence through the nipple 28 into the blower element 22. The pressure of the air or other cooling medium is not sufficient to lift the valve 42 into a closed position against the seat 44 with the result that this valve remains open.

In the passage of the air through the element 22, it will take up or absorb its thermal capacity in heat units from said element and its volume is such that a portion of the heat laden air will discharge out through the valve 41 and the remaining portion will discharge or blow out through the nozzles 22^a. The valve 41 may open to atmosphere or may be connected to the furnace ash pit or any other convenient place other than the wind box, should the furnace be thus equipped with one. In some instances as in a relatively narrow furnace the major portion of the heat laden cooling medium or air will discharge through said valve 41 and the minor portion will discharge through the nozzles. In wider furnaces the discharge may be substantially equal or the minor portion is discharged through the valve and the major portion is discharged through the nozzles, depending, of course, upon the size of the furnace.

Such cooling fluid as issues through the nozzles performs an important function when the element is in the stand-by position because it provides a zone of reduced temperature about the exterior of the element by actually deflecting or otherwise preventing impingement of the flames and products of combustion with the element. However, the cooling medium discharged through the nozzle is not of such a volume as to reduce the temperature in the passes but in fact it promotes combustion. Thus, the element is "ventilated" so to speak so that its temperature is maintained below that which permits its sagging, warping or burning out. To increase the thermal capacity of the cooling medium or air if so desired, the valve 47 is opened in the pipe 46, thus causing a fog-like mist to enter the chamber 40 to be taken up by the incoming air from the pipe 39. The moisture laden air will pass into the element 22 where it is capable of absorbing greater quantities of heat units, in fact, turning to a low pressure steam, to pass out through the valve 41 and nozzles 22^a as before described. Should condensation take place in the pipe 36 or elsewhere in the line, the water of condensation will drain back into the chamber 40 and into the manometer tube 48, which being of U-shape form and connected to the bottom of the chamber will fill up When the level in the chamber approaches that of the discharge end of the tube, said tube will spill or overflow and thus maintain a constant level in said chamber. In this manner the tube provides an excess water outlet and a trap at the same time which prevents the cooling fluid from escaping at this point.

It is necessary to blow the soot from the water tubes during the operation of the boiler furnace and with our improved blower the operation is as follows: The three way valve 35 is brought into the position shown in Fig. 3 wherein the pipe 30 is connected to the steam supply line 37 under a much higher pressure than the cooling medium used in stand-by or inoperative position. The steam entering the element will drive the air within the same out through the valve 41 and the pressure of the steam will lift the flap valve 42 up against the seat 44 which closes the valve 41 so that the only exit for the steam is out through the nozzles 22^a. It is apparent that both the cooling medium for the stand-by position and the higher pressure of steam for soot blowing is supplied to the element through one and the same pipe 30. The element 22 is now rocked in one direction and then in the other to the predetermined angular positions by means of the hand wheel 34 and sprockets and chains 24, 33 and 32 respectively, which positions are determined by the before mentioned stop means associated with the sprocket 24, and are so arranged as to prevent the closing of the valve 41 by gravity. When the steam or blowing medium is released among the boiler tubes, a whirlwind-like current is created which scours the tubes and thoroughly removes the particles of soot and fine ash which have accumulated thereon. When the blowing operation is over and the element is in its stand-by position the valve 38 is closed and the three way valve 35 is actuated to again connect up the cooling fluid with the blower element as before described.

It is apparent from the foregoing description that our improved soot blower has many advantages:—The blower element being supported at its ends in the side walls of the boiler setting eliminates the use of any hanging supports from the water tubes which supports or hangers quickly burn out. Again the element is free to expand longitudinally without any damage to the blower head or boiler setting as often resulted in

blowers now used wherein one end which is plugged terminates within the furnace. Again both ends of the element are visible from without the furnace and should oxidization require renewal of the element, this may be done by removing the valve 41 and disconnecting the blower head and withdrawing the element from that end, and inserting a new one without the necessity of a shut down of the boiler. Heretofore with elements supported by hangers and terminating short of one side wall of the setting, the elements would sag after the hangers burned out so that it was impossible to rotate them for blowing and it was impossible to withdraw them on account of the sag.

Again the elements may be made of ordinary iron and need not be of the special alloy kind because they are maintained substantially cool under the action of the cooling fluid in the stand-by periods. It is again pointed out that both the cooling medium and the blowing medium pass to the blower element through the same supply pipe. This simplifies the construction of the blower and reduces the cost of manufacture and installation thereof.

Due to the efficient cooling of the element by the construction before described, element protecting masonry is unnecessary and the element may be placed with safety in an exposed position in the boiler setting where the advantages of soot blowing are of great value, thereby enabling portions of the boiler, heretofore inaccessible, to a blowing medium to be cleaned. By supporting the elements in the side walls of the setting and by the elimination of the usual intermediate hangers or other supports from adjacent water tubes, it is possible to use our improved element, say for instance, in positions between tube rows and to rotate said element through any desired angle.

While in describing our invention we have referred to certain details of mechanical construction as well as form and arrangement of the parts, this is for the purpose of description and illustration only so that we do not wish to be limited thereto except as may be pointed out in the appended claims.

We claim as our invention:

1. A soot blower embodying therein, a blower element having a plurality of discharge orifices therein, and a discharge opening at one end, means for supplying a cooling medium to said element, said orifices and opening being so arranged that a portion of said cooling medium may discharge through said orifices and another portion thereof may discharge through said end opening, and means for automatically closing said end opening when said blower is placed in operation.

2. A soot blower embodying therein, a blower element having a plurality of discharge openings throughout its length and a discharge opening at one end thereof, means for supplying a cooling medium to said element, whereby a portion of said fluid may be discharged through said orifices and another portion may be discharged through said opening, and means for closing said opening.

3. A soot blower embodying therein, a blower element having a plurality of discharge openings throughout its length and a discharge opening at one end thereof, means for supplying a cooling medium to said element, whereby a portion of said fluid may be discharged through said orifices and another portion may be discharged through said opening, and means for automatically closing said opening.

4. A soot blower embodying therein, a blower element having a plurality of discharge openings throughout its length and a discharge opening at one end thereof, means for supplying a cooling medium to said element, whereby a portion of said fluid may be discharged through said orifices and another portion may be discharged through said opening, and means operable upon an increase in pressure in said element to close said last mentioned opening.

5. A soot blower embodying therein, a blower element having a plurality of discharge openings throughout its length and a discharge opening at one end thereof, means for supplying a cooling medium to said element, whereby a portion of said fluid may be discharged through said orifices and another portion may be discharged through said opening, and means operable upon an increase of pressure in said element to cause all of the medium to discharge through said orifices.

6. A soot blower embodying therein, a blower element having a plurality of orifices throughout its length, and means for placing one end of said element in communication with the atmosphere when said blower is in its normal position of rest and for shutting off such commuication when the blower is in operation.

7. A soot blower embodying therein a blower element having a plurality of discharge orifices throughout its length and open at one end, means for supplying either a low or a high pressure medium into said element, and means adapted to be actuated by said high pressure medium to close said end.

8. In a boiler structure, the combination with the boiler setting of a soot blower, said blower comprising a blower element rotatably supported at its ends in the side walls of the setting and opening at its ends through said side walls, a blower head on one end of said element without one side

wall and a normally open valve on the other end without the other side wall and adapted to close under a pressure greater than standby pressure.

9. A soot blower embodying therein, a blower element having a plurality of discharge orifices therein, and having a discharge opening at one end, means for supplying air to said element when in standby position and means for introducing moisture into said air.

10. A soot blower embodying therein, a blower element having a plurality of discharge orifices therein, and having a discharge opening at one end, means for supplying a cooling medium to said element and means for increasing the thermal capacity of said medium before it enters the blower element.

11. A boiler structure embodying therein, a furnace setting including side walls, a soot blower element journalled at its ends in and extending through said side walls, said element having a plurality of discharge openings between its ends, a blower head on one end of said element without one side wall, means for connecting the other end of said element to the atmosphere, a valve controlling the flow through said means, and means for admitting either a low or a high pressure fluid to said element from the head end, said valve being normally arranged to close under the influence of the high pressure fluid.

12. A soot blower embodying therein, a blower element having a plurality of discharge orifices therein, and having an opening at one end capable of discharging to atmosphere, a single conduit for supplying either a cooling medium or a blowing medium to said element, and means for automatically closing said end when said blower is in operation.

13. A soot blower embodying therein, a blower element having a plurality of discharge orifices therein, and having an opening at one end capable of discharging to atmosphere, a single conduit for supplying either a relatively low pressure cooling medium or a high pressure blowing steam to said element, and means for automatically closing said end when said blower is placed in operation.

14. The combination with a soot blower element having a cleaning fluid channel therein and having a plurality of orifices therein communicating with said channel, of means for supplying a relatively low pressure air to said element, and means for saturating said air with water vapor before entering said element to generate a low pressure steam in the element itself which passes out through said orifices.

In testimony whereof, we have hereunto set our hands this 27th day of May, 1925.

PAUL LIPPERT.
JOHN S. DEAN.