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BOILER ATTACHMENT

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2 Sheets-Sheet 1

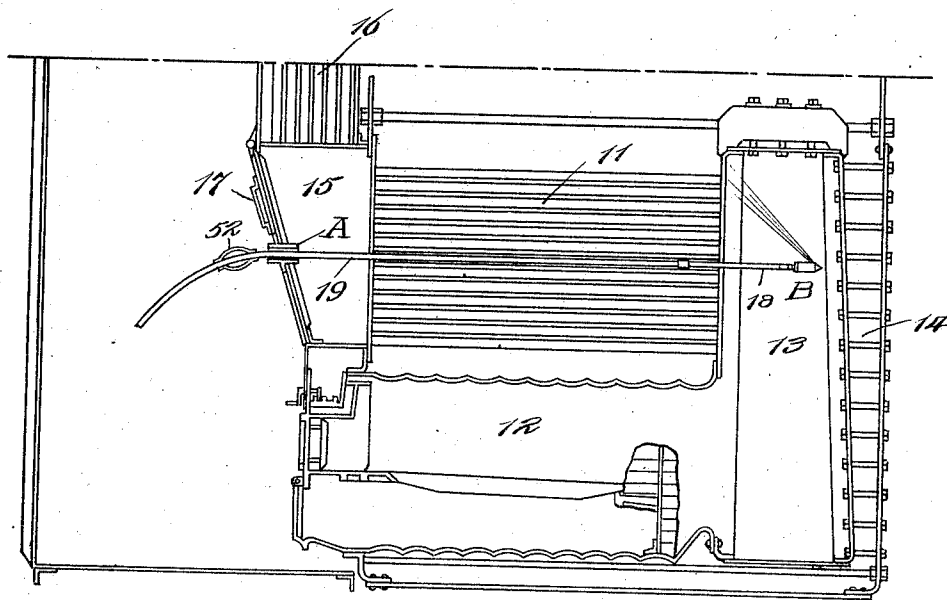


Fig. 1.

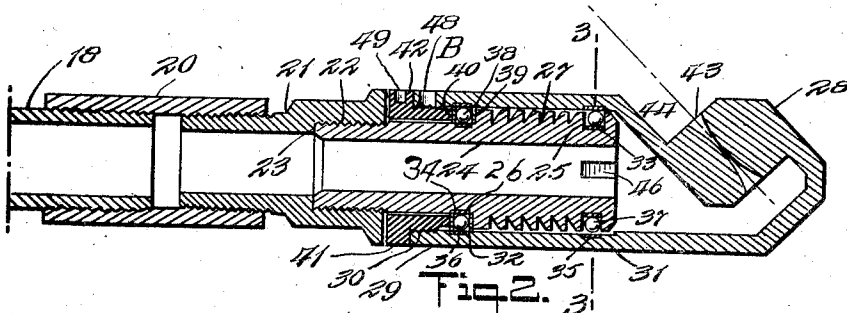


Fig. 2.

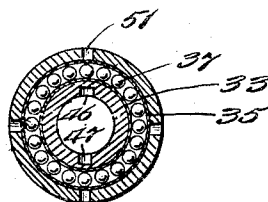


Fig. 3.

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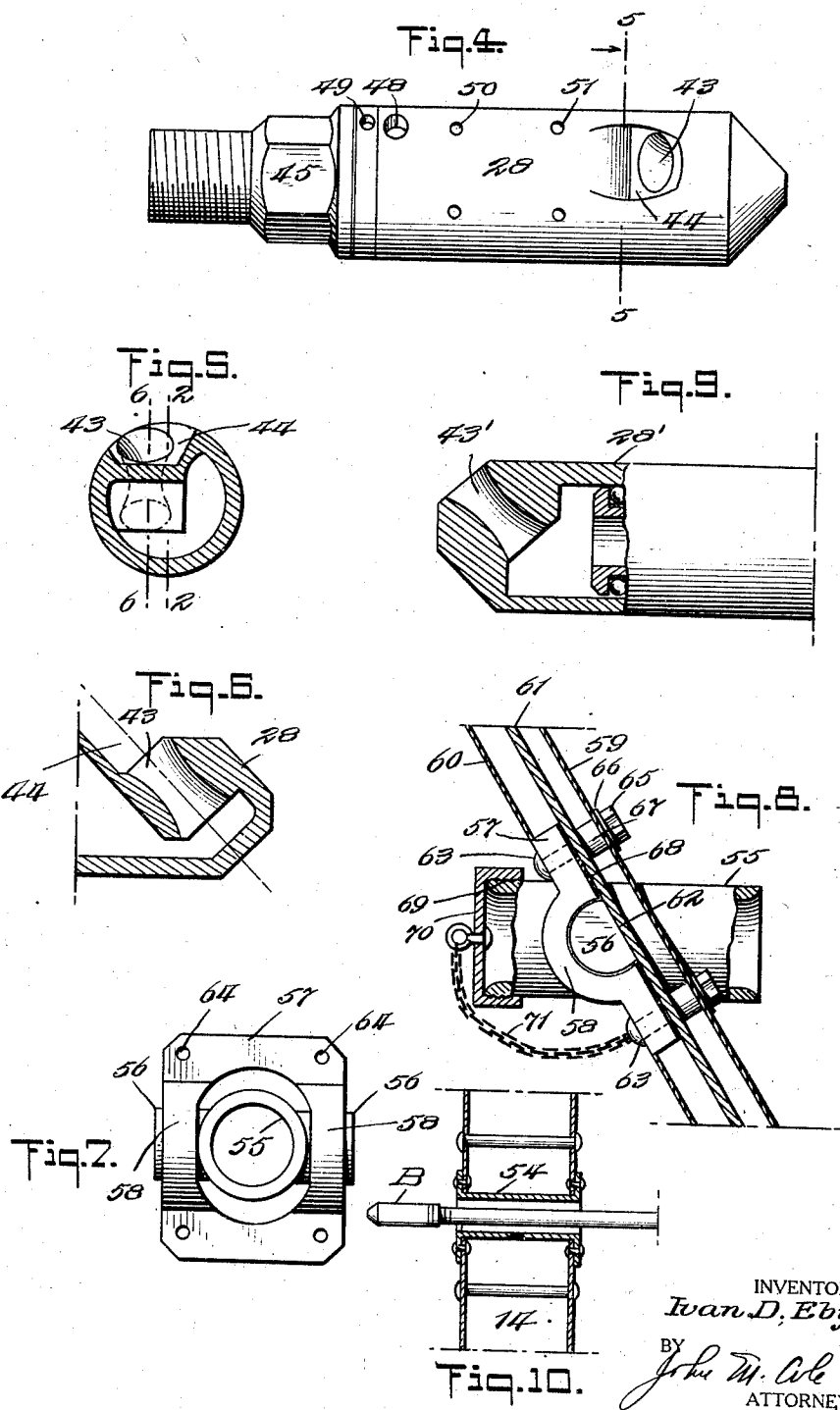
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2 Sheets-Sheet 2



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BOILER ATTACHMENT

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The present invention relates to improvements in boiler attachments and more particularly to devices designed for use in blowing the soot out of the tubes of the boiler.

5 It is well known that a deposit of soot tends to accumulate in boiler tubes. This soot is one of the best heat insulators known, and even a very thin coating of soot brings about considerable heat loss, thereby reducing the efficiency of the boiler. It is, therefore, desirable for efficient operation to frequently clean this soot from the tubes. This operation has generally been neglected by the operating force in the boiler room on account of heavy labor required and excessive heat present in cleaning the soot with the less expensive devices usually available for the purpose. The installation of effective soot-blowing apparatus heretofore available has been very expensive and therefore comparatively seldom used.

Devices for blowing soot, heretofore available, have, in general, involved the use of fixtures permanently mounted adjacent the boiler tubes, and these fixtures, besides being expensive to install, require inspection and deteriorate rapidly. In some cases they require the closing up of a boiler tube, thereby lowering the efficiency of each furnace of the boiler and inviting corrosion and scale.

30 The present invention contemplates boiler attachments, by means of which one can readily clean the soot from the boiler tubes without great effort. It also contemplates a soot blowing arrangement by which the boiler may be cleaned at frequent intervals without the necessity of shutting down the boiler, opening the smoke doors, or cutting the boiler off the steam line. It also contemplates the provision of a soot blowing device which utilizes a jet of steam introduced into the combustion chamber to blow the soot in the direction of the draft, and the removal of the device for producing the steam jet upon the completion of the blowing of the soot.

45 The devices heretofore in use have generally required installation of the complete soot blowing attachments for each furnace of the boiler. The present invention, on the other hand, provides for a simple attachment

for each furnace in the boiler, which can be installed in an inexpensive manner, and the use of a single device which may be introduced into any of the furnaces to blow the tubes thereof. In this manner, the installation expense is much lower because a single soot blowing device may be utilized to blow all the boilers in the power plant or on board the ship.

The accompanying drawings show, for the purposes of illustrating the invention, one of the many possible embodiments in which the present invention may take form, together with modifications of certain parts.

In these drawings:

Fig. 1 is a section through a boiler illustrating the attachments in position for blowing soot;

Fig. 2 is a section through the nozzle end of a soot blower taken on the line 2—2 of Fig. 5;

Fig. 3 is a cross section taken on the line 3—3 of Fig. 2;

Fig. 4 is a side elevation;

Fig. 5 is a section on the line 5—5 of Fig. 4;

Fig. 6 is a section taken on the line 6—6 of Fig. 5;

Fig. 7 is an end view of an attachment for the smoke box door;

Fig. 8 is a side elevation of the device of Fig. 7, with parts in section, showing the same attached to the smoke box door;

Fig. 9 is a view of a modified form of nozzle arrangement; and

Fig. 10 illustrates the insertion of the soot blower through a tube in the water leg of the boiler.

For the purpose of illustrating the invention, the same is shown in use in a Scotch marine type boiler. It is, of course, obvious that the invention is in no wise limited to this type of boiler as it is capable of general application. The boiler here illustrated has the conventional heating section 11, made up of a plurality of tubes, the furnace 12, combustion chamber 13, water leg 14, smoke box 15, and uptake 16. The smoke box door 17 is provided with attachments, designated generally by the letter A, which include a tubular member substantially in alignment with one

of the central tubes of each furnace of the boiler.

The head of the soot blowing device, designated by the letter B, is mounted on the end of a length of pipe 18 which, in turn, is connected with a tubular member 19 which may conveniently be in the form of a piece of steam hose. The hose, pipe, and blower B are all of sufficiently small diameter to be able to pass freely through one of the tubes of the heating section and through the tubular member carried by the smoke box door.

The working end of the soot blowing device is illustrated in detail in Figs. 1 to 6, inclusive, and will now be described. The piece of pipe 18 is connected by means of an ordinary pipe coupling 20 with an externally threaded tubular member 21. The member 21 is internally threaded at the other end, as shown at 22, and is provided with a shoulder 23 against which another tubular member 24 may be tightened. The outside of the inner tubular member 24 is provided with two spaced apart grooves 25 and 26 and a series of grooves 27 for a purpose to be described.

A revolvable head 28 having a tubular end 29, internally threaded at 30, is carried outside the tubular member 24. This head is provided with grooves 31 and 32 outside the grooves 25 and 26 of the inner tubular member and these grooves are preferably provided with steel split rings 33, 34, 35 and 36, which provide hard wearing surfaces for the interposed series 37 and 38 of balls. To take care of end thrust, washers 39 and 40 are preferably provided for the latter set of balls. A follower 41 is provided with a shoulder 42 which is drawn up against the end of the revolvable head 28 by means of the threads, as shown. The length of this follower is such that it brings the washer 40 in the proper position relative to the balls 38. The revolvable head 28 is provided with a nozzle 43 which, as shown in Figs. 5 and 6, is placed at an angle to the axis of the revolvable head and is placed a short distance to one side of the center of the head. This nozzle, in the form here shown, opens into a cavity 44 in the side of the revolvable head.

The device so far described may be assembled and disassembled in the following manner. The rings 33 and 34 are snapped into position in the grooves 25 and 26 and the rings 35 and 36 are worked into the grooves 31 and 32. The washers 39 and 40 and follower 41 are slipped over the end of the tubular member 24 and the coupling member 21 threaded into position to bring the shoulder 23 against the end of the tube. In order that this may readily be done, the coupling member 21 is provided with a hexagonal head 45 and the tubular member 24 with slots 46 and 47. The open end of the revolvable head is inserted over the free end of the tubular member 24 until the aperture

48 is in line with the groove 25. The balls 37 are then inserted to fill the ball race and the head is then moved to bring the hole 48 in line with the groove 26 whereupon the balls are inserted as before. The follower 41 is then tightened in position. This may be done by spanner wrenches whose pins cooperate with the hole 48 in the follower and the holes 50 and 51 in the revolvable head.

In disassembling the device, the reverse operations are performed. The holes 50 and 51 are preferably so located that they are opposite the rings 35 and 36 so that the rings may be removed by an instrument inserted through these holes.

The operation of the soot blowing device is as follows: The revolvable head and attached pipe and hose are inserted through the tubular member A in the smoke box door, and through one of the boiler tubes to a position substantially like that indicated in Fig. 1. Steam is then turned on and escapes at high velocity through the nozzle. This escaping jet of steam is directed toward the adjacent header where it enters a tube and cleans the soot off the tube wall. The reaction of the jet which comes from the off-center nozzle causes the revolvable head 28 to rotate on the bearings and, in this manner, the jet of steam travels through a conical path and reaches a circular zone of boiler tubes. The operator, by grasping the handle 52 on the steam hose outside the smoke box door, is able to reciprocate the hose and attached pipe and revolvable head so that the head is moved back and forth in the combustion chamber. The moving of this head causes the steam jet to reach tubes spaced at varying distances from the central tube and, in consequence, the steam jet blows the soot out of all the tubes in the furnace. After the operation has been completed, the operator withdraws the hose, attached pipe and revolvable head from the boiler and the same apparatus may be used in another furnace. The flexibility of the hose permits handling the soot blower in the restricted space of the boiler room.

It will be noted that the present form of construction provides a steam passage having a large area all the way to the nozzle, and that a single nozzle is used. The nozzle is in the form of a Venturi tube, somewhat as indicated. It is considerably smaller in diameter than the steam supply pipe so that the pipe and blower head act as a steam chest for the nozzle, the steam velocity in the pipe and blower head being comparatively low. These features make for high steam pressure right at the nozzle and provide an exceedingly strong and effective jet, which will impinge with maximum force on a single boiler tube. The concentration of the steam jet to one tube makes it very effective in cleaning the soot out of the tube.

Some boilers are provided with a tubular member 54 which is expanded into the water leg 14, as illustrated in Fig. 10. In this case the soot blower may be introduced in the combustion chamber through the tube 54. A revolvable head 28' suitable for use in this arrangement of boiler is illustrated in Fig. 9. This head is the same as that heretofore described in detail except that the axis of the nozzle 43' is changed so that the steam jet will be directed in the same direction as before. The same arrangement of ball bearings may be used in view of the fact that the thrust produced by the pressure of the steam in the revolvable head will always tend to pull the revolvable head off the tubular member 24. In either case, the grooves 27, above mentioned, are provided in order to reduce the leakage of steam. They form a labyrinth which checks the escaping steam.

The attachment A for the smoke box door is illustrated in detail in Figs. 7 and 8. This device consists of a tubular member 55 having trunnions 56 and a plate like member 57 having straps 58 adapted to fit the trunnions 56. In mounting this device on the smoke box door, the inner casing 59, the outer casing 60 and the intermediate heavy plate 61 of the smoke box door are cut as by an acetylene torch to provide openings for the tubular member 55 and plate 57. The trunnions 56, which are preferably cast round, are then chipped to provide a straight face 62 disposed at such an angle that when the face 62 is brought against the plate 61, the tube 55 will be horizontal. I prefer this construction on account of the wide variation in the angle of smoke box doors. The members 55 and 57 are fastened in place by means of four bolts 63 which pass through apertures 64 in the corners of the plate 57 through the smoke box door. These bolts are fastened in place by means of nuts 65, washers 66 and spacers 67 in an obvious manner. In order that leakage of air through the smoke box door may be minimized, a gasket 68 may be provided, if desired. The outer end of the tubular member 55 is threaded at 69 and a threaded cap 70 is adapted to be mounted on the tube in order to close it up when it is not in use, thereby preventing the leakage of air through the tube into the smoke box. In order that this cap may not be lost when removed from the tube, a chain 71 is connected to the cap and to some part fixed to the smoke box door.

While I have described the soot blower as being operated by steam, it is, of course, obvious that one could use compressed air, if desired.

What is claimed is:

1. The combination with a boiler having a heating section, a combustion chamber, and a smoke box, a smoke box door having a centrally disposed opening, of a soot blower in-

sertible through said opening and through the heating section into the combustion chamber, said soot blower including a tubular member, and a revolvable head provided with a single, obliquely disposed nozzle capable of producing a strong jet of steam and directing it onto a restricted area on the tube sheet of the boiler, the steam supply passages being substantially unrestricted up to the nozzle so that high pressure steam is available at the nozzle, the nozzle being so disposed that the reaction of the jet rotates the head, the tubular member and head being reciprocable in the opening and the heating section.

2. The combination with a boiler having a heating section, a combustion chamber, a smoke box adjacent the heating section, a smoke box door having a tubular member transversely mounted thereon, of a soot blower insertible through said tubular member and through the heating section into the combustion chamber, said soot blower including a second tubular member, a length of pipe, and a revolvable head provided with a single, obliquely disposed nozzle capable of producing a strong jet of steam and directing it onto a restricted area on the tube sheet of the boiler, the steam supply passages being substantially unrestricted up to the nozzle so that high pressure steam is available at the nozzle, the nozzle being so disposed that the reaction of the jet rotates the head, the hose and head being reciprocable in the first tubular member and the heating section, the length of the pipe being greater than the spacing of the smoke box door from the heating section and sufficient to support the revolvable head in the combustion chamber, and a closure for the first tubular member when the soot blower is withdrawn.

3. The combination with a boiler having a heating section, and a combustion chamber, of an opening through the walls of the boiler disposed adjacent the heating section, and a soot blower insertible through said opening to project it into the combustion chamber through the heating section, said soot blower including an independently revolvable head provided with a nozzle to direct a jet toward the heating section and so disposed that the reaction of the jet rotates the head, the head being reciprocable in the opening.

4. The combination with a boiler having a heating section, a combustion chamber, and a smoke box, a smoke box door having a centrally disposed opening, of a soot blower insertible through said opening and through the heating section into the combustion chamber, said soot blower including a tubular member, a length of pipe, a revolvable head provided with a single, obliquely disposed nozzle capable of producing a strong jet of steam and directing it onto a restricted area on the tube of the boiler, the steam supply passages being substantially unrestricted up

to the nozzle so that high pressure steam is available at the nozzle the tubular member and head being reciprocable in the opening and heating section, the length of the pipe being greater than the spacing of the smoke box door from the heating section and sufficient to support the revolvable head in the combustion chamber, and a handle on the tubular member outside the opening in the smoke box door.

5. A soot blower for boilers comprising a length of pipe insertible through and reciprocable along a boiler tube, a tubular member connected to the pipe, and a head revolvably mounted relative to the pipe, the head having a single, obliquely disposed nozzle capable of producing a strong jet of steam and directing it onto a restricted area on the tube sheet of the boiler, the steam supply passages being substantially unrestricted up to the nozzle so that high pressure steam is available at the nozzle.

6. A soot blower for fire tube boilers comprising a member insertible through one of the tubes and extending beyond the header of the boiler, said member including a reaction revolvable head provided with a single, obliquely disposed off-center nozzle capable of producing a strong jet of steam and directing it onto a restricted area on the tube sheet of the boiler, the steam supply passages being substantially unrestricted up to the nozzle so that high pressure steam is available at the nozzle.

7. In a soot blower, an inner tube open at both ends, an outer tubular member of larger diameter than the inner tube, ball and thrust bearings revolvably supporting the outer tubular member on the inner tube, one end of the outer tubular member extending beyond the end of the inner tube and being closed and provided with a nozzle carried within the cylindrical outline of the outer tubular member and so disposed that an escaping jet is directed at an acute angle to the axis of the tube, the thrust being taken by the thrust bearing.

8. In a soot blower, an inner tube open at both ends, spaced apart ball bearings carried by the outside of the tube, an outer tubular member mounted on the ball bearings, one end of said member being internally threaded, a follower threaded into the said member and against one of the ball races to provide a thrust bearing, and a nozzle carried within the cylindrical outline of the said member.

9. In a soot blower, an inner tube open at both ends, spaced apart ball bearings carried by the outside of the tube, an outer tubular member mounted on the ball bearings, one end of said member being internally threaded, a follower threaded into the said member and against one of the ball races to provide a thrust bearing, a labyrinth

between the ball bearings, and a nozzle carried within the cylindrical outline of the said member.

10. In a soot blower, an inner tube open at both ends, spaced apart ball bearings carried by the outside of the tube, an outer tubular member mounted on ball bearings, one end of said member being internally threaded, a follower threaded into the said member and against one of the ball races to provide a thrust bearing, a nozzle carried within the cylindrical outline of the said member, and a coupling member threaded onto the inner tube.

11. In a soot blower, an inner tube open at both ends, spaced apart ball bearings carried by the outside of the tube, an outer tubular member mounted on ball bearings, one end of said member being internally threaded, a follower threaded into the said member and against one of the ball races to provide a thrust bearing, and an obliquely disposed off-center nozzle carried by the said member.

12. In a soot blower, a length of pipe, a coupling member attached to the pipe, an inner tube threaded into the coupling member, an outer tubular member whose remote end is closed, means for mounting the tubular member on the tube to permit free rotation of the member and to prevent axial movement thereof, and an obliquely disposed off-center nozzle in the remote end of the tubular member, said nozzle being carried within the cylindrical outline of the tubular member.

13. In a soot blower, an inner tube open at both ends, an outer tubular member of larger diameter than the inner tube, ball bearings revolvably supporting the outer tubular member on the inner tube, one end of the outer tubular member extending beyond the end of the inner tube and being closed and provided with a nozzle, the outside of the inner tube having a labyrinth to reduce the escape of gas between the tubes.

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