Nov. 10, 1925. 1,561,004

J. T. LEMON

FLUE CLEANING APPARATUS FOR BOILERS

Filed Sept. 1, 1920 4 Sheets-Sheet 1

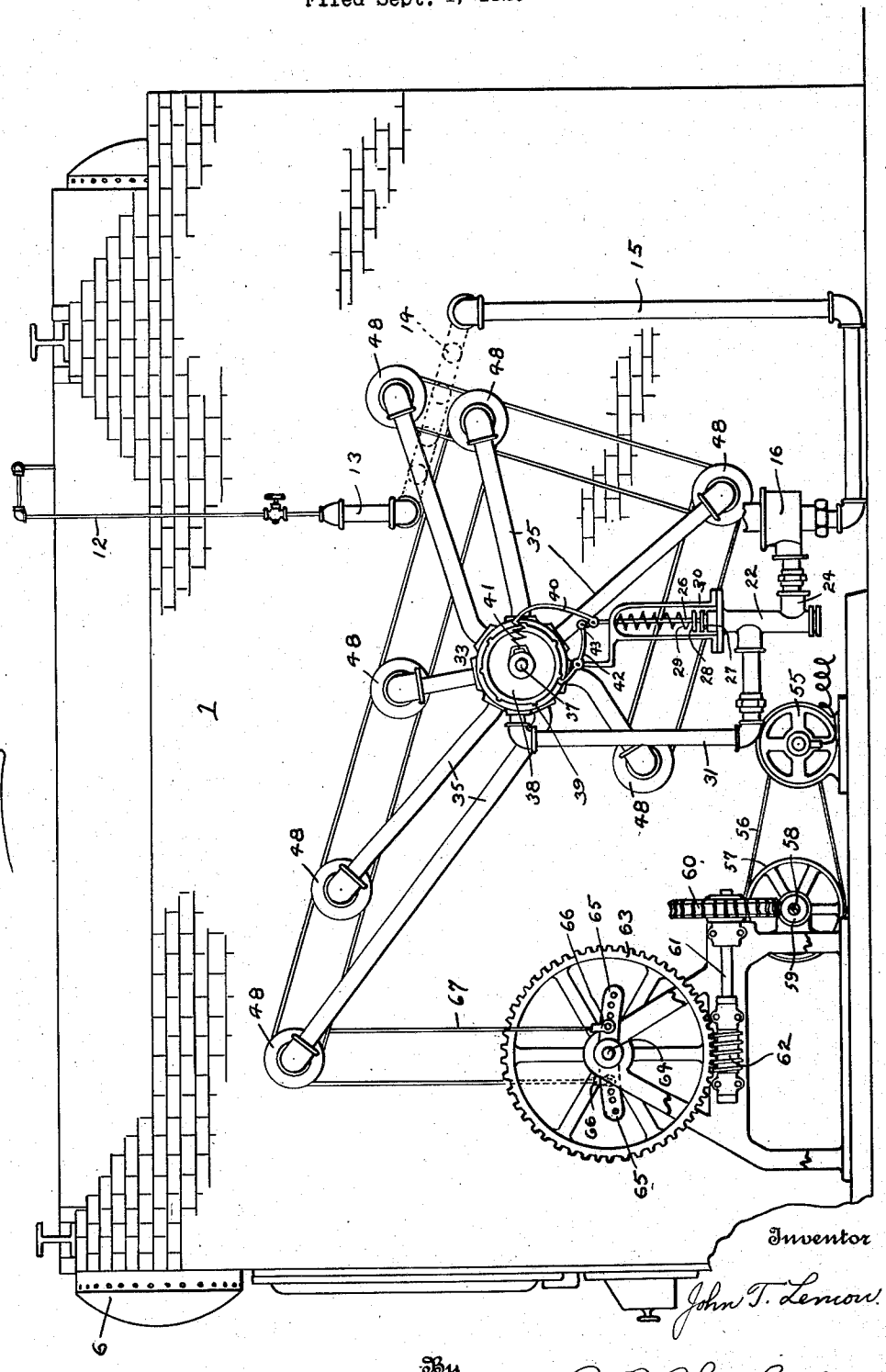



Fig. 1

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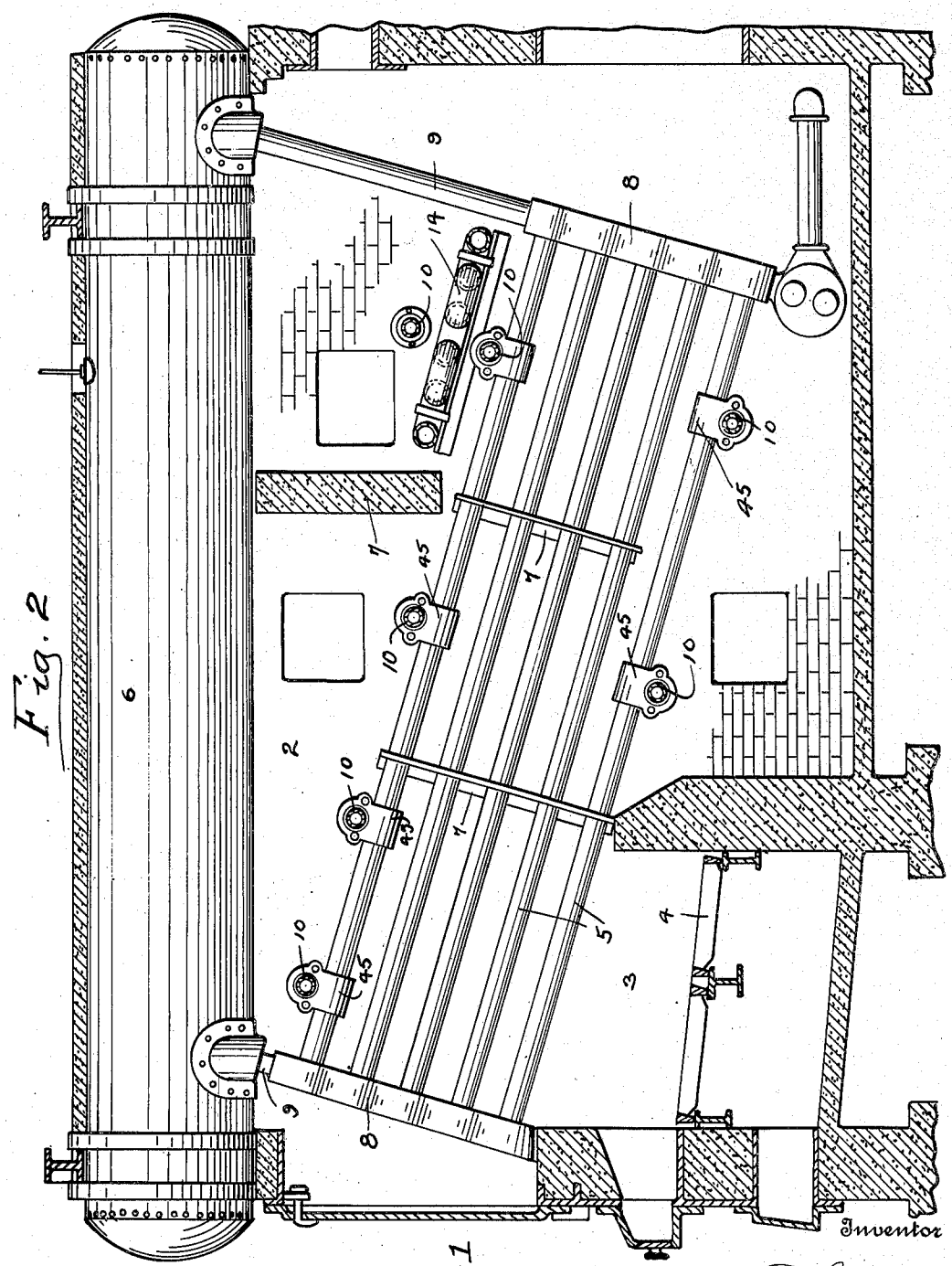



Fig. 2

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FLUE CLEANING APPARATUS FOR BOILERS

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Fig. 3

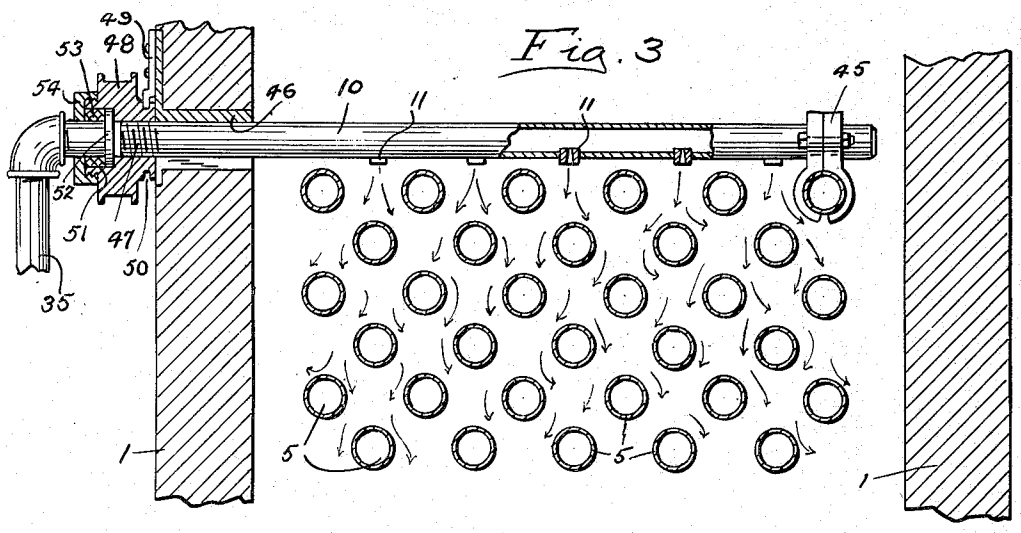



Fig. 4

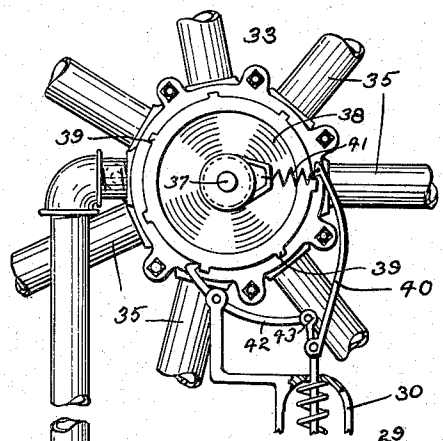
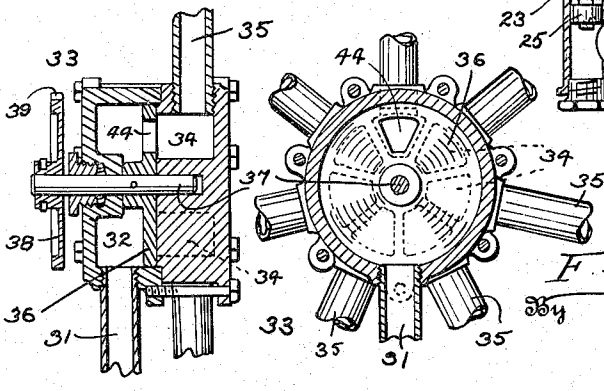



Fig. 5



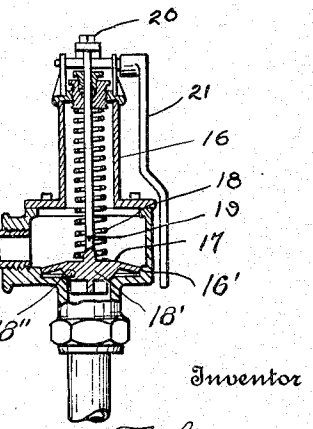




Fig. 6

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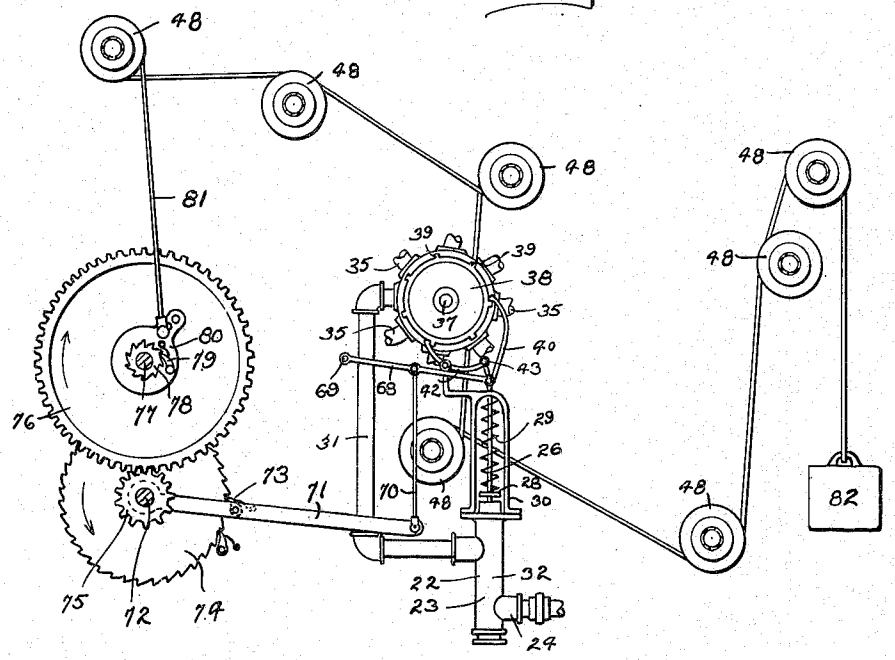
Nov. 10, 1925. 1,561,004

J. T. LEMON

FLUE CLEANING APPARATUS FOR BOILERS

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Fig. 7



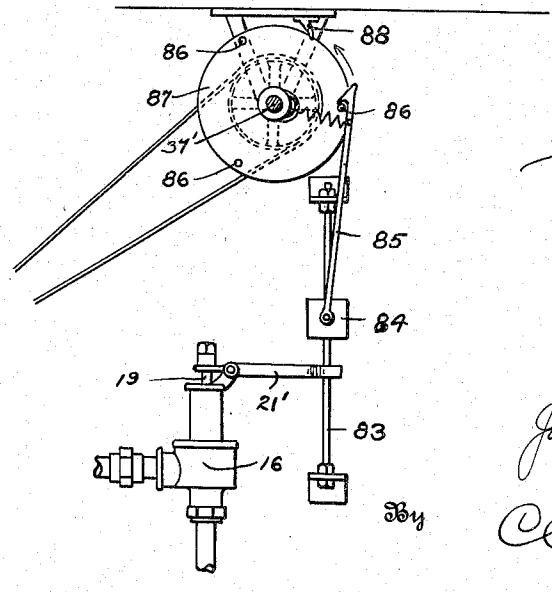




Fig. 8

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Patented Nov. 10, 1925. 1,561,004

# UNITED STATES PATENT OFFICE.

JOHN T. LEMON, OF COLUMBUS, OHIO.

## FLUE-CLEANING APPARATUS FOR BOILERS.

Application filed September 1, 1920. Serial No. 407,384.

*To all whom it may concern:*

Be it known that JOHN T. LEMON, a citizen of the United States, residing at Columbus, in the county of Franklin and State of Ohio, has invented certain new and useful Improvements in Flue-Cleaning Apparatus for Boilers, of which the following is a specification.

This invention relates generally to water tube boilers, and has particular reference to an improved automatic soot blower construction for such boilers, wherein a plurality of blower tubes are provided and situated to transversely overlie the water tubes of a boiler, said blower tubes being provided with nozzles and in communication with a source of steam supply, the construction being such that steam may be admitted into said blower tubes and then ejected from said nozzles under considerable pressure so that the ejected fluid will come into contact with the outer surfaces of the water tubes, whereby such tubes will be cleaned of all carbon or soot deposit so that the surfaces of said tubes will be maintained clear and free of crustings, coatings or other obnoxious deposits which interfere, if not removed, seriously with the efficiency of a boiler of the water tube variety.

Among the objects of the invention are to provide a boiler flue cleaning construction of the above character which will be entirely automatic in operation so that the element of manual control, heretofore so largely necessary in apparatus of this character, will be reduced to a minimum so that the operation of the structure will be rendered positive, efficient and reliable by reason of the automatic features provided. More particularly, the invention consists partly in providing means of a novel character for effecting the rotation or oscillation of the blower tubes, in order that the nozzles of said tubes may be differently positioned with respect to the water tubes, whenever fluid is forcibly ejected from said nozzles by progressive or succeeding operations. It has been common in the art, to rotate these blower tubes by means of individual operating devices situated exteriorly of the boiler setting; however, this method of operating the blower tubes has not been altogether satisfactory owing to the irregularities in adjustment or lack of adjustment of the blower tubes so that the nozzles thereof may be directed to the best advantage in removing soot. The present invention particularly comprehends an automatic and improved structure for automatically rotating the blower tubes at predetermined intervals so that the nozzles thereof may be properly directed to secure efficient results in effecting the removal of soot or the like from the water tubes.

Another object of the invention resides in providing an automatic valve structure, responsive to boiler pressures, for delivering a heated fluid, such as steam, at regulated intervals to the blower tubes, and in accomplishing this end, the invention makes use of an automatic pop valve structure to which steam is led from a superheater situated within the boiler proper, said valve structure being of such character that the same will normally resist the flow of the steam from the superheater, when the pressure of the steam reaches a predetermined poundage, said valve will be forced open to permit of the flow of the steam from the superheater to a distributor valve from which radiate pipes leading to the various blower tubes of the apparatus, the arrangements of parts being such that upon the opening of the pop valve structure, mechanism will be operated to adjust the mechanism of the distributing valve in such manner that the steam from the superheater will be permitted to pass through the distributing valve to one or more of the blower tubes. By this construction it will be obvious that the distributing valve will serve to permit steam to flow in regulated order to the blower tubes, that is, each blower tube will receive steam from the superheater in turn so that the entire system of blower tubes will be progressively charged with steam in an automatic and successive manner from the boiler in accordance with the fluid pressure within the latter and without relying upon manually operated agencies to effect the operation thereof.

Further objects of the invention reside in providing a small steam line connection between the steam drum of a boiler and the superheater for supplying the blower system, said steam line being of very small cross sectional area, in order that the steam from the drum may be withdrawn and led into the superheater in a constant and uniform manner without creating drastic pressure fluctuations within the drum, a feature which contributes materially toward uniformity in boiler operation and overcomes

what has heretofore been a serious objection against the use of blower soot cleaners; in providing means of an automatic nature for effecting the positive operation of the pop valve structure and to insure the operation of the latter at predetermined intervals; in providing means for automatically rotating the blower tubes in such manner that the nozzles of said tubes will be properly positioned with respect to the water tubes, and to cause said nozzles to automatically return to the initial starting position after completing their cycle of oscillation, and in the provision of an automatic structure for rotating the blower tubes by mechanism operated by the action of the pop valve structure.

With these and other objects in view, as will appear as the description proceeds, the invention further consists in the novel features of construction, combinations of elements and arrangements of parts, hereinafter to be fully described and to have the scope thereof pointed out in the appended claims.

In the acompanying drawings, forming a part of this specification, and in which similar characters of reference denote like and corrresponding parts:

Figure 1 is a view in side elevation disclosing more particularly the application of the improved boiler tube cleaner apparatus comprising the present invention to the setting of a water tube boiler.

Figure 2 is a vertical longitudinal sectional view taken through said boiler and disclosing the positions of the blower tubes with respect to the water tubes of the boiler, and also the position of the superheater employed by the apparatus.

Figure 3 is a transverse vertical sectional view disclosing the position of one of the blower tubes with respect to the water tubes, and illustrating specifically the connections between said blower tube and the rotating and steam supplying elements thereof.

Figure 4 is a view partially in side elevation and in vertical section disclosing the construction of the pop valve and distributing valve structures of the apparatus.

Figure 5 is a vertical sectional view taken through the distributing valve.

Figure 6 is a similar view taken through the distributing valve on a plane at right angles to the section disclosed in Figure 5.

Figure 7 is a diagrammatic view disclosing a slightly modified form of the apparatus, in which the mechanism for operating the distributing valve is also employed for rotating the blower tubes, and,

Figure 8 is a detail view of the attachment for rendering the operation of the pop valve structure positive and instantly responsive to predetermined steam pressures.

In the form of the boiler shown in the accompanying drawings, the numeral 1 designates the wall or setting thereof, which is adapted to enclose the usual combustion chamber 2 and associated parts. Located within the setting is the usual fire box 3, grate construction 4, the rearwardly inclined water tubes 5 and the longitudinally extending overhead steam drum 6. It will be appreciated that this construction is common in water tube boilers generally and that the same has been disclosed only for the purpose of illustrating the application of the cleaning apparatus comprising the present invention to boilers of this particular character. As the description proceeds, it will be manifest that the invention may be applied to any desired type of water tube boiler, and hence is not limited to the particular variety of boiler disclosed in the drawings. It will be understood that the gas passage through the boiler is suitably baffled as at 7, in order to let the gases of combustion arising from the fire box 3 train around the tubes 5 in the usual manner to insure the full heating thereof. Also, the water tubes are provided with the usual headers 8, which communicate by means of connections 9 with the drum 6, whereby the usual thermal circulation of water within the tubes 5 and the drum 6 may take place.

In boilers of this character, it frequently occurs that the efficiency thereof is appreciably diminished by the accumulation or collection of carbon or other similar soot deposit upon the outer surfaces of the tubes 5, which deposit if not immediately removed will have a tendency to cake or harden and in this manner to coat and cover the exterior surfaces of said tubes. This encrustation manifestly insulates, as it were, the heat conducting surfaces of the tubes from the heat passing through the boiler and thereby causes a drop in the efficiency of the boiler by reason of the inability to properly transmit heat to the water contained within said tubes. To prevent the accumulation of deposit of this nature, the present invention provides a plurality of automatically operated, in contrast to manually operated, blower tubes 10. These tubes, in common with analogous structures of the prior art, are situated so as to be transversely disposed with respect to the tubes 5 and, as shown in Figure 3, the said blower tubes are provided at suitable longitudinal intervals with nozzles 11, which open toward the water tubes 5. Manifestly, by permitting steam or other fluid under relatively high pressures to flow into the tubes 10, said fluid will be discharged forcibly from the latter tubes by way of the nozzles 11, and will impinge or strike upon the outer surfaces of the tubes 5, with sufficient force and power so as to effectively remove all combustion deposit

from the surfaces of the tubes 5. Inasmuch as the efficiency of this method of removing deposit has already been set forth in prior patents and treatises on this subject, it is not deemed necessary at this point to dwell particularly on the phenomenon accompanying the removal of such deposit by the agency of steam pressure.

The present invention is particularly concerned with the manner of mounting, rotating and delivering steam or other fluid to the tubes 10, and to this end the steam drum 6 is provided with a pipe line 12, which leads from the upper portion thereof downwardly and exteriorly of the setting 1 to the outer connection 13 of a blower superheater 14. It will be observed that the pipe line 12 is of relatively smaller cross sectional area, and by this construction the line 12 is permitted to deliver steam from the drum 6 in small uniform and well regulated quantities, and to prevent the steam demands caused at intervals by means of the blower apparatus, from affecting the constant pressures within the steam drum, thus enabling steam pressure within the latter to be maintained uniform and constant, without fluctuations such as would tend to affect the normal delivery of steam from said drum. The use of the small pipe line 12 and the superheater 14 is therefore of primary importance in providing a structure which will permit the cleaning apparatus to be employed during the regular operation of the boiler. At this point it may be stated that owing to the steam required by many previous blower systems, it has not always been possible to utilize the same when the normal steam demands upon the boiler are present. However, by the present invention the boiler will be permitted to continue to supply steam, when in active operation, in the usual manner and yet to permit the blower or cleaning apparatus to be utilized simultaneously and without affecting the steam output of the boiler.

It will be observed that the superheater 14 is situated at the end of the gas passage through the boiler, and hence, the use of the superheater 14 will not interfere with the normal heating of the water tubes 5, said superheater being situated so as to only use that portion of the heated gases that are normally permitted to escape from the boiler. By the provision of the pipe line 12, steam will be withdrawn in a more or less moist condition from the drum 6, and will then be led into the coils of the superheater 14, whereby the temperature of the steam will be raised so that the same will assume a dry superheater condition under relative high pressures, in order that steam may be withdrawn from the superheater and discharged from the nozzles of the tube blowers into engagement with the water tubes 5, the superheated steam being employed preferably on account of its thorough cleaning or detergent action in removing deposit from the walls of the water tubes.

Leading from the superheater 14 is a pipe line 15, which extends downwardly contiguous to one of the outer walls of the setting and terminates in connection with the inlet end of a pop valve structure 16. This valve structure is located exteriorly of the setting and is formed to include a valve casing in which a reduced cylindrical valve seat 16′ is provided. This valve seat, as usual in valves of this character, is adapted to snugly receive a valve disc 17, which is normally maintained within said seat by reason of a spring 18, which is positioned between the valve casing and the disc 17 so as to force the valve 18′ into engagement with the seat 18″ against the pressure of the steam within the line 15. The disc 17 is provided with an upwardly extending stem 19, around which the spring 18 is coaxially positioned, and the upper end of the stem carries nuts 20 by means of which the compression upon the spring 18 may be regulated. Also, the stem 19 has its upper end connected for movement with a hand operated lever 21, which may be employed for testing the operation of the structure 16. Normally, therefore, through the provision of the valve structure 16, steam will be prevented from flowing from the superheater 14, however, when the pressure of the steam within the superheater or the line 15 reaches a predetermined poundage, the valve 17 will be elevated against the pressure or resistance offered by the spring 18, thereby permitting steam to flow from the line 15, through the valve 16 and into a distributor actuator 22.

The actuator 22 consists essentially of a cylinder 23, into the lower end of which steam is admitted as at 24 from the pop valve 16. Slidably mounted within this cylinder 23 is a loosely fitting piston 25 from which a stem 26 projects vertically upwardly. This stem passes through a gland 27 provided in the upper end of the cylinder 23 and has connected therewith a collar 28, upon which presses one end of a spring 29. The upper end of the spring 29 engages with a fixed cage 30 carried by the cylinder 23, whereby the normal tendency of said spring 29 will be to force the piston 25 downwardly. However, upon the admission of steam into the lower end of the cylinder, said piston is forced upwardly, and steam is permitted to flow through and from the actuator 22 so that said steam will be permitted to pass through a pipe line connection 31 which leads into the supply chamber 32 of a distributing valve 33.

It will be observed that in the form of

the invention described, a plurality of blower tubes 10 are provided, and in order to render their operation efficient, it is necessary that steam should be supplied to the same in successive or progressive order, whereby each will be permitted to discharge steam into engagement with the tubes 5 in prearranged turns. It is, therefore, the function of the distributing valve 33 to direct the steam in a proper successive manner to each of the blower tubes. This is accomplished automatically and may be admirably effected by forming the distributing valve with a plurality of separate pockets or recesses 34, from which radiate communicating pipes 35, which extend to certain of the ends of each of the blower tubes 10. Normally, communication between the supply chamber 32 and the pockets 34 is prevented by means of a rotating disc 36, which is fixed upon a shaft 37, the latter being journaled for axial rotation within the valve 33, and having its outer end equipped with a wheel 38, from which project spaced teeth 39. These teeth are designed to cooperate with a pivoted dog 40, which is movably connected with the upper end of the stem 26, and the free end of said dog is normally pressed toward the circumference of the wheel 38 by means of a spring or its equivalent 41. Also, the cage 30 is provided with a pivoted stop arm 42, which is also designed to engage with the teeth of the wheel 38 for the purpose of arresting or limiting the movement of the latter, and said arm is moved into or out of engagement with the teeth by being pivotally connected as at 43 with the upper end of the stem 26. By this construction it will be manifest that when steam is admitted, as previously described, into the lower end of the cylinder 23, the piston 25 will be forced upwardly, thereby causing corresponding upward movement on the part of the stem 26. This upward movement of the latter causes the dog 40 to be elevated so that the same will engage with the tooth adjacent thereto and also permits the arm 42 to be rocked in such manner that its free end will clear the teeth 39. After a suitable quantity of steam has been discharged through the blower tubes, the pressure within the superheater and line 15 will drop, which will permit the pop valve to be closed by responding to the influence of its spring 18. Wherefore, when this occurs, the stem 26 will be forced downwardly by the absence of steam pressure within the cylinder 23, by the spring 29, thus causing the dog 40 to be similarly lowered in conjunction with said stem. Since the free end of the dog 40 is in engagement with one of the teeth 39, it will be apparent that the wheel 38 and the shaft 37 will be rotated a predetermined distance. This distance is regulated by the stop arm 42, which after downward motion of the stem has been initiated, will return into engagement with the circumference of the wheel 38, in order that the free end of the stop arm will engage with one of the teeth of said wheel so as to resist the rotation of the latter and to thereby cause the opening 44 within the disc 36 to align with the next adjacent pocket or recess 34 provided in the distributing valve, whereby when the steam pressure within the line 15 again reaches the required poundage, steam will be permitted to flow, as previously, described, into the pipe line 31 and hence into the supply chamber 32 of the distributing valve, whereupon the steam will flow through the opening 44 and into the pocket in registration therewith. From this particular pocket the steam passes by way of one of the pipes 35 to the particular blower tube to be supplied with steam, from which steam is discharged by way of the nozzles 11 into soot removing engagement with the water tubes 5. The construction described automatically operates to successively and progressively supply the various blower tubes with steam under pressure in their proper turn.

As shown in Figure 3, the blower tubes are mounted for rotation by providing their closed inner ends with clamps 45, which are arranged to engage with one of the side tubes of the bank of tubes 5. These clamps are provided with openings in which the closed ends of the blower tubes are permitted to freely rotate, also, the clamps 45 are preferably of the split variety in order that the same may be conveniently connected with anyone of the tubes 5. To rotatably support the other ends of the tubes 10, the setting 1 is provided with a plurality of bearing sleeves 46, through which the open ends of the tubes 10 rotatably project. The outer or open ends of the tubes 10 are threaded as at 47, to receive the internally threaded bores of sheave wheels 48, which by being threaded to the tubes 10 will operate to cause the rotation or oscillation of the latter. To prevent undue longitudinal movement on the part of the blower tubes, the sleeves 46 are provided with fingers 49, which are adapted to be received within grooves 50 provided in the inner faces of the wheels 48. By this construction it will be manifest that undue outward movement on the part of the blower tubes will be prevented, but when the fingers 49 are removed from engagement with the grooves 50, it will be apparent that the blower tubes may be moved longitudinally and outwardly of the boiler setting in order that repairs or adjustments may be conveniently made without requiring the operator to enter the interior of the boiler. To connect the pipes 35 with the tubes 10, the wheels 48 are provided with enlarged bores 51, which are adapted to

receive the annularly shouldered ends 52 of the pipes 35, and behind these ends 52 packings 53 are positioned, which are normally forced into engagement with the ends 52 by means of threaded nuts 54. By this construction it will be apparent that a substantial fluid tight connection will be provided between the rotatable tubes 10 and the stationary distributing pipes 35.

Heretofore, it has been the common practice in the art to rotate the blower pipes manually, and it has been ordinarily accomplished by providing the lower end of the tubes with sprockets from which manually operated chains depend to permit of the manual rotation of the blower tubes. The present invention aims particularly to improve this construction by providing means for automatically oscillating the blower tubes so that steam ejected from the nozzles thereof will be properly directed into engagement with the bank of water tubes. Therefore, the present invention employs in one of its forms an electrically driven motor 55, from the armature shaft of which extends a driven belt 56, the latter being disposed to pass over the wheel 57 mounted upon a horizontally journaled shaft 58. This shaft 58 is provided with a worm 59, which meshes with a similar worm 60 carried upon a shaft 61 journaled at right angles to the shaft 58. This shaft 61 is, in turn, provided with a worm 62, which meshes with a gear 63 fixed to a shaft 64. By means of this gear the speed of the motor 55 will be reduced so that the shaft 64 will rotate at the required low and proper speeds. The ends of the shaft 64 are provided with oppositely extending crank arms 65, with which are connected the ends 66 of a cable 67. This cable is trained around the various sheave wheels 48 of the blower tubes, and is suitably connected with said wheels, whereby upon the rotation of the shaft 64, the said cable 67 will be suitably pulled or moved so as to properly rotate the tubes 10, and to thereby position the latter in such manner that the nozzles 11 thereof will occupy various positions with respect to the tubes 5 when steam is admitted therein. In other words, steam will be permitted to issue from the nozzles 11 in such manner that the same will contact at different longitudinal positions with respect to the tubes 5, and by this construction no portion of the tubes will be overlooked in distributing superheated steam longitudinally of the same. By the crank construction 65, it will be manifest that an oscillatory motion will be imparted to the blower tubes, which motion is best calculated to produce the required efficient steam distribution. It will be observed that the crank arms 65 are provided with various openings, permitting the ends 66 of the cable 67 to be secured at various positions with respect to the shaft 64. By this adjustment the throw of the crank arms will be varied permitting more or less rotative movement to be imparted to the blower tubes.

In Figure 7 of the drawings, another form of the invention has been disclosed, in which the motor 55 has been eliminated, and the rotation of the blower tubes effected by the mechanism for operating the distributing valve. As shown, in this figure, the stem 26 is pivotally connected at its upper end with a link 68, which is pivoted as at 69 upon any suitable permanent support. The link 68 is intermediately connected with a second link 70, which extends downwardly and is secured to the free end of a ratchet arm 71. This arm is loosely pivoted about a shaft 72, and carries a dog 73, which is adapted to engage with a ratchet wheel 74 fixed to the shaft 72. Manifestly, whenever the stem 26 rises by reason of the passage of steam through the cylinder 23, motion will be imparted to the link 68, causing the arm 71 to be oscillated. This oscillation on the part of the arm 71 results in the rotation of the shaft 72 by the medium of the dog and ratchet wheel construction 73 and 74. This motion on the part of the stem 26 is therefore taken advantage of to effect the rotation of the blower tubes. For rotating the blower tubes, the shaft 72 is provided with a pinion 75, which meshes with a gear 76 mounted upon a shaft 77. This shaft is equipped with a ratchet 78 with which is engaged a dog 79, the latter being pivotally carried by a crank arm 80. Manifestly, upon the rotation of the shaft 77 through the ratchet construction previously described, motion will be imparted to the crank arm 80 in unison with the shaft 77. This crank arm is connected with the lower end of the cable 81, which is trained around and is secured to the sheave wheels 48, the opposite end of said cable having connection with a weight 82. By this construction, the sheave wheels and consequently the blower tubes will be successively rotated by the operation of the stem 26, thus eliminating the motor 55 and associated mechanism, rendering the operation of the device automatic, economical and independent of manual regulation. Also, in this construction, another advantage is presented, that is, when the blower tubes have been revolved to their limit in a given direction, the same do not return in progressive steam delivering stages to their initial positions, as is the case in the preferred form. In other words, steam discharged from the nozzles of the blower tubes do not successively strike places on the tubes 5 which have been immediately treated by previous operations. In the modifications disclosed, the blower tubes after the same have completed their rotation in a

given direction will return to an initial position automatically without delivering steam, and in this manner the adjacent lengths of the tubes 5 may be properly treated in turn by moving the blower tubes regulated distances. In the preferred form of the invention, or the form described in Figures 1 to 6 inclusive, the blower tubes are oscillated in successive steps so as to deliver steam into engagement with the tubes 5, however, when the blower tubes reach their limit of movement in a given direction, which movement is regulated by the throw of the crank arm 65, the said blower tubes then start to return to their initial position, but while returning discharge steam at successive intervals upon the tubes 5. Thus, places upon the tubes 5 which have just been treated with the steam flow will again be treated to a second immediate following ejection of steam, while the positions treated by the discharge of the nozzles from the initial position of the blowers will be obliged to wait for treatment until the blowers return finally to their initial position. In other words, the positions treated during the intermediate portions of the cycle of movement of the blower tubes are at closer intervals than those treated at the ends of the cycle of movement of the blower tubes, a condition which is ununiform and does not provide regularity of treatment for all portions of the boiler tubes. In the construction disclosed in Figure 7, this irregularity is not present, since all portions of the tubes 5 are treated at regular and uniform intervals, by the construction afforded by the use of the weight 82 in returning the blower tubes to their initial position of operation, without emitting steam, after the same have reached their limit of rotation in a given direction. It will be observed that the cable 81 will be pulled downwardly until the arm 80 passes the vertical center of the gear 76, which permits the weight 82 to respond so as to quickly turn the arm 80 and the blower tubes until the said arm 80 reaches its upper position, the release or slip between the arm 80 and the shaft 77 being afforded by the use of the dog and ratchet construction 79 and 78.

In Figure 8, an addition for the pop valve structure is provided for rendering said structure positive and reliable in operation. It may occur in the operation of a pop valve of this nature that after use the same will have a tendency to leak, whereby when the pressure within the superheater reaches a predetermined poundage, the valve will simply elevate a slight distance without fully opening and in this manner preventing the operation of the apparatus. However, as shown in Figure 8, this condition will be obviated by providing the stem 19 of the valve structure with the usual operating lever 21, which is so positioned as to provide a forked end which receives a vertically extending rod 83. Slidably mounted upon this rod 83 is a weight 84, which is pivotally connected with an arm 85. This arm extends upwardly and is disposed for engagement with pins 86 provided upon a wheel 87, the latter being preferably mounted upon the distributor shaft 37'. By this construction the wheel 87 will be caused to revolve slowly, and the same will elevate the weight 84 by reason of the arm 85. After the weight has been elevated a certain distance, the arm 85 will engage with a stop 88 of a permanent nature, this stop operates to release the forward end of the arm 85 from engagement with any one of the pins of the wheel 87, thereby permitting the weight 84 to drop sharply, and to strike the lever 21'. This results in elevating sharply the valve disc 17 of the pop valve structure, and permits the steam from the superheater to engage the under portion of the disc 17 so as to maintain the latter elevated during the flow of the steam through the pop valve. This construction therefore renders the operation of the pop valve reliable and efficient and prevents steam seepage from interfering with the operation of the valve. Any suitable means may be provided for rotating the shaft 37', such for example as the motor 55. Also, by this construction, the distributor may be operated from the shaft 37'.

What is claimed is:

1. In a flue cleaning apparatus for boilers, a plurality of blower units mounted for rotation in connection with the setting of a boiler, said units being capable of receiving steam under pressure and to direct such steam into engagement with the exterior surfaces of said water tubes, a source of steam supply, pipe connections governed by steam controlled valve means leading from said steam supply and in communication with said blower units to supply the latter successively at regulated intervals with steam under pressure, sheave wheels connected with said blower units, and a cable construction cooperative with said wheels for effecting simultaneously the rotation of said blower units.

2. In a flue cleaning apparatus for boilers, a plurality of blower units, a source of steam supply, pipe connections between said source of steam supply and said blower units, an automatically operating valve structure located within said pipe connections and operative upon predetermined steam pressure to permit of the flow of steam to said blower units, and a distributing valve structure situated within said pipe connections and automatically operative to direct the flow of said steam to said blower units in a successive manner.

3. In a flue cleaning apparatus for boilers, a plurality of blower units, a source of steam supply, pipe connections between said source of steam supply and said blower units, an automatically operating valve structure located within said pipe connections and operative upon predetermined steam pressure to permit of the passage of steam therethrough, and a distributing valve situated within said pipe connections and automatically operative to successively direct steam to each of said blower units.

4. In a flue cleaning apparatus for boilers, a plurality of blower units capable of discharging steam under pressure into cleaning engagement with the exterior surfaces of the water tubes of said boiler, a source of steam supply, connections between said source of steam supply and said blower units for transmitting steam to the latter, a valve automatically operative upon predetermined steam pressure within said connections to permit of the passage of the steam therethrough, a distributing valve cooperative with said connections for directing said steam successively to each of said blower units subsequent to the operation of said first named valve, and means operative upon the opening of said first named valve to effect the operation of said distributing valve.

5. In a flue cleaning apparatus for boilers, a plurality of blower units, a source of steam supply, connections between said source of steam supply and said blower units, an automatically operative valve for controlling the flow of steam through said connections, said valve being responsive to predetermined steam pressure to permit of the passage of steam therethrough, a distributing valve situated within said connections and operative subsequent to the opening of said first named valve to permit of the flow of said steam to a predetermined blower unit, and mechanism situated between said first named valve and said distributing valve for automatically effecting the operation of the latter.

6. In a flue cleaning apparatus for boilers, a plurality of blower units, a source of steam supply including a superheater arranged to be positioned within said boiler, a controlling valve, a connection between said superheater and said controlling valve, said valve being responsive to steam pressure within said connection to permit of the passage of steam therethrough when the latter reaches a predetermined poundage, a distributing valve, a connection between said controlling valve and said distributing valve, means situated within said latter connection and operative upon the passage of steam therethrough to effect the operation of said distributing valve, and a plurality of pipes leading from said distributing valve and in communication with said blower units, said distributing valve serving to direct the steam successively and separately to each of said blower units.

7. In a flue cleaning apparatus for boilers, a plurality of blower units, the steam drums, a pipe connection leading from one of the steam drums of said boiler, a controlling valve in communication with said connection, said valve being automatically operative on predetermined steam pressure within said connection to permit of the passage of steam therethrough, a distributing valve, a connection between said controlling valve and said distributing valve, said latter connection including a cylinder having a piston slidably mounted therein, a stem arising from said piston, spring and ratchet mechanism cooperative with said stem for effecting the operation of said distributing valve upon the passage of steam between the connections between said distributing and controlling valves, pipes extending from said distributing valve to said blower units, said distributing valve comprising means operative by the spring and ratchet mechanism for governing the passage of steam in a progressive manner through each of said pipes.

8. In a flue cleaning apparatus for boilers, a drum, a relatively small pipe connection extending from said drum, a superheater located within said boiler and in communication with said pipe connection, a pipe leading from the discharge end of said superheater, a controlling valve located within said pipe and automatically responsive to fluid pressure to permit of the passage of fluid therethrough, a distributing valve capable of receiving said fluid after the passage of the latter through said controlling valve, blower units, pipes extending from said distributing valve to said blower units, and means operative by the opening of said controlling valve for actuating said distributing valve to permit of the progressive flow of steam to each of said blower units.

9. In a flue cleaning apparatus for boilers, a plurality of blower units rotatably mounted in connection with the setting of a boiler, a source of steam supply, a pipe connection between said source of steam supply and said blower units, a controlling valve situated within said pipe connection and automatically responsive to steam pressure to control the passage of steam therethrough and means actuated by said valve to permit the passage of steam to said blower units in a successive manner, and means operative upon the passage of steam through said controlling valve to effect the partial rotation of said blower units.

10. In a flue cleaning apparatus for boilers, a plurality of blower units rotatably journaled in connection with the setting of a boiler, a source of steam supply, pipe

connections between said source of steam supply and said blower units, a controlling valve for governing the flow of steam from said source of steam supply to said blower units, and means operative upon the passage of fluid through said controlling valve to automatically and simultaneously effect an adjustment in position of said blower units.

11. In a flue cleaning apparatus for boilers, a plurality of rotatably mounted blower units, a source of steam supply, steam controlled pipe connections between said source of steam supply and said blower units, means for automatically rotating said blower units a predetermined distance, and other means cooperative with said blower units to return the latter to their initial positions after the same have been rotated a predetermined distance by said first named means.

In testimony whereof I affix my signature.

JOHN T. LEMON.