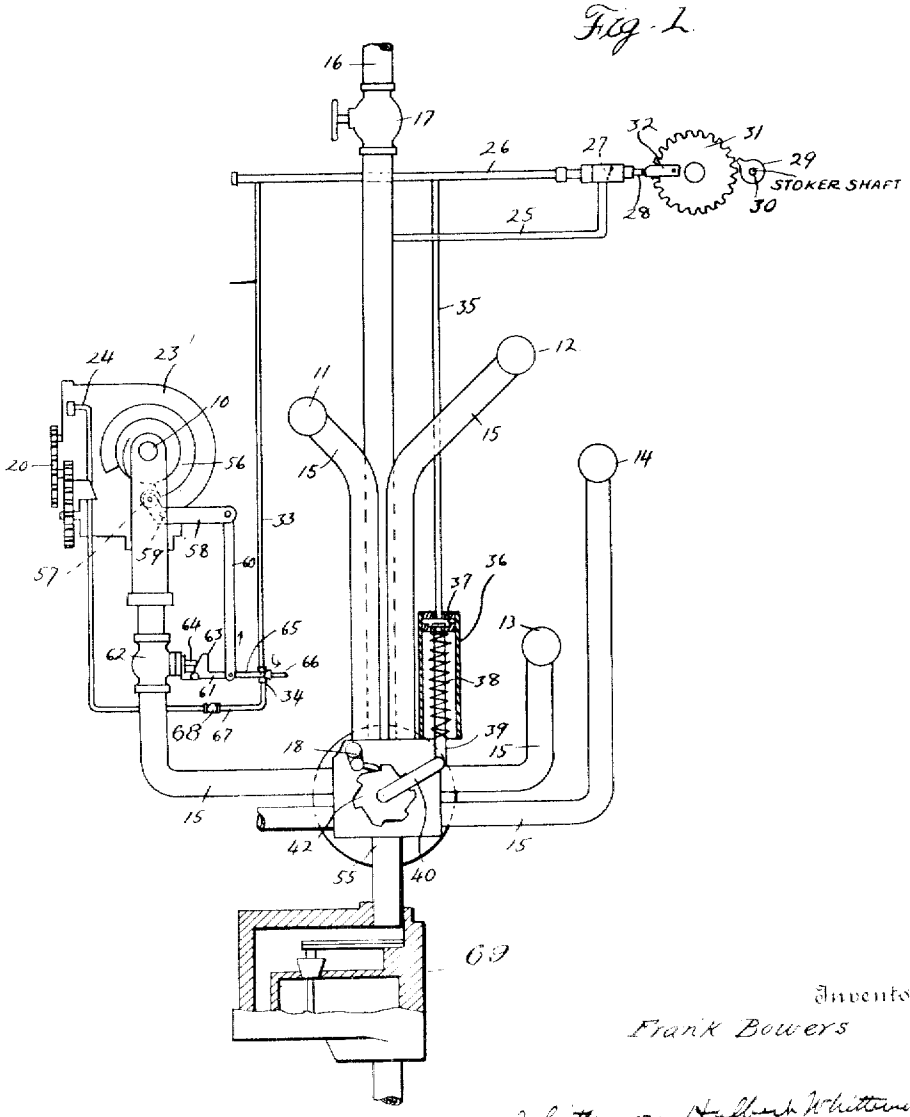
March 1, 1932. F. BOWERS 1,847,468

BOILER CLEANER

Original Filed June 10, 1918 4 Sheets-Sheet 1

Fig. 1.




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March 1, 1932. F. BOWERS 1,847,468

BOILER CLEANER

Original Filed June 10, 1918 4 Sheets-Sheet 2

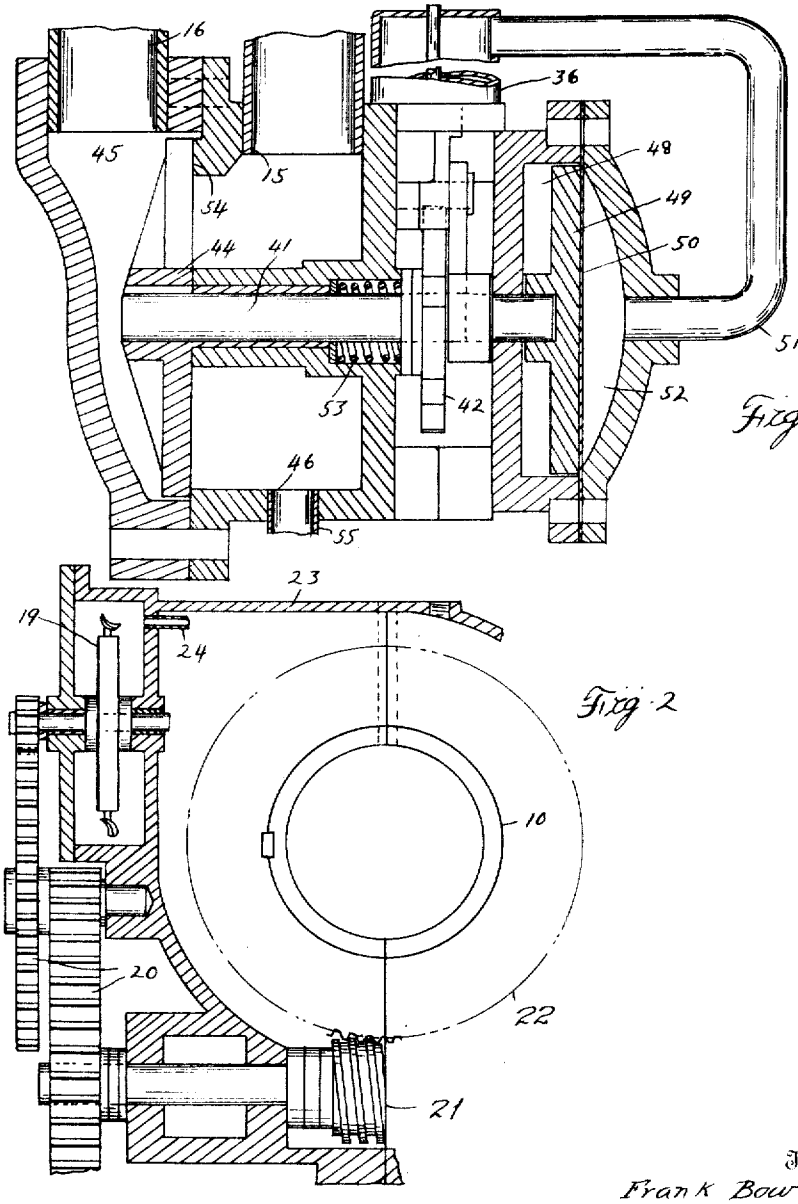



Fig. 5.

Fig. 2

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March 1, 1932. F. BOWERS 1,847,468

BOILER CLEANER

Original Filed June 10, 1918 4 Sheets-Sheet 3

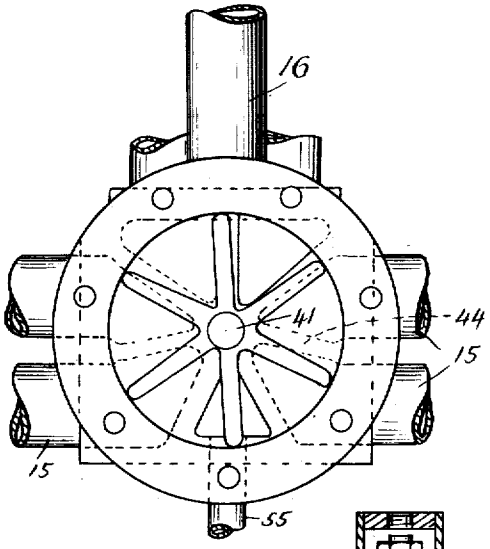



Fig. 3.

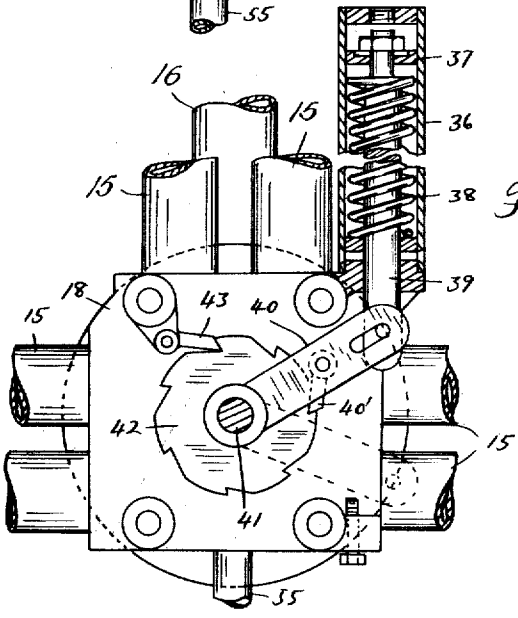
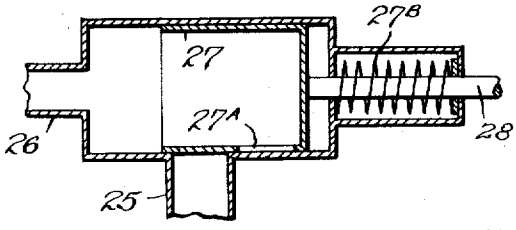



Fig. 4.

Fig. 6.




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March 1, 1932. F. BOWERS 1,847,468

BOILER CLEANER

Original Filed June 10, 1918 4 Sheets-Sheet 4

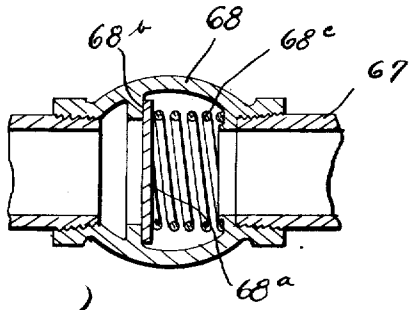



Fig. 8.

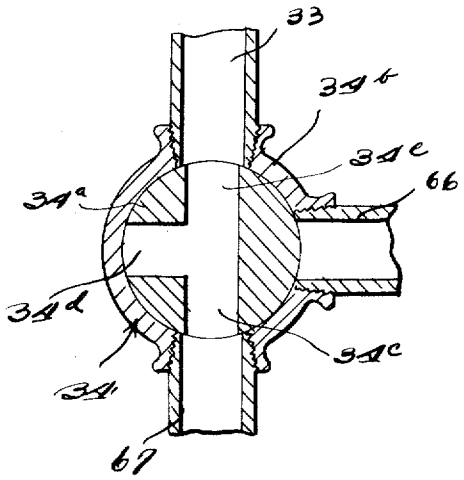
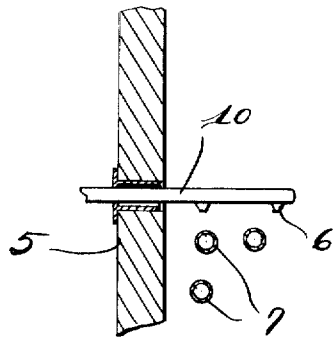



Fig. 7.



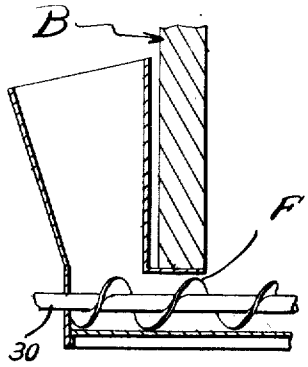




Fig. 9.

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# UNITED STATES PATENT OFFICE

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## BOILER CLEANER

Original application filed June 10, 1918, Serial No. 239,140. Divided and this application filed August 28, 1924. Serial No. 734,732. Renewed March 9, 1931.

The invention relates to boiler cleaners and has among its objects to provide a boiler cleaner actuated by a stoker or other fuel feeding mechanism. A further object of the invention is to provide a boiler cleaner and operating mechanism therefor having a novel control.

This application is a division of my application Serial No. 239,140 filed June 10, 1918.

Referring to the drawings:

Figure 1 is a diagrammatic view showing one embodiment of my invention;

Figure 2 is a sectional view showing the steam turbine and mounting;

Figure 3 is an elevational view of a valve for successively admitting steam to the blower units;

Figure 4 is a detail view of a mechanism for actuating the valve showing in section a steam plunger for actuating said mechanism, and;

Figure 5 is a sectional view showing the aforesaid valve provided with a friction reducing attachment.

Figure 6 is a detail sectional view showing the valve actuated by the fuel feeding mechanism.

Figure 7 is a view similar to Figure 6 showing one of the valves actuated upon rotation of each blower element.

Figure 8 is a detail sectional view showing one of the check valves forming a part of the construction, and

Figure 9 is a diagrammatic view of a boiler showing a blower element and fuel feeding mechanism associated with the same.

Referring to the drawings and particularly to Figure 9 thereof, the reference character B designates a boiler which may be of any desired character and which is shown as being provided with a fuel feeding mechanism F adapted to be driven by the shaft 30. The fuel feeding mechanism may be of any desired character the showing in Figure 9, being merely diagrammatic, and may be adapted to feed either solid or powdered fuel to the boiler either from the top or the bottom of the same. In any event the fuel feeding mechanism F is designed to feed fuel to the boiler in dependence upon the steam demand in accordance with the usual method or operating stokers.

In Figure 1 of the drawings reference characters 10, 11, 12, 13 and 14 designate blower units which project through the wall 5 of the boiler, these units being preferably of the type comprising rotatable steam pipes having discharge nozzles 6 for discharging cleaning fluid adjacent the parts of the boiler to be cleaned, such as the tubes 7. Each of these units is provided with a supply pipe 15 for supplying cleaning fluid such as steam, air, etc., preferably steam from a main steam line 16 controlled by a valve 17. An automatically controlled valve 18 is employed for successively connecting each of the branch pipes 15 to the main steam line. In the construction shown in Figure 1 each of the units 10, 11, etc., is provided with a driving mechanism which is shown only in association with the unit 10, being merely indicated diagrammatically in connection with the other units. This mechanism comprises a steam turbine 19 which, through gears 20, a worm 21, and worm wheel 22 (see Figure 2) is connected to drive the corresponding unit. The turbine casing is rigid with the head 23 of the blower unit and also serves to carry the gearing. Steam to each of the turbines is admitted through the respective inlet pipes 24 which at one end open into the corresponding branch supply pipes 15. By this arrangement the supply of steam to all of the turbines is governed by the automatically controlled valve 18, the latter being controlled by a steam plunger and stoker mechanism in a manner hereinafter described.

Leading from the main steam line 16 is a branch 25 which is connected to the lateral header 26 through a valve 27 which as shown in Figure 6, may be in the nature of a hollow plunger ported at $27^a$. The plunger is normally maintained in such position by spring $27^b$, that the port $27^a$ is out of register with branch 25, thus serving to prevent passage of the steam from the branch to the header 26. The valve 27 is actuated into open position by a plunger or stem 28, the port $27^a$ then registering with the branch 25. The stem is actuated to automatically operate the blower sys-

tem as will be presently apparent by a connection to some suitable member which is movable in the normal operation of the boiler. Preferably it is operated as shown in Figure 1 by a connection to the shaft of the stoker or other fuel feeding apparatus which supplies fuel to the boiler furnace B. In detail the construction comprises a one tooth gear 29 mounted on the shaft 30 which may, as illustrated, be the shaft of the fuel feeding mechanism, although it will be readily apparent that the gear 29 may be actuated by any other actuated part of the fuel feeding mechanism if desired, this gear meshing once each revolution with a large gear 31 carrying one or more cams 32 which once each revolution acts on the stem 28 of the control valve 27 to admit steam from steam line 16 and branch 25 to the header 26. The header 26 also is connected with the branch 15 through pipe 33 having a three way valve 34. Valve 34 includes a plug $34^a$, which as shown in Figure 7 of the drawings is rotatable in a casing $34^b$. This plug has the passages $34^c$, $34^d$ and $34^e$ adapted to control communication between pipe 33, branch 15 and an exhaust outlet, in a manner hereinafter to be more fully described. Pipe 67 connects one opening of the three-way valve 34 with the unit branch supply line 15. This conduit is provided with a check valve 68 of the character shown in Figure 8 of the drawings, this check valve including a valve member $68^a$ normally held on its seat $68^b$ by a spring $68^c$. The arrangement is such that cleaning fluid may pass from the header 15 to the three-way valve 34 but may not pass beyond the valve 68 in the reverse direction. Header 26 has a further pipe connection 35 which communicates with a cylinder 36. When the stoker mechanism opens the valve 27 steam is admitted into header 26 and pipe 35 above the piston 37 which operates in cylinder 36, preferably against the tension of the spring 38. The plunger 39 of piston 37 is connected at its lower end to an arm 40 which is pivoted at 41 and arranged to operate the multiple way valve 18. A suitable pawl 40′ and ratchet 42 and locking dog 43 serve to make the valve operate in one direction only. The detailed construction and operation of the valve and ratchet mechanism is shown in Figures 3, 4 and 5.

The valve 18 comprises a plate member 44 which controls the communication between the inlet 45 from the main header and the various branch supply pipes 15 leading to the units 10, 11, 12, etc., respectively. In addition to the main supply pipe connection and the five branch supplies there is a port 46 leading to the drain pipe 55. This cover plate or rotary valve 44 is connected to turn with the ratchet wheel 42 and is thus operated through the arm 40 and piston 37 as previously described.

When the steam pressure is high there is danger of the plate or valve member 44 being placed under such friction as to make its operation by the steam plunger difficult. To overcome this objection I have provided a novel arrangement shown as applied to the valve 18 in the modification thereof shown only in Figure 5 whereby the stem 41 of the plate is projected into a chamber 48. The end of this valve stem abuts against a plate 49 which is connected to a suitable diaphragm 50. This diaphragm extends across the chamber 48 dividing it into two parts. The part opposite stem 41 is provided with a steam connection 51 which leads to the upper end of the chamber 36. By this arrangement whenever steam is admitted above piston 37 it will simultaneously be admitted through the pipe 51 to the space 52 on the right hand side of the diaphragm, as shown in Figure 5. This will tend to force the diaphragm 50 and the plate 49 toward the left and exert a sufficient pressure on the end of the stem 41 to counterbalance the pressure on the opposite side of the plate or valve member 44, thus preventing the binding of the valve irrespective of the amount of steam pressure employed in the system. Whenever the valve 34 is adjusted to release the pressure on the top side of the piston 37, it will thus release the pressure in the cylinder 36 and also release the pressure on the right hand side of the diaphragm 50 allowing the spring 53 to return the stem 41 toward the right and thus hold the plate or valve member 44 in sufficiently tight contact with the wall 54 to avoid leakage. The valve 18 is so constructed that after having made the connection successively to each of the units it will connect header 16 with a drain 55, thus serving to drain the header 16 of condensate between the operating periods of the system.

This drain line 55 is provided with a thermostatic drain valve 69, as described in detail in my copending application Serial 239,140. This drain valve, as is usual for valves of this type, is provided with a thermostatic element which, in contact with the relatively cooler condensate, moves to open the drain valve and free the drain line of condensate. When the condensate has been blown down, and live steam begins to pass through the valve, the thermostatic element is moved to close the drain valve.

Secured to rotate with each unit 10, 11, 12, etc., is a cam 56 which extends around only a portion of the periphery, and located in the path of this cam is a roller 57 carried by one end of a rock-arm 58 which is pivoted at 59. The other end of the rock arm 58 is connected by a rod 60 to a lever 61 which is pivoted to the casing of the valve 62, the valve being normally spring closed. When, however, the cam 56 strikes against the roller

57 it will rock the arm 58 raising the rod 60 and forcing the projection 63 of the lever 61 against the end of the valve stem 64. This will open the valve 62 and hold it in its open position so that steam passes to the unit 10 as long as the cam 56 is in engagement with the roller 57. As soon, however, as the unit has rotated to the position shown in Figure 1 the roller will be released by the cam and return to its normal position, permitting the valve 62 to be closed by its spring and thus automatically shut off the supply of steam from the branch 15 to the unit. A valve operating member 65 also receives its movement from the rod 60 to operate the three way valve 34 as will be presently apparent. An exhaust pipe 66 also communicates with one of the branches of the three way valve 34, the other two branches being the pipe 33 communicating with header 26 and a pipe 67 provided with check valve 68 as hereinbefore described, communicating with branch 15 of unit 10.

In operation the blower units 10, 11, 12, etc., are caused to function successively, the operation of the units being exactly similar, to that described for the first unit 10. Each blower unit is caused to operate through one rotative cycle each time the system is placed in operation. By connecting the control mechanism to the stoker shaft 30, the blowers are automatically operated in direct proportion to the number of operations of the stoker, the cleaning operations thus corresponding to some extent to the rate of combustion in the boiler. In place of the cam 32 acting on the stem 28, the gear 31 could carry contacts and thus exercise an electrical control similar to that disclosed in my copending application referred to above.

Describing a cycle of operation as applied to one of the units, it being understood that any number of units may be included in the system, whenever the stoker shaft 30 rotates the gear 31 to bring cam 32 into registration with the end of the plunger 28 of valve 27, it will move the plunger 28 to the left of the position shown in Figure 1 and permit steam to flow through the branch pipe 25 and to header 26. As the latter is in open communication with the top of cylinder 36 above the plunger 39 by means of the branch pipe 35, this will place pressure on the top of the plunger and move the latter downwardly in the cylinder so as to actuate the valve 18 through an arc sufficient to open the steam supply 16 to the branch pipe 15 for the first unit 10. In its non-operative condition, and before actuation of plunger 39, the valve 18 is so positioned as to place the steam supply line 16 in communication with the drain pipe 55 as hereinafter described. The movement of the valve 18 is accomplished through the arm 40, pawl 40′ acting on the ratchet 42 and shaft 41 which carries the valve member 44. Steam will then flow to the supply pipe 15, causing full line pressure to build up in this branch pipe. From the branch pipe, steam at full pressure is supplied to the turbine 19 of unit 10, causing the blower pipe to rotate by reason of the gearing 20 and through the action of the cam 56 acting on the roller 57 of rock arm 58, the rod 60 will be actuated to lift the lever 61 to open the valve 62 admitting steam from branch 15 to the blower unit 10. The upward movement of the rod 60 also raises the valve operating member 65 for actuating the three way valve 34 so as to connect the header 26 with the exhaust 66 through passages $34^d$ and $34^e$ and close communication between the header 26 and pipe 67 leading to branch pipe 15. This will relieve the pressure in the header 26 and thereby release the pressure on top of the plunger 39 and allow the latter to be returned by the spring 38 to its normal raised position ready to receive the next impulse. During this upward movement of the plunger the locking dog 43 serves to hold the ratchet 42 fixed, the pawl 40′ idling over the ratchet into position for the next downward movement of the plunger for rotating the valve 18 to connect the next blower unit with the main steam supply so as to cause the blower of the next unit to function.

As soon as the blower pipe of the unit 10 has been rotated to bring the low point of the cam 56 into registration with the roller 57 on the lever 58, the valve operating mechanism 60, 61, 65 will move back to its initial closed position, thus allowing the valve 62 to shut off the supply of steam to the unit 10. At the same time the mechanism 60, 61, 65 operates the three way valve 34 to shut off communication between the header 26 and the exhaust 66 and to re-open communication between the branch pipe 15 and the header 26 by passages $34^c$ and $34^e$. Steam from the branch pipe 15 then passes thru header 26 and branch pipe 35 thus restoring the pressure to the top of the plunger 39 and actuating the valve 18 so as to open communication between the main supply pipe 16 and the unit 11. This cycle of operation will then be carried out for each of the units 12, 13 and 14 or whatever number there may be in the installation.

After the operation of the last blower unit, the plunger 39 is actuated by virtue of the passage of cleaning fluid from the supply pipe 15 of the last unit, thru check valve 68, pipe 67, three way valve 34, pipe 33, header 26, and pipe 35, as hereinbefore described. The valve 18 is thus moved ahead one notch, placing the main fluid supply header 16 in communication with the drain pipe 55, which drain pipe is provided with the thermostatic drain valve as hereinbefore described. The entire system will now remain inoperative until plunger 28 of valve 27 is again actuated by cam 32. In the case of all of the blower

units, the line 67 is left in communication with the line 33 thru three way valve 34, the check valve 68 in each line preventing passage of fluid from header 26 to the respective branches 15.

From the foregoing description it will be apparent that one or more units are automatically operated and controlled, the particular system illustrated comprising five blower units automatically successively operated by a periodic movement of the fuel feeding mechanism of a boiler, preferably though not necessarily the boiler to which the blower units are attached.

What I claim as my invention is:—

1. In a boiler cleaner, the combination with a soot blower cleaner unit and a boiler fuel feeding mechanism, of a prime mover for actuating said cleaner unit, and means operated by said fuel feeding mechanism for introducing cleaning fluid to said prime mover and unit.

2. In a soot blower system, the combination with a plurality of soot blowers and a fuel feeding mechanism, of a control for successively introducing cleaning fluid to said units and means periodically actuated by the fuel feeding mechanism for operating said control.

3. In a boiler cleaner, a source of cleaning fluid, a fuel feeding mechanism, a rotatable soot blower, means for rotating said blower, means actuated by said mechanism for controlling the passage of cleaning fluid from said source to said rotating means for operating the same and a valve automatically operated when the rotating means is actuated, for admitting cleaning fluid to the soot blower.

4. In a boiler cleaner, a fuel feeding mechanism, a source of cleaning fluid, a rotatable soot blower, a prime mover for rotating said blower, means actuated by said mechanism for automatically and periodically admitting cleaning fluid from said source to the prime mover for operating the same, and a valve automatically actuated when the prime mover is caused to operate for admitting cleaning fluid to the soot blower.

5. In a boiler cleaner, a fuel feeder mechanism, a source of cleaning fluid, a plurality of rotatable soot blower units, a prime mover for rotating each of said units, a common control for directing cleaning fluid from said source successively toward said units, fuel feeder controlled mechanism for actuating said common control, and a valve for each unit automatically actuated by the corresponding prime mover for admitting cleaning fluid from said source to the blower unit.

6. In a boiler cleaner, a fuel feeding mechanism, a plurality of rotatable soot blower cleaner units, a source of cleaning fluid, a valve for each unit for admitting cleaning fluid thereto from said source, a cleaning fluid operated prime mover for each unit for rotating the unit and actuating the said corresponding valve to admit cleaning fluid to the unit, a multiple control valve for successively admitting cleaning fluid from said supply to said prime movers, and means actuated by said mechanism for actuating said multiple control valve.

7. In a boiler cleaning system comprising a plurality of blower units, means for delivering a cleaning fluid to said units; a distributor for controlling the delivery of said fluid to said units; means cooperating with the stoker of the boiler for operating said distributor; means controlled by said distributor for rotating each of said units, and means operable by said rotating means for permitting the discharge of said fluid from said units.

8. In a boiler system, the combination with a boiler cleaner unit including a movable cleaner element, of means for controlling the introduction of cleaning fluid to said unit, means responsive to the introduction of cleaning fluid to said unit for moving said element, and means actuated by a boiler fuel feeding mechanism adapted to actuate said control means.

9. In a boiler system, the combination with a boiler cleaner unit including a rotatable blower element, of means for controlling the admission of cleaning fluid to said unit, means responsive to the introduction of cleaning fluid to said unit for imparting rotation to said element, and means actuated by a boiler fuel feeding mechanism for actuating said control means.

10. In a boiler system, the combination with a boiler cleaner unit including a rotatable blower element, of means for controlling the admission of cleaning fluid to said unit, means responsive to the introduction of cleaning fluid to said unit for imparting rotation to said element, and means actuated by a boiler fuel feeding mechanism for periodically actuating said control means.

11. In a boiler system, the combination with a plurality of blower units each including a movable blower element, of means for controlling the introduction of cleaning fluid to said units, means responsive to the introduction of cleaning fluid to said units for rotating said elements, and means actuated by a boiler fuel feeding mechanism for actuating said control means.

12. In a boiler system, the combination with a plurality of blower units each including a movable blower element, of means for controlling the introduction of cleaning fluid to said units, means responsive to the introduction of cleaning fluid to said units for rotating said elements, and means actuated by a boiler fuel feeding mechanism for periodically actuating said control means.

13. In a boiler system, the combination

with a plurality of blower units, each including a movable blower element, of means for controlling the introduction of cleaning fluid to said units successively, means responsive to the introduction of cleaning fluid to said units for imparting movement to the blower elements when cleaning fluid is being delivered to said units, and means actuated by a boiler fuel feeding mechanism for actuating said control means.

14. In a boiler system, the combination with a plurality of blower units, each including a movable blower element, of means for controlling the introduction of cleaning fluid to said units successively, means responsive to the introduction of cleaning fluid to said units for imparting movement to the blower elements when cleaning fluid is being delivered to said units, and means actuated by a boiler fuel feeding mechanism for periodically actuating said control means.

15. In a boiler system, the combination with a fuel feeding mechanism, of a blower unit including a blower element, control means for supplying cleaning fluid to said unit, and means responsive to the movement of said mechanism for actuating said control means.

16. In a boiler system, the combination with a fuel feeding mechanism, of a blower unit including a blower element, control means for supplying cleaning fluid to said element, means responsive to the movement of said mechanism for actuating said control means, and means responsive to the control means for rotating said blower element.

17. In a boiler system, the combination with a fuel feeding mechanism, of a blower unit including a blower unit, control means for supplying cleaning fluid to said element, and means for periodically actuating the control means, said last named means being actuated by the boiler fuel feeding mechanism whereby the frequency of the said periods of actuation of the control means are dependent upon the amount of movement of said mechanism.

18. The method of operating a boiler which consists in feeding fuel to the boiler, and discharging cleaning fluid adjacent a portion of the said boiler in periods dependent upon the rate of fuel feed.

19. The method of cleaning a boiler having a fuel feeding mechanism which consists in discharging a cleaning fluid adjacent a portion of said boiler at intervals dependent upon the operation of said fuel feeding mechanism.

20. The method of cleaning a boiler having a fuel feeding mechanism which consists in successively discharging cleaning fluid from a plurality of spaced points adjacent portions of said boiler at intervals dependent upon the operation of said fuel feeding mechanism.

21. The combination with a boiler system having a part movable during the operation thereof, of a boiler cleaner unit for cleaning parts of the boiler, and means actuated by the said moving part for automatically controlling the operation of the said boiler cleaner unit.

22. The combination with a boiler and a fuel feeding mechanism for the same, of a boiler cleaner unit for cleaning parts of the boiler, and means actuated by said fuel feeding mechanism for controlling the operation of said boiler cleaner unit.

23. The combination with a boiler and a fuel feeding mechanism for the same, of a boiler cleaner unit for cleaning parts of the boiler, and means operable in dependence upon the actuation of said fuel feeding mechanism for effecting an actuation of said boiler cleaner unit.

24. The combination with a boiler and a fuel feeding mechanism for the same, of a plurality of boiler cleaner units for cleaning parts of the boiler, and means operable in dependence upon the actuation of said fuel feeding mechanism for effecting a successive actuation of said boiler cleaner units.

25. The method of cleaning a boiler having a fuel feeding mechanism which consists in effecting a removal of the deposits from those surfaces of the boiler exposed to the products of combustion periodically in dependence upon the operation of said fuel feeding mechanism.

26. The method of cleaning a boiler which consists in effecting a removal of the deposits from those surfaces of the boiler exposed to the products of combustion periodically in dependence upon the amount of fuel fed to the boiler.

27. The combination with a boiler, of a cleaner unit for cleaning parts of the boiler, and means operable in dependence upon the quantity of fuel fed to the boiler for controlling the operation of said cleaner unit.

28. The combination with a boiler system having a part movable during the operation thereof, of a boiler cleaner unit for cleaning parts of the boiler, a valve for controlling the flow of cleaning fluid to the said unit, and means actuated by the moving part of the boiler system for causing cleaning fluid to move said valve to admit cleaning fluid to said boiler cleaner.

29. The combination with a boiler system having a part movable during the operation thereof, of a boiler cleaner unit for cleaning parts of the boiler, a valve for controlling the flow of cleaning fluid to said boiler cleaner unit, means actuated by the said moving part for causing cleaning fluid to actuate said valve to move the same to open or closed position, and means for causing the cleaning fluid to act on said valve to relieve the fric-

tional resistance tending to retard actuation of the valve.

30. The combination with a boiler system having a part movable during the operation thereof, of a boiler cleaner unit for cleaning parts of the boiler, means including a valve proper and a valve seat for controlling the flow of cleaning fluid to the boiler cleaner unit, means actuated by the said moving part for effecting movement of said valve proper relative to its seat to control the flow of cleaning fluid to the said boiler cleaner unit, and means operable upon the actuation of said last mentioned means for moving the said valve relative to its seat for relieving the frictional resistance tending to prevent movement of the valve to open and closed positions.

31. The combination with a boiler system having a part movable during the operation thereof, of a boiler cleaner unit for cleaning parts of the boiler, means including a valve seat and a valve member for controlling the flow of cleaning fluid to said boiler cleaner unit, said valve member being rotatable relative to said seat and also movable toward and away from said seat, means actuated by the said moving part for causing the cleaning fluid to effect a rotation of said valve member relative to its seat to control the flow of cleaning fluid to the boiler cleaner unit, and means operable upon the actuation of said last mentioned means for moving said valve member away from its seat to relieve the frictional resistance tending to retard rotation of the valve member.

In testimony whereof I affix my signature.

FRANK BOWERS.

tional resistance tending to retard actuation of the valve.

30. The combination with a boiler system having a part movable during the operation thereof, of a boiler cleaner unit for cleaning parts of the boiler, means including a valve proper and a valve seat for controlling the flow of cleaning fluid to the boiler cleaner unit, means actuated by the said moving part for effecting movement of said valve proper relative to its seat to control the flow of cleaning fluid to the said boiler cleaner unit, and means operable upon the actuation of said last mentioned means for moving the said valve relative to its seat for relieving the frictional resistance tending to prevent movement of the valve to open and closed positions.

31. The combination with a boiler system having a part movable during the operation thereof, of a boiler cleaner unit for cleaning parts of the boiler, means including a valve seat and a valve member for controlling the flow of cleaning fluid to said boiler cleaner unit, said valve member being rotatable relative to said seat and also movable toward and away from said seat, means actuated by the said moving part for causing the cleaning fluid to effect a rotation of said valve member relative to its seat to control the flow of cleaning fluid to the boiler cleaner unit, and means operable upon the actuation of said last mentioned means for moving said valve member away from its seat to relieve the frictional resistance tending to retard rotation of the valve member.

In testimony whereof I affix my signature.

FRANK BOWERS.

## CERTIFICATE OF CORRECTION.

**Patent No. 1,847,468.** **March 1, 1932.**

**FRANK BOWERS.**

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, line 39, claim 17, for "unit" second occurrence read element; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 12th day of July, A. D. 1932.

M. J. Moore,
Acting Commissioner of Patents.

(Seal)

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