

1,374,551.

Patented Apr. 12, 1921.

2 SHEETS—SHEET 1.

Fig 1

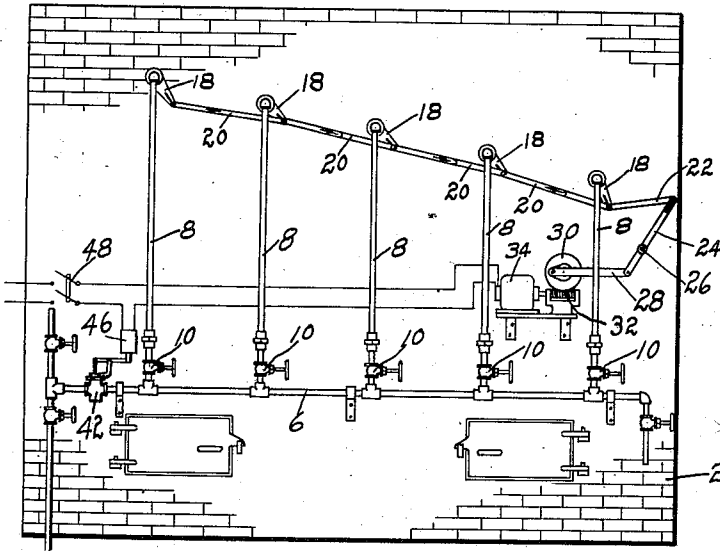
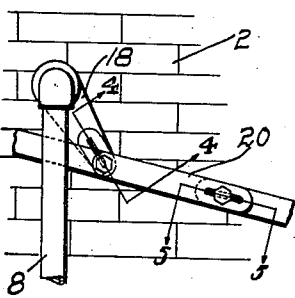


Fig 3

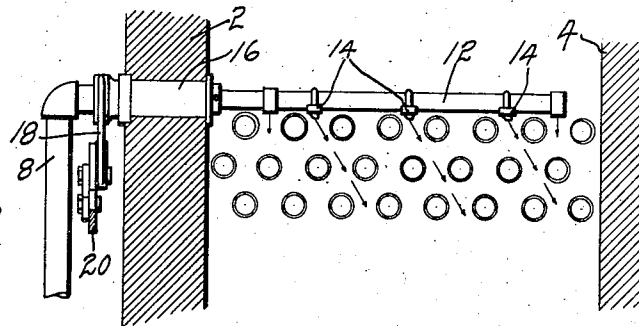


Fig 2

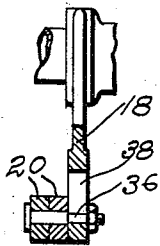


Fig 4

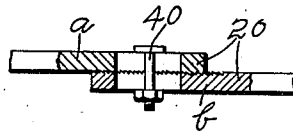


Fig 5

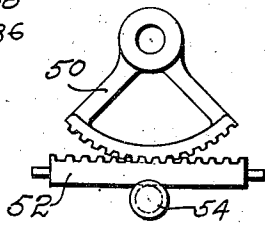


Fig 6

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SOOT CLEANING APPARATUS.
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2 SHEETS—SHEET 2.

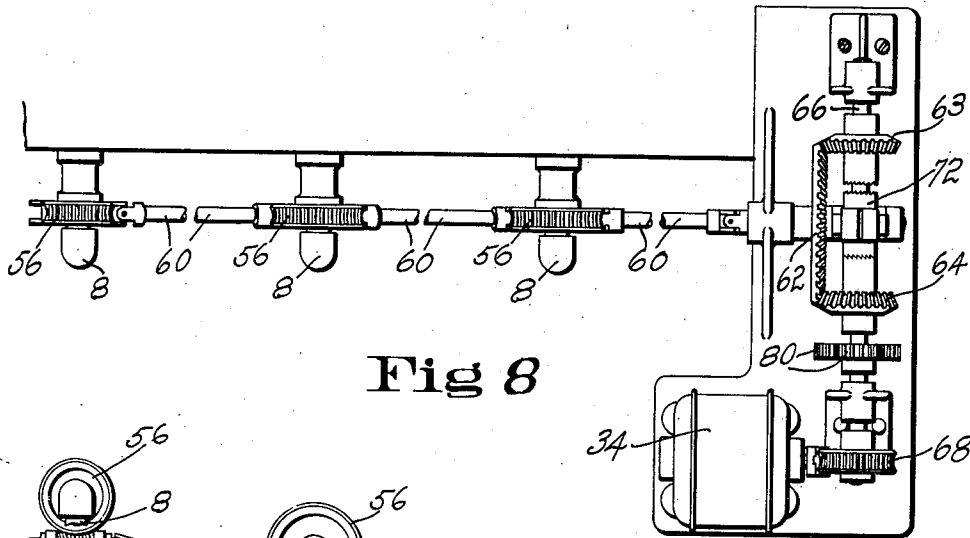


Fig 8

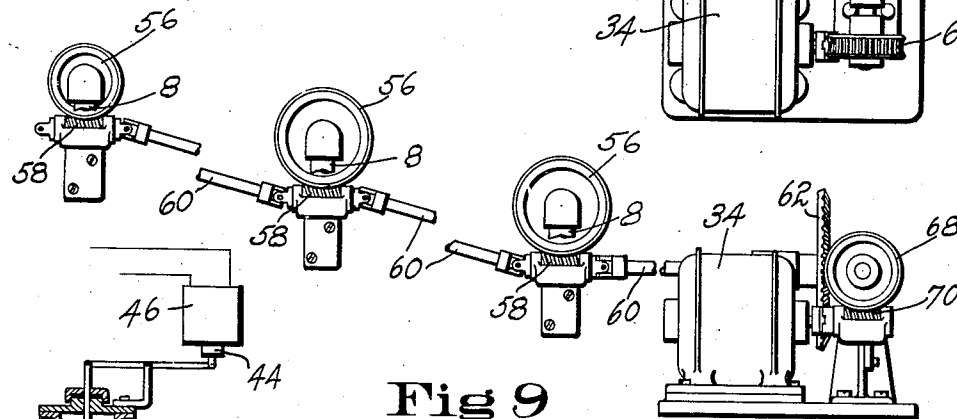


Fig 9

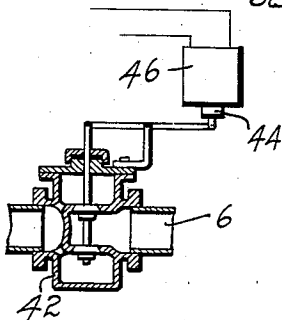


Fig 7

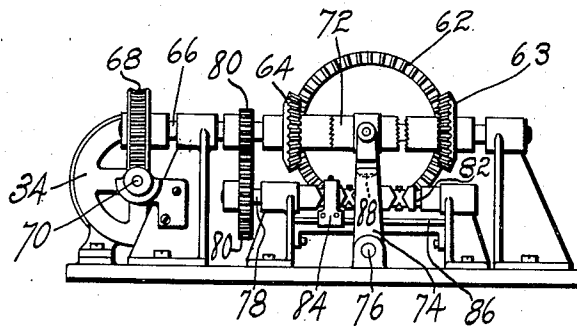


Fig 10

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UNITED STATES PATENT OFFICE.

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SOOT-CLEANING APPARATUS.

1,374,551.

Specification of Letters Patent.

Patented Apr. 12, 1921.

Application filed September 10, 1917. Serial No. 190,471.

To all whom it may concern:

Be it known that I, CHARLES W. E. CLARKE, a citizen of the United States, residing at Brookline, in the county of Norfolk and State of Massachusetts, have invented certain Improvements in Soot-Cleaning Apparatus, of which the following description, in connection with the accompanying drawings, is a specification, like reference characters on the drawings indicating like parts in the several figures.

This invention relates to boiler cleaning apparatus and is especially concerned with the apparatus of this character which utilizes a jet of high pressure fluid to effect the cleaning action. Inasmuch as the fluid usually employed for this purpose is steam, it will hereinafter be referred to as steam, although it is obvious that other high pressure fluids might be used, as for instance, compressed air. Apparatus of this type is commonly known in the trade as a "soot cleaner" and will be referred to hereinafter by that term.

A common construction of boiler cleaners of this type consists of a steam supply pipe extending into the boiler and provided with a series of nozzles designed to direct jets of steam against the surfaces of the tubes to be cleaned, the pipe being mounted for movement to enable the jets to play over a considerable region in the boiler. The movement of the pipe for the purpose of swinging the jets from one part of the boiler to another is produced by hand, and a serious difficulty encountered in the use of apparatus of this character is the fact that if a workman is ignorant of the manner in which the apparatus operates, or is careless or anxious to finish the job as quickly as possible, he will move the jets of steam back and forth so rapidly that the jets will not be directed on the different parts of the boiler which they are supposed to clean for a sufficient length of time to enable them to properly perform their cleaning function. In other words, it is necessary for a jet of steam to act on the surface to be cleaned for a certain length of time, as distinguished from sweeping it rapidly over the surface to be cleaned, and a failure to allow the jet to act for the required period, prevents it from properly cleaning the surface against which it is directed.

A further difficulty encountered in the

use of apparatus of this character is the fact that the long continued impact of a jet of steam under high pressure has an injurious effect on the surfaces against which it strikes and if the workman allows the jet of steam to run for too long a time without moving it, it may result in rupturing the boiler tubes.

The present invention has for its chief object to improve boiler cleaning apparatus of the type designated with a view to making it more efficient and more automatic in action and particularly to avoiding the difficulties heretofore experienced from the causes just described.

The manner in which it is proposed to accomplish this general object and the various features of this invention will be readily understood from the following description when read in connection with the accompanying drawings, in which,

Figure 1 is a side elevation showing a boiler equipped with a soot cleaning apparatus embodying this invention;

Fig. 2 is a vertical cross sectional view through a part of the boiler;

Fig. 3 is a side elevation showing, on a larger scale, a part of the apparatus shown in Fig. 1;

Fig. 4 is a cross sectional view on the line 4—4, Fig. 3;

Fig. 5 is a cross sectional view on the line 5—5, Fig. 3;

Fig. 6 is a side elevation showing a slightly modified construction which may be applied to the apparatus shown in Fig. 1;

Fig. 7 is a cross sectional view of a valve shown in Fig. 1;

Fig. 8 is a plan view showing another embodiment of the invention;

Fig. 9 is a side elevation of the mechanism shown in Fig. 8; and

Fig. 10 is a side elevation of the reversing mechanism which forms a part of the apparatus shown in Figs. 7 and 8.

Referring now to the drawings and particularly to Figs. 1 and 2, 2 and 4 indicate, respectively, walls of the boiler which in the construction shown is of the water tube type. A steam header 6 runs along the wall 2 and supplies a series of risers 8, the flow of steam from the header to the risers being controlled by suitable valves 10. Each of the risers 8 supplies steam to a horizontal pipe 12 which is positioned in the boiler, as shown in Fig. 2, and is provided with sev-

eral nozzles 14 each designed to direct a jet of steam against the boiler tubes to be cleaned. The construction shown is of the well known Vulcan type in which the nozzles are arranged to direct the steam diagonally, the nozzles of the adjacent pipes 12 being set at different angles so as to effectually clean all the surfaces of the tubes on which the soot accumulates. The pipe 12 is mounted in a sleeve 16 in the wall of the boiler and it is connected to the riser 8 in such a manner that it permits the pipe to rotate about its longitudinal axis to transfer the point of operation of the jets from one part of the boiler to another.

The construction so far described is substantially like that of the ordinary Vulcan installation in a water tube boiler. In such installations, however, each of the pipes 12 usually is equipped with a sprocket wheel over which a chain runs to a point within convenient reach of the workman, so that by operating the chain he can swing the jets back and forth over the desired range of action. Obviously, in an apparatus of this character the quality of the work done is entirely under the control of the workman and if he oscillates the pipe 12 too rapidly the result may be anything but that desired.

According to the arrangement shown, each of the pipes 12 has rigidly connected to it an arm 18 and these arms are all connected by links 20 to a link 22 which is pivoted to the upper end of a lever 24 fulcrumed at 26 and having its lower end pivoted to one end of a pitman 28, the other end of this pitman being pivoted eccentrically to a worm wheel 30 arranged to be operated by a worm 32 driven by a motor 34 of any convenient type.

It will now be understood that this arrangement transforms the rotary motion of the motor 34 into a relatively slow oscillating movement of the steam supply pipes 12, causing all of these pipes to oscillate simultaneously. Inasmuch as it is desirable to have the jets of certain of the pipes 12 play over a greater angular range of movement than those of the other pipes, the connection between each of the links 20 and its cooperating arm 18 is made adjustable and the links 20 are also made adjustable so that they can be lengthened or shortened. For this purpose the shouldered pivot bolt 36 which connects each arm 18 to the ends of the links 20 cooperating therewith is made adjustable in a slot 38 formed in each arm 18, as clearly shown in Fig. 4; and the links 20 are each made in two parts, indicated at *a* and *b*, Fig. 5, which are slotted and secured together by a bolt 40, the overlapping portions of the links preferably being toothed to prevent their slipping. It is preferable also to make the connection between the lever 24 and the

link 22 adjustable so that the length of stroke of the entire set of links 20 may be adjusted. It is obvious that this arrangement provides for a very wide range of difference in the angular movement of the several levers 18 and consequently of the pipes 12 which they operate.

The connections between the pipes 12 and the motor 34 are such that the rate of oscillation of the pipes is very slow even though a comparatively high speed motor is used and, since this speed is predetermined and can be made that at which the jets will perform their cleaning function most effectually, this arrangement entirely overcomes the difficulties above described which have been experienced heretofore. In using this apparatus the workman first starts the motor and then by operating the valves 10 turns the steam on to and shuts it off from the different pipes 12 in succession, the usual practice being to admit steam to one of the pipes 12 only one at a time. The speed at which the jets are played over the tubes in the boiler and the range of movement given to the jets is entirely beyond the control of the workman, the only thing required of him being to turn the steam on and off of the pipes 12.

For the purpose of preventing injury to the boiler tubes which might be caused by the workman leaving the steam turned on to one or more of the pipes 12 when the mechanism that oscillates the pipes is not in operation, a controlling mechanism is provided which prevents the admission of steam to the pipes 12 when the operating mechanism for the pipes is inactive. This result might be accomplished by a great variety of mechanisms. In the arrangement shown in Figs. 1 and 7 of the drawings, a master valve 42 controls the admission of steam to the header 6 that supplies steam to the risers 8. An electric motor is shown at 34 and the valve 42 is arranged to be electrically operated and is connected in the circuit that supplies the motor 34. As shown in Fig. 7, the valve 42 is of the balanced type and is normally maintained in a closed condition by the weight of the core 44 of a solenoid 46. This solenoid is in series with the motor 34, and a switch 48 controls the admission of electric power to both the motor and the solenoid. When this switch is closed the flow of current through the circuit starts the motor into operation and raises the core 44 of the solenoid 46, thus opening the valve 42 and admitting steam to the header 6. Thereafter the workman can admit steam to any of the pipes 12 that he desires by opening the corresponding valve 10. The motion imparted to the pipes by the power driven mechanism prevents the jets of steam issuing from the nozzles 14 from injuring the tubes against which the jets impinge. As soon as the switch 48 is opened to stop the motor 34

the solenoid 46 becomes deenergized and the weight of the core 44 automatically closes the valve 42, so that even if one or more of the valves 10 are left open, no harm can result since the supply of steam is cut off from all the pipes 12 as soon as the motor 34 stops.

It is sometimes desirable to swing certain of the pipes 12 through an angle greater than 180 degrees, and Fig. 6 shows a mechanism that could be substituted for the arms 18 of the arrangement shown in Fig. 1, in order to accomplish this object. In this modification each pipe 12, or as many of these pipes as it is desired to swing through an angle of 180 degrees or more, has fixed thereto a toothed sector 50. Each of these sectors meshes with a rack 52 mounted to slide over a roll 54, which holds it in engagement with the sector, all of these racks being connected by the links 20 of the construction shown in Fig. 1. It is obvious that this mechanism would permit the movement of the pipes 12 through any desired angle since, while the stroke of all the racks 52 is uniform, the radii of the sectors 50 may be made larger or smaller, as desired, thus decreasing or increasing the angle of movement of any sector produced by the reciprocating movement of its cooperating rack.

Another arrangement for oscillating the pipes 12 and swinging them through any desired angle is shown in Figs. 8, 9 and 10. In this construction each of the pipes 14 has a worm wheel 56 fast thereon, each wheel meshing with a worm 58 mounted to rotate in suitable bearings. These worms are connected by universal joints and sections of shafting 60 to a gear 62 which forms part of an automatic reversing mechanism that is driven by a motor 34. The arrangement is such that the worms 58 are given a certain number of revolutions in one direction and then an equal number of revolutions in the opposite direction. The driving mechanism between the motor 34 and the gear 62 comprises two bevel pinions 63 and 64, both loosely mounted on a shaft 66 which is driven by the motor 34 through a worm wheel 68 fast on said shaft and a worm 70 fast on the motor shaft. A clutch member 72, mounted between the bevel gears 63 and 64, is splined to the shaft 66 so that it rotates with said shaft but can slide longitudinally thereon into engagement with cooperating clutch members formed on the hubs of the two bevel gears 63 and 64. The position of the clutch member 72 is controlled by a lever 74 fulcrumed below the shaft 66 at 76. A shaft 78, mounted below the shaft 66 and driven from said shaft by gears 80, is provided with a spiral reversing cam path 82 which receives a follower carried by a slide 84 mounted to reciprocate on a guideway 86. This slide thus is moved

back and forth on the guideway 86 at a rate depending on the pitch of the cam path 82 and on the ratio of the gears 80. When the parts are in the positions in which they are shown in Fig. 10, the clutch 72 is in engagement with the bevel gear 64 and the slide 84 is being moved toward the right. The upper end of this slide is arranged to engage a spring member 88 carried by the lever 74 and to shift this lever toward the right, and thereafter, by compressing the spring 88, to move out of engagement with it. The shifting movement of the lever, however, moves the clutch 72 out of engagement with the gear 64 and into engagement with the gear 63, thus rendering the latter gear effective to rotate the gear 62 and thereby to drive the shafting 60 and the worms 58 in the opposite direction to that in which they were driven by the gear 64. The slide 84 then completes its movement toward the right and reverses, effecting a reverse shifting movement of the clutch 72 during its stroke toward the left. This operation is continued as long as the motor 34 continues to run. Obviously any other suitable reversing mechanism might be substituted for that shown. It is evident that this mechanism gives the pipes 12 an oscillating movement like that imparted to them by the mechanism shown in Figs. 1 to 6, but that the angular extent of the movement imparted to any one of the pipes may be made as great or small as desired by properly proportioning the worm wheel 56 and the worm 58 which drives it.

It will be evident to those skilled in this art that the invention herein disclosed may be embodied in many forms differing from the embodiments herein described and accordingly it will be understood that the invention is not limited to the specific forms shown.

What is claimed as new is:

1. A soot cleaning apparatus for boilers comprising, in combination, a plurality of steam supply pipes mounted in the boiler for movement about their longitudinal axes, each of said pipes being provided with one or more nozzles inside the boiler, a motor, and connections between said motor and said pipes to oscillate each pipe about its longitudinal axis, said connections including means to give some of said pipes greater angular movements than others.

2. A soot cleaning apparatus for boilers comprising, in combination, a steam supply pipe in the boiler provided with a nozzle for directing a jet of steam against the parts to be cleaned, an electric motor, connections between said motor and said pipe for enabling the motor to move the pipe to transfer the point of operation of the jet from one part of the boiler to another, and a com-

mon means for controlling the supply of current to said motor and the supply of steam to said pipe.

3. A soot cleaning apparatus for boilers
5 comprising, in combination, a steam supply pipe in the boiler provided with a nozzle for directing a jet of steam against the parts to be cleaned, a motor operated from a source of power independent of the steam
10 flowing through said pipe, connections between said motor and said pipe operative

to move the pipe about its axis to transfer the point of operation of said jet from one part of the boiler to another, and means for controlling both said motor and also the 15 supply of steam to said pipe constructed and arranged to prevent the admission of steam to the pipe except during the time that said motor is moving the pipe.

In testimony whereof I have signed my 20 name to this specification.

CHARLES W. E. CLARKE.