

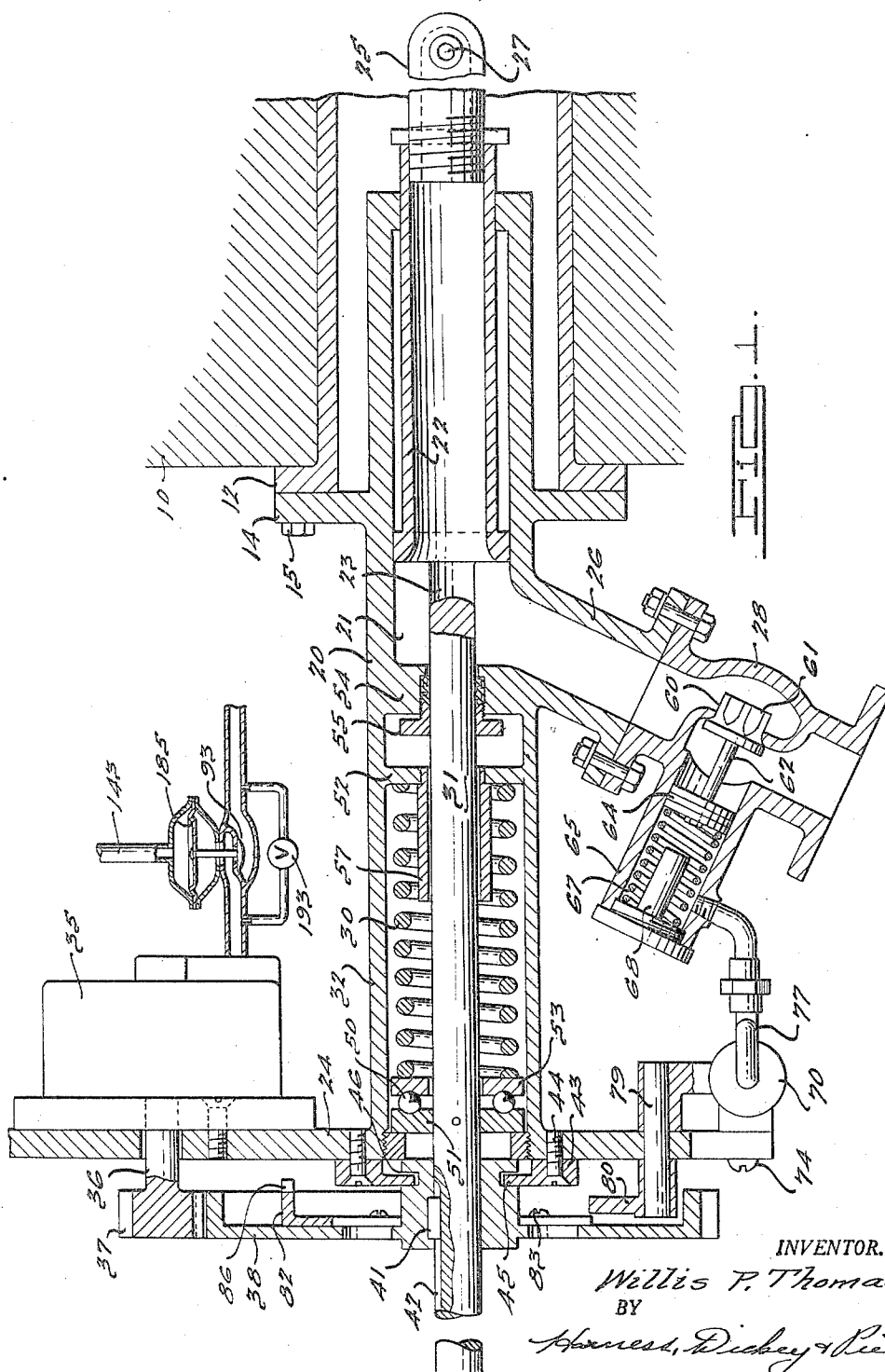
Dec. 20, 1949

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AUTOMATICALLY PROJECTABLE AND RETRACTABLE
SOOT BLOWER HEAD CONSTRUCTION

2,491,838

Filed Jan. 24, 1946

2 Sheets-Sheet 1



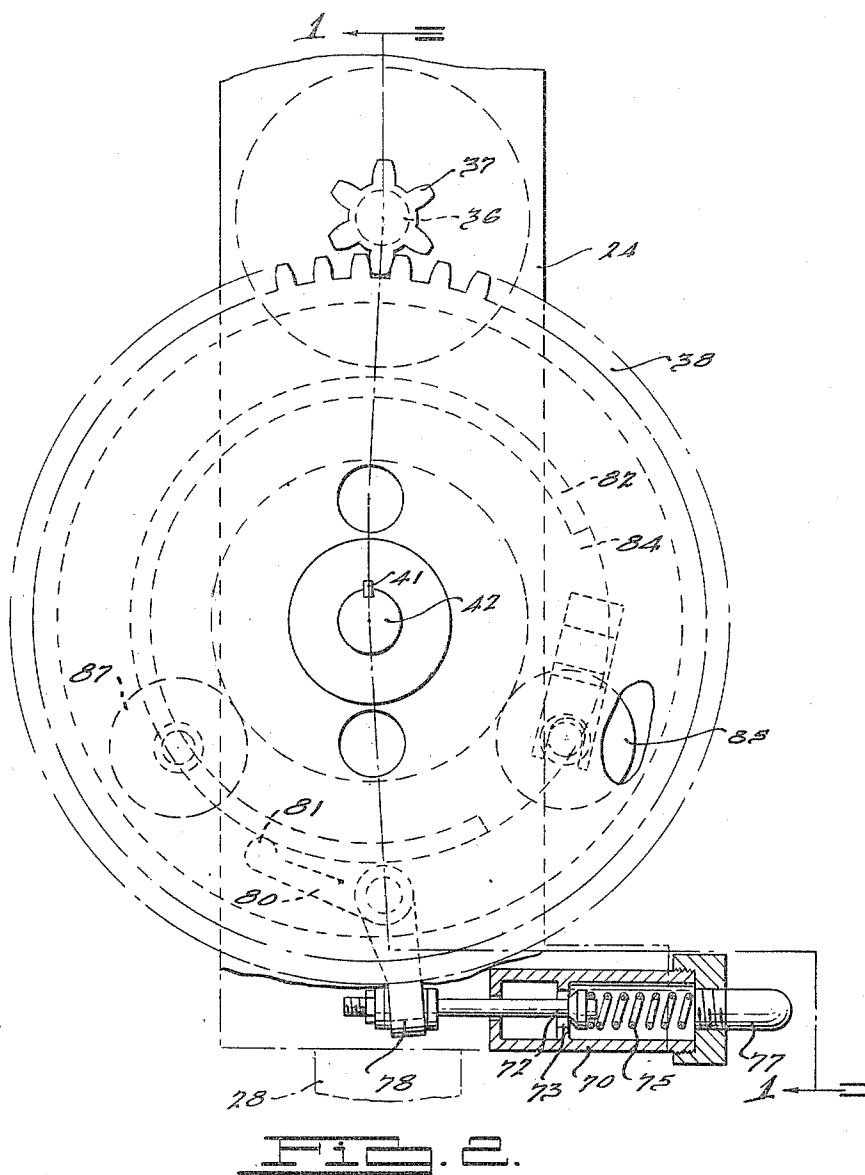
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UNITED STATES PATENT OFFICE

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AUTOMATICALLY PROJECTABLE AND RETRACTABLE SOOT BLOWER HEAD CONSTRUCTION

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2 Claims. (Cl. 15—317)

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The present invention relates to cleaning devices for heat exchangers, boilers and the like, and particularly to soot blowers for water-tube boilers.

A primary aim of the invention is to provide an improved soot blower of the so-called "projection" type wherein the blower nozzle elements (from which the cleaning fluid is projected against the surfaces to be cleaned) are retracted when not in use, and at such times lie outside the hotter zones of the combustion space and are thus protected against injury by the high temperatures prevailing in such zones. Such retraction is desirable under extreme operating conditions for the reason that the soot blowing elements stand empty for a large proportion of the time and therefore do not then have the benefit of the cooling effect of the blowing medium. Various constructed types of projection soot blowers have accordingly been proposed and used in the past. In those most commonly employed, screw-threaded elements or the like have been used to actuate the extending and retracting mechanism for the blower elements. Such mechanisms are inherently slow in operation, so that the periods during which the elements were in process of projection and retraction constituted a very considerable proportion of the total time required to clean the boiler. The present invention aims to provide improved means for rapidly projecting and retracting the elements of a soot blower of the indicated variety, so that the total time required to clean the boiler is substantially reduced. It will be appreciated that this is particularly advantageous in systems wherein a plurality of blowing units are arranged to be sequentially operated in accordance with a predetermined selection without the operator being required to manually manipulate valves or other parts during the actual cleaning of the boiler, as in the system disclosed in the copending application of Curtis L. Howse, Serial No. 572,153, filed January 10, 1945.

Another object of the invention is to provide improved means whereby the cleaning agent itself (ordinarily steam, air, or a mixture of these) is utilized to extend the nozzle elements to their operative positions in a rapid and positive manner, return springs being used to retract the elements after blowing is completed, and both the extending and retracting movements being relatively very rapid, so that the total cleaning time is greatly reduced.

Still another object is to provide such a projection-type soot blower so designed that the blowing elements may be operated entirely automatically under the influence of an automatic blow-controlling system such as that disclosed in the co-pending application of Curtis L. Howse above referred to, the present invention being

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adapted to be interconnected to the control system of the Howse application in such manner that the extension and retraction of the blower units, as well as their blowing action, are completely automatic.

Other objects will be apparent upon consideration of the present disclosure in its entirety.

In the drawings,

Fig. 1 is a substantially diametric, longitudinal sectional view of a projection-type soot blower unit constructed in accordance with the present invention, parts being broken away, taken as indicated by the line and arrows 1—1 of Fig. 2, and Fig. 2 is an end elevational view.

Referring now to the drawings, reference character 10 designates the wall of a boiler, which is fragmentarily illustrated as representative of an enclosure or setting within which are located heat exchange surfaces and/or other parts to be cleaned. The wall box 12 extends through the wall to provide a passage for the blowing unit which extends therethrough to the interior of the heating chamber. The body portion or housing 20 of the blower unit is preferably attached to the outer flange of the wall box, as by means of a mating flange 14 and machine screws 15, flange 14 being formed integrally with the body housing 20. The portion of the body housing which projects into the wall box is chambered to provide a horizontal cylinder 21 perpendicular to and projecting into the wall. The blower spindle 22 is formed as a hollow piston slidable in the cylinder 21 to carry the nozzle piece 25, threadedly attached to the end of the piston, inwardly and outwardly and thereby move the nozzle from the projected, operative position to its retracted, protected position, and vice-versa.

The outer end of the spindle piston member 22 is open to permit free entry of the blowing fluid, while at its inner end it has in effect only a restricted outlet, by reason of the restricted size of the discharge orifices 27 in the nozzle piece 25. A laterally projecting flanged boss 26 carried by the housing 20 outside the furnace wall constitutes an inlet for the blowing fluid, the admission of which is controlled by a blow valve, the body of which is generally designated 28.

The pressure of the blowing agent is utilized to project the piston 22 and attached nozzle piece 25. Projection of the nozzle piece is opposed by a coil compression spring 30 surrounding a shaft 31 attached to and constituting a coaxial outward extension of the piston 22, to which it is attached by means of forked arms 23. The arms 23 furnish a skeletonized connection which imposes no substantial opposition to free flow of the blowing agent into the interior of the piston 22, whence it may find its way into the attached nozzle element 25, as will be apparent.

The nozzle element 25, together with its

attached piston 22 and shaft 31, may be rotated during the blowing operation to direct the concentrated blasts from the nozzle orifices 27 successively against the portions within the boiler assigned for cleaning to the particular nozzle unit under consideration. Ordinarily the nozzle unit is rotated one full revolution during each cleaning operation, but the blow valve 28 may be so controlled that the cleaning blast is delivered during only a predetermined portion of such full revolution. Rotation of the shaft 31, and so of the nozzle element 25, is preferably induced by an air motor 35 of the type disclosed in the co-pending Howse application above referred to. The motor shaft 36 carries a pinion 37 which meshes with and drives a gear 38 feathered on the shaft 31 by slidably interfitted key and keyway portions 41 and 42 respectively. Motor 35 may be rigidly attached to a supporting bracket formed as an integral flange 24 carried by the outer end of the housing 20. Gear 38 is also secured to the bracket flange 24 in such manner as to hold the gear against axial movement while permitting free rotation thereof. Such securing means preferably consists of a split ring 43 attached as by screws 44 to the outer face of the bracket flange 24 and having inwardly projecting flange portions 45 which ride in a peripheral slot 46 in the hub of gear 38. It will be seen that the shaft 31 is at all times free to slide in the gear 38 without disturbing the position of the latter or the driving connection between the motor 35 and shaft 31. A ball thrust bearing 50 is preferably interposed between the spring 30 and the spring abutment 51 pinned to the shaft 31, so that rotation of the shaft does not torsionally stress or distort the spring. The other end of the spring 30 bears against an integral web 52 formed in the housing 23. An additional cross web 54 forming the outer head of cylinder 21 carries a packing gland generally designated 55, serving to seal the cylinder at the point of emergence of the shaft 31. The outwardly extending portion of housing 20 is chambered at 32 to provide a cylindrical casing for the spring 30, thrust bearings 50 and other working parts. The extent to which the nozzle piece 25 is projected and the degree of compression of the spring 32 are limited by an abutment collar 57 carried by web 52, surrounding the shaft 31, and projecting through the spring to be engaged by the combined spring abutment and bearing race 53 upon full compression of the spring.

The valve 23 which controls the flow of cleaning fluid opens against the supply pressure, the valve element 60 being of the tapered, longitudinally sliding plug type to afford a relatively gradual opening and closing action, the graduated effect being further controlled by longitudinal slots 61 formed in the periphery of the valve plug and of graduated width and depth to permit an increasing relative rate of flow as the valve is opened, and vice versa. The valve is connected, by means of a stem 62, to a piston 64 slidable in a cylinder 65 shown as cast integrally with the valve casing 23 and opening thereinto on the inlet side so that the bottom of the piston is constantly subjected to the supply pressure. The cylinder and piston are axially aligned with the path of movement of the valve. The valve is biased to closed position by a spring 67 housed in the cylinder above the piston and acting in compression to urge the latter downwardly and the valve against its seat. A buffer 68 may be provided to limit the outward travel of the piston

and thereby the extent of opening of the valve and the compression of the spring. In my preferred construction, the cross-sectional area of the piston exceeds that of the head of valve 60 sufficiently so that the fluid supply pressure tends to open the valve with a force greater than the closing effort exerted by spring 67. The space within cylinder 65 above the piston is normally sealed, however, and the opening effort exerted by the supply pressure is gradually balanced by leakage past the piston. Thus, when the system is standing in the condition depicted in Fig. 1, the pressures on opposite sides of piston 64 are balanced and spring 67 is effective to hold the valve 60 against its seat. When the valve is to be opened, the cylinder space above the piston is vented through a pilot valve, the body of which is generally designated 70. The pressure above the piston is thereupon reduced to atmospheric, the closing effort of spring 67 is overbalanced by the opening effort exerted upon the bottom of the piston by the fluid supply pressure, and the valve 60 is raised from its seat. The rate of opening movement of the blow valve 60 is controlled by the rate at which the pressure can vent through the outlet port 73 of the pilot valve 70, and this will be seen to be a factor preventing undesirably sudden and violent projection of the nozzle-piston assembly, the cylinder and piston assembly 64-65 acting as a dashpot and cooperating with the tapered contour of, and the channels 61 in, the valve 60 to limit the rate of effective opening movement of the latter.

Pilot valve body 70 is connected to cylinder 65 by pressure-tight conduit means generally designated 77. The valve element 72 is of the poppet type, longitudinally slidable in the cylindrical casing 70 and normally closed against a seat surrounding the outlet port 73 in one end of the casing. The pilot valve is urged toward closed position by a coil compression spring 75 housed within the valve chamber. The stem of the valve projects from the end of valve casing 70 and is pivoted to the end of a crank arm 78 by which the valve is actuated. Crank 78 is fast upon a shaft 79 projecting through and journaled in the bracket flange 24, to which the valve body 70 may also be directly attached by means of screws 74. Also fast upon shaft 79, upon the opposite side of the supporting flange 24, is a follower crank 80, termed a "trigger," having a toe portion 81 engageable by a cam 82 carried by the inner face of gear 38 and constituting a cylindrical flange concentric with the axis of rotation of the gear and its supporting shaft 31. The cam, of right-angular cross section, may be attached to the web of the gear by means of screws 83. Cam flange 82 is so positioned with respect to the toe of follower crank or trigger 80 as to hold the latter in a position which maintains valve 72 open as long as toe 81 is engaged by the flange. Cam flange 82 is cut away, as indicated at 84, in those areas in which it is desired to allow valve element 72 to close. Closure of valve 72 prevents escape of pressure from the closed system comprising cylinder 65, valve casing 70, and the connected conduit means 77, so that the pressure above piston 64 then builds up, by leakage past the piston until, as the pressures upon both sides of the piston approach balance, the spring 67 urges the valve 60 against its seat.

It will be seen that a fixed relationship exists between the angular position of the nozzle 27 and the opening and closing of the valve 60, since the valve is controlled by cam 82 which

turns with the nozzle. The fluid is accordingly only delivered to the nozzle during those portions of the rotative movement of the nozzle head in which the nozzles are directed toward the portions assigned for cleaning to the particular nozzle installation. It will also be seen that by changing the angular length of the cam and cut-out portions 82 and 84, the nozzle head may be made to blow during any desired portion or portions of a complete circle each time the valve 60 closes, the blowing element 25 is retracted.

Where the blowing unit described above is to be incorporated as one of several similar heads which it is desired to operate in a predetermined sequence, it may be incorporated in a system such as that disclosed in the copending application of Curtis L. Howse, Serial No. 572,153, filed January 10, 1945, for "Mechanical control for progressive air-blowing system."

The apparatus of the Howse application referred to includes a diaphragm-operated valve designated 83 in the Howse application and shown at 93 in Fig. 1 hereof, for controlling the air supply to the motor 35 to start and stop it. (The motor is designated 48 in Fig. 1 of the drawing of the Howse application.) The valving means in question, by starting and stopping the air motor at desired times, causes the blowing unit to function in a desired sequential relationship with respect to other blowing units, each of which is similarly driven and controlled. The air motor is always stopped with the cam 82 in such a position that the blow valve 60 is closed, and the motor turns the cam assembly and nozzle 25 through one complete revolution during each blowing cycle.

The controlling means for the air motor includes a pair of supplemental valves, designated 85 and 87 in the present application (45, 47 respectively in the Howse application above referred to) mounted on the bracket 24 and actuated in sequence by a special lobe 86 formed upon cam flange 82 and corresponding to the lobe 54 shown upon cam 53 in Fig. 5 of the drawing of the Howse application. Valves 85 and 87, by controlling the pressure in the conduit 143 leading to the diaphragm actuating means 185 for the valve 93, control, in conjunction with other apparatus forming a part of the Howse invention, and accordingly not shown herein, the opening and closing of the valve 93 and so the operation of the air motor and the blowing head driven thereby. Conduit 143 and diaphragm 185 will be recognized as corresponding to the elements respectively designated 43 and 85 in the Howse disclosure, and these and the other parts discussed in this paragraph constitute supplemental control devices typifying apparatus with which my present invention is adapted to be used. It will be understood, however, that the blowing unit disclosed herein might be operated entirely independently, under manual or other suitable control. For example, the driving motor 35 may be started and stopped at will by a simple hand valve such as is shown at 193. The valve element 60 will then be opened in like fashion by the pressure of the blowing fluid against the piston 64 as soon as the pressure above the piston is vented by opening of the pilot valve 72, and the blowing fluid, entering the cylinder 21, projects the piston and nozzle assembly 22-25 and discharges from the latter in desired directions as such assembly is rotated by the motor 35. Other variations from the specific

preferred arrangement herein disclosed may, of course, also be made without departure from the spirit and scope of the subjoined claims.

I claim:

1. A projection-type soot blower, including a blower nozzle element axially movable between projected and retracted positions, said nozzle element having restricted outlet orifice-defining portions whereby blowing fluid admitted to said nozzle element under pressure will move said nozzle element to projected position, means for admitting blowing fluid under pressure to said nozzle element, means for retracting said nozzle element when the admission of blowing fluid is interrupted, said nozzle element also being rotatable about a longitudinal axis, means for so rotating said nozzle element, said means for admitting blowing fluid comprising a valve incorporating a throttling portion, means for actuating the valve including means interconnecting said valve and said rotating means to control the actuation of the valve, said interconnecting means establishing a predetermined relationship between the angular position of the nozzle element and the actuation of said valve, and means for limiting the rate of movement of said valve.

2. A projection-type soot blower, including a blower nozzle element axially movable between projected and retracted positions, said nozzle element having restricted outlet orifice-defining portions whereby blowing fluid admitted to said nozzle element under pressure will move said nozzle element to projected position, yielding means normally holding said nozzle element in retracted position, means for admitting blowing fluid under pressure to said nozzle element for overcoming said yielding means and moving said nozzle element to projected position, said yielding means being adapted to automatically move said nozzle element to retracted position upon cessation of blowing fluid pressure, said means for admitting blowing fluid comprising a valve incorporating closure means and throttling means, pressure responsive means for actuating said valve, said pressure-responsive actuating means including metering means adapted to control the rate of actuation of said valve, whereby the rate of admission of blowing fluid and the rate of projection and retraction of said blower nozzle element may be modified by the conjoint action of said throttling means and said metering means.

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