

May 18, 1943

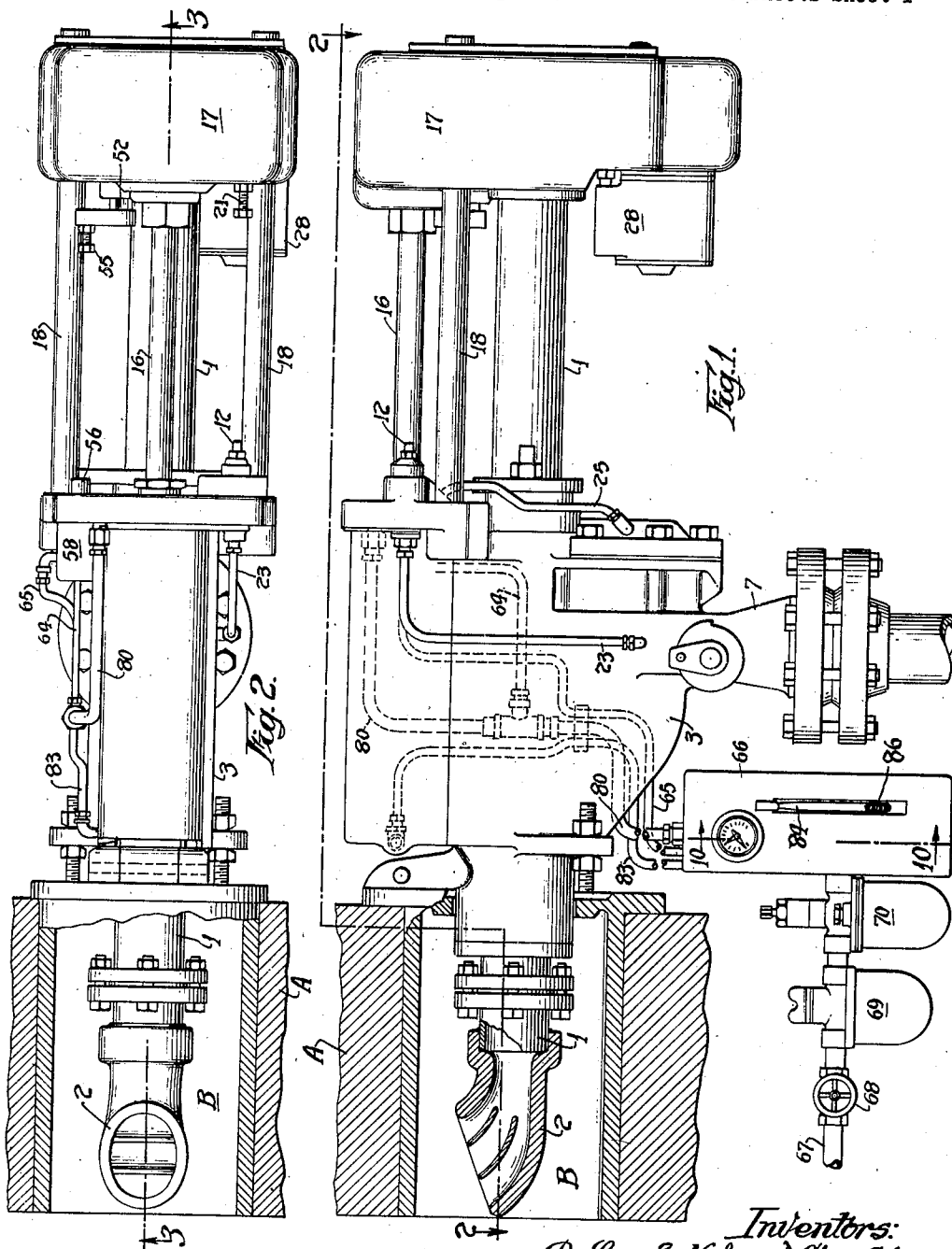
DE LOS E. HIBNER ET AL

2,319,682

SOOT BLOWER

Filed Aug. 14, 1940

6 Sheets-Sheet 1



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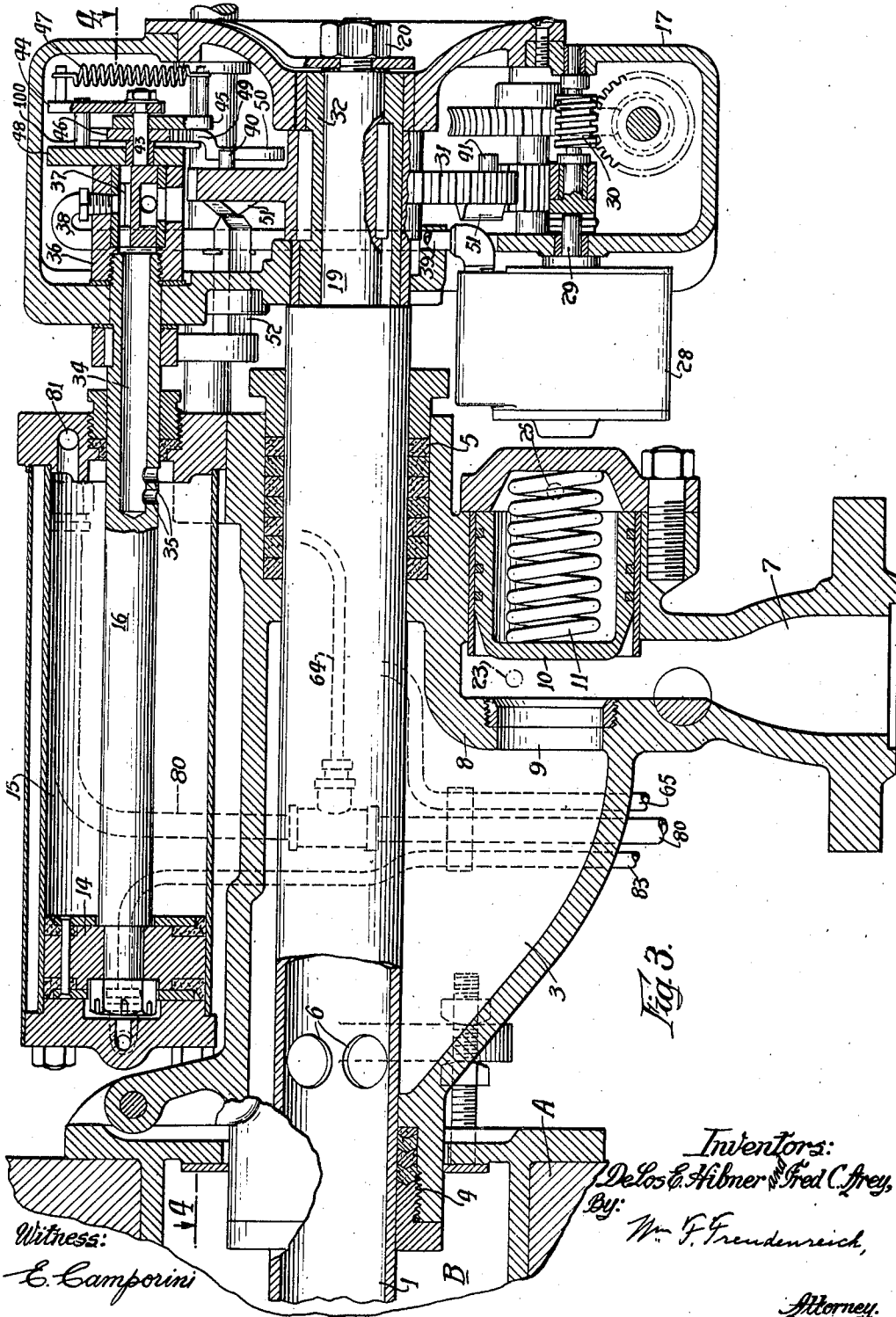
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SOOT BLOWER

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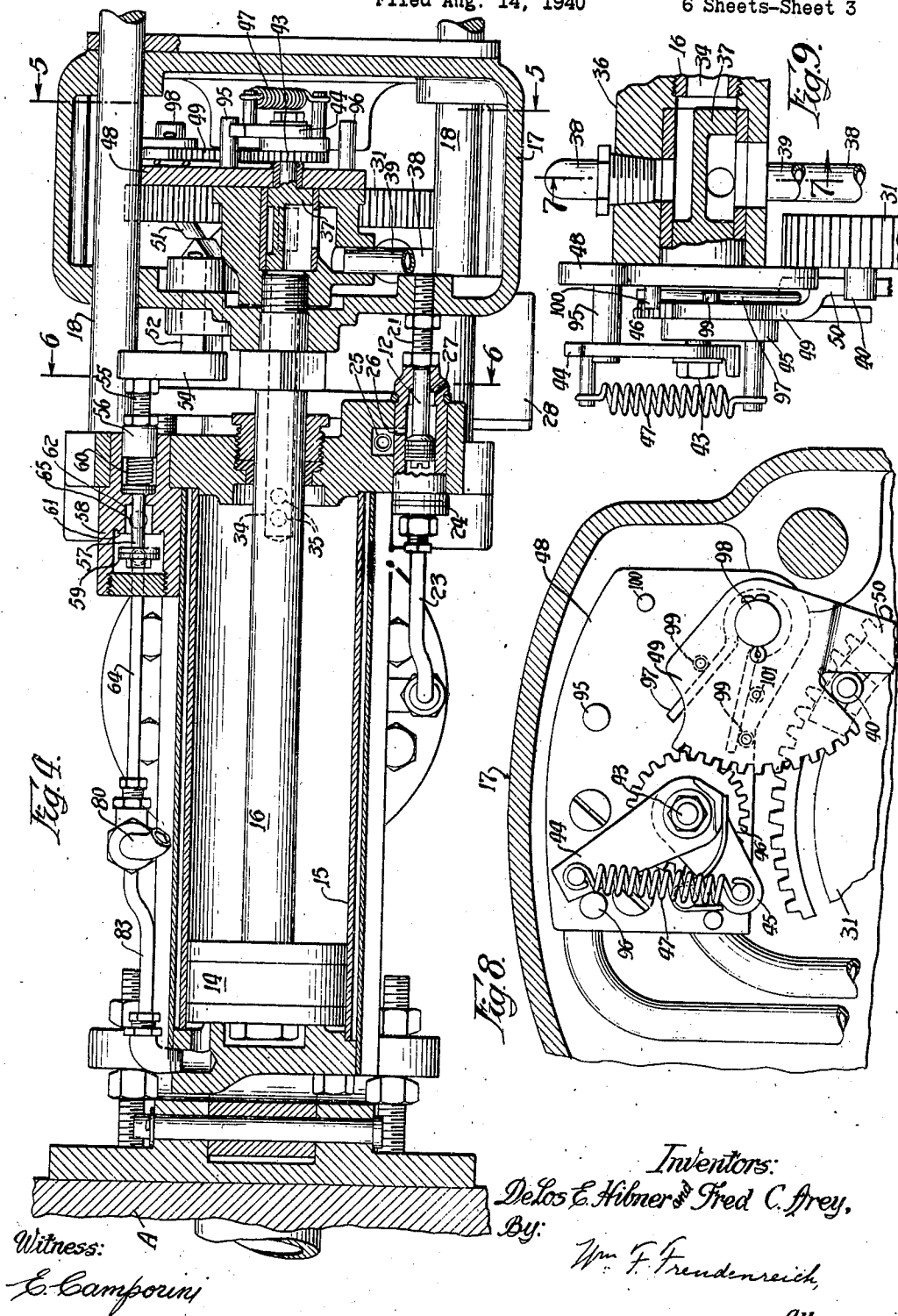
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Fig. 5.

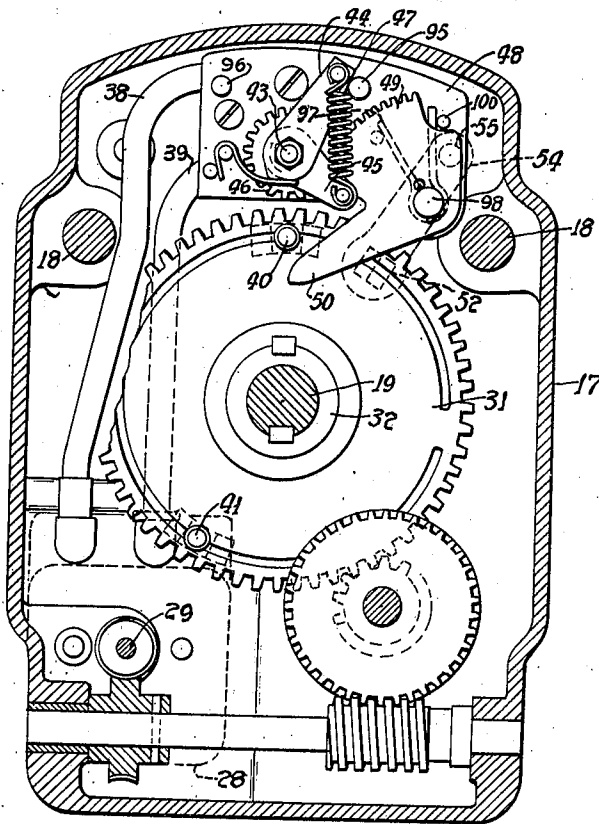


Fig. 6.

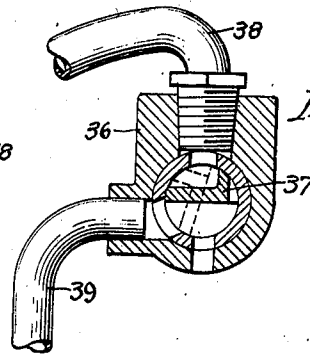
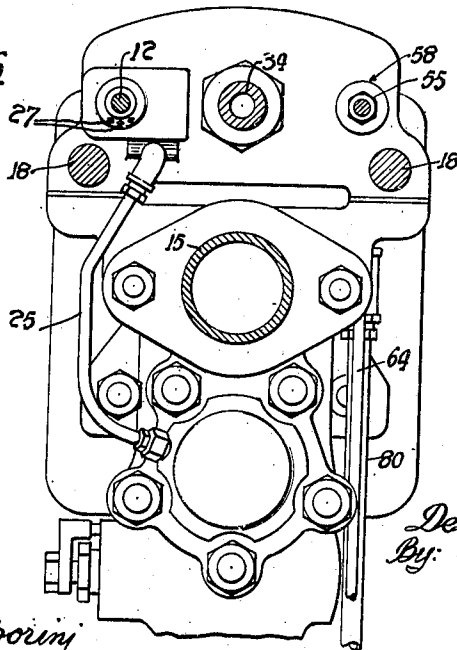


Fig. 7.

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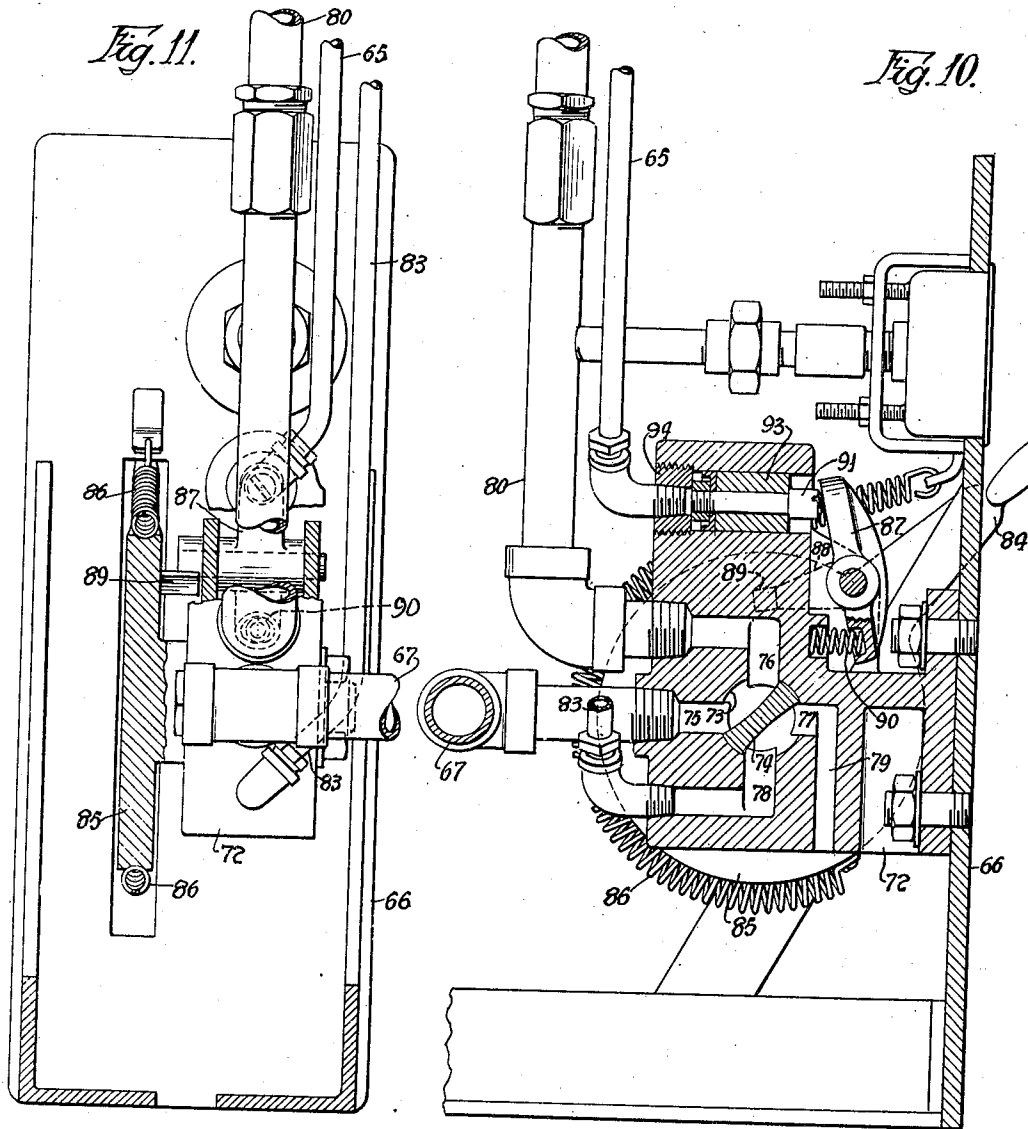
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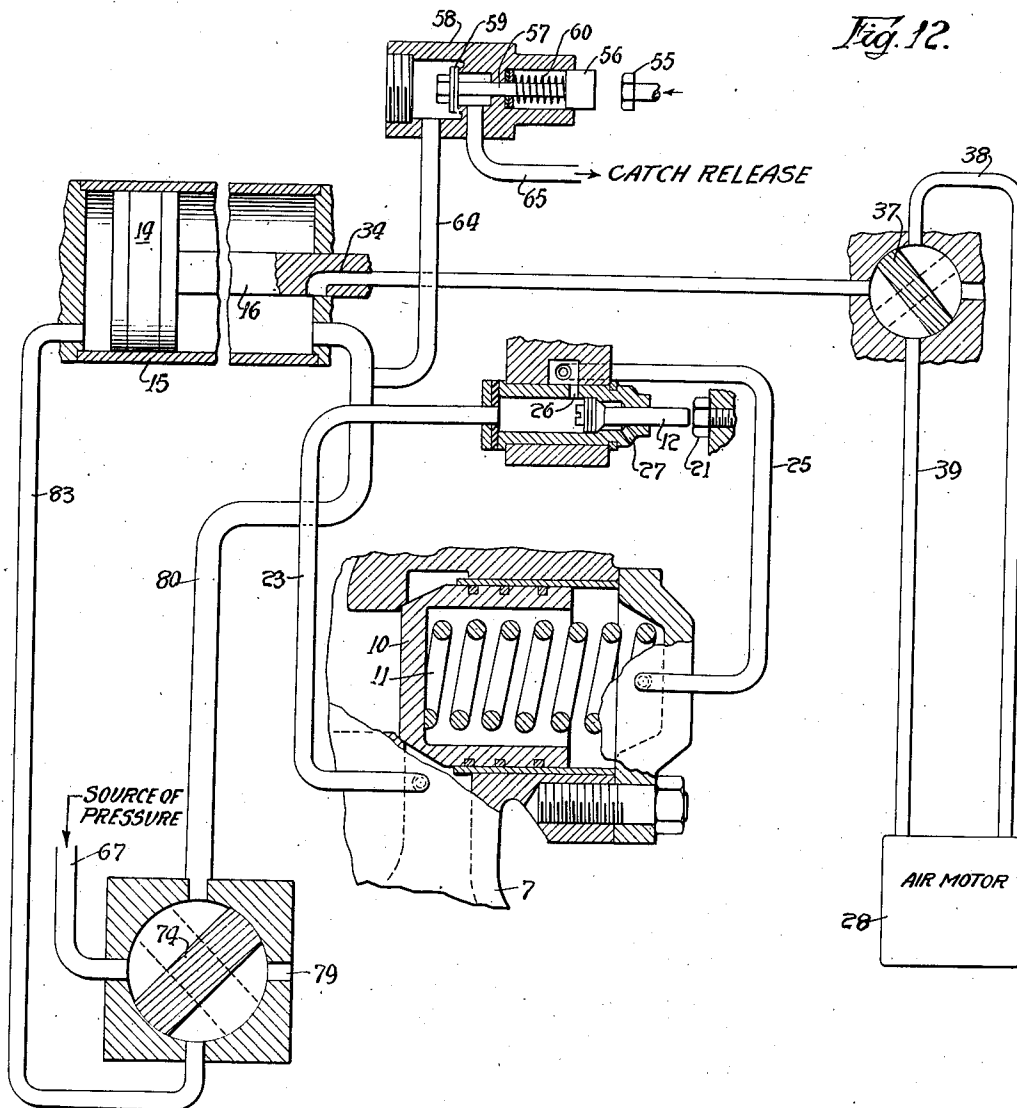
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UNITED STATES PATENT OFFICE

2,319,682

SOOT BLOWER

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Application August 14, 1940, Serial No. 352,528

9 Claims. (Cl. 122—392)

In the modern types of soot blowers devices for steam boilers, the jetting elements or nozzles are permanently located in furnaces or combustion chambers where they are subjected to intense heat. Whereas the boiler tubes are cooled through contact with the water that is being converted into steam, the usual jetting element or nozzle of a soot blowing unit is left unprotected except during the short and infrequent intervals during which cleaning fluids are flowing through the same. The object of the present invention is to protect soot blowing elements from the intense heat to which the usual devices are subjected during their periods of idleness.

While it is possible to provide the blowing elements with means to cause cooling fluids to carry away heat that is absorbed or would otherwise be absorbed by the elements, this method of cooling is not entirely satisfactory. Therefore, the object of the present invention may further be said to make it possible effectively to guard against overheating the blowing elements during their idle periods, without the use of cooling fluids or the like.

In carrying out the present invention, each blowing element is mounted so as to be movable between a working position and an idle position wherein at least the greater part thereof lies beyond the influence of the furnace heat. Therefore, viewed in one of its aspects, the present invention may be said to have for its object to produce a simple and novel soot blower blowing unit, the actual blowing element of which may be shifted between a working position within a furnace or combustion chamber and a position in which it may remain comparatively cool.

In a still further aspect, the present invention may be said to have for its object to produce a simple and novel operating and control system for the type of unit just described, whereby a cycle is started, carried out and finally ended, automatically upon the mere shifting of a handle, lever or other simple controlling device.

The various features of novelty whereby the present invention is characterized will hereinafter be pointed out with particularity in the claims; but, for a full understanding of the present invention and of its objects and advantages, reference may be had to the following detailed description taken in connection with the accompanying drawings, wherein:

Figure 1 is a side view of a complete automatic blowing unit arranged in accordance with the present invention, applied to the wall of a boiler setting which is shown in section; Fig. 2 is a sec-

tion taken on line 2—2 of Fig. 1; Fig. 3 is a vertical axial section taken on line 3—3 of Fig. 2, but on a much larger scale, and the blowing element having been shifted from the idle position in Figs. 1 and 2 to the working position; Fig. 4 is a section on line 4—4 of Fig. 3; Fig. 5 is a section on line 5—5 of Fig. 4; Fig. 6 is a section on line 6—6 of Fig. 4; Fig. 7 is a section through the reversing valve; Fig. 8 is a view similar to Fig. 5, but on a larger scale and showing only a fragment of the apparatus; Fig. 9 is a view, partly in elevation looking at the righthand side of the apparatus as it appears in Fig. 8, with the casing omitted, while the reversing valve is shown in section corresponding to the plane of line 9—9 of Fig. 8; Fig. 10 is a section through the controlling panel on line 10—10 of Fig. 1, but on a much larger scale; Fig. 11 is a rear view of the controlling panel, on the same scale as Fig. 10, portions being broken away; and Fig. 12 is a diagram illustrating the various valves and power devices.

Referring to the drawings, A represents a thick wall of a boiler setting through which a tubular soot blowing element is adapted to extend from a supporting head on the exterior of the wall. In the present instance the tubular blowing element 1 has on its inner or free end a nozzle or distributor 2 for the cleaning fluid. At times when cleaning fluid is being discharged from the nozzle, the latter must lie within the furnace or combustion chamber on the inner side of the boiler setting where the heat is so intense that the life of the nozzle is short if the nozzle be left in its working position. One of the features of the present invention is to make it possible to withdraw the nozzle from the zone of intense heat except at times when it is required to discharge cleaning fluid. In the arrangement illustrated, the cleaning element is so mounted and the wall A is of such thickness, that the nozzle may be retracted within a chamber or recess B extending into the wall A from the inner face. When the nozzle lies within this recess or chamber, as shown in Figs. 1 and 2, it is shielded against the intense heat of the furnace and its useful life is therefore indefinitely prolonged. In the arrangement shown, the blowing element 1 extends horizontally through and is lengthwise slidable and rotatable in a hollow stationary head 3 lying on the outside of and mounted on the wall A. As best shown in Fig. 3, the head is provided with two aligned stuffing boxes 4 and 5, at the inner and outer ends thereof, respectively, surrounding the

blowing element and preventing the escape of steam or other cleaning fluid past the outer surface of said element. The blowing element contains holes 6 through which steam or other cleaning fluid may enter from the interior of the head.

Cleaning fluid, usually steam, enters the head through a tubular inlet portion 7 at the bottom. A partition or diaphragm 8 separates the space within the member 7 from that within the head proper, there being an inlet 9 opening in this partition. This inlet is controlled by a valve 10 in the form of a cup-shaped piston whose axis is parallel to the axis of the blowing element. This valve, as is common in soot blowers, is adapted to be closed by a spring 11 and fluid pressure behind the same and to be opened by fluid pressure acting against the opposite side thereof. Thus, when there is only atmospheric pressure in the inlet member 7, the spring holds the valve closed. When steam is turned on and is permitted to flow into the space behind the valve, the valve still remains closed. However, if the space behind the valve is vented to atmosphere, the pressure of the steam against the opposite side of the valve is sufficient to force the valve open, as indicated in Fig. 3, against the resistance of the spring. The operation of the valve 10 is controlled by the usual pilot valve 12, best shown in Fig. 4.

The blowing element 1 may conveniently be moved lengthwise between its working and idle positions by means of a piston 14 slidable in a long cylinder 15 fastened on top of the head 3 with its axis parallel with that of the blowing element. The piston is connected to what may be termed the front end of a long piston rod 16 that projects out beyond the rear end of the cylinder. The rear end of the piston rod passes through and is fixed to the front wall of a housing 17 that lies behind the head 3 and is slidably mounted on two sturdy rods 18 fixed to the head 3 and extending rearwardly therefrom on opposite sides of and parallel to the axis of the blowing element. The rear or outer end of the blowing element is closed and is provided with an extension in the form of a stub shaft 19 of reduced diameter that extends entirely through the housing. A nut 20 on the rear end of the stub shaft secures the housing and the blowing element together.

As best shown in Fig. 4, the housing has at the front a forwardly projecting lengthwise adjustable stud 21 that is aligned with the stem of the pilot valve 12. The parts are so proportioned that, as the piston 14 approaches its extreme forward position, the stud strikes the stem of the pilot valve and forces that valve forward into the position that causes the space behind the main valve 10 to be vented and that valve to open if steam has been turned on. Conversely, as the housing starts to retreat, the stud moves away from the pilot valve and thus causes the stem supply to the blowing element to be shut off. The manner in which the pilot valve controls the main valve can be seen in Figs. 1, 3 and 4. Thus, there is a small pipe 23 leading from the righthand side of the partition 8 in Fig. 3 to the forward end of the casing member of the pilot valve; there is also a pipe 25 leading from the space behind the valve 10 to a port 26 in the pilot valve casing; and there is a vent 27 to atmosphere in the rear end of the pilot valve casing. The parts are so proportioned that when the movable member of the pilot valve is

pushed in as in Fig. 4, the space behind the main valve 10 exhausts through the vent 27. However, when the stud 21 moves away from the pilot valve, the steam entering the pilot valve casing through pipe 23 shifts the movable member of the latter valve so as to establish communication between pipes 23 and 25.

At times when the blowing element is discharging cleaning fluid, it must also be turned so as to cause the jets or streams to sweep over a considerable area. In the arrangement shown, this rotation is caused by a motor 28 mounted on the front side of the housing 17 and having its shaft 29 extending through the front wall of the housing and into driving connection with the first element of a speed-reducing gearing 30, the final element of which is a large gear wheel 31 keyed to a sleeve 32 which surrounds and is in turn keyed to the stub shaft 19. In the particular arrangement shown, the blowing element is not turned continuously in one direction but is given oscillatory movements of variable, predetermined angular lengths. Consequently, means must be provided for energizing and de-energizing the motor and also for reversing the same.

Since the power for shifting the blowing element between its working and idle positions is preferably compressed air, the motor for turning the blowing element may advantageously be of the pneumatic type.

It will be seen that the rear or outer end of the piston rod 16 contains a long axial bore 34 of considerable diameter and that one or more ports 35, extending through the surrounding wall of the rod, place the bore in communication with the space within the cylinder 15 at times when the piston is in its forward position, as indicated in Fig. 3. The bore 34 communicates with a chamber within a nut-like casing 36 screwed upon the rear end of the piston rod within the housing 17 and serving to clamp the piston rod to the front wall of the housing. Within this casing is a reversing valve 37 which admits air from the bore 34 into either of two pipes 38 and 39 leading to the motor, connecting each of these pipes to atmosphere while the other is connected to the bore. Consequently, with the piston 14 in the rear end of the cylinder, as in Figs. 1 and 2, the ports 35 find themselves far to the rear of the cylinder and opening into atmosphere. Therefore, if air is admitted into the rear end of the cylinder, it can find no escape and therefore pushes the piston forward. Then, just before the piston reaches the limit of its forward movement, the ports 35 are brought into position to permit air to flow from the interior of the cylinder to the motor. As has heretofore been explained, the main steam valve is opened through the operation of the controlling pilot valve when the piston 14 is almost at the limit of its forward movement. Therefore, when the piston has travelled to its forward position, carrying the blowing element from the idle to the working position, not only does steam begin to flow through the cleaning element, but the motor begins to turn the latter. Thereafter, the steps previously taken must be reversed so as to shut off the steam, stop the motor and carry the nozzle of the blowing element back into its protecting recess or chamber. The point at which this restoration of the initial idle conditions occurs is conveniently controlled by the common expedient of providing the large gear wheel 31 with a pair of stops 40 and 41 that

may be adjusted so as to be spaced at any angular distance from each other. These stops, as will hereinafter be explained, shift the reversing valve and also shut off the supply of air to the rear end of the cylinder 15 (and thus to the motor) and cause air to be admitted into the front end of the cylinder so as to push the piston back into the rear end of the cylinder.

The reversing valve is preferably of the snap action type so that just as the end of each turning movement is reached, the valve is quickly thrown from one position to the other. The operating mechanism for the reversing valve is best shown in Figs. 3, 4, 5, 8 and 9. It will be seen that the movable member of the reversing valve has a readwardly-extending stem 43 to the extreme end of which is fixed a radial arm 44. On this stem, in front of the arm 44, is a loose radial arm 45 having fastened thereto a pinion 46. The free ends of the arms 44 and 45 are connected together by a tension spring 47 of such length that normally the two arms are held at about right angles to each other, as in Fig. 8. Mounted upon a stationary, vertical plate 48 arranged within and transversely of the housing 17 is a rocking toothed segment 49 meshing with the pinion 46. This segment is provided with a finger 50 that projects into the circular path of travel of the stop pins 40 and 41 on the gear wheel 31.

Assuming that as viewed in Fig. 5 the gear wheel is turning in the clockwise direction, it will be seen that the pin 40 is about to engage with the finger 50. As the gear continues to turn, the pin contacts the finger and drives it ahead so as to turn the segment 49 in the counter-clockwise direction. This causes the pinion 46 and the arm 45 to turn in the clockwise direction, thus placing the spring 47 under tension. As soon as the tension of the spring becomes great enough, the arm 44 is quickly snapped from the position illustrated in Fig. 5 to that which it occupies in Fig. 8. The pneumatic motor now begins to run in the reverse direction and the large gear wheel 31 begins to turn slowly in the counter-clockwise direction. However before the gear wheel has travelled back very far, the supply of air to the motor is shut off and the turning movement of the gear wheel and the blowing element ceases. At this time, as heretofore stated, air is admitted into the front end of the cylinder so that the housing and the blowing element are pushed back into their idle positions. These latter steps are carried out in part by a simple valve device which may be operated by suitable stops on the gear wheel 31.

In the arrangement shown, each of the stop pins 40 and 41 is carried upon a wedge-shaped block or cam 51 which lies on the front side of the gear wheel 31, while the corresponding pin projects through the gear wheel and from the opposite or rear face thereof. Slideably arranged in and projecting through the front wall of the housing 17, above the blowing element, is a bar 52 which is made noncircular in cross section or is otherwise formed or equipped to permit lengthwise sliding movements while held against turning movements. This bar is so positioned that whenever one of the pins is reaching a predetermined limit of its movements, the cam-shaped piece 51 thereon is exerting a wedging or camming action against the end of the bar 52 and is forcing the latter forward. In other words, it takes a combination of movements to operate the bar 52, namely the sliding

movement of the housing into its forward position and, thereafter, the turning movement of the gear wheel. The bar 52 has an arm 54 fixed to the forward end thereof and extending laterally at right angles thereto. This arm has on the front side thereof, near its free end, a forwardly-projecting, adjustable stud 55 which, when pressed forwardly, engages a head 56 on the rear end of a stem 57 extending into a little valve casing 58 and carrying on its forward end, within this valve casing, a disk valve 59. A spring 60, surrounding the valve stem on the outside of the valve casing and bearing against the forward face of the head 56, normally holds this valve against a seat 61 surrounding the entrance to a pocket or recess 62 opening out of the rear end of the main chamber in the valve casing. Air is normally admitted into the main chamber in the valve casing 58 through a pipe 64, and a pipe 65 leads from the recess or auxiliary chamber 62. When the valve 59 is closed, no air can flow from the pipe 64 into the pipe 65. However, just at the time when the reversing valve for the motor is being shifted, the valve 59 is unseated and thereupon air may flow from the pipe 64 into the pipe 65 and thus, as it will appear, cause the rear end of the cylinder 15 and the motor to be vented to atmosphere while air is admitted into the front end of the cylinder so as to force the piston rearwardly or to the right, as viewed in Fig. 4.

The supply of air for moving the piston 14 back and forth and for operating the motor is controlled from a suitable remote station through the operation of a simple controlling member.

As shown in Fig. 1, there is a suitable board or panel 66 within convenient reach of an operator. An air pipe 67 containing a manual shut off valve 68, a strainer 69 and a lubricator 70 extends behind the board or panel. On the rear side of the panel is fastened a casting 72 containing a cylindrical bore 73 within which is disposed a rotary valve 74 in the form of a relatively thin flat piece extending lengthwise of the bore and diametrically across the same. There are four ports spaced ninety degrees apart from each other and connected to the bore 73, these ports being indicated, respectively, at 75, 76, 77 and 78. The air supply pipe 67 is connected to the port 75. The port 77, which is diametrically opposite the port 75, is connected to atmosphere through a passage 79. Connected to the port 76 is a pipe 80 extending up past the head of the blower unit and, as shown in Fig. 3, opens into the rear end of the cylinder 15 through a port 81 in the rear cylinder head. The pipe 64 is a branch of the pipe 80 so that, when the valve 74 is in a position to connect together the ports 75 and 76, as in Fig. 10, air is delivered both to the rear end of the cylinder 15 and into the main chamber of the valve casing 58. By turning the valve 74 through an angle of ninety degrees in the counter-clockwise direction, communication between the pipe 80 and the air supply pipe is shut off and the pipe 80 is vented to atmosphere through port 77 and passage 79. Connected to the port 78 is a pipe 83 which leads up to the forward end of the cylinder 15. When the valve 74 is in the position to admit air from the supply pipe to the pipe 80, the pipe 83 is venting to atmosphere through the ports 78, 77 and the passage 79.

The valve 74 may conveniently be operated by a hand lever 84 fixed to the same and protruding from the front of the panel. The inner end

of the lever may be in the form of a disk 85 having a trough-like periphery. Fastened at one end to the disk is a long coil spring 86 which lies in the peripheral groove or trough in and extends part way around the same; the other end of the spring leaving the disk in a tangential direction and being fastened to the panel. The tension of the spring is least when the handle is in its down position and increases as the handle is swung up to the position it occupies in Fig. 10, namely, the position which sets the blower unit in operation. Near the disk is mounted a dog 87 pivoted at the middle and having a radial finger 88 that extends into the path of a lug 89 on one side of the disk. A spring 90 tends constantly to hold one end of the dog against a stop 91, namely in such a position that the lug 89 will strike the under side of the finger 88 when the handle is raised and thus raise the finger until the lug passes the same. As soon as the lug travels beyond the end of the finger, the latter snaps back behind the lug and prevents the handle from swinging down until the finger is lifted out of the way.

The stop 91 is at the end of a pin or screw extending through a thick piston 93 slidable in a suitable bore in the upper part of the casting 72. The stop 91 is exposed at one end of said bore while the other end of the latter is closed by a plug 94 into which the pipe 65 is screwed. Consequently, when the valve 59 is unseated, as heretofore explained, air passes from pipes 80 and 64 through valve casing 58 and into pipe 65. Thereby the piston 93 at the controlling panel is forced back and shifts the dog 87 until the finger thereon rises clear of the lug on the disk 85, whereupon the spring 86 comes into play and throws the handle 84 down and turns the valve 74 through an angle of ninety degrees from the position indicated in Fig. 10. Only after the valve 74 has thus been shifted is the supply of air to the pneumatic motor for turning the blowing element shut off; thus permitting the blowing element to move far enough in the reverse direction, after the reversing valve has been operated, to carry the then active cam 51 clear of the bar 52, and allowing the valve 59 to close. The system is now ready for a repetition of the cycle when the controlling handle is again raised.

Although pressure is maintained in the front end of the cylinder 14, after a cycle of operations has been completed, until the hand valve 67 is closed no harm is done if that valve is left open.

The entire control system, both for the cleaning fluid and for the power devices or motors, is illustrated diagrammatically in Fig. 12. The operation has heretofore been fully described; but, for a fuller understanding, it may further be noted that while in Figs. 1 and 2 the blowing element and parts reciprocable therewith are shown fully retracted and in Figs. 3 and 4 as being fully extended, Fig. 8 illustrates the conditions existing at the instant that a turning movement in one direction of the blowing element has been completed and the reversing valve has been operated. At this time the valve 59 is still open and it remains so until the motor has run long enough in the reverse direction to carry the cam 51 away from the bar 52.

It should perhaps be noted that the arm 44 on the reversing valve is limited in its swinging movements by two stops 95 and 96 fixed to and projecting rearwardly from the stationary plate 48. The spring snaps the arm 44 from one of

these stops to the other at the end of each angular stroke of the gear wheel 31. Also, in order that the gear wheel cannot turn too far in either direction, stops are preferably provided to limit the angular movement of the segment 49 whose finger 50 then serves as a stop for the gear wheel. So that the stopping action of the gear wheel may be a yielding one, the segment 49 is provided with a hairpin spring 97 the closed end of which partially surrounds the pivot pin 98. The arms of the spring lie between and press against a pair of pins 99 projecting from the front face of the segment, and they also play between widely spaced pins 100 and 101 fixed to the plate 48. When one of the arms of the spring strikes either the pin 100 or the pin 101, the segment 49 need not stop abruptly but may continue its movement while that arm is being pressed back toward the other arm. This is of advantage in case the snap action device becomes sluggish and needs an extra push to make it operate properly.

While we have illustrated and described with particularity only a single preferred form of our invention, we do not desire to be limited to the exact structural details thus illustrated and described; but intend to cover all forms and arrangements which come within the definitions of our invention constituting the appended claims.

We claim:

1. A soot blowing element mounted for turning movements and also for lengthwise movements between a working position and an idle position, a motor to move the said element lengthwise, a second motor to turn said element, an automatic reversing device for said second motor, a controller having a movable member in one position of which the first motor is caused to move said element into its working position and in a second position of which that motor is caused to return said element to its idle position and said second motor is caused to stop, and means controlled by said element while in its working position to cause said member to assume its said second position after said element has turned through a predetermined angle.

2. A tubular soot blowing element mounted for turning movements and also for lengthwise movements between a working position and an idle position, a pneumatic motor to move said element lengthwise, a second pneumatic motor to turn said element, means controlled by the first motor to energize the said second motor when said element occupies its working position, and means controlled by the said element for energizing the first motor to cause it to drive said element into its idle position after said element has made a predetermined angular movement while in its working position.

3. The combination with a hollow head, of a tubular blowing element mounted in said head for turning movements and also for lengthwise movements between a working position and an idle position, guide rods extending from one side of said head parallel to said element, a housing slidable along said rods, one end of said element being so connected to the housing as to be rotatable therein and be held against lengthwise movement relatively thereto, a power device connecting said head and said housing to move the latter from and toward the head, a motor carried by the housing, speed reducing gearing in the housing connecting the motor and the said

element together, and means to admit cleaning fluid from the head to said element.

4. The combination with a hollow head, of a tubular blowing element mounted in said head for turning movements and also for lengthwise movements between a working position and an idle position, guide rods extending from one side of said head parallel to said element, a housing slidable along said rods, one end of said element being so connected to the housing as to be rotatable therein and be held against lengthwise movement relatively thereto, a power device connecting said head and said housing to move the latter from and toward the head, a motor carried by the housing, speed reducing gearing in the housing connecting the motor and the said element together, an automatically closing valve in said head to control the admission of cleaning fluid to said element, and a part on said housing to engage with said valve when the housing comes near the head and open the valve.

5. The combination with a hollow head, of a tubular blowing element mounted in said head for turning movements and also for lengthwise movements between a working position and an idle position, guide rods extending from one side of said head parallel to said element, a housing slidable along said rods, one end of said element being so connected to the housing as to be rotatable therein and be held against lengthwise movement relatively thereto, a cylinder fixed to the head with its axis parallel to that of said element, a piston in said cylinder, a piston rod extending from said piston and connected to said housing, a motor carried by said housing, speed reducing gearing in the housing connecting the motor to the blowing element, a two-position valve to control the admission of fluid under pressure into one or the other end of the cylinder, a handle for moving said valve into one of its positions, and means to cause said valve to shift into its other position after said element has turned through a predetermined angle while the housing is nearest the head.

6. A soot blowing element mounted for turning movements and also for lengthwise movements between a working position and an idle position, a motor to move the said element lengthwise, a controller having a handle in one position of which the first motor is caused to move said element into its working position and in a second position of which that motor is caused to return said element to its idle position, a spring adapted to move said handle into the first of said positions, a catch adapted to hold

said handle in its second position against the resistance of the spring, and means controlled by said element to trip the catch after said element has made a predetermined angular movement while in its working position.

7. A tubular soot blowing element mounted for turning movements and also for lengthwise movements between a working position and an idle position, a pneumatic motor to move said element lengthwise, a second pneumatic motor to turn said element, means controlled by the first motor, and including a reversing valve, to energize the said second motor when said element occupies its working position, and means controlled by said element for shifting its reversing valve and for energizing the first motor to cause it to drive said element into its idle position after said element has made a predetermined turning movement while in its working position.

8. In combination, a support, a soot blowing element mounted in said support for lengthwise sliding movements and also turning movements about its axis, a cylinder mounted on said support parallel to said support, a piston in said cylinder, a piston rod extending from the piston through one end of the cylinder, means connecting the protruding end of the piston rod to said element so as to be rotatable relative to each other and to compel them to move lengthwise in unison with each other, means to supply the cylinder with an energizing fluid to move the piston in either direction, a motor for rotating said element, and means controlled by the lengthwise position of said element to start the motor to begin a cleaning operation and stop the motor at the end of the cleaning operation.

9. A tubular soot blowing element mounted for turning movements and also for movements between a working position and an idle position, a pneumatic motor to move said element from each of said positions to the other, a second pneumatic motor to turn said element, means controlled by the first motor, and including a reversing valve, to energize the said second motor when said element occupies its working position; and means controlled by said element for shifting the reversing valve upon completion of a predetermined turning movement while said element is in its working position, for then de-energizing the second motor, and finally energizing the first motor to cause it to drive said element into its idle position.

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