April 11, 1950 DE LOS E. HIBNER ET AL 2,504,073

POWER-DRIVEN SOOT BLOWER

Original Filed Aug. 5, 1944 4 Sheets-Sheet 1

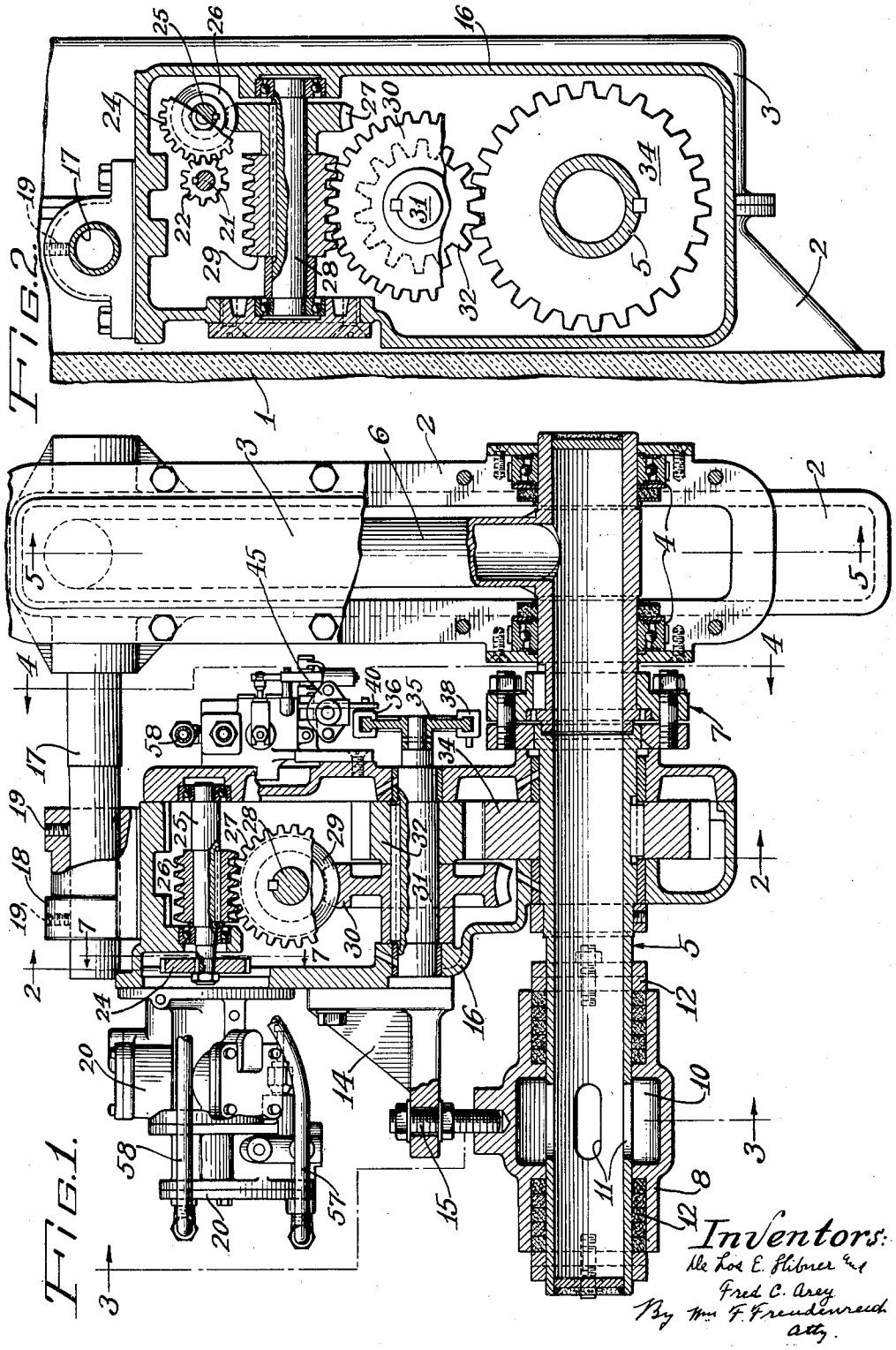


FIG. 2.

FIG. 1.

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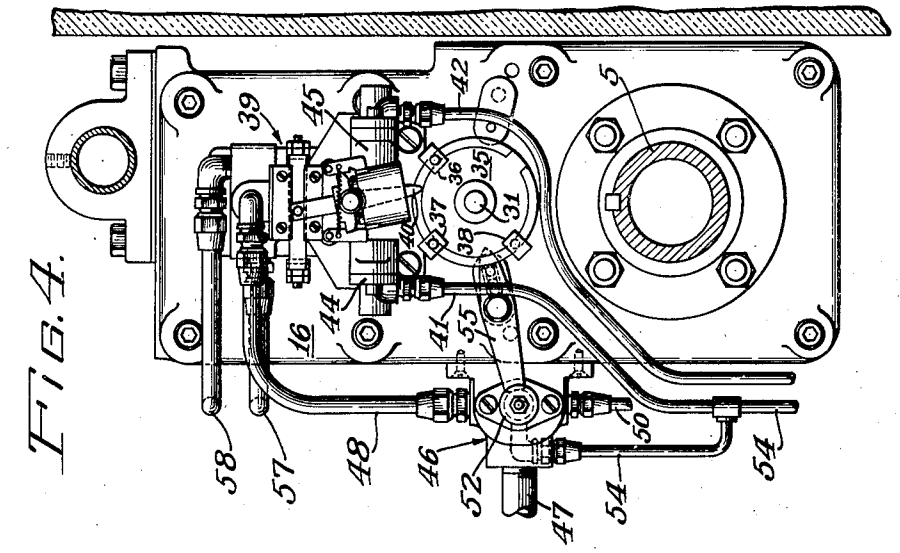


FIG. 4.

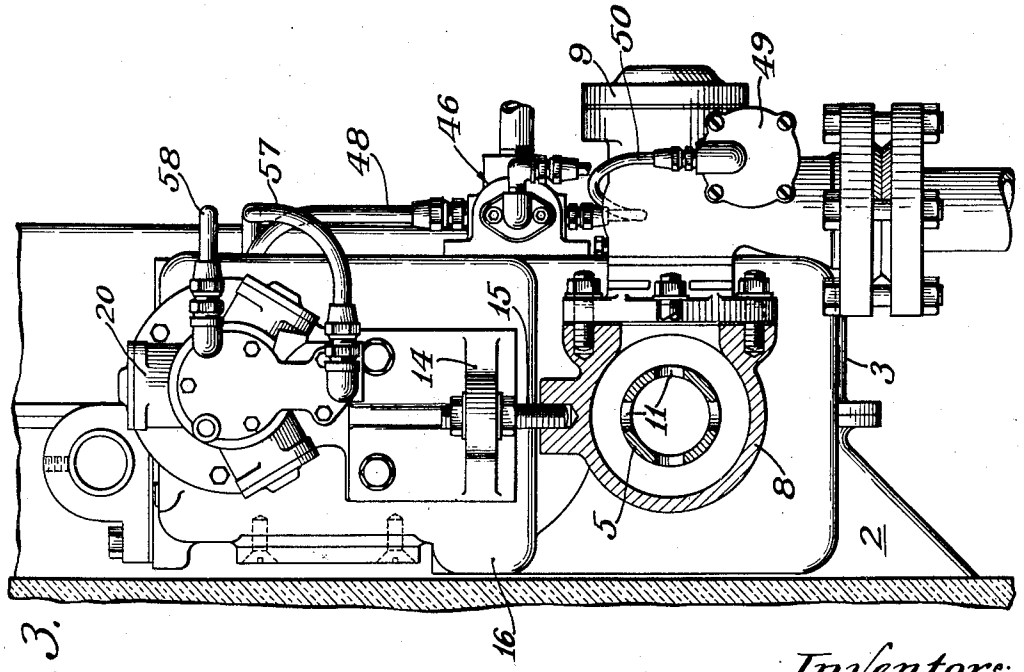


FIG. 3.

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Original Filed Aug. 5, 1944 4 Sheets-Sheet 3

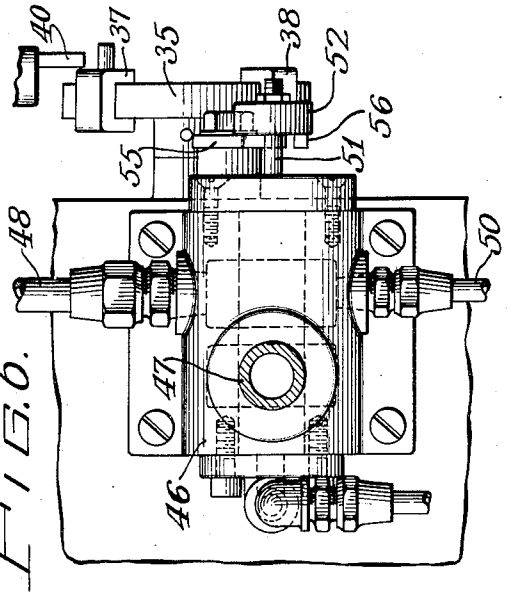


FIG. 6.

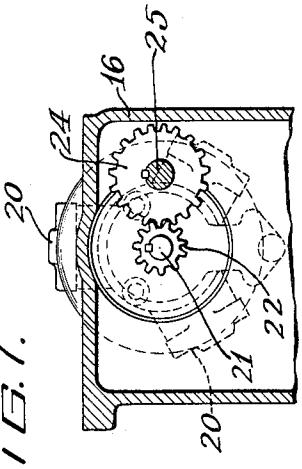


FIG. 7.

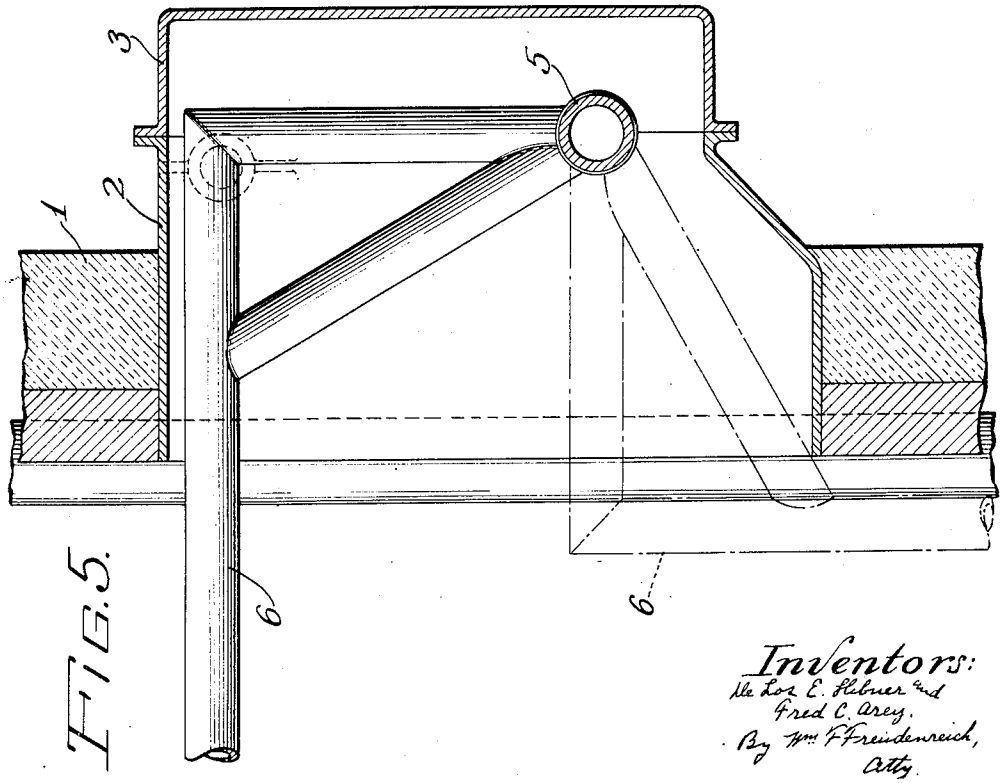


FIG. 5.

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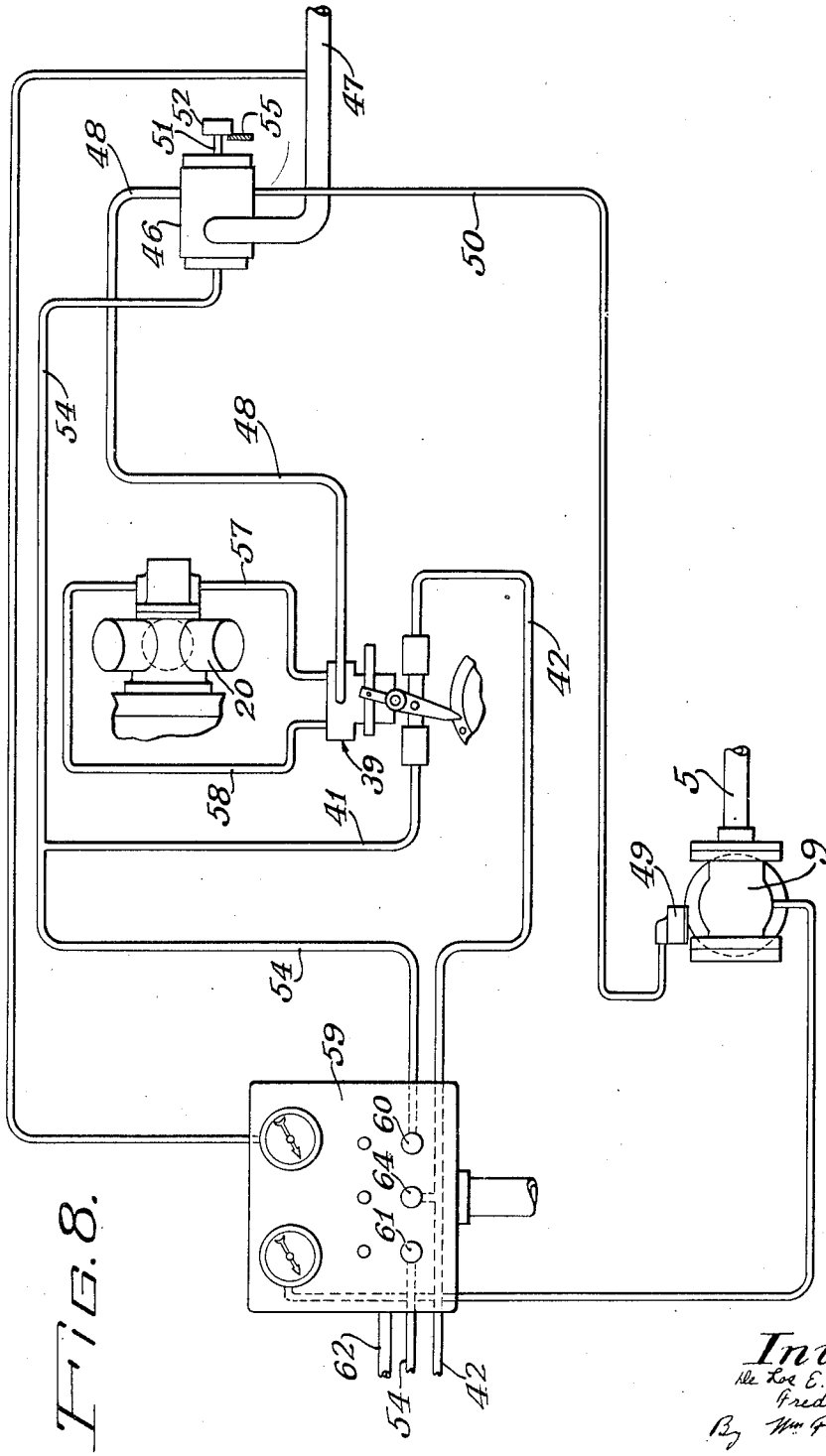


Fig. 8.

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UNITED STATES PATENT OFFICE

2,504,073

POWER-DRIVEN SOOT BLOWER

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Original application August 5, 1944, Serial No. 548,184. Divided and this application April 22, 1947, Serial No. 743,223

1 Claim. (Cl. 15—317)

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In our patent, No. 2,368,612, granted January 30, 1945, we have disclosed a soot blower apparatus in which the tubular blowing element swings between a vertical idle position close to the inner side of a furnace wall and a working position crosswise of the furnace and at right angles to said wall. The present invention relates to apparatus of this general type and has for its object to provide for the swinging element a simple and efficient power driven operating means that requires the attendant merely to move a small device, such as a push button for example, to start and complete a blowing cycle and, if desired, an emergency button or the like to cause the cycle to be cut short, when necessary.

This application is a division of our application Serial No. 548,184, filed August 5, 1944, and having become Patent No. 2,421,940, wherein the structural features relating to the mounting of a soot blower unit on a furnace wall, also disclosed herein are claimed.

The various features of novelty whereby our invention is characterized will hereinafter be pointed out with particularity in the claim; but, for a full understanding of our 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 view, partly in elevation and partly in section, of an apparatus embodying the present invention; Fig. 2 is a section on line 2—2 of Fig. 1; Fig. 3 is a section on irregular line 3—3 of Fig. 1; Fig. 4 is a section on line 4—4 of Fig. 1; Fig. 5 is a section on line 5—5 of Fig. 1; Fig. 6 is a view, on a larger scale and looking toward the right from a point to the left of Fig. 4 of the main air valve and certain parts appearing to the right of the valve in Fig. 4; Fig. 7 is a section on line 7—7 of Fig. 1; and Fig. 8 is a diagram illustrating the control system for the blower.

In the drawings the actual blowing element and the mounting for the same on the furnace wall are shown as being substantially like the same parts in our aforesaid Patent No. 2,368,612. In other words, 1, as appears in Fig. 5, represents a furnace wall having therein a long, narrow, vertical opening in which is fitted and fixed a housing 2 open on the inner side of the furnace wall and projecting a substantial distance outwardly from the latter; the housing being divided into two sections on a plane remote from and parallel to the wall; the outer section being secured to the inner section in any suitable way

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to permit the clamping between the sections of a pair of bearings 4 that support a tubular shaft 5; and the tubular blowing element 6 being fixed to the shaft and receiving cleaning fluid therefrom.

As best shown in Fig. 1 the tubular shaft 5, which is closed at both ends, extends barely beyond the housing on one side, while projecting a considerable distance on the other side. This shaft is preferably made in two sections coupled together outside of the housing, as indicated at 7, at a point between the housing 2 and the gear casing to be described later. The endmost portion of the long, protruding part of the shaft extends through and is rotatable in an extension 8 of a blower head 9 of any usual or suitable type. The central part of the member 8 contains a chamber 10 surrounding the shaft and larger in diameter than the latter. Cleaning fluid, usually steam, passes from the head into the chamber 10 and from there into the interior of the shaft through ports 11 in the wall of the latter. Escape of cleaning fluid from chamber 10 along the exterior of the shaft is prevented by suitable packing 12 that surrounds the shaft in the tubular end sections of member 8.

The head 9 is hung from an overlying bracket 14 by means of an adjustable screwthreaded rod or stud 15. The bracket projects from the side of a gear casing 16 which is in turn hung from a sturdy round bar 17 fixed at one end to and projecting from one side of the housing 2 near the top of the latter and above and parallel to the tubular shaft. The tubular shaft of course passes through the lower part of the gear casing which therefore provides a further bearing for the shaft. In the arrangement shown the casing has on top a block 18 containing a long bore in which the round bar 17 is a sliding fit. Set screws 19 serve to lock the block to the bar, while permitting detachment of the latter when desired.

The tubular shaft 5 is adapted to be oscillated by a suitable engine 20 fixed to the side of the gear casing above the bracket 14; this engine being conveniently similar to those shown in our prior application Serial Number 539,552 filed June 9, 1944, which issued May 4, 1948, as Patent No. 2,441,112 and to which reference may be had for the details thereof. This engine drives the tubular shaft through gearing located in the gear casing. As can be seen from Figs. 2 and 7, the engine shaft 21 has thereon, in the gear casing, a pinion 22 that meshes with a gear wheel 24 on a shaft 25. On this latter shaft, as

best shown in Fig. 1, is a worm 26 which meshes with a worm wheel 27 on a shaft 28. On the shaft 28 is a worm 29 meshing with a worm wheel 30 on a shaft 31 that parallels the tubular shaft 5 and protrudes at one end from the side of the gear casing toward the housing 2. There is also on the shaft 31 a pinion 32 which meshes with a gear wheel 34 on the tubular shaft. Consequently, when the engine runs, the tubular shaft turns slowly in a direction that is determined by the direction in which the engine shaft rotates.

Although the tubular shaft turns through an angle of only about ninety degrees (as illustrated by the two extreme positions indicated by full and broken lines, respectively, in Fig. 5), the engine must rotate many times to swing the blowing element from one extreme position to the other.

The shaft 31 serves not only as a part of the driving means between the engine and the tubular shaft, but also as a part of a controller to reverse the engine after the latter has made a sufficient number of turns to raise the tubular blowing element into the full line position of Fig. 5; thereby causing further operation of the engine in a direction to lower the blowing element again into the dotted or broken line position in Fig. 5. For this purpose there is fixed on the protruding end of the shaft 31 a disc 35 on which are a plurality of peripheral lugs that can be adjusted circumferentially of the disc independently of each other. In the arrangement shown, there are three such lugs, those numbered 36 and 37 serving to operate a reversing valve, while lug 38 acts to shut off the supply of energizing fluid to the engine at the end of a cycle of operation.

Mounted on the outside of the gear casing above the disc 35 is a reversing valve 39 which, like that in our aforesaid application Ser. No. 539,552, may be shifted by pneumatically operated plungers or pistons, or mechanically by the lugs 36 and 37 on the disc 35; the shifting of the reversing valve through the action of the lugs being effected by causing one or the other of these lugs to engage with and move an operating finger 40 for the valve. For operating the reversing valve through the action of fluid pressure, we have provided a pair of pipes, 41 and 42, to deliver air under pressure into either of the two cylinders 44 and 45; these cylinders containing pistons or plungers, not shown, associated with the valve as in the last mentioned application.

Mounted on what may be called the front side of the gear casing is a self-closing valve 46 similar to the main valves in our aforesaid application Ser. No. 539,552. It is believed sufficient to explain the functions of the valve since the structural details thereof are not features of the present invention. Air under pressure is supplied to the valve through a pipe 47 and, when the valve is open, air flows therefrom to the reversing valve 39 through a pipe 48 and to a pneumatic actuator 49 for the usual pilot valve in the blower head 9 through a pipe 50. As best seen in Figs. 4 and 6, the movable element of main valve 46 has a stem 51 protruding from the casing thereof; this stem being provided with a head 52 on its outer end. When air under pressure is introduced into the main valve device through a pipe 54 the movable element of the main valve is driven in the direction to cause air from pipe 47 to flow out through pipes 48 and 50; the stem 51 being caused to protrude farther in such open position of the valve than it does when the valve is closed. As

in the last mentioned application, there is a rocking dog or latch 55 tending constantly to swing into and remain in a position wherein one end thereof lies under or behind the head 52 to hold the main air valve open. The other end of the latch lies in the path of a pin 56 on the lug 38 which is adjustably mounted on the wheel or disc 35.

It will be seen that the pipe 41, which leads to one of the pneumatic actuators for the reversing switch or valve, is a branch of pipe 54 that delivers the fluid to open the main air valve. Thus air is admitted simultaneously to the main air valve to open the same and to the operating means for the reversing valve, in the starting of a cycle. Consequently, if the reversing valve is not in the proper position to cause the engine to run in the direction to swing the blowing element up at the time of opening the main air valve to energize the engine, the reversing valve will be shifted to establish the proper conditions.

The reversing valve is connected to the engine by two pipes 57 and 58. Either of these pipes may be the supply pipe for the engine and the other the exhaust pipe, depending on the position of the reversing valve; the direction of rotation of the engine being determined by the direction of flow through these pipes.

Any desired number of blower units may be operated from a simple control panel. In the diagram, Fig. 8, there is a small panel 59, adapted to control two units. In the main, this panel may be like that illustrated in detail in our aforesaid application Ser. No. 539,552; there being two push buttons, 60 and 61, that serve to admit air under pressure, supplied through a pipe 62, to the pipes 54 of two units. A third button 64 is adapted to admit air to the pipes 42 of both units, simultaneously. In other words, either blower unit may be started independently of the other by pressing the corresponding push button, 60 or 61, while both units may be caused to return to their idle positions through the actuation of a single push button 64; the admission of air to the pipes 42 causing the engines to be reversed if they be not already rotating in the direction to swing the tubular blowing elements down into their idle positions.

Before describing the operation of the apparatus in more detail, attention is called to the fact that whereas in Figs. 1 and 5 the blowing element is shown only in the fully raised or fully lowered positions, Fig. 4 illustrates conditions as they exist when the blowing element is in an intermediate position. However, starting from a position of rest, with the blowing element hanging straight down, the lug 38 is holding the latch 55 clear of the head 52 on the valve stem 51; the reversing valve is in the position it occupies in Fig. 4; and the lug 37 is engaged with or near the actuator 40 for the reversing valve. Upon pressing push button 60 air flows from pipe 62 into pipe 54 and is carried thereby, and by branch pipe 41, to the main air valve device to open the main air valve and to the pneumatic actuator for the reversing valve to shift the same if it be not already in the desired position. The engine now starts and the blowing element begins to swing up. As the lug 38 on the control disc moves away from the latch, the latter swings under the head 52 on the outer end of the stem of the movable member of the main air valve, as shown in Fig. 4, and holds the main air valve open. When the blowing element is about to reach its extreme raised position the lug 36 engages the actuator 40 for the reversing valve and

causes this valve to be shifted and the engine to be reversed. As the blowing element nears its idle position again, toward the end of a cycle, the lug **37** again shifts the reversing valve and the lug **38** trips the latch **55**; the tripping of the latch allowing the main valve to close and causing the engine to stop. Should the engine stop before the reversing valve has been shifted then, upon beginning the next cycle through the actuation of button **60**, the pneumatic actuator will throw the reversing valve into the proper position for repeating the cycle just described.

In an emergency, the pressing of button **64** will cause all of the units that are connected in the system to return their blowing elements to their idle positions as quickly as possible, reversing such of the engines as are at the time driving their blowing elements upward and causing those elements to start back before reaching the normal turning points.

It will be seen that by having all of the lugs **36**, **37** and **38** on a single disc, a setting of the controls for any desired sweep of the tubular blowing element may easily be made, because the workman sees all three lugs while he is adjusting any one of them. Furthermore, by employing a single push button for returning any desired number of blowing elements to their idle positions and individual buttons to cause them to swing in the opposite direction, the control panel as well as the control system as a whole is greatly simplified.

We claim:

In combination, a tubular blowing element mounted for swinging movements to and from an idle position, a rotary engine, gearing between the engine and said element to cause the latter to operate at a much lower speed than the engine, means to deliver energizing fluid to the engine, a valve to control the direction of rotation of the engine, a valve to shut off the supply of fluid to the engine, means to open the shut off valve, a latch to hold the latter valve open, a disc driven by the engine, and devices adjustable circumferentially of the disc to control the first of said valves and to trip said latch to complete and end a blowing cycle after the same has been started.

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