

April 23, 1929.

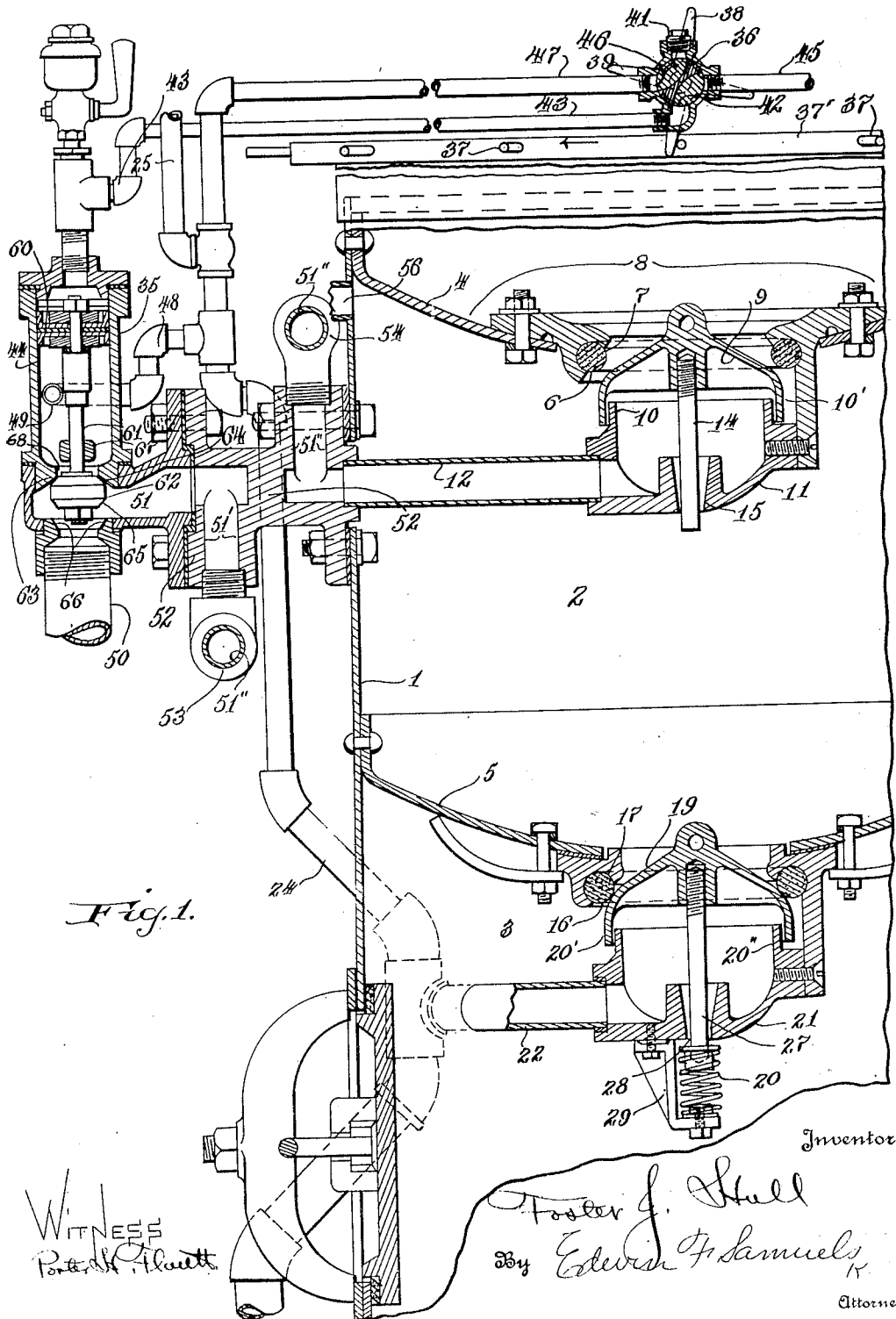
F. J. HULL

1,710,169

SAND BLAST MACHINE FOR APPLYING PRESSURE TO ABRASIVES

Filed July 2, 1927

3 Sheets-Sheet 1



April 23, 1929.

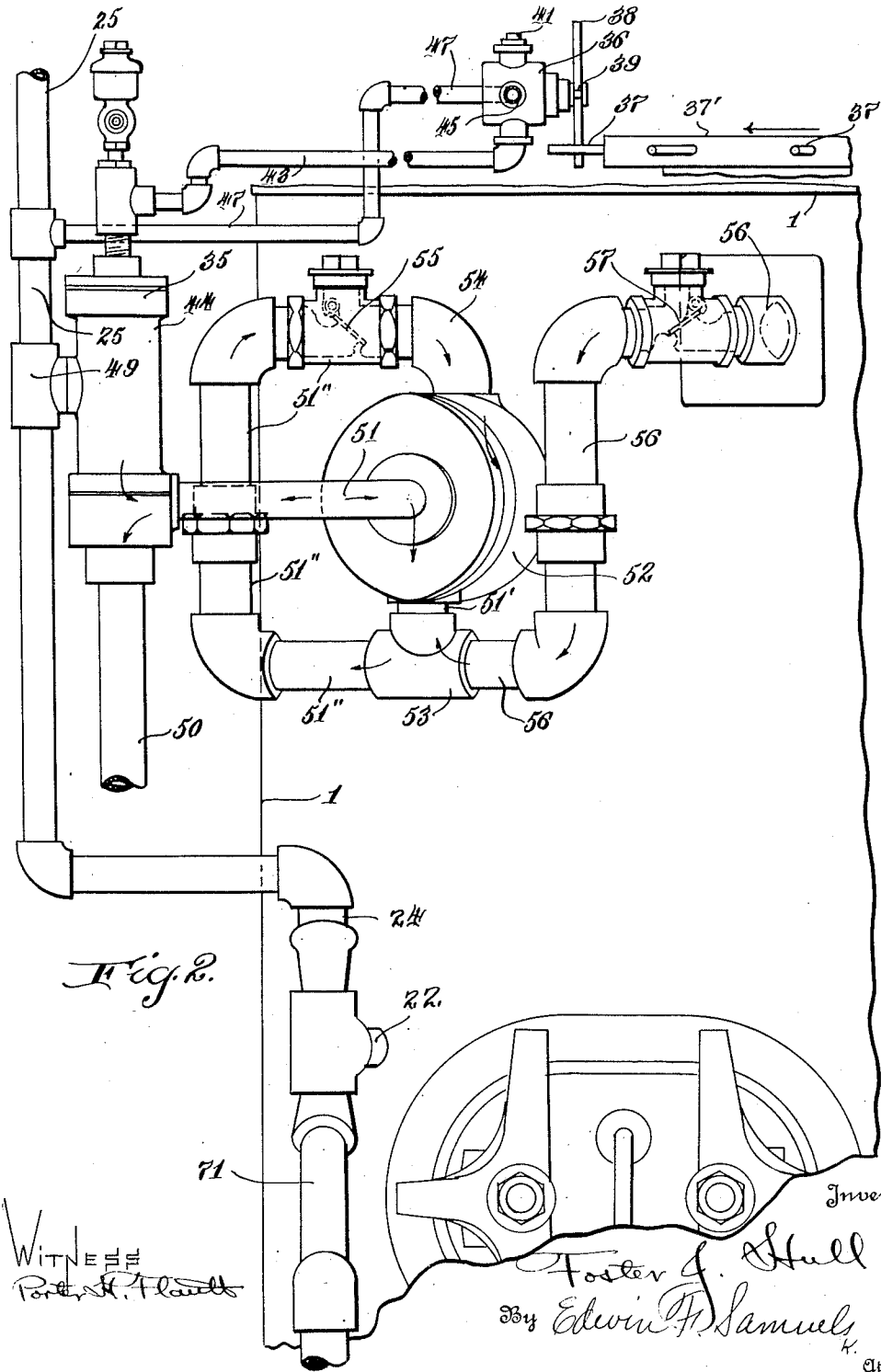
F. J. HULL

1,710,169

SAND BLAST MACHINE FOR APPLYING PRESSURE TO ABRASIVES

Filed July 2, 1927

3 Sheets-Sheet 2



April 23, 1929.

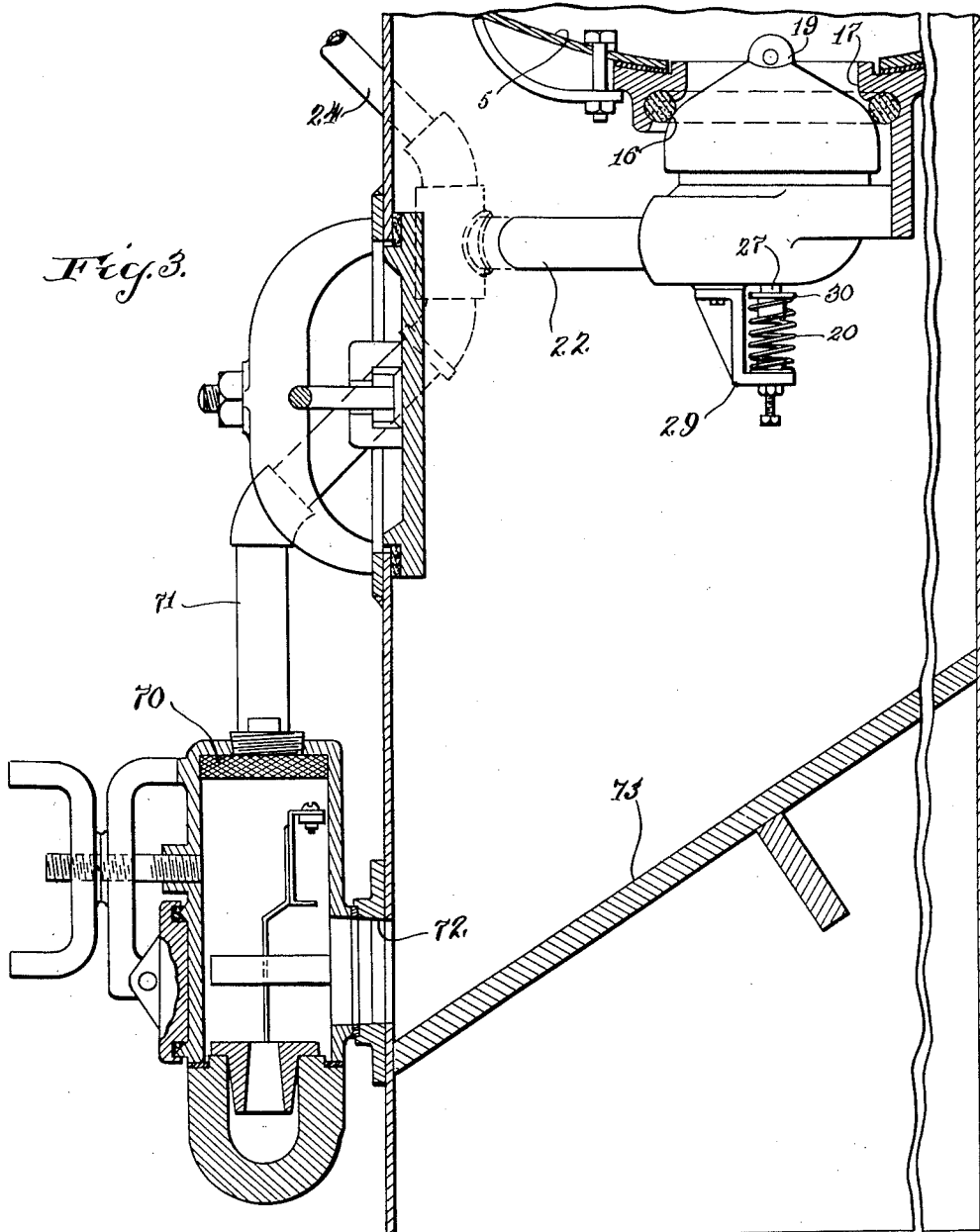
F. J. HULL

1,710,169

SAND BLAST MACHINE FOR APPLYING PRESSURE TO ABRASIVES

Filed July 2, 1927

3 Sheets-Sheet 3



WITNESS
Robert H. Flavelle

Foster J. Hull Inventor
By Edwin H. Samuels
Attorney

UNITED STATES PATENT OFFICE.

FOSTER J. HULL, OF HAGERSTOWN, MARYLAND, ASSIGNOR TO PANGBORN CORPORATION, OF HAGERSTOWN, MARYLAND, A CORPORATION OF MARYLAND.

SAND-BLAST MACHINE FOR APPLYING PRESSURE TO ABRASIVES.

Application filed July 2, 1927. Serial No. 203,058.

The subject of the invention is a sand blast pressure tank and apparatus for applying air pressure to granular abrasive, the same being used in connection with a sand blast machine in which castings and other articles to be cleaned or abraded are subjected to a blast of granular abrasive projected by air or other fluid under pressure. The invention relates particularly to the provision of means whereby a continuous supply of abrasive under pressure is provided so as to make possible a continuous discharge of abrasive at the nozzle avoiding stoppage for filling, etc. In the form of the invention illustrated the air pressure tank employed is divided into two sections, each-section having a concave top which serves as a basin or container for abrasive, the center of the concavity being formed with a downwardly disposed valve seat and a valve for passing and controlling the passage of abrasive downwardly into each chamber, the valves being held in contact with the seat by the fluid pressure from below and opened by the weight of the valve and the abrasive when the pressure is released or equalized.

In accordance with the principle of the invention air pressure is built up in and exhausted from the upper chamber alternately as the abrasive is discharged and admitted respectively. The release is provided, i. e., the exhaust of the pressure to normal atmosphere, to admit abrasive to the upper chamber by opening the abrasive valve to the outside. Pressure is then built up in the upper tank so that the abrasive may be passed from the upper tank to the lower tank where a supply of abrasive under air pressure is maintained continuously.

The upper valve is closed by the inflow of air under pressure. On account of the absence of a sufficiently positive application of pressure in the lower chamber to close the valve it is assisted in the closing operation by a spring.

The operation of the abrasive valves and the air pressure supply is determined by a controller valve, referred to as a star wheel valve, operated from the sand blast table. A continuous supply of abrasive under pressure is thus made available and fed to the nozzle during the entire period of operation of the machine.

When the pressure in the upper chamber is released the escape of the air from within the body of the abrasive particles raises the particles and produces a boiling action, and the rush of the exhaust carries some of the particles into the passages. This formerly resulted in clogging of the passages.

An important feature of the invention resides in the provision, in addition to the inlet air pressure passage supplying air under pressure to the upper chamber, of a separate exhaust passage protected from the abrasive with means for controlling the inflow and exhaust accordingly, whereby the tendency to clog with abrasive the inlet air passage, which in the previous constructions served as both inlet and exhaust passage, is overcome. The clogging difficulty experienced in the prior existing practice was an incident to the exhaust by way of the air inlet passage. The entrance of the air through this passage with the tendency of the air to expand in the passage causes a deposit of moisture therein. The former practice of exhausting the upper chamber through the inlet passage had the effect of carrying the abrasive into this passage where it becomes moistened from the deposited moisture clogging the passage with moist abrasive.

In the present machine where the momentum of the incoming air is applied directly to the abrasive valves to close them, being preferably confined between closely related relatively moving baffles, the discharge of the abrasive through the air inlet passage is most harmful, as the clogging interferes with the operation of the abrasive valves.

In the accompanying drawings I have illustrated an apparatus for applying air or other fluid pressure to the abrasive prior to mixing, said apparatus embodying the features of my invention in the preferred form.

In the drawings:

Figure 1 is a fragmentary central vertical section through the tank, also showing the controller valves, the showing of the pipe connections being diagrammatic in the sense that they are somewhat distorted for purposes of illustration; a fragment of the sand blast table turret is also shown.

Figure 2 is an elevation at right angles to Figure 1 showing the upper portion of the tank fragmentarily and showing the cylinder

valve and star wheel valve in elevation, the pipe connections also being shown in elevation.

Figure 3 is a fragmentary section of the lower portion of the tank taken in the same plane as is Figure 1, the main portion of the view being below that shown in Figure 1 and including the bottom of the tank.

Referring to the drawings by numerals, each of which is used to indicate the same or similar parts in the different figures, the apparatus, as shown, comprises a sand blast pressure tank 1 divided into two chambers comprising an upper or primary chamber 2 and a lower or secondary chamber 3. The tank has a concave head 4 serving as the top wall of the upper chamber and a concave central partition 5 serving as the top wall of the lower chamber and the bottom wall of the upper chamber.

In the center of the concavity of the head or top wall 4 of the upper chamber is a downwardly disposed abrasive valve seat 6 surrounding a valve opening 7, it being understood that reclaimed and new abrasive to be used in the blast is delivered to the basin or concavity 8 formed by the head 4. Cooperating with the seat 6, which is preferably in the form of a packing ring or gasket, is the upper valve 9 for controlling the abrasive, the said valve closing upwardly against the seat and opening downwardly into the chamber 2. This valve is preferably of the inverted bell form and encircles at its lower edge, which is shown in the form of a short cylinder 10', the periphery or mouth 10, also cylindrical, of the discharge nozzle 11 of the inlet air pressure pipe 12 leading to the upper chamber 2 of the tank. It will be further noted that the valve 9 is provided with a depending stem 14 which cooperates and slides in a guide 15 in the bottom center of the discharge nozzle 11.

The central partition 5 is provided at the center of its concavity with a downwardly disposed valve seat 16, also preferably in the form of a soft ring or packing, encircling the valve opening 17 which is closed by the lower abrasive controlling valve 19 which closes upwardly against the seat 16. Both valves are held in closed position against the weight of the abrasive by the excess of pressure from below in the respective tanks, as hereinafter described, the lower valve having in addition a spring 20 to assist in moving it to its seat.

This valve 19 is similar to the valve 9 and similarly encircles the inlet pressure air nozzle 21 leading to the lower chamber. This valve also has the lower edge of its bell formed in a short cylinder 20' encircling the cylindrical mouth 20'' of the nozzle 21, the pressure air being led to said nozzle by an air pipe 22 connected to the air pressure by an air pipe 24, the source of air under pressure being indicated by reference character 25.

In the form shown the valve 19 has a cen-

tral pin or stem 27 which slides in an opening 28 in the bottom center of the nozzle 21, the spring 20 being applied to the lower end of the stem 27, and being supported by a depending bracket 29 secured to the bottom of the nozzle and bearing at its upper end against a flange 30 secured to the valve stem.

Figures 1 and 2 are more or less diagrammatic as to the piping and placing of the controller or star wheel valve, cylinder valves, air pressure supply, etc., the pipes being distorted for purposes of illustration.

The admission of air to the upper chamber 2 and the release therefrom is determined by cylinder valve 35, which valve is in turn controlled and operated by controller valve 36 shown in the form of a star wheel valve which, in the preferred form of the invention shown, is operated at predetermined intervals by suitable dogs or radial arms 37 engaging star wheel 38 which serves as the shaft or axis of the star wheel valve 36. The arms or pins 37 may be operated in any suitable manner, being preferably carried by a work carrying device, as a sand blast table, shown fragmentarily at 37'.

The star wheel valve 36 is in the form of a three-way valve or, in the specific form shown, a four-way valve having one opening plugged at 41. Of the other three openings one indicated by reference character 42 is connected by a pipe 43 to the top of the cylinder 44 of the cylinder valve 35. The next opening in left handed rotation from the opening 42, the same being indicated by reference character 45, is open to the outside air and referred to as the exhaust opening, the opening 42 being referred to as the cylinder valve connection. The third star wheel valve opening 46 is connected in any suitable manner, as by means of pipe 47, to the air pressure supply 25, which air pressure supply 25 is also connected by a pipe 48 to a central inlet 49 of and to the cylinder valve cylinder 44.

The cylinder valve cylinder is also provided with an exhaust to the outside air at its lower end at 50 and further connected laterally at its lower end just above the exhaust pipe by a passage 51 to a flanged fitting 52, said passage 51 entering said fitting centrally and connecting with a radial passage 51' which leads outwardly through a T 53, the left branch of said T, see side view Figure 2, leading to a passage or pipe 51'', which extends around the fitting 52 and enters the top of the same by way of an elbow 54 included in the passage 51'', the elbow 54 forming a continuation of the passage 51'' which enters the tank by way of the pressure inlet 12, said passage including a non-return valve 55 which prevents the exhaust of air by way of the passage 12, 51'', 51', 51 under any and all circumstances and consequently prevents the entrance of abrasive into this pipe.

The right hand branch of the T 53 at the bottom of the fitting 52 is connected by way of a pipe 56 to the top chamber 2 of the tank 1, the pipe 12 being a supply or inlet pressure pipe and the connection 56 being an exhaust pipe containing a nonreturn valve 57 to control the flow of air, as described. The exhaust pipe is located well up near the top edge of the tank where it is partly protected from flying particles of abrasive thrown up by the boiling action described. The main object of the two passages, however, is to avoid the accumulation of abrasive in the inlet compressed air passage where it will be wet by the moisture deposited therein by the expanding compressed air, resulting in clogging of the passage with wet abrasive.

An important feature of the invention resides, as already pointed out, in the means whereby the exhaust of air from the upper chamber by way of the air pressure supply passage 12 and consequent clogging of the control valves and passages is prevented. The second passage 56 and the nonreturn valves in connection with the control valves cause the exhaust of the chamber to take place through the passage 56 only. This prevents accumulation of moisture from the inflowing expanding compressed air in the exhaust passage from which passage abrasive cannot be wholly excluded. The wet abrasive clogs while the dry material gives little trouble. The single direction of flow also has an important bearing, as the rush of the air and accumulated pressure serve to break down any barriers of accumulated abrasive. The inlet pressure passage 12, while it is at times open to the exhaust by way of the cylinder valve, is closed at its other end by the nonreturn valve 55, preventing the entrance of abrasive into this passage, which is necessarily wet from the expanding compressed air. The one way in both passages also helps to prevent clogging.

It will be understood that the abrasive in the chamber 2 having been placed under pressure and the pressure being suddenly released, the air impounded within the bounds of the abrasive thus being caused to suddenly expand and escape, causes what is termed a boiling of the abrasive, filling the entire volume of the chamber with moving particles which tend to pass out through the exhaust and which have, prior to the development of the device described, caused clogging of the passage 12 and of the abrasive valve, the result being that the apparatus was from time to time rendered inoperative. The necessity for frequent overhauling and consequent loss of the use of the apparatus is avoided and overcome by means of this portion of the invention.

The cylinder control valve 35 comprises in connection with the cylinder 44 a piston 60 mounted to reciprocate in the cylinder after

the manner of the usual pump or engine piston. It will be noted in this connection that the passage 43 from the star wheel control valve enters the cylinder at the head and hence above the piston in all positions.

The piston is mounted on a piston rod 61 which carries at its lower end a double acting or two surface valve 62 which cooperates as to its upper valve surface with a downwardly disposed pressure valve seat 63, the valve surface being indicated by reference character 64, and as to its lower exhaust valve surface 65 with an exhaust valve seat 66 at the lower end of the cylinder. It will be noted that the passage 51, 51', 51'' leading to the pressure supply passage 12 is connected to the cylinder between the pressure valve seats 63 and the exhaust valve seat 66 and that the exhaust pipe or passage 50 is connected to or leads from the exhaust valve seat 66. The pressure passage 49 enters the cylinder valve below the piston and above the pressure valve seat 63, i. e., between the piston and the pressure valve seat. The piston rod is provided with a guiding member 67 which enters a guide passage or cooperates with a guide surface 68 just above the pressure valve seat 63.

The connection 24 leading from the supply of air under pressure to the inlet air pressure passage 22 in the lower chamber has been described. The air pressure supply passage 24 is also connected to air and abrasive mixing valve 70, the pipe being indicated by reference character 71.

It is not considered necessary to describe the mechanism of the mixing valve, the same being of any preferred construction, the one specifically illustrated being shown in detail in my co-pending application No. 98,977.

The disclosure also includes a passage 72 for the abrasive, the same leading from the bottom of the tank to the mixing valve and the bottom chamber is preferably provided with an inclined bottom wall 73 leading the abrasive to the passage 72.

In the operation of the pressure applying apparatus, it being first assumed that the exhaust valve passage 50 and seat 66 of the cylinder control valve are open, the upper abrasive valve 9 being likewise held open by the weight of the abrasive in the basin or receptacle 8 formed by the concavity in the top of the tank, the air in the upper tank is in this position of the apparatus exhausted or open to the outside air through and by way of passage 56, including the T 53 and radial passage 51' leading to the central passage 51 in the fitting 52 and hence to the cylinder valve immediately above the exhaust seat 66 which is open. The pressure seat 63 is at this time closed by the pressure valve seating surface 64.

The star wheel valve in this position of the apparatus provides an opening of the pas-

sage 43 from on top of the cylinder 44 above the piston 60 to the outside air by way of exhaust passage 45 of said valve, the piston being held in the upper position by air under pressure entering the cylinder at the center from the pressure supply 25 by way of pressure pipe 49.

After the passage of a predetermined period sufficient to allow the admission of the necessary load of abrasive into the upper chamber 2, the position of the star wheel controller valve 36 is changed in any suitable manner, as by hand or by contact with the star arms 39 of the radial pins 37 carried by the rotary turret of the sand blast table shown fragmentarily at 37', Figures 1 and 2, beyond the tank 1. The valve is thus rotated, connecting the port 42 to the port 46 whereby the passage 43 which leads to the top of the cylinder above the piston is connected to the air pressure pipe 47 from the air pressure supply 25. The downward pressure on the top of the piston 60 resulting from the admission of air pressure by way of pipe 43 added to the downward pressure on the top of the pressure and exhaust valve 62 moves the latter downward bringing it into contact with the exhaust valve seat 66 and closing the exhaust valve passage 50 opening the passage through the pressure seat 64 and admitting air under pressure to the passage 51, hence through 51', 51'' and 12 to the upper chamber. The rush of air from the nozzle 10 enters the skirt of the bell valve 9, serving to close the latter immediately, the excess of pressure built up by the admission of pressure air to the chamber holds the valve closed until the end of this step of the operation. It will be understood that the nozzle or cup 10 and the lower edge 10' of the valve act as closely related relatively moving baffles, directing the incoming air against the valve, applying the momentum of the air to the closing of the valve. In the lower chamber with the valve 19 the construction is the same, but the closing effect of the air is less marked, as this chamber is not filled with compressed air and discharged in the regular operation of the machine, as is the upper chamber.

The one way valve 57 in the passage 56 prevents the by-passing of the air through the passage 56 which might reduce the tendency to close the valve 9 and retard its closure.

By the building up of pressure in the chamber 2 to the pressure of the air supply air under pressure being admitted by way of passage 48, cylinder 44, passages 51, 51', 51'' and 12 when the piston valve is in its lower position the pressure on the opposite sides of the abrasive supply valve 19 at the top of the lower chamber is equalized and the weight of the valve and the abrasive on top of the valve serves to open it, overcoming

the slight tension of the spring 20. The accumulated abrasive in the upper chamber is thus permitted to pass through the opening 17 in the valve seat 16 into the lower chamber 3 where it passes down the inclined floor 73 accumulating above and about the mixer valve opening 72.

The timing of the parts being such as to produce the desired operation, the position of the star wheel controller valve is again changed by contact with one of the pins 37 carried on the rotary table 37' with one of the arms of the star, the valve being returned to the original position in which the top of the cylinder 44 of the cylinder controller valve 35 is again connected to the exhaust port 45 of the star wheel valve, the pressure pipe 47 being closed, i. e., connected to the plug 41. In this condition of the valves the piston is returned to its top position and the passage 57 leading from the top of chamber 2 is again open to the exhaust, the passage 12 and 51'' being closed by the nonreturn valve 55.

The exhaust of the air pressure from the upper passage 56 relieves the downward pressure on the valve 19 in the top of the lower chamber 3 cooperating with the opening 17 which admits abrasive to the lower chamber 3 permitting the valve to move toward closing position, actuated by the flow of air from the cylindrical nozzle 20'' into the skirt cylinder 20'. The weight of the abrasive having been removed from the top of the valve, the action of the spring 20 serves to assist and complete the closing operation and the pressure below the valve, the pressure being in the mean time exhausted from the upper chamber, holds the lower valve in closed position. In this way loss of pressure from the lower chamber is prevented and abrasive under air pressure is fed continuously to the mixing valve.

Regarding the spring 20 it will be understood that in the absence of this spring there would be a tendency, when the pressure is exhausted from the chamber 2 and air under pressure is being admitted to the lower chamber 3, for the air to seep around the valve prior to its closing tending to equalize the pressure and retard the closing operation. For this reason the assistance of the light spring 20 is regarded as desirable, bringing the valve in contact with its seat and permitting the complete exhaustion of chamber 2 to atmospheric pressure, while the pressure in the lower chamber is retained constant substantially at air supply pressure thus furnishing a supply of abrasive under pressure which is continuous throughout the operation of the machine, without interruption for filling, building up pressure, etc., and consequent loss of time of the machine and time of the operative.

I have thus described specifically and in detail means for applying fluid pressure to the

abrasive in connection with a sand blast machine, the description referring to the apparatus and the operation specifically and in detail in order that the nature and operation of the invention and the manner of applying the same may be clearly understood, however, the specific terms herein are used descriptively rather than in a limiting sense, the scope of the invention being defined in the claims.

What I claim as new and desire to secure by Letters Patent is:

1. In a sand blast apparatus, means for applying fluid pressure to the abrasive comprising a tank having upper and lower chambers, valves for the admission of abrasive by gravity to the upper chamber and from the upper to the lower chamber, means for providing a supply of air under pressure and an air pressure passage delivering air into each said chamber the passage to the upper chamber projecting the air against the abrasive inlet valve therein in the direction of closing, an exhaust passage leading from the upper chamber and nonreturn means for this passage and nonreturn means for the inlet passage to the upper chamber, a controller valve for the passages connected with the upper chamber and timing means operating said controller valve to successively admit air to and exhaust air from the top chamber, pressure being maintained in the lower chamber.

2. In a sand blast apparatus, means for applying fluid pressure to the abrasive comprising a tank having primary and secondary chambers, a valve and passages providing for and controlling the admission of abrasive to said primary chamber and from the primary to the secondary chamber, means for maintaining a supply of air under pressure and an air pressure passage delivering air into each said chamber, a separate exhaust passage leading from the primary chamber, said pressure and exhaust passages being spaced apart where they enter and leave the tank and having a portion in common providing a pressure and an exhaust seat, valve means co-operating with said seats and automatic means operating the same for controlling the inlet and exhaust passages to and from the upper chamber maintaining continuous pressure and a supply of abrasive in the lower chamber and means excluding the pressure air from the exhaust passage and the exhaust air from the pressure passage leading to the primary chamber.

3. In a sand blast apparatus, means for applying fluid pressure to the abrasive comprising a tank having primary and secondary chambers, valves and passage providing for and controlling the admission of abrasive to said primary chamber and from the primary to the secondary chamber, means for maintaining a supply of air under pressure and an air pressure passage delivering air into each said chamber, a separate exhaust passage lead-

ing from the primary chamber at a point spaced away from the air pressure passage, said passages leading to and from the primary chamber having means connecting them to adjacent points of control and a single automatic means for controlling both the inlet and exhaust passages to and from the primary chamber excluding the exhaust from the air pressure passage and the pressure air from the exhaust passage maintaining continuous pressure and a continuous supply of abrasive in the lower chamber.

4. In a sand blast apparatus, means for applying fluid pressure to the abrasive comprising a tank having primary and secondary chambers, valves for the admission of abrasive to said primary chamber and from said primary to the secondary chamber, means for providing a supply of air under pressure and an air pressure passage with a means delivering air into the primary chamber tending to close the abrasive valve therein, an exhaust passage leading from the primary chamber, controlling means for said passages connected to the primary chamber, said controller comprising a controller valve, timing means for operating the same at intervals and a cylinder and piston valve controlled by said controller valve, means having an air pressure port, an exhaust port and valve means operating to close and open them alternately and connected to the piston to be operated thereby, the air pressure passage and the exhaust passage for the primary chamber being connected to said pressure and exhaust ports of the latter valve whereby the operation of the piston serves to alternately admit pressure to the upper chamber and exhaust the air therefrom by way of the respective pressure and exhaust ports.

5. In a sand blast apparatus, means for applying pressure to the abrasive comprising a tank having upper and lower chambers with an abrasive controlling valve in the top of each chamber, said chambers having seats engaged by said valves from a direction opposite to the flow of abrasive, means for supplying air under pressure, means for generating and exhausting pressure in and from the upper chamber comprising an inlet air pressure passage leading to said chamber, an exhaust passage for said upper chamber, a non-return valve in the air pressure passage leading to the upper chamber, an air pressure passage to the lower chamber, the air pressure tending to close the abrasive valve leading to the upper chamber, and means comprising a controller valve controlling and timing the flow of compressed air to said upper chamber and the release by way of the exhaust passage from the upper chamber.

6. In a sand blast apparatus, means for applying pressure to the abrasive comprising a tank having upper and lower chambers with an abrasive admission valve in each

chamber, an inlet air pressure passage leading to each chamber, the pressure passage to the upper chamber having delivery means in close engagement with the abrasive valve in

5 said upper chamber to close the same, a separate exhaust passage for said chamber and an automatic controller valve, an air pressure supply passage to said controller valve and means operating the controller valve to
10 alternately open the exhaust passage and connect the air pressure passage to the air pressure supply, and means for preventing the passage of the exhaust through the delivery means in the upper chamber.

15 7. In a sand blast apparatus, means for applying air pressure to the abrasive comprising a tank having primary and secondary chambers, valves for the admission of abrasive to the primary chamber and from the
20 primary chamber to the secondary chamber and means for providing a supply of air under pressure including an air pressure passage leading to each chamber, an exhaust passage leading from the primary chamber, non return
25 means in both the pressure and exhaust passages of the primary chamber, means for controlling the passages to and from the primary chamber to successively admit air to

and exhaust air from the said chamber whereby a continuous supply of abrasive under 30 pressure is maintained in the secondary chamber.

8. In a sand blast apparatus, means for applying air pressure to the abrasive comprising a tank having primary and secondary 35 chambers, valves for the admission of abrasive to the primary chamber and from the primary chamber to the secondary chamber and means for providing a supply of air under pressure and an air pressure passage 40 leading to each chamber, an exhaust passage leading from the primary chamber, non return valves in both the pressure and exhaust passages of the primary chamber, means for 45 controlling the passages to and from the primary chamber to successively admit air to and exhaust air from the said chamber whereby a continuous supply of abrasive under pressure is maintained in the secondary chamber, overlapping, relatively moving, air 50 baffles presenting the air supply which flows to the upper chamber to the abrasive valve leading thereto to close the valve.

Signed by me at Hagerstown, Maryland, this 28th day of June, 1927.

FOSTER J. HULL.