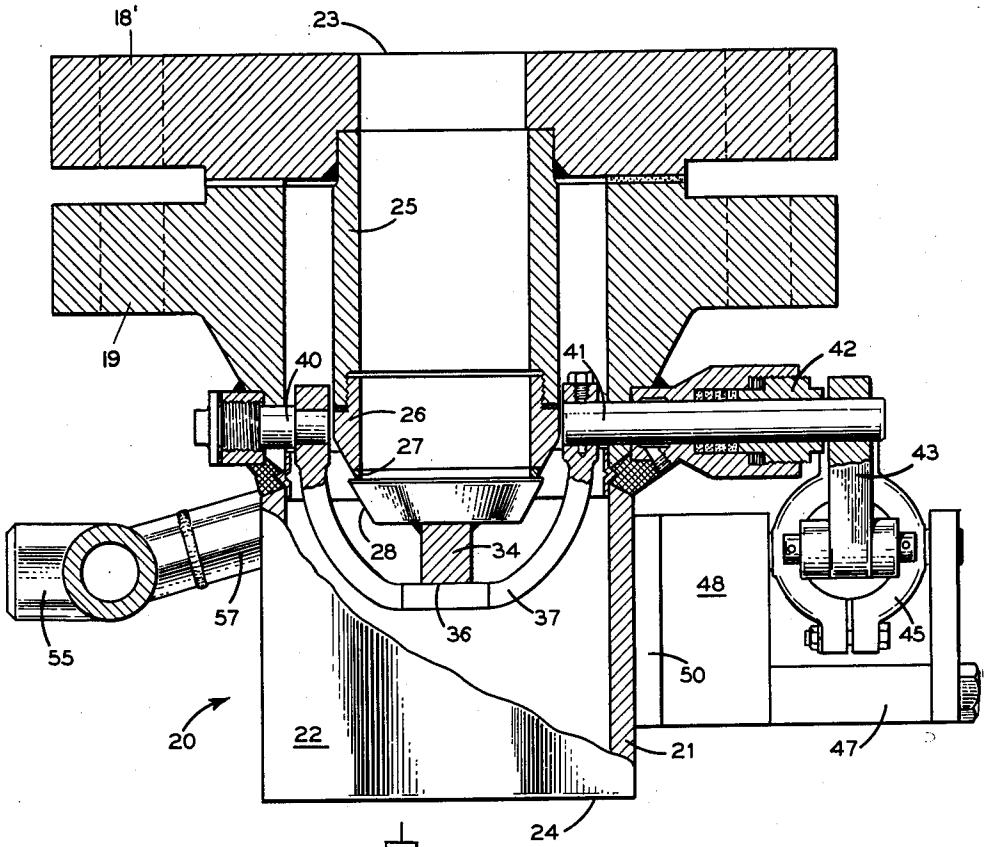
Jan. 29, 1963 L. W. YODER 3,075,539

POSITIVELY ACTUATED VALVE MEANS

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FIG. 2



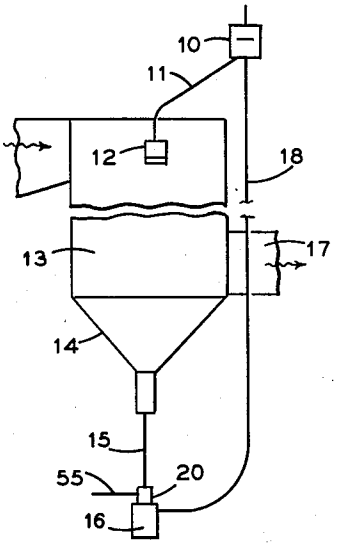


FIG. 1

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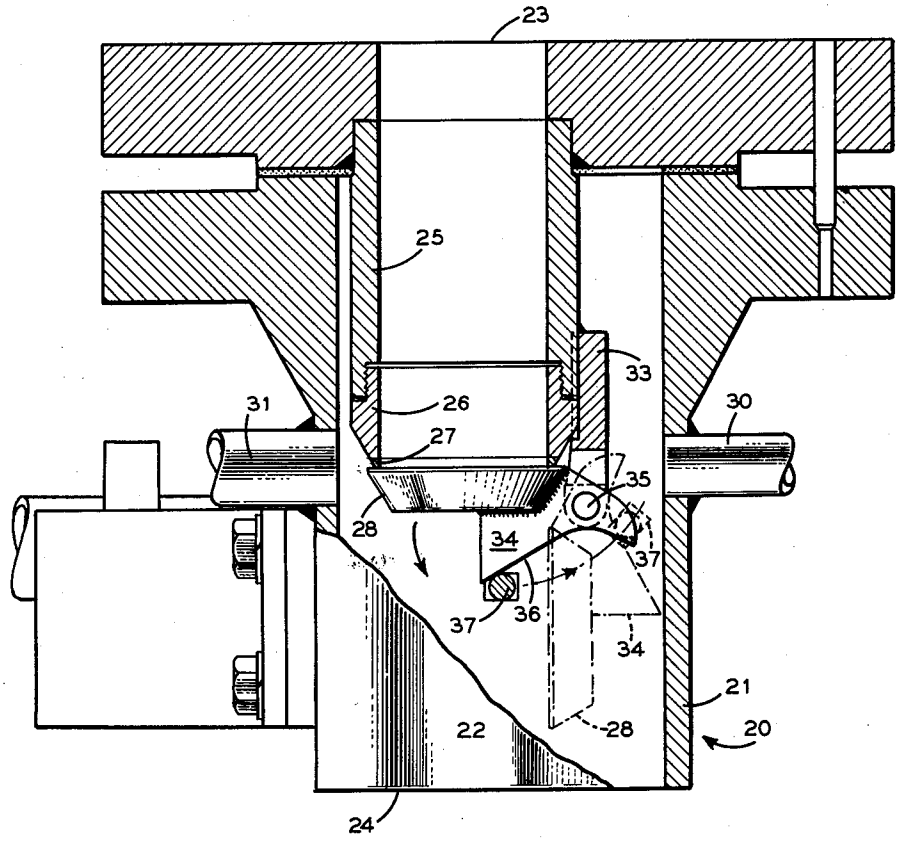
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POSITIVELY ACTUATED VALVE MEANS

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FIG. 3



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POSITIVELY ACTUATED VALVE MEANS

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FIG. 4

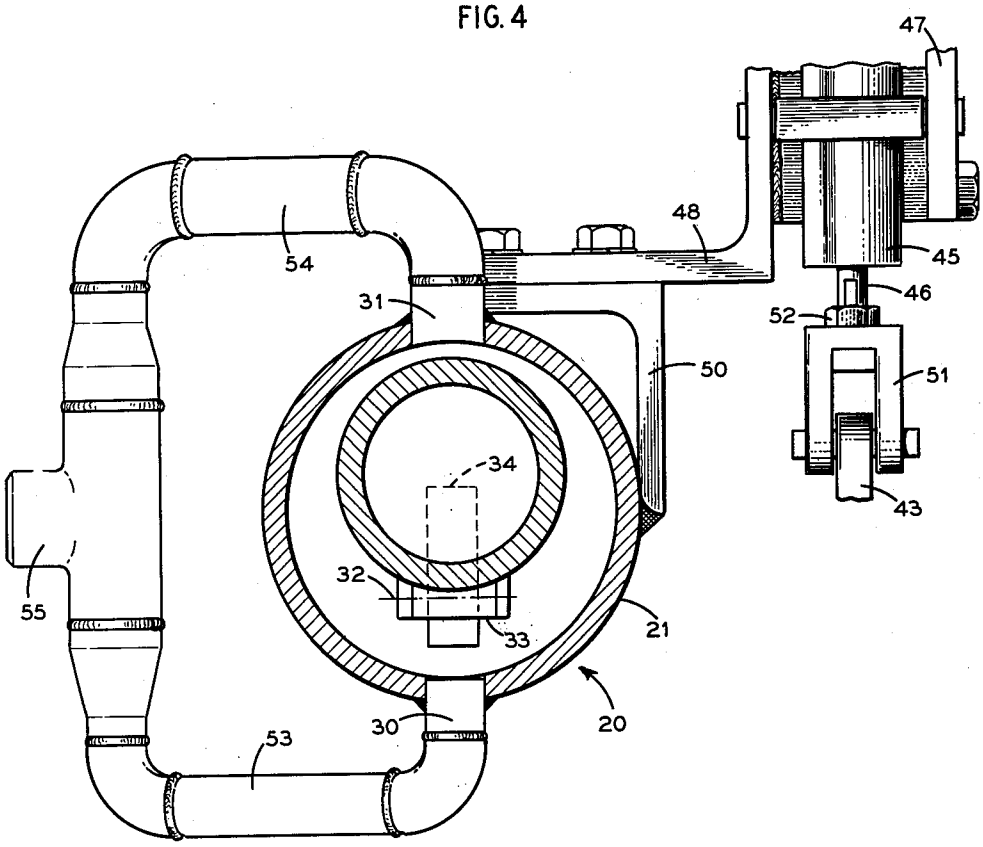
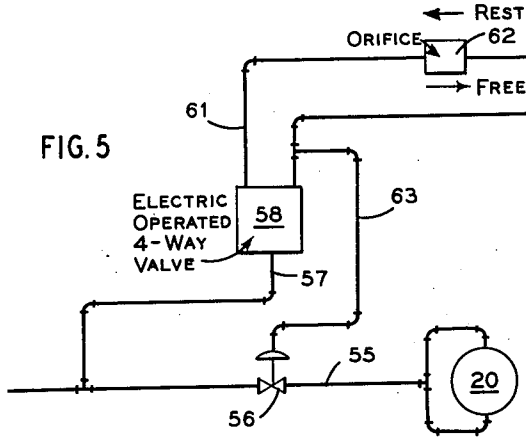


FIG. 5



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United States Patent Office 3,075,539 Patented Jan. 29, 1963

3,075,539

POSITIVELY ACTUATED VALVE MEANS

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Filed May 26, 1958, Ser. No. 737,650
3 Claims. (Cl. 137—240)

The present invention relates to power operated valves having a positively actuated opening and closing movement, and more particularly to a valve constructed for the gravitational movement of particle-form solid materials therethrough when the valve is open and sealed against high fluid pressure when the valve is in its closed position. This invention is an improvement over the valve disclosed in my copending application Serial No. 568,613, now Patent No. 2,937,050.

The invention is exemplified in a shot cleaning system for heat exchange surfaces and while not limited thereto, is particularly useful in a conveying system of the batch type wherein the particle-form material is collected and thereafter elevated under high fluid pressures for reuse in the cleaning system. The use of shot cleaning with particle-form solid materials is well known, and is particularly effective in cleaning the heat exchange surfaces of vapor generators contacted by ash containing heating gases. In such units, the shot or other particle-form solid materials is periodically introduced at the top or in the upper end portion of a bank of convection heat exchange elements to move downwardly under the influence of gravity, ricocheting against the surfaces of the heat exchange elements and dislodging solid deposits therefrom. After passing over the heat exchange surfaces of the unit, the shot is collected in a closed vessel beneath the unit and returned to the upper portion of the unit for reuse. The return of the particle-form materials to the upper portion of the unit is obtained by the use of high pressure fluid such as gases or even liquids.

The valve of the present invention is positioned in the shot passageway leading to the closed vessel in which the shot is collected. With the use of a high pressure fluid to elevate the material, the tendency would be for the fluid to pass upwardly through the shot flow passageway and to mingle with the heating gas stream leaving the vapor generator, unless means were provided to effectively close this path of fluid flow.

The present invention provides a power actuated valve positioned adjacent the shot entrance to the closed tank and which is positively opened and closed in response to the movement of a power piston. During the valve closing cycle, the high pressure elevating fluids for transportation of the solids are projected across the valve seat as jets so as to remove any shot or other particle-form solid materials from the valve seat. Advantageously, the introduction of the fluid jets precedes the closing movement of the valve so that a period, for example, of one second or more, elapses between the introduction of the fluid jets and the closing of the valve. After the collected shot has been elevated to its uppermost position, the valve is positively opened by the operation of the power piston so that shot may again be accumulated in the closed tank of the conveying system.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which I have illustrated and described a preferred embodiment of the invention.

Of the drawings:

FIG. 1 is a diagrammatic elevation of a shot cleaning system including the valve of the present invention;

FIG. 2 is an enlarged elevation, partly in section, of the valve shown in FIG. 1;

FIG. 3 is an enlarged elevation, partly in section, viewed from the side of FIG. 2;

FIG. 4 is a plan of the valve, partly in section, shown in FIGS. 2 and 3; and

FIG. 5 is a diagrammatic showing of the fluid flow control system of the invention.

As shown in FIG. 1, a typical shot cleaning system includes an upper reservoir **10** in which a charge of cleaning shot or other solid particle materials is collected. Periodically, as required in the operation of a shot cleaning system, the shot is passed downwardly through a distributing conduit **11** to a distributor **12** positioned in the upper portion of the convection gas pass **13** of a heat exchanger. In the embodiment shown, the gravitational movement of the shot over convection banks of heating tubes positioned within the gas pass **13** is concurrent with the movement of the heating gases therethrough. The convection banks may include superheater tubes, economizer tubes or air heater tubes, or any combination of tubular heating elements.

The shot in moving downwardly through the gas pass **13** is collected in a hopper **14** at the bottom thereof where the shot is subjected to the elutriating effects of a cleaning gas before the shot is passed downwardly through a spout **15** to a closed pressure vessel **16** positioned beneath the gas pass. The heating gases turn in the upper portion of the hopper **14** of the gas pass **13** to leave through side outlet **17** in moving toward a stack, or other points of use, such as a direct contact evaporator (not shown). The turning movement of the gases in leaving the gas pass **13** has a tendency to separate larger particles of solid materials from the gases so that both shot and larger ash particles will be collected in the lower portion of the hopper **14**.

The shot collected in the tank or closed pressure vessel **16** is returned to the upper reservoir **10** by the periodic introduction of high pressure fluid thereto to lift the shot through a connecting conduit **18**. With the application of high pressure fluid to the vessel **16**, such fluid would tend to pass upwardly through the spout **15** and escape through the outlet **17** with the spent heating gases leaving the convection gas pass. To avoid an escape of lift fluid in the manner described, a valve **20**, such as a check valve, is positioned in the spout **15** adjacent the pressure vessel **16**. As hereinafter described, the valve **20** of the present invention is positively actuated to open and close as required in the operation of the shot cleaning system.

The valve **20** of the present invention is enclosed in an enlarged section **21** of the down spout **15** so as to form a closed vessel or body **22** having an upper inlet **23** and a lower outlet **24** opening therefrom. As shown in FIGS. 2, 3 and 4, the body **22** is provided with a downward extension **25** of the spout **15** which projects into the body **22**, as supported at its upper end by a flange **18'** which is bolted to a flange **19** attached to the upper end of the body. With this construction, the valve mechanism may be removed from its enclosure for inspection or maintenance. The lower end portion of the extension is advantageously provided with a replaceable end portion **26** which is threaded to engage a correspondingly threaded end of the extension. The end portion **26** is advantageously bevelled at its lower end to form a knife-like edge **27** which is hardened to resist wear and to provide a seat against which the closing member **28** engages. On opposite sides of the body, at the elevation of the hardened edge **27** of the exten-

sion, a pair of fluid inlet pipes 30 and 31 are positioned. As hereinafter described, the pipe inlet 30 adjacent and normal to the pivotable axis 32 of the closing member of the valve is smaller than the inlet 31 on the opposite side of the body.

The pivotable closing member 28 of the valve is formed of a disc or plate having an exterior diameter slightly greater than the diameter of the hardened edge 27 of the replaceable end 26 of the spout extension. The closing member is provided with a pivotable axis 32 which is offset to one side of the pipe extension 25 and positioned downwardy adjacent the end of the extension. The axis of the closure member is horizontal and is mounted on the extension 25 by a bracket 33. The member 28 is mounted on its axis 32 by a plate 34 which is welded thereto and embraces the shaft 35 forming the axis 32. As shown particularly in FIG. 3, the lower surface of the plate 34 is contoured to form a camming surface 36 which is engaged by a bail-like element or yoke 37 which is pivotably rotated through an arc of movement of approximately 50 degrees to positively open and shut the member 28 relative to the seat forming edge 27.

As shown more particularly in FIG. 2, the yoke 37 is rotated about an axis defined by a pair of horizontally disposed, coaxial stub shafts 40 and 41 extending through the wall of the valve body. The shaft 40 is fixed in position relative to the wall of the valve and on its inner end engages one end of the yoke. Shaft 41 is mounted for rotation in a bearing 42, with one end thereof attached to an end of the yoke 37 and the opposite end attached to an arm 43. The shaft 40 and the rotatable shaft 41 are each suitably arranged for lubrication and are sealed to avoid leakage of high pressure fluid outwardly from the body 21.

Rotation of the yoke 37 through an arc of movement sufficient to open and close the valve is obtained by a pneumatic cylinder 45 having a piston and piston rod 46 connected with the arm 43. As shown in FIG. 4, the cylinder 45 is trunnion mounted in a cradle 47 which is secured to the valve body 21 by a bracket 48 bolted to an angle bracket 50 welded directly to the exterior wall of the body. The piston rod is secured to a clevis 51 by a threaded connection having a lock nut 52 thereon. The clevis 51 is pivotably connected with the end of the arm so that movement of the piston rod rotates the shaft 41 and the yoke 37.

As shown in the drawings, pressure fluid is delivered to the inlet pipes 30 and 31 through branch pipes 53 and 54, respectively, as received from a pressure fluid supply pipe 55. The pipe 55 is provided with pressure fluid from a source of supply, such as a compressor or the like, which also supplies fluid to the cylinder 45 to actuate the operation of the valve 20.

A diagrammatic illustration of the valve control mechanism is shown in FIG. 5, where the flow of fluid to the valve 20 is regulated by a solenoid operated flow control valve 56 located in the supply pipe 55. A pipe 57 opens to the supply pipe 55 at a position upstream of the valve 56, i.e. between the valve 56 and the source of pressure fluid, and is connected at its opposite end with an electrically operated timer valve 58. From the valve 58, two fluid flow pipes 60 and 61 lead to opposite ends of the cylinder 45. The pipe 60 is connected to the valve 20 closing end of the cylinder, so that when fluid pressure is applied to the cylinder 45 through the pipe 60 the member 28 is moved into its closing position relative to the seat of the edge 27. The pipe 61 leading to the opposite end of the cylinder 45 is provided with a valve 62 of the orifice type so that when fluid pressure is applied to the line 61 the valve 62 is fully open for flow to the valve 20 opening end of the cylinder.

During the valve 20 closing portion of the control cycle regulated by element 58, the exhaust flow of fluid through the pipe 61 from the cylinder toward the element 58 is restricted by the action of the orifice valve so that the actual closing of valve 20 is delayed an adjustable amount. Simultaneously with the application of fluid pressure on the cylinder 45 through the pipe 60, fluid pressure is applied through the pipe 63 to actuate valve 56 so that fluid will flow through pipe 55 to the inlets 30 and 31 of the valve 20. Thus, pressure fluid will flow to the valve 20 for a selected period of time, for example, one second, before member 28 closes the valve 20.

While in accordance with the provisions of the statutes I have illustrated and described herein the best form and mode of operation of the invention now known to me, those skilled in the art will understand that changes may be made in the form of the apparatus disclosed without departing from the spirit of the invention covered by my claims, and that certain features of my invention may sometimes be used to advantage without a corresponding use of other features.

What is claimed is:

1. In apparatus of the class described, a closed body having inlet and outlet openings therein for the gravitational movement of particle-form solid materials therethrough, an annular seat positioned within said body, a closure member pivotable about a transverse axis and rotatable to engage said seat in closing relationship, a camming surface on said closure member below said transverse axis, an element operable to continuously engage said camming surface and movable through an arc having an axis parallel to the axis of and effective to move said closure member into closing relationship to said seat while contacting one end portion of said camming surface and to positively open said closure member relative to said seat while contacting the opposite end portion of said camming surface, and means for rotating said element through its arc of movement.

2. In apparatus of the class described, a closed body having inlet and outlet openings therein for the gravitational movement of particle-form materials therethrough, a tubular sleeve extending through said inlet opening into said closed body, means forming a replaceable terminal closure seat at the discharge end of said tubular sleeve within said body, a closure member pivotable about a transverse axis and operable to engage said seat in sealing relationship, a camming surface below said transverse axis and integral with said closure member, a bail-like element operable to continuously engage said camming surface and movable through an arc having an axis parallel to the axis of and effective to move said closure member into seat engaging position while contacting one end portion of said camming surface and to positively open said closure member relative to said seat means when contacting the opposite end portion of said camming surface, and a power piston connected to said bail-like element to operate said element through its arc of movement.

3. In apparatus of the class described, a closed body having inlet and outlet openings therein for the gravitational movement of particle-form solid materials therethrough, means forming a closure seat within said body, fluid jet means for sweeping the end of said closure seat and discharging through the outlet opening of said body, a closure member pivotable about a transverse axis and rotatable to engage said seat in closing relationship, a camming surface below said transverse axis and integrally formed on said closure member, a bail-like element operable to continuously engage said camming surface and movable through an arc having an axis parallel to the axis of and effective to lock said closure member against said seat while contacting one end portion of said camming surface and to positively open said closure member relative to said seat when contacting the opposite end portion of said camming surface, a fluid actuated power piston connected to said bail-like element to rotate said element through its arc of movement, and means

for actuating flow of fluid through said jet means in timed coordination with the actuation of said power piston.

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