Dec. 24, 1935. W. A. ROSENBERGER 2,025,247

FLOW CONTROL MECHANISM

Filed Feb. 9, 1934 2 Sheets-Sheet 1

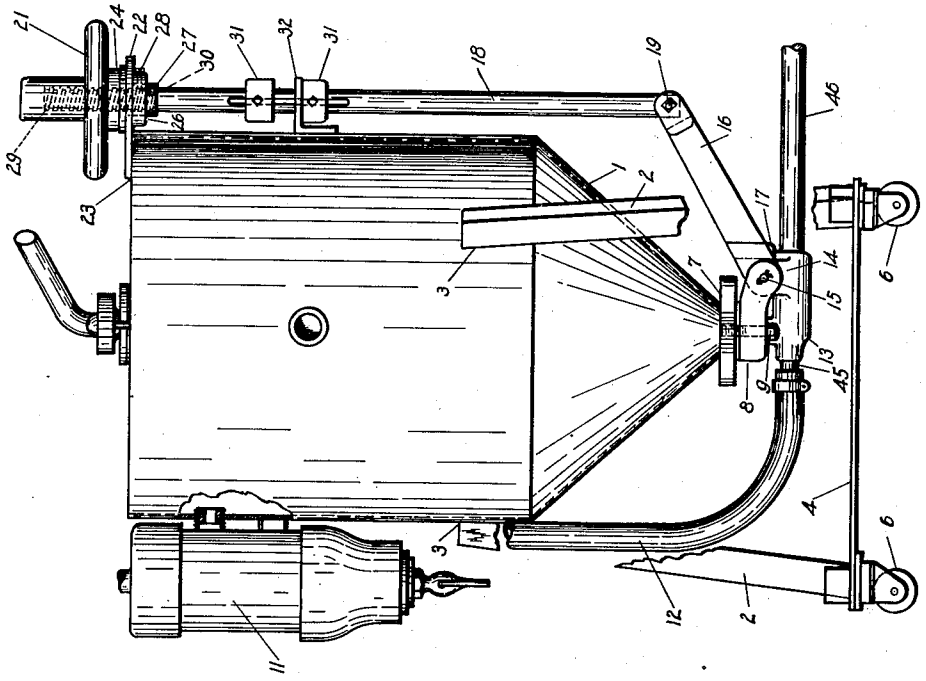


Fig. 1

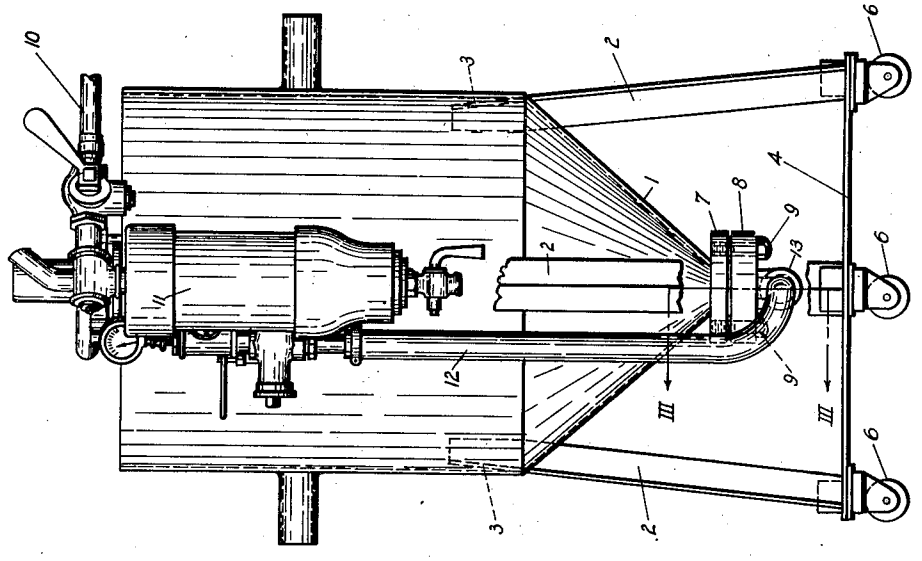


Fig. 2

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FLOW CONTROL MECHANISM

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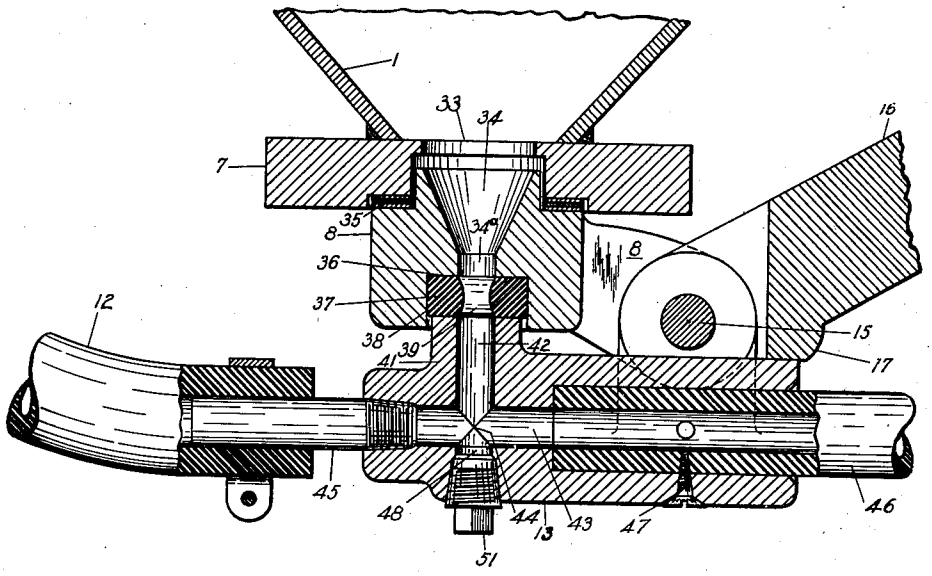


Fig. 3

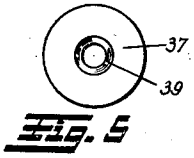


Fig. 5

Fig. 4

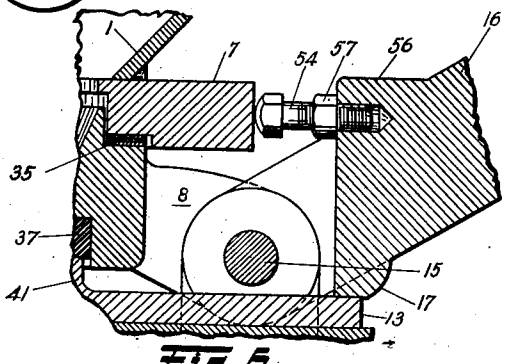


Fig. 6

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UNITED STATES PATENT OFFICE

2,025,247

FLOW CONTROL MECHANISM

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Application February 9, 1934, Serial No. 710,555

10 Claims. (Cl. 51—12)

This invention relates to sand or other abrasive blasting apparatus of the type generally shown in my Patent 1,899,528, dated February 28, 1933.

It is a major object of my invention to devise a novel valve and mixing mechanism for abrasive material or the like that consists of a small number of parts, is efficient and durable, and yet that may be produced at low cost.

It is a further important object of my invention to provide a novel valve which is capable of very accurate and sensitive adjustment.

It is also an object of this invention to provide a valve which is capable of very great accuracy and yet simple and inexpensive.

Another object of this invention is to provide a valve in which the opening is of substantially the same shape for any adjustment of the valve.

Another object of this invention is to so devise a valve for handling abrasive material that it has no moving parts in contact with the flow of abrasive material.

Another object of this invention is to provide a valve for handling abrasive material that is so constructed that the parts which are subjected to the greatest wear from the abrasive stream may be easily and inexpensively replaced.

Another object of this invention is to provide a valve for regulating the flow of abrasive material to a mixing chamber that is so constructed that bodily movement of the mixing chamber is operable to vary the valve opening.

Another object of this invention is to provide a valve for regulating the flow of abrasive material in a sand blasting apparatus having a resilient ring which is adapted to be axially compressed in a recess in the lower end of the abrasive hopper by pivotal movement of the mixing chamber.

Another object of this invention is to provide an abrasive flow control device having an axially compressible resilient ring, with means for applying an adjustable initial pressure to the ring for predetermining the maximum flow of material and at the same time maintaining a tight connection between the ring and its cooperating conduit.

It is another object of the present invention to provide a valve mechanism of the character wherein the flow is controlled by compressing a flexible element, with means for limiting the degree to which the element may be compressed, to thereby limit the minimum flow to a predetermined value.

Further objects of the present invention will become apparent as the detailed description thereof proceeds in connection with the annexed drawings, and from the appended claims.

In the drawings:

Figure 1 is an elevational view of a sand blast tank showing the controlling mechanism of the present invention associated therewith.

Figure 2 is an elevational view of the device shown in Figure 1, and illustrates the device as it appears when viewed from the left-hand side of that figure.

Figure 3 is a vertical cross sectional view along line III—III of Figure 2, looking in the direction of the arrows.

Figure 4 is a top plan view of the device shown in Figures 1, 2 and 3 and illustrates the parts as they appear when the hopper is removed.

Figure 5 is a detailed end view of the resilient valve member.

Figure 6 is a fragmental sectional view similar to Figure 3, but illustrates a modified form of adjustable stop for the valve operating mechanism.

Referring to the drawings in which the same numerals are used to indicate like parts throughout the several views, a hopper 1 is adapted to hold an abrasive material, such as sand. Legs 2, welded or otherwise suitably secured to hopper 1 at 3, may rest on a small platform 4 provided with casters 6 to facilitate the portability of the unit.

A flange 7, welded on the bottom of the pressure hopper 1, has a bracket 8 suitably secured thereto, as by means of bolts 9, and comprises a part of an abrasive flow control valve as shown in Figure 3. A compressed fluid, such as air, is delivered to the hopper 1 through a pipe line 10 and a moisture separator 11. A flexible hose 12 connects the separator 11 with a mixing chamber 13 which is disposed below the hopper.

The mixing chamber 13 has integral lugs 14 pivoted to the ears provided on bracket 8 by means of a pin 15. Pivotal operation of the mixing chamber controls the abrasive flow as will be explained in detail with reference to Figure 3. A lever 16 pivoted on the pin 15 is provided with a preferably integral lug 17, which contacts the upper surface of the mixing chamber 13 beyond the fulcrum pin 15.

Although I have illustrated lever 16 and mixing chamber 13 as being separately formed they may, if desired be integrally formed without departing from the spirit of the invention.

A suitable operating rod 18 is connected to the lever 16 by means of a bolt 19. A handwheel 21 is rotatably journalled in a plate 22 suitably

secured to the top of the hopper 1 as by welding at 23. Axial movement of wheel 21 is prevented by a shoulder 24 formed on wheel 21, and by a collar 26, which is secured to an extension of the wheel hub 27 by means of a set screw 28. The hub of the handwheel is preferably provided with left-hand threads 29 which engage cooperating threads 30 on the operating rod 18. Longitudinal movement of rod 18 is effected by rotating the handwheel 21.

By reason of the left-hand thread organization, clockwise rotation of wheel 21, (when viewed from above) effects downward movement of rod 18, while counter-clockwise rotation of wheel 21 imparts a lifting action to rod 18.

A pair of collars 31 are adjustably secured on the rod 18 by means of set screws which cooperate with a flat side of rod 18 and are adapted to engage a bracket 32 to limit the movement of the rod and serves to indicate the position of the valve mechanism, which will now be described.

Referring to Figure 3, an aperture 33 provided in flange 7 registers with a funnel-shaped orifice 34 terminating in a throat 34*a*, the latter being formed in the bracket 8.

A plurality of gaskets 35 provide a tight seal between the bracket 8 and the flange 7. The bracket 8 has a cylindrical recess 36 in its lower side. A resilient ring-shaped member 37 which is preferably made of rubber, engages walls 38 of recess 36 and has a circular orifice 39 registering with the throat 34*a*. A projection 41, extending at right angles to the axis of the mixing chamber, has a bore 42 in registry with the orifice 39 of the resilient ring 37 and intersects a bore 43 of the mixing chamber at 44.

The upper face of portion 41 of member 13 preferably lies in the same plane as the axis of pin 15, so that when member 13 is rocked, so as to compress ring 37, the lugging surface thereof will move substantially parallel to the axis of member 37.

Compressed fluid is adapted to be delivered to the bore 43 from the hose 12 by means of a nipple 45 screw threaded into the left-hand end of the mixing chamber. The abrasive, such as sand is delivered under pressure from the mixing chamber through a hose 46 to a nozzle (not shown). The hose 46 is held in the mixing chamber 13 by means of wood screws 47 engaging the sidewalls of the chamber and the hose. An opening 48 in the bottom of the mixing chamber 13, is preferably fitted with a plug 51 so as to provide a readily accessible mixing chamber cleaning opening. This makes it possible to readily clean the bore 42 in the event of clogging.

The flow of abrasive from the pressure hopper 1 into the mixing chamber 13 is regulated by the application of a variable axially directed pressure to the resilient valve member 37. As previously pointed out lug 17 on the lever 16 contacts the mixing chamber beyond the fulcrum pin 15, and as portion 41 of mixing chamber 13 engages member 37, which is effected by rocking upward movement thereof, the lever 16 in the clockwise direction about pin 15 as an axis, produces axial compression of resilient ring 37. Since the walls 38 of recess 36 prevent lateral expansion of the outer surface of the ring, the inner surface thereof is compelled to move inwardly in a direction at right angles to its axis. The area of opening 39 is substantially inversely proportional to the axial force applied to the ring, but the axial cross section of the opening preferably remains substantially circular throughout the entire range of its variation in size. It is by virtue of the provision of a cylindrical orifice in the ring 37 that the cross section of the opening remains a circle from maximum to zero opening.

Although I have illustrated and prefer to employ a mixing chamber that is mounted for rocking movement, it may if desired be guided for rectilinear movement toward and away from member 8 and be actuated by a rack and pinion organization or any other suitable mechanism. This mechanism provides a control valve that is very desirable in an abrasive blast or other apparatus because it affords a very sensitive and accurate control of material flow, and the valve compressing member is substantially frictionless in operation as it is mounted for rocking movement upon pin 15 and may smoothly move toward and away from member 37.

With reference to Figure 1, the upper of stops 31 is preferably secured to rod 18 in such position as to definitely limit downward movement of rod 18 so as to definitely limit the extent to which ring 37 is compressed by portion 41 of mixing chamber. This stop also performs the function of preventing the lower end of rod 18, lever 16, and the mixing chamber from being subjected to stresses that might break or distort them.

Lower stop 31 is preferably so adjusted that when it is in contact with the lower side of member 32 portion 41 of member 13 will compress ring 37 sufficiently to prevent air or sand from leaking past upper and lower surfaces of member 37 and members 8 and 41 respectively, but not sufficiently to materially reduce the size of opening 39.

When it is desired to inspect or replace member 37 it is only necessary to remove pin 15 as this operation allows mixing chamber 15 and lever 16 to drop downwardly and away from the valve passage.

Although I have illustrated means as being associated with the valve actuating mechanism for initially compressing or "pre-loading" ring 37, a separate device, independent of the actuating mechanism, may be used if desired without departing from the spirit of my invention.

A modified form of the adjustable stop that may be used in the device is shown in Figure 6 and is associated with lever 16. With continued reference to Figure 6, a bolt 54 is screw threaded into a lug 56 on the lever 16 and a lock nut 57 is provided to hold the bolt 54 in adjusted position therein. The bolt 54 is so adjusted when it is disposed in contact with flange 8 that a slight initial pressure is applied to ring 37 to prevent the leakage of abrasive and fluid pressure and yet not substantially deform the ring. This adjustable stop may be provided in addition to stops 31 provided on the actuating rod 18 but in this form of my invention it is preferably used in lieu of the lower of stops 31. Instead of using the handwheel mechanism, a power operated mechanism of any suitable form or any other similar suitable mechanism may be employed to apply pressure to rod 18, lever 16, mixing chamber 13 or directly to the resilient valve ring member 37. For example, a piston actuated by fluid pressure may be used to control the rod 18 from a remote point. For instance, an electric motor having a controlling mechanism connected to the nozzle so that the operator may readily vary the abrasive contact of the blast without the necessity of his leaving his work may be used if desired. Likewise, an elec-

tromagnet or electric motor control may be provided for remote operation or for automatic operation in accordance with a predetermined condition.

In the operation of the invention, the compressed fluid in pipe line 10 maintains a pressure in the abrasive hopper 1. The separator 11 eliminates the excess moisture from the compressed fluid. A high velocity fluid stream is provided by the hose 12 at the mixing chamber 13. The pressure in the hopper 1 allows the abrasive to flow down into the bore 42 of the mixing chamber at a rate proportional to the area of the opening in member 37. When the abrasive reaches the intersection 44 of the bore 42 and the bore 43, it is carried by the high velocity fluid stream through the blasting hose 46. A very accurate control of the abrasive flow is provided by applying a torque moment to the lever 16 and consequently to the resilient valve member 37. By applying sufficient pressure to the member 37, the passage may be entirely closed, if this operation is desired and upper stop 31 is adjusted to permit it to take place. A peculiar advantage in using the axially compressed ring member 37 is that an opening of circular cross section is provided throughout the entire variation of the size of the opening. This results in a substantially Venturi-shaped passage and insures a better distribution of the abrasive in the high velocity fluid stream irrespective to what degree member 37 is compressed. Another advantage in using the above mentioned valve member is that it is simple, easy and inexpensive to replace. This arrangement also eliminates all moving parts from the abrasive stream.

The adjustable stop mechanism prevents pressure leakage between the resilient valve member and the cooperating parts as well as determines the maximum opening of the orifice. By mounting the mixing chamber and valve mechanism in accordance with my invention, the complete assembly may be easily dismantled to replace worn parts.

For the purposes of illustration the novel valve is shown as applied to a sand blast apparatus but it is obvious to those skilled in the art that the invention has a wide range of applications.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. In a sand blasting device, a deformable member having an aperture therein and adapted to be deformed to reduce the size of said aperture; a mixing chamber operably associated with said member and having a passage therein communicating with said aperture; said mixing chamber having a surface engaging said member, means mounting said mixing chamber for movement so as to cause the engaging surface thereof to move substantially axially with respect to said deformable member and compress the latter; and means for effecting movement of said mixing chamber.

2. The device described in claim 1, wherein said mixing chamber is mounted for rocking movement about an axis that is spaced from the axis of said member.

3. In a valve for use in sand blasting apparatus, a valve body having a passage extending therethrough; a deformable element disposed in contact with said valve body and having an aperture therein communicating with said passage; a valve actuating member having an engaging surface adapted to contact said deformable element and a port disposed in registry with said aperture; means mounting said valve actuating member for rocking movement, said valve actuating member being operable to compress said deformable element between said valve body and the engaging surface of said valve actuating member and thereby decrease the area of said aperture when the latter member is rocked in one direction; and means for rocking said valve actuating member in said one direction.

4. The device set forth in claim 3, wherein said valve actuating member is mounted for rocking movement about an axis that is disposed transversely to the axis of the aperture in said deformable element.

5. The device described in claim 3, wherein the engaging surface of said valve actuating member is disposed substantially normal to the axis of the aperture located in said deformable element, and said valve actuating member is mounted for rocking movement about an axis that is disposed substantially in the plane of its engaging surface.

6. The device described in claim 3, wherein said valve actuating member is mounted for rocking movement upon said valve body.

7. The device described in claim 3, together with means for placing said deformable element under a predetermined initial compression.

8. In a sand blasting apparatus, a valve comprising an apertured deformable member, operable to undergo closing actions when it is deformed to predetermined degrees, means for supplying abrasive to said valve; a movable mixing element cooperating with said valve and adapted to receive abrasive therefrom; means for moving said mixing element; and means for causing said mixing element to apply deforming forces to said deformable member and thereby actuate said valve when it is moved.

9. In a sand blasting or like device, a valve body having a passage extending therethrough; a deformable element disposed in contact with said valve body and having an aperture therein communicating with said passage; a valve actuating member having a clamping surface adapted to contact said deformable element and a port disposed in registry with said aperture; means mounting said valve actuating member for rocking movement toward said valve body for compressing said deformable element between the clamping surface of said valve actuating member and said valve body, and thereby decrease the area of said aperture, comprising pivot means disposed substantially normal to the axis of the aperture in said deformable element; a lever mounted for rocking movement about said pivot means as an axis, said lever and said valve actuating member having contacting portions remote from the axis of said pivot means for establishing a driving connection therebetween; and means for rocking said lever.

10. In a valve for use in sand blasting apparatus, a valve body having a passage extending therethrough, a deformable element disposed in

contact with said valve body and having an aperture therein communicating with said passage, a valve actuating member having an engaging surface adapted to contact said deformable element and a port disposed in registry with said aperture, means mounting said valve actuating member for rocking movement, said valve actuating member being operable to compress said deformable element between said valve body and the engaging surface of said valve actuating member and thereby decrease the area of said aperture when the latter member is rocked in one direction, means for rocking said valve actuating member in said one direction, and means for limiting rocking movement of said valve actuating member in the opposite direction, to thereby place said deformable element under a predetermined degree of initial deformation.

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