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[31] 48322/67

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[54] PNEUMATIC MATERIAL HANDLING APPARATUS

7 Claims, 3 Drawing Figs.

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[50] Field of Search..... 302/53, 24,
25, 42

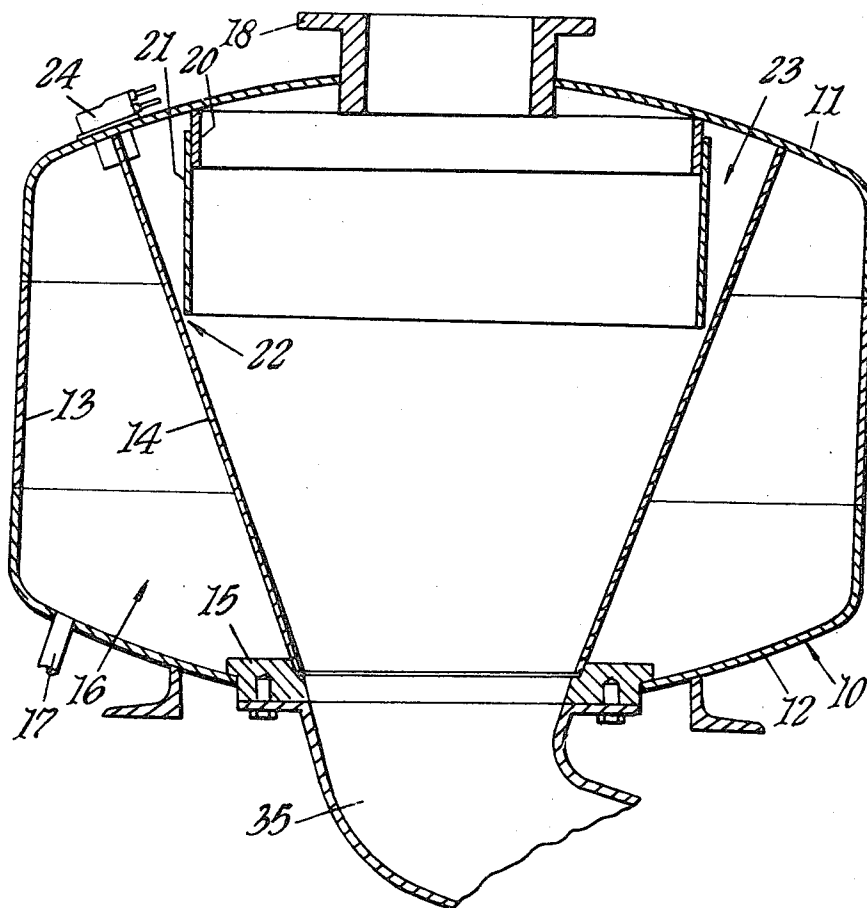
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ABSTRACT: A material-handling apparatus comprising a compressed air reservoir within which is a material supply vessel interconnecting the upper and lower ends of the air reservoir to strengthen the air reservoir against bursting. The supply vessel has a closable upper opening through which it can receive material and a lower opening through which the material can be discharged by closing said upper opening and then permitting compressed air from the air reservoir to enter the supply vessel near its upper end. To avoid the use of pipes to interconnect the compressed air reservoir with the material supply vessel, the interior of the compressed air reservoir communicates with the interior of the material supply vessel directly through one or more valve members in the wall or walls of the material supply vessel.



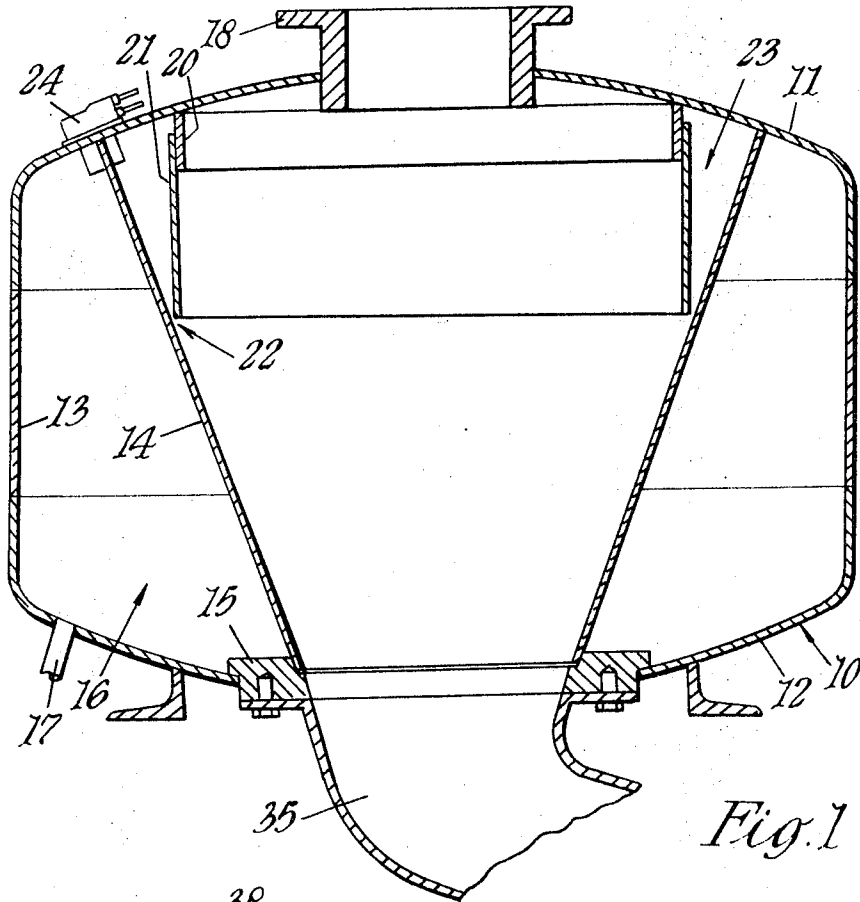


Fig. 1

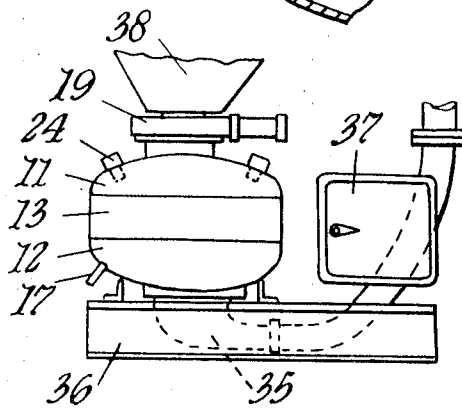


Fig. 2

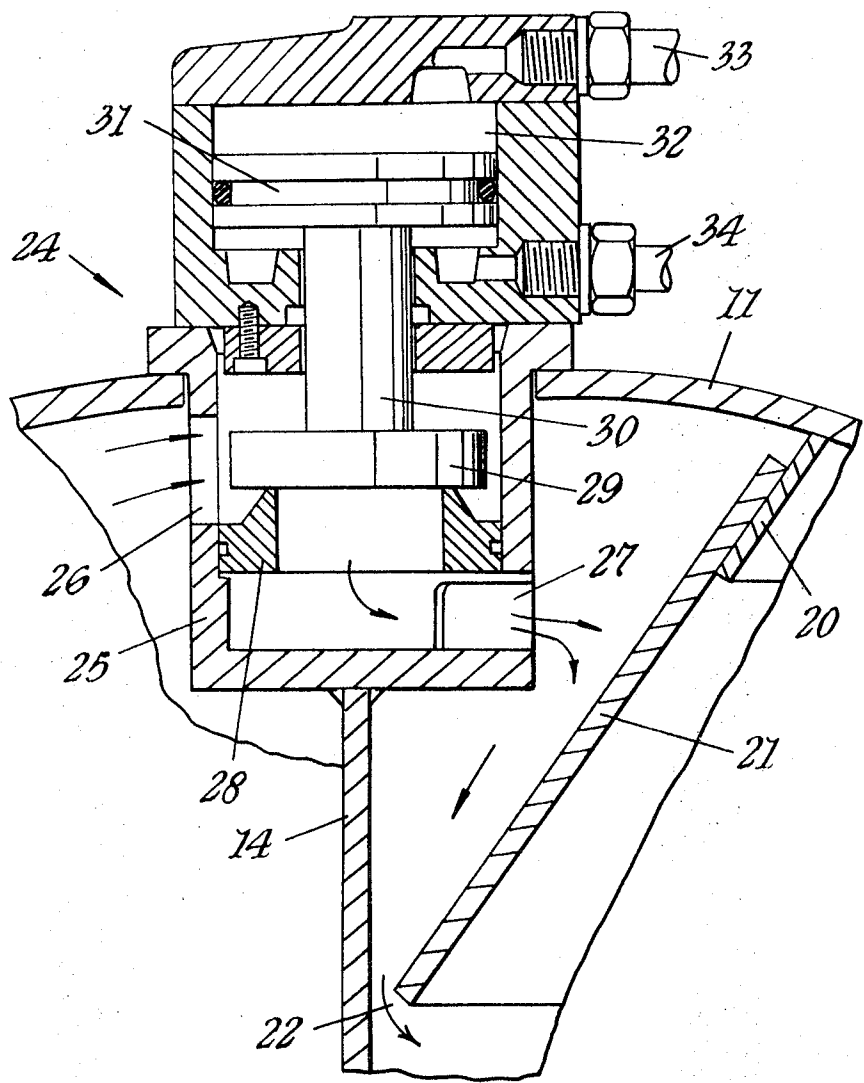


Fig. 3.

PNEUMATIC MATERIAL HANDLING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to material-handling apparatus of the kind in which a fluid, or a powdered or granular wet or dry material is to be conveyed by compressed air along a pipeline to a receiving point such as, for example, a processing plant for the material.

In such apparatus the material is initially fed from a hopper into a material supply vessel that can be subsequently sealed from the hopper and, thereafter, compressed air is passed into the supply vessel to cause the material to be discharged into the pipeline.

2. Description of the Prior Art

It is known to provide a material supply vessel which incorporates its own compressed air reservoir and thus avoids the need for separate air reservoirs. In the known combined material supply vessel and air reservoir the material supply vessel is located within the air reservoir and both comprise separate units each with their own individual top closures, and each designed to suit its own particular function, the compressed air passing from the interior of the air reservoir to the interior of the material supply vessel by means of pipes controlled by valves.

The use of pipes for conveying the compressed air produces time lags which affect the time of the sequence of operation of the apparatus.

The invention simplifies the construction of the material supply vessel and utilizes it to strengthen the air reservoir, thus permitting the air reservoir to be made of a lighter gauge material than would otherwise be necessary.

The invention also eliminates the prior use of pipes for conveying air from the compressed air reservoir to the material supply vessel and so avoids the aforesaid time lag.

SUMMARY OF THE INVENTION

The material-handling apparatus disclosed herewith comprises a compressed air reservoir having upper and lower ends and within this air reservoir is a material supply vessel, the upper end of the compressed air reservoir serving also as the upper end of the material supply vessel.

The upper end of the material supply vessel has a closable opening through which material may be fed into the supply vessel. The material supply vessel has a lower opening that is rigid with the lower end of the compressed air reservoir, and the material in the supply vessel is dischargeable through this lower opening. Preferably, the material supply vessel is a frustoconical member. Because the material supply vessel rigidly interconnects the upper and lower ends of the compressed air reservoir it strengthens the reservoir against air pressure tending to move said upper and lower ends apart. This strengthening effect means that the end closures of the compressed air reservoir can be made of lighter gauge material than would otherwise be necessary. Further, because the upper end of the compressed air reservoir also acts as the upper end of the material supply vessel, the use of an individual upper end for the material supply vessel is avoided with a resultant reduction in cost. At or near the upper end of the sidewall or walls of the material supply vessel is at least one air inlet opening that is closable by a valve, this valve, when open, permitting compressed air to flow directly from the compressed air reservoir into the material supply vessel thus avoiding the use of pipes to convey air from the compressed air reservoir to the material supply vessel. This air inlet valve may comprise a piston and cylinder operated valve member.

In operation the one or more air inlet openings in the sidewall or walls of the material supply vessel are closed by means of the valve in each of said openings so as to seal the material supply vessel from the compressed air reservoir. The compressed air reservoir is then charged with compressed air.

The closable opening in the upper end of the material supply vessel is opened and material is fed through said opening into the material supply vessel. This material supply opening is then closed and the one or more air inlet openings in the sidewalls of the material supply vessel are opened to permit compressed air from the air reservoir to flow directly into the material supply vessel to act on the upper surface of the material therein and force it downwardly through the lower opening in the discharge vessel into a pipeline extending away from the material supply vessel.

DESCRIPTION OF THE DRAWING

FIG. 1 is a section through the combined material supply vessel and air reservoir;

FIG. 2 is an external view of the device of FIG. 1 with associated parts; and

FIG. 3 is an enlarged section through a suitable valve member.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The compressed air reservoir 10 comprises an upper domed end 11 and a lower domed end 12 each formed by dished members secured together by a cylindrical wall or control ring member 13. Secured to the upper domed end 11 is the large diameter end of a frustoconical member 14 whose smaller diameter end is secured to a ring 15 which in turn is received in an opening provided in the lower domed end 12.

The annular space 16 formed between the outer surface of the frustoconical member 14 and the inner surface of the member 13 and ends 11 and 12 receives compressed air through a pipe 17 connected with any suitable source of compressed air such as an air compressor.

Provided in the center of the upper domed ends 11 is a flanged opening 18 which is controlled by a pneumatically operated slide valve 19. Secured to the upper domed end 11 is a baffle member comprising a ring 20 to which is secured a secondary ring 21 which extends close to the inner surface of the frustoconical member 14 to leave an annular gap 22. The space 23 formed between the external surfaces of the rings 20, 21, part of the domed end 11 and part of the internal surface of the frustoconical member 14 is supplied with compressed air from the annular space 16 through a valve member 24. The rings 20, 21, are, of course, by way of example only and may be replaced by a single ring of suitable size.

The valve member 24 comprises a cuplike member 25 which is secured to the upper domed end 11 and the frustoconical member 14 and has an inlet opening 26 and an outlet opening 27 which can communicate with one another through a valve seat 28. Engageable with the seat 28 is a valve member 29 connected by a stem or rod 30 to a piston 31 reciprocable in a cylinder 32 secured to the upper end of the cuplike member 25. The cylinder 32 is provided with pressure fluid connections 33 and 34.

Secured to the ring 15 is an outlet pipe 35. The compressed air reservoir 10 is supported on a chassis 36 which also supports a control box 37. The material is stored in a hopper 38.

The material-handling apparatus operates as follows. With the valve 24 closed the pneumatically operated slide valve 19 is opened to allow material to pass from the hopper 38 into the material supply vessel formed by the frustoconical member 14. When the supply vessel is full the slide valve 19 is closed and then compressed air is supplied below the piston 31 through the fluid connection 34 to raise the piston 31 in the cylinder 32 thus lifting the valve member 29 off the seat 28 allowing compressed air from the space 16 to flow through the inlet opening 26 and the outlet opening 27 into the space 23. The compressed air then flows through the annular gap 22 to convey the material along the outlet pipe 35. The valve 24 is then closed by admitting pressure through the connection 33, the air reservoir being repressurized whilst the slide valve 19 is opened to recharge the material supply vessel.

The apparatus can be modified by extending the depth of the dished upper and lower member 11 and 12 and joining them directly together instead of through the member 13.

The construction according to the present invention produces a simple fabricated assembly which is cheap to manufacture compared with known arrangements. Due to the fact that the frustoconical member 14 helps to support both of the dished ends 11 and 12 they can be formed of thinner material than previous with a consequent saving in weight and cost.

The annular slot 22 is buried in material upon the frustoconical member being filled and the compressed air which passes therethrough has sufficient velocity down the inner surface of the cone to move every particle of material away, whether it be sticky or wet. Preferably the area of the slot 22 is equal to the area of the outlet opening 27. The layer of compressed air issuing from the slot 22 provides a boundary layer between the material and the inner surface of the frustoconical member 14 and this can extend around the bend of the outlet pipe 35 and possibly as far as the vertical portion of the pipe. This layer of air also avoids choking at the first bend of the pipe 35.

By avoiding the need to convey the compressed air from the air reservoir to the material supply vessel through pipes the operating cycle of the individual components can be increased. It is envisaged that a 5 second blow cycle can be achieved with the construction described.

It is desirable for the inlet opening 18 to be large enough to provide an almost instantaneous gravity from the hopper 38.

In the structure described the valve 24, of which there may be a plurality, is located within the shell directly on the line of the frustoconical wall 14 so that when opened the compressed air can blast immediately into the annular space 23 in the shortest possible period of time and from there through the slot 22, thereby taking the shortest possible journey from the space 16 to the interior of the material-conveying vessel.

The sequence of operation of the various valves can be effected automatically and this can be means of sensing the level of material within the material-conveying vessel or by a cam-timing device or by sensing the rise and fall in air pressure within the air reservoir.

The pipe 17 is normally smaller in diameter than the apertures 26, 27 of the valve 24 and, therefore, as the material flows into the frustoconical member 14 the air pressure in space 16 builds up to main line pressure, say 80 lbs./square inch. After the valve 24 has been opened and the material discharged, both the air reservoir and material delivery vessel are exhausted to atmosphere but if no valve is provided in the pipe 17 a residual pressure of 2 to 5 lbs./square inch may prevail. These two pressures may be used to operate the continuous cycling by means of two pressure-operated switches and associated solenoid air valves located in the control cabinet 37. One pressure operated switch set to "make" at say 80 lbs./square inch on a rising pressure and the other set to "make" at say 5 lbs./square inch on a falling pressure. The control valve affecting cycling may comprise a four or five way double solenoid air valve of the kind which only requires momentary energization to reach and hold its desired position.

Continuous cycling can be interrupted by breaking the circuit in the control box 37 and restarted by closing the circuit. This can be effected remotely from a signal from an electric

level sensing probe in a remove hopper. The valve member 24 may be moved to and from its closure setting by electrically operated solenoids.

It is possible to effect control and sequencing by pressure operated devices instead of using electrically operated devices.

While only one embodiment of the present invention has been illustrated together with some modifications thereof, it will be apparent to those skilled in the art that other various changes and modifications may be made therein without departing from the spirit of the invention, and having thus described my invention, what I claim is:

1. A material-handling apparatus comprising a compressed air reservoir having upper and lower ends interconnected by a cylindrical wall, means for admitting compressed air to said air reservoir, a material supply vessel having upper and lower ends and disposed inside the reservoir in spaced relation to said cylindrical wall, the upper end of the material supply vessel connected to the upper end of the air reservoir and the lower end of the supply vessel connected to the lower end of the air reservoir to strengthen the reservoir and forming a passage for material from one end of the air reservoir through the other end thereof, a closable inlet opening at the upper end of the supply vessel through which the supply vessel can be supplied with material, a lower outlet opening in the supply vessel through which the material can be expelled from the supply vessel by means of compressed air supplied from the air reservoir after said inlet opening has been closed, at least one valve-controlled opening in the material supply vessel between the compressed air reservoir and the material supply vessel through which the compressed air is supplied to the supply vessel from the compressed air reservoir.

2. A material-handling apparatus as claimed in claim 1, and wherein the material supply vessel is of frustoconical form tapering downwardly, the valve-controlled opening being at or near the upper end of the frustoconical form, and a baffle in the material supply vessel adjacent the opening serving to direct air entering through said airflow opening in a direction against the sides of the frustoconical form.

3. A material-handling apparatus as defined in claim 2, wherein the upper end of the compressed air reservoir comprises the upper end of the material supply vessel.

4. A material-handling apparatus as defined in claim 1, wherein the lower end of the supply vessel around said outlet opening is secured and sealed to the lower end of the compressed air reservoir.

5. A material-handling apparatus as defined in claim 1, wherein the upper end of the compressed air reservoir has an inverted cup or dish-shape, and the lower end of the compressed air reservoir has an oppositely dished shape.

6. A material-handling apparatus as defined in claim 1, wherein means is included for closing said material supply opening and at the same time opening the valve-controlled opening to establish communication between the air reservoir and the supply vessel so that the compressed air will flow from the reservoir into the supply vessel to cause the material therein to be blown out of said outlet opening for the material.

7. A material-handling apparatus as in claim 6, wherein said valve-controlled opening is in a wall of said supply vessel so that when the valve is opened, there is direct communication between the air reservoir and the supply vessel.