United States Patent

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[54] **INLET MEANS FOR BAG-FILLING MACHINE**
13 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **177/114,** 141/68, 222/56, 251/147
[51] **Int. Cl.** **G01g 13/24**
[50] **Field of Search** 177/105, 114, 116, 118; 222/56; 141/67, 68; 251/147

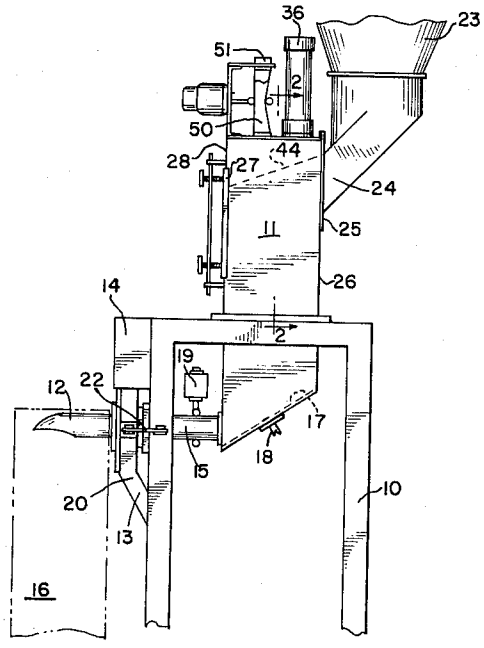
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ABSTRACT: A gate valve, located in the rear wall of the chamber, has a rectangular frame-type seat and a vertically sliding gate overlying same. Guide strips, spaced inwardly from each side edge of the gate so as to leave said side edges unconfined, hold the gate against the seat. An inlet chute communicates with the chamber through said gate. The upper edge of the opening of the inlet chute is spaced below the upper portion of said frame-type seat to provide a free space in the upper part of the chamber, even though the gate is open. An air cylinder closes the gate at the beginning of each bag-filling cycle, and opens it at the end. Air pressure is supplied to the chamber during the bag-filling cycle and vented out at the end of the cycle. Material in the chamber is fluidized during the bag-filling cycle, causing it to move horizontally through the spout and into the bag.



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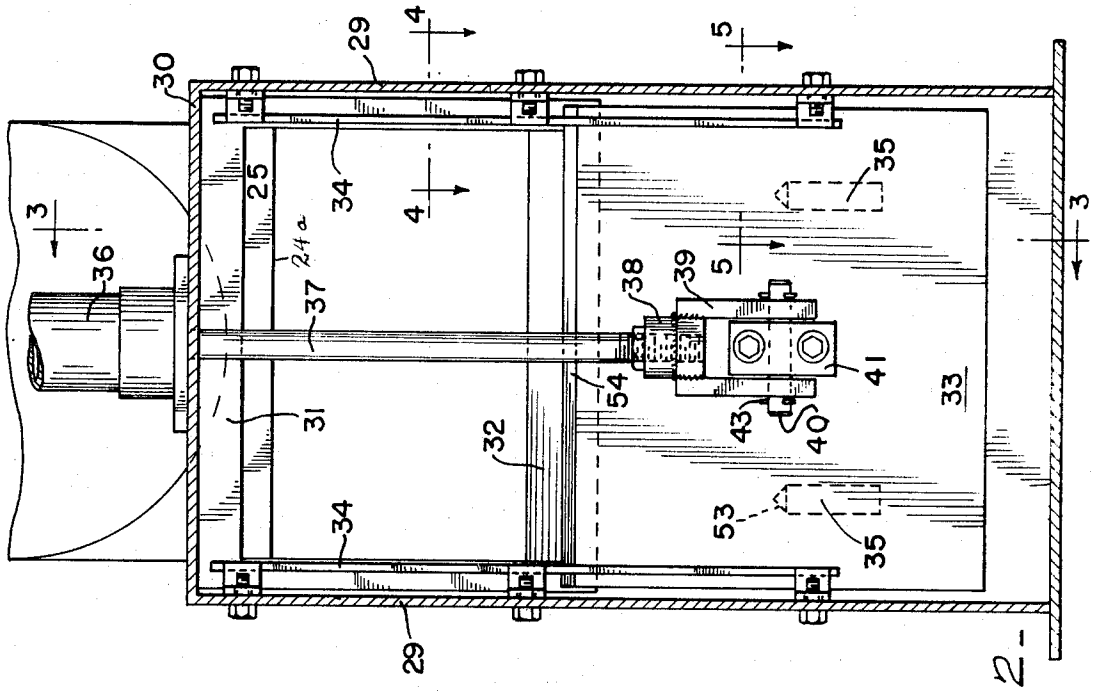


FIG. 2

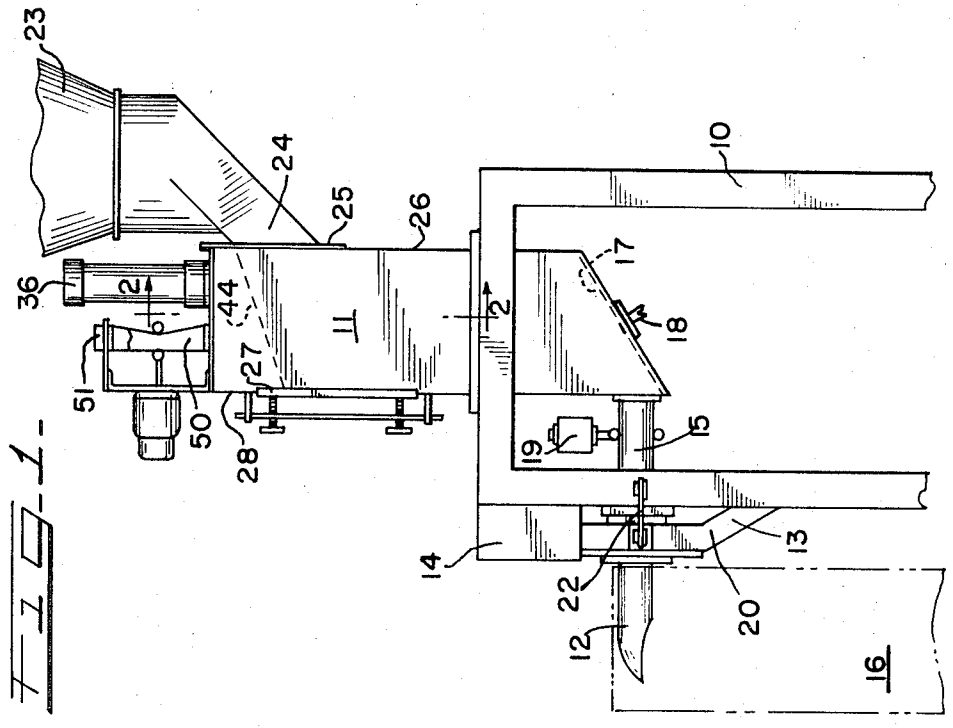


FIG. 1

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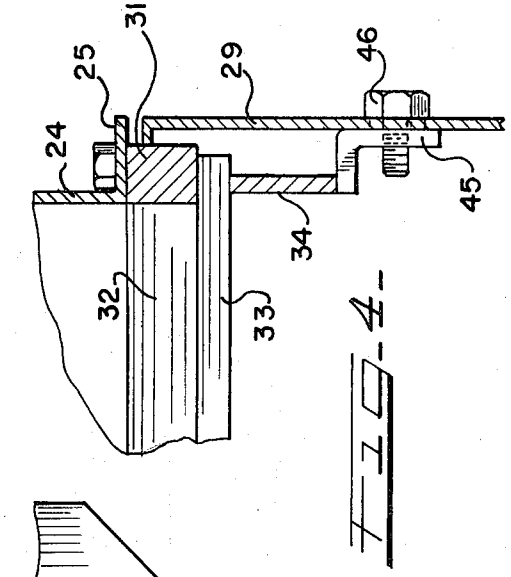


FIG. 4

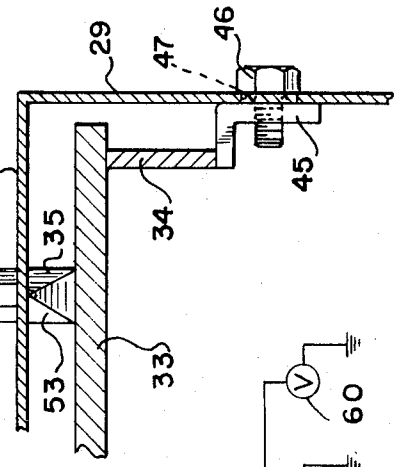


FIG. 5

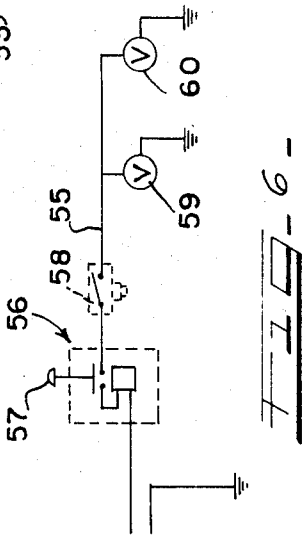


FIG. 6

FIG. 3

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INLET MEANS FOR BAG-FILLING MACHINE

This invention relates to improved inlet means for bag filling machines of the closed chamber type.

As pointed out in Van Pernis, U.S. Pat. No. 3,322,219 of May 3, 1967, it is desirable to provide an arrangement which maintains a free space at the top of the chamber but which does not require the use of a level-sensing means within the chamber to close the inlet valve.

Furthermore, in certain types of inlet valves now used in bag-filling machines, such as a butterfly-type valve, the material tends to block the movement of the valve member into its closed position. This prevents the pressure buildup within the chamber.

The problem is particularly pronounced in the case of granular materials, which term is used herein to include pellets, seeds, and the like, because the size of the particles located between the valve member and its seat, and which prevent the seating of the valve, cause a more pronounced pressure loss.

The arrangement shown is particularly suitable for granular materials for the further reason that it permits the use of an inlet pipe of larger cross section than that suitable for granular materials in the aforesaid Van Pernis arrangement. Therefore, the chamber is charged more rapidly, permitting more bag-filling cycles per minute. However, the present invention is also suitable for certain types of powdered materials.

According to my invention, I provide an inlet located in the sidewall of the chamber below the top wall of the chamber so that a free space will be provided above the inlet, in combination with a vertically slidable gate valve having the upper portion of its seat extending into the free space so that upward movement of the gate into its closed position will not be blocked by the presence of particles between the valve element and its seat.

Another feature of my invention is the provision of guide means for the gate which leave the side marginal portions of the gate unconfined, thus preventing the entrapment and compaction of particles which is encountered in grooved guide means, and which may result in a jamming of the gate.

Still another feature is that the gate valve is closed at the time the bag-filling cycle is initiated, as contrasted with prior arrangements which require level-sensing means and a separate control circuit for closing the inlet valve for the purpose of providing the free space in the top of the chamber.

Other objects, features and advantages of my invention will become apparent as the description proceeds.

With reference now to the drawings in which like reference numerals designate like parts:

FIG. 1 is a side elevation of a bag-filling machine embodying my invention;

FIG. 2 is a vertical section taken along line 2—2 of FIG. 1 showing the sliding gate in its open position;

FIG. 3 is a vertical section taken along line 3—3 of FIG. 2;

FIGS. 4 and 5 are horizontal sections taken along lines 4—4 and 5—5 of FIG. 2 showing the cooperation of the gate and the guide strips; and

FIG. 6 is a circuit diagram illustrating the operation of my invention.

With reference now to FIG. 1, the bag-filling machine comprises the machine framework 10 which supports a chamber 11 adapted to receive the powdered or granular material to be fed into the bags. A bag-supporting spout 12 communicates with the lower end of the chamber 11 and is mounted at the upper end of a spout-supporting frame 13. The spout-supporting frame may also serve as a support for other equipment not shown, such as a bag clamp and a bag saddle.

The spout-supporting frame 13 is connected to suitable scale mechanism 14, such as that shown in my copending application, Ser. No. 799,356, filed Feb. 14, 1969. Since the spout-supporting frame 13 has relative vertical movement with respect to the machine framework 10, a flexible connection is provided between the spout 12 and the chamber 11 in the form of a rubber tube 15.

A valve-type bag 16 is slipped over the spout 12 to receive material located in the chamber 11. A fluidizing pad 17 is located in the lower end of the chamber 11 and is connected to an air supply pipe 18. Fluidization of the material in the lower part of the chamber 11 will cause the material to flow horizontally through the tube 15 and spout 12 into the bag 16. A spout valve in the form of an air-actuated pinch valve 19 engages the rubber tube 15 to cut off the flow of fluidized material through the spout when the contents of the bag reach a predetermined weight, such as 100 pounds.

The spout-supporting frame 13 includes a spout-mounting plate 20 through which the spout 12 extends and to which it is suitable secured. The upper portion of the frame 13 is offset forwardly so that it is disposed beneath the scale mechanism 14. The spout-supporting frame 13 is confined to substantially vertical movement by upper and lower leaf springs which extend between the machine framework 10 and the spout-supporting frame 13, as described in the aforesaid copending application, only the upper leaf springs 22 being shown herein. Disposed above and to the rear of the chamber 11 is a supply hopper 23 for the material which is fed into the chamber 11. The supply hopper 23 communicates with the chamber 11 through a sloping inlet chute 24 of rectangular cross section. A 45° slope, as shown, has been found to be satisfactory for rapid feeding.

The lower end of the inlet chute terminates in a rectangular plate 25 which is bolted to the valve seat 31, hereinafter described.

An inspection door 27 is provided in the front wall 28 of the chamber. The chamber also has a rear wall 26, sidewalls 29 and a top wall 30.

The valve seat 31 is in the form of a frame providing a rectangular opening. The lower span of the frame is cut diagonally as at 32 so as to form a continuation of the slope of the lower wall of the inlet chute 24. The valve gate 33 is in the form of a rectangular plate which overlies the seat 31 and is confined to vertical movement by guide strips 34. Backup blocks 35 are mounted on the rear wall 26 of the chamber below the seat 31 and cooperate with the guide strips 34 to maintain the gate 33 in the same plane as that defined by the seat 31, these being operative only when the gate is in its open position, as shown in FIG. 3.

A double-acting air cylinder 36 is mounted on the top wall 30 for actuating the gate plate 33 through a piston rod 37. The latter is threaded at its lower end into a collar 38 which forms a part of a clevis 39. The clevis is connected by a pin 40 to a mounting block 41, which is secured to the front surface of the gate 33. As shown in FIG. 3, the holes 42 in the clevis arms which receive the pin 40 are elongate in the horizontal direction to allow slight horizontal movement of the gate 33 into sealing engagement with the seat 31. The pin 40 is maintained in position by cotter pins 43, as shown in FIG. 2.

When the gate valve is in its closed position, the gate 33 completely covers the opening of the seat 31 so as to block movement of material from the feed chute 24 into the chamber 11. When it is desired to feed material from the supply hopper 23 into the chamber, the air cylinder 33 is actuated to lower the gate plate 33 into the position shown in FIGS. 2 and 3. According to my invention the material flows into the chamber, but does not completely fill it because the upper wall of the feed chute 24 is below the top wall 30 of the chamber. The level of the material within the chamber is indicated by the dotted lines 44 in FIGS. 1 and 3, the slope indicating the angle of repose.

Then, when it is desired to fill a bag, the air cylinder 36 is actuated at the same time that the pinch valve 19 is opened in order to elevate the gate 33 into its upper or valve-closed position. This is accomplished by depressing a start button 57 which initiates the bag-filling cycle.

The operation is best illustrated by the electric circuit diagram of FIG. 6, although it is understood that an equivalent pneumatic control circuit may be employed.

The circuit 55 includes a cycle-initiating relay 56 having a start button 57 and also includes a cycle-terminating switch 58 which is actuated by the scale mechanism 14. When the contents of the bag reaches a predetermined weight, the scale mechanism trips, and opens the switch 58 to terminate the bag-filling operation. The circuit 55 also includes a normally closed solenoid valve 59 and a normally open solenoid valve 60. The normally closed solenoid valve 59 supplies air to the double-acting cylinder of the pinch valve 19 to open same when the circuit 55 is energized, and this is what establishes the filling cycle. The normally open solenoid valve 60 supplies air to the other end of the pinch valve cylinder to close same when the circuit 55 is deenergized, that is, between filling cycles.

One feature of the present invention is that the inlet valve is closed and opened by the same control means that opens and closes, respectively, the spout valve 19. The normally closed solenoid valve 59 supplies air to the bottom of the cylinder 36 to close the gate valve when the circuit 55 is energized, that is, during the filling cycle. The normally open solenoid valve 60 supplies air to the top of the cylinder 36 to open the gate when the circuit 55 is deenergized, and to maintain it open between filling cycles.

As described in the aforementioned Van Pernis patent, in a closed-chamber bag-filling machine it is desired to feed top air into the chamber during the filling cycle, and to vent it out at the conclusion of the filling cycle. This air supply and venting means includes an air supply valve 50 and a vent valve 51, both being actuated by single-acting air cylinders. The fluidizing air to pad 17 and the actuating air to close the vent valve 51 are controlled by normally closed solenoid valve 59, and the actuating air to close the top air valve 50 is controlled by the normally open solenoid valve 60, as described in said patent.

The guide strips 34 are mounted on brackets 45, as shown in FIGS. 4 and 5, which are screwed to the sidewalls 29 of the chamber 11. The holes 47 in the sidewalls which accommodate the screws 46 are elongate in the horizontal direction, as shown in the upper part of FIG. 3 so as to provide a guide setting which permits suitable sliding movement of the gate 33. The clearance required is of the order of from 0.002 to 0.010 inches. The contacting surfaces of the guide strips 34, and the gate 33, the seat 31, and the backup blocks 35 are preferably machined to provide this clearance.

During the bag-filling cycle, air is supplied to the chamber through the air supply valve 50 at a rate on the order of from 30 to 60 cubic feet per minute, which creates a low pressure on the order of from 2 to 6 pounds per square inch within the chamber. The desired feed rate varies with the material being fed, and is controlled by the pressure setting of the air supply means.

This air pressure forces the gate 33 against the seat 31 to provide a reasonably tight seal. The small loss of air through the slide gate will not affect the chamber pressure materially due to the nature of the air supply means as described in the aforesaid Van Pernis patent.

Although, in the case of granular material, the air pressure within the chamber 11 could escape upwardly through the supply bin 23 when the gate is opened, the use of the vent 51 relieves the sealing pressure between the gate and its seat which facilitates sliding gate movement.

As shown in FIGS. 4 and 5, the gate valve arrangement herein shown avoids the use of grooves for guiding the gate and the consequent entrapment and compaction of material in a groove which would interfere with free movement of the gate.

The feature of this arrangement is that the side marginal portion of the gate is unconfined in both the closed and the open position. When in closed position, the lower edge of the gate 33 is elevated almost up to the lower edge of the seat 31. Therefore, there will be no gate interposed between the rear wall 26 and the guide strips 34. As the chamber 11 partially empties itself, the material adjacent at least the upper portion of the rear wall 26 falls away, including the material between guide strips 34 and sidewalls 29, because there is no narrow groove in which it can become entrapped. The upper surface of the backup blocks 35 is sloped as shown at 53 in FIGS. 2 and 5 so that material will not accumulate thereon.

Then when the gate is lowered, there will be no compaction which interferes with free movement of the door. The clearance between the edge of the gate 33 and side wall 29, and between the front surface is sufficient to avoid compaction where material is present.

Although the guide strips 34 do not prevent transverse movement of the gate, such transverse movement is prevented by the rigidity of the piston rod. There may be a slight amount of transverse play between the clevis 39 and block 41, but this is small with respect to the clearance between the side edge of the gate 33 and the sidewall 29. Thus, even though the connection is a fixed connection with respect to transverse movement, the clevis 33 and the elongate holes 42 do permit both horizontal movement of the gate in a direction perpendicular to the seat, as previously indicated, and a universal pivotal movement which permits self-alignment of the plane of the gate with respect to the seat.

It will be noted in FIGS. 2 and 3, that the top span of the seat 31 is spaced above the edge 24*a* of the upper wall of the inlet chute 24.

Due to the inlet arrangement which provides a free space at the top of the chamber, there is no possibility that particles of material will become jammed between the upper gate edge 54 and the top span of the seat. Therefore, the gate can move into its fully closed position and permit the buildup of pressure. The gate edge 54 is sloped so that material particles will not be carried up and jammed between the gate edge and the top wall 30.

The advantages of this aspect of my invention are more apparent when the seat or frame 31 provides a rectangular opening, but other shapes are suitable, as long as any substantially horizontal downwardly facing seat edges or frame spans are located above the chute edge 24*a*.

I claim:

1. A bag-filling machine adapted for receiving material from a supply bin comprising a closed chamber, a bag-filling spout connected with the lower part of said chamber, means for causing material in the lower part of said chamber to flow horizontally through said spout and into a bag, spout valve means for controlling the flow of material through said spout, means for supplying air under pressure to said chamber, and means for admitting material to said chamber comprising a gate valve located in a sidewall of said chamber, and an inlet chute extending from said gate valve for communication with said supply bin, said gate valve comprising a vertically sliding gate in the form of a plate, a valve seat in the form of a frame providing an opening, said gate overlying the inner surface of said seat, guide means for holding said gate against said valve seat, power means for slidably moving said gate between an upper valve-closed position and a lower valve-open position, cycle-initiating means for opening said spout valve means and for moving said gate into said upper valve-closed position, cycle-terminating means, including bag weight responsive means, for closing said spout valve and for moving said gate into said lower valve-open position when the contents of the bag have reached a predetermined weight, said inlet chute communicating with the sidewall of said chamber at a point spaced beneath the top of said chamber so that the level of the material fed into said chamber will be spaced from the top of said chamber to provide a free space in the portion of said chamber, and the upper portion of said valve seat extending into said free space so that movement of the gate into its closed position will not be blocked by particles disposed between the gate and said upper portion of said valve seat.

2. A bag-filling machine as claimed in claim 1 in which the air supplied to said chamber urges said gate against said valve seat, means actuated by said cycle-terminating means for cutting off said chamber air and for venting said chamber in

order to relieve the air pressure on said gate and to facilitate its sliding movement.

3. A bag-filling machine as claimed in claim 1 in which said means for causing material to flow horizontally through said spout comprises fluidizing means located in the lower part of said chamber.

4. A bag-filling machine as claimed in claim 1 in which said power means comprises a double-acting air cylinder, air supply means for each end of said cylinder, said cycle-initiating means controlling the air supply for actuating said cylinder into the valve-closed position, and said cycle-terminating means controlling the air supply for moving said cylinder into the valve-open position.

5. A bag-filling machine as claimed in claim 4 in which said chamber air supply means includes an air-actuated chamber air supply valve, said cycle-terminating means also controlling the actuating air to said chamber air supply valve to close same.

6. A bag-filling machine as claimed in claim 5 including an air-actuated vent valve communicating with said chamber, said cycle-initiating control means also controlling the actuating air to said vent valve to close same.

7. A bag-filling machine as claimed in claim 1 in which said guide means comprise two vertically disposed guide strips engaging the inner surface of said gate, and spaced transversely inwardly from the side edges of said gate, said side edges being unconfined.

8. A bag-filling machine as claimed in claim 7 in which said power means includes an air cylinder having a piston rod, means for connecting said piston rod to said gate, said gate being maintained against substantial transverse movement by said piston rod.

9. A bag-filling machine as claimed in claim 8 in which said means for connecting comprises pin and clevis means permitting movement of said gate in a direction perpendicular to the plane of said seat under the influence of air pressure supplied by said air supply means.

10. A bag-filling machine as claimed in claim 7 in which said guide strips are of rectangular cross section, and are oriented so that the edge of narrower dimension engages said gate.

11. A bag-filling machine as claimed in claim 10 including supporting brackets mounted in the sidewall of said chamber and secured to said guides for mounting same, said brackets being adjustable in a direction perpendicular to the plane of said valve seat.

12. A bag-filling machine adapted for receiving material from a supply bin comprising a closed chamber, a bag-filling spout connected with the lower part of said chamber, fluidizing means located in said chamber for fluidizing material in the lower part of said chamber to cause it to move horizontally through said spout and into a bag, means including bag weight responsive means for cutting off the flow of material through said spout when the contents of the bag have reached a predetermined weight, means for admitting material to said chamber comprising a gate valve located in a sidewall of said chamber, and an inlet chute extending from said gate valve for communication with said supply bin, said gate valve comprising a vertically sliding gate in the form of a plate, a valve seat in the form of a vertically disposed frame providing an opening, said gate overlying the inner surface of said seat, an air cylinder located above said gate and having a piston rod connected to said gate for actuating same between an upper valve-closed position and a lower valve-open position, and guide means for holding said gate against said valve seat including a plurality of vertically disposed guide strips engaging the inner surface of said gate and spaced transversely inwardly from the side edges of said gate, said side edges being unconfined, said inlet chute communicating with the sidewall of said chamber at a point spaced beneath the top of said chamber so that the level of the material fed into said chamber will be spaced from the top of said chamber to provide a free space in the upper portion of said chamber, the upper portion of said valve seat extending into said free space so that movement of the gate into its closed position will not be blocked by particles disposed between the gate and said upper portion of said valve seat.

13. A bag-filling machine as claimed in claim 12 including means for supplying top air to said chamber to urge said gate against said valve seat, means actuated by said bag weight responsive means for cutting off said top air and for venting said chamber when the flow of material through said spout is cut off in order to relieve the air pressure on said gate and to facilitate its sliding movement.

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