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Chicago, Ill.
 Continuation-in-part of Ser. No. 660,259,
 Aug. 14, 1967, abandoned.

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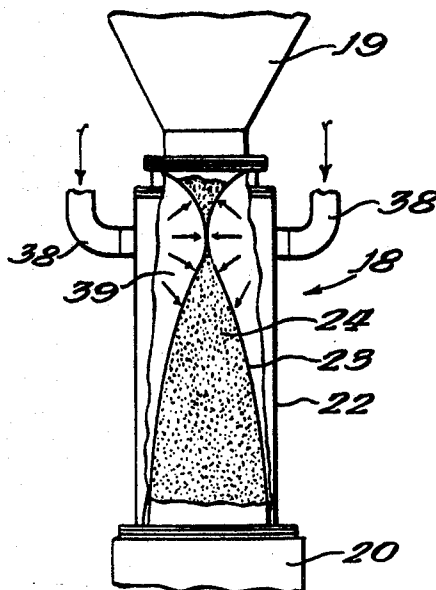
[54] **METHOD AND APPARATUS FOR FILLING BAGS**
 11 Claims, 22 Drawing Figs.

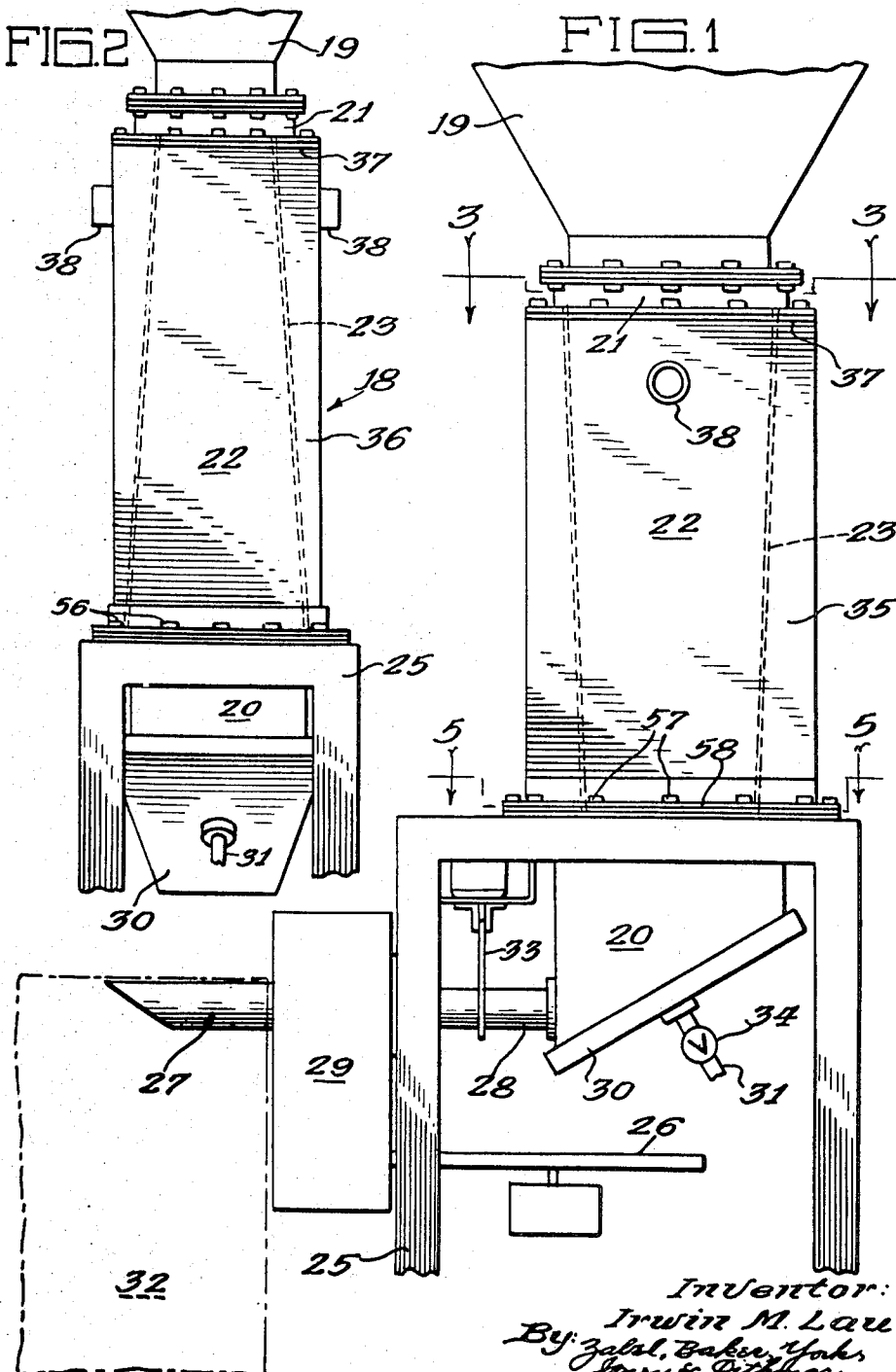
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 [50] Field of Search. 103/148;
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 206, 207, 209, 214, 226, 386.5, 389, 302/29

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ABSTRACT: A bag-filling machine has a flexible sleeve extending from the supply bin to the feed hopper. The feeding action is obtained by squeezing the sleeve to force the charge of powdered material contained therein downwardly through the feed chamber and a communicating spout into a bag hung on the spout. A casing surrounds the flexible sleeve. Air under pressure is introduced into the space between the casing and the sleeve to squeeze the sleeve. In a modification, the sleeve is squeezed by rollers. When a given weight of material has been fed into the bag, a scale mechanism trips and shuts off further flow of material through the spout by means of a pinch valve behind the spout, and terminates the squeezing action.





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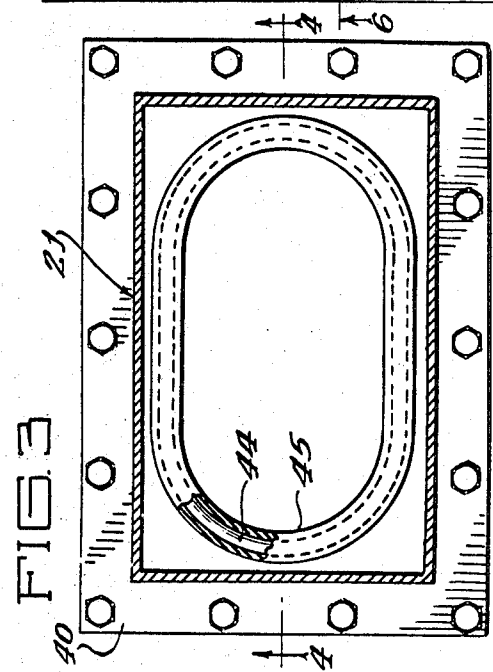
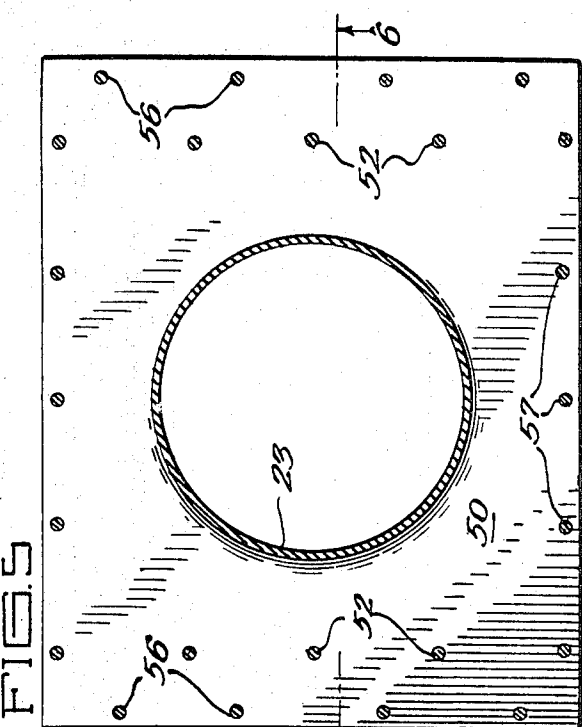
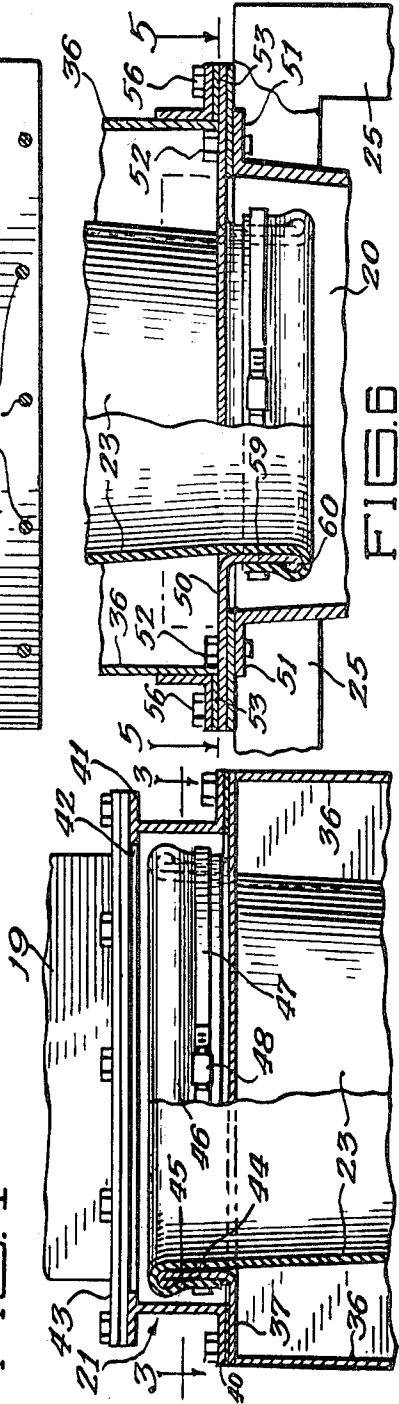
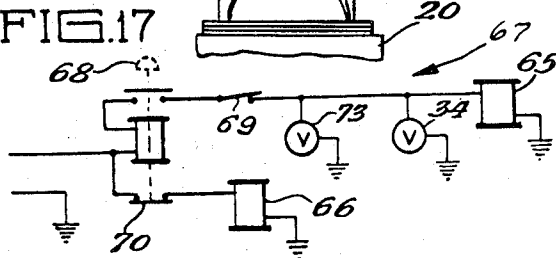
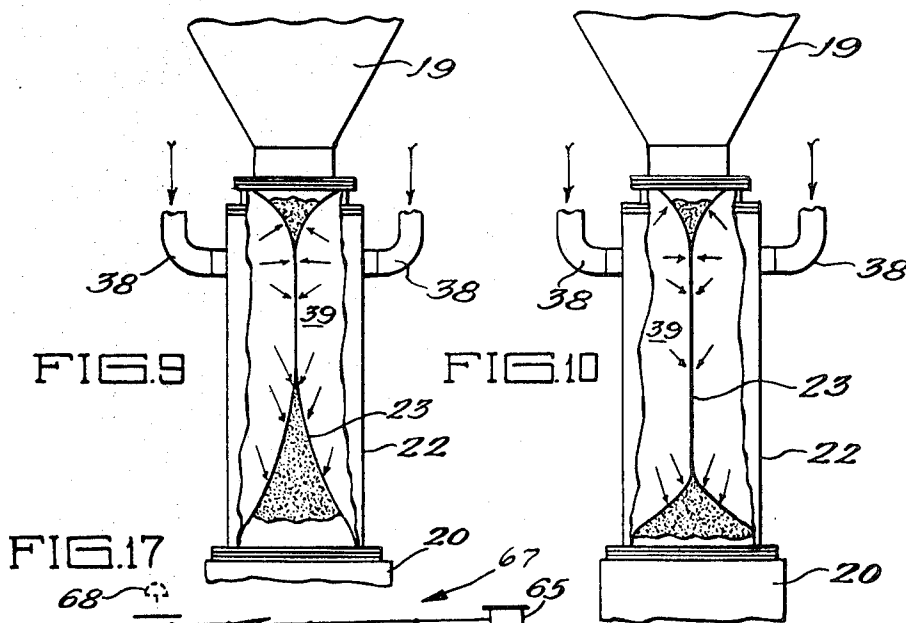
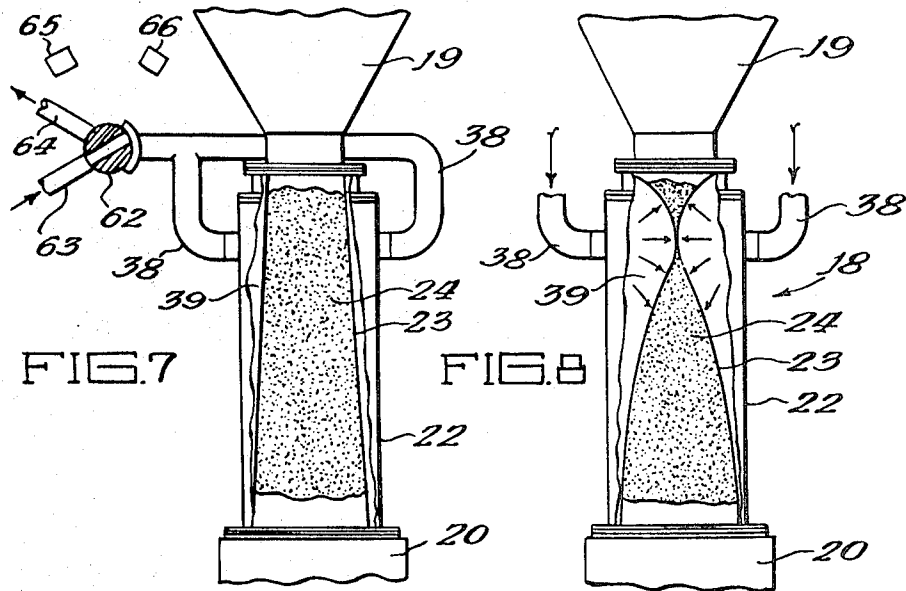


FIG. 4





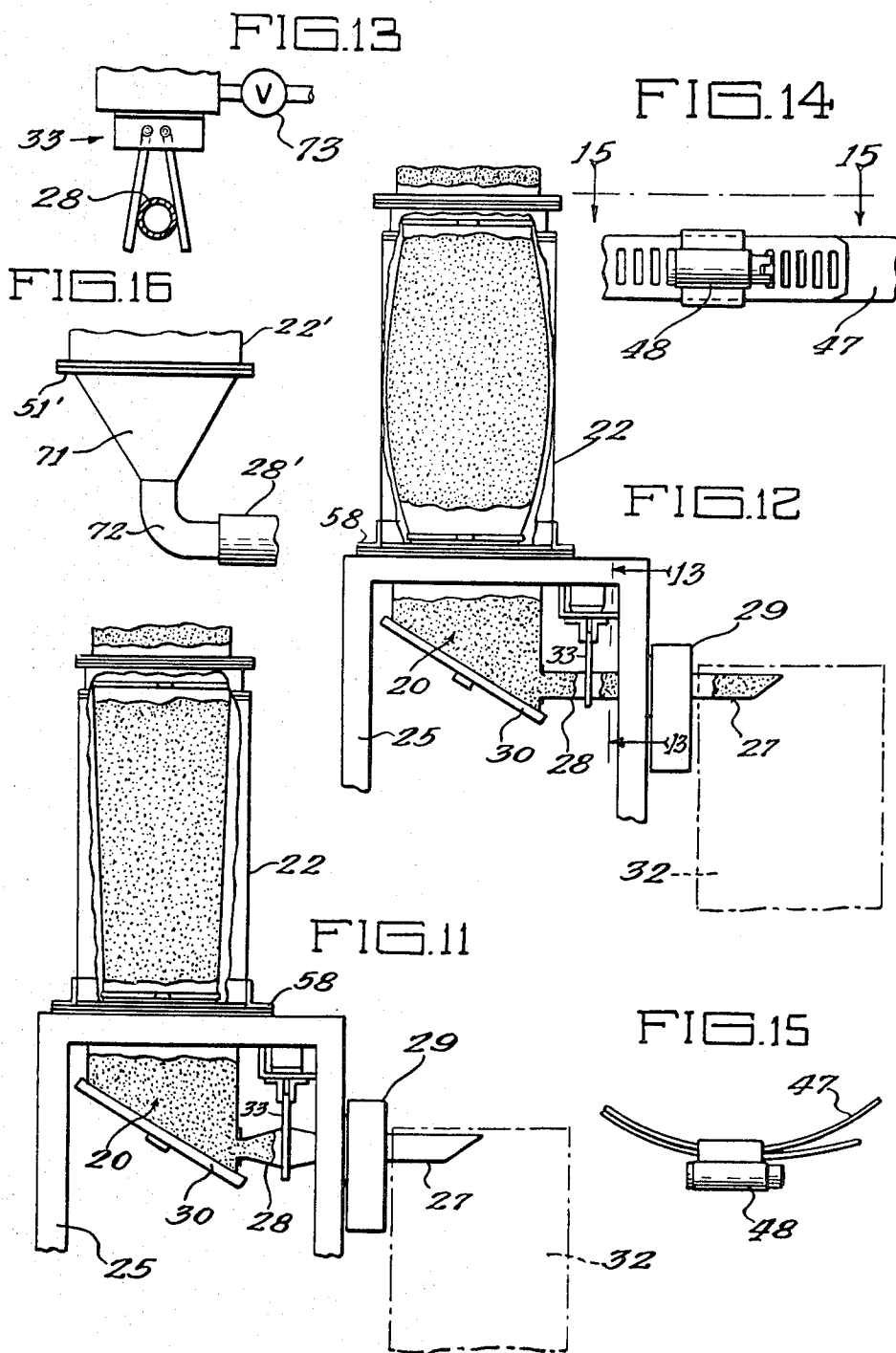


FIG. 18

FIG. 19

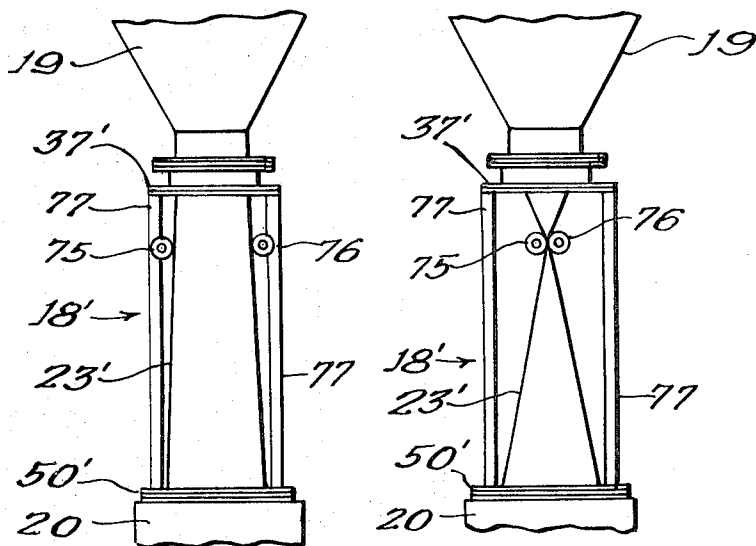
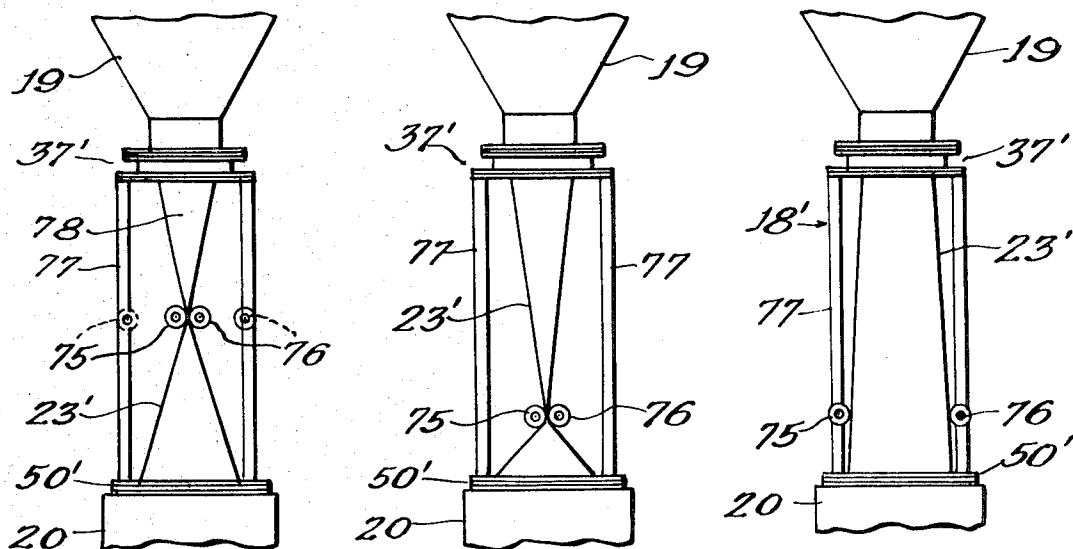


FIG. 20

FIG. 21

FIG. 22



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METHOD AND APPARATUS FOR FILLING BAGS

This application is a continuation-in-part of Ser. No. 660,259 filed Aug. 14, 1967 now abandoned.

This invention relates to improvements in method and apparatus for filling bags, and is of particular advantage in packing certain very fine powders which are difficult to pack with presently available equipment.

In the case of finely ground gap graphite, for instance, the material is very difficult to handle and does not flow as rapidly as other powders. For instance in a fluidizing machine of the type shown in my prior U.S. Pat. No. 2,963,994, it took 34 seconds to fill a 60-pound bag of graphite, whereas the same machine will fill a 100-pound bag of coarser powders and granular materials in about half this time.

Other materials, such as kaolin clay, talc, and diatomaceous earth are similarly difficult to pack. The characteristic of all of these four materials is that they are light and fluffy and of smaller particle size than that of the average powder. Increasing the volume of fluidizing air does not materially improve the packing speed nor does pressuring the chamber with top air.

The movement of fluidized material is due to gravity. According to my invention, I substitute a mechanical force for the gravitational force acting on the material to be packed. The mechanical force extrudes the material through the spout. As a result, the amount of fluidizing air required is greatly reduced, and in some instances can even be eliminated. The great reduction in the amount of fluidizing air required results in a much denser packing in the bag.

According to one embodiment of my invention, I achieve the extruding action by causing the material to flow of dimensions into a flexible sleeve, and then compressing the sleeve by air pressure. The sleeve when contracted shuts off movement of material from the bin to the feed chamber. The sleeve is therefore of dimensions such that the amount of material displaced is somewhat more than required to fill the bag. When the scale trips, the air pressure on the sleeve is released and another charge of material drops from the supply bin into the sleeve as the sleeve expands.

According to another embodiment of my invention, the extruding action is caused by rollers which engage the sleeve and move downwardly.

In the drawings:

FIG. 1 is a side elevation of a preferred embodiment of my invention;

FIG. 2 is a rear elevation thereof;

FIG. 3 is a plan section taken along lines 3-3 of FIGS. 1 and 4;

FIG. 4 is a vertical section taken along line 4-4 of FIG. 3;

FIG. 5 is a plan section taken along lines 5-5 of FIGS. 1 and 6;

FIG. 6 is a vertical section taken along line 6 of FIG. 5;

FIGS. 7 to 10 are rear views, similar to FIG. 2, but with the casing broken away, illustrating the operation of the sleeve;

FIGS. 11 and 12 are side views with the casing broken away, showing the sleeve in the FIG. 7 and FIG. 10 position respectively;

FIG. 13 is a section taken along line 13-13 of FIG. 12 illustrating the pinch valve;

FIG. 14 and 15 are detailed side and top elevations respectively of the clamping means;

FIG. 16 is an elevation of a modified feed hopper;

FIG. 17 is a circuit diagram illustrating the operation; and

FIGS. 18 to 22 are diagrammatic views, similar to FIGS. 7 to 10, showing a modification of my invention.

FIGS. 1 and 2 show a bag filling machine 18 which is adapted for location beneath a supply bin 19. The bag-filling machine includes a feed hopper 20 at its lower end, inlet means at its upper end including an adapted assembly 21 for connection with the bin 19, and a flexible sleeve 23 extending between the two. A casing 22 surrounds the sleeve.

The bag-filling machine 18 also includes a supporting framework 25 and a scale mechanism generally indicated by the reference numeral 26. A spout 27 communicates with the

lower end of the feed hopper 20 by means of a flexible rubber tube 28. Suitable spout supporting mechanism 29, such as the floating frame arrangement of my aforesaid prior patent, is provided which also provides a connection with the scale mechanism 26.

A fluidizing pad 30 is located at the bottom of the feed hopper 20 and is connected to an air supply pipe 31. A valve-type bag 32 may be fitted over the spout 27 and supported therefrom.

The material 24 flows in a horizontal direction through the spout 27 and into the bag 32. When the weight of the bag and contents reaches a predetermined amount such as 100 pounds, the scale mechanism 26 is tripped and an air-actuated pinch valve 33 (FIG. 13) engages the flexible rubber tube 28 to cut off the flow of material.

The flexible sleeve 23 is connected at its upper end to the adapter assembly 21 by a top collar plate 37 and at its lower end to the feed hopper 20 by bottom collar plate 50. The top collar plate 37 constitutes the top wall of the casing 22, the casing having sidewalls 35 and end walls 36. Conduit means 38 on the sidewalls 35 permit introduction of air into the space 39 between the walls of the casing 22 and the flexible sleeve 23.

When air is introduced into the space 39, the sleeve will be progressively contracted as shown in FIGS. 7 to 10 which will force the material 24 downwardly into the feed hopper 20 from which it flows horizontally through the spout 27 and into the bag 32. The horizontal movement of the material through the spout 27 is aided by fluidizing the material which is adjacent to the pad 30 in the feed hopper. The fluidizing air to the pad 30 is preferably cut off by a valve 34 at the same time that the pinch valve 33 is closed.

As shown in FIGS. 3 and 4, the adapter assembly 21 comprises a box like structure having lower flanges 40 and a top mounting plate 41 welded thereto in which is provided an opening 42 of generally oval configuration. The mounting plate 41 is of a shape and size corresponding to the lower flange 43 of the bin 19 so that the two may be bolted together with a suitable gasket in between.

The adapter assembly 21 is secured to the upper end of the casing 22 by screws taking into the top collar plate 37.

The top collar plate 37 includes an upstanding collar 44 of oval shape having a bead or seam 45 at its upper edge. The flexible sleeve 23 extends upwardly through the oval opening defined by the collar 44, and its end 46 is folded downwardly over the collar and clamped thereto by clamping means comprising a band 47 and screw threaded tensioning means 48 of a conventional type, as shown in FIGS. 14 and 15. Thus the upper part of the casing is securely sealed with respect to the flexible sleeve 23.

The bottom collar plate 50 is secured to flanges 51 on the feed hopper 20 by screws 52 (FIGS. 5 and 6). A gasket 53 is confined between the bottom collar plate 50 and the casing flanges 51.

The casing 22 is provided with bottom flanges 58 (FIG. 1) by means of which the casing may be secured to the bottom collar plate 50 by screws 56 and 57. The screws 57 take into the feed hopper flanges 51.

The bottom collar plate 50 carries a downwardly extending collar 59, as shown in FIG. 6. The lower end of sleeve 23 is folded upwardly over the beaded edge 60 of the collar 59 and is secured by clamping means 47, 48, in a manner similar to that previously described for the upper end of the casing.

The means for alternately applying and releasing the pressure on the sleeve 23 is shown diagrammatically in FIG. 7 and comprises a two-way valve 62 interposed between the conduit means 38 on the one hand, and a source 63 of low-pressure air (e.g. 6 p.s.i.) and a vent 64 on the other hand. The valve is shifted in either direction by the solenoids 65 and 66, respectively.

As shown in FIG. 17, the pressure line solenoid 65 is connected in the operating circuit 67 so that depression of the start button 68 will close the circuit to the pressure line sole-

noid 65 to pressurize the space 39 and at the same time will energize the solenoid valve 73 to open the pinch valve 33.

When the scale mechanism 26 trips and opens the microswitch 69 to close the air actuated pinch valve 33 (through deenergization of the solenoid valve 73), a real relay switch 70 closes the circuit to the vent line solenoid 66 to release the pressure within the space 39. The solenoid valve 34 for supplying air to fluidizer pad 30 may preferably be connected into the operating circuit 67 so that fluidizing air is supplied only at the time that the pinch valve is open.

The dimensions of the oval collar 43 are such that its periphery is equal to the periphery of the circular lower collar 59 so that the flexible sleeve 23 may be cut from tubular material of a uniform diameter. The advantage of the particular oval arrangement shown is that the flat sides of the oval tend to collapse toward the major axis, without any buckling or reentrant folds occurring at the ends of the oval. Thus an effective closure is provided which prevents further material from dropping into the sleeve from the bin until such time as the air pressure is released. The absence of reentrant folds is illustrated in FIG. 12 where, when in collapsed position, the folded edges of flexible sleeve are bowed out slightly in the direction of the end walls.

The air inlets provided by the conduit means 38 are located at the upper portion of the sidewalls 35 so that they will be opposite the flat sides of the oval. Thus the kinetic energy of the airstream causes the sleeve to contract initially at its upper portion as shown in FIG. 8. As the pressure builds up, the middle portion and then the bottom portion contracts, as shown in FIGS. 9 and 10, thus providing a downwardly progressive contracting action which pushes a greater volume of material downwardly than if the initial collapse occurred at the mid portion of the sleeve. The progressive action is aided by the fact that the combination of oval shape at the top and circular shape at the bottom produces a downwardly diverging configuration when viewed from the front or rear, as shown in FIG. 7. Thus the initial closure will tend to take place at the narrower portion of the sleeve, which, with respect to the flat sides of the oval, is at the upper end. If desired, a specially molded sleeve can be used which has a thinner wall section at the top to enhance the progressive contraction, but satisfactory results have been obtained with a rubber sleeve of uniform wall thickness, approximately a quarter of an inch thick.

The pressure of the air in space 39 must be sufficiently low as to prevent blowout of the sleeve. Air pressures of from 1 to 9 p.s.i. are satisfactory. However, in order to assure rapid filling, higher pressures within this range are preferred. Automatic pressure limitation in combination with a substantially instantaneous pressure build up is obtained by a constant delivery pump, sometimes referred to as a positive displacement blower, having a weighted pressure relief valve located between the pump and the two-way valve 62, as described in U.S. Pat. No. 3,322,219. In the embodiment shown and described herein, a 6 p.s.i. pressure provided very rapid feeding. The conduit 38 and associated elements 63 and 64 were of 2 inch pipe, and the constant delivery pump had a rating of from 40 to 100 cubic feet per minute.

Fluidizing air was supplied to the pad 30 at the rate of 2 cubic feet per minute, as contrasted with from 5 to 12 cubic feet per minute on the pad in the fluidizing machine of the type shown in my aforesaid prior patent when packing coarser powders and granular materials at a rapid rate.

FIG. 16 shows a modified feed hopper 71 which is of conical shape, and secured to a cylindrical casing 22'. Due to the conical shape, the fluidizing pad 30 can be eliminated since a satisfactory flow rate of fine powders can be obtained by use of the sleeve 23 alone. An elbow 72 connects the feed hopper 71 with the rubber tube 28'.

In the embodiment shown, the casing 22 was substantially 33 inches high, 20 inches wide, and 14 inches from front to back. The lower collar was substantially 12 inches in diameter, and the upper collar substantially 7½ inches wide and 13½ inches long, accommodating a rubber sleeve 23 of substantially 12 inches in diameter.

The reason for rapid flow with only a small amount of fluidizing air is not fully understood, but it is believed that in the fluidizing chamber of the usual bag filling machine, the greater part of the air functions to fluidize the entire lower portion of the column of material. If the lower part of the column does not have a fluid characteristic, the weight of the column would not be uniformly distributed over the cross section of the chamber, and the gravitational force would not be sufficient to cause horizontal flow through the spout at the desired flow rate.

A smaller part of the air is entrained in the material immediately adjacent the pad and, moving horizontally with said adjacent material, reduces the friction between the particles, thus performing a lubricating function for the horizontally moving material.

Where a mechanical force is substituted for the gravitational force, the only fluidizing air required is that necessary for lubrication, and this required amount varies according to the air already entrained in a fluffy powder, and also according to the self-lubricating characteristics of the particles. Thus it follows that by substitution of a mechanical force of predetermined magnitude for the usual gravitational force, the amount of fluidizing air required is determined primarily by the amount of lubrication required, and hence is greatly reduced.

In the modification shown in FIGS. 18 to 22, the casing is eliminated and a pair of rollers 75, 76 are provided for squeezing the sleeve 23'. The sleeve is secured at its upper and lower ends respectively, to a top collar plate 37' and bottom collar plate 50'. These are maintained in spaced relationship by posts 77 which also form a part of the structure of the machine 18'. Suitable means, not shown, are provided for moving the rollers inwardly from the FIG. 18 position to the FIG. 19 position to squeeze the sleeve 23' and then to move them downwardly through the FIG. 20 position and into the FIG. 21 position, thus forcing the material out of the chamber 20 and into a bag in the same manner as in FIGS. 7 to 10. When the scale mechanism trips, means are provided to move the rollers 75 and 76 outwardly into the FIG. 22 position, thus discontinuing the extruded action. The outward movement can occur at any vertical position of the rollers, as illustrated by the dotted line rollers in FIG. 20, depending upon the time that the scale trips, which in turn depends on the desired bag weight or capacity.

According to this modification, some material from the bin will flow into the space 78 above the roller 75, 76, as the rollers move downwardly, but otherwise the action is substantially the same as described in connection with FIGS. 7 to 10.

Although only preferred embodiments of my invention have been shown and described here, it will be understood that various modifications and changes can be made in the constructions shown without departing from the spirit of my invention as pointed out in the appended claims.

I claim:

1. The method of filling bags with powdered material contained in a supply bin which comprises the steps of permitting gravitational movement of material from the lower portion of said supply bin into an elongate chamber, applying a mechanical force to the material in said chamber to force said material downwardly through said elongate chamber and into a bag and at the same time relieving the material in said elongate chamber from the weight of the material in said supply bin, fluidizing said material to an extent sufficient only to lubricate the particles thereof during horizontal movement, and discontinuing the application of said mechanical force and permitting downward gravitational movement of material from said bin into said elongate chamber.

2. The method of filling bags with powdered material contained in a supply bin which comprises the steps of introducing material from the lower portion of said supply bin into an elongate chamber having flexible walls, squeezing the walls of said chamber to force said material downwardly through said elongate chamber and into a bag, fluidizing said material to a slight extent at a point between said chamber and said bag,

blocking the flow of material from said elongate chamber into said bag when a predetermined amount of material has been received within said bag, and discontinuing said squeezing action and permitting downward movement of material from said bin into said elongate chamber.

3. The method of claim 2 in which said walls are squeezed progressively downward.

4. A bag-filling machine comprising material inlet means, a feed hopper spaced below said inlet means, a bag-receiving spout communicating with said feed hopper, fluidizing means located in said feed hopper, a vertically extending flexible sleeve connecting said inlet means with the upper part of said feed hopper, and means for squeezing said sleeve to force material contained within said sleeve downwardly into and through said feed hopper and spout and into said bag.

5. A bag-filling machine as claimed in claim 4 in which said sleeve-squeezing means comprises a pair of oppositely disposed rollers mounted for horizontal movement between a first position in which said sleeve is substantially unsqueezed and a second position in which said rollers engage said sleeve to squeeze same, and for downward movement when in said second position.

6. A bag filling machine as claimed in claim 4 in which said sleeve-squeezing means comprises a casing surrounding said sleeve, and means for establishing air pressure in the space between the casing and said sleeve.

7. A bag-filling machine as claimed in claim 4 which includes means for terminating the operation of said squeezing means when a predetermined amount of said material has been fed into said bag, whereby a fresh charge of material may flow from said inlet means into said sleeve.

8. A bag-filling machine as claimed in claim 7 which includes means for cutting off the flow of material through said spout, and bag weight responsive means controlling the operation of said cut off means and said terminating means.

9. A bag-filling machine as claimed in claim 4 which in-

cludes a top collar plate secured to said inlet means and having an upwardly extending collar, a bottom collar plate secured to said feed hopper and having a downwardly extending collar, the upper end of said sleeve extending through said collar and being folded down over the external surface thereof, first clamping means surrounding said folded down end and clamping same to said collar, the lower end of said sleeve extending through said downwardly extending collar and being folded up over the external surface thereof, and second clamping means surrounding said folded up end portion and clamping same to said collar.

10. A bag-filling machine comprising material inlet means, a feed hopper spaced below said inlet means, a bag-receiving spout communicating with said feed hopper, a vertically extending flexible sleeve connecting said inlet means with the upper part of said feed hopper, a top collar plate secured to said inlet means and having an upwardly extending collar of oval cross section, a bottom collar plate secured to said feed hopper and having a downwardly extending collar of circular cross section, the upper end of said sleeve extending through said collar and being folded down over the external surface thereof, first clamping means surrounding said folded down end and clamping same to said collar, the lower end of said sleeve extending through said downwardly extending collar and being folded up over the external surface thereof, and second clamping means surrounding said folded up end portion and clamping same to said collar, and means for squeezing said sleeve to force material contained within said sleeve downwardly into and through said feed hopper and spout and into said bag.

11. A bag-filling machine as claimed in claim 10 in which the peripheries of said collars are equal to each other, in length, said sleeve being of tubular rubber stock of uniform diameter.

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