

July 30, 1935.

K. MIDDELBOE

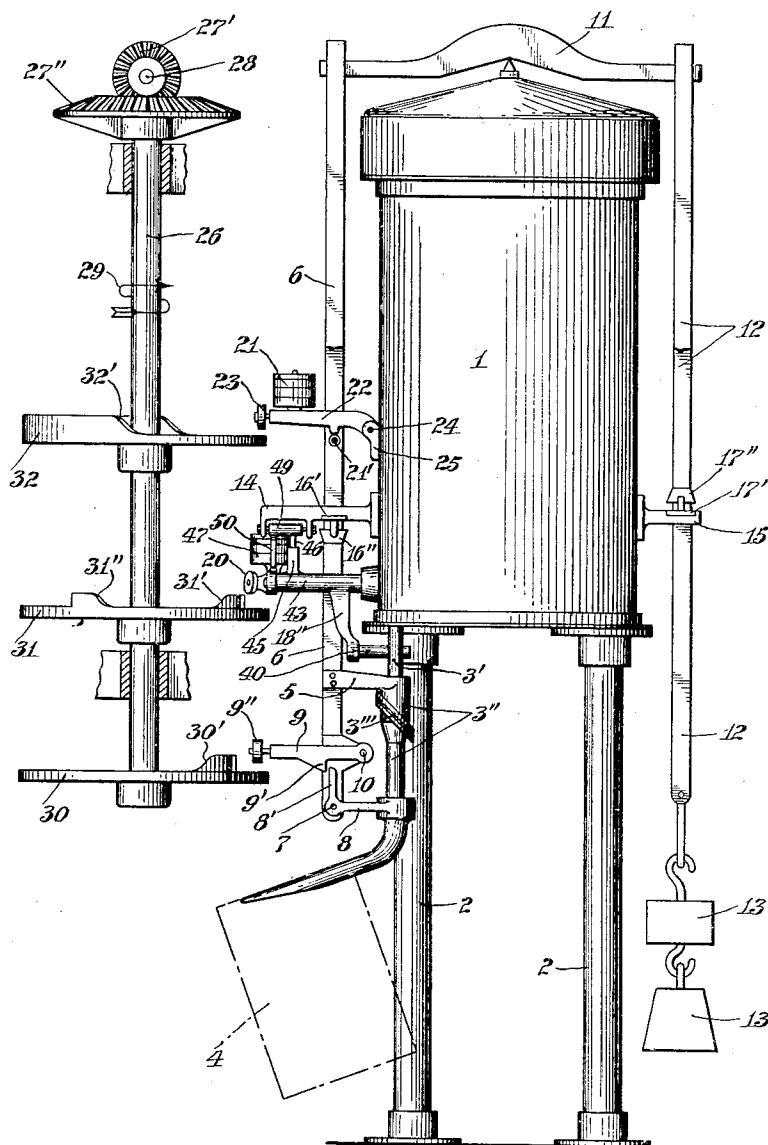
2,009,408

APPARATUS FOR PACKING PULVEROUS MATERIAL INTO BAGS

Filed July 18, 1931

4 Sheets-Sheet 1

Fig. 1.



INVENTOR.

Kristian Middelboe

BY

Redding, Greely, Shea & Campbell
ATTORNEYS.

July 30, 1935.

K. MIDDELBOE

2,009,408

APPARATUS FOR PACKING PULVEROUS MATERIAL INTO BAGS

Filed July 18, 1931

4 Sheets-Sheet 2

Fig. 2.

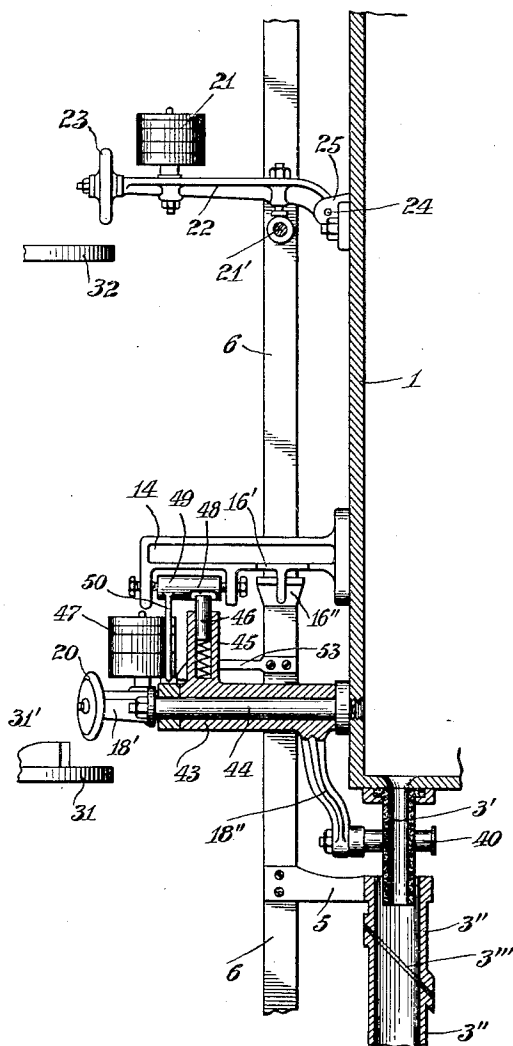
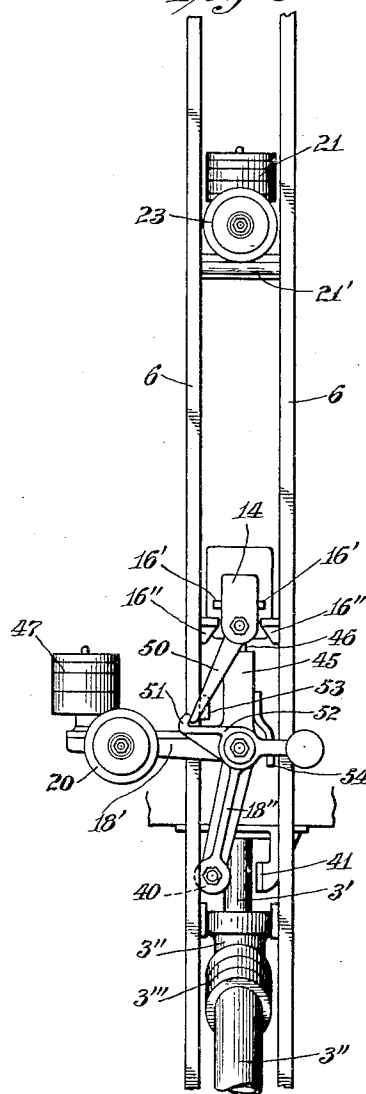


Fig. 3.



INVENTOR.
Kristian Middelboe
 BY
Redding, Giesler, Olsen & Campbell
 ATTORNEYS.

July 30, 1935.

K. MIDDELBOE

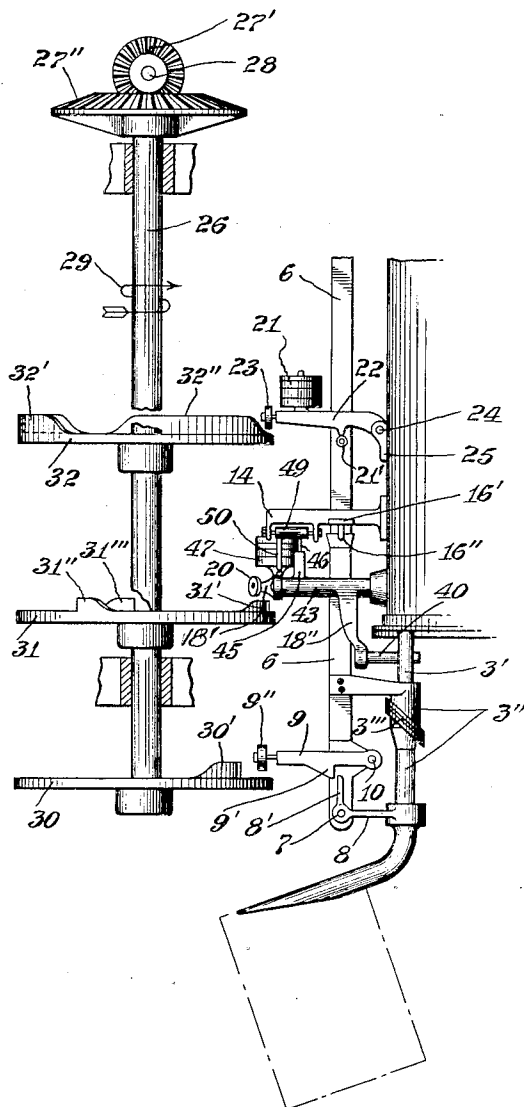
2,009,408

APPARATUS FOR PACKING PULVEROUS MATERIAL INTO BAGS

Filed July 18, 1931

4 Sheets-Sheet 3

Fig. 4.



INVENTOR
Kristian Middelboe
 BY
Reuben G. Gable, Oliver S. Campbell
 ATTORNEYS

July 30, 1935.

K. MIDDELBOE

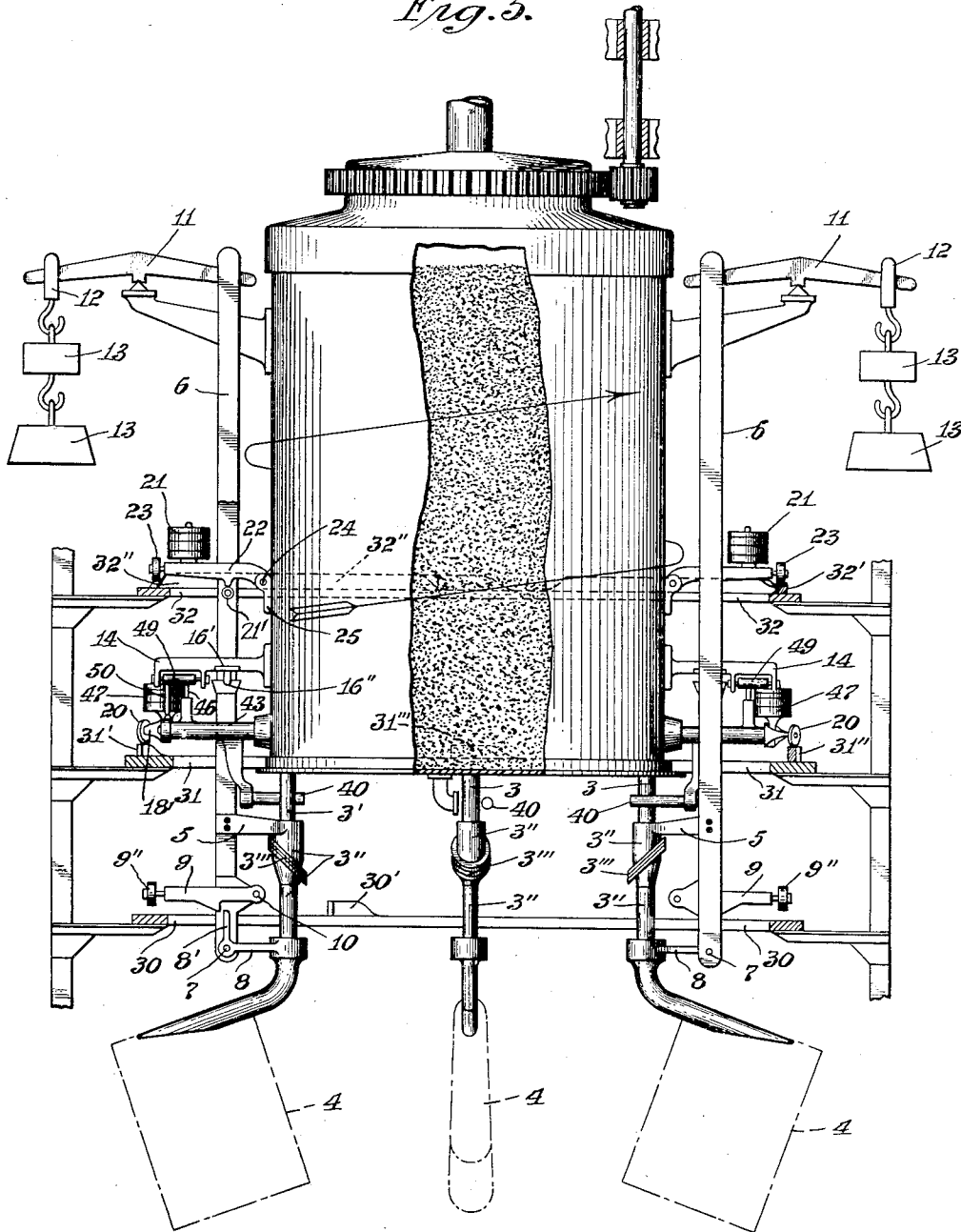
2,009,408

APPARATUS FOR PACKING PULVEROUS MATERIAL INTO BAGS

Filed July 18, 1931

4 Sheets-Sheet 4

Fig. 5.



INVENTOR
Kristian Middelboe
BY
Redding, Grady, O'Leary & Campbell
ATTORNEYS

UNITED STATES PATENT OFFICE

2,009,408

APPARATUS FOR PACKING PULVEROUS MATERIAL INTO BAGS

Kristian Middelboe, Frederiksberg, near Copenhagen, Denmark, assignor to F. L. Smidth & Co., New York, N. Y., a corporation of New Jersey

Application July 18, 1931, Serial No. 551,697
In Great Britain July 24, 1930

6 Claims. (Cl. 249—60)

The filling of bags, particularly valve bags, with pulverous material, such as cement or the like, and with simultaneous weighing of the material, is subject somewhat to the difficulty that the bag cannot be filled completely with material, because the latter, when filled into the bag, is mixed with some air. This is especially true in the operation of filling machines in which the cement or other material, by addition of a certain quantity of air, is given such a fluid consistency that the material will flow like a liquid under the influence of gravity as a constant stream through the pipes through which the material is filled into the bag. In other types of filling machines, such as those in which the material is forced through the filling pipes by means of a rotary vane or a fast worm conveyor, some air will be suspended in the material supplied to the bag.

It has been attempted to overcome this difficulty in some degree by giving the valve opening of the bag such a shape that the escape of air from the bag is facilitated, and also by rapping the outside of the bag during the filling process, whereby also the removal of air entrapped in the material will be facilitated. In spite of all such precautions, however, the degree of filling has never been quite satisfactory.

The present invention has for its object, in filling material in an air-mixed state, to increase the degree of filling beyond what has been attained heretofore. According to the invention this object is attained by stopping, for one or more periods, during the filling of a bag, the supply of material to the bag in order thus to give the entrapped air a chance to escape from the material. The material is not supplied continuously to the bag, but periodically, which of course causes a corresponding increase in the filling time, but as shown by experiments the degree of filling of the bag is increased so much that the saving in bag material will be far in excess of the costs due to the increase in filling time.

This delay, however, may be shortened somewhat by using the above mentioned known means for facilitating the removal of air from the material filled into the bags. A good ventilation at the valve opening of the bag will shorten the period during which the supply has to be interrupted in order to let the air escape from the material in the bag. This increased ventilation may be attained partly by a powerful exhaust of air at the valve opening, and partly by the provision of ample openings for the air to es-

cape at the top end of the bag. The filling time may also be shortened by rapping on the outside of the bag, during the supply of material as well as during the periodical stops.

In the drawings, in which a convenient and practical embodiment of the invention is illustrated,

Figure 1 is a view in elevation of a non-rotary filling machine fitted with devices for the periodic cutting off of the supply of material to the bag.

Figures 2 and 3 are detail views on a larger scale of some parts of the mechanism shown in Figure 1, Figure 2 being a view in sectional elevation as seen from the right hand in Figure 3, and Figure 3 being a view in elevation, as seen from the left hand in Figure 2.

Figure 4 is a view similar to Figure 1, showing a device constructed in accordance with the present invention and providing for the interruption of the filling operation twice, thus illustrating a mechanism wherein the filling operation may be interrupted a plurality of times.

Figure 5 is a view similar to Figure 1, showing a rotary type filling machine.

The filling machine proper consists mainly of a filling tank 1, which is carried by supports 2, and from the bottom of which the material is supplied as a uniform stream, by way of a stationary discharge pipe 3' and a movable filling pipe 3'' joined thereto, to the bag suspended on the last mentioned pipe. The connection between the two pieces of pipe is such as to permit relative movement and may be of telescopic construction.

By means of a skew joint 3''' the filling pipe 3'' is divided into an upper and a lower part supported each by one of two arms 5 and 8, respectively, carried by the hanger 6 of the weighing mechanism. The arm 8 is pivoted about a point 7 of the hanger 6 of the weighing mechanism, and during the filling of the bag the said arm is maintained in the position shown on the drawings by means of a latch lever 9, which is pivoted at a point 10 on the hanger 6, a stop 9' of the latch 9 engaging an arm 8' extending from the arm 8. The free end of the lever 9 is fitted with a guide roll 9''.

The top end of the hanger 6 is suspended from one end of a two-armed lever 11, the other end of which on the other side of the tank 1 carries another hanger 12 which supports weights 13 adapted to counterbalance the bag until such time as it has received the predetermined weight of material. The hangers 6 and 12 are guided by

brackets 14 and 15, respectively, on the side of the tank 1. These brackets serve also to limit the motion of the hangers, when the filled bag is removed from the machine, the brackets being provided with stops 18' and 17', facing downward and upward, respectively, and the hangers 6 and 12 being fitted with corresponding stops 16'' and 17'' respectively.

The discharge pipe 3' for the tank 1 constitutes a gate for the material and this gate is governed from the outside by means of a lever mechanism in such a manner that the gate is held in open position when the lever mechanism is locked in a raised position, but is closed when the said mechanism is released, which is effected automatically by the hanger 6 moving downward in consequence of the tilting of the balance beam 11. The mechanism serving to effect this release is shown in detail in Figures 2 and 3 from which it will be seen that the discharge pipe 3' is a flexible tube and may be compressed between a movable roller 40 and a fixed bracket 41. The roller is carried by the vertical arm of a bell crank lever 18', 43, 18'', pivoted on a stud 44 on the tank 1, the horizontal arm 18' supporting a guide roll 28, which is actuated by devices to be described. The locking and releasing mechanism for this lever may consist of a pawl device such as that to be described and adapted to maintain the lever in position, as long as the hanger 6 is in its upper position, but released in direct consequence of the downward motion of the hanger.

A device of this sort, as shown in Figures 2 and 3, may comprise a spring-controlled pawl 46 mounted in the hollow arm 45 of the bell-crank lever 18', 43, 18'' and engaging a groove 48 in a cylinder 49 suspended on the bracket 14. When the notch 51 of a latch 52 fixed on the hub 43 of the bell crank lever engages a trigger 50 extending from the cylinder 49, the pawl 46 is compelled to remain in the groove 48 and thereby keep the bell-crank lever in a raised position, so that the tube 3' is not choked, but when a lug 53 on the hanger 6, in the downward movement of this latter, presses the latch 52 downward, so as to release the trigger 50, the pawl 46 is also released, and the weight 47 on the arm 18' may cause the bell crank to compress and close the tube 3'. A stop 54 is fixed to the hollow arm 45 of the bell-crank lever to tilt the latch 52 together with the bell-crank lever, so that the trigger 50 by gravity may assume the position in which it is to be locked when the bell-crank lever is raised again.

The hanger 6 is fitted with a stud 21', on which rests a lever 22 carrying a weight 21 and a guide roll 23, which is actuated by a device to be described. The lever is shown as pivoted at 24 on a bracket 25, secured to the tank 1. The mass of the weight 21 should be adjusted so as to correspond to the weight of the bag 4—when filled with cement mixed with air, for example, less than the intended full weight of the bag, at which weight it is desired to stop temporarily the further supply of material to the bag in order that air may escape therefrom.

The levers 9, 18' and 22, armed with the guide rolls 9'', 20 and 23, are governed by a constantly rotating governing device shown at the left-hand side of Figure 1. This device consists of a vertical shaft 26 rotated in the direction indicated by the arrow 29, from a shaft 28 by means of gear wheels 27' and 27''. This shaft 26 supports, at three different levels, corresponding to the position of the levers 9, 18' and 22, three cam

discs attached to the shaft, viz., a cam disc 30 corresponding to the lever 9, another cam disc 31 corresponding to the lever 18', and a third cam disc 32 corresponding to the lever 22. The first disc 30 is fitted with a cam 30' directed upward, the second disc 31 with two or more spaced cams 31' and 31'' directed upward, and the third disc 32 with a cam 32' of considerable length.

The operation of the described mechanism is as follows, it being assumed that in the position of the mechanism shown an empty bag has just been hung on to the filling tube 3'':

At this moment the cam 31' on the disc 31 is just passing the guide roll 20 and will therefore rock the lever 18', 43, 18'', permitting the discharge pipe 3' to be opened, the lever being maintained in this position by the locking devices described. At the same time the drop of the cam 32' of the disc 32 is passing below the guide roll 23 and permits the adjusted weight 21 to exert its determined pressure on the hanger 6. This extra load on the hanger causes the weighing mechanism to come into equilibrium at the moment when the bag 4 is still lacking a certain part of the prescribed full weight of material, and when this occurs the lever 18', 43, 18'' will be released and the filling tube 3' will be closed by the roller 40, so that the flow of material will be interrupted. After the lapse of a period of time, during which no material is added to the bag, the high part of the cam 32' will pass below the guide roll 23 and the hanger 6 will be relieved of the lever weight 21. During the period when no material is added to the bag the air in the bag has an opportunity to escape from the material filled into the bag, and when the period is ended the other cam 31'' on the disc 31 will be situated below the guide roll 20 and will, therefore, once more rock the lever 18', 43, 18'', whereby the discharge pipe 3' will be opened again for further filling of the bag. The pipe 3' will again be closed by the further downward movement of the hanger 6 when the bag has been fully filled to the prescribed degree. When this has been accomplished the filled bag will be removed automatically by the action of the cam 30' on the disc 30 on the guide roll 9'', whereby the latch lever 9 is lifted, releasing the stop 8' and the arm 8 and permitting the filling pipe 3'' to swing downward on the pivot 7 and discharge the bag.

In the foregoing description it is assumed that the stream of material filling the bag is interrupted once during the filling of a bag, but there is nothing to prevent the mechanism from being arranged in such a manner, by suitable arrangement of the cams on the discs that the flow of material can be interrupted more than once during the filling of the bag. For example, Figure 4 illustrates a filling mechanism wherein provision is made for the interruption of the filling operation twice. The reference characters have been applied to this figure to correspond with the reference characters which have been applied to Figure 1 and it will be seen that the disc 32 is formed with an additional cam 32'' to engage the roller 23 and raise the weight 21 to take its pressure from the hanger 6. Pressure is exerted by the weight when the roller 23 is disengaged by the cam 32'' at the time the cam 31' on the disc 31 is engaging the guide roll 20 to rock the lever 18', 43 and 18'' to permit the discharge pipe 3' to be opened. The lever is maintained in such position by the locking devices 46, 49 and 50. The added load on the

hanger causes the weighing mechanism to come into equilibrium at a time when the bag 4 still lacks a certain part of the prescribed full weight of material. At such time the lever 18', 43, 18'' will be released and the filling tube 3' will be closed by the roller 40 to interrupt the filling operation. After the lapse of a predetermined time during which no material is introduced into the bag, the high part of cam 32' will pass below the guide roll 23 and the hanger 6 will be relieved of the lever weight 21.

During the period when no material is added to the bag the air therein has an opportunity to escape. When the period of interruption is ended, the other cam 31'' on the disc 31 will be situated below the guide roll 20 and will therefore once more rock the lever 18', 43 and 18'' whereby the discharge pipe 3' will be opened again for the further filling of the bag. After the lapse of a brief period of time the roll 23 is disengaged by the cam 32' and the pressure then exerted on the hanger 6 by the weight 21, together with the weight of the material in the bag will overbalance the weights 13, when the bag 4 is still lacking a certain part of the prescribed weight of the material, so that the lever 18', 43, 18'' will be released and the filling tube 3' will be closed by the roller 40. After the lapse of a further period of time, during which no material is added to the bag the high part of the cam 32'' will pass below the guide roll 23 and the hanger 6 will again be relieved of the lever weight 21.

During the period when no material is added to the bag, the air in the bag has an opportunity to escape from the material introduced into the bag and when this period is ended the other cam 31''' on the disc 31 will be situated below the guide roll 20. The lever 18', 43, 18'' will thus once more be actuated, opening the discharge pipe 3' for a final filling operation. The pipe 3' will again be closed by the further downward movement of the hanger 6 when the bag is fully filled to the prescribed degree.

It will be understood that in the operation of such a mechanism as that just described in which provision is made for the interruption of the filling operation twice, the initial filling of the bag takes place when the roller 23 rests upon the disc 32, the roller 40 being then held from the filling tube 3'. This initial filling will be continued until the weight of the material in the bag plus the weight 21 is sufficient to pull down the hanger 6 against the counterbalance weights 13. At this time the bag has not been completely filled and during the interruption of the filling the air may escape. To continue the filling of the bag after the escape of the air the cam 32' raises the roller 23 and thereby takes from the hanger 6 the effect of the weight 21. As the roller 23 is thus lifted the cam 31'' of the disc 31 acts upon the roller 20 and, through the lever 18', 43 and 18'', removes the roller 40 from the filling tube 3' and so permits the filling to be continued. This first supplemental filling then continues so long as the roller 23 is held in its elevated position by the high part 32', but when the cam 32' passes from below the roller 23 then the hanger 6 is subject to the action of the weight of material then in the bag 4 plus the weight 21 and these combined weights will depress the hanger 6 and so cause the roller 40 to stop the flow of material through the tube 3'. It being assumed that in the operation of this mechanism the bag is not yet completely filled and that an opportunity should be

afforded for the further escape of air from the bag, a further supplemental flow of material should be permitted. To accomplish this the cam 32'' then engages the roller 23 and lifts the weight 21 from the hanger 6. At this time the cam 31''' of the disc 31 engages the roller 20 and through the lever 18', 43 and 18'' moves the roller 40 from the filling tube 3' and permits the flow of material to be resumed. This second supplemental flow will then continue until the weight of the accumulated material in the bag 4 counterbalances the weights 13 and so again effects the interruption of the filling after which the now completely filled bag is discharged from the machine.

Figure 5 illustrates a filling and weighing machine of the rotating type constructed in accordance with the present invention. This machine corresponds generally in function and during operation to the machine shown and described in Figure 4. The discs 30, 31 and 32 on the stationary type of machine have been replaced by rings bearing the same reference character and upon which the correspondingly identified cams are formed. The rings are stationary while the machine rotates causing the rolls 9'', 20 and 23 to move along the rings to be actuated by the respective cams. In so far as the construction in Figure 5 is concerned, it will be seen that the relatively stationary and rotating parts have been reversed, illustrating the manner in which the present invention can be applied to the weighing and filling mechanisms of the rotating type, as well as to mechanisms of the non-rotary type.

I claim as my invention:

1. Apparatus for filling bags with pulverous material comprising a source of supply, a filling pipe, a counterbalanced hanger by which the bag is supported during the filling, means to prevent the flow of material through the filling pipe, means whereby the operation of said flow preventing means is initiated by the downward movement of the hanger as the weight of the bag increases, independent means acting, while the bag is supported by the hanger, upon the first named means to permit the flow of material to be continued, and a cam and operating connections whereby said independent means is actuated.

2. Apparatus for filling bags with pulverous material comprising a source of supply, a filling pipe, a counterbalanced hanger by which the bag is supported during the filling, means to prevent the flow of material through the filling pipe, means whereby the operation of said flow preventing means is initiated by the downward movement of the hanger as the weight of the bag increases, means to apply downward pressure to the hanger to cause downward movement thereof when the bag is partly filled, and means independent of the hanger to relieve the hanger of the pressure of the last named means and permit the filling of the bag to be continued.

3. Apparatus for filling bags with pulverous material comprising a source of supply, a filling pipe, a counterbalanced hanger by which the bag is supported during the filling, means to prevent the flow of material through the filling pipe, means whereby the operation of the flow-preventing means is initiated by the downward movement of the hanger as the weight of the bag increases, a weighted lever bearing normally on the hanger to cause downward movement thereof when the bag is partly filled, and a rotating

cam disc to cooperate with said lever and relieve the hanger of its weight.

4. Apparatus for filling bags with pulverous material comprising a source of supply, a filling pipe, a counterbalanced hanger by which the bag is supported during the filling, means comprising a weighted lever to prevent the flow of material through the filling pipe, and a cam and operating connections independent of the hanger and arranged to cooperate with said means to permit the flow of material through the filling pipe.

5. Apparatus for filling bags with pulverous material comprising a source of supply, a filling pipe, a counterbalanced hanger by which the bag is supported during the filling, means to apply downward pressure to the hanger to cause downward movement thereof when the bag is partly filled, means to prevent the flow of material through the filling pipe, means to effect the discharge of the bag when filled, and cam discs rotating together and cooperating with said several means respectively.

6. A machine for filling bags with pulverous material, comprising a source of supply, a filling pipe through which the material is delivered from the source of supply into the bag to be filled, a device to control the flow of material through the filling pipe, mechanism to control said device and tending normally to move the device to closed position, weighing mechanism, a vertically movable suspending rod connected to the weighing mechanism and supporting the bag to be filled, means to retain said controlling mechanism in open position, means actuated by the movement of the suspending rod to release the controlling mechanism and permit it to stop the flow, and means to reset the controlling mechanism to open position, such means including an arm of the controlling mechanism and a cam arranged to co-act with said arm to reset the mechanism to open position at a predetermined point in the operation of the machine.

KRISTIAN MIDDELBOE.