

- [54] **AUTOMATIC BAG OPENING AND FILLING APPARATUS**
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[51] **Int. Cl.**.....**B65b 43/46**
[58] **Field of Search**.....**141/114, 10, 67, 68, 166, 141/313-317, 232, 233, 140-143, 156-162, 173-175, 350; 53/384, 385, 386, 188, 190**

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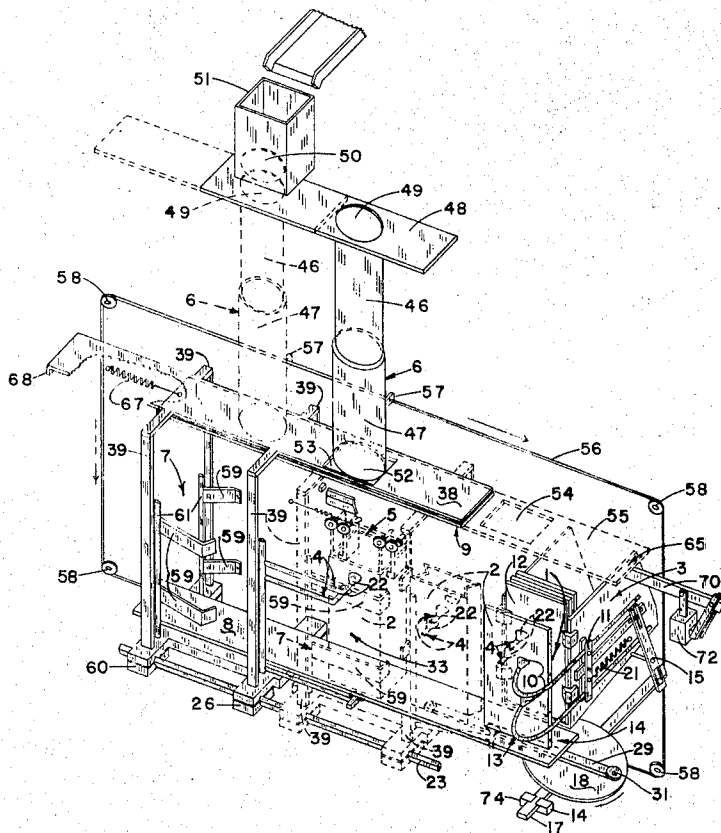
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[57] **ABSTRACT**

An automatic bag opening and filling apparatus comprising: means for removing a bag from a hopper and transferring same to a fill station; means for at least partially opening said bag during the transfer operation; means for holding the bag at the fill station such that the bag is fully open at the top thereof; and means for conveying a filled bag from the fill station to a bag closing device. The apparatus also comprises means for preventing the transfer of product at the fill station when a bag is not removed from the bag hopper. In a preferred embodiment, vacuum means are used to transfer the bag to the fill station and to partially open said bag during the transfer whereas mechanical gripping means are used to hold the bag at the fill station.

5 Claims, 5 Drawing Figures



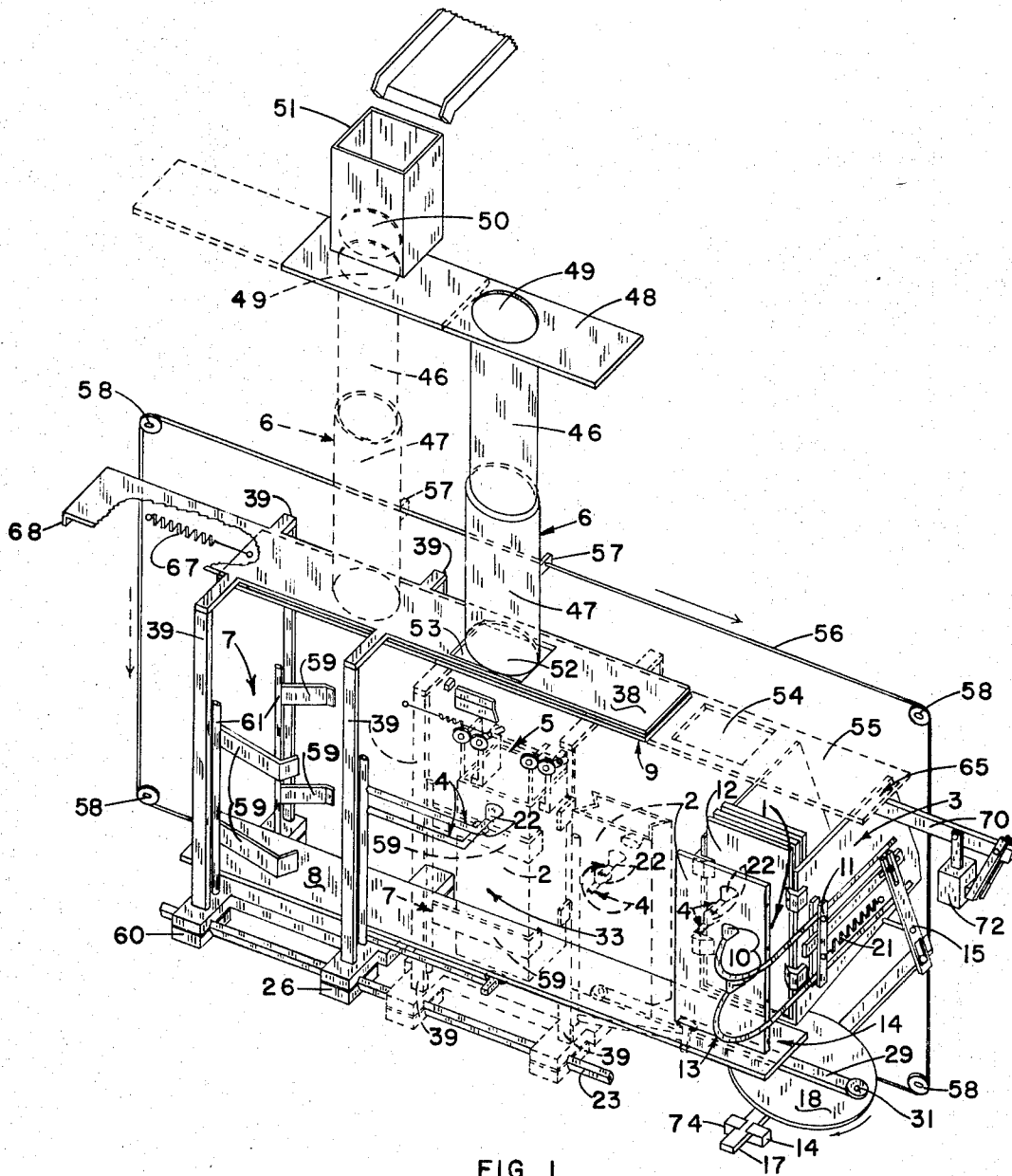
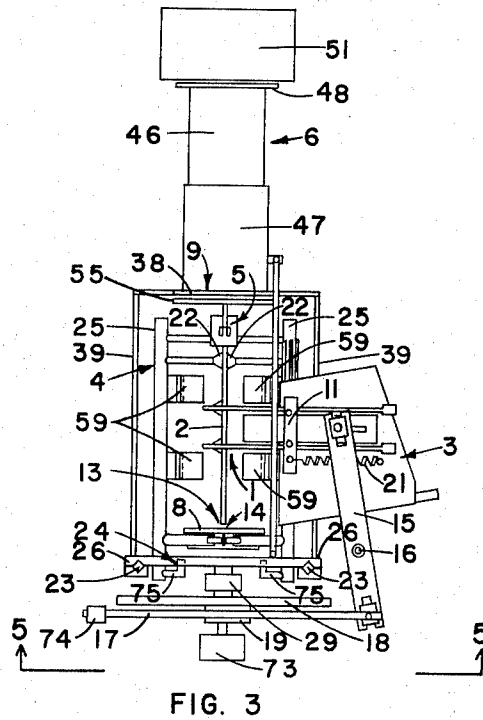
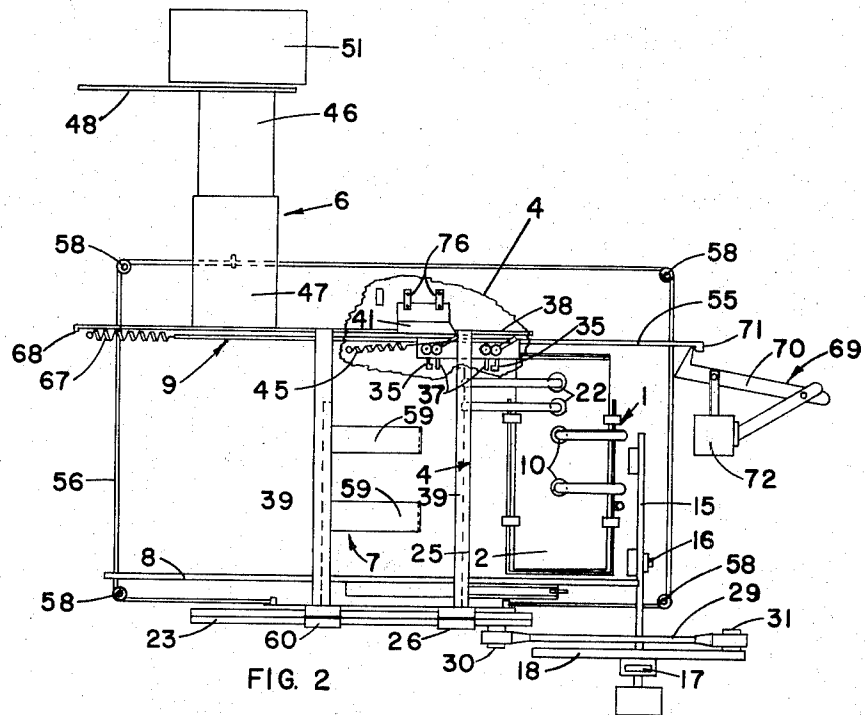


FIG. 1

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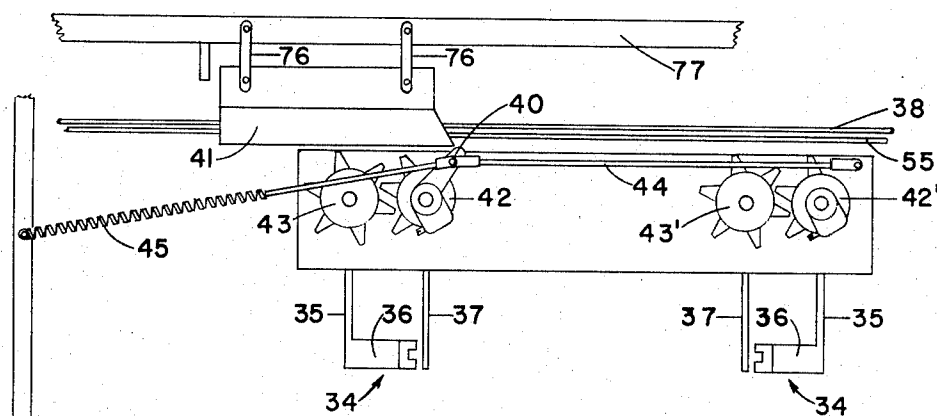


FIG. 4

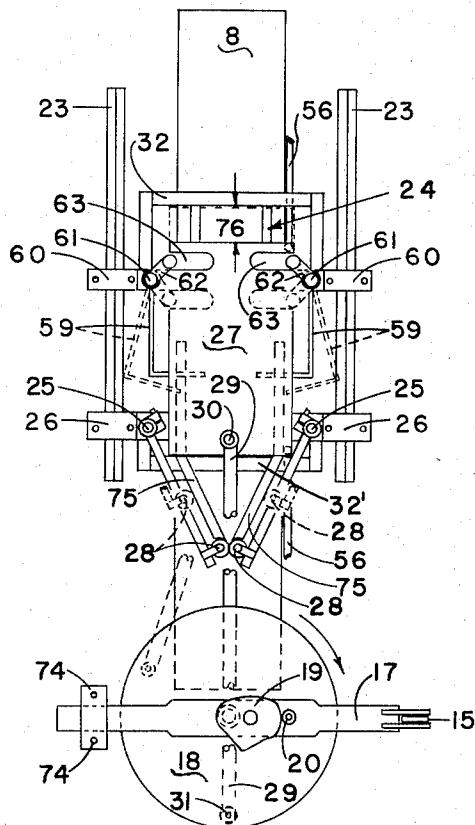


FIG. 5

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AUTOMATIC BAG OPENING AND FILLING APPARATUS

BACKGROUND

This invention relates to an automatic packaging machine. More specifically, this invention relates to an automatic bag packaging machine. Still more particularly, this invention relates to an apparatus for automatically opening and filling bags with solid materials.

Heretofore, several machines have been proposed which will either open bags automatically or fill bags automatically or open and fill bags automatically. In general, however, these prior art machines have not been suitable for use with relatively large multiwall bags or with relatively large, though particulate, goods such as ice and charcoal. For example, many of the prior art machines will not effectively deliver a single bag from a hopper storage of such bags, successively, to the opening and filling sections of the apparatus. Obviously, when the delivery mechanism fails to deliver a bag and the subsequent filling operation is completed the product will be dropped onto the machine and lost unless certain safeguards are provided. Moreover, many of the prior art machines will not effectively open the larger multiwall bags and this too will result in loss of product during the filling operation. As a result of these shortcomings of the prior art machines, many bag filling operations, especially those of ice and charcoal and similarly shaped solids continue to be performed manually.

BRIEF DESCRIPTION OF THE INVENTION

It is, therefore, an object of this invention to provide an improved apparatus for automatically opening and filling bags. It is a further object of the present invention to provide an improved apparatus which is suitable for use with relatively large multiwall bags. It is a still further object of this invention to provide an improved apparatus which is suitable for use in the automatic packaging of relatively large, particulate, products such as ice and charcoal. It is still another object of this invention to provide an apparatus which will not result in product loss if a bag is not removed from the hopper supply of such bags. It is yet another object of this invention to provide an apparatus which will positively open the bags prior to delivery of the product thereto. These and other objects and advantages will be apparent from the description hereinafter set forth and the accompanying drawings.

In accordance with the present invention, the foregoing and other objects are accomplished with an apparatus comprising: a hopper for holding a supply of bags; means for removing a bag from said hopper and delivering same to a bag opening device; means for detecting a non-delivery of such a bag; means for first partially opening said bag; means for completely opening said bag; and means for delivering a product to the opened bag.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of an apparatus within the scope of the present invention, with certain detail omitted for purposes of clarity, showing the sequential operation thereof;

FIG. 2 is a front view of an apparatus within the scope of the present invention with certain detail omitted for purpose of clarity, showing the position of the several components thereof at the time of a bag transfer;

FIG. 3 is an end view of an apparatus within the scope of the present invention;

FIG. 4 is an enlarged front view of a portion of an apparatus of the present invention showing the bag opening means in greater detail; and

FIG. 5 is a bottom view of an apparatus within the scope of the present invention with certain detail omitted for purposes of clarity.

DETAILED DESCRIPTION OF THE INVENTION (PREFERRED EMBODIMENT)

As can best be seen in FIG. 1, the apparatus of the present invention comprises: a removal and transfer means 1 for removing a bag 2 from a storage hopper 3 and transferring said bag to a position remote from said hopper; a transfer and opening means 4 for transferring said bag from said remote position to a filling station and at least partially opening said bag; holding and opening means 5 for holding said bag during the filling operation and completely opening the top of said bag; filling means 6 for transferring a measured load into said bag; transfer means 7 for conveying the filled bag along dead plate 8; and fill control means 9 for controlling the flow of material into an opened bag. For purposes of clarity with respect to operation, movable means, such as transfer and opening means 4, filler means 6, and transfer means 7, have been shown in FIG. 1, with solid lines at one, synchronized, extreme and with broken lines at the opposite extreme of their respective paths of travel and at an intermediate position in the case of transfer and opening means 4. To avoid undue confusion, however, the movement of removal and transfer means 2 and holding and opening means 5 has not been so illustrated.

As can best be seen in FIG. 3, the removal and transfer means 1 comprise at least one, and preferably a plurality of vacuum cups 10—10 movably mounted on carriage 11 such that said cups may move into contact with the lead bag 12 and then outwardly from the hopper 3 to a position 13 remote from said hopper. Preferably, when the cups 10—10 have reached the remote position 13, the bag carried thereby will be centered with respect to the fill and close track 14, which track is defined by the extent of the dead plate 8. It will, of course, be appreciated that the exact location of the remote position 13 is not critical, and hence, that the transfer of the bag from the removal and transfer means 1 to the transfer and opening means 4 may be effected at any point. Moreover, it is contemplated that a single means could be used to either partially or completely effect both functions. The use of separate means to effect the separate functions will, however, result in a higher speed operation and is, therefore, preferred.

In the embodiment illustrated in the Figures, which embodiment is preferred, movement of the vacuum cups 10—10 is effected with lever 15, which lever pivots about pin 16. As can best be seen in FIG. 5, a reciprocal motion of the lever 15 about pin 16 is imparted by shaft 17 which shaft, in turn, moves

backward and forward as crank plate 18 rotates, driving cam 19, and in turn, shaft 17 through cam follower 20, and bias spring 21. It will, of course, be appreciated that other means could be employed to effect the requisite movement of vacuum cups 10—10. The means as previously described, and illustrated, is, however, preferred since, as will become more apparent from the disclosure set forth hereinafter, the sequential movement of bags from station to station is easily synchronized when the rotation of crank plate 18 controls movement in both directions with one complete cycle per revolution thereof.

As can be seen in FIGS. 2 and 3, the transfer and opening means 4 comprises opposed vacuum cups 22—22, which cups are slidably mounted on opposed slide rails 23—23 with a suitable slide assembly 24 through support rods 25—25. Obviously, a plurality of opposed vacuum cups could be employed to grasp the bag 2 at its remote location for further transfer to the filling station. Moreover, other suitable means, such as mechanical grabber, could be substituted for the vacuum cups 22—22 to accomplish the desired objective.

As can best be seen in FIG. 5, the slide assembly 24, comprises opposed carriages 26—26 and a slide block 27. As can also be seen in FIG. 5, support rods 25—25, which rods carry vacuum cups 22—22, are pivotally mounted on carriages 26—26 and carry wedge cam followers 28—28 near the bottom thereof. The slide block 27 is driven in a reciprocal motion by crank plate 18 through crank arm 29. As can be seen in FIG. 5, the crank arm 29 is pivotally secured to slide block 27 with pin 30 and to crank plate 18 with pin 31. As will become apparent from the disclosure set forth hereinafter, as crank plate 18 rotates, the slide block 27 slides between opposed limit drives 32—32' and reciprocates between the two extremes of its reciprocal path. These extremes will, of course, correspond to the remote point or position 13 from which the bag 2 is received by the transfer and opening means 4 and the fill station 33. It will, of course, be appreciated that the period of time that the transfer and opening means 4 is at both extremes or stations can be varied. For example, when the slide block 27 is secured directly to the carriages 26—26, this period of time will depend upon the rotation speed of crank plate 18 and the time required for crank arm 29 to pass the center point. In a preferred embodiment, however, and as illustrated in the figures, this period of time will be increased through the use of suitable linkages or indirect drives such as opposed limit drives 32—32' which are positioned such that the slide block 27 moves a predetermined distance before movement of the carriages 26—26 begins each time the crank arm passes the center point.

As can best be seen in FIG. 4, the holding and opening means 5 comprise two sets of holding plates 34—34, which plates operate from opposite directions to grasp both the inner and outer sides of both gussets on bag 2. In the embodiment illustrated, the outer plates 35—35 of each set carry gripping plates 36—36 which extend inwardly to assure a positive gripping of the bag. Moreover, as inner plates 37—37 rotate into the partially open bag, the top thereof will open sufficiently to assure an unobstructed flow of product into the bag. As will become apparent from the disclosure set forth

hereinafter, plates 35—35 and 37—37 rotate into a gripping position each time the crank plate 18 makes a complete revolution. In this regard, it should be noted that the holding and opening means 5 is carried by fill control plate 38, which plate is, in turn, slidably mounted on rails 23—23 with opposed supports 39—39 and driven by slide assembly 24. The holding and opening means 5 also comprises an actuating lever 40, which lever, when tripped by tripping element 41, rotates drive gear 42 and meshing gear 43, directly, and drive gear 42' and meshing gear 43', indirectly, through transfer rod 44, to thereby close gripping plates 34—34. The gear rotation is reversed, and hence, the plates opened, by spring 45.

The filling means 6 will be, preferably, a volumetric dispenser which may comprise at least two concentric cylinders 46 and 47 assembled in a telescopic fashion such as illustrated in the attached figures. In the embodiment illustrated, the volume of product to be transferred to the opened bag at the filling station 33 may be varied by varying the height of the product shutoff plate 48. As can best be seen in FIG. 1, when filling means 6 is positioned in the manner illustrated by broken lines, the open top 49 is aligned with a similarly shaped opening 50 in the bottom of product hopper 51 and product will flow into the fill chamber. While in this position, the bottom of the fill chamber is closed by fill control plate 38. When the filling means 6 is in the position shown by solid lines in FIG. 1, the open bottom 52 of the fill chamber will be aligned with opening 53 in fill control plate 38 above the open bag positioned at the fill station 33. Product will, therefore, be free to flow into the open bag if the opening 53 in fill control plate 38 is also aligned with opening 54 in the secondary fill control plate 55. As can be seen in the Figure, when the fill chamber is in this position, opening 50 in the bottom of product hopper 51 is closed by product shut-off plate 48. Movement of the fill chamber is, of course, effected through the use of cable or chain 56 which is fixedly attached to the filling means 6 through the use of suitable means such as soldering or the like at 57. To facilitate synchronization of all movement, it has been found advantageous to also secure the cable or chain 56 to limit drives 32—32' such that said cable or chain will move freely about pulleys or sprockets 58—58.

As can best be seen in FIG. 1, the transfer means 7 comprises at least one pair and preferably at least two pair of opposed L-shaped flight bars 59—59. The flight bars 59—59 are pivotally mounted on opposed carriages 60—60 with rods 61—61 and are, in turn, slidably secured to slide rails 23—23. As can be seen FIG. 5, the transfer means 7 also comprises position control levers 62—62, which levers controls the outward and inward rotations of said flight bars. As can also be seen the FIG. 5, the inward and outward rotation of said L-shaped flight bars is effected as levers 62—62 follow slits 63—63, which slits are provided in slide block 27, as said slide block moves between limit drives 32 and 32'. It will, of course, be appreciated that the L-shaped flight bars are rotated outwardly in a manner illustrated with broken lines in FIG. 5 when the slide block 27 moves from the fill station position to the remote bag position 13. As a result, the flight bars will be clear of the fill and close track 14, on the return

stroke, and hence, will clear the filled bag at the fill station.

An important feature of the present invention resides in the "fill-no fill" characteristic of the fill control means 9 which prevents the discharge of the measured load contained in filler means 6 when a bag does not reach the remote position 13 or some other preselected position. In a preferred embodiment of the present invention, and as illustrated in the appended drawings, the fill control means 9 comprises a top, fill control plate 38, and a bottom, secondary fill control plate 55. In general, these plates may be of any convenient length and width, but preferably, will be of the same length and width and will extend from the lock position 65 to a point beyond the open bottom 52 of the filling means 6, when said filling means is aligned with the opening 50 in product hopper 51 so as to prevent the discharge of product from said filling means while in this position. As can best be seen in FIGS. 2 and 3, the top plate is fixedly attached to opposed carriages 26—26 and 60—60 with supports 39—39, and hence, is driven in a reciprocal path by slide block 27. The bottom plate 55, on the other hand, floats below the top plate and in normal operation is urged toward the fill position by spring 67. The extent of travel is, however, limited by lip 68 which extends downwardly from an end of top plate 38. Moreover, when the force exerted by spring 67, as in a preferred embodiment, is sufficient to move the bottom plate at a speed greater than the top plate, lip 68 will also limit the rate at which the bottom plate moves, thus causing both plates to move toward the fill position at the same speed as though the two plates were one. On the return stroke, however, the bottom plate is driven by slide block 27 through lip 68. It will, of course, be appreciated that the force exerted by the slide block 27 on the return stroke must override the force of spring 68 and that both plates; i.e., plates 38 and 55, will move as a single plate. As has been previously noted, plates 38 and 55 comprise corresponding openings 53 and 54, respectively, which openings will be aligned at all times, during normal operation, and which align with the open bottom 52 of the filling means 6 when said plates and said filling means are in the fill position.

The fill and control means also comprises a no-bag locking element 69 which is fashioned so as to prevent movement of the secondary fill control plate 55 in the event that a bag is not transferred from the hopper 3 to the remote, transfer position 13. The locking element comprises a latching bar 70 which locks under lip 71 which extends downwardly from the trailing edge of the secondary fill control plate 55. The locking element also comprises a latch actuator 72. In general, the locking element may be of the normally locked or normally unlocked variety. It is however preferred to use a normally locked element; i.e., an element which locks the secondary control plate 55 after each fill cycle and then releases said plate only after a bag has been detected at the preselected detection point. The latch actuator may be operated pneumatically, electrically or mechanically. Vacuum operation, will, however, be convenient, and hence, is preferred. Moreover, any suitable means may be employed to detect the presence or absence of a bag at any convenient location and then energize the latch actuator if the condition sensed is

normal. An electric eye (not shown), positioned so as to detect a bag at the remote, transfer position 13, is however preferred. To operatively install such a detection device is, of course, well within the ordinary skill of the art, and hence, is not described or illustrated in the present case.

OPERATION

In the operation of the apparatus of this invention, the crank plate 18 may be rotated directly, as illustrated, with motor 73 or indirectly in any one of several ways known in the prior art. In general, the rate at which the crank plate is rotated may be varied over a wide range; however, operation within the range from about twenty to about thirty revolutions per minute has been found most effective, and hence, is preferred. As the crank plate 18 rotates from a neutral position; i.e., a position wherein vacuum cups 10—10 are in contact with the lead bag in hopper 3, the vacuum on said cups is energized by an appropriately positioned solenoid or similar switch and the lead bag removed from the hopper as cam 19 drives slide 17 toward said hopper and between guides 74—74, thus causing the upper portion of lever 15, which carries said vacuum cups 10—10, to move away therefrom. When cam follower 20 reaches the apex of cam 19, the crank plate 18 will be in a position as illustrated in FIG. 5 and the crank arm 29 will have reached the limit of its inward or return stroke. At this point, the bag 2 will be located at the remote position 13 and the vacuum cups 22—22 will be in a face-to-face relation and in contact with the opposite sides of said bag. The vacuum to cups 22—22 may be energized at the time contact is made with the bag or the vacuum may be energized after said contact is made so long as the vacuum is energized before said cups begin to move toward the fill station 33. Once the vacuum cups 22—22 are contacted with the bag and the vacuum thereon, the vacuum on cups 10—10 may be deenergized and the transfer completed. Again, this may be accomplished through the use of appropriately positioned solenoids or similar switches. Since vacuum cups 22—22 will not begin to move toward the fill station until the crank arm 29 has passed the center point and slide block 27 has traveled a distance X at which time it contacts limit drive 32, ample time is provided for the transfer of the bag from removal and transfer means 1 to transfer and opening means 4.

As the crank plate 18 continues to rotate from the position shown in FIG. 5, slide block 27 first moves a distance X and into contact with limit drive 32. As has been previously noted, this movement of the slide block 27 rotates the L-shaped flight bars 59—59 inwardly to a position as illustrated by the solid lines in FIG. 5. It will, of course, be appreciated that on the second and subsequent cycles the flight bars 59—59 will engage a filled bag positioned at the fill station, in a manner illustrated in FIG. 1, such that continued movement of the slide block 27 will cause the bag to be conveyed over the dead plate 8 and onto a live conveyor, not illustrated, and thence to a conventional bag closing device. Once the slide block 27 has contacted limit drive 32 and continues to move due to the urging of crank arm 29, opposed carriages 26—26 and 60—60 begin to slide on rails 23—23. This movement will, of course, continue until the crank plate has rotated 180°

relative to the position shown in FIG. 5. As the opposed carriages 26—26 and 60—60 move outwardly on this stroke, opposed vacuum cups 22—22 rotate outwardly and thereby open the top portion of the bag as cam followers 28—28 follow wedge cams 75—75. At the same time, cable or chain 56 which is secured to at least one of said carriages is urged in the direction indicated with a solid arrow in FIG. 1 thereby driving the filling chamber 6, which chamber has been previously filled from hopper 51, toward the fill station 33. The open bottom 52 of said chamber is closed by fill control plate 38, which plate is also moving as a result of the fixed attachment to opposed carriages 26—26 and 60—60. In normal operation, a bag 2 will be sensed at the remote location 13 and the latch 70 drawn downwardly by a vacuum cylinder 72 to thereby free secondary fill control plate 55. Once the latch 71 is clear of control plate 55, said plate will be drawn against lip 68 by spring 67 and thereafter will move with primary fill control plate 38 to the fill position. In the event a bag is not detected, however, latch 71 will not be released and the secondary fill control plate will not move. As the fill chamber 6 and fill control plate 38 continue to move toward the fill station 33, from opposite directions, actuating lever 40 will contact and then be tripped by tripping element 41 thereby closing gripping and opening plates 34—34. It is, of course, essential that this occur after cam followers 28—28 have cleared wedge cams 75—75 and the bag is both open at the top and positioned such that inner plates 37—37 enter said bag and contact the inside of the bag slide walls while the gripping plates 36—36, which are carried by outer plates 35—35, contact the outside of said side walls. After the gripping and opening plates are thus positioned, the opened bag continues to move until it reaches the fill station 33. At this same time, fill chamber 6 will be positioned just above the open bag and openings 53 and 54 in fill control plates 38 and 55, respectively, will be aligned with the open bottom 52, thereof, as illustrated in FIG. 1, and the measured load will drop into the open bag. It will, of course, be appreciated that the weight of the product will be sufficient to complete the opening of the bottom portion of the bag. It will also be appreciated that, in the event a bag had not been detected at the remote position 13, opening 54 would not have been aligned with opening 53, and hence, the product would not be discharged from the fill chamber. It will further be appreciated that at the same time the bag from the hopper reaches the fill station 33, the L-shaped flight bars 59—59 will have reached the end of dead plate 8 and the bag filled during the previous cycle transferred to a live conveyor for further processing.

Once the crank arm 29 has reached the limit of its outer stroke, the opposed carriages 26—26 and 60—60 will remain stationary until said arm passes center and the slide block 27 has travelled a distance X on the return stroke. This will, of course, allow ample time for the filling operation. As the crank arm passes center and slide block 27 travels the distance X, however, the vacuum to cups 22—22 will be blocked and the L-shaped flight bars 59—59 will be rotated outwardly, in the manner previously described, such that said bars will clear the filled bag on the return stroke. At this same time, tripping element 41 will be pivoted away from lever 40 through pivotal mounting 76—76, with a

vacuum cylinder or similar means, not illustrated, which mountings are secured to frame element 77, so as to open gripping and opening plates 34—34 and thereby prevent backward movement of the bag. As the slide block 27 continues to move, the transfer and fill cycle will be reversed with vacuum cups 22—22 returning to the remote position 13 and contacting a bag in that position, the fill chamber returning to a position below the hopper 51 and the fill control plates returning to a position such that latch 70 engages lip 71. The complete cycle will then be repeated once for each complete revolution on the crank plate 18.

While in the foregoing specification a particularly preferred embodiment of the invention has been set forth in considerable detail for purposes of making a complete disclosure thereof both as to its method and apparatus aspects, it will be apparent to those skilled in the art that numerous changes may be made in such details without departing from the spirit and principles of the invention. Accordingly, reference should be made solely to the appended claims to determine the true scope of the present invention for which protection has been sought and granted.

Having thus described and illustrated the invention, what is claimed is:

1. An automatic bag opening and filling apparatus for a packaging line, comprising:

- a. a frame;
- b. a bag hopper, fixedly attached to said frame, for retaining a plurality of closed bags;
- c. a product filling apparatus, fixedly attached to said frame and positioned above the packaging line, downstream from said hopper;
- d. means, movably mounted on said frame, for removing the foremost bag from said hopper to an upright position on the packaging line and remote from said hopper;
- e. means, movably mounted on said frame, for transferring the closed upright bag along the packaging line to said filling apparatus, said transfer means also including means for opening the closed bag during the transferring without interrupting the travel of the bag;
- f. means, pivotally mounted on said frame, for aligning the opened bag under the filling apparatus and for holding the gussets of the bag open during the filling of the bag, said means also serving to protect the bag gussets during the filling of the bag; and
- g. means, attached to said frame, for removing the filled bag from the filling apparatus.

2. The apparatus as defined in claim 1 wherein said means for opening the closed bag comprises at least two oppositely positioned suction means movably mounted on said frame.

3. The apparatus as defined in claim 1 further comprising:

- h. means, associated with said filling apparatus, for controlling the flow of the product from said filling apparatus, said control means serving to prevent the transfer of the product out of the filling apparatus if a bag is not positioned under the filling apparatus.

4. An automatic bag opening and filling apparatus for a packaging line, comprising:

- a. a frame having formed on one end thereof a bag hopper;
- b. first reciprocating means, associated with said frame, for removing the foremost bag, in succession, from the hopper;
- c. second reciprocating means, associated with said frame, for transferring the foremost bag to the filling apparatus while simultaneously opening the bag;
- d. means, associated with said frame, for aligning the opened bag under the filling apparatus, said align-

- ning means also serving to hold the top edges of the bag open and to protect these edges during the filling of the bag; and
 - e. means, associated with said frame, for removing the filled bag from under the filling station.
5. The apparatus as defined in claim 4 further comprising:
- f. means associated with said frame, for preventing the discharge of the filling apparatus when a bag is not positioned under the filling apparatus.

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