The present invention relates to an apparatus for opening and emptying bags of material.

It is common in many industries to obtain materials which are packaged in large multiwalled paper bags of approximately 100 lbs. capacity. These materials must be removed from the bags after receipt prior to being processed. It has long been realized that opening and emptying bags of material by hand is far too slow and costly and therefore machines have been developed to replace manual labour. These machines, however, have all suffered from certain disadvantages; one of the principal disadvantages is that they are not fully mechanised. Some hand operation is necessary especially that of disposing of the bag after it has been emptied and preparing the machinery for reception of the next bag.

None of the existing machines for opening and emptying bags of material have been adaptable for attachment to existing machinery for processing materials and have therefore been unsatisfactory.

The present invention overcomes the disadvantages of these known machines by providing an apparatus for opening and emptying bags of material which is capable of readily being attached to material processing apparatus, the machine being designed to receive and empty bags from a feed conveyor as fast as the latter can be loaded. The apparatus according to the present invention is simple and inexpensive to operate, and disposes of the empty bags after the material has been removed.

The apparatus according to the present invention consists of a frame to which are mounted a chute for guiding the bags into place and an open ended box compartment containing a pair of collapsible platforms onto which the bag is placed. A bag opening device which may either be a travelling knife or a series of stationary knives operates between the two collapsible platforms. When a bag is placed on the two platforms and they begin to collapse, the bag is opened by the knife, the outer extremities of the bag being folded upward about a bag folding plate positioned over the joint between the two collapsing platforms. As the platforms collapse and fold about the bag folding plate the ends of the bag are brought into contact with the upper portion of the bag folding plate. The bag folding plate is provided with a pair of bag gripping arms which then close on the ends of the bag and hold the bag against the bag folding plate.

The bag folding plate is then moved to a position outside the open ended box compartment and the bag gripping arms release the bag allowing the bag to fall away from the mechanism. A vibratory mechanism may be employed to ensure that the bag is empty before being gripped on the bag folding plate.

In the drawings which illustrate embodiments of the invention,

Figure 1 is a side elevation of the apparatus according to the invention,

Figure 2 is a plan view of the apparatus,

Figure 3 is a section in elevation of the lever linkage which control the motion of the bag folding plate and the two folding platforms.

Figure 4 is an exploded perspective of the bag gripping arm operating mechanism,

Figure 5 is an elevation of the cam shaft of the apparatus,

Figure 6 is a sectional elevation of the apparatus with the folding platforms folded about the bag folding plate,

Figure 7 is a sectional elevation of the apparatus with the bag folding plate in the position where the bag is released,

Figure 8 is an elevation of the folding platforms,

Figure 9 illustrates an alternative embodiment with regard to the bag opening mechanism, and

Figure 10 illustrates the relationship of the slots in the sides of the box compartment.

The apparatus illustrated in Figure 1 comprises a main frame 28 at one end of which is mounted a chute 20 and at the other end of which an open ended box compartment 21 is pivoted on a shaft 43. Box compartment 21 pivots inside main frame 28. Mounted on the end of shaft 43 is a pulley 42 around which a drive belt 41 is connected. A motor 40 supplies driving power to the belt 41. Mounted above and across the centre of the box compartment is a bag folding plate 22 which is supported by lever arms 23 and 24, lever arm 23 being pivoted about axle 25. Mounted on either side of bag folding plate 22 are a pair of bag gripping arms 44 and 45 which are operated by means of crank lever 27 and hook 26. Chute 29 on the outer extremity of box compartment 21 carries the bags over the cam shaft.

The mechanism for operating the bag gripping arms is illustrated in exploded view of Figure 4. The bag gripping arms 44 and 45 which in their closed position bear against the two sides of bag folding plate 22 are connected to cam plates 31 and 30, respectively. These cam plates are in turn mounted on pins 33 and 34, respectively, attached to plate 32 which is mounted to one edge of bag folding plate 22. The crank lever 27 is pivoted on pin 33 and is connected by means of slot 46 to pin 47 mounted on cam plate 31, pin 48 on cam plate 31 rides in slot 49 on cam plate 30.

Cam plates 30 and 31 are spring loaded in such a manner that bag gripping arms 44 and 45 are urged against the sides of bag folding plate 22.

Figure 2 is a plan view of the apparatus according to the present invention. Bag folding platforms 50 and 51 are mounted in the centre of box compartment 21. Bag folding plate 22 being positioned above the space between the two platforms. The two platforms 50 and 51 are pivoted about pivot points 52, 53 and 54, respectively. Platforms 50 and 51 are provided with rows of bars 56 and 57, respectively.

Figure 3 illustrates a side view section of the lever mechanism for operating the folding platforms 50 and 51 and the bag folding plate 22. As discussed previously bag folding plate 22 is mounted and controlled by means of lever arms 23 and 24. In the bottom of arm 24, a slot 58 has been cut. Pin 59 runs in slot 58 and is fixed which lever arm 60 which is controlled by cam 61. Platforms 50 and 51 which are pivoted about points 52 and 54 have slots 62, 63 and 64 and 65 cut in their side members, respectively. Lever 66 is pivoted about point 52 and has a pin which rides in slot 62. Lever 67 is pivoted about point 54 and has a pin which rides in slot 64. A pair of cranked arms 68 and 69, are pivoted about pin 70 which rides in slot 74 and on the sides of box compartment 21 and slot 72 cut in the sides of frame 28. The upper ends of crank arms 68 and 69 are fixed by means of pins 73 and 74 to projecting portions of lever arms 66 and 67.

To the outer extremity of lever 66 a notched member 75...
A vibrator 76 is attached to one side of main frame 28. A vibrator 76 is attached to one side of main frame 28.

Figure 5 illustrates the cam shaft and drive mechanism of the apparatus according to the present invention. Cam shaft 77 is driven by spur gear 78 mounted on one end of the shaft. Spur gear 78 is in turn driven by pinion gear 79 which is mounted on the shaft 43. Cam shaft 77 carries cams 80, 81, 82, 83 and 84. Cams 80 and 81 are operable against shoulders 85 and 86 to reciprocate the open ended box compartment 21 about axle 43. Cam shaft 71 is mounted in pivots which are mounted on the end of open ended box compartment 21. Cam 82 drives lever 83 to draw knife 84 across the bottom of the bag. Cams 61 on either end of the cam shaft operate levers 69 which are connected to levers 24 to operate the bag folding plate.

Figure 6 illustrates the embodiment of the present invention when the folding platforms 50 and 51 are tilted about bag folding plate 22.

Figure 7 illustrates the apparatus during its cycle of operation when the bag gripping arms 44 and 45 have opened to release the bag over the side of the machine.

Figure 9 illustrates an alternative embodiment for cutting the bag. This embodiment may be used with bagged materials which are relatively heavy and flow freely. As the platforms 50 and 51 fold the bag bears against the cutting knives and is opened whereupon the contents of the bag falls freely out.

The operation of the apparatus according to the present invention as shown in the drawings is as follows:

Referring to Figure 1, a bag is delivered down the chute 20 onto the floating platforms 50 and 51. The following sequence of operations of the machine is initiated. The motor 40 is energized and by means of belt 41 drives pulley 42 in a clockwise direction. Pulley 42 which is connected by means of shaft 43 to pinion gear 79 (Figure 5) which in turn drives spur gear 78 mounted on cam shaft 77. Cam shaft 77 is rotated causing cam 82 to deflect lever 83 and thereby draw knife 84 across the bottom of the bag. Subsequent to this operation bag folding platforms 50 and 51 commence to fold about bag folding plate 22 (Figure 6) due to the lowering of open-ended box compartment 21 by cam 81 operating against shoulders 85 and 86. As bag folding platforms 50 and 51 fold the bag about bag folding plate 22 notch member 75 is brought into contact with crank lever 27 and causes bag gripping arms 44 and 45 (Figure 1) to grip the ends of the bag.

A vibrator 76 is incorporated on one end of frame 28 in order to ensure that the contents of the bag flow freely therefrom during the above operations. After the bag has been emptied the bag folding plate 22 is caused to move to the right by the action of cam 61 on levers 60 and 24. At the extreme limit of the motion (Figure 7) of bag floating plate 22 crank arm 27 engages with a hook 26 which causes bag gripping arms 44 and 45 to loosen the bag which is then conducted away from the machine by a chute 29.

Although in the above description, the activating device is shown as a motor driven cam shaft, all the necessary motions may be obtained by other means such as air or hydraulically operated cylinders, working by means of slots and cam faces embodied in the machine frame.

The machine will work at a predetermined time cycle, initiated by a full bag entering the machine operating a switch, and means are adapted at the end of the entry chute 20 to prevent the next bag entering the machine before the cycle is completed.

What I claim as my invention is:

An apparatus for opening and emptying a bag of material comprising a frame, an axle mounted in gearings set into the sides of said frame near one end thereof; an open ended box compartment pivoted on said axle and positioned inside said frame; a pair of pivotally mounted platforms inside said box compartment; a cutting mechanism mounted in said box compartment between said platforms; a bag folding plate mounted above said cutting mechanism; a pair of bag gripping arms, one mounted on each side of said bag folding plate; a chute adapted to deliver a bag onto said platforms; driving means for reciprocating said box compartment about said axle; first coupling means between said box compartment and said platforms adapted to tilt said platforms so the centre edges are lowered and the outer edges are raised when said box compartment is driven by said driving means, thereby to fold said bag about said bag folding plate; second coupling means adapted to close said bag gripping arms against the sides of said bag folding plate after said bag has been folded about said bag folding plate; bag shaking means adapted to shake said bag after it has been gripped by said bag gripping arms, thereby to ensure the emptying of said bag, third coupling means adapted to displace said bag folding plate beyond one end of said box compartment and to actuate said second coupling means to open said bag gripping arms thereby to release said bag for disposal.

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