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APPARATUS FOR OPENING AND EMPTYING BAGS

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4 Sheets-Sheet 1

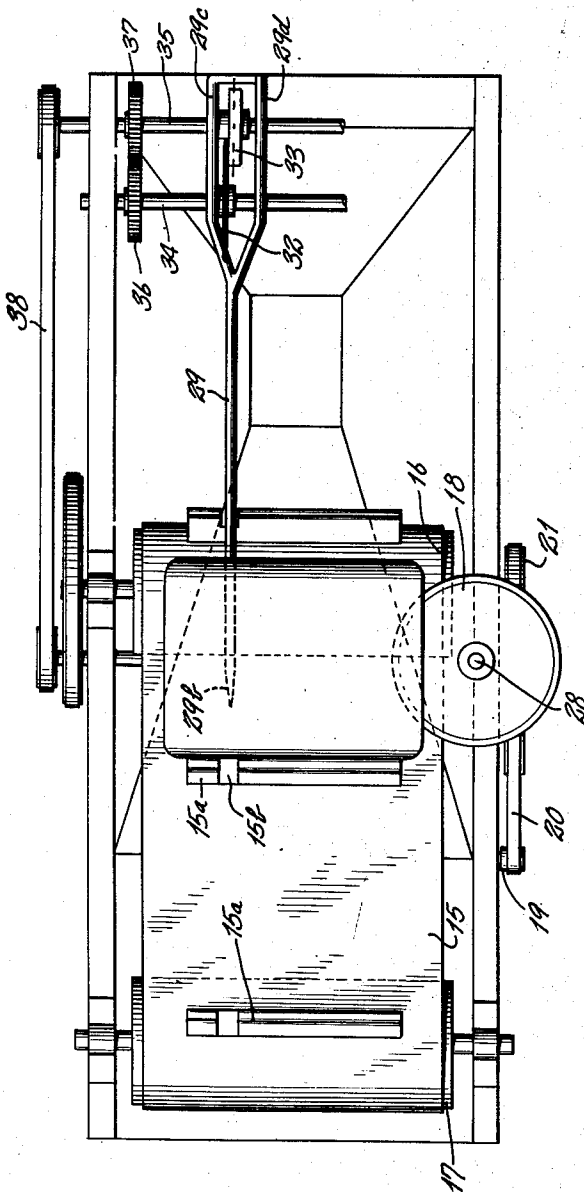


Fig. 1.

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4 Sheets-Sheet 2

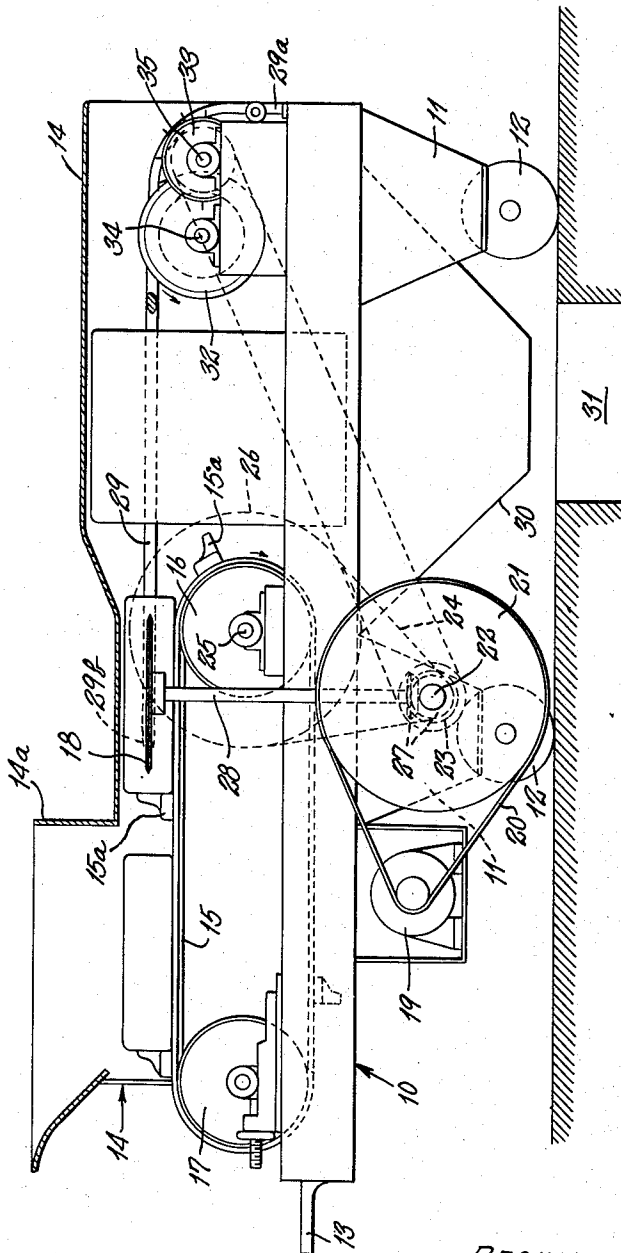


Fig. 2.

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4 Sheets-Sheet 3

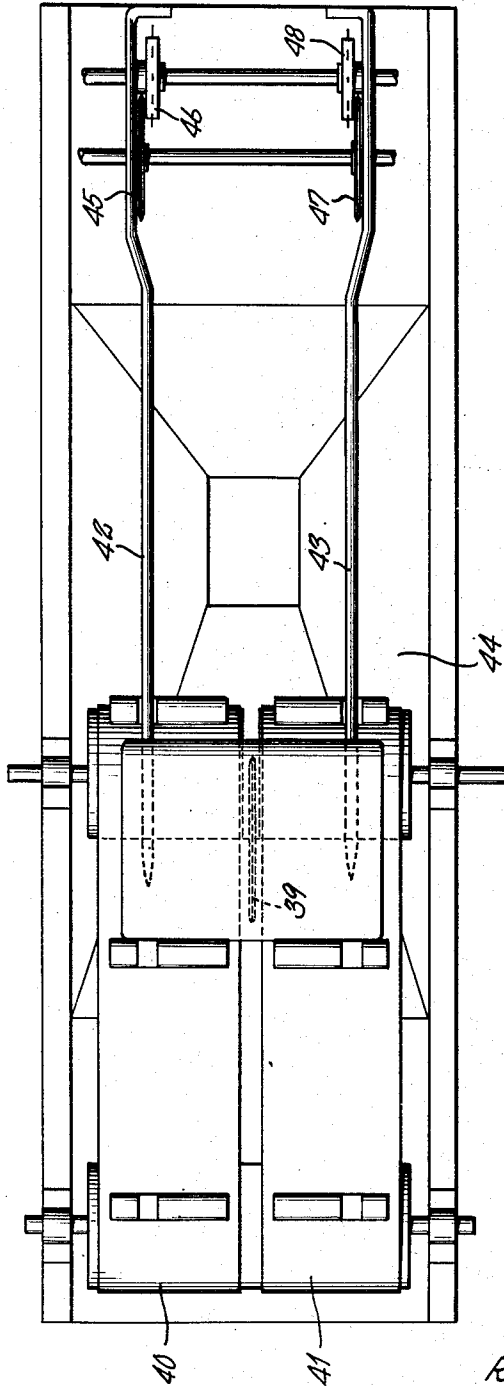


Fig. 3.

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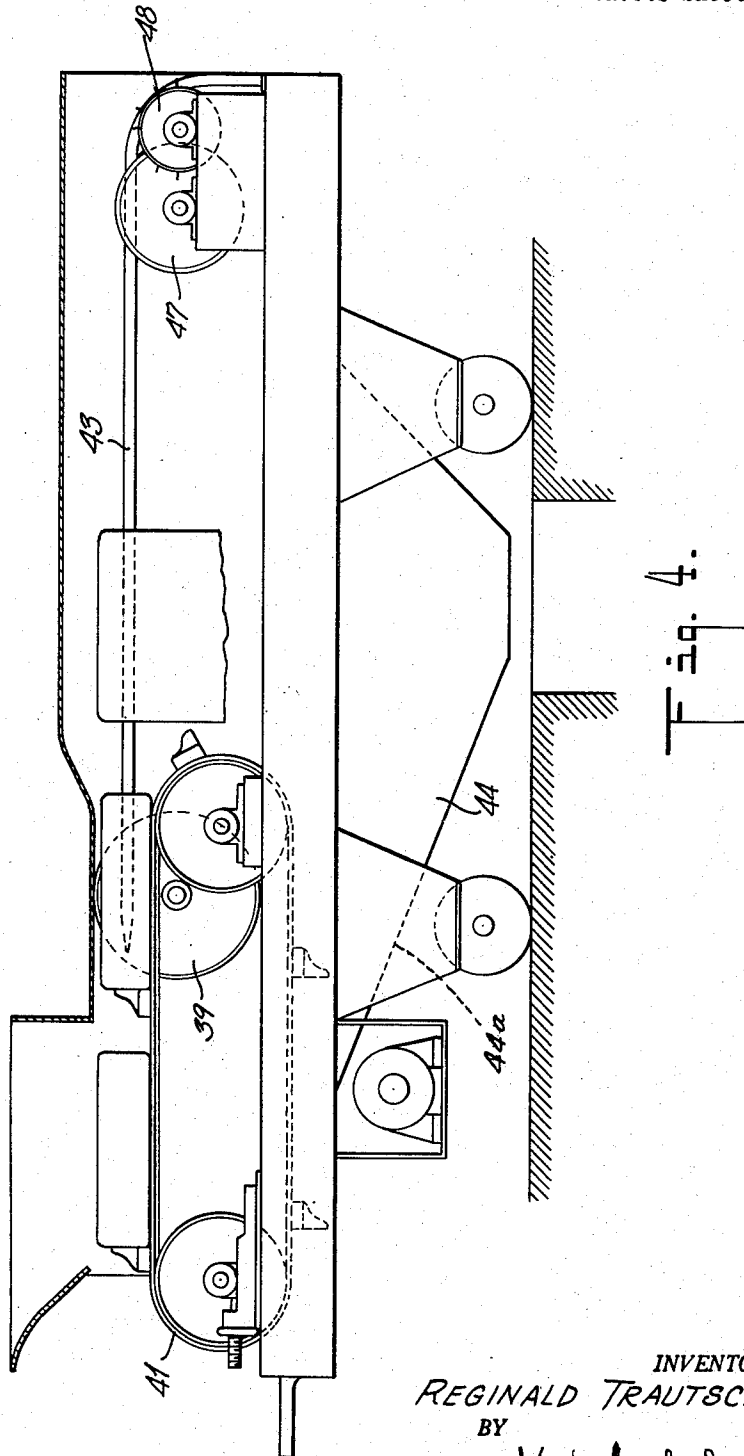


Fig. 4.

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APPARATUS FOR OPENING AND
EMPTYING BAGS

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This invention relates to container opening devices, and more particularly to an automatic device for opening and emptying filled bags of sheet material such as paper, and thereafter for disposing of or ejecting the empty bags.

The invention in one aspect thereof comprises an automatic machine for cutting open and emptying in succession a plurality of filled containers such as paper bags. The apparatus effectively and efficiently empties such bags of their entire contents which normally are of pulverulent material such as sugar or flour, and thereafter ejects the bags automatically from the machine whereupon such emptied and ejected bags can be baled. A conveyor is provided for moving the bags in succession past a cutting member referred to as a slitter knife. The bags may be not only conveyed by the conveyor but may be aligned by upstanding vanes secured thereto for getting behind a portion of each bag and pushing same so that each bag will be presented to the slitter knife in a preselected attitude. The slitter knife is, in one modification of the invention, positioned for slitting one end of the bag and thus mounted for rotation about a substantially vertical axis. Substantially concurrently with the slitting of the end of the bag the conveyor-pusher device or conveyor mounted vane urges the bag against an impaling spike which is positioned for piercing the bag near the end opposite to the slit extremity. The impaling or piercing of the bag is substantially concurrent with the slitting of its end, and the impaling spike preferably is mounted horizontally with the point thereof extending at least partially over the conveyor. A conveyor such as a belt conveyor may be employed or, if desired, a pusher actuated by, for example, an hydraulic mechanism alone may be employed for urging each bag seriatim past the slitter knife and against the impaling spike. After the bag has been slit and impaled, the conveyor is effective to push same along the spike either under its own action or under the combined action of bags following the impaled slit bag whereby the latter is moved to a discharge station which preferably is located over a discharge hopper. The location of the impaling spike adjacent or near the extremity of the bag opposite to the slit extremity, of course, provides for a pivoting of the bag on the impaling spike whereby the slit end swings downwardly so that the contents of the bag empty through the slit end into the discharge hopper. The oncoming bags are effective to urge the empty bag further along the impaling spike to a mechanism

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for ejecting or disposing of the empty bags. In the modification shown this mechanism comprises a knife for slitting preselected portions of each bag which thus will enable the bag to be drawn or pulled off of the spike by means of, for example, a series of rotating hooks or spikes which may be mounted upon a suitable wheel whereby the slit emptied bag is discharged from the apparatus.

Apparatus of this character suggested in the past have been incapable of obtaining an efficient and complete emptying of the container and further has failed efficiently to dispose of the container after it has been emptied without considerable manual labor.

One of the objects of the present invention is to overcome the above difficulties or to reduce same to insignificance.

Various further and more specific objects, features and advantages of the invention will clearly appear from the detailed description given below when taken in connection with the accompanying drawings which form a part of this specification and illustrate, by way of example, preferred arrangements of apparatus for carrying out the invention. The invention consists in such novel methods and combinations of features and method steps as may be shown and described in connection with the equipment herein disclosed.

In the drawings:

Fig. 1 is a plan view of one modification of the present invention;

Fig. 2 is a side view of the modification shown in Fig. 1;

Fig. 3 is a plan view of a second modification of the present invention; and

Fig. 4 is a side view of the apparatus shown in Fig. 3.

Referring now to Figs. 1 and 2, it is often desirable when emptying a large number of paper bags, for example, of the multi-wall type containing some material such as flour, to be able to dump the contents of the bags into a preselected charging port which, for example, may conduct the material to suitable mixing vats as in a bakery wherein large numbers of bags of flour are emptied over mixing vats. Often such charging ports are located at various positions in the factory and it is desirable to be able to move an automatic bag opening machine to any one of them. Consequently the portability of the automatic opening machine is a desirable characteristic which is incorporated in the device herein described.

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In the form of the invention shown in Figs. 1 and 2, the automatic device is mounted upon a portable frame which is referred to as a buggy and in general is constituted by a frame member 10 having legs 11 for suitable wheels as at 12. The buggy may be moved by hand, for example, by thrusting upon a handle 13.

Supported upon the frame or chassis 10 is a housing 14 which is adapted for surrounding the major portion of the apparatus comprising the invention and which serves to minimize the spreading of dust resulting from the emptying of the bags.

Also mounted upon the frame 10 is the above-mentioned conveyor as at 15 which in the form shown comprises an endless belt mounted upon a head pulley 16 and a tail pulley 17 and which is adapted for moving the bags toward the bag slitting and impaling device as will be explained hereinafter.

There is provided in the housing 14 a suitable receiving hopper 14a which is designed for receiving the bags which are to be emptied and directing them down onto the conveyor 15. The latter is provided with a series of vanes or pushing devices which are designed for pushing or urging same into the slitting and impaling mechanism in a preselected attitude. Such pushing devices are referred to herein as vanes, cleats, flights or pusher palms and are indicated as at 15a. Each of the cleats 15a is provided with a cut away portion as at 15b which is formed therein for the purpose of avoiding collision with the impaling spike to be described below. That is, the cut away portion 15b accommodates the impaling spike as it moves past it.

The bag cutting element in the form shown is constituted by a knife which is positioned for cutting one extremity of each of the bags, such knife being shown as at 18 and preferably being of the rotary variety driven by suitable power means such as a motor 19. The knife 18 is referred to as a slitter knife, rotates upon a substantially vertical axis, and is positioned near the discharge extremity of the conveyor 15, that is, substantially over the head pulley 16 with the center thereof to the left of the center of the head pulley 16 as viewed in Figs. 1 and 2 whereby slitting of the bag occurs well before the discharge of the bag by the conveyor.

Bags of the type which preferably are employed in this apparatus are substantially oblong and may be of the so-called sewn-taped end type or of the pasted bottom type. In the event that the apparatus is employed for slitting open the ends of the sewn-taped end bags, it is desirable for the slitter knife 18 to be positioned either above or below the tape of the bag in order to avoid cutting such tape whereby small chips of paper may be cut away and dumped with the contents of the bag. It would be substantially impossible to cut each bag accurately along the sewn tape. Consequently, it is desirable to cut either above or below such tape. In the event that a pasted bottom bag is employed, it is not necessary so to position the knife above or below a center line because it is possible to slit the end of such a bottom directly along the horizontal center line thereof.

The operative interconnection between the motor 19 and the head pulley 16 comprises, for example, a belt or chain as at 20 for driving a wheel or sprocket wheel 21 which is secured to a shaft 22. The latter, at the opposite extremity thereof, has secured thereto a pulley 23 which, by means of a suitable belt or sprocket chain

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connection as at 24, drives a shaft 25 of the head pulley 16 by means of a pulley 26 on said shaft 25.

The slitter knife 18 is also driven by the motor 19 through any suitable operative interconnection, for example, as shown in Fig. 2, comprising a pair of bevel gears 21 which transmit power from the shaft 22 to a vertical shaft 28 upon which the slitter knife 18 is mounted.

The conveyor 15 can be driven at any suitable speed and in the form shown the motor 19 is driven at a speed sufficient to drive the conveyor 15 at about 56 feet per minute.

As shown in Figs. 1 and 2, the impaling spike which is also referred to as the bag spike, is shown as at 29 and is fixedly secured to the frame part of the machine as at 29a which constitutes the base thereof. The bag spike 29, of course, is provided with a pointed extremity as at 29b which extends partially over the conveyor 15 and is positioned in such a manner that the piercing or impaling of the bag occurs substantially concurrently with the slitting of an extremity thereof by the knife 18. The opposite extremity of the bag spike 29 is in arcuate bifurcated form having arcuate curved legs as at 29c and 29d.

The bag spike 29 throughout substantially the entire length thereof, at least up to the arcuate bifurcated portion, is horizontal and is positioned such that the cut-out portions 15b of the cleats 15a are in alignment therewith when such cleats are on the "upper run" of the conveyor 15, thereby insuring the complete impaling of each bag. The pointed extremity 29b, in order so to insure the complete impaling of each bag, preferably extends to the left of the center line of the head pulley 16 as shown in Fig. 1.

The bag spike 29 extends to the right, as viewed in Figs. 1 and 2, substantially beyond the discharge point of the conveyor 15 and over a discharge hopper 30 which may be positioned over a charging port 31.

The mechanism for ejecting each of the bags from the apparatus after it has been emptied, in the form shown, is constituted by a rip knife 32 which is mounted for rotation about a horizontal axis and acts in cooperation with a spike wheel 33 positioned adjacent thereto whereby each emptied bag is slit vertically in such a manner that it may be pulled off of the spike 29 by means of such spike wheel. The latter is also mounted for rotation about a horizontal axis. Rip knife 32 is mounted upon a shaft 34 and spike wheel 33 upon a shaft 35. These two shafts are preferably geared together as shown in Fig. 1 by means of gears 36 and 37, the shaft 35 being driven by means of the motor 19, for example, through the intermediary of a belt or sprocket chain 38 which is mounted upon suitable pulleys or sprocket wheels on said shaft 22 and the shaft 35.

In operation a succession of full bags are placed in the receiving hopper 14a, and each bag is engaged by a vane 15a and is urged toward the slitter knife 18 and the bag spike 29. The full bag is slit while lying flat upon the conveyor, the slit being formed in one extremity thereof and the bag spike by virtue of the pushing action of its vane 15a is pierced near the other end thereof substantially concurrently while the bag is being slit. The bag thereafter is discharged by the conveyor and is urged by the action of the flight 15a, or jointly, by the action of such flight and the oncoming bags therebehind, over the dis-

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charge hopper 30 whereby the slit bag pivots about the spike 29 and the slit extremity hangs downwardly and the contents of the bag are emptied. If desired, a suitable bag agitating means can be employed (not shown) for shaking each of the bags to insure that all of the contents are emptied. This might be aided by a high frequency longitudinal oscillation of the bag spike. After each bag is emptied it is thrust up against the rip knife 32 and its vertically hanging sides are slit thereby, the spike wheel 33 thereafter engages same and discharges it through an opening in the righthand (Figs. 1 and 2) extremity of the housing 14.

Thus, it will be seen that as the successive bags advance and are pushed further along the bag spike, they, on clearing the conveyor 15, pivot on the spike and hang open end down. The bags remain in this suspended position for a short interval and spill their contents into the discharge hopper until the oncoming bags push the empty bags against said rip knife. The latter opens up the sides of the bags and as they advance further the spike wheel engages the now collapsed bags and ejects them over the arcuate portion of the bag spike. It will be noted that while a bag pivots from horizontal position on the conveyor to vertical position suspended on the spike the contents are urged out of the bag under the influence of gravity and centrifugal force. Furthermore, a bag may swing downwardly while so impaled and slap against the side of the hopper thereby assisting in emptying the contents.

The slitting of the end of the bag and the inserting of the bag spike after slitting has commenced, while the loaded bag is supported on and carried by the moving conveyor, serves a specific purpose. The rotary slitter knife, entering the bag first, tends to loosen the bag's contents somewhat thereby facilitating the insertion of the bag spike. Also, when the end of the bag has been completely slit, the bag spike has also passed completely through the bag so that the bag can immediately be discharged from the conveyor.

The action of the spike wheel 33 is not only one of discharging the empty bags but it also assists in dislodging any material which may have adhered to the inside of the bag because it agitates each bag before ejecting it.

The modification of the invention shown in Figs. 3 and 4 is substantially identical to that of the first two figures above described with the exception that the slitter knife 13 is moved so that it will slit each bag substantially in the center midway between the ends thereof as shown in Fig. 3. The bag is thus cut in two. The slitter knife in the embodiment of Fig. 3 is shown as at 39. In order to accommodate this position of the slitter knife 39, the bag conveyor must be divided into two identical endless belts which are mounted for movement in side by side relationship, such conveyors being shown as at 40 and 41. Suitable head and tail pulleys are provided for mounting the conveyors 40 and 41.

Instead of supporting the slit bag by means of a single spike 29 as shown in Figs. 1 and 2, the embodiment of Figs. 3 and 4 employs a pair of parallel horizontal spikes as at 42 and 43 which are identical in construction to bag spike 29 with the exception that they are positioned for impaling opposite extremities of the bags substantially symmetrically relative to the central slit therein. That is, the bag spikes 42 and 43 are located

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approximately equal distances from the plane of the rotary slitter knife 39.

After each of the bags is slit by the embodiment of Figs. 3 and 4, it is urged over a discharge hopper 44 and both of the extremities are supported by means of the spikes 42 and 43. As shown, the slitter knife 39 is positioned for cutting all the way through the bag, that is, cutting or slitting both the lower and upper and the side surfaces thereof. Thus upon being urged upon the spikes 42 and 43 each half of the bag, being separated, hangs vertically downwardly after pivoting upon its respective bag spike whereby the contents are emptied into said hopper 44. It should be noted that the latter hopper is of slightly different conformation compared with the hopper 30 in that portions of it as at 44a extend beneath the slitter knife 39 in order to insure that any material within the bag which leaks therefrom during the slitting action is dropped into the discharge hopper.

Each of the bag spikes 42 and 43 is provided with a rip knife and spike wheel analogous to knife 32 and spike wheel 33 above described. The rip knife for the spike 42 is shown as at 45 and its corresponding spike wheel as at 46, and the rip knife for the bag spike 43 is indicated at 47 and its corresponding spike wheel at 48.

In all of the embodiments or modifications shown it may be possible to provide suitable bag shaking means for agitating the bags after they have been discharged by the conveyor 15 or 40, 41 and, if desired, the spikes 42, 43 may be vibrated to accomplish this purpose or separate bag agitating means may be provided.

Although only two embodiments of the present invention have been illustrated and described in detail, it is to be expressly understood that the invention is not limited thereto. For example, if desired, the slitter knife 39 may be positioned for slitting only the under portion of the bag and it thereafter may be pushed over the discharge hopper hanging somewhat in the shape of a V, whereupon a second knife may be employed for cutting the upper portion of the bag in order to separate the two halves. Also, if desired, suitable guide bars may be employed for forcing such halves of the bag downwardly with a slapping or vibrating action in order to assist in emptying same. Furthermore, any suitable conveyor such as an hydraulic actuated pusher can be employed instead of the conveyor as described above.

While the invention has been described with respect to certain preferred examples which have given satisfactory results, it will be understood by those skilled in the art after understanding the invention that various changes and modifications may be made without departing from the spirit and scope of the invention and it is intended therefore in the appended claims to cover all such changes and modifications.

What is claimed as new and is desired to be secured by Letters Patent is:

1. In apparatus for slitting and emptying a container, a slitter knife; a horizontal impaling spike, said knife and spike being fixed in position; said knife and spike being positioned relative to such container to cut open one extremity thereof and to impale same near the opposite extremity in response to movement of the container relative to said knife and spike into slitting and impaling relationship respectively therewith.

2. In apparatus of the class described, a slitter knife; a conveyor having a discharge end for

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moving a plurality of bags in succession past said knife for slitting one of the ends of each bag; a discharge hopper positioned at the discharge end of said conveyor; a spike positioned to extend over said hopper and partially over said conveyor for impaling each bag successively, each bag being impaled near the end opposite to its slit end whereby each bag after being discharged by said conveyor pivots on said spike with its slit end hanging downward to empty the contents thereof.

3. In apparatus of the class described, a slitter knife, a conveyor for moving a plurality of bags in succession past said knife for slitting one of the ends thereof; a spike positioned for impaling the bags in succession at the opposite ends thereof in response to movement of the bags by the conveyor onto said spike; and a discharge hopper beneath said spike and positioned for receiving the contents of each slit bag after being slit by said knife at one end thereof and supported thereover by said spike.

4. In apparatus of the class described, a horizontal conveyor belt having spaced pusher palms mounted thereon for engaging filled bags carried thereby; a horizontal rotatable knife positioned over said belt for slitting bags successively at one of the ends thereof, said bags being carried in succession past such knife by said conveyor; a bag impaling spike positioned parallel to said belt with the point thereof positioned for impaling each of said bags substantially concurrently with the slitting thereof by said knife, the spike impaling the bags near the ends opposite to the slit ends; a discharge hopper, said spike passing over said hopper whereby each bag is split and impaled and thereafter urged over said hopper by said conveyor for emptying the bag; a rip knife positioned near the base of said spike for cutting portions of each empty bag below said spike; and a spike wheel positioned near said rip knife for engaging and discharging empty bags after being cut by said rip knife.

5. In apparatus of the class described, a knife; a conveyor for moving a plurality of filled bags in succession past said knife for cutting a slit therein; and a spike fixedly mounted at one of its extremities, the opposite extremity being pointed and positioned for extending partially over said conveyor, whereby it is located for impaling successively the bags which are moved toward same, said conveyor being effective for urging the bags into an impaled relationship with said spike and for discharging each bag therefrom while so impaled, whereby each bag pivots upon said spike and discharges its contents through the cut therein formed by said knife.

6. In apparatus of the class described, a conveyor for moving a plurality of bags in succession along a common path; a cutting member positioned for slitting one of the extremities of the bags as they are moved thereby upon said conveyor; an impaling spike positioned for impaling said bags in succession, the impaling of the bags occurring near the extremities thereof opposite to the slit extremities; a rip knife positioned adjacent to said spike for cutting preselected portions of the bags after they have been emptied; and an ejector member for engaging and ejecting each bag after it has been cut by said rip knife.

7. In apparatus of the class described, an impaling spike; a knife member positioned in spaced relationship to said spike at a preselected distance therefrom; a conveyor for supporting a bag and having a pusher mechanism for pushing a bag

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upon said spike and into engagement with said knife member whereby it is impaled on said spike and is slit by said knife member, said pushing mechanism urging the bag onto the spike whereby the latter becomes the support of the bag and the latter is emptied of its contents through the slit formed therein.

8. In apparatus of the class described, a knife; a conveyor for moving a plurality of bags in succession past said knife for slitting one of the ends of each bag; a spike having a point which is horizontally spaced from said knife and is fixedly positioned over said conveyor for impaling each bag successively near the end opposite to its slit end, whereby each bag, after being discharged by said conveyor, pivots on said spike with the slit end thereof hanging downwards; the axis of said spike being substantially parallel to the direction of movement of said conveyor.

9. In apparatus of the class described, a pair of substantially parallel horizontal spikes; a mechanism for impaling a succession of bags upon said spikes; a cutting member for cutting open the bags so impaled to form a slit between said spikes; said mechanism including a conveyor for moving such succession of bags past said cutting member, such spikes being positioned for partially overlapping said conveyor, each bag pivoting upon such impaling means to discharge at least a portion of its contents through the cut formed by such knife; a pair of rip knives associated with respective of said spikes for cutting preselected parts of the emptied bags to facilitate ejection thereof from the apparatus; and means associated with respective of said rip knives for engaging and ejecting the emptied bags after being cut by said rip knives.

10. In apparatus of the class described, impaling means comprising a pair of substantially parallel horizontal spikes; a conveyor for conveying a succession of filled bags onto said spikes; a knife for cutting each bag so impaled along a line intermediate said spikes, said conveyor moving said succession of filled bags past said knife for cutting same, said spikes partially overlapping said conveyor for impaling the bags, each bag being pivotable upon such impaling means to discharge at least a part of its contents through the cut formed by such knife; and means for removing the bags from the spikes.

11. A bag opening apparatus having in combination: a conveyor for moving a plurality of bags in succession along a common path and for discharging the bags at a discharge station; a bag slitter knife positioned for slitting in succession the bags which are moved by said conveyor; and a spike extending over said discharge station and having a point which extends over said conveyor near the discharge station for impaling the bags in succession which are moved upon said conveyor, said knife and spike being positioned for entering each bag on opposite sides of a center line thereof, whereby each bag when discharged by said conveyor pivots upon said spike and the contents thereof empty through the slit formed therein.

12. In apparatus of the class described, a knife, a conveyor for moving a plurality of filled bags in succession past said knife for cutting a slit therein; and impaling spike means positioned for partially overlapping said conveyor for impaling successively the bags which are moved thereon toward same, each bag pivoting upon such impaling means for discharging at least

a portion of its contents through the cut formed therein by said knife.

13. In apparatus of the class described, a knife, a conveyor for moving a plurality of filled bags in succession past said knife for cutting same; and impaling spike means positioned for partially overlapping said conveyor for impaling successively the bags which are moved thereon toward same, each bag pivoting upon such impaling means for discharging at least a portion of its

contents through the cut formed therein by said knife.

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