Nov. 11, 1969 R. M. KUHLMAN 3,477,592

DENESTER

Filed March 27, 1968 3 Sheets-Sheet 1

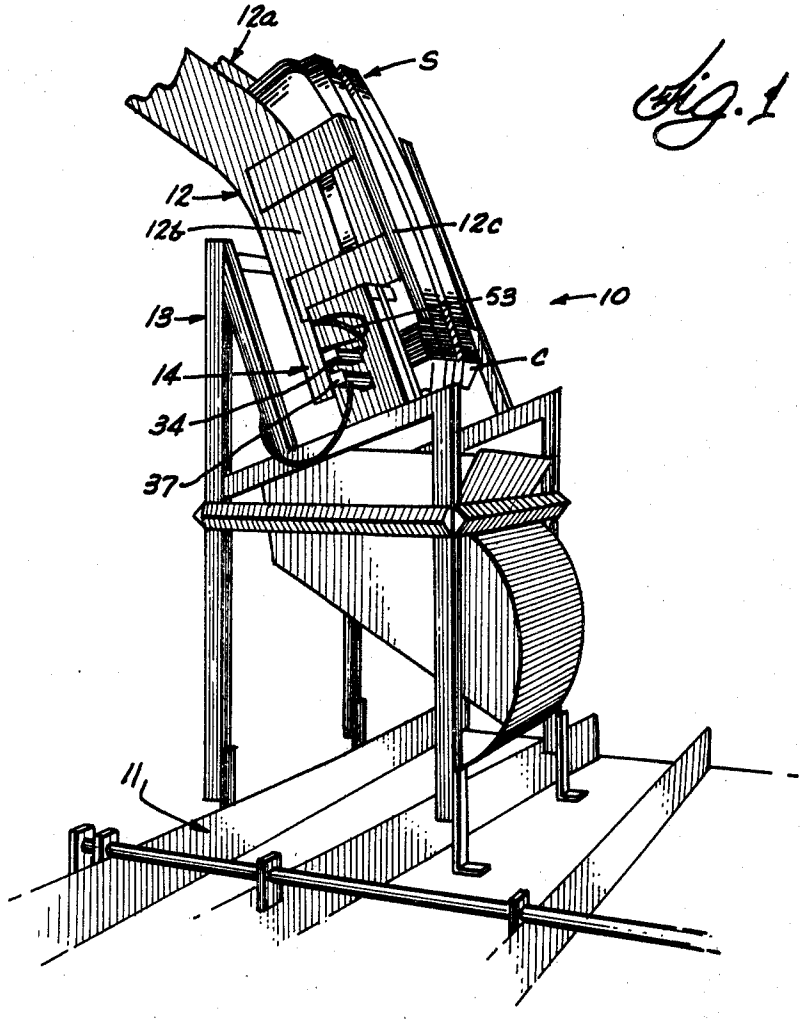

Fig. 1

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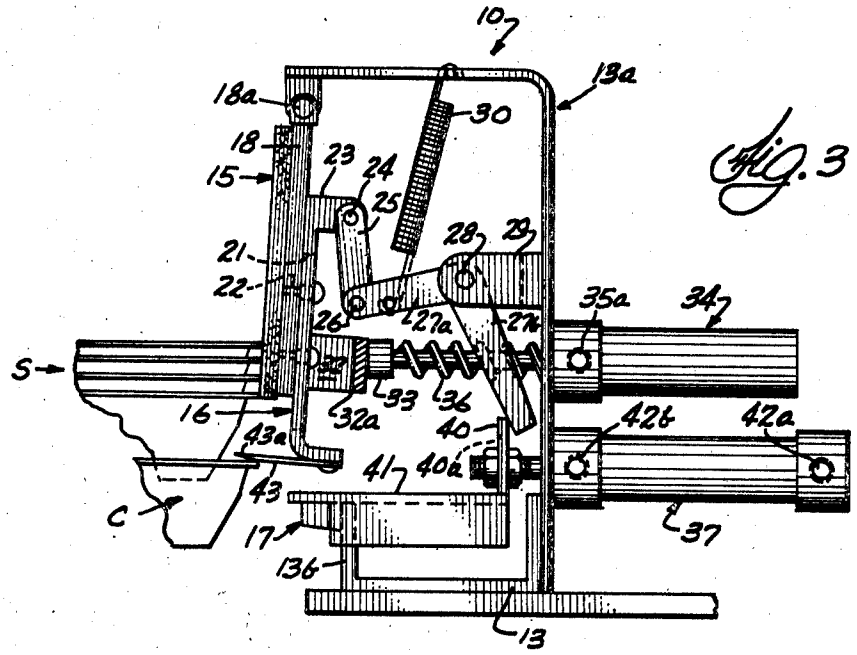

Fig. 3

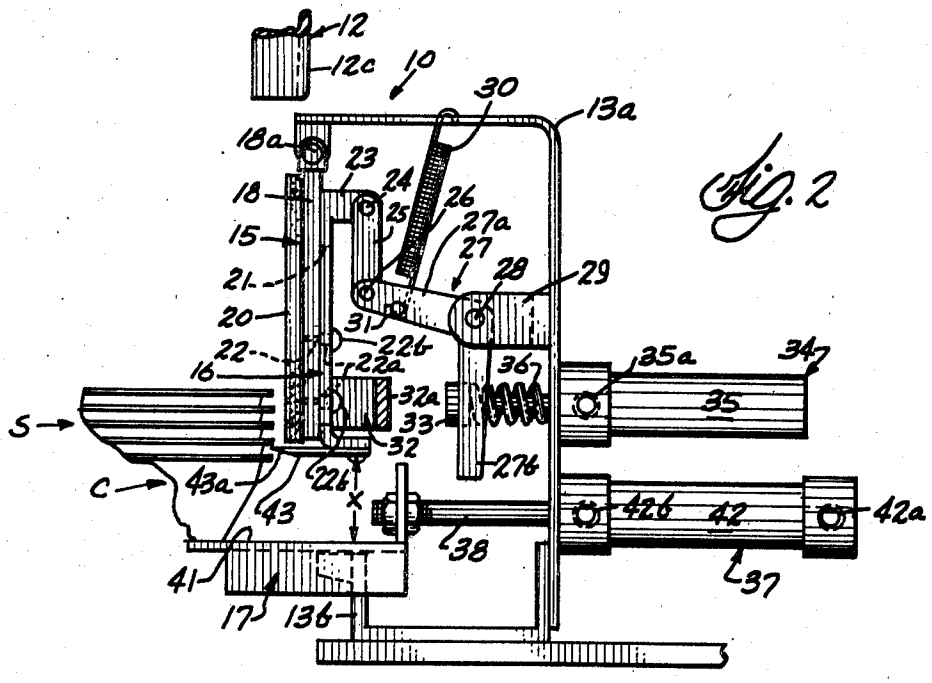

Fig. 2

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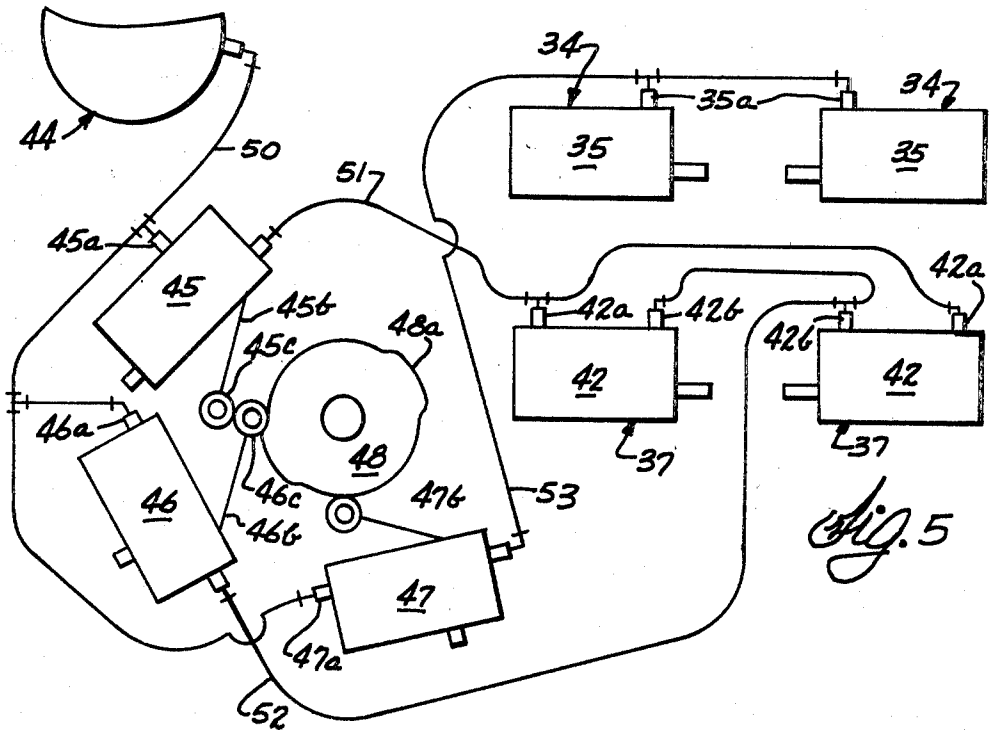

Fig. 5

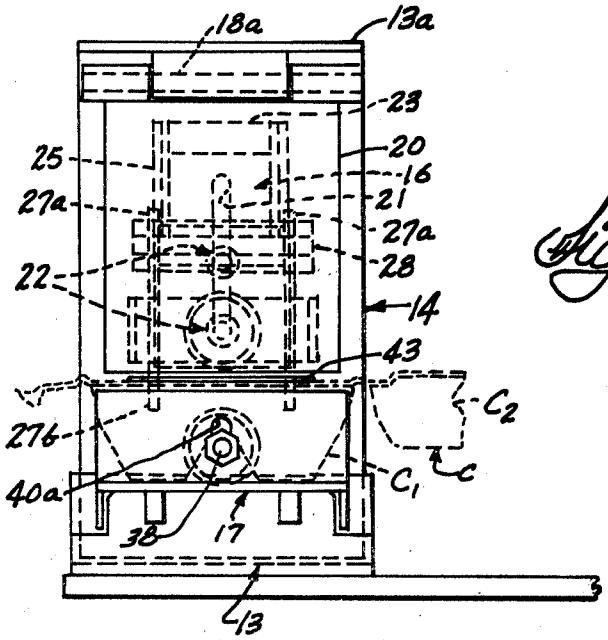

Fig. 4

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3,477,592

DENESTER

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Int. Cl. B65g 59/06; B65h 3/28
U.S. Cl. 214—8.5 5 Claims

ABSTRACT OF THE DISCLOSURE

An apparatus for successively denesting individual articles from the bottom of a stack of articles arranged in nested relation. The stack initially rests upon a power-actuated indexing means when the latter is in an extended position. While the stack is so disposed, it is resiliently engaged and retained in said position by a power-actuated stack-holding means. Simultaneous with the stack being resiliently engaged by the stack-holding means, a projecting portion of a stripper element is positioned between the peripheries of the two lowermost articles in the stack. The indexing means is then retracted so as to be spaced laterally from the bottom of the stack, whereupon the stripper element projecting portion is moved downwardly relative to the stack-holding means causing the lowermost article to become denested from the remainder of the stacked articles.

BACKGROUND OF THE INVENTION

In the packaging industry it is common practice when handling, storing, or shipping in bulk a large number of empty cartons (e.g. molded pulp egg cartons) to nest the cartons together when the latter are in fully open condition. Once a predetermined number of the cartons are arranged in nested relation so as to form a stack, the stack is then subjected to compressive force of predetermined magnitude so as to compact the stack to a convenient size. Frequently the stack is then overwrapped so as to preserve and protect the cartons.

When the cartons are to be used, the overwrap is removed from the stack and then the individual cartons are removed from the stack for filling. Because of the configuration of the stacked cartons, the inherently roughened surface of molded pulp, and the compressive force utilized to compact the stack, denesting of the cartons from the stack, frequently becomes a difficult and awkward manipulation.

In commercial egg packing plants, it is customary for the denesting operation to be performed by automatic equipment. Various forms of such equipment have heretofore been produced; however, because of certain design characteristics they are beset with one or more of the following shortcomings: (a) the equipment is of costly, complex and bulky construction, (b) the equipment is subjected to frequent breakdown or jamming, (c) the equipment often tears or mutilates the cartons, (d) the operation of the equipment is slow, (e) the equipment is not readily capable of accommodating cartons varying in size and shape over a wide range.

SUMMARY OF THE INVENTION

Thus, it is an object of this invention to provide a denester which avoids the shortcomings associated with prior equipment of this general type.

It is a further object of this invention to provide a denester which may be readily integrated with conveyor systems and the like presently found in commercial egg packing plants.

It is a further object of this invention to provide a denester the cycle of operation of which may be interrupted at anytime without adversely effecting the apparatus or the cartons being handled thereby.

It is a still further object of this invention to provide a denester which is capable of handling a wide variety of nested articles with but a minimum of change-over time involved to accommodate the various articles.

It is a still further object of this invention to provide a denester which has high capacity with but a minimum of power requirements.

Further and additional objects will appear from the description, accompanying drawings and appended claims.

In accordance with one embodiment of this invention a denester is provided which includes an indexing means mounted for movement between an extended position wherein it engages the bottom of a stack of nested articles, and a retracted position wherein it is laterally spaced from the bottom of the stack. The denester also includes an adjustably mounted stack-holding means disposed above the indexing means. The stack-holding means, when in one position of adjustment resiliently engages the stack of nested articles and retains same in a predetermined position when the indexing means assumes the retracted position. When the stack-holding means assumes a second position of adjustment, it is spaced from the stack whereby the latter, due to its own weight, moves downwardly a predetermined distance. An adjustable stripper element is also provided which, when in a first position of adjustment, has a portion thereof disposed adjacent the underside of the stack-holding means and projecting between the peripheries of the two lowermost articles of the stack when the latter is being resiliently engaged by the stack-holding means. The stripper element, when actuated from the first position of adjustment to a second position of adjustment, causes the projecting portion thereof to contact the periphery of the lowermost article in the stack and move said article downwardly past the indexing member while the latter is in the retracted position, and effect denesting of the said article from the remaining articles of the stack. The denester is also provided with control means for effecting adjustment of said indexing means, said stack-holding means, and said stripper means in a predetermined time sequence.

For a more complete understanding of the invention, reference should be made to the drawings wherein:

FIG. 1 is a fragmentary perspective view of one form of the improved denester shown in combination with a horizontally disposed conveyor;

FIG. 2 is a fragmentary enlarged front elevational view of the denester of FIG. 1 and showing the indexing means in an extended position and the stack-holding means in a release position;

FIG. 3 is similar to FIG. 2 but showing the indexing means and stack-holding means in changed positions and the stripper element in a denesting position;

FIG. 4 is a fragmentary left end elevational view of the denester shown in FIG. 2; and

FIG. 5 is a schematic diagram of a control system for the illustrated denester.

Referring now to the drawings and more particularly to FIG. 1, one form of the improved denester or denesting appartus **10** is shown. The denester as illustrated is adapted for use in successively removing or denesting a molded pulp egg carton C from the lower end of a stack or bundle S of similar egg cartons arranged in nested relation. The denested carton, due to the force of gravity, is caused to be deposited upon a horizontally disposed conveyor **11** positioned beneath the denester.

The illustrated egg cartons C are of a type commonly referred to as a 2 x 6 style. Such cartons (see FIG. 4) normally comprise a cellular tray section C_1 and a cover section C_2 which is integral with and hingedly connected to the back wall of the tray section. The cartons in ques-

tion may be of the style disclosed in Lambert U.S. Patent 2,978,162. As will be hereinafter discussed the denester **10** is not limited for use with this particular type article but may be readily adjusted to accommodate other types of egg cartons, as well as trays for fragile articles, filler flats, or other nestable articles of comparable design.

The cartons C are nested when in a fully open position so that the respective tray and cover sections will nest within one another. Because of the cellular configuration of the tray sections, sticking therebetween oftentimes becomes acute.

The stack S is held in a stabilized upright position by a suitable guide member **12**, see FIGS. 1 and 2, which is mounted on a frame member **13**. The height and size of the frame member will depend upon the height and size of the conveyor **11** utilized to move the denested carton to a predetermined egg loading station, not shown. The guide member **12** may be an optional accessory and is open at the top for loading one or more bundles of cartons therein. The bundle is positioned within the guide member so that the underside of the carton tray section C_1 faces downwardly.

The lower end of the guide member **12** is also open and is disposed adjacent to an assembly **14** which is shown more clearly in FIGS. 2–4. The assembly **14**, as illustrated, comprises basically a stack-holding unit **15**, a stripper element **16**, and an indexing member **17**. There are, in fact, two assemblies **14** which are of like construction and are disposed on opposite sides of the stack S. It should be noted, however, that by reason of having two independent assemblies **14** which operate in opposition to one another in a manner to be hereinafter described, each assembly may be adjusted separately so that the assemblies can be self-aligning with respect to the configuration of the stack accommodated therebetween. For convenience only one of the assemblies is illustrated and will be described in detail hereinafter.

The stack-holding unit **15** includes a clamping plate or jaw **18** which is pivotally connected at its upper end **18***a* to a fixed extension **13***a* of the frame **13**. The inner face, or the face of the plate which is adjacent the side of the stack S is covered with a resilient soft shoe or pad **20** which engages certain cartons in the stack S at predetermined intervals during the cycle of operation of the denester which will be described more fully hereinafter. Slidably connected to the backside of plate **18** is the stripper element **16**. To permit a sliding motion of element **16** with respect to plate **18**, an elongated vertically disposed slot **21** is formed in the element. Disposed within the slot **21** are a pair of vertically spaced studs **22** which are threaded into the backside of plate **18**. An unthreaded shank portion **22***a* of each stud is disposed within the slot **21**. The outer or exposed end of each shank portion terminates in an enlarged head **22***b* which because of its dimension is impassable through the slot.

In FIGS. 2–4 it will be noted that there is formed on the upper end of the element **16** an outwardly extending nub **23**. To the outer distal end of nub **23** are pivotally connected at **24** the upper ends of a pair of link members **25**, see FIG. 4. The lower end of each member **25** is pivotally connected at **26** to one arm **27***a* of a corresponding one of a pair of bell-crank levers **27**. Each lever **27** in turn is pivotally connected at **28** to a bracket **29** affixed to the frame extension **13***a*. The second arm **27***b* of each lever **27** depends from pivotal connection **28**.

Upon levers **27** being pivoted as a unit about connection **28** in a counterclockwise direction so as to assume the position shown in FIG. 3, the stripper element **16** is caused to move downwardly relative to the stack-holding unit **15** and effect denesting of the lowermost carton in the stack. The denesting operation of stripper element **16** will be discussed more fully hereinafter.

The bell-crank levers **27** are biased in a clockwise direction to the positions shown in FIG. 2 by a coil spring **30**, which has one end thereof affixed to frame extension **13***a* and the other end affixed to a pin **31** which interconnects the lever arms **27***a* of the pair of bell-crank levers **27**.

Spaced below nub **23** and affixed to stripper element **16** is a U-shaped member **32**, see FIGS. 2 and 3. The leg portions of member **32** have the ends thereof connected to element **16** and the bail or central portion **32***a* of the member is spaced from the adjacent portion of the element in which the elongated slot **21** is formed. Portion **32***a* functions as a bumper piece against which one end **33***a* of piston rod **33** engages when said piston is moving to its extended position as shown in FIG. 3. The piston comprises a part of an air-actuated piston-cylinder unit **34**. The cylinder **35** of the unit is affixed to the frame extension **13***a*, see FIGS. 2 and 3. The means of controlling the actuation of piston rod **33** will be described in detail hereinafter.

Disposed between the exposed end **33***a* of piston rod **33** and the cylinder **35** or frame extension **13***a* and in encircling relation with a portion of the rod is a coil spring **36**. The function of spring **36** is to cause the exposed end of the rod to engage the bumper piece **32***a* of member **32** and actuate the plate **18** into stack-holding position, once air pressure in cylinder **35** has been released.

A second piston-cylinder unit **37** is provided which is positioned beneath unit **34**, see FIGS. 2 and 3. The piston rod **38** of unit **37** has the outer end thereof affixed to an upright flange **40**, the latter comprising a portion of the indexing member **17**. In addition to flange **40**, the indexing member **17** comprises an elongated base **41** which is slidably supported by an unpstanding leg **13***b* carried by the frame **13**.

When rod **38** assumes a fully extended position with respect to cylinder **42** of unit **37**, see FIG. 2, the base **41** is disposed within the path of movement of the stack S and is adapted to be engaged by the lowermost carton in the stack. When the stack is engaging base **41**, the lowermost carton in the stack is properly indexed with respect to a stripper blade **43**, the latter forming a part of the element **16**, see FIG. 2.

When piston **38** is in its fully retracted position with respect to cylinder **42**, as seen in full lines in FIG. 3, the base **41** is spaced laterally from the lowermost carton of the stack. While the base **41** remains in this retracted position, the lowermost carton in the stack is free to be moved downwardly therepast by the stripper element.

It will be noted in FIGS. 2, 3 and 5 that unit **37** is actuated in both directions by air pressure whereas unit **34** is actuated in only the direction towards retraction by air pressure. It is to be understood of course that the invention is not limited to this precise arrangement. With the illustrated arrangement, however, an advantage to be gained thereby is that any failure of air pressure will result in the stack S being automatically gripped between the stack-holding units **15** disposed on oposite sides of the stack.

It will be observed in FIG. 2 that the blade **43** which is positioned adjacent the lower side of element **16** is also disposed adjacent the underside of the plate **18** and shoe **20**. In such position the blade **43** is spaced a predetermined distance X above extended base **41** of indexing member **17**. This spacing or distance X may vary and will depend upon the height of the tray section of the lowermost carton in the stack. Where, for example, the spacing X is to be reduced in order to accommodate an article of lesser height, such as a filler flat, this may readily be accomplished by mounting adapted blocks, not shown, on the upper, or contacting, surface of base **41**. If, on the other hand, the spacing X is to be increased from that shown in FIGS. 2 and 3, such may be readily accomplished by removing the suporting leg **13***b* and substituting a shorter one therefor and loosening the connection between the end of piston **38** and flange **40**. Because of an elongated slot **40***a*, see FIG. 4, formed in flange **40**, the base **41** and flange **40** may be lowered as a unit until the base engages the substituted supporting

leg, whereupon the connection between the end of the piston and the flange can once again be tightened.

Once the proper spacing X has been determined, the inwardly projecting edge **43***a* of the blade **43** is aligned between the adjacent peripheral portions of the two lowermost cartons in the stack. Upon the clamp plate **18**, which carries stripper element **16**, being moved to a stack-holding position such as shown in FIG. 3, the projecting edge **43***a* of the blade **43**, shown in dotted lines in FIG. 3, moves toward the stack and becomes disposed intermediate the peripheral portions of the two lowermost cartons of the stack. Subsequent to the blade edge **43***a* being so positioned, the stripper element **16** is then actuated downwardly independently of clamp plate **18** causing the lowermost carton to be denested from the bottom of the stack.

The downward independent movement of the stripper element **16** is effected upon movement of the indexing member **17** from its extended position to its retracted position. For approximately the first half of the retracting movement of member **17**, the stripper element **16** is uneffected. However, upon the upper edge of flange **40** engaging the depending arms **27***b* of the pair of bell-crank levers **27**, the latter are caused to pivot in a counterclockwise direction about point **28** as member **17** coninues its retracting. The counterclockwise motion of the bell-crank levers **27** is transformed into downward linear motion of stripper element **16** through link members **25** pivotally connected to the other arms **27***a* of levers **27**.

As aforenoted, bell-crank levers **27** are biased by coil spring **30** in a clockwise direction and as a result, stripper element **16** will automatically assume its up position, as seen in FIG. 2, when the indexing member **17** resumes its extended position.

A control system for actuating the stack-holding units and the index members in a predetermined timed sequence is shown schematically in FIG. 5. Included within the system is an air supply **44**, a plurality of cam-operated valve switches **45**, **46** and **47**, a cam **48**, suitable piping **50** interconnecting the air supply **44** to switches **45**, **46** and **47** and further piping **51**, **52** and **53** which effects the following respective interconnections: switch **45** to ports **42***a* of piston-cylinder units **37**; switch **46** to ports **42***b* of units **37**; and switch **47** to ports **35***a* of piston-cylinder units **34**.

An input port **45***a* of switch **45** is normally open and thus, air pressure is normally exerted on the piston **38** of each unit **37** causing said piston to assume an extended position, which, in turn, causes base **41** of the indexing member to assume the stack-supporting position shown in FIG. 2. Switch **45** is provided with an elongated follower arm **45***b*, which when moved in a clockwise direction from that shown in FIG. 5, causes the input port **45***a* to be closed. How such clockwise motion is imparted to arm **45***b* will be described more fully hereinafter.

An input port **46***a* of switch **46** is normally closed and thus, ports **42***b* of units **42** are not under pressure and cooperate with ports **42***a* to permit the pistons **38** to readily assume their normal extended positions. Switch **46** also is provided with an elongated follower arm **46***b*, the movement of which controls the opening and closing of port **46***a*. Arm **46***b* is biased so that a roller **46***c* mounted on the distal end of arm **46***b* is in constant contact with the periphery of cam **48**. It should also be noted that arm **45***b* of switch **45** is also biased so that a roller **45***c* carried on the end of the arm is in constant contact with the periphery of roller **46***c*. Thus, by reason of this arrangement, closing of input port **45***a* of switch **45** occurs simultaneously with the opening of input port **46***a* of switch **46**.

In switch **47**, an input port **47***a* is provided which is normally closed so as to enable the clamp plates **18** and associated shoes **20** of the units **15** to normally assume a stack-holding position by reason of the pistons **33** of units **34** being biased by springs **36** to be extended and engaging the bumper pieces **32***a* of members **32**, the latter being carried by clamp plates **18**. As in the case of switches **45** and **46**, switch **47** is also provided with an elongated follower arm **47***b*, which, when actuated in a counterclockwise direction from the position shown in FIG. 5, causes input port **47***a* to be opened whereupon air pressure is introduced into input ports **35***a* of cylinders **35** and effect retraction of pistons **33**. Once pistons **33** are retracted, coil springs **30** come into play causing the clamp plates **18** to automatically move to a release position, see FIG. 2.

The peripheral configuration of cam **48**, as seen in FIG. 5, includes a pair of nodes **48***a* which are arranged in diametric relation. Each node spans a sector of approximately 30°–40° and thus effects the desired sequence of operation of switches **45**–**47** when the latter are disposed in the relative positions as shown. Obviously the peripheral shape of the cam **48** and the relative disposition of the switches may be varied without departing from the scope of the invention. In the illustrated embodiment of the cam **48**, the peripheral shape thereof is substantially symmetrical and thus, interruption of the operation of the denester may occur at anytime without adversely affecting the sequence of operation of the denester when operation thereof is resumed.

As seen in FIG. 4, the clamp plates **18** and associated shoes **20**, the stripper elements **16** and the indexing members **17** are shown of such a size as to contact and operate on only the tray sections C of the nested cartons C of the stack S. The reason for this particular arrangement is that with this particular article, the jamming or stacking problem is only of concern in the tray sections because of the plurality of posts and pockets formed therein. In instances, however, where the stacking problems involve both the tray and cover sections or the article as a whole, such as in the case of a filler flat, the shape and size of the denester components may be readily varied to meet the peculiarities of the articles to be denested without departing from the scope of the disclosed invention.

The guide member **12**, as seen more clearly in FIG. 1, includes a channel-shaped element **12***a*, and a pair of flange pieces **12***b* which are fixedly secured to and are disposed in front of the flange portions **12***c* of element **12***a*. The spacing between the element flange portions **12***c* and the flange pieces **12***b* as well, corresponds closely to the lengths of the nested cartons. On the other hand, the spacing between the base portion of the channel-shaped element and flange pieces **12***b* corresponds substantially to the distance of each of the nested cartons from the front wall of the tray section thereof to the front wall of the cover section, when the cover section is in its fully opened position as seen in dotted lines in FIG. 4. Thus by reason of these aforenoted spaced dimensions of the guide member **12**, the stack S may readily slide downwardly within the guide member as the lowermost carton is denested from the bottom end of the stack. Where the articles to be denested differ in shape and size from those illustrated in the drawings, the guide member configuration may be varied accordingly.

In certain instances it might be desirable for the stack S of cartons to be inverted from that shown—that is to say, the open sides of both the tray and cover sections face downwardly. When such is the case, however, the space X between base **41** and blade **43** will be reduced substantially from that shown in a manner as previously suggested. Furthermore, base **41** should be retracted to a greater extent than that shown in FIG. 3 or the base **41** should be provided with a slot of suitable dimensions through which the blade can pass, so that in either case there will be no interference between the blade **43** and the base **41** when the blade is moved downwardly relative to the lower side of the stack-holding unit **15** to effect denesting of the lowermost carton.

Thus, it will be seen that an improved denester has been provided which is simple in construction, effective in operation, and may be readily incorporated and used in combination with existing conveyor and loading equipment

commonly found in numerous commercial packing plants. Furthermore the improved denester is adapted to readily accommodate articles varying over a wide range in both size and shape.

I claim:

1. An apparatus for successively denesting individual articles from the bottom of a stack of articles arranged in nested relation, said apparatus comprising indexing means mounted for movement between an extended position wherein a portion thereof subtends and engages the bottom of the stack, and a retracted position, wherein said portion is laterally spaced from the stack bottom; first power means for effecting movement of said indexing means between said extended and retracted positions; stack-holding means mounted above said indexing means for movement between a first position wherein said holding means resiliently engages opposite sides of the stack without engaging the lowermost article thereof and retains the stack in a predetermined elevated position with respect to the indexing means portion, and a second position wherein said holding means is out of contact with the stack and the latter is free to move downwardly a predetermined distance due to its own weight; second power means for effecting movement of said stack-holding means; adjustable stripper elements carried by said stack-holding means, each element having a projecting portion disposed adjacent the underside of said holding means and positioned between the peripheral edges of the two lowermost articles in the stack when the latter is being retained by said holding means in said predetermined elevated position, said stripper elements, while said holding means is in said first position, being movable independently thereof to an extended position relative to the underside of said holding means whereby the lowermost article of the stack is moved thereby to a denested position with respect to the remainder of the stack; means engaging said stripper elements and operable by said first power means for effecting independent movement of said stripper elements to said extended position only when said first power means is moving said indexing means to said retracted positions; and control means operatively engaging said first and second power means for effecting independent actuation of same in a predetermined time sequence.

2. The apparatus of claim 1 wherein said first and second power means are pneumatically actuated piston-cylinder assemblies.

3. The apparatus of claim 2 wherein said control means includes a movable cam, and a plurality of switches adjustably mounted adjacent the periphery of said cam and actuated by the latter upon movement thereof, said switches being operatively connected to said piston-cylinder assemblies.

4. The apparatus of claim 1 including guide means for stabilizing the stack of nested articles when released by said stack-holding means.

5. The apparatus of claim 1 wherein said stack-holding means is biased to assume a stack-holding position with respect to the stack of nested articles and said stripper element projecting portion is biased to assume a position adjacent the underside of said stack-holding means.

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U.S. Cl. X.R.

221—221