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DENESTING APPARATUS WITH ARTICLE GRIPPING DISCHARGE ASSISTANT

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3 Sheets-Sheet 1

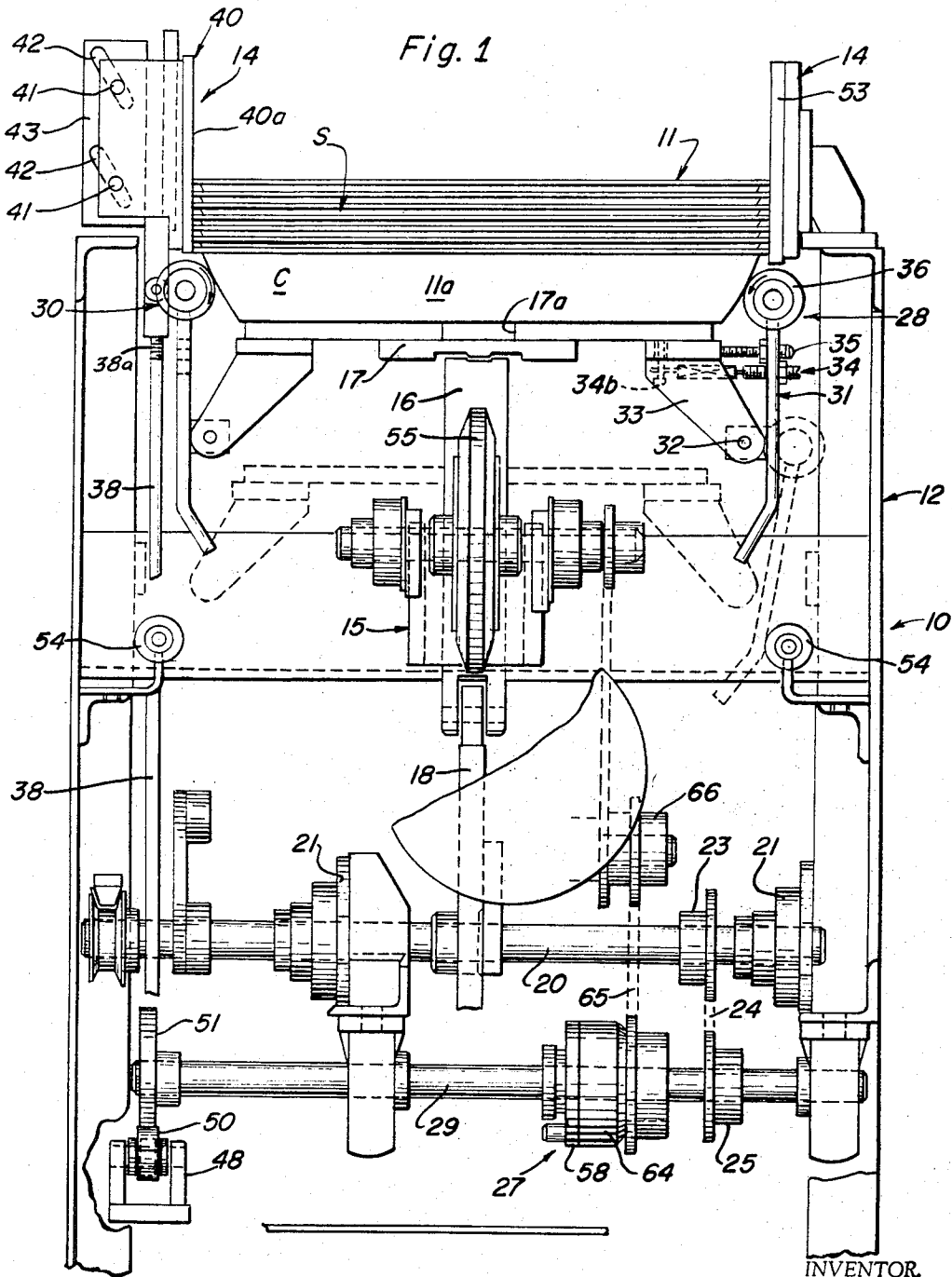


Fig. 1

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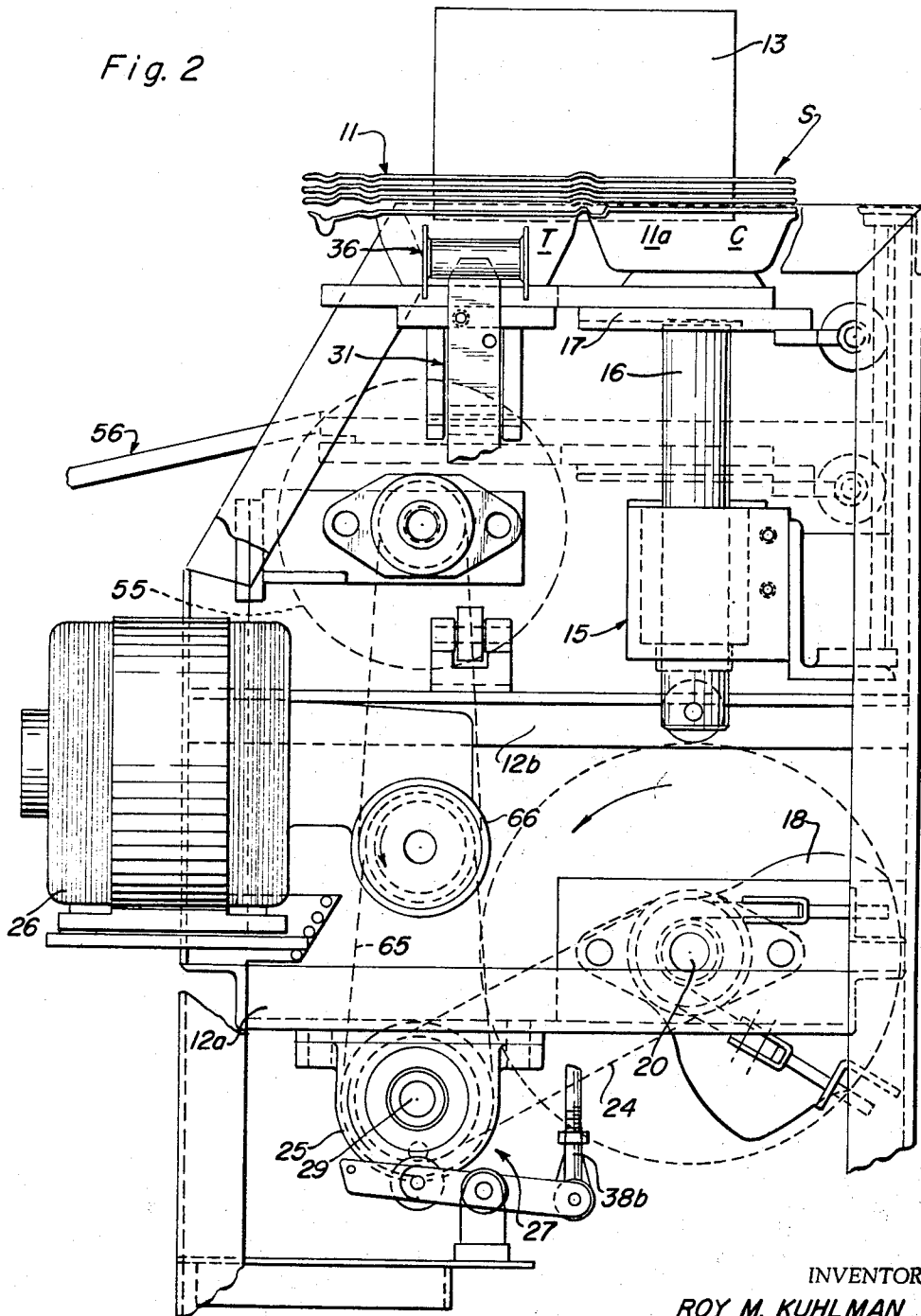
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3 Sheets-Sheet 2



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**DENESTING APPARATUS WITH ARTICLE GRIPPING DISCHARGE ASSISTANT**

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**ABSTRACT OF THE DISCLOSURE**

This invention relates to a method of an apparatus for facilitating denesting of individual articles (e.g., molded pulp egg cartons) from a stack or bundle thereof wherein said stack is formed by a plurality of like articles arranged in nested relation and while so disposed having a predetermined compressive force exerted thereon. Generally, the articles in question embody a plurality of abrupt projections and/or depressions and the surface texture of each article is coarse with the result that the combination of these factors causes a high coefficient of friction to be established between adjacent nested articles which frequently renders the denesting of the articles an awkward, frustrating, and difficult operation.

*Background of the invention*

To facilitate understanding of the invention in question the same will be described in relation to molded pulp egg cartons. It is to be understood of course that the invention is not intended to be limited for use solely with such an article but has application to articles such as molded pulp filler-flats or the like.

Molded pulp egg cartons are used in large numbers in the merchandizing and retailing of eggs for human consumption. Such cartons are generally capable of accommodating a dozen eggs, and each carton comprises a cellular tray section, and a cover section hingedly connected to one side of the tray section. The most popular types of egg cartons are the 1 x 6 and 3 x 4 styles. In the 2 x 6 style there are two parallel rows of pockets, each row containing six pockets of uniform size and shape. The 3 x 4 carton, on the other hand, has three parallel rows of four pockets each.

In the molding of such cartons, it is customary for the pockets of the tray sections to form on the underside thereof depending posts. The depending posts of the upper tray section are adapted to nest in the pockets of the lower tray section when the cartons, in fully opened condition, are arranged in stacked relation.

Various mechanical devices have heretofore been utilized to effect denesting of the nested cartons; however, because of certain inherent design characteristics such devices have been beset with numerous shortcomings. For example, they are not capable of readily functioning properly with cartons of various sizes and shapes. Furthermore, they frequently damage, tear, or mar the carton during the denesting operation. Lastly such devices are oftentimes of complex and costly design and require an inordinate amount of maintenance, service and/or repair to keep in proper working order.

*Summary of the invention*

Thus, it is one of the objects of this invention to provide a method of an apparatus for readily denesting stacked nested articles while not beset with the aforementioned shortcomings.

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

In accordance with one embodiment of this invention

an apparatus is provided for denesting an article from a stack of articles arranged in nested relation. The apparatus in question includes a first means for releasably retaining a stack of articles in an upright position with the lowermost article having the undersurface thereof exposed. An article-supporting second means is provided which is movable relative to the first means in directions toward and away from the undersurface of the lowermost article in the retained stack. Third means are carried by the second means for yieldably engaging and moving upwardly relative to the undersurface of the lowermost article while the second means is moving upwardly toward the first means. Upon the second means reversing direction and moving away from the first means, the first means is simultaneously actuated to release the retained stack, whereby the third means frictionally pulls downwardly the released stack. Upon the released stack having moved downwardly as a unit a predetermined distance, the first means once again retains the stack in a fixed position while the third means continues its downward movement carrying with it the engaged article and causing the latter to be separated from the bottom of the retained stack.

*Description of the drawings*

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

FIG. 1 is a fragmentary front elevational view of one form of the improved apparatus and showing a stack of nested articles positioned thereon;

FIG. 2 is a fragmentary right side elevational view of the apparatus of FIG. 1;

FIG. 3 is an enlarged fragmentary front elevational view of the improved apparatus showing the undersurface of the lowermost article about to be initially engaged by the article-supporting means;

FIG. 4 is a fragmentary side elevational view of a clutch mechanism utilized for controlling the movement of the support which engages the undersurface of the lowermost article of the stack; and

FIG. 5 is a fragmentary side elevational view of a clutch mechanism which controls the operation of the stack-retaining means.

*Description*

Referring now to the drawings, an apparatus 10 is shown for use in denesting or separating an individual article 11a from the lower end of an upright stack S of nested articles 11. The articles 11 in this instance are illustrated as molded pulp egg cartons of the 2 x 6 style and each having a cellular tray section T and a non-cellular dish-type cover section C hingedly connected to the upper edge of the back side of the section T, see FIG. 2. The articles 11, prior to being nested are each disposed in a fully open position, whereby the tray section T and cover section C of one article are nested within the respective sections of the article disposed therebeneath. The apparatus and method will be described hereinafter in relation to nested molded pulp egg cartons. It is to be understood, of course, that this is done merely to facilitate understanding of the invention and is not intended to be limited thereto. The apparatus and method may have application to various other nested articles (e.g., molded pulp filler-flats, sometimes referred to as egg trays).

Apparatus 10 comprises an upright frame 12 having mounted on the upper end thereof a chute or guideway 13 in which is disposed upright the stack S of nested articles 11 so that the undersurface of the tray section T and the top surface of the cover section C of the lowermost article 11a face downwardly. Positioned at the lower end of chute 13 is a stack retaining mechanism 14, the

structure and function of which will be described more fully hereinafter.

The frame 12 includes a pair of vertically spaced horizontal bracing members 12a and b, see FIG. 2. Mounted adjacent the upper member 12b is a bearing assembly 15, which is adapted to slidably accommodate a reciprocating vertical shaft 16. The upper end of shaft 16 engages a horizontally extending platform 17. The platform is preferably of such dimension that it will subtend both the tray section and cover section of the lowermost article 11a of the stack S.

The vertical movement of shaft 16 in the illustrated embodiment is controlled by a cam 18 which is mounted on a horizontally disposed shaft 20. Shaft 20, as seen in FIG. 2, is supported by bearings 21, which are secured to the lower portion of the frame 12. Keyed to shaft 20 is a sprocket or pulley 23 connected by suitable drive chain or belts 24 to a sprocket or pulley 25 which in turn is keyed to a second shaft 29. Power to shaft 29 is obtained from an electric motor 26, see FIG. 2, through a clutch mechanism 27 to be described more fully hereinafter.

Carried by platform 17 and disposed at opposite sides thereof and adjacent the narrow ends of the tray section T of the article 11a, are gripping devices 28 and 30. Each device is of like construction and includes an elongated arm 31 having an upper portion 31a and a lower portion 31b; see FIG. 3. The arm 31 is pivotally connected at 32 to a depending bracket 33 affixed to the underside of platform 17. The lower end segment of arm portion 31b is curved inwardly a slight amount for a purpose to be described more fully hereinafter.

Disposed intermediate pivot connection 32 and the underside of platform 17 is an adjustable spring unit 34. As seen more clearly in FIG. 3, unit 34 comprises a coil spring 34a having one end thereof connected to a stud 34b depending from the platform undersurface. The opposite end of spring 34a is connected to an externally threaded stud 34c. The stud 34c projects through a suitable opening 31c, see FIG. 3, formed in arm 31 and terminates on the opposite side (outside) of the arm. Threadably connected to the outer end of stud 34c is a nut 34d. By adjusting the nut 34d the amount of spring tension may be readily varied as desired.

Threadably mounted on arm 31 and disposed above unit 34 is a stop 35. The inner end of stop 35 engages an edge of platform 17 and thus determines the limit to which the arm upper portion 31a can be moved inwardly of the upper surface of the platform toward the adjacent article undersurface.

Mounted on the upper end segment of arm 31 is a roller or wheel 36. The axis 36a of roller 36 is parallel to the pivotal axis 32 of arm 31. The diameter of the roller is such that a substantial segment 36b of the periphery of the roller extends inwardly of the axis of arm 31. The outer periphery of roller 36 is provided with serrations or knurls 37 which make an effective purchase or frictional contact with the undersurface of the lowermost article 11a during certain segments of operation of the apparatus; the latter will be described more fully hereinafter.

Roller 36 is provided with a one-way clutch mechanism 36c which permits the right-hand roller of device 28 in FIG. 1 to rotate only in a counterclockwise direction and the left-hand roller of device 30 to rotate only in a clockwise direction. The aforesaid rotations of the rollers 36 occur only when the platform 17 and associated arms 31 are moving upwardly as a unit and the peripheries of the rollers have initially engaged the undersurface of the tray section T of the lower end article.

Upon the gripping devices 28-30 reaching their limit of upward movement, the stack retaining mechanism 14 is actuated to a release position by an adjustable trigger element 38 which is disposed vertically adjacent one side of frame 12, see FIG. 1. The upper end 38a of element 38 engages an adjustable shoe plate 40 which has a

flat inner face 49a frictionally engageable with an edge portion of the stacked articles 11. Plate 40 in one embodiment carries a pair of vertically spaced pins 41 which are adapted to be disposed within a pair of slots 42 formed in a bracket 43 affixed to the frame. Upon element 38 being moved upwardly, shoe plate 40 moves angularly outwardly away from the edge of the stack. Actuation of element 38 is effected by a cam assembly 44, seen more clearly in FIG. 5.

Assembly 44 includes an arm 45 which is pivotally connected at one end to the lower terminus 38b of element 38. The opposite end of arm 45 is connected to a coil spring 46. Intermediate the ends of the arm is a pivotal connection 47 to a bracket 48 carried by the frame 12. Mounted on arm 45 intermediate the end thereof connected to spring 46 and pivot connection 47 is a follower 50 which is in rotatable engagement with the periphery of a cam 51, the latter being keyed to the driven shaft 29, see FIG. 1. Spring 46 exerts a clockwise force on arm 45 which causes the shoe plate 40 to normally assume a stack-retaining position and the follower also to positively engage the periphery of cam 51. A nub 51a is provided on the periphery of cam 51 which, when in contact with follower 50, overcomes the bias of spring 46 and exerts a counterclockwise force on the arm 45 and upward movement of element 38.

As the platform 17 and associated devices 28 and 30 are moved downwardly as a unit, the released stack S and the engaged lowermost article 11a will follow the downward movement of the platform and associated parts until shoe plate 40 once again returns to a position whereby the stack, except for the lowermost article, is retained between shoe plate 40 and a fixed shoe plate 53 by a squeezing force. After the stack has moved downwardly approximately 1/4" before being again retained by mechanism 14, gripping devices 28 and 30 continue their downward movement, whereupon the peripheries 36b of rollers 36 will take a firm purchase on the undersurface of the article 11a by reason of the one-way clutch mechanism 36c and cause the article 11a to be separated from the bottom of the retained stack.

The devices 28 and 30 will retain their purchase on the separated article 11a until the platform 17 and associated parts have reached a predetermined down position at which point the curved end of the lower portion 31b of arm 31 engages a cam surface, nub, or roller 54 which is secured to a frame upright member, see FIG. 1. Cam roller 54 causes arm 31 of device 28 to pivot in a clockwise direction relative to its pivot connection 32 (in the case of arm 31 of device 30, the cam roller 54 would cause same to pivot in a counter-clockwise direction) whereby the purchase on the undersurface of the article 11a by the roller periphery 36b would be released and the article would then freely rest upon platform 17.

The platform 17 as it continues further its downward movement with the article resting thereupon, will reach a point whereby the periphery of a discharge roller 55 will extend through a center elongated slot 17a formed in platform 17, see FIG. 1, and frictionally engage the undersurface of the article 11a supported by the platform. Discharge roller 55 is power-driven to rotate continuously in a counterclockwise direction, as viewed in FIG. 2, whereupon as the undersurface of the article makes contact with the periphery of the roller 55, the article will be moved immediately and automatically onto a discharge ramp 56. From the ramp 56, the article is conveyed manually or mechanically away from apparatus 10 to an egg-loading station, not shown.

Movement of the support platform 17 is controlled by the clutch mechanism 27, shown in FIGS. 1 and 4. The mechanism 27 includes a clutch plate 58 which is keyed to the horizontally disposed shaft 29. Mounted on the exposed face of plate 58 is a pin 61 which is adapted to engage a pivotally mounted stop lever 62. Lever 62 is biased by spring 63 to assume a position, as shown in

FIG. 4, wherein it will engage pin 61 and prevent further clockwise rotation of clutch plate 58. When pin 61 is engaging lever 62, the plate 58 is out of driving engagement with a driven second plate 64. Plate 64 is driven by a belt or chain 65 from a power take-off 66 of motor 26.

Lever 62 is movable to a disengaged position with respect to pin 61 by a linkage 67 connected to a solenoid 68. Once the lever 62 is moved to a disengage position, not shown, the clutch plate 58 is free to be driven by plate 64 so as to make one complete revolution. Actuation of solenoid 68 may be effected by a switch, not shown, disposed along discharge ramp 56 whereby the switch is operated by a carton as the latter moves along the ramp 56.

In the illustrated embodiment of the apparatus only one pair of gripping devices 28-30 are shown mounted on opposite sides of the platform 17; however, if desired two pairs of such devices might be utilized with one pair operative upon opposite ends of the tray section T of the article and the other pair simultaneously operative upon opposite ends of the cover section C of the said article.

The stack retaining mechanism 14 may differ from that shown whereby both plates 40 and 53 are adjustable rather than just plate 40.

The improved method of denesting involves arranging and retaining a stack of nested articles in a substantially upright position whereby the undersurface of the lowermost article is exposed. While the article stack is so disposed, the exposed undersurface of the lowermost article is yieldably engaged by an element moving relative to the stack in a direction toward the stack. The element then reverses its relative direction of movement away from the stack whereby it takes a purchase on the lowermost article undersurface. Simultaneously with the reversal in direction of movement of the element the retained stack is released whereby the lowermost article and remainder of the stack move downwardly as a unit with the element. Upon the remainder of the stack having moved a predetermined distance as a unit, the stack is once again retained in a fixed position while the element and the lowermost article continue in the same direction causing the lowermost article to become separated from the bottom of the stack. The purchase on the separated lowermost article by the element is subsequently released freeing the article whereby the latter may be moved independently to an egg-loading station.

In practicing the above described method the disposition of the stack of articles, the relative movement of the element, and the operation of the element to effect a purchase on the end article may be other than that shown in FIGS. 1-3.

Thus, it will be seen that an apparatus has been provided which is of simple mechanical structure and is capable of being readily adjusted to accommodate articles of varying size and shape. In addition the yieldability of the gripping element when making initial contact with the end article and the intensity of the purchase effected by said element on the article, may be readily varied to suit the characteristics of the material of which

the articles are made. For example, where the article undersurface is relatively hard and/or smooth, the intensity of the purchase effected can be increased.

While several embodiments of this invention have been described above, further modifications may be made thereto and it is contemplated, therefore, by the appended claims, to cover any such modifications as fall within the true spirit and scope of this invention.

I claim:

1. An apparatus for denesting from a stack of nested articles the lowermost article of the stack, each of the nested articles having the underside thereof provided with downwardly tapered opposed side wall portions; said apparatus comprising adjustably mounted first means for releasably engaging opposite peripheral portions of the stack and retaining same in selected elevated positions, second means for engaging and supporting the underside of the lowermost of the stacked articles when said first means is in a predetermined position of adjustment, said second means being adjustably mounted beneath said first means for movement towards and away from said first means, and third means carried by said second means and adjustable independently thereof for movement into yieldable engagement with the downwardly tapered opposed side wall portions of the lowermost article while said first means is releasably engaging the stack and said second means is moving a predetermined distance towards said first means; said third means including a roller gripping device mounted for rotation in only one direction, said device rotating in said one direction when the periphery thereof is in contact with the side wall portion of the lowermost stacked article and when said third means is moving said predetermined distance towards said first means, said device assuming a non-rotating condition and frictionally gripping relation with the lowermost stacked article side wall portion to effect denesting of the lowermost article upon said third means moving said predetermined distance away from said first means.

2. The apparatus of claim 1 wherein said device includes a one-way clutch and said gripping device has a roughened peripheral surface.

3. The apparatus of claim 1 including a control means operatively connected to said first and second means for effecting automatic adjustment thereof in a predetermined timed sequence.

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