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(54) **DENESTING APPARATUS**

(57) The present invention provides a denesting apparatus (100), the apparatus comprising:
- one or more closed loop conveying tracks (130, 230), each closed loop conveying track comprising a plurality of sets of one or more de-stacking means movingly configured thereon through one or more de-stacking means moving mechanism;
- one or more stacking magazines (120, 220), each adapted to hold a stack of sheets (110, 210) supported thereon;
wherein each of the plurality of sets of de-stacking means (240) is adapted to selectively engage an uppermost sheet from at least one of the stacking magazines in any desired order either sequentially and/or simultaneously so as to discharge the picked-up sheets onto an out-feed conveyor in any desired manner either one besides another or otherwise one overlapping the other.

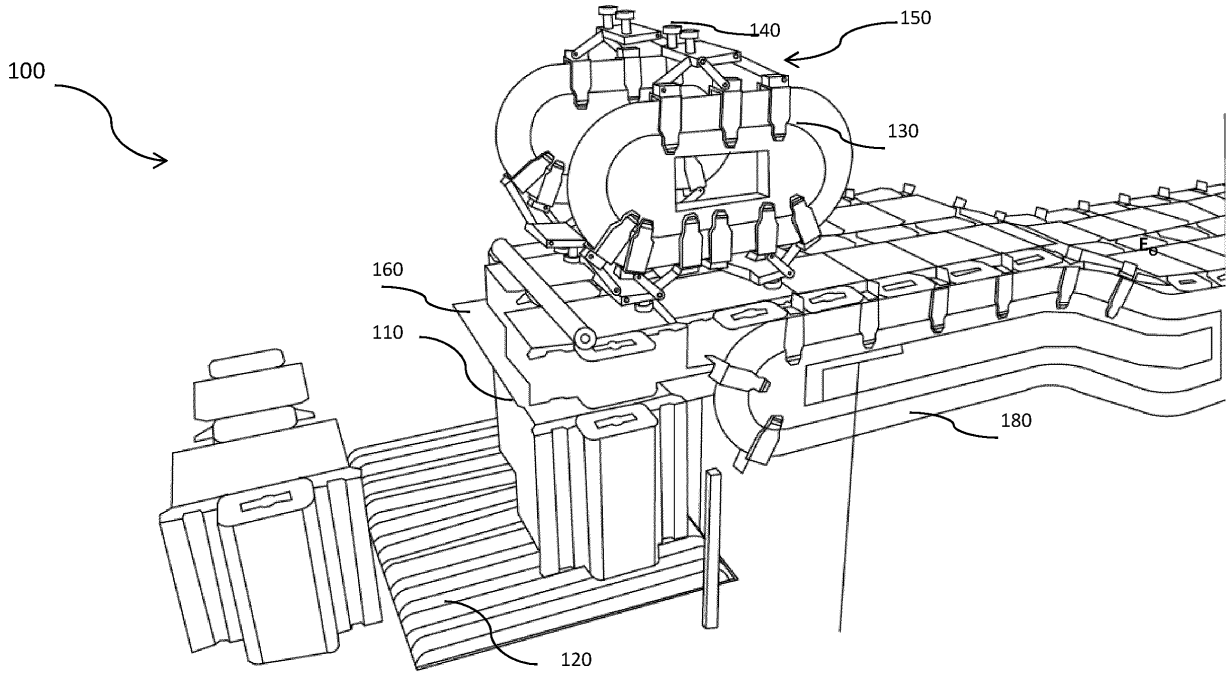

Fig. 1

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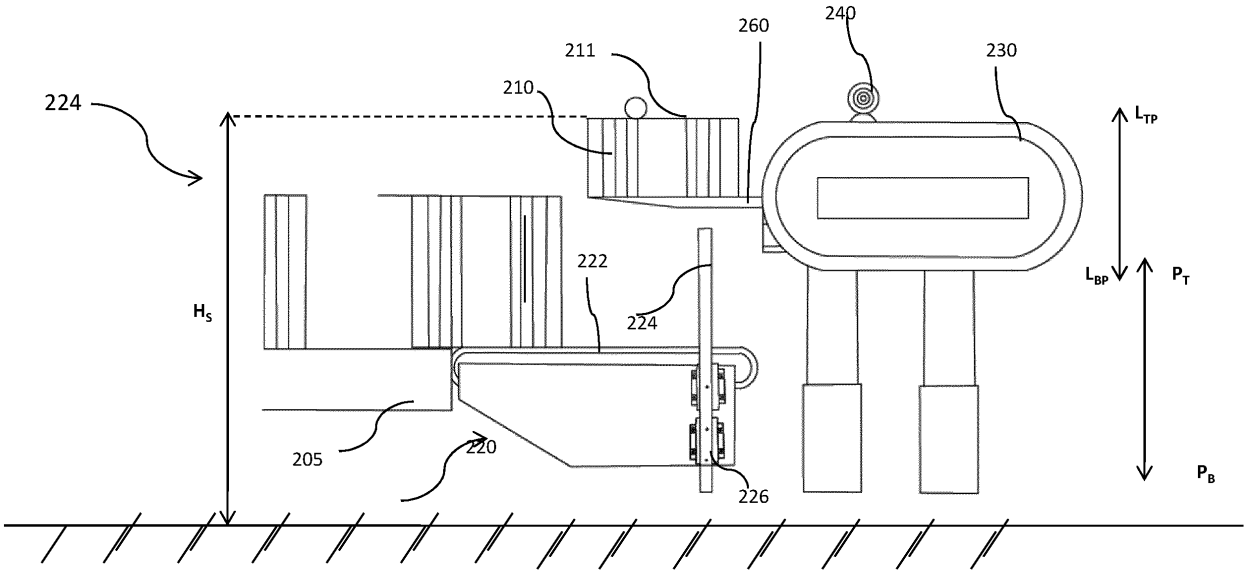
224
211
260
240
230
210
222
224
H_S
205
220
226
L_{TP}
L_{BP}
P_T
P_B

Fig. 4c

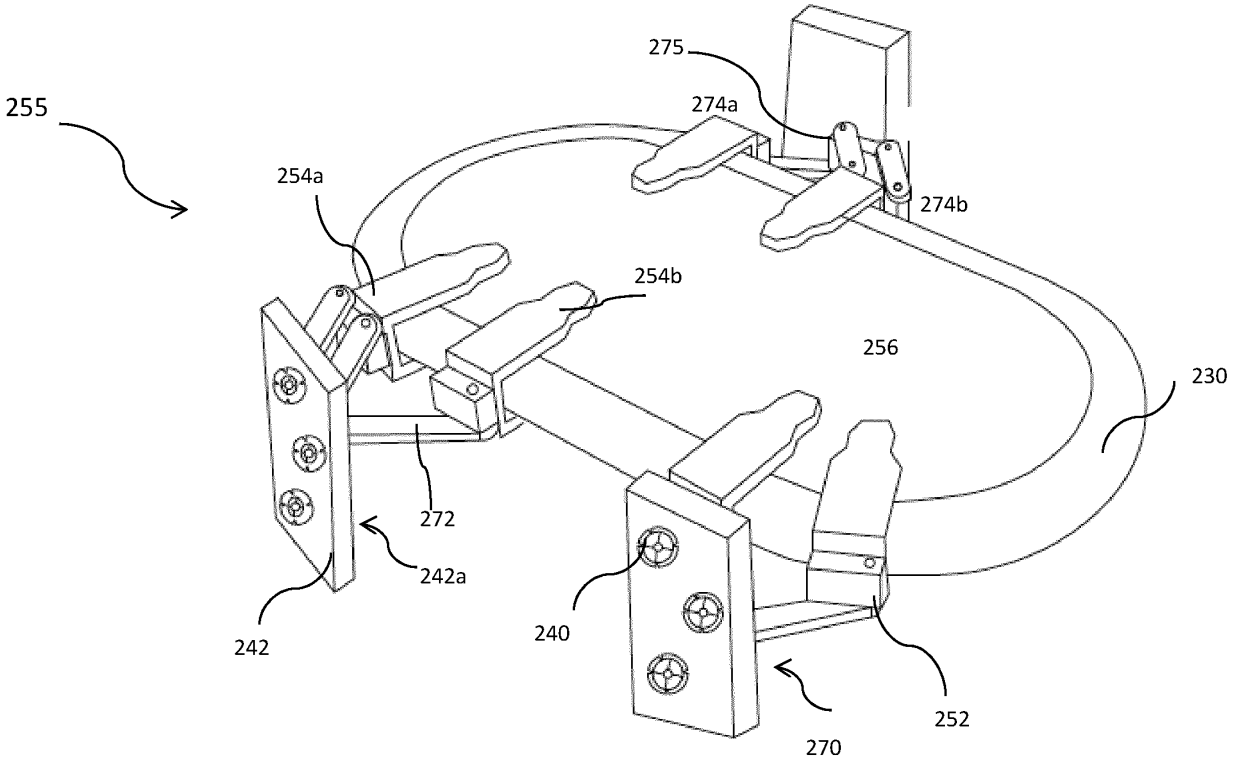
255
275
274a
254a
274b
254b
256
230
272
242a
242
240
252
270

Fig. 5a

Description

TECHNICAL FIELD

[0001] The present invention relates generally to a de-nesting apparatus for denesting one or more stacks of sheets.

BACKGROUND

[0002] In the recent years, there has been a many-fold increase in the trend of grouping large number of items such as food items, including liquid foods, home essentials, stationary items, beverage containers, and the like, in the form of secondary packages, for various purposes such as to enable bulk selling, easy transportation, handling, and the like.

[0003] Recently there has been a considerable increase in use of cardboard based packaging for holding liquid foods and beverages which resulted in an increase in the manufacture of cardboard packaging or cartons in a variety of shapes and sizes.

[0004] Cardboard based packaging is generally formed of foldable blank or sheets, received generally from one or more stacks and therefore, during the packaging manufacturing process, it is required to sequentially and individually de-stack or unstuck these blanks or sheets from the stacks thereof which are then fed on to a packing line for formation of various kind of packaging.

[0005] Conventionally, the step of de-stacking of these blanks or sheets has been performed by utilizing various kind of pickers such as for example, manipulators, which may also take the form of robots and/or robotic arms, adapted to pick up a top sheet from the stack intermittently. Unfortunately, such pickers are often not cost-efficient and have a high turn-around time and therefore do not reconcile well at instances where a continuous infeed of these sheets at a high speed is required.

[0006] Accordingly, numerous efforts have been imparted to produce tools that de-stack sheets from the stacks individually, sequentially and at a high speed. Examples include various mechanical assemblies including so called fingers and/or grippers adapted to lift and/or pull away either the uppermost or lowermost sheet from the stack. However, these fingers and grippers based pulling mechanisms were generally adapted to pull either a fixed size sheet or at least having similar shape and/or size convenient to be handled by such fingers or grippers. Additionally, such devices may result in high rates of rejection since the sliding contact of these pulling devices frequently damages the sheets and therefore, were not preferred.

[0007] While it is usually desirable to provide a system which de-stacks sheets of material as quickly as possible, it is also important that the same de-stacking apparatus may be utilized for a variety of shapes and sizes of sheets. To overcome the problems of mechanical assemblies, various kind of air-nozzle based de-stacking mechanisms were introduced.

[0008] For example, WO2008015347 discloses the use of a retractable blower member disposed generally perpendicularly to a stack of sheets so as to blow a jet of air onto the flat items thereby removing the top sheet from the stack thereof.

[0009] Similarly, US20110229297 discloses a denesting apparatus having a product carrier plate including a pair of air nozzle assemblies operable to separate a tray from the stack of trays and force the tray against the product carrier plate such that movement of the product carrier plate can selectively discharge the separated tray.

[0010] However, these air nozzle-based side blowing mechanisms are generally not effective in un-stacking sheets having different thickness. Further, in most instances, these de-stacking mechanisms blew away more than one sheet, which is not acceptable particularly in an automated system.

[0011] Therefore, various other solutions were tried out to denest the top sheet from stacks thereof. Recently, the trend has been shifting towards use of a variety of suction mechanisms for performing the denesting operation. These mechanisms generally utilize suction mechanisms either singly or in conjunction with air nozzles.

[0012] For example, EP1541508 discloses a device for the de-stacking of flat objects laid on a stack. The device has a suction device located above the stack support, and a pushing away device with pushing components. The suction device and pushing away device are located at a fixed distance above the stack support, and the pushing components on their end face facing the stack support during the pushing away of an object from the suction head of the suction device have a stop for the next object lifted from the stack by the suction head. US 3,401,831 discloses a denester which, in addition to the suction grippers, includes nozzles which blow pressurized air between the outermost tray and the tray immediately succeeding it, in order to facilitate their separation. Such suction mechanism utilizes suction heads/nozzles which further requires vacuum hoists/supply to create negative air pressure for suction. Therefore, these arrangements are often overly complex in design, and were also undesirably slow in their operation.

[0013] Recently, various kind of de-stacking means or cups-based mechanisms have been utilized due to their simple structure and designs. For example, as disclosed in US5,254,071, these mechanisms generally include a drive mechanism with a vacuum cup which is alternatively brought close, put into contact then moved away from the stack of sheets. The vacuum cup is laid against the top sheet of the stack and then carries away the top sheet to bring it away from the stack before laying it down on another work area, for example, on a packaging line conveyor.

[0014] In some other variations, de-stacking means were utilized to pick the sheet/tray from bottom as described in US20140056684 which discloses a tray de-

nesting apparatus presenting stacks of trays placed upside down within a storage area to a picker mechanism and separating single trays from the stack of trays. A de-stacking means is used to remove individual trays from the tray stack. After picking up the individual tray, a driven rotary device inverts the tray and places the tray onto a tray conveyor located beneath the denesting apparatus.

[0015] However, all such packaging apparatuses have certain shortcomings as well. Firstly, these de-stacking means based mechanisms utilize drive mechanisms adapted to pick up and denest the sheets in accordance to a predetermined distance setting from a predetermined stack. Such system is, however, not designed for cases where a same packaging is a combination of different kind of sheets, such as e.g. a package blank combined with a partition blank.

[0016] Secondly, when a particular stack is exhausted, it is necessary to temporary suspend the denesting operation while the stack is replenished. As a result, the continuous supply of the sheets to the packaging line is interrupted and therefore reduces productivity of these packaging lines. Further, in automatic conveying lines these interruptions have to be managed with various compensating tools or mechanisms which further hugely impacts the costs and is therefore not preferred.

[0017] Accordingly, as can be understood from the foregoing discussion, none of the existing solutions completely provides flexibility of varying the de-stacking operation in accordance to varying requirements of multiple stacks simultaneously while preventing suspending the operation. Thus, in the context of the above, it is desirable to provide a denesting device that overcomes these problems associated with the prior art, is inexpensive to manufacture, and allows to carry out de-stacking of multiple stacks of different sheets of varying configurations in various desired manner, without requiring to change any functional elements thereof.

SUMMARY

[0018] In one aspect of the invention, a denesting apparatus for denesting sheets of foldable blanks from one or more stacks thereof is provided. The denesting tool includes one or more closed loop conveying tracks comprising a plurality of sets of de-stacking means movingly configured thereon through a de-stacking means moving mechanism. The denesting apparatus further includes one or more stacking magazines each adapted to hold a stack of sheets to be denested. In operation, each of the plurality of sets of de-stacking means is adapted to selectively engage an uppermost sheet from at least one of the stacking magazines and discharge it onto an outfeed conveyor. The picking up of the sheets from the one or more stacks may be performed in any desired order either sequentially or otherwise simultaneously so as to discharge the picked-up sheets in any desired manner either one besides another or in an overlapping manner i.e. one over the other.

[0019] Generally, the de-stacking means may be a conventionally known suction cup and/or vacuum cup having a generally bell-shaped structure and formed of a generally soft material such as a rubber, silicon, and the like, that is impenetrable by air.

[0020] Optionally, the de-stacking means moving mechanism includes a plurality of de-stacking lugs, each adapted to movingly engage one of the sets of one or more de-stacking means through an engagement means.

[0021] Further optionally, each of the de-stacking lugs is movingly configured onto one of the closed loop conveying tracks through one or more de-stacking movers movingly configured thereon.

[0022] In a specific embodiment, the denesting apparatus comprises two parallel closed loop conveying tracks wherein the de-stacking means moving mechanism includes a plurality of de-stacking lugs movingly configured onto the parallel closed loop conveying tracks through one or more de-stacking movers movingly configured thereon and wherein the de-stacking movers on the parallel closed loop conveying tracks are independently controlled to achieve rotation of the picked-up sheet.

[0023] Possibly, the engagement means may be any conventionally known mechanism suitable for supporting one or more de-stacking means onto the de-stacking lugs and is selected from one or more of, but not limited to, a supporting plate. Alternatively, the engagement means includes an articulating engagement assembly for movingly engage one of the sets of one or more de-stacking means onto the one or more de-stacking lugs, and adapted to provide generally a vertical and/or transversal movement along with a longitudinal movement, enabling a picking up a sheet from one of the stacking magazines.

[0024] Possibly, the articulating engagement assembly includes an articulated bracket having a first end connected to a first de-stacking mover through a first de-stacking lug, a second open end connected to a second de-stacking mover through a second de-stacking lug and a pivotally movable center end connected to a supporting plate having one or more de-stacking means configured thereon, such that a longitudinal movement of the de-stacking movers towards and/or away from each other enables a generally vertical movement to the supporting plate and in turn to the one or more de-stacking means so as to pick up a sheet positioned at a distance thereto.

[0025] Further possibly the supporting plate is a generally horizontally rotatable plate facilitating rotation of the sheet picked up by the one or more de-stacking means.

[0026] Optionally, the one or more stacking magazine is a vertically movable supporting rack adapted to move between a top position $\mathbf{P_T}$ and a bottom position $\mathbf{P_B}$ using a vertical movement mechanism.

[0027] Further optionally, the vertical movement comprising a vertical rail comprising one or more stacking movers movingly configured thereon and each of the

stacking movers engaging the supporting rack using a connecting member such that the stacking member is movable between the top position P_T and the bottom position P_B through the stacking movers.

[0028] Alternatively, the vertical movement mechanism may be any suitable movement mechanism.

[0029] Possibly, the top position P_T of the stacking magazine is positioned at a height H_T away from a base platform, corresponding to the base position P_B, such that a top sheet of the stack is positioned at a height H_S suitable to be picked up by at least one of set of the de-stacking means.

[0030] Generally, the denesting apparatus further includes a retractable lifting means positioned over the one or more stacking magazine and adapted to support at least a sub-stack of sheets such that the top sheet of the corresponding sub-stack is positioned at the height H_S suitable to be picked up by at least one of the de-stacking means.

[0031] Further, the retractable lifting means is adapted to be vertically movable such that after removal of the top sheet, the next top sheet is always positioned at the height H_S suitable to be picked up by the one or more de-stacking means.

[0032] Furthermore, the retractable lifting means is configured to retract back and move back to its base position, once each of the sheets supported thereon is picked up by the one or more de-stacking means.

[0033] Additionally, the retractable lifting means is further configured to open and pick up another sub-stack of the sheets at its base position.

[0034] Possibly, the apparatus further includes an infeed conveying line connected to the one or more stacks such that as soon as an empty magazine is received at its bottom position, it gets replenished with new stack of sheets.

[0035] Optionally, the stacking magazine may be a horizontally moving conveyor.

[0036] Optionally, the one or more closed loop conveying tracks, the lifting plate, and the one or more stacking magazines are adapted to move at a predetermined pitch so as to denest the stacks of the one or more sheets onto the out-feed conveyor continuously.

[0037] Alternatively, the one or more closed loop conveying tracks, the lifting plate, and the one or more stacking magazines are adapted to move intermittently at a variable pitch as required, so as to denest the stacks of the one or more sheets onto the out-feed conveyor intermittently.

[0038] Preferably, the vertical movement of the stacking magazine is configured in such a way that when the lifting plate is in its retracted position, the stacking magazine is in its top position such that the top sheet is positioned at the height H_S suitable to be picked up by the one or more de-stacking means.

[0039] Optionally, the denesting apparatus includes a first powering means enabling a movement of each of the one or more closed loop conveying tracks, the infeed conveyor, the retractable lifting means, the stacking magazine and the out-feed conveyor.

[0040] Further optionally, the first powering means may be selected from one or more of but not limited to various conventionally known linear motors, asynchronic motors, machines, servo drives, and the like conventionally known in the art.

[0041] Possibly, each of the plurality of movers is individually powered by a second powering means, preferably a linear motor, utilizing each of the movers as a rotor thereof and the corresponding track as a stator thereof.

[0042] Alternatively, the second powering means may be selected from one or more of, but not limited to, various conventionally known asynchronic motors, machines, servo drives, and the like, conventionally known in the art.

[0043] Particularly, the sheet of foldable blank is formed of a material selected from one or more of, but not limited to, a carton, paperboard, thermoplastic, hybrid material, and the like.

[0044] Possibly, the denesting apparatus further comprises a control unit for optimizing the movement of the one or more closed loop conveying tracks, the one or more de-stacking means, the one or more stacking magazines, the retractable lifting means, and the incoming conveying line.

[0045] Further possibly, the control unit includes one or more sensors, one or more input units, a processor unit and an output unit.

[0046] In yet another aspect of the invention, a method of denesting one or more stacks of sheets, each supported onto a corresponding stacking magazine, using the denesting apparatus of the present invention, is provided. The method includes receiving one or more stacks of sheets of a predetermined material. The method further includes picking up a top sheet from the one or more stacks in a predetermined manner either sequentially or otherwise simultaneously. The method further includes placing the picked-up sheet onto the out-feed conveyor in any desired manner, either one besides the other or otherwise one over the other.

[0047] Optionally, the method includes rotating the picked-up sheet before placing it onto the out-feed conveyor.

[0048] Optionally, the step of picking up the one or more sheets from the one or more stack includes the step of contacting at least the one or more de-stacking means, with one of the stacks such that the top sheet of the stack is picked up by the corresponding de-stacking means.

[0049] Optionally, the method includes picking one sheet at a time sequentially.

[0050] Alternatively, the method includes picking more than one sheet at a time simultaneously.

[0051] Further alternatively, the method includes dropping the simultaneously picked up sheet either simultaneously one besides other or otherwise sequentially one over the other.

[0052] Possibly, the method includes moving the each of the one or more or more pair of de-stacking lugs to-

gether in a predetermined sequence of vertical movement and/or transversal movement and/or longitudinal movement, so as to position the corresponding de-stacking means in contact with the top sheet of the desired stack of sheet.

[0053] Further possibly, the pushing sequence is determined by the control unit on the basis of an input from a user and/or input from one or more sensors.

[0054] Other aspects, features and advantages of the subject matter disclosed herein will be apparent from the description, the drawings, and the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0055]

FIG. 1 illustrates a schematic diagram representing a denesting apparatus, in accordance with a preferred embodiment of the present invention;

FIG. 2 illustrates a schematic diagram representing an exemplary denesting apparatus, in accordance with a preferred embodiment of the present invention;

FIG. 3 illustrates a schematic diagram representing another exemplary denesting apparatus, in accordance with another preferred embodiment of the present invention;

FIGS. 4a, 4b, 4c, 4d illustrate a front view diagram representing the exemplary denesting apparatus at different steps, in accordance with a preferred embodiment of the present invention;

FIG. 5a illustrates a perspective view diagram representing an exemplary engaging means, in accordance with the preferred embodiment of the present invention;

FIG. 5b illustrates a perspective view diagram representing another exemplary engaging means, in accordance with another embodiment of the present invention;

FIG. 6 depicts a flowchart illustrating the method for denesting sheets from one or more stacks, in accordance with an embodiment of the present invention; and

FIG. 7 depicts a flowchart illustrating the method steps of making each of the stacks ready for denesting operation, in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION

[0056] The present application discloses a denesting apparatus, for picking up sheets individually from one or more stacks in any desired order and discharging them onto an out-feed conveyor in any desired manner. The denesting apparatus while being efficient, is able to destack sheets from multiple stacks having sheets of different shapes, sizes and material without requiring any changes in the functional elements thereof. Further, the sheets may be picked up either simultaneously or otherwise sequentially and may be discharged on to an out-feed conveyor, placed either one besides another or otherwise one over another, either continuously or otherwise intermittently and in varying configurations, speeds, and the like, without requiring making any change within the apparatus.

[0057] As illustrated in FIG. 1, the present invention provides a denesting apparatus **100** for de-stacking one or more stacks of sheets or b**110** individually and dropping them onto an out-feed conveyor **180.**

[0058] The denesting apparatus **100** includes one or more overhead closed loop conveying tracks **130** comprising a plurality of sets of de-stacking means **140** movingly configured thereon, through a de-stacking means moving mechanism **150.** The denesting apparatus **100** further includes one or more stacking magazines **120**, each adapted to support one of the one or more stacks of sheets **110.** Further, each of the stacking magazines **120** is connected to an incoming conveying line (not shown) carrying a supply of stacks of sheets **110.** The denesting apparatus **100** furthermore includes a retractable lifting mechanism **160** adapted to support at least a sub-stack of the stack of sheets **110** such that a top sheet is positioned at a height suitable to be picked up by at least one of the sets of de-stacking means **140.** In operation, the one or more stacks of sheets **110** are first positioned onto the one or more stacking magazines **120.** Thereafter, one or more sets of the de-stacking means **140** is movingly positioned towards the one of the one or more stacks **110** such that the top sheet from at least one of the stacking magazines **120** is picked up in any desired order, and discharged towards the out-feed conveyor **180** in any desired manner.

[0059] In description of the FIGS. 2-3 that follow, elements common to the schematic system will have the same number designation unless otherwise noted. In a first preferred embodiment, as illustrated in Fig. 2, an exemplary denesting apparatus **200** having a single closed loop conveying track **230** for denesting one or more stacks of sheets **210**, including a first stack **210a** positioned onto a first stacking magazine **220a**, and a second stack **210b** positioned onto a second stacking magazine **120b,** onto an out-feed conveyor **280.**

[0060] The closed loop conveying track **230** includes a plurality of sets of one or more de-stacking means **240** movingly configured thereon through a de-stacking means moving mechanism **250.** The de-stacking means moving mechanism **250** includes a plurality of de-stacking lugs 252 (Figs 5A, 5b), each movingly configured onto the closed loop conveying track **230** through a de-stack-

ing mover **254** (Figs 5A, 5b). Further, each of the de-stacking lugs **252** is adapted to engage to at least one of the sets of de-stacking means **240** through an engagement means **255** (Fig. 5a). In a preferred embodiment of the present invention, the engaging means **255** includes an articulating engagement assembly **270** movingly engage one of the sets of one or more de-stacking means **240** onto one or more de-stacking lugs **252.** In such an embodiment, each set of the one or more de-stacking means **240** is positioned onto a supporting plate **242**, having a first side **242a** connected to a pair of de-stacking movers **254a**, **254b**, pivotally and movably attached to each other through one or more articulated mounting brackets **272.** The articulated bracket **272** is a conventionally known mounting bracket and includes a first attachment bracket **274** connected to a second attachment bracket **276** at their distal ends at a connection point **C** such that the articulated bracket has three open ends, i.e. a first open end **274a** at a proximal end of the first attachment bracket **274**, a second open end **276a** at the proximal end of the second attachment bracket **276** and a pivotally movable center end **275** at the connection point **C.**

[0061] Further, as illustrated in Fig.5a, the articulated movement assembly **270** includes a first de-stacking mover **254a** connected to a second de-stacking mover **254b** through the articulated mounting brackets **272**, each of the movers **254a**, **254b** connected at one of the open ends **274a**, **274b** of the articulated bracket **272**, such that the articulated bracket **272** is pivotally movable in a generally vertical plane throughout the longitudinal range of motion of the first mover **254a** and the second movers **254b**, towards and/or away from each other. The articulated assembly **270** is connected to the first side **242a** of the supporting plate **242** at the pivotally movable center end **275** thereof.

[0062] In a collapsed position, where the articulated mounting bracket **272** is closed, such that each of the pair of pivotally connected de-stacking movers **254a, 254b** are oriented in a substantially coinciding position, the supporting plate **242** is at its initial position. In an opened position, where the articulated mounting bracket **272** opens up pivotally, the pair of the movers **254a, 254b** may be moved towards or away from each other such that the corresponding supporting plate **242** is moved vertically upward or pivotally towards or away from corresponding de-stacking lugs **252a, 252b.**

[0063] One skilled in the art will recognize that the articulated movement assembly **270** having the pair of movers **254a, 254b** is pivotally connected for longitudinal movement in a generally horizontal plane in a conventional manner. The articulated movement assembly **270** is movingly supported on to the closed loop conveying track **230** such that a horizontal longitudinal movement of the movers **254a, 254b** towards and away from each other is possible. Such a movement of the pair of movers **254a, 254b** provides operative power for enabling the movement of the mounting bracket **272** between its collapsed position and its open position, thereby enabling a range of vertically upward and pivotal extensions along with a longitudinal movement of the shaping supporting plate **242** onto the closed loop conveying track **230.**

[0064] Therefore, by appropriate manipulation of the first mover **254a** and the second mover **254b** and therefore the articulated assembly **270**, the supporting plate **242** and the corresponding set of de-stacking means **240** may be positioned at any desired distance away from the de-stacking lugs **252**, while moving in an operative orientation generally in a vertical and/or transversal and/or horizontal direction.

[0065] In yet other embodiments, the engagement means **255** may be any conventionally known mechanism suitable for supporting the set of one or more de-stacking means **240** onto the de-stacking lugs **252** and is selected from one or more of but not limited to a supporting plate as illustrated in Fig. 5b

[0066] In a modification of the first embodiment, as illustrated in FIG. 3, the denesting apparatus **200** includes multiple and preferably a pair of overhead closed loop conveying tracks **230** namely **230a, 230b** for denesting one or more stacks **210** including a first stack **210a** positioned onto a first stacking magazine **220a,** and a second stack **210b** positioned onto a second stacking magazine **220b.**

[0067] In such an embodiment, the individual movement of the sets of de-stacking means **240** of each of the tracks **230a, 230b** may be utilized to speed up the process by utilizing either as a dedicated track **230** for predetermined stacks **210** or otherwise in situations where there is a need of simultaneously pick up and drop down of the sheets within stacks **210** onto the out-feed conveyor **280.** In yet other embodiments, de-stacking means **240** of both the tracks may be adapted to sequentially or simultaneously pick up the top sheet from the same stack **210.** In yet other embodiments, the sets of de-stacking means of the pair of tracks **230a**, **230b** may be utilized in any possible manner so as to de-stack one or more, stacks **210**, onto the out-feed conveyor **280.**

[0068] This embodiment is particularly advantageous due to the fact that it provides multiple closed loop conveying tracks **230** and therefore the de-stacking means **240** each powered by a single light weight powering means for managing the operation of the denesting apparatus **200** and therefore is considered as a further efficient way to implement various embodiments of the present invention.

[0069] FIGS. 2 and 3 schematically show the arrangement of the basic components of the denesting apparatus **200** of the present invention. However, in the construction of commercial functional units, secondary components such as couplers, connectors, support structures and other functional components known to one of skill in the field of denesting apparatuses and more particularly the denesting of foldable blanks for use with conveyor systems, may be incorporated within the denesting apparatus **200.** Such commercial arrangements are included in

the present invention as long as the structural components and arrangements disclosed herein are present. Accordingly, it is to be contemplated that the denesting apparatus **200** may be configured to be used for any kind of foldable blank of any possible shapes as deems possible without deviating from the scope of the current invention.

[0070] In a preferred embodiment, the one or more stacks of sheets **210** may be formed of a plurality of sheets in the form of foldable blanks, each adapted to form a primary or secondary package and/or a component thereof. For example, and as illustrated in Fig 2, the first stack **210a** positioned onto the first stacking magazine **220a** may be stack of plurality of blanks each adapted to form a box shaped secondary package. Further, the second stack **210b** positioned onto the second stacking magazine **220b** may be a stack of plurality of partition sheets, each adapted to form a partition for the box shaped secondary package. However, in other embodiments, the stack of sheets **210**, may include any number of stacks of sheets, adapted to form any kind of output product, to be denested using the apparatus **200** of the present invention. Each of the stacking magazines **220a**, **220b** is connected to an incoming conveying line **205** each carrying a supply of stack of sheets **220a**, **220b** respectively.

[0071] In an embodiment and referring to Figs 4a-4d, the stacking magazines **220** are generally vertically movable storage racks **222** adapted to move between a top position $\mathbf{P_T}$ and a bottom position $\mathbf{P_B}$ through a vertical movement mechanism **224.** The top position $\mathbf{P_T}$ is positioned at a height $\mathbf{H_T}$ away from a base platform corresponding to the base position $\mathbf{P_B}$, such that the top sheet of the stack **210** is positioned at a height $\mathbf{H_S}$ suitable to be picked up by at least one set of the de-stacking means **240.**

[0072] Further in such embodiments, in preferred instances, as illustrated in Fig. 4, the vertical movement mechanism **224** includes a vertical rail (not shown) positioned besides the storage rack **222** having one or more stacking movers **226** movingly configured thereon, and adapted to engage the storage rack **222** using a connecting member (not shown) such that the storage rack **222** is movable between its top position $\mathbf{P_T}$ and the bottom position $\mathbf{P_B}$ through the stacking movers **226.**

[0073] However, in other instances, the vertical movement mechanism **224** may be any suitable movement mechanism.

[0074] The denesting apparatus **200** further includes a retractable lifting means **260**, illustrated in Figs 4a-4d positioned over each of the one or more stacking magazines **220** and adapted to support at least a sub-stack of the sheets, such that the top sheetis positioned at the height $\mathbf{H_S}$ suitable to be picked up at least by one set of the de-stacking means **240** of the one or more closed loop conveying tracks **230.**

[0075] In an embodiment, the retractable lifting means **260** is generally a flat lifting plate and is moveable vertically between a base position $\mathbf{L_{BP}}$ and a top position $\mathbf{L_{TP}}$ thereof, such that at any moment the top sheet is made to be positioned at the $\mathbf{H_S}$ suitable to be picked up by at least one set of the de-stacking means **240.** Further, the retractable means **260** is movable between an open position $\mathbf{P_O}$ and a retracted position $\mathbf{P_R}$ (not shown). Such lifting plate may alternatively also consist of a plurality of forks that may move away or towards each other

[0076] In some instances, as illustrated in Fig. 4a, the base position $\mathbf{L_{BP}}$ of the retractable lifting means **260** is generally same as the top position $\mathbf{P_T}$ of the storage rack **222** of the stacking magazine **220** such that when moved to open position $\mathbf{P_O}$ from the retracted position $\mathbf{P_R}$, the retractable lifting means **260** supports the entire stack **210** thereon. Further, in such instances, the lifting means **260** moves vertically with removal of each top sheet to a distance same as a thickness of the sheet such that the top sheet is always positioned at the height $\mathbf{H_S}$, The top position $\mathbf{L_{TP}}$ of the lifting means **260** is such that a bottommost sheet **215** (Fig. 4d) of the stack **210** is positioned as the top sheet. Once the stack **210** has been completely denested, lifting means **260** is adapted to retract back to the retracted position $\mathbf{P_R}$ and vertically move down to the base position $\mathbf{L_{BP}}$.

[0077] The out-feed conveyor **280** is generally an outgoing conveyor positioned substantially below the one or more closed loop conveying track **230** at a height $\mathbf{H_C}$ from the base platform, substantially similar to the height $\mathbf{H_T}$ of the top sheet such that the already pick up top sheet may be suitably dragged and/or dropped onto the out-feed conveyor **280** for further processing.

[0078] The denesting apparatus **200** further includes a first powering means (not shown) for enabling a movement of the one or more closed loop conveying tracks **230**, the in-feed conveyor **205**, each of the one or more stacking magazines **220**, the retractable lifting mechanism **260**, the out-feed conveyor **280** and various subcomponents thereof. In a preferred embodiment, the first powering means is a linear servo motor adapted to move each of the one or more closed loop conveying tracks **230**, the in-feed conveyor **205**, each of the one or more stacking magazines **220**, the retractable lifting mechanism **260**, the out-feed conveyor **280** at a first predetermined pitch facilitating a continuous operation of each of the components of the denesting apparatus **200** such that the incoming supply of the stacks of sheets **210** is continuously denested and transferred onto the out-feed conveyor **280** in any desired order and in any desired manner. However, in other embodiments, the first powering means is a linear servo motor adapted to move each of the one or more closed loop conveying tracks **230**, the in-feed conveyor **205**, each of the one or more stacking magazines **220**, the retractable lifting mechanism **260**, the out-feed conveyor **280** at a dynamically adjustable variable pitch facilitating an intermittent operation of each of the components of the denesting apparatus **200** such that the incoming supply of the stacks **210** of the sheets is denested and transferred onto the

out-feed conveyor **280**, intermittently and when desired.

[0079] The denesting apparatus **200** further includes a second powering means (not shown) for enabling a movement of each of the movers including, the de-stacking movers **254**, and the stacking movers **226** along the corresponding tracks and/or rails. In a preferred embodiment, the first powering means is linear servo motor. In such an embodiment, the linear motor is a generally moving magnet type of motor conventionally known in the art. Further in such embodiments, the linear motor utilizes the corresponding tracks and/or rails as a stator and each of the movers as a rotor thereof.

[0080] In other embodiments, the movers **254, 226** are utilized as stator whereas the tracks or rails are utilized as the rotors. In such an embodiment, each of the movers **254, 226** may include built in coils and each of the corresponding tracks or rails may include magnets configured thereon in a longitudinal direction such that the movers are able to come into an electromagnetic interaction, thereby enabling a movement thereof.

[0081] The denesting apparatus **200** may further include one or more control units (not shown) for managing the operations thereof, and particularly for managing the working of the first powering means and/or the second powering means and more particularly the movement of the de-stacking movers **254a and b,** so as to optimize the sequence of the longitudinal and/or vertical and/or transversal movement of the supporting plate **242**, and therefore the one or more support pads **240**, in a predetermined sequence. The predetermined sequence is particularly required to be evaluated in the instances where a specific predetermined order has to be followed for picking up the top sheets **211**, from the one or more stacks 210.

[0082] In some embodiments, the control unit may include an input unit for receiving inputs related to the predetermined order of denesting the stacks **210** and the desired manner of discharge of the already picked up top sheets **211**, onto the out-feed conveyor **280.** Further, the control unit may include a plurality of sensors (not shown) for tracking the parameters such as for example, position, width and/or height of the of the sheets or blanks to be discharged, for sensing when the one or more stacks **210** is empty, for sensing if the lifting means reached its top position, and the like. The control unit may further include a processor unit for processing the data captured by the input unit on the basis of predetermined logics / rules for facilitating the movement of the plurality of movers **254**, **226**, the vertical movement of the stacking magazine **220**, and the retractable lifting mechanism **260.** The control unit may further include an instruction unit that delivers the instructions to various components such as various powering means, linear motors, motors, driving units, or the like, to facilitate a desired and smooth operation.

[0083] In some embodiments, the control unit may be provided as a computer program product, such as may include a computer-readable storage medium or a non-transitory machine-readable medium maintaining instructions interpretable by a computer or other electronic device, such as to perform one or more processes.

[0084] In some embodiments, each of the plurality of sheets of the stack **210** is generally formed from a recyclable material selected from one or more of but not limited to any desired material such as including all kind of papers, fiberboard, corrugated board, foldable blanks, hybrid material, or any combinations thereof. Further, the shape and size, including the thickness of the sheets or blanks , may be varied depending on the design constraints and requirements for its application. In some other embodiments, the sheets or blanks may be made of a light weight plastic material selected from one or more of, but not limited to, plastic material such as group of thermoplastics including acetal, acrylic, cellulose acetate, polyethylene, polystyrene, vinyl, and nylon. In yet other embodiments, the sheets or blanks may be made of any material suitable to be denested using the denesting apparatus **200**, of the present invention

[0085] In an embodiment, the one or more de-stacking means **240** is formed of a conventionally known suction cup and/or vacuum cup having a generally bell-shaped structure and formed of a generally soft material such as a rubber, silicon, and the like, that is impenetrable by air. As may be contemplated by a person skilled in art, such de-stacking means **240** has been vastly utilized for lifting an object by application of vacuum created there within, when applied with a force against a flat surface such as a sheet. The number, size, and dimension of such de-stacking means **240**, is determined on the basis of weight, dimensions, and material of the sheets or blanks to be picked up from the stack **210.** In some embodiments, where the sheet or blank is of a heavy material, the denesting apparatus **200** may further be provided with a supply of negative pressure, for example, in the form of a vacuum creator, which may be utilized by de-stacking means **240** for picking such heavy sheets.

[0086] It is to be contemplated that while the number of stacks **210** has been mentioned as two in exemplary embodiments, the present invention may be utilized for any number of stacks without deviating from the scope of disclosure and depending upon the design constraints of the package to be formed. For example, in some instances, the one or more stacks **210** may include a first stack **210a** of foldable blank of carton, a second stack **210b** of a partition for the carton, a third stack **210c** holding sheet for forming a handle of the carton and so on. In other embodiments, the denesting apparatus **200** may be used to denest only a single stack **210.** In all such embodiments, the number of stacking magazines **220** remains equal to number of stacks **210** so as to individually support the stacks **210** thereon.

[0087] In a preferred embodiment of the present invention, each of the conveyors of the denesting apparatus **200** including the one or more closed loop conveying tracks **230**, the in-feed conveyor **205**, and the receiving conveyor **280** is generally a vertically positioned closed

loop conveying track conventionally known in the art. In other embodiments, each of the conveyors of the denesting apparatus **200** including the one or more closed loop conveying tracks **230**, the in-feed conveyor **205**, and the out-feed conveyor **280** may be a generally horizontal positioned closed loop conveying track. In yet other embodiments of the present invention, each of the conveyors of the denesting apparatus **200** including the one or more closed loop conveying tracks **230**, the in-feed conveyor **205**, and the receiving conveyor **280** may be configured as a virtual closed loop conveyor.

[0088] The virtual closed loop conveyor, as knon in the art, is generally a closed loop conveyor similar to a circular conveyor, in which the circular connecting edges of the conveyors on both the ends are replaced by straight shiftable conveyor portions adapted to move back and forth and avoiding the need of moving the movers through the entire circumference of the closed loop conveying track, and is therefore a very fast alternative to the conventionally known closed loop conveying tracks. Further, the closed loop conveyor being made of longitudinal rails, is therefore much more cost efficient than any conventionally known closed loop conveying tracks and/or conveyors. Additionally, the back and forth movement may also be helpful in providing additional pressure while performing operations such as pushing operation is therefore further preferred.

[0089] While the stacking magazine **220** has been disclosed to be a generally vertically movable supporting rack **222**, in some embodiments, the stacking magazine **220** may be a horizontal conveyor (not shown) adapted to receive a supply of stacks **210** of the sheets or blanks such that the top sheet of one of the stack **210** is positioned at a distance suitable to be picked up by the one or more de-stacking means **240.** Further, once the stack **210** is exhausted, another stack **210** is positioned at the distance suitable to be picked up by the one or more de-stacking means **240** such that there is no interruption there between.

[0090] In use, as disclosed earlier, the denesting apparatus **200** is adapted to be positioned onto an input line of a package manufacturing unit provided with one or more stacks **210** of foldable blanks for forming generally box shaped secondary packages. The denesting apparatus **200** denests the foldable blanks from the one or more stacks **210** placed onto the one or more stack magazines **220** in any predetermined order and places onto the out-feed conveyor **280** in any desired manner. Each of the stacks **210** is denested in a generally top to bottom manner, however, not restricted to any particular way of denesting and therefore it is contemplated that the denesting apparatus of the present invention may be utilize to perform denesting operation in any possible way without deviating from the scope of the present invention.

[0091] Fig. 6 with reference to Figs. 1 through 5, is a flow diagram illustrating a method **600** of de-stacking sheets or blanks from one or more stacks **210** thereof placed onto one or more stacking magazines **220**, either simultaneously, or otherwise sequentially in any desired manner, either one besides other or otherwise in an overlapping manner, using denesting apparatus **200** of the present invention.

[0092] The method **600** starts at step **602** and proceeds to step **604** where one or more stacks **210** of sheets is received onto one or more stacking magazines **220.** The one or more stacking magazines **220** is positioned generally at a distance from the one or more overhead closed loop conveying tracks **230** such that the top sheet of each of the stacks **210** is positioned at the height H_S and at a distance suitable to be picked up by at least one of the set of de-stacking means **240** of the one or more closed loop conveying tracks **230.** Thereafter, the steps proceed to step **606**, where the one or more sets of de-stacking means **240** picks up at least one of the top sheets **211** from at least one of the stacks **210.** In an embodiment, the one or more sets of de-stacking means **240** is adapted to pick up one or more top sheets **211** from the one or more stacks **210** sequentially in any possible order. In another embodiment, the one or more sets of de-stacking means **240** of the one or more closed loop conveying tracks **230** is adapted to pick one or more top sheets **211** from the one or more stacks **210** simultaneously at the same time. However, in other embodiments, each of sets of the de-stacking means **240** is adapted to pick up the top sheet from the one or more stacks **210** independently of the other sets of de-stacking means **240.** Once the one or more de-stacking means picks up the one or more top sheets **211** from the one or more stacks **210**, the method proceeds to step **608**, where each of the stacking magazine **220** is made ready to be denested such that the top sheet of the each of the stack **210** is positioned at the height H_S suitable to be picked up by at least one of the set of de-stacking means **240** of the one or more closed loop conveying tracks **230.** Such a step involves multiple sub-steps and is described in flow chart as illustrated in Fig. 7, as a method 700 for keeping each of the stacks **210** ready for being denested and will be described later on.

[0093] Once each of the stack **210** on each of the stacking magazine **220**, has been made ready for being denested, the method proceeds to step **610**, where each of the set of de-stacking means **240**, discharges the already picked up sheets **211**, by placing and/or dropping it onto the out-feed conveyor **280** in any desired manner. In an embodiment, the one or more sets of de-stacking means **240** is adapted to drop the picked up top sheets **211** sequentially one besides other in any possible arrangement. In other instances of the same embodiment, the one or more sets of de-stacking means **240** is adapted to drop the picked-up sheets **211** sequentially one over the other in an overlapping manner. In another embodiment, the one or more sets of the de-stacking means **240** of the one or more closed loop conveying track **230** is adapted to drop the picked-up sheets **211** simultaneously one besides other in any possible arrangement. In another instances, the one or more sets of de-stacking

means **240** of the one or more closed loop conveying tracks **230**, is adapted to drop the picked-up sheets **211** simultaneously one over the other in an overlapping manner. However, in other embodiments, each of the set of de-stacking means **240** is adapted to drop up the picked-up sheets **211** independently of the other de-stacking means **240** in any desired order and in any desired manner.

[0094] In some embodiments, the method **600** further includes an optional step **609** of rotating the picked-up sheets **211** before dropping onto the out-feed conveyor **280** at step **610.** The supporting plate **242** in such embodiments is adapted to be rotated horizontally in a range of angles so as to rotate the picked-up sheet **211** at any desired angle before being dropped onto the out-feed conveyor **280.**

[0095] The method **700**, as illustrated in Fig. 7 for preparing each of the one or more vertically movable stacking magazines **220** with the one or more stacks **210** positioned in such a way that the top sheet is always positioned at the height $\mathbf{H_S}$ suitable to be picked up by at least one of the set of de-stacking means **240** of the one or more closed loop conveying tracks **230.**

[0096] The method starts at step **702** and proceeds to step **704** where the vertically movable supporting rack **222** is moved to its top position $\mathbf{P_T}$ as illustrated in Fig. 4a. The method then proceeds to step **706** where the retractable lifting means **260**, vertically positioned anywhere between its base position $\mathbf{L_{BP}}$ and the top position $\mathbf{L_{TP}}$, is moved to its open position $\mathbf{P_O}$ such that at least a sub-stack **214** gets supported thereon the lifting means **260** as illustrated in Fig. 4a, 4b. In a preferred embodiment, the lifting means **260** is opened at its base position $\mathbf{L_{BP}}$, such that the entire stack **210** is supported onto the lifting means **260.**

[0097] Thereafter, at step **708**, the vertically movable supporting rack **222** moves back to its base position $\mathbf{P_B}$ and may be replenished there at by the incoming conveying line **205** as illustrated in Fig. 4c. At step **710**, the retractable lifting means **260** vertically moves up till it reaches its top position $\mathbf{L_{TP}}$ such that the bottom most sheet **215** is positioned as the top sheet as illustrated in Fig. 4d. Such a vertical movement of the lifting means **260** is synchronized with the removal of the top sheet and is therefore moved vertically each time the top sheet is removed, and to a distance same as the thickness of the sheet **290** so as to assure that the top sheet is always positioned at the height $\mathbf{H_S}$, Thereafter, at step **712** when the lifting means **260** is exhausted, retracts back to its retracted position $\mathbf{P_R}$ and moves vertically downwards to its base position $\mathbf{L_{BP}}$. The method 700 further includes a step **714** performed in parallel to the step **712** where the supporting rack **222,** replenished with new stack **210** moves vertically upwards till it reaches its top position $\mathbf{P_T}$ such that there is no interruption within the denesting operation of de-stacking means **240.** Thereafter at step **714**, the method **700** checks if there are more stacks to be denested, and if yes, loops back to step **706** and is repeated until there are more stacks to be denested. If, however no further stacks are to be denested, the storage rack **222** moves to its base position $\mathbf{P_B}$ and kept in a suspended state.

INDUSTRIAL APPLICABILITY

[0098] The present invention relates to a denesting apparatus **200** for continuously and/or intermittently at a constant and/or variable speed, de-stacking sheets individually from one or more stacks in any desired order and discharging them onto an out-feed conveyor in any desired manner.

[0099] Particularly advantageously, the denesting apparatus **200** is adapted to receive a supply of stacks **210** of foldable blanks in form of sheets , from an incoming conveying line **205**, adapted to continuously fill any of the already exhausted stacks **210** such that there are no interruptions during refilling the stacking magazines **220** with new stacks **210.**

[0100] Additionally, the possibility of providing different kind of pushing sequence to the one or more sets of de-stacking means **240** allows picking up the top sheets **211** in any desired order and discharging in any desired manner. Such an optimized and focused picking up and dropping down the sheets in addition to a complete control of the speed, direction of the placement of the sheets, allows the possibility of using a same conveying line for discharging multiple sheets together while utilizing the width of the out-feed conveyor and avoiding misalignment and therefore, any damage to the sheets being discharged there through.

[0101] Particularly, the present invention is additional advantageous in providing an input line of packaging apparatus of different sub-parts of the packages, in accordance with the predetermined shape and configurations of the packages to be achieved.

[0102] Further, the denesting tool is adaptable to different dimensions of foldable blanks and is therefore well suitable to process packages of different sizes and shapes with ease and efficiently and not requiring changing the entire apparatus for denesting sheets of different predetermined shapes and sizes.

[0103] Further, the present invention provides the possibility of manufacturing the conveyor system with integrally formed denester apparatus 200. Such a conveyor system for forming secondary package, while being cost-efficient, is very quick and easy to use and offers comfortable handling of packages of any shape, size or any variety of configurations.

[0104] Additionally, since the denester apparatus of the present invention while being applicable onto the conveyor system, does not impact the rest of the conveying process. A single conveyor system may utilize as many as denesting apparatuses within the same arrangement. Further, in case of one denesting apparatus is not working, rest can keep working and therefore, the fault tolerance of the plant can be increased.

[0105] While the denesting apparatus **200** of present invention has been disclosed with reference to foldable blanks, it may be used to denest all currently known sheet types, e.g., constructed of materials such as thermoplastic, hybrid materials, woven metallic fabric that may include ferrous or nonferrous metals, etc., or any other suitable material. Even in instances where heavy sheets are to be picked up, the strength or number of de-stacking means **240** may be adapted in accordance without having to change the entire apparatus **200.**

[0106] Moreover, it is also contemplated for a person skilled in the art that the denesting apparatus **200** of the present invention may be implemented in various industries such as food industry, transport industry, house hold appliance industry in denesting of any kind of product or group of products, of any shape, size or any variety of configurations, without limiting it to the packaging industry.

Claims

1. A denesting apparatus, the apparatus comprising:

One or more closed loop conveying tracks, each closed loop conveying track comprising a plurality of sets of one or more de-stacking means movingly configured thereon through one or more de-stacking means moving mechanism;
one or more stacking magazines, each adapted to hold a stack of sheets supported thereon;

wherein each of the plurality of sets of de-stacking means is adapted to selectively engage an uppermost sheet from at least one of the stacking magazines in any desired order either sequentially and/or simultaneously so as to discharge the picked-up sheets onto an out-feed conveyor in any desired manner either one besides another or otherwise one overlapping the other.

2. The apparatus of claim 1, wherein the de-stacking means are selectively engaged by an engagement means having an articulating engagement mechanism.

3. The apparatus of claim 2, wherein the articulating engagement mechanism comprises:

- a supporting plate adapted to fixedly support one or more de-stacking means thereupon;
- a pivotally movable mounting bracket having a first open end connected to a first articulated mover, a second open end connected to a second articulated mover and a pivotally movable central end connected to the supporting plate;

wherein a longitudinal movement of the first articulated mover and the second articulated mover towards and/or away from each other enables a vertical movement of the supporting plate thereby selectively facilitating a pick-up movement of the de-stacking means for picking up the sheets from at least one of the stacking magazines.

4. The apparatus of claim 3, comprising two parallel closed loop conveying tracks and wherein de-stacking means moving mechanism includes a plurality of de-stacking lugs movingly configured onto the parallel closed loop conveying tracks through one or more de-stacking movers movingly configured thereon and wherein the de-stacking movers on the parallel closed loop conveying tracks are independently controlled to achieve rotation of the picked-up sheet.

5. The apparatus of claim 1, wherein at least one of the one or more stacking magazines is a vertically movable stacking magazine adapted to move between a top position and a bottom position using a vertical movement mechanism.

6. The apparatus of claim 5 further comprising a lifting means adapted to hold at-least a sub-stack of the stack of sheets placed onto the vertically movable magazine.

7. The apparatus of claim 6, wherein the lifting means is a retractable lifting plate positioned over the vertical movable stacking magazine such that when the lifting plate is in a retracted position, the vertical movement of the stack is adapted to facilitate positioning of the top sheet to the height suitable to be picked up and/or dragged by at-least one of the set of de-stacking means.

8. The apparatus according to any of aforementioned claims, comprising a first powering means for enabling a movement of the closed loop conveying tracks, wherein the first powering means is a linear motor.

9. The apparatus according to any of aforementioned claims, comprising a second powering means for enabling a movement of each of the plurality of movers including the de-stacking movers and the stacking movers wherein further the second powering means is selected from one or more of but not limited to a linear motor, servo motors and synchronic and/or asynchronic motor drives.

10. The apparatus of claim 1 further comprising a control unit for optimizing a movement of each of the closed loop conveying tracks, the de-stacking movers, the de-stacking means, the lifting plate, and the stacking movers in such a way that an uninterrupted denesting operation is achieved.

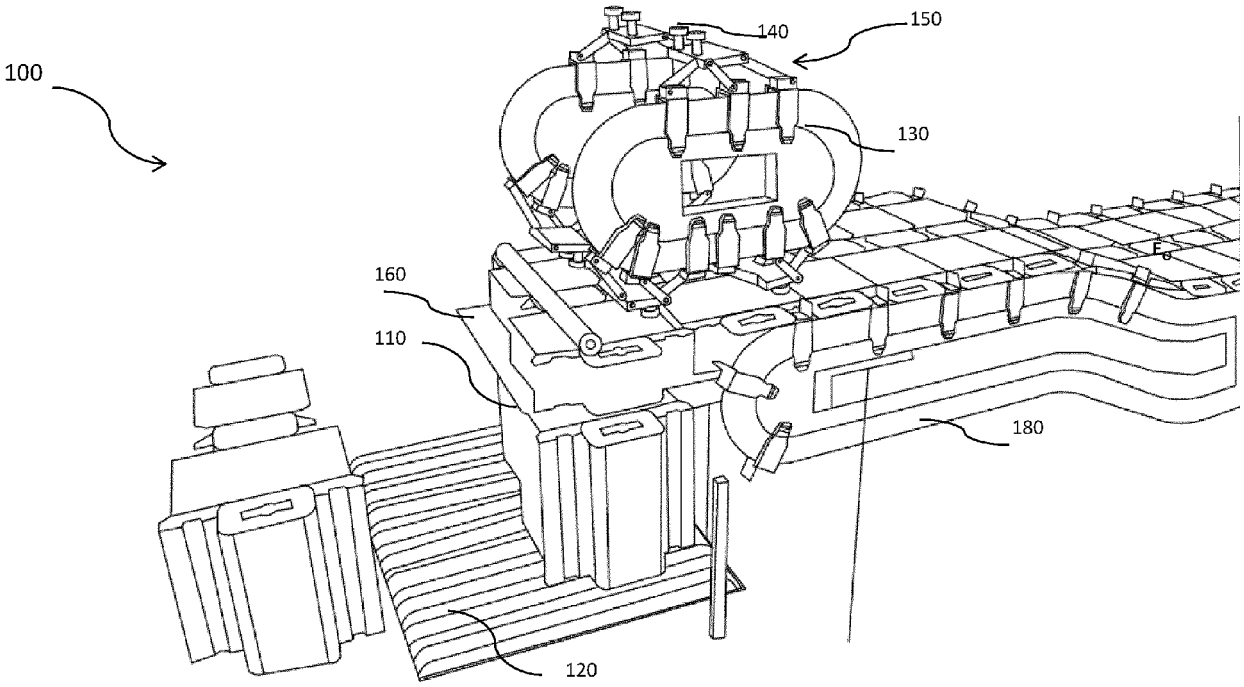

Fig. 1

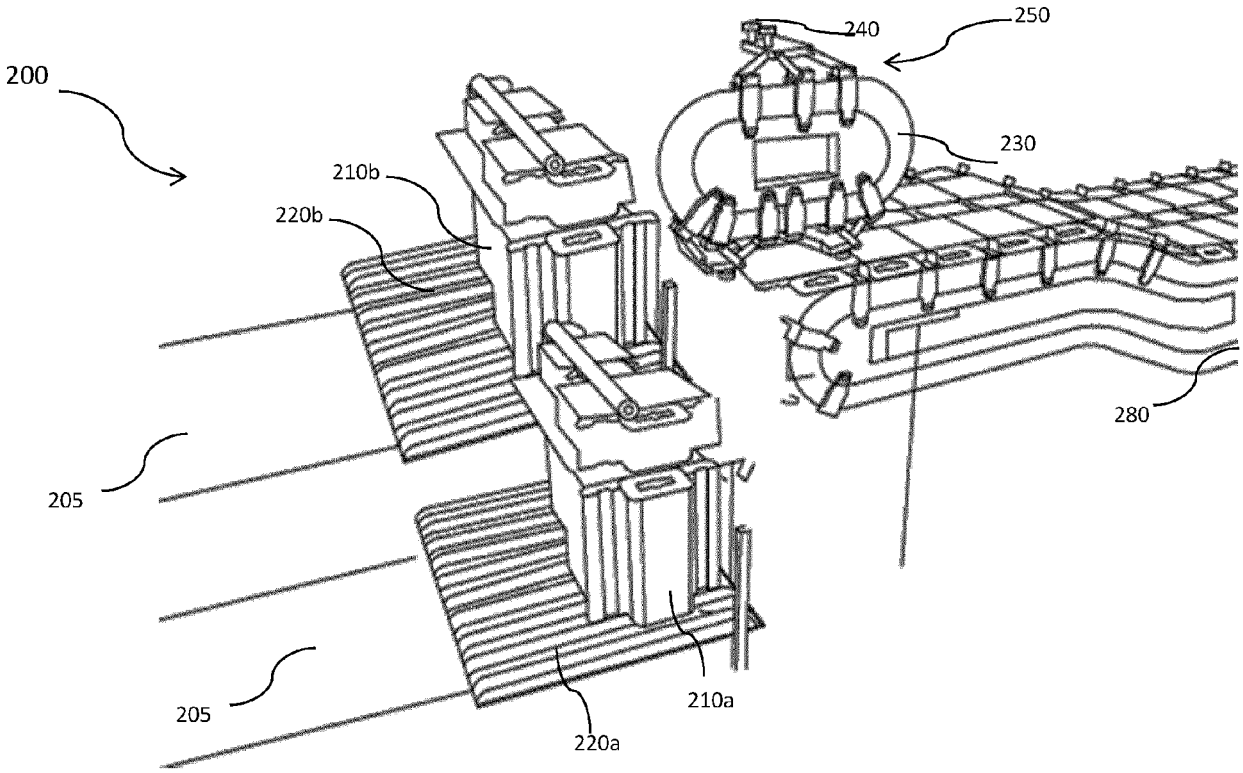

Fig. 2

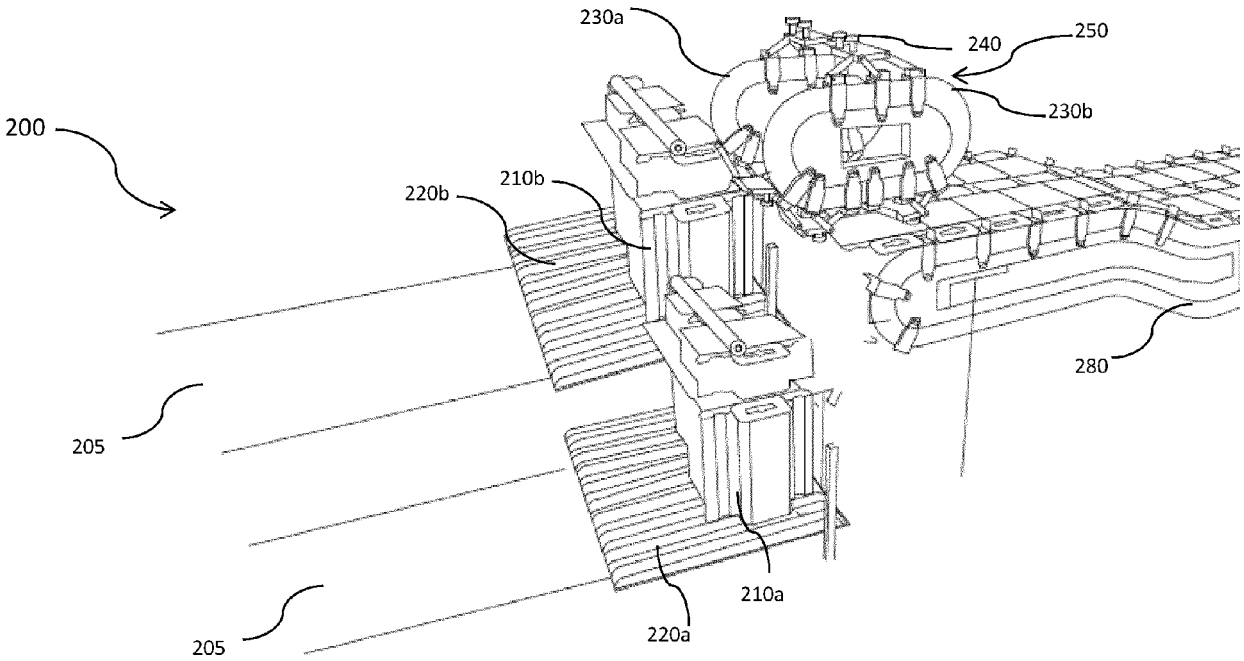

Fig. 3

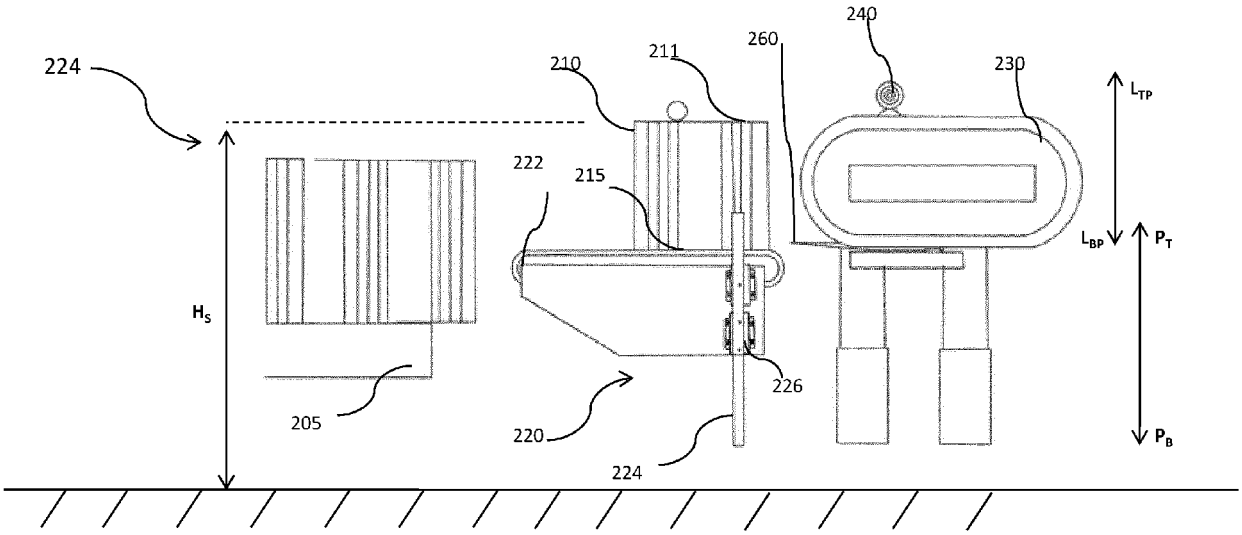

Fig. 4a

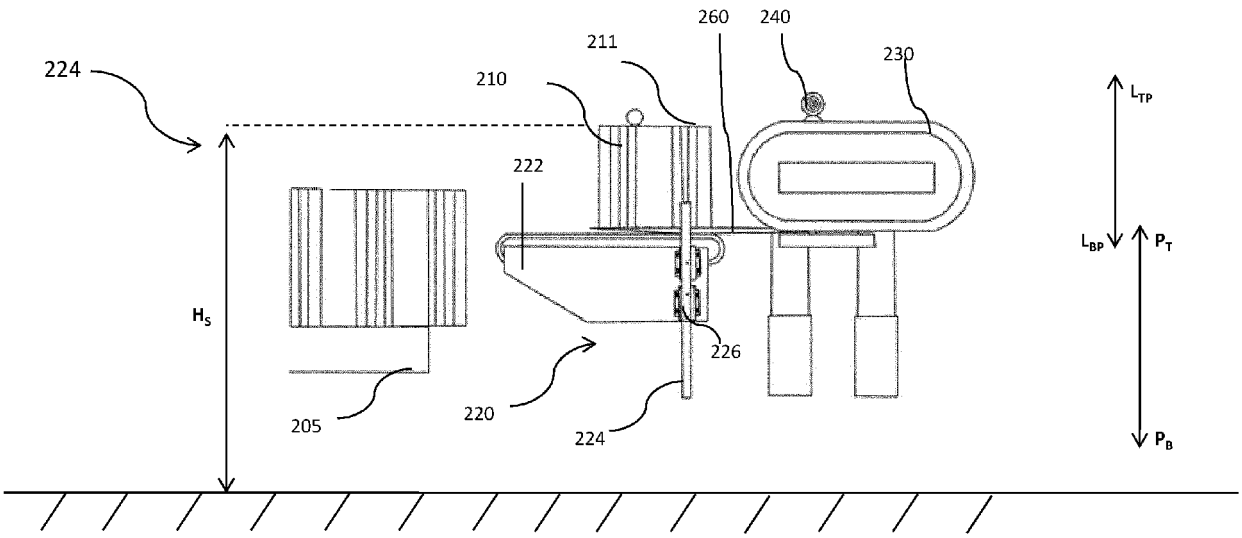

Fig. 4b

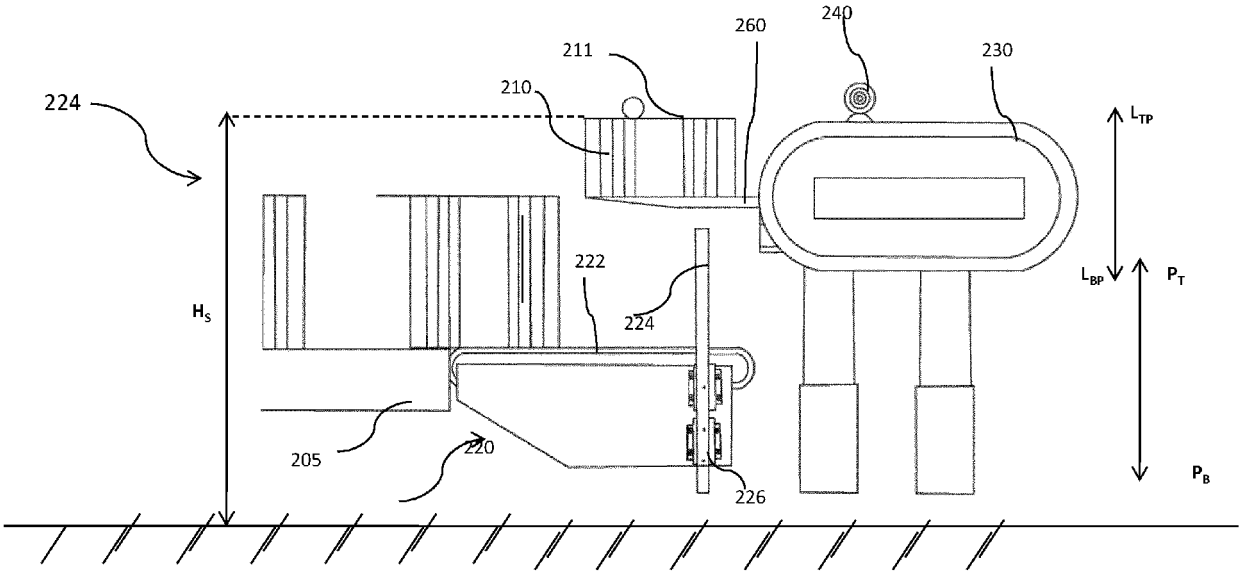

Fig. 4c

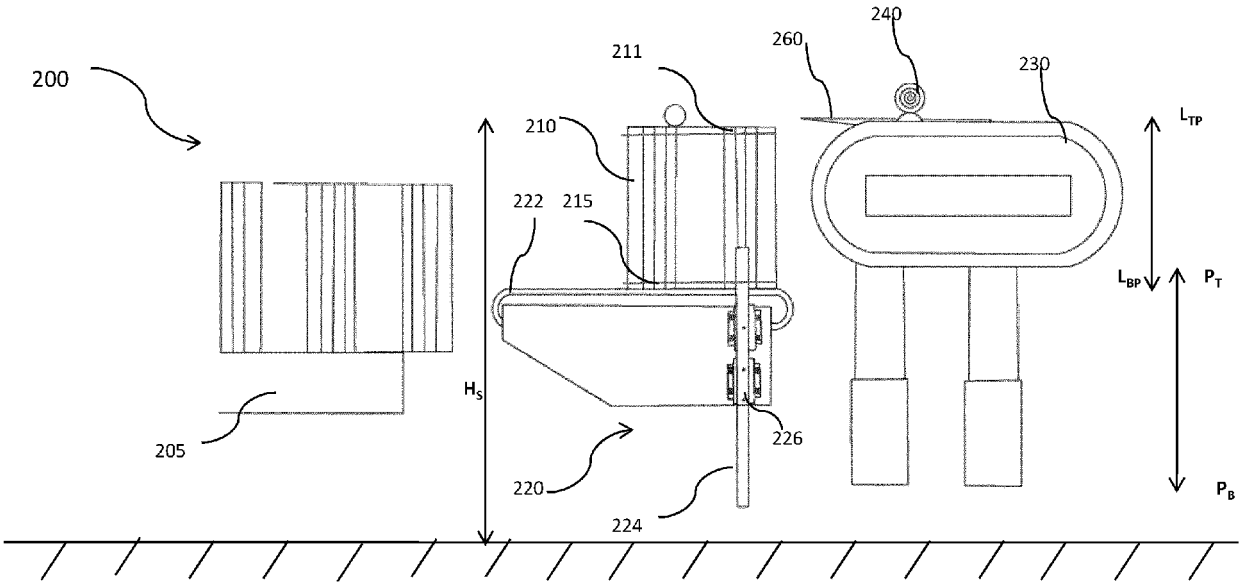

Fig. 4d

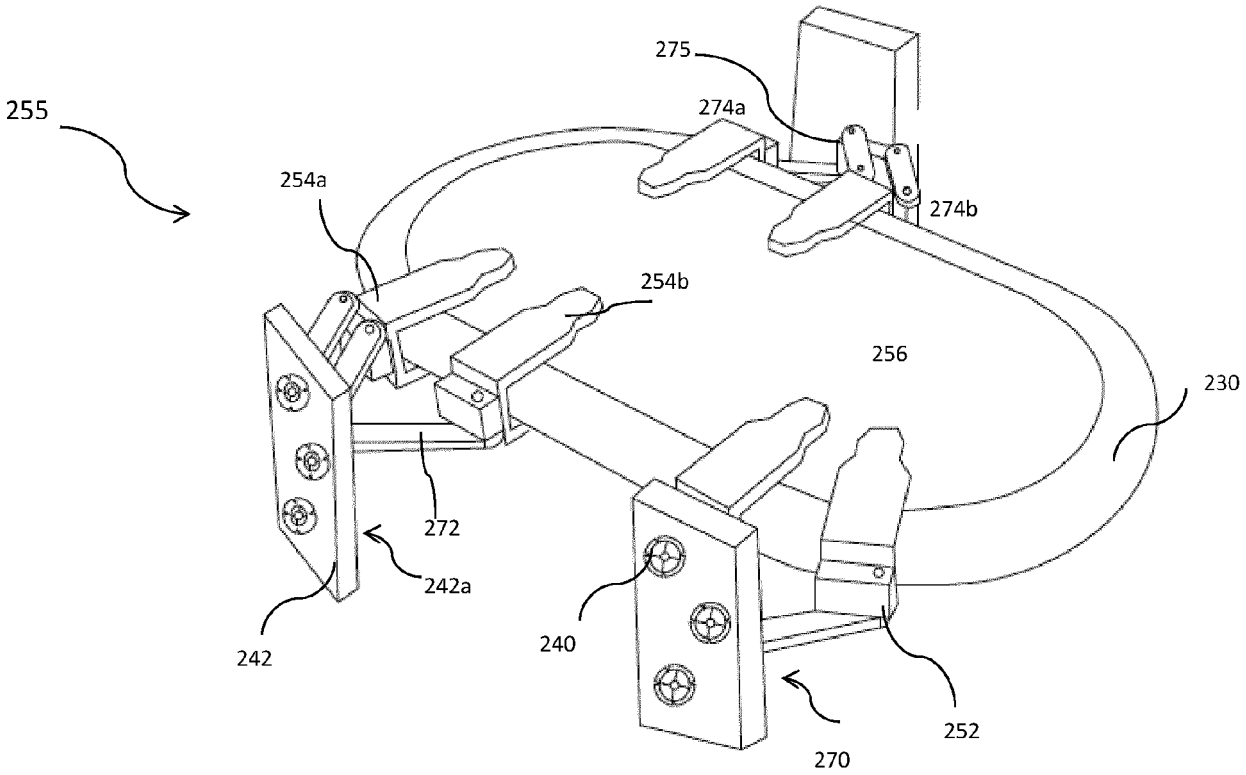

Fig. 5a

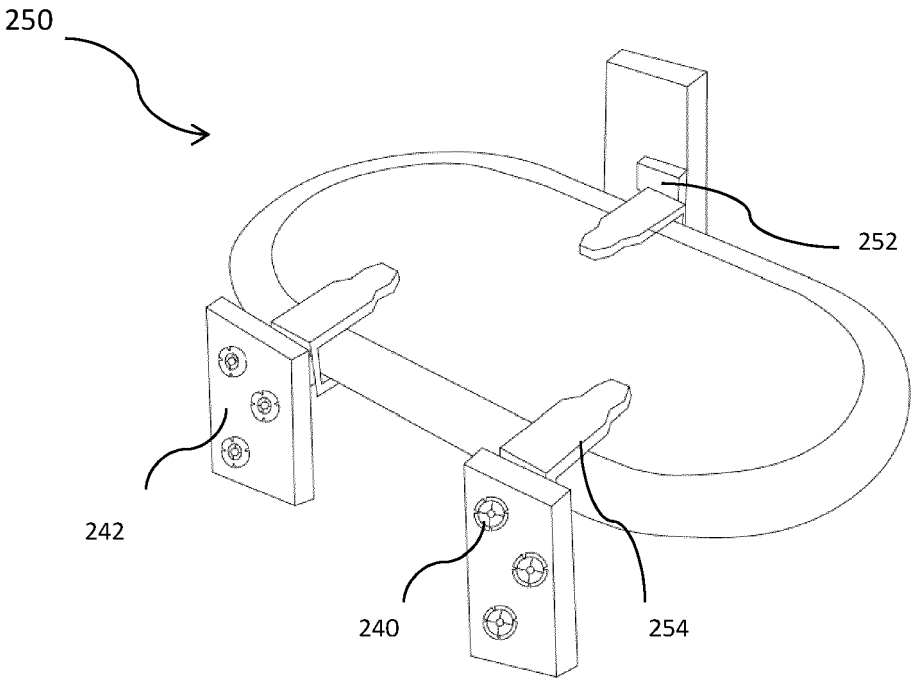

Fig. 5b

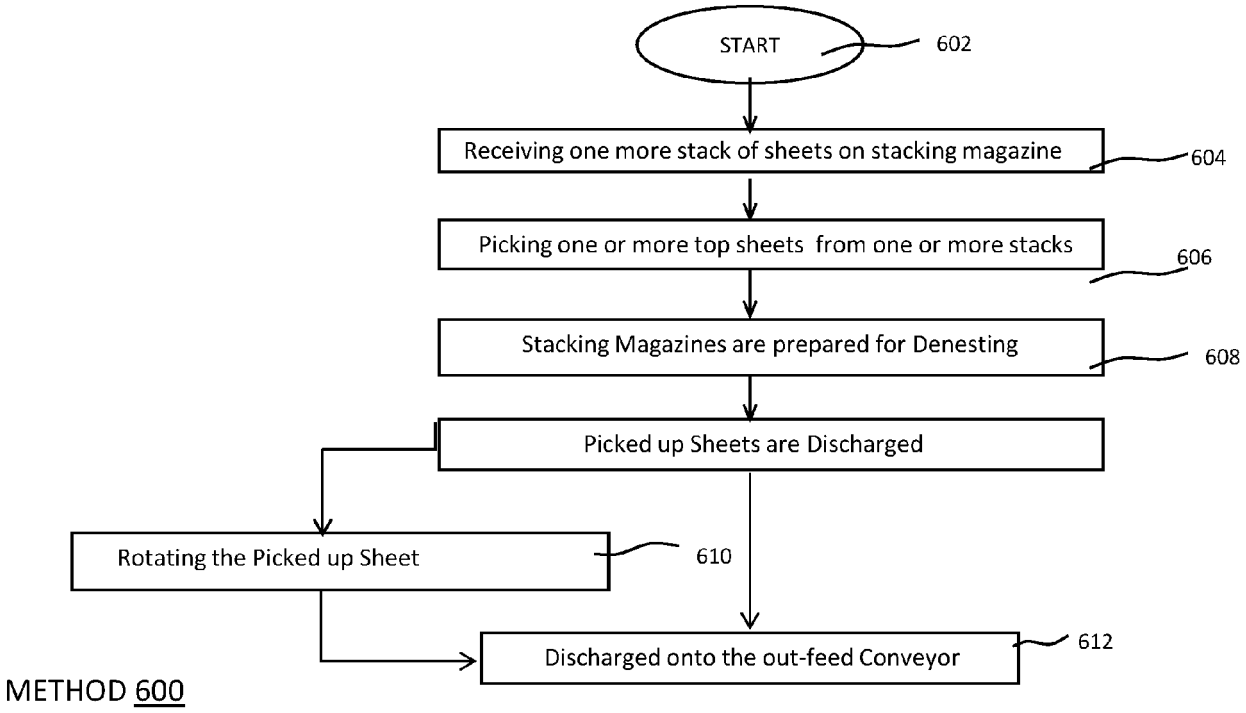
START
602
Receiving one more stack of sheets on stacking magazine
604
Picking one or more top sheets from one or more stacks
606
Stacking Magazines are prepared for Denesting
608
Picked up Sheets are Discharged
Rotating the Picked up Sheet
610
Discharged onto the out-feed Conveyor
612
METHOD 600

Fig. 6

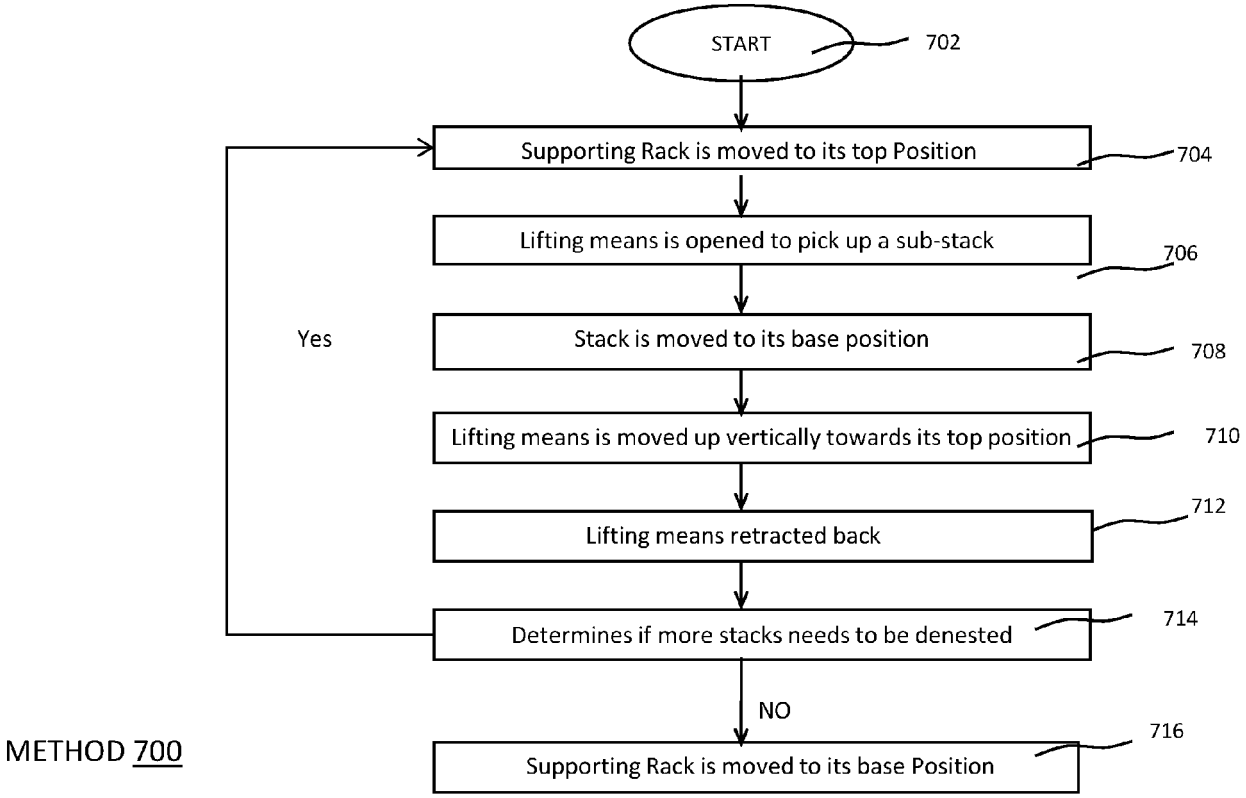
START
702
Supporting Rack is moved to its top Position
704
Lifting means is opened to pick up a sub-stack
706
Yes
Stack is moved to its base position
708
Lifting means is moved up vertically towards its top position
710
Lifting means retracted back
712
Determines if more stacks needs to be denested
714
NO
Supporting Rack is moved to its base Position
716
METHOD 700

Fig. 7

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 19 21 9765

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2015/139772 A1 (RAPP REINHARD [DE] ET AL) 21 May 2015 (2015-05-21) * the whole document *	1,4,5, 8-10	INV. B65H29/66 B65H3/08 B65H3/44
A	JP S62 77149 U (.) 18 May 1987 (1987-05-18) * the whole document *	1	B65H3/36 B65H5/24 B65H1/14 B65H1/26
A	JP S54 128282 U (.) 6 September 1979 (1979-09-06) * the whole document *	2,3	
A	DE 20 2018 103487 U1 (STOCK MASCHB GMBH [DE]) 23 August 2018 (2018-08-23) * the whole document *	6,7	

TECHNICAL FIELDS SEARCHED (IPC)

B65H
B65G
B31B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	11 June 2020	Ureta, Rolando

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

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