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## (54) Method and apparatus for stacking and accumulating bags

(57) An apparatus for stacking and accumulating bags is disclosed. The stacker includes three sets of fingers (226, 227 and 229). One set of fingers are prestacking fingers and the other two sets are stacking fingers. The distance the prestacking fingers travel to get into a stacking position, from a rest position, is relatively short. The stacking fingers travel a single path, that is different from the path the prestacking fingers travel.

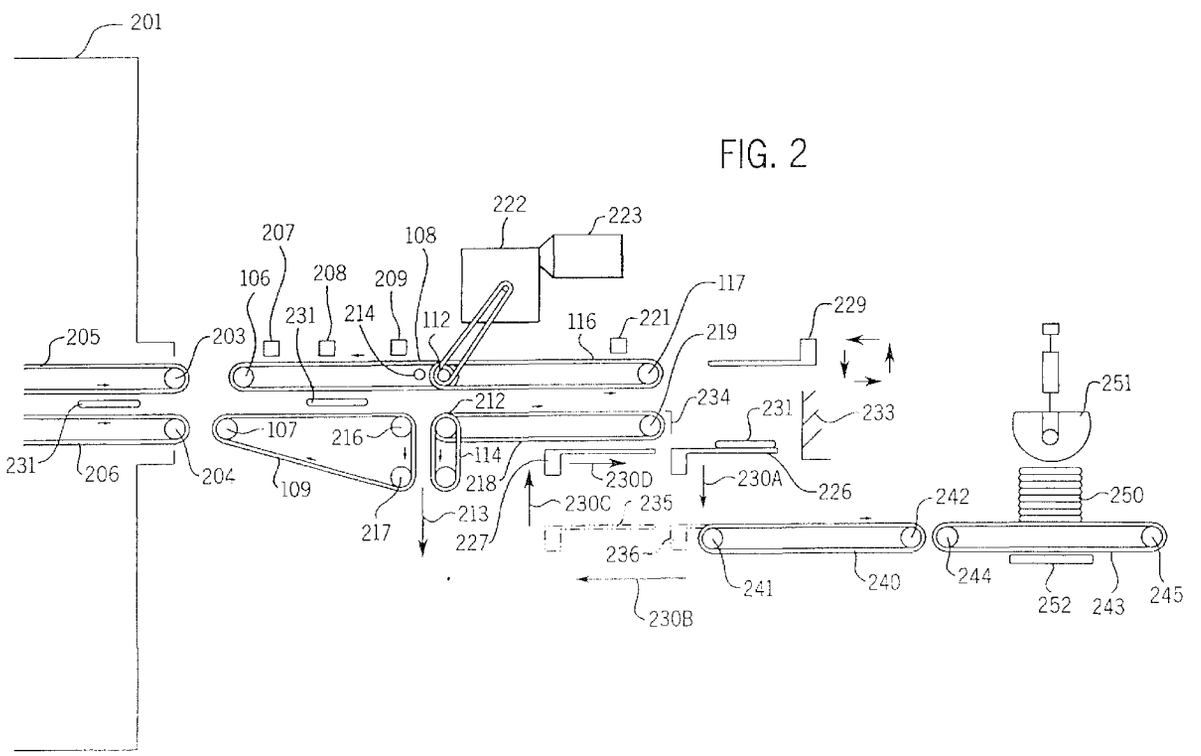


FIG. 2

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## Description

The present invention relates generally to the art of bag making equipment. More specifically, it relates to equipment for stacking and accumulating folded bags.

Plastic or poly bags are currently made using high speed equipment that can form, perforate, separate, fold stack and wrap bags. The present invention is directed to stacking and temporarily accumulating the bags after they have been folded.

After bags have been folded (typically single, double or triple folded) they are often stacked and then packaged. The stack ranges from five to twenty-five bags. The bags should be uniformly folded and stacked to work well with downstream automated wrapping equipment.

One prior art stacker operates in conjunction with a triple folder, such as CMD Corporation's model 3013 triple folder. The bags are discharged from the triple folder with corrugating rolls. The corrugating rolls have upper discs that mesh with lower discs. As each bag passes through the rolls, the bag is given a corrugated shape. Bags with such a corrugated shape travel farther without support than do un-corrugated bags.

The bags are expelled from the folder and land on a stacker "hand" in the prior art stacker. A stacker hand is comprised of a number of fingers that catch the bags. After a few bags are caught, the hand retracts, dumping the bags on a conveyor where the remainder of the stack is formed. The hand then returns to a resting position, until it moves to begin catching the first few bags of the next stack. All bags after the first few are dropped from the folder to the stack on the conveyor. Diverters (vertical separators) on the conveyors separate adjacent stacks.

Only the first few bags are caught by the hand because the hand needs time to return to the position to catch the first bag of the subsequent stack.

When bags travel without support they are more likely to get out of alignment, and result in an improper stack. Thus, the bags travel a foot or two feet to form a stack, and increase the likelihood improper stacking. Because it is difficult to use automated packaging equipment (located downstream of the stacker) with improperly stacked bags, the long drop is undesirable.

Another prior art stacker is described in U.S. Patent 5,388,746. This stacker uses two sets of fingers (i.e. two hands) that follow a single rectangular path. When the first hand is full, the second hand replaces it. However, because the hands follow a single path, one hand does not move into position to catch the bags until after the other hand has left the catching position.

Accordingly, a stacker that reduces the distance bags travel unsupported is desired. The stacker should be able to operate at a high rate of speed, preferably using pneumatics (rather than servo motors) to reduce the cost. The design will preferably have hands that catch the bags and travel different paths, so that a second hand can quickly move into position to catch bags after another hand has left that position. It is also desirable to have the hands that support the folded bags be capable of moving at multiple speeds so that they can travel as slow as possible, given the time constraints of the process.

The stacker would preferably include an inspection device to reject improperly folded bags before the stack is made. The inspection should be adjustable for various widths and lengths of bags.

In addition to a stacker, it is desirable to have a machine which can take stacks of folded bags from the stacker and accumulate the stacks to create a buffer for downstream equipment (such as a wrapper or automatic packager). The accumulator will preferably sense the number of stacks present and control the speed of the downstream equipment.

Such a stacker and accumulator should preferably be capable of creating neat, proper stacks that are conveyed to downstream equipment such as an automatic packager. The stacks should be of a selectable count, and the bags should be allowed to be a variety of heights, lengths, and widths, film types, gauges, colors, fold configurations, and styles. Preferably, such a stacker will be modular, so different downstream equipment can be used with it.

An apparatus for stacking objects is comprised of a first and second set of fingers in one embodiment of the invention. The fingers each have their own paths of travel, and move into and out of resting and stacking positions. In one alternative the stacking position is formed by guides on 4 sides of the position.

According to a second aspect of the invention a pneumatic mover (such as an air cylinder) is coupled to the first set and/or second set of fingers.

According to a third aspect of the invention the first and second sets of fingers approach the stacking position from different directions.

According to a fourth aspect of the invention a conveyor is provided to transport the objects to the stacking position. A sensor is provided along the conveyor to detect objects that should be rejected.

According to another aspect of the invention a height sensor is placed near the stacking station and senses when the stack of objects reaches a predetermined height. One set of fingers are then moved in-response to the stack reaching the predetermined height.

According to another aspect of the invention a third set of fingers having a third path of travel are provided. The third path of travel is the same as the first path of travel. The first, second and third sets of fingers may be moved independently. The third set of fingers may be pneumatically moved.

According to yet another aspect of the invention the second set of fingers are prestacking fingers, and the second path of travel is shorter than the other path of travel. Means for moving the first set of fingers into the stacking station after a stack has been started and for

removing the second set of fingers from the stacking station before the stack is completed are provided. The first set of fingers may be moved at a plurality of speeds by a pneumatic mover.

According to a different aspect of the invention a method for stacking objects includes moving a first set of fingers into and out of a stacking position from a first direction. Also, a second set of fingers are moved into and out of a stacking position from a second direction. In one embodiment the steps of moving include the step of directing air into and out of an air cylinder.

Another aspect of the invention includes the step of conveying the objects to the stacking position and detecting objects to be rejected. Also, in an alternative the height of the stack is sensed and one set of fingers is lowered when the stack reaches a predetermined height.

In another aspect of the invention a third set of fingers are moved into and out of the stacking position. The first and third sets fingers are moved along the same path. The first, second and third sets of fingers may be moved independently, and at a number of speeds.

In another embodiment the second set of fingers are prestacking fingers and they are moved into the stacking position when a stack is to be started. They are then moved out before the stack is completed. The first or third sets of fingers are moved into the stacking position after the new stack is to be started. The movements may be accomplished pneumatically.

Other principal features and advantages of the invention will become apparent to those skilled in the art upon review of the following drawings, the detailed description and the appended claims.

The present invention will now be described further, hereinafter, by way of example only, with reference to the accompanying drawings; in which:-

Figure 1 is a perspective view of a stacker and accumulator constructed in accordance with the present invention;

Figure 2 is a side view of a stacker constructed in accordance with the present invention;

Figure 3 is a side view of stacking fingers and prestacking fingers used in the present invention;

Figure 4 is a top view of a set of fingers used in the present invention;

Figure 5 is a top view of stacking fingers and prestacking fingers used in the present invention;

Figure 6 is a side view of an accumulator constructed in accordance with the present invention;

Figure 7 is a top view of an accumulator constructed in accordance with the present invention; and

Figure 8 is a schematic of the piping for the pneumatics used to control the movement of a stacker constructed in accordance with the present invention.

Before explaining at least one embodiment of the invention in detail it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of the components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments or of being practiced or carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein is for the purpose of description and should not be regarded as limiting. Like reference numerals are used to indicate like components.

The present invention will be illustrated with reference to the stacker and accumulator shown in the Figures, and described as being used with plastic bags. It should be understood at the outset that the Figures and description are merely exemplary, and that products other than bags could be stacked and/or accumulated.

Figures 1 and 2 show a stacker 101 and an accumulator 102 from a perspective view and side view, respectively. Generally, stacker 101 receives bags from a folding device 201 (Figure 2) such as CMD Corporation's model 3013 triple folder. Stacker 101 stacks the bags, and when the stack reaches a predetermined number, the stacker is transferred to accumulator 102. The stack is held in accumulator 102 and then transferred to a downstream device, such as a Hayssen® wrapper. The bags may be folded in any style, and be comprised of a wide variety of materials. Also, a wide variety of dimensions of bags may be used.

The operation of stacker 102 will be described in detail below with respect to Figures 1 and 2. It should be noted that the views are from opposite sides of the machine. Thus, in Figure 1 the bags to be stacked travel from right to left, while in Figure 2 the bags to be stacked travel from left to right.

Stacker 101 includes a frame 105 (Figure 1) that allows for adjusting the height of a pair of infeed rolls 106 and 107 (preferably from 43 to 48 inches from the floor). The adjustability allows infeed rolls 106 and 107 to be aligned with a pair of outfeed rolls 203 and 204 of folder 201. Ropes or belts 205 and 206 are guided by discharge rolls 203 and 204, respectively. Additionally, corrugating rolls may be used to put a corrugation into each bag. This will help the bag travel in a straight line when unsupported.

Infeed rolls 106 and 107 form a nip to receive an incoming bag 231 from folder 201. As shown on Figure 2 roll 106 may be slightly offset from roll 107. The position of roll 106 may be adjusted to open or close the nip, to allow for flexibility for variations in different bags. The nip will allow a bag 1/4 inch thick to pass through, in the preferred embodiment.

Infeed rolls 106 and 107 each drive a set of ropes 108 and 109, respectively. Ropes 108 and 109 are preferably poly-urethane hollow tubes. The ends are spliced together with a steel barb for easy replacement. Ropes 108 are returned by a roll 112, and ropes 109 are returned by rolls 216 and 217.

During operation a folded bag 231 is discharged by folder 201 and caught in the nip between rolls 106 and 107 and transferred by ropes 108 and 109, past sensors 207 - 209 (Figure 2). The preferred embodiment uses Sick brand, retro-reflective, photo eyes. The eyes emit a signal that is reflected back and sensed. When an object is between the eye and the reflector it will block that light and a signal is sent to a controller (such as a microprocessor). The eyes used have a lens that allows the detection of clear plastic material. The controller is not shown, but would include the necessary input and output connections in a manner well known in the art.

Sensors 207-209 are used to detect improperly folded bags. When a bag is improperly folded it is too long in either the direction of travel, or two wide (perpendicular to but in the same horizontal plane as the direction of travel). Sensors 207 and 209 cooperate to detect bags that are too long. If the folded bag covers both sensors 207 and 209, then it is too long, and the controller causes the bag to be rejected. Sensors 207 and 209 are preferably located in the center of the bag.

Sensor 208 cooperates with another sensor directly behind it (not shown). The sensors are offset from the center of the bag by equal amounts determined by the tolerance of the width. If sensor 208 or the other sensor detects the bag, then the bag is too wide, and subsequently rejected. The locations of the sensors are adjustable, so that bags of different lengths and widths may be accommodated.

Rejected bags are disposed of along a path shown by arrow 213 (Figure 2). Ropes 109 make a downward turn at roll 216, and cooperate with a set of ropes 114 to form the rejection path. Both ropes 114 and 109 have a downward direction along the rejection path. The rejected bags are directed into the rejection path by a blast of air from an air pipe 214. Air pipe 214 can be located either upstream or downstream of roll 112, and need only be positioned to insure that rejected bags will follow the rejection path.

The rejection of bags can be continuous (if the user so desires) or automatic as described above. Also, if the downstream equipment (such as a Hayssen® wrapper) cannot keep up with the incoming bags, then even good bags can be rejected. Because the rejected bags are discharged toward the floor, access is preferably provided between framing 105 to allow access to the rejected bags.

Bags that are not rejected are carried between two sets of ropes 116 and 218. Ropes 116 travel around roll 112 and a roll 117, and ropes 218 travel around roll 212 and a roll 219. Ropes 114 and 218 share a common roll 212, even though they travel in opposite directions. Roll or shaft 212 has some pulleys that are driven (and cooperate with ropes 218) and others that are idlers (and cooperate with ropes 114) to allow for the opposite directions of travel.

Roll 112 is shown to be driven by a gear reducer 222 and motor 223. All the rolls that are driven, are done so by motor 223, although the connections are not shown for clarity. Of course, other arrangements of rolls, ropes, belts, motors, gear reducers and pulleys could be used.

As the folded bags are carried by ropes 218 and 116 they pass under another sensor 221. Sensor 221 is also a photo eye and is used to count bags. The number of bags that are not rejected, and thus stacked, is kept track of. The user can select the number of bags in each stack (from 5 to 25 in the preferred embodiment, although other ranges may be used). When the selected number of bags are counted by sensor 221 the trailing edge of the last bag is sensed, and based on that the stacking operations (described later) are initiated. Sensor 221 is located close to rolls 117 and 219 to allow accurate initiation of the stacking operations. In alternative embodiments one of sensors 207-209 is used to count the bags and sense the trailing edge.

When the bags reach the end of ropes 117 and 219, they fall onto fingers. The preferred embodiment uses three sets of fingers, 226, 227 and 229. Fingers 226 and 227 are used for stacking and fingers 229 are used for prestacking. Stacking fingers 226 and 227 follow a single clockwise rectangular path, as shown by arrows 230A-230D. In an alternative embodiment fingers 226 and 227 follow different paths. Stacking fingers 226 are shown in a stacking position and fingers 227 are shown in a resting position. Other positions 235 and 236 for stacking fingers 226 and 227 are shown with dashed lines.

Fingers 229 are shown in a resting position. Prestacking fingers 229 follow a counter-clockwise rectangular path, (different from that of stacking fingers 226 and 227) as shown by arrows. The arrows indicate that, in the preferred embodiment, not only do fingers 229 follow a different path than fingers 226 and 227, they approach the stacking position from different directions, and thus fingers 226 and 227 do not interfere with the movements of fingers 229.

The three sets of fingers interact to insure that bags are always supported, and that the incoming bags can operate at high speeds. When in the position shown, stacking fingers 226 catch the bags (shown as 231) as they leave ropes 116 and 218. The fingers are in the positions shown in figure 2 in the middle of a cycle, i.e. after a stack has been started, but before it is completed. The bags 231 are guided into a proper position by a set of vertical bars 233 at the downstream end of stacking fingers 226. A set of vertical bars 234 contain the upstream end of the bags. A pair of side plates prevent the bags from being displaced in the cross direction. Thus, the bags being stacked are contained and guided on all sides by the bars and plates which form a stacking station. Bars 233 and 234 are used rather than plates to allow the fingers to travel through them.

Another sensor (not shown) is positioned to sense bags 231 stacked on fingers 226, at a height near (preferably less than two inches below) that of roll 219 and

detects the top of the stack of bags. When the stack get high enough the photo eye is blocked, and the controller causes fingers 231 to be lowered. The controller requires that the eye be blocked for greater than a predetermined time to distinguish bags falling past the sensor. In the preferred embodiment fingers 226 are lowered until the eye stops detecting a bag. This arrangement reduces the distance the bags fall before being stacked on fingers 226 and keeps the top of the stack at about the same height to give consistent stacking. In the preferred embodiment the stack typically increments by about one half inch to one inch, and the distance each bag has to fall to the stack is preferably 2 inches or less. In an alternative embodiment the stack is incremented down a predetermined amount for each bag (or some number of bags). The process continues until the user-set number of bags have been stacked (as counted with sensor 221).

When the count is complete, prestacking fingers 229 move directly down from the resting position to catch bags to be stacked (the prestacking position). The prestacking position is at or near the position in which fingers 226 are shown in Figure 2. The distance prestacking fingers 229 move is relatively little (about two inches in the preferred embodiment). Because they travel such a short distance fingers 229 can be in position to catch bags before the first bag in each stack arrives. The short distance also allows use of pneumatics to move the fingers, rather than a costly and complex servo motor. In an alternative embodiment an air pipe is provided to direct a blast of air straight down on the last bag of a stack, to insure the tail of the bag is onto the stack before the prestacking fingers move into position.

When prestacking fingers 229 reach the prestacking position, stacking fingers 227 (in the resting position) begin to move to the stacking position. After a slight delay prestacking fingers 229 are retracted to the right, leaving stacking fingers 227 holding the bag(s). The slight delay is provided so that the bags are always supported. Prestacking fingers 229 then complete the travel to the right, clearing the bags, and move up, and then return to the resting position (shown in Figure 2).

Thus, as may be seen, prestacking fingers 229 move quickly and catch the first bags of each stack while the stacking fingers are moving into position. This reduces the need for servo motors to move the fingers. However, in one embodiment servo motors are used to move one or more sets of fingers. Another alternative is to use only two sets of fingers that either follow different paths or they follow the same path and one set always acts as a prestacker and catches the first few bags in each stack. In the preferred embodiment the prestacking fingers cooperate with the stacking fingers and because they follow a different path, they do not interfere with each others movements. Stacking fingers 226 and 227 follow a clockwise path, while prestacking fingers 229 follow a counter-clockwise path.

Meanwhile, after the last bag in the stack is counted, fingers 226 move to position 236, which places the stack of bags on a set of ropes 240, which are guided by a pair of rolls 241 and 242. Fingers 226 then retract to position 235, and then travel to the resting position, assuming it has been cleared by the other stacking fingers.

Thus, a complete cycle for one set bf stacking fingers would be to begin at rest in the position occupied by fingers 227 in Figure 2, and then move to the stacking position when the previous stack is completed. The stacking fingers travel about 12 inches to reach the stacking position (much more than the two inches the prestacker has to travel). The fingers increment down as bags are added to the stack. When the stack is completed the bags are deposited on ropes 240, and the fingers return to the rest position. During this time prestacking fingers 229 have made two complete cycles, one for each set of stacking fingers.

Referring now to Figures 3-5 the interaction of the stacking and prestacking fingers can be seen. Figure 3 is a side view of the fingers mounted on frame 105. Stacking fingers 226 are shown in a position below prestacking fingers 229. Vertical bars 233 and 234 are shown, and one side plate 301, that form the space within which the bags are stacked. The distances between the side plates and vertical bars may be adjustable, to accommodate a wide range of bag sizes. Figure 4 shows that fingers 229 are comprised of a plurality of bars having spaces therebetween.

Figure 5 shows a top view of fingers 226 and 229 mounted on frame 105. Fingers 229 and 226 follow different paths and, as shown, do not interfere with the other's movements.

In the preferred embodiment the fingers are controlled with an XY pneumatic positioner. This avoids using a costly and complex servo motor. The speed of each motion is controlled by flow control. The piping and flow control for the stacking fingers is such that they can move up or down, and the down motion can be in increments or at three different speeds.

Three speeds are obtained by using a 4-way, double solenoid 3 position, 5 port valve, such as model H243 available from Humphrey. The valve has a holding position in the center so that when its unactuated, it will hold a mid-stroke position (for incrementing). The exhaust port of that valve is diverted to three additional parallel valves. Each of the three additional valves have a flow control associated with its exhaust. The valve selected (and associated flow control) determines the speed of the movement. In alternative embodiments 2 or 3-way valves or valves that control the flow themselves may be used.

The valves are operated such that when a stack of bags is incrementing down towards position 236 the fingers move slowly. When the stack is complete the fingers move at one of three speeds: low, medium or high, to set that stack down onto ropes 240. The speed is determined by the number of bags the user selected to place in each stack. For larger stacks (and lesser dis-

tances) the speed is slower. Alternatively, the speed of the downstroke may be directly selected by the user. After depositing the stack the fingers move at high speed back to the rest position.

Referring now to Figure 8, the piping for the pneumatics is shown. A 4-way valve 801 has output ports connected to an air cylinder 802 through hoses 804 and 805. Air cylinder 802 is linked to and moves one set of stacking fingers. Valve 801 has an exhaust port with a muffler 806 when the speed at which fingers travel does not need to be limited (for example when the fingers return to the resting position from position 235). An input port is connected to an air supply through a hose 807.

An exhaust port is connected to hose 808, for controlling the speed of the fingers when they are carrying a stack of bags. A hose 809 is connected to hose 808 and leads to a valve 810. Valve 810 has a flow control 811 on its exhaust, and a muffler 812 is attached to flow control 811. Flow control 811 is set to provide a slow speed, thus valve 810 is opened when a slow speed is desired.

Similarly, a hose 814 is connected to hose 808 and leads to a valve 815. Valve 815 has a flow control 816 on its exhaust, and a muffler 817 is attached to flow control 816. However, flow control 816 is set to provide a medium speed, thus valve 815 is opened when a medium speed is desired. A hose 819, valve 820, flow control 821 and muffler 822 are similarly arranged. However flow control 821 is selected for high speed operation.

Referring again to Figure 2, ropes 240 are intermittently moved, in cooperation with a set of ropes 243 which are guided by a pair of rolls 244 and 245. After a stack of bags have been deposited on ropes 240, ropes 240 and 243 begin moving and the stack of bags is advanced to position 250. If a stack had been at position 250 it is advanced to accumulator 102.

When the bags are at position 250 they are directly beneath a pneumatic squasher 251. Pneumatic squasher 251 moves downward and applies pressure to the top of the stack. A plate 252 underneath the ropes supports the stack so squasher 251 creases the bags, thus creating a cradle which is perpendicular to the direction of travel. The cradle makes the stack more stable so that as it is intermittently moved it has less tendency to tip over or so the bags have less tendency to slide and create a sloppy stack. In an alternative embodiment the squasher includes fingers which shape the cradle. For example, the fingers may be curved to control the arc of the cradle, or the fingers may be flat to flatten the stack.

Referring now to Figures 6 and 7, accumulator 102 is shown. Accumulator 102 includes rolls 602-611 mounted on framing 601. Rolls 602-611 each have a motor shown therewith, and each drive ropes which form a conveyor leading from squasher 251 to a packager 615. In the preferred embodiment packager 615 is a Hayssen® IL-11P wrapper.

The motion of accumulator 102 is intermittent, but is controlled separately from rolls 241, 242, 244 and 245. In one embodiment a single roll replaces rolls 242 and 244. In the preferred embodiment, each section of accumulator 102 may be operated independently of the other sections. The accumulator includes ten sections as shown, although there could be more or less than ten. Each section acts cooperatively with the other sections to transfer the stacked bags from squasher 251 to the end of accumulator 102. The use of numerous sections gives the ability to back up stacks of bags or purge them out, depending on the in-feeding rate and the out-feeding rate. Preferably, each motor provides a smooth acceleration and deceleration so the stacks are not disturbed. The speed may be selectable from a number of preset speeds (five e.g.). Each section includes one of sensors 622-631, so the number of stacks located within the accumulator may be determined.

One advantage of the accumulator is it creates a buffer between the intermittent motion stacker and the downstream continuous motion wrapper or packager. This is advantageous since many types of continuous motion wrappers need to be held at close to a constant speed.

The ten sections in accumulator 102 use feedback with sensors to detect how many stacks have accumulated. If there are only a few stacks (two or three, e.g.) the downstream wrapper would be operated at a slow speed (ten percent under normal e.g.). Conversely, if the accumulator gets close to being full, the downstream equipment can be run at a higher speed (ten percent over normal e.g.). If the accumulator remains full even at the higher speed, the controller can cause good bags to be rejected using airpipe 214, thereby slowing down the stacking speed. If the number of stacks falls to one or two the downstream wrapper could be stopped, rather than have it wrap poorly. After stacks begin to back up in the accumulator the wrapper can be restarted.

As one skilled in the art should recognize, the stacker and accumulator described above are of a modular design and thus may be used with any downstream equipment. The stacker may be used without any downstream equipment.

Numerous modifications may be made to the present invention which still fall within the intended scope hereof. Thus, it should be apparent that there has been provided in accordance with the present invention a method and apparatus for stacking bags and accumulating stacks of bags that fully satisfies the objectives and advantages set forth above. Although the invention has been described in conjunction with specific embodiments thereof, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art. Accordingly, it is intended to embrace all such alternatives, modifications and variations that fall within the spirit and broad scope of the appended claims.

## Claims

1. An apparatus for stacking objects comprised of:

   a first set of fingers (226) having a first path of travel, wherein the first path of travel includes a stacking position and a resting position; and a second set of fingers (229) having a second path of travel, and characterised in that the second path of travel is not the first path of travel, and the second path of travel includes a stacking position and a resting position.

2. An apparatus as claimed in claim 1 in which the stacking position includes a plurality of guides forming a stacking station.

3. An apparatus as claimed in claim 1 or 2 in which a pneumatic mover coupled to the first set of fingers.

4. An apparatus as claimed in claim 1, 2 or 3 in which a pneumatic mover coupled to the second set of fingers.

5. An apparatus as claimed in anyone of claims 1 to 4 in which the first path of travel includes a path toward the stacking position in a first direction and the second path of travel includes a path toward the stacking position in a second direction.

6. An apparatus as claimed in claim 2 or anyone of claims 3, 4 or 5 when appendent on claim 2 and further comprising a conveyor for transporting the objects to the stacking position, and at least one sensor (207-209) for detecting objects to be rejected, wherein the sensor is located along the conveyor and upstream of the stacking station.

7. An apparatus as claimed in claim 2 or anyone of the preceding claims when appendent on claim 2 and further comprising a height sensor disposed adjacent the stacking station for sensing when the stack of objects reaches a predetermined height.

8. An apparatus as claimed in claim 7 and further comprising means for moving the first set of fingers, wherein the fingers are moved in response to the stack reaching the predetermined height.

9. An apparatus as claimed in anyone of the preceding claims and further comprising a third set of fingers (227) having a third path of travel, and wherein the third path of travel is the same as the first path of travel.

10. An apparatus as claimed in claim 9 and further comprising means for moving the first, second and third sets of fingers independently.

11. An apparatus as claimed in claim 2 or anyone of the preceding claims when appendent on claim 2 in which the second set of fingers are prestacking fingers, and the second path of travel is shorter than the first path of travel, and means for moving the first set of fingers into the stacking station after a stack has been started and for removing the second set of fingers from the stacking station before the stack is completed.

12. An apparatus as claimed in anyone of the preceeding claims and comprising means for moving the first set of fingers at a plurality of speeds.

13. An apparatus as claimed in claim 12 in which the means for moving includes a pneumatic mover.

14. A method for stacking objects comprising the steps of:

   moving a first set of fingers (226) into a stacking position from a first direction;
   moving the first set of fingers out of the stacking position; and characterised by
   moving a second set of fingers (229) into a stacking position from a second direction; and
   moving the second set of fingers out of the stacking position.

15. A method as claimed in claim 14 in which the steps of moving include the step of directing air into and out of an air cylinder.

16. A method as claimed in claim 14 or 15 and further comprising a step of conveying the objects to the stacking position and detecting objects to be rejected.

17. A method as claimed in claim 14, 15 or 16 and further comprising sensing the height of a stack of objects in a stacking station and moving one set of fingers when the stack reaches a predetermined height.

18. A method as claimed in anyone of claims 14 to 17 and further comprising the step of moving a third set of fingers (227) into and out of a stacking position, wherein the first and third sets fingers are moved along the same path.

19. A method as claimed in claim 18 in which the first, second and third sets of fingers are moved independently.

20. A method as claimed in anyone of claims 14 to 19 in which the second set of fingers (229) are prestacking fingers, and the prestacking fingers are moved into the stacking position when a stack is to

be started, and then moved out before the stack is completed, and wherein the first (226), or a further (227) set of fingers are moved into the stacking position after the new stack is to be started.

**21.** A method as claimed in anyone of claims 14 to 20 in which the first set of fingers are moved at a plurality of speeds.

**22.** A method as claimed in anyone of claims 14 to 21 in which the fingers are moved pneumatically.

**23.** An apparatus for stacking objects and characterised in that it comprises:

a first set of fingers (226) having a stacking position and a resting position;
a second set of fingers (229) having a stacking position and a resting position; and
a third set of fingers (227) having a stacking position and a resting position.

**24.** An apparatus for stacking objects characterised in that it comprises:

a set of stacking fingers having a stacking position and a resting position; and
a set of prestacking fingers having a stacking position and a resting position.

**25.** An apparatus as claimed in claim 24 in which the first set of stacking fingers have a path of travel and the set of prestacking fingers have a path of travel, and wherein the paths are substantially the same.

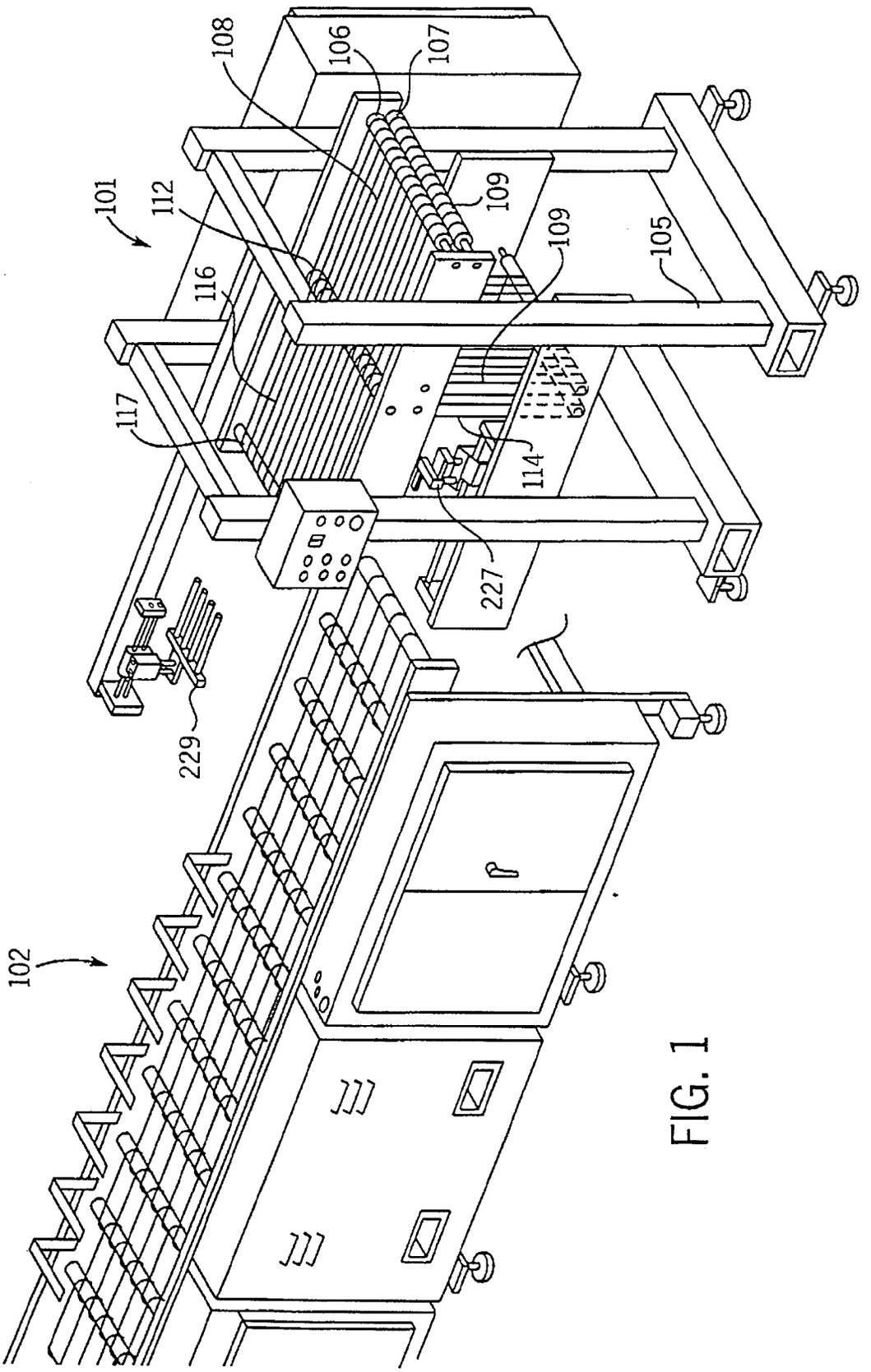
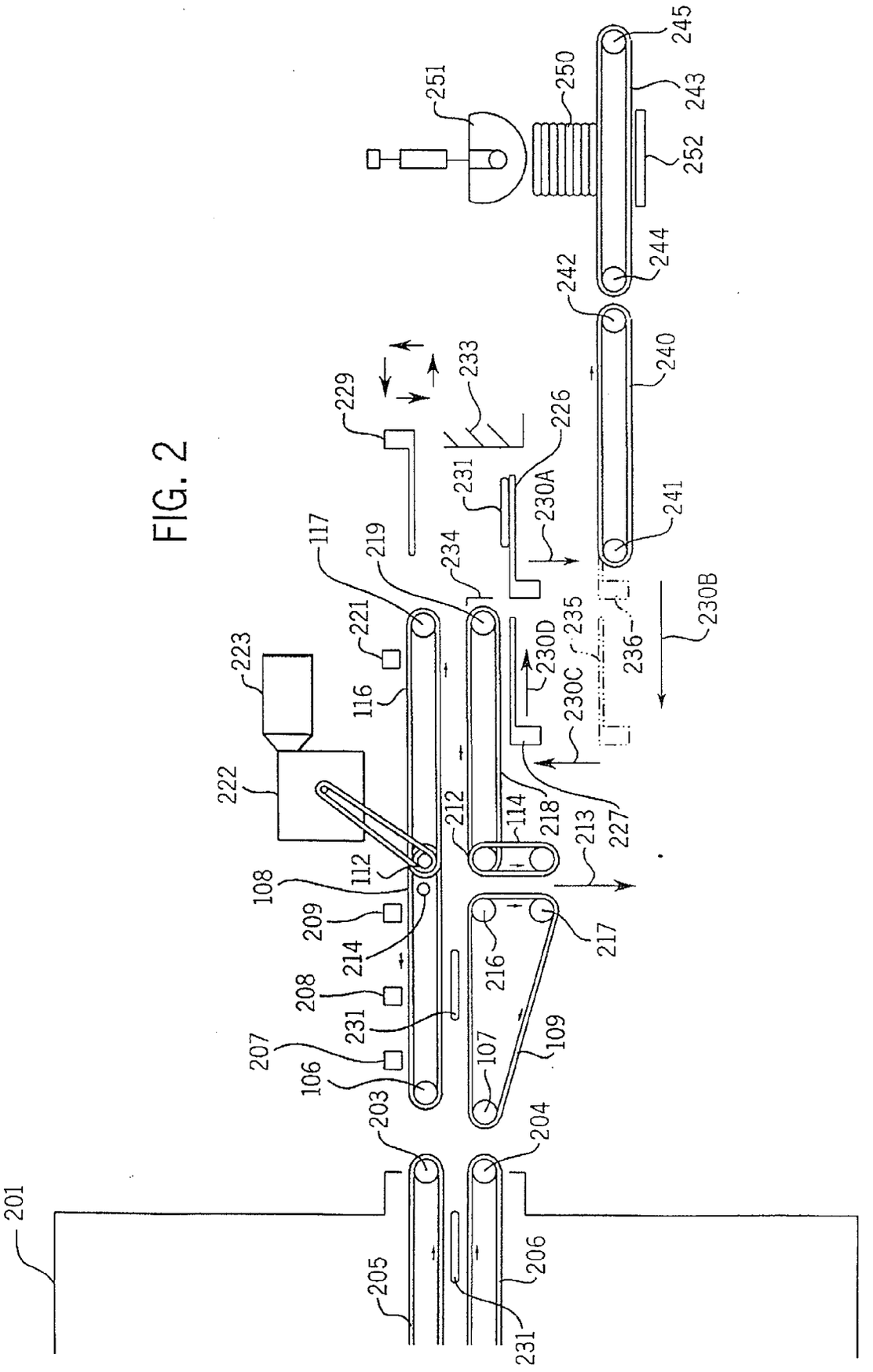



FIG. 1

FIG. 2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114
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213
227
222
223
116
221
117
219
234
230C
230D
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230B
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251

FIG. 3

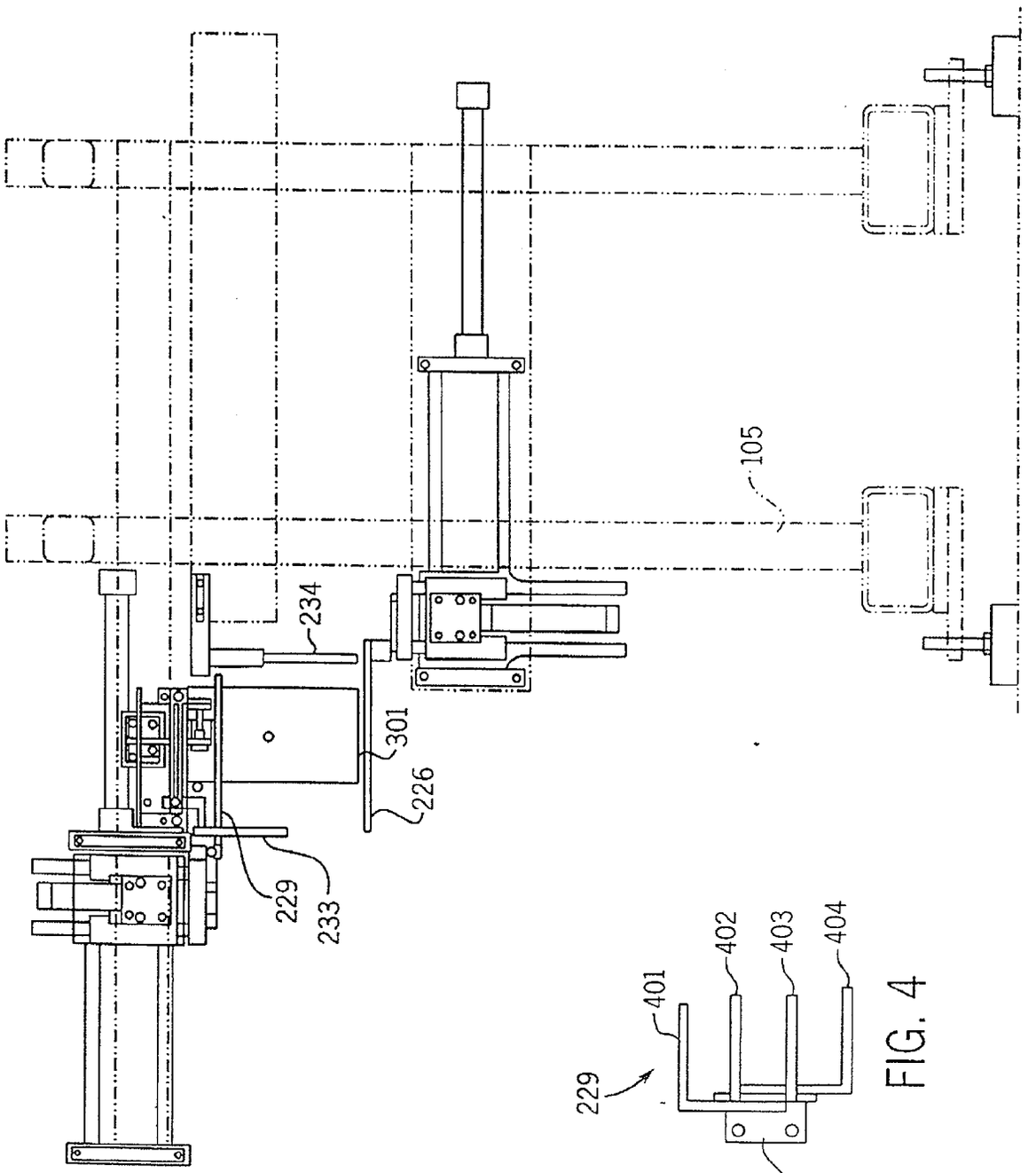





FIG. 4

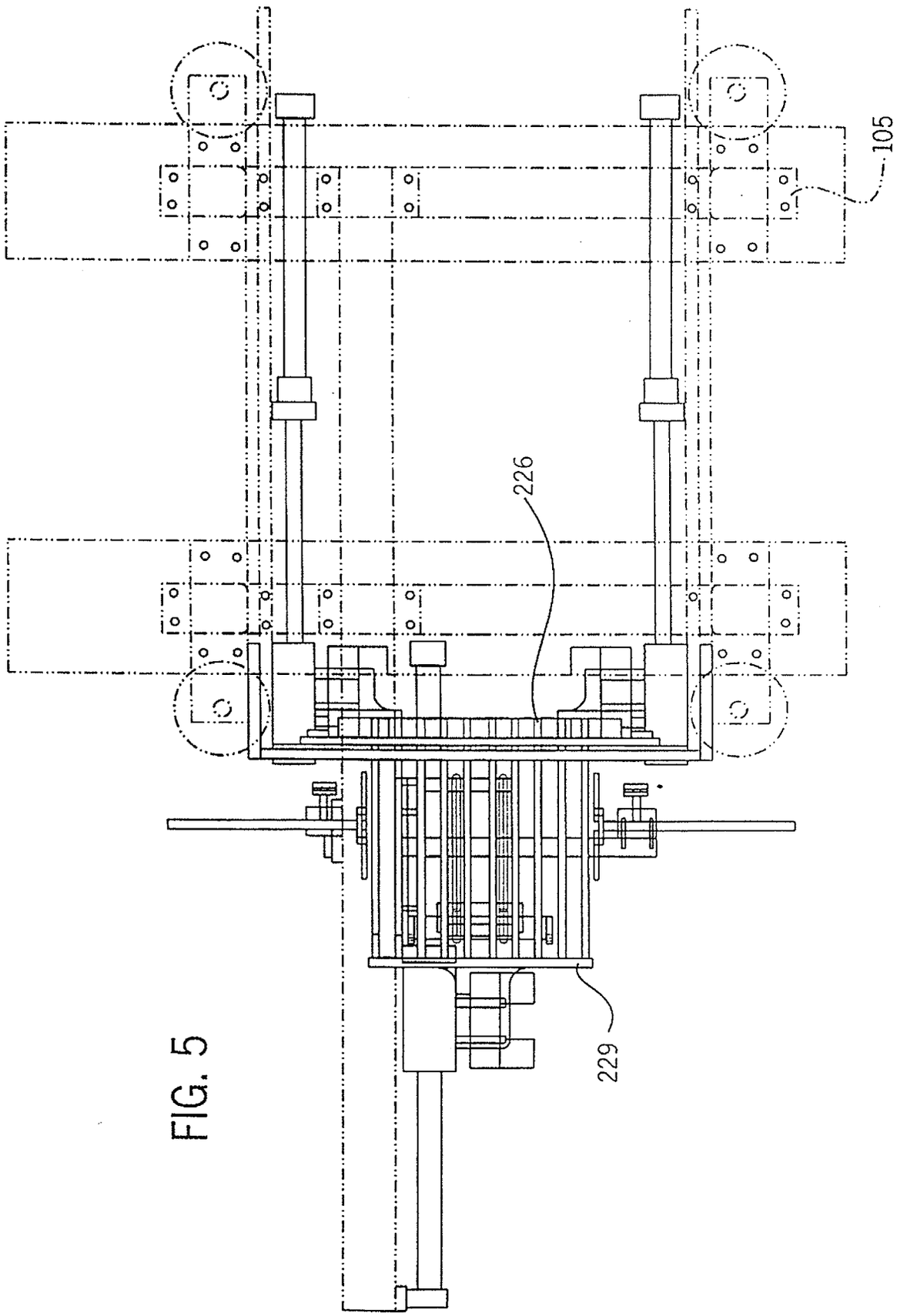


FIG. 5

FIG. 6

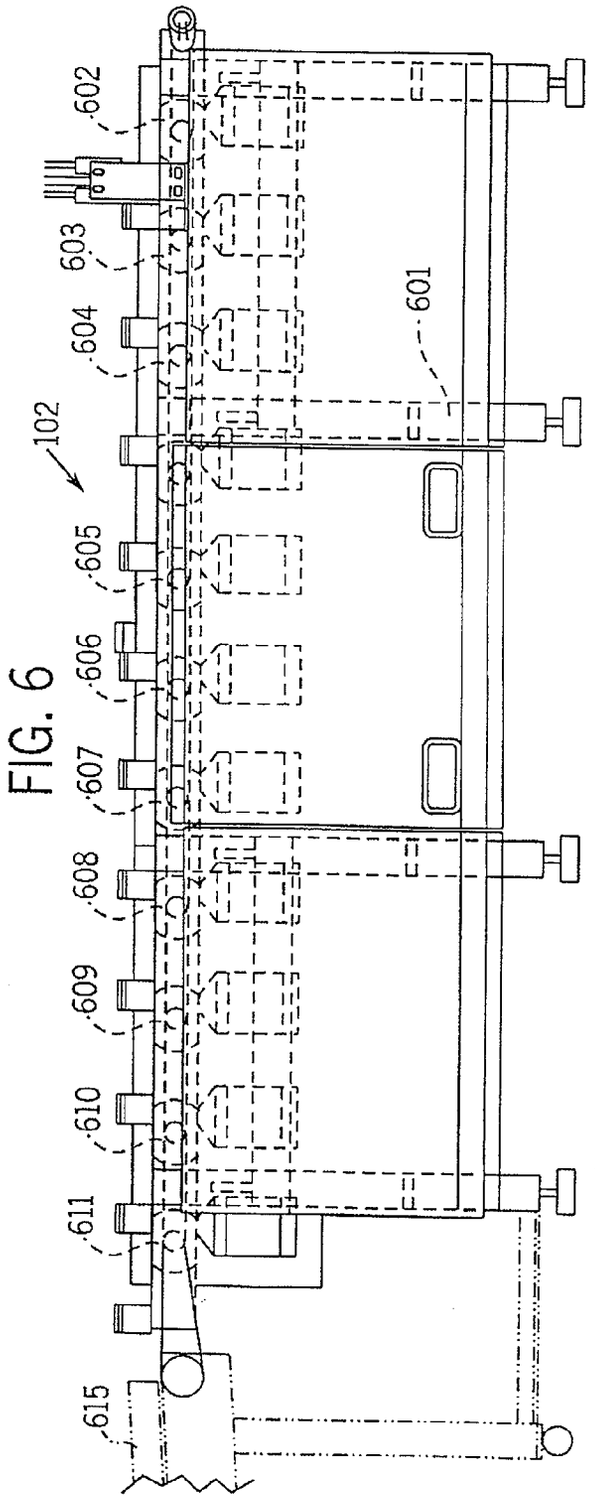
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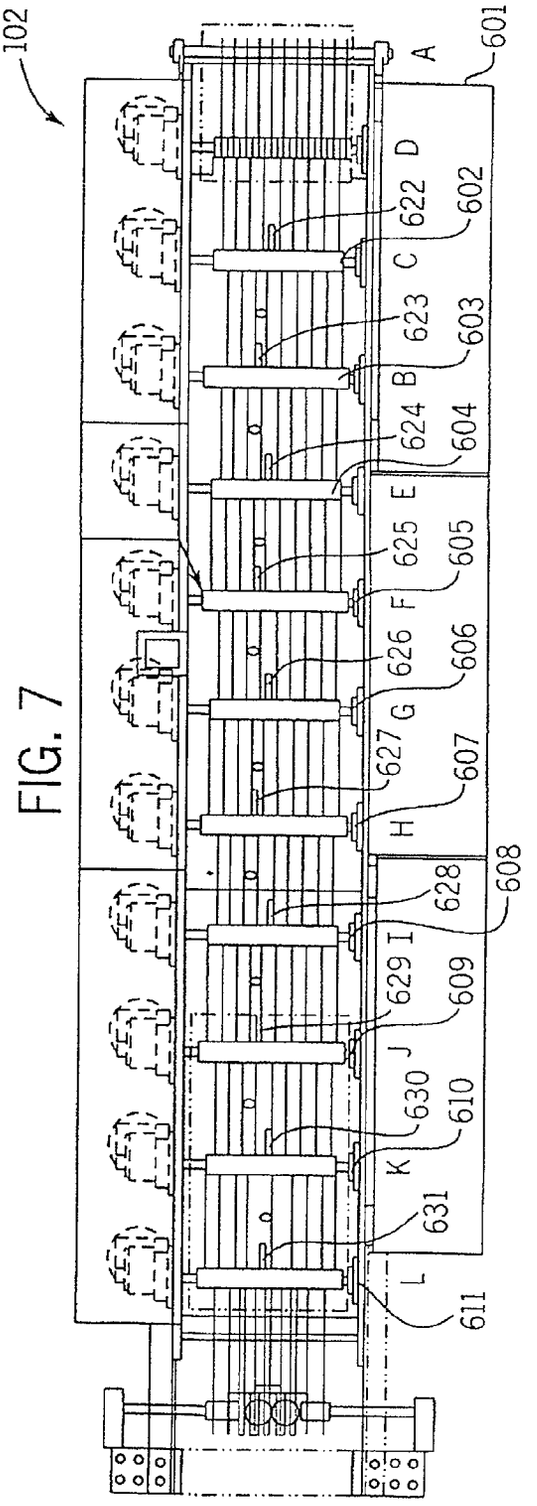
FIG. 7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A
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622
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C
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B
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E
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G
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H
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I
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K
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L
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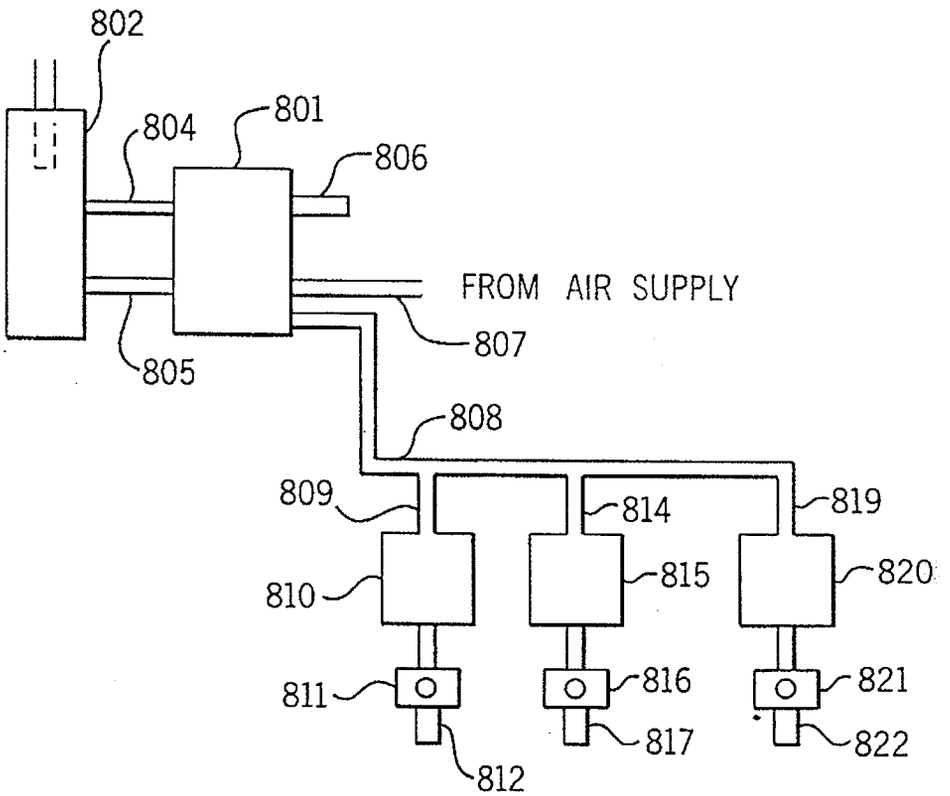
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FROM AIR SUPPLY
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FIG. 8