

April 26, 1960

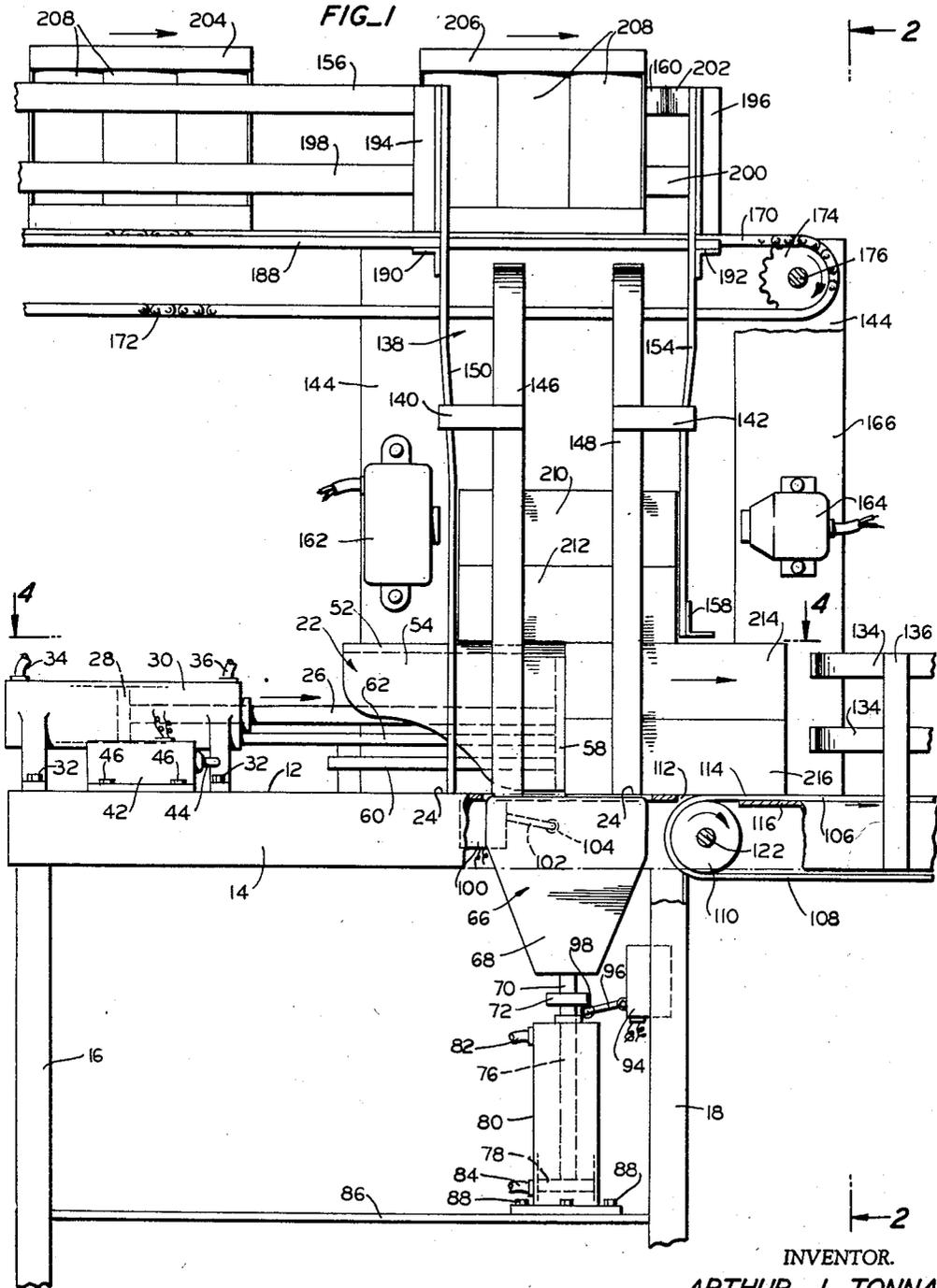
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PIGGY-BACK CARTON STACKER

Filed April 23, 1958

3 Sheets-Sheet 1



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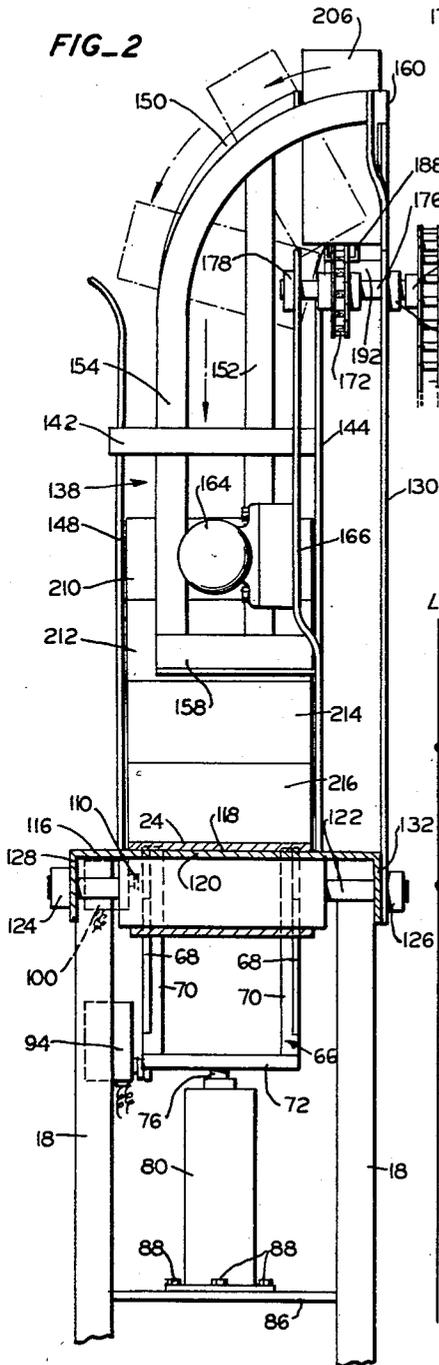
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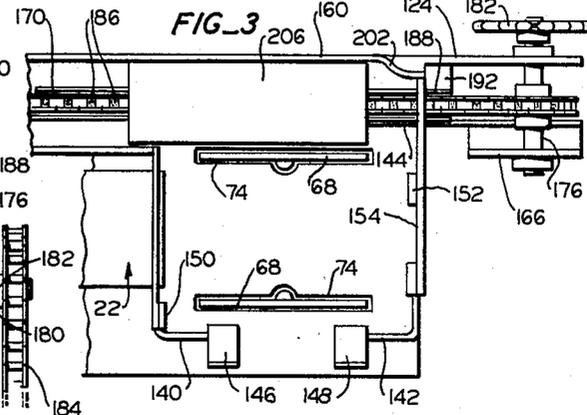
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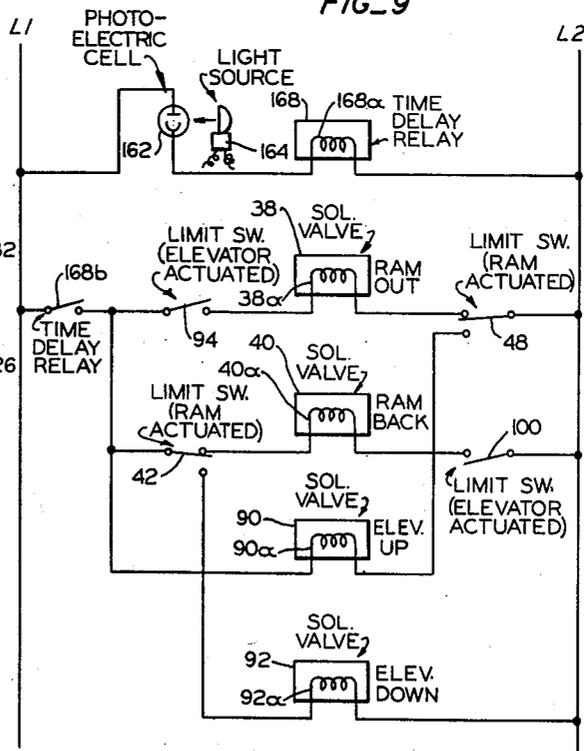
FIG_2



FIG_3



FIG_9



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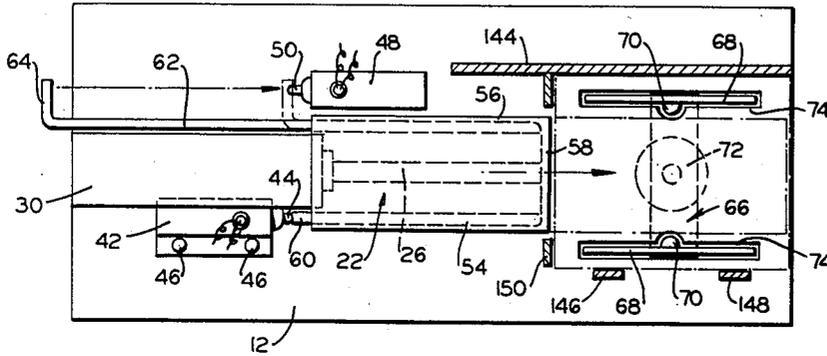
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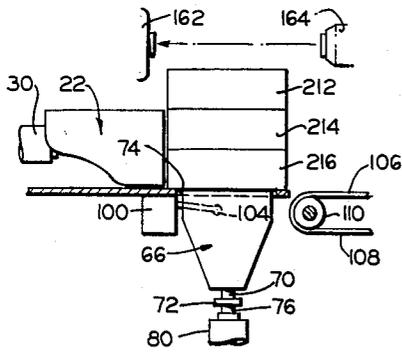
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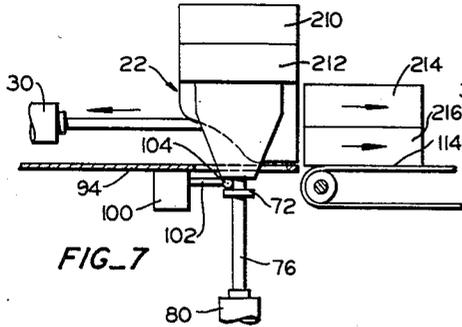
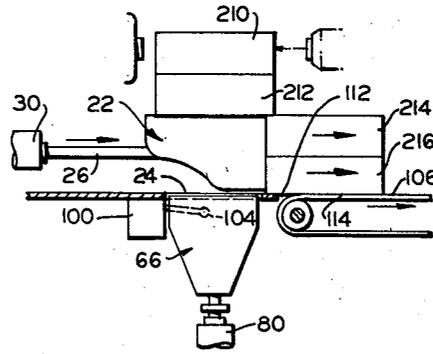
FIG_4



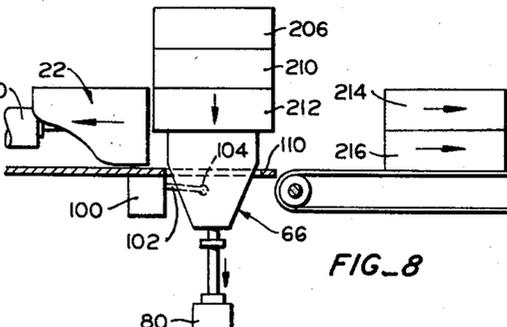
FIG_5



FIG_6



FIG_7



FIG_8

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PIGGY-BACK CARTON STACKER

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2 Claims. (Cl. 214-6)

This invention relates to carton stackers and more particularly to a stacker which is adapted for automatic stacking of cartons atop one another in predetermined numbers.

It is an object of this invention to provide a machine adapted for production line use which will automatically stack cartons in predetermined numbers atop one another in "piggy back" fashion at high speed.

It is another object of this invention to provide a machine of the character described, the normal operation of which will not be affected by substantial variations in the rate of carton feed to the machine.

Still another object of this invention is to provide a machine of the character described which may be readily adapted to receive cartons of various shapes and sizes, singularly or in multiples.

Other objects and advantages of this invention will become apparent from the following description taken in conjunction with the drawings forming part of the specification in which:

Figure 1 is a view in side elevation partially broken away of the machine of this invention illustrating the direction of carton flow therethrough.

Figure 2 is a sectional view taken along the line 2-2 of Figure 1 with cartons undergoing upset being shown in phantom outline.

Figure 3 is a fragmentary view in plan of the machine.

Figure 4 is a view in section taken along the line 4-4 in Figure 1.

Figures 5, 6, 7 and 8 are simplified views in side elevation showing, in order, the sequence of operations of the machine of this invention.

Figure 9 is an across-the-line wiring diagram illustrating a preferred method of control for the machine of this invention.

Referring now to the drawings, there is provided a supporting framework having a horizontal bed 12 comprising an inverted channel member 14 carried upon uprights 16 and 18. A ram 22 is disposed for reciprocation in a horizontal plane above the surface 24 of bed 12 being connected by a rod 26 to ram actuating means comprising a piston 28 and a cylinder 30, the latter secured to bed 12 by means of studs 32. Hydraulic lines 34 and 36 are provided to communicate with either end of the cylinder 30, and solenoid control valves 38 and 40 (Figure 9) are provided for controlling the flow of fluid through these lines to such cylinder. A reversible limit switch 42 having a plunger 44 is secured to bed 12 at one side of cylinder 30 by means of studs 46. Secured to the other side of cylinder 30 is a similarly reversible limit switch 48 having a plunger 50.

The ram 22 is comprised of a web member 52 with shaped flange members 54 and 56 secured perpendicular to and depending from either side of the web member. A rectangular face plate 58 is secured intermediate flanges 54 and 56 and the web member 52 in perpendicular relationship thereto. The connecting rod 26 is secured perpendicular to the rear side of the face plate 58 and serves

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to carry the ram 22 in its reciprocal movement above bed 12. A pair of elongated rods 60 and 62, respectively secured to flanges 54 and 56, extend rearwardly beneath web member 52, paralleling connecting rod 26. Rod 62 is provided with a right angle projection 64 for effecting reversal of the contacts of the limit switch 48 by engaging the plunger 50 thereof when the ram 22 reaches its extended position indicated in phantom outline in Figure 4. Rod 60 is aligned to engage the plunger 44 of the limit switch 42, in effecting reversal of the contacts of such switch upon ram retraction.

A carton carrying elevator 66 is disposed for vertical reciprocal movement adjacent the ram 22 and is comprised of a pair of partially tapered spaced-apart parallel plates 68 secured to upright semi-cylindrical members 70, which latter are secured to cross members 72 at either end thereof. The parallel plates 68 of elevator 66 are spaced apart a distance sufficient to permit reciprocation therebetween of the ram 22 without physical interference with the up and down movement of the elevator 66; and a pair of parallel rectangular slots 74 are provided in bed 12 to permit reciprocation therethrough of the elevator plates 68. The elevator 66 is carried in its reciprocal movement upon the upper end of rod 76 which is secured perpendicular to and intermediate the ends of cross member 72. Elevator 66 is actuated by means comprising a piston 78 reciprocating in a cylinder 80 which latter communicates at either end with hydraulic lines 82 and 84 and is secured to horizontal framework member 86 in an upright position by means of studs 88. Solenoid control valves 90 and 92 (Figure 9) are provided for controlling the flow of fluid through lines 82 and 84 to and from the cylinder 80.

Fastened to an upright framework member 18, slightly above and to one side of the elevator actuating means, is a normally open limit switch 94 having pivotally connected thereto a link 96 which is positioned to effect the closure of the contacts of the limit switch by engaging elevator cross member 72 at the lower portion of the elevator's stroke through roller 98 rotatably secured to the free end of the link. A similar normally open limit switch 100 is mounted upon the underside of bed 12 adjacent the path of travel of elevator cross member 72. The contacts of switch 100 are closed as the elevator 66 reaches the upper portion of its stroke through the action of a pivotally mounted link 102 which engages the elevator cross member 72 through roller 104 rotatably secured to the free end of the link.

A stacked-carton conveyor 106, comprising an endless belt 108 trained at one end about idler roller 110 and passing through slot 112 in horizontal bed 12, is disposed adjacent the elevator 66 to be driven in rotation by means (not shown) in a direction from left to right as indicated in Figure 1. The conveyor 106 has a carton-carrying upper reach 114 substantially co-planar with the upper carton-supporting surface 24 of bed 12, and is aligned with the ram 22 in its path of reciprocating travel. An inverted channel member 116 serves to support the conveyor belt 108 which moves upon the upper surface 118 of the web 120 thereof. Roller 110 is fixedly secured to shaft 122 journaled in bushings 124 and 126. Bushing 124 is secured to flange 128 of channel member 116 and bushing 126 is secured to upright member 130, in turn secured to flange 132 of channel member 116. Guide rails 134 positioned horizontally at either side of the conveyor 116 are supported by upright members 136 secured to flanges 128 and 132 of channel member 116.

Positioned above the bed 12 in alignment with the path of up and down reciprocating movement of the elevator 66, is a carton-receiving hopper 138 which is comprised of horizontally disposed rails 140 and 142, which at their inner or rearward ends are secured to upright

framework member 144 and extend perpendicularly outward therefrom, being at their outer ends bent at right angles toward each other and respectively secured to central upright members 146 and 148. Rail 140 is further secured intermediate its extremities to curved upright member 150, and rail 142 is secured to upright member 152 and curved upright member 154. Central upright members 146 and 148 are secured at their lower ends to bed 12 and curve outwardly at their upper ends to facilitate receipt of cartons by the hopper 138. Upright member 150, offset outwardly at its upper end, is at its lower end secured to bed 12 and, as shown in Figure 2, curves backwardly at its upper end, being secured thereat to horizontal guide rail 156. Upright member 154 is secured to bracket 158, which latter is secured at its inner end to member 144. Member 154 is positioned opposite member 150 and, like the latter, is offset outwardly at its upper end. Upright member 154 is likewise backwardly curved at its upper end and is secured thereat to horizontal guide rail 160. Also secured to bracket 158 is the member 152 which extends upwardly therefrom, being secured at its upper extremity to member 154 and being provided with an outward offset at its upper end similar to those of members 150 and 154. The members 150, 152 and 154, offset at their upper ends and disposed about the hopper 138, define an enlarged upper entry or mouth for such hopper.

Photoelectric control means comprising a photocell 162 and a light source 164, respectively secured to framework members 144 and 166, are positioned adjacent the hopper 138 such that the path travelled by the light beam emitted by light source 164 in reaching photocell 162 traverses the hopper 138. The photoelectric control means, which provides the machine with a self-control feature, acts through a time delay relay 168 in controlling the machine operation.

A feed conveyor 170 is disposed adjacent the upper end of the hopper 138, the chain 172 of the conveyor being trained around sprocket 174 to be driven thereby. Sprocket 174 is secured to shaft 176 journaled in bushings 178 and 180, respectively, which latter are secured to upright members 166 and 130. Sprocket 182, and the shaft 176 to which it is fixedly secured, are driven in rotation by chain 184, trained around sprocket 182, and in turn drive in rotation sprocket 174 and conveyor chain 172 trained thereabout. Segments 186, preferably of rubber or of a material with similar gripping characteristics, are bonded to alternate links of chain 172 throughout its length to facilitate the carrying of cartons thereon. The chain 172 is guided in its rotation by a narrow channel member 188 secured to upright member 130 through use of brackets 190 and 192. Positioned at either side of the feed conveyor 170 are upright members 194 and 196 secured to brackets 190 and 192, and respectively carrying pairs of horizontally disposed guide rails 156 and 198, and 160 and 200. The rail 160 near its right end (Figure 1) is provided with an inwardly extending offset 202.

In operation, upright cartons 204 and 206, with cans 208 similarly upright therein, are fed by conveyor 170 from left to right in Figure 1, being maintained in upright condition by the horizontal guide rails 156, 198, 160 and 200 until reaching a position approximately that of carton 206. Here the upper forward portion of the carton is engaged by the offset 202 of rail 160, which exerts an upsetting moment upon the carton causing it to tumble from its upright position upon feed conveyor 170 to a position upon its side in the hopper 138. The upsetting of the carton is facilitated by the limited support offered thereto by the chain 172 and the channel 188. The position which such upset carton will assume in the hopper will of course depend upon the number of cartons stacked therein at the time. The carton may thus fall to the surface 24 of the bed 12, or atop another carton. However, in the course of normal

operation, the carton will drop from the conveyor upon its side atop other stacked cartons, rather than directly upon bed 12 because of the sequence of operation of the elevator 66 and ram 22 as described hereinafter. In falling into the hopper 138 the carton breaks the beam of the photoelectric control means momentarily, or for a substantial period of time, depending upon the position which it ultimately assumes in the carton stack. With the photoelectric control means positioned as shown in Figure 1, the light beam thereof is broken for a substantial period of time only by a fourth carton such as 210, side-stacked piggy-back atop three others in the hopper 138. Any carton falling to a position therebelow such as that of carton 212, effects only momentary interruption of the beam. From the description of the machine operation set forth hereinafter, it will be appreciated that such a position for the photoelectric control means is essential to assure that the machine will operate at all times to effect the stacking of cartons in pairs, with automatic machine shut-off, should two stacked cartons not be available for positioning by the elevator adjacent the ram.

To prevent momentary energizing and de-energizing of the control system as a result of momentary interruption of the beam of the photoelectric control means, the relay 168 (Figure 9), incorporating a time delay feature, is provided. The solenoid 168a of the time delay relay 168 is connected in series with the photocell 162 and is energized to break the circuit through such relay by holding the moving contact 168b of the relay open when the beam of the photoelectric control means is maintained. As shown in Figure 9, this relay at one terminal is connected directly to electrical line L1 and at the other terminal is series connected to parallel circuits comprised of ram and elevator actuating valves and associated limit switches, and thus said relay controls the energizing of the control system in response to the photoelectric control means.

For the purpose of describing the sequence of machine operation, the condition of Figure 5 is initially assumed with three cartons stacked atop one another upon surface 24 of bed 12, the elevator 66 being in retracted position slightly below the surface 24 of bed 12 and the ram 22 being retracted to the far left. In this condition, limit switch 94 is closed and limit switch 48 is positioned to effect series connection of the control solenoid 38a for ram actuating valve 38 with time delay relay 168 and electrical line L2. The control solenoid 92a of elevator actuating valve 92 is series connected with time delay relay 168 through limit switch 42. Limit switch 100, which is connected in series with the control solenoid 40a of ram actuating valve 40, is open. The positions of limit switches 42 and 94, it may be noted, are the reverse of the normal positions for these switches shown in Figure 9.

With the stacking of a fourth carton 210 atop three others, as shown in Figure 6, the beam of the photoelectric control means is broken, effecting closure of the movable contact 168b of time delay relay 168 by de-energizing the relay solenoid 168a. The control solenoid 38a for ram-actuating valve 38 is thereby energized, causing the valve 38 to effect connection of line 34 to a pressurized hydraulic fluid supply line (not shown) and connection of line 36 to a return line (not shown). Fluid flowing into cylinder 30 through line 34 causes piston 28 and ram 22 connected thereto to extend to the right. The ram 22 engages the lower pair of piggy-back-stacked cartons 214 and 216, with its face plate 58 squarely abutting the aft ends thereof. The cartons are thereupon moved by ram 22 to the right, as indicated in Figure 6, to pass over the retracted elevator 66 and the slots 74 therefor in bed 12 and beneath bracket 158 and the lower ends of the uprights 152 and 154 secured thereto. The uprights, and the brackets to which they are secured, serve to prevent cartons 210 and 212, and such other cartons

as may be stacked above, from moving with the lower pair of cartons 214 and 216, in effect permitting the ram 22 to shear such lower pair of cartons from cartons stacked above in the hopper 138. The web member 52 of the ram 22 is disposed to clear bracket 158 and the lower surface of the third stacked carton 212, permitting ram 22 to move cartons 214 and 216 to the right beneath carton 212. The web member 52, however, maintains the cartons 210 and 212 in elevated position as the ram moves the pair of stacked cartons to the right. This prevents the top carton 210 from dropping from its beam-interrupting position of Figure 6 with a consequent breaking of the valve control circuits through the actuation of the time delay relay 168. Only after moving, relatively, to a position approximately midway of the length of cartons 214 and 216, does the third carton 212 contact the upper surface of the ram web member 52, tilting downwardly thereon, eventually to be substantially supported by such member as shown in Figure 6. As the pair of piggy-back-stacked cartons 214 and 216 move past the right-hand edge of slot 112 of bed 12, they are engaged by the stacked-carton conveyor 106 which operates with its carton-carrying upper reach 114 moving from left to right (Figure 6). The piggy-back-stacked cartons are thereupon carried by the conveyor down the line for packing, as by a tray packer (not shown) or for other disposition.

As the ram 22 approaches its fully extended position, having pushed cartons 214 and 216 substantially past the right-hand edge of slot 112, the projection 64 of rod 62 engages plunger 50 of limit switch 48. Limit switch 48 is caused thereby to reverse its position, effecting closure of valve 38 to the flow of fluid therethrough from hydraulic lines 34 and 36 by deenergizing the control solenoid 38a for the ram actuating valve 38 by way of breaking its connection with electrical line L2. Limit switch 48 at the same time energizes the control solenoid 90a for elevator actuating valve 90, connecting it with electrical line L2. With the energizing of the control solenoid 90a, valve 90 connects hydraulic line 84 to a pressurized hydraulic fluid supply line (not shown) and hydraulic line 82 to a return line (not shown). Hydraulic fluid is thereby admitted through line 84 to cylinder 80 causing the piston 78 and the elevator connected thereto to move upward, the plates 68 of elevator 66 moving through the slots 74 in bed 12 to engage the underside of carton 212. The cartons 210 and 212 are thereby maintained by elevator 66 in an elevated position clear of ram 22 as the latter retracts, as explained below, between the plates 68 of the elevator 66.

With the raising of elevator 66 to the extended position, closure of limit switch 100 is effected through engagement of link 102 and its roller 104 with elevator cross member 72. This energizes the control solenoid 40a of ram actuating valve 40, the limit switch 42 effecting connection between the control solenoid 40a and the time delay relay 168 when the ram 22 is in a non-retracted position. With energizing of the control solenoid 40a, the ram actuating valve 40 effects connection of hydraulic line 36 to a pressurized hydraulic fluid supply line (not shown) and connection of hydraulic line 34 to a return line (not shown), resulting in the admission of fluid to cylinder 30 through line 36. The piston 28 and the ram 22 connected thereto are forced to retract to the left as shown in Figures 7 and 8 between the upraised plates 68 of elevator 66 and beneath the cartons 210 and 212 maintained in elevated position by the elevator 66. With the start of retraction of ram 22, the limit switch 48 is caused to reassume its normal position effecting closure of valve 90 to the fluid flow of hydraulic lines 82 and 84 by de-energizing the control solenoid 90a through disconnection thereof from electrical line L2. As the ram 22 approaches its fully retracted position, rod 60 is caused to engage the plunger 44 of limit switch 42, effecting reversal of the switch and the de-energizing of

the control solenoid 40a for the ram actuating valve 40 by breaking the connection thereof to time delay relay 168. With deenergizing of its control solenoid 40a, the valve 40 is closed to the flow of fluid through hydraulic lines 34 and 36. Limit switch 42 at the same time effects the energizing of the control solenoid 92a for elevator actuating valve 92 by connection thereof to time delay relay 168. With energizing of the control solenoid 92a, valve 92 effects connection of line 82 to a pressurized hydraulic fluid supply line (not shown) and connection of line 84 to a return line (not shown), resulting in admission of fluid to cylinder 80 to move piston 78 and elevator 66, connected thereto, downward. The cartons 210 and 212 carried by elevator 66 are thereby lowered onto the surface 24 of bed 12 adjacent ram 22 to the right, ready for the start of another cycle.

It will be observed in Figure 8 that the carton 206 and others following it into the hopper, maintain interruption of the beam of the photoelectric control means as the elevator lowers the cartons 210 and 212 to bed 12. This of course prevents stoppage of the machine which would otherwise occur were the beam of the photoelectric control means not so interrupted.

It will be appreciated that the embodiment of this invention described above may be altered, changed or modified without departing from the spirit or scope of the invention as herein claimed. Thus, the machine may easily be adapted to stack cartons in various numbers atop one another by varying the elevation of the photoelectric control means relative to the hopper and by changing the dimensions of the ram and elevator and the clearances for the reciprocating travel thereof. Provision may similarly be made for handling cartons of various shapes and sizes. Further, this invention is not necessarily limited to a machine for receiving single cartons in upright condition to be individually side-stacked piggy-back fashion, but is equally useful for receiving cartons in various multiples and dispositions to be stacked atop one another in units of two or more.

What is claimed is:

1. A handling and transfer system for the automatic handling, re-orienting, and grouping of loaded six-sided cartons, whereby said cartons may be changed from a first condition of single file positional movement in which they are supported with corresponding sides undermost and horizontally disposed to a second condition of positional movement in which they are disposed in stacks of two or more with said corresponding sides being then vertically disposed and co-planar, said system comprising a first conveyor having a horizontally disposed portion, a second conveyor having a horizontally disposed portion, said second conveyor portion being disposed at a substantially lower level than said first conveyor portion, and transfer means for effecting the change of said cartons from said first condition of positional movement to said second condition of positional movement, said transfer means comprising: means adapted to extend in a lateral direction across the path of travel of said cartons on the horizontally disposed portion of said first conveyor to urge said cartons horizontally transversely of said first conveyor portion and for tipping said cartons through a 90° angle to leave said conveyor portion; platform support means disposed at the level of said second conveyor portion and positioned to receive said cartons as they drop downwardly from said first conveyor portion; vertically disposed chute-defining guide means operable to maintain the cartons in the attitude in which they leave said first conveyor portion and to stack said cartons in vertical alignment on said platform support means; reciprocally movable pusher means mounted for movement transversely of said platform support means and operable to push a given plurality of said stacked cartons, including the lowermost carton, off of said platform support means and onto said second conveyor portion; and reciprocally movable carton support means mounted for up and down

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movement relative to said platform means operable when moved upwardly to support the remainder of said stacked cartons during operation of said pusher means and operable when moved downwardly to deposit the remainder of said stacked cartons on said platform support means.

2. A handling and transfer system for the handling, re-orienting, and grouping of loaded cartons, whereby said cartons may be changed from a first condition of movement as separated units to a second condition of movement as groups of stacked units, said system comprising a first conveyor, a second conveyor, the latter being disposed at a substantially lower level than the former, and transfer means for effecting transfer of said cartons from said first condition to said second condition of movement, said transfer means comprising: means adapted to extend in a lateral direction across the path of travel of said cartons on said first conveyor to move said cartons off of said first conveyor; platform support means disposed adjacent said second conveyor and positioned to receive said cartons as they drop downwardly from said

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first conveyor chute-defining guide means operable to guide said cartons between conveyor levels and to stack said cartons on said platform support means; reciprocally movable pusher means mounted for movement transversely of said platform means and operable to move a given plurality of said stacked cartons, including the lowermost carton, off of said platform support means and onto said second conveyor; and reciprocally movable carton support means mounted for up and down movement relative to said platform means operable when moved upwardly to support the remainder of said stacked cartons during operation of said pusher means and operable when moved downwardly to deposit the remainder of said stacked cartons on said platform support means.

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