Feb. 25, 1969 L. A. PAUL ET AL 3,429,459

PALLETIZER

Filed Oct. 21, 1966

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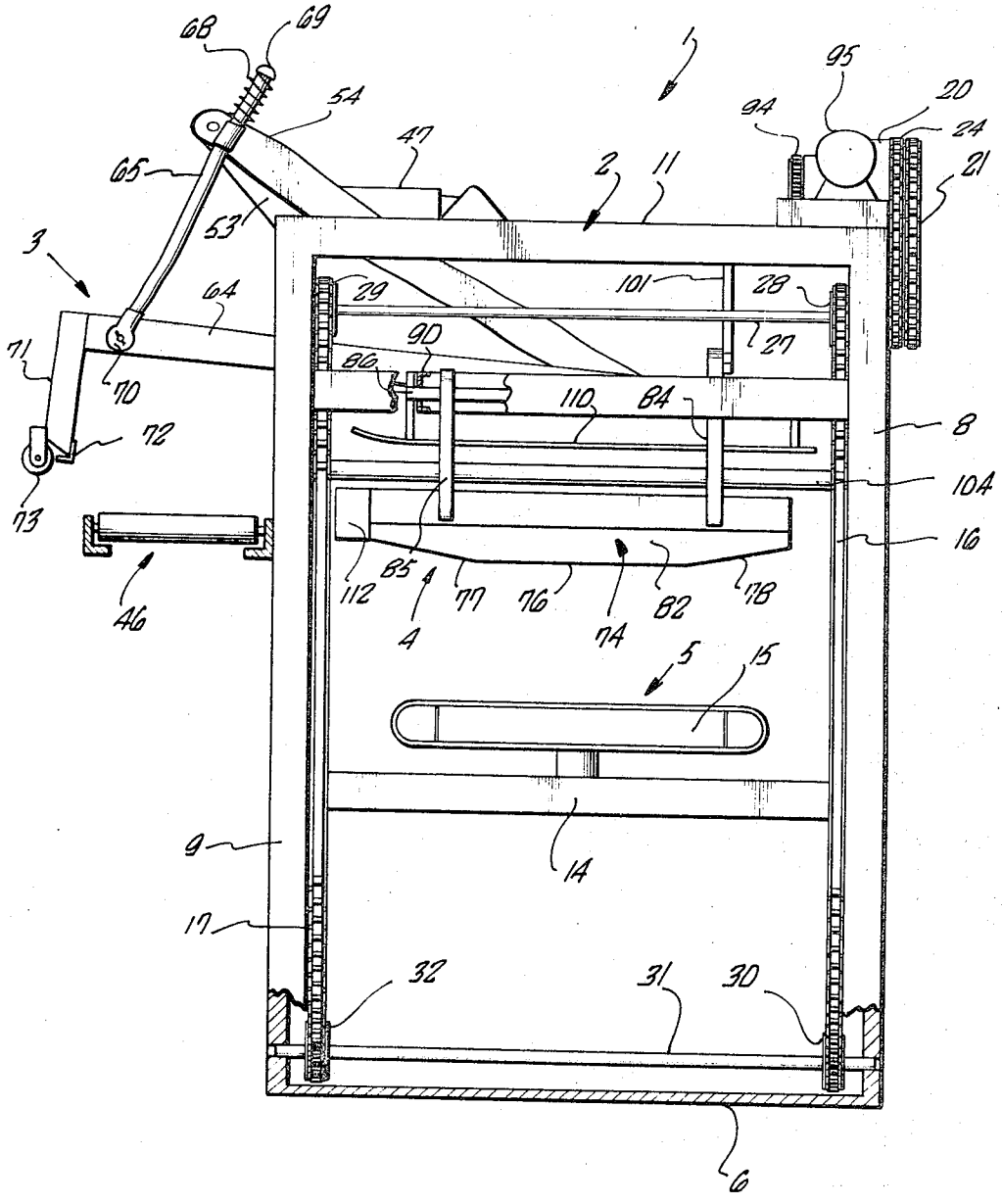



FIG. 1

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Feb. 25, 1969 L. A. PAUL ET AL 3,429,459

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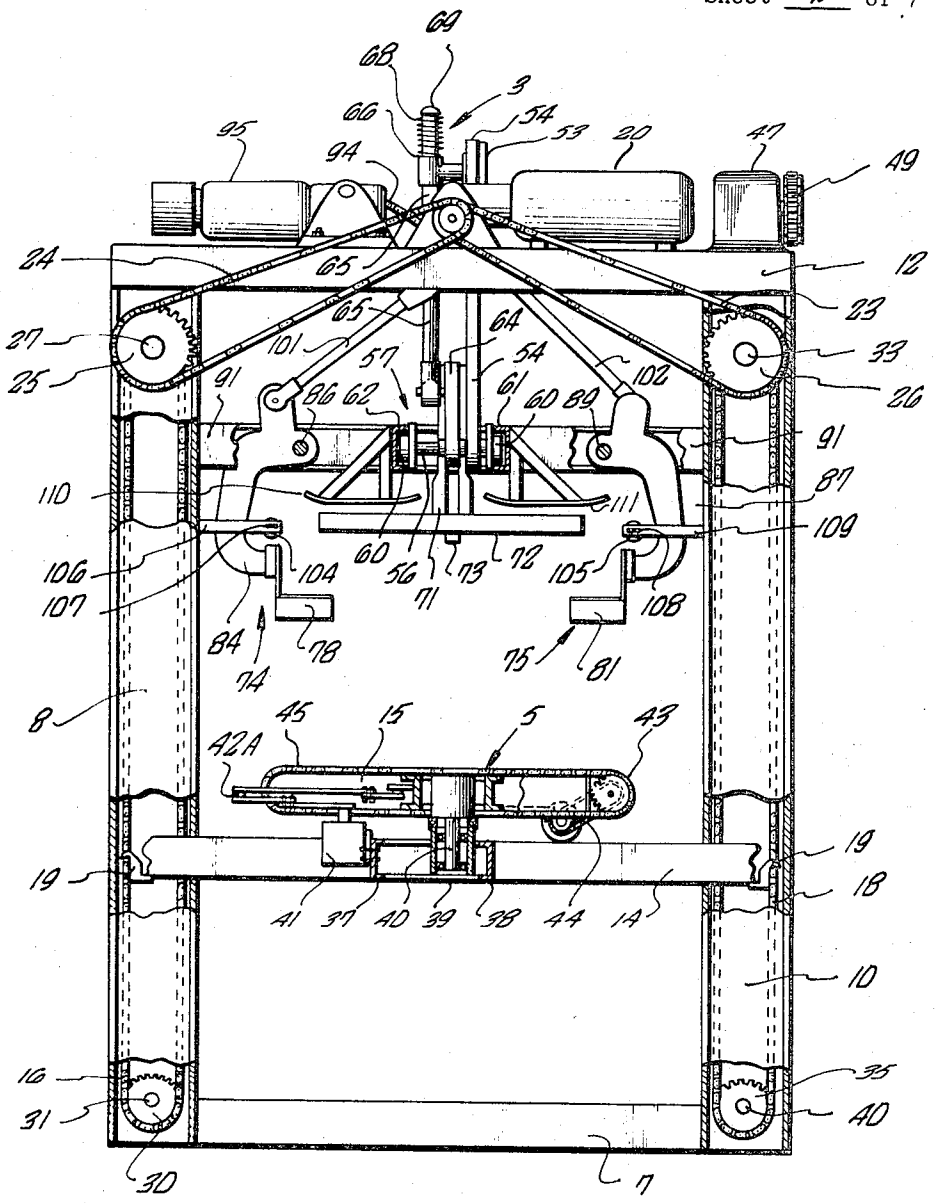



FIG. 2

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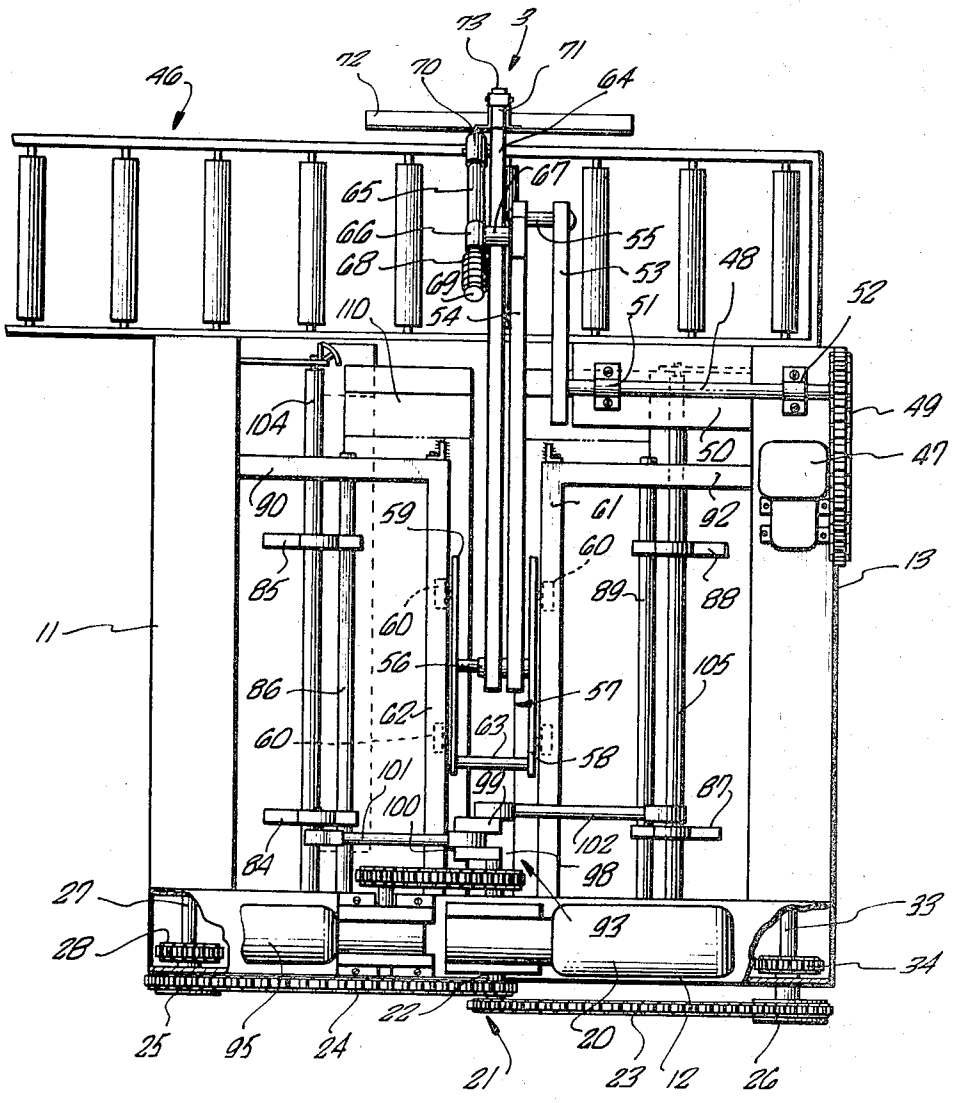



FIG. 3

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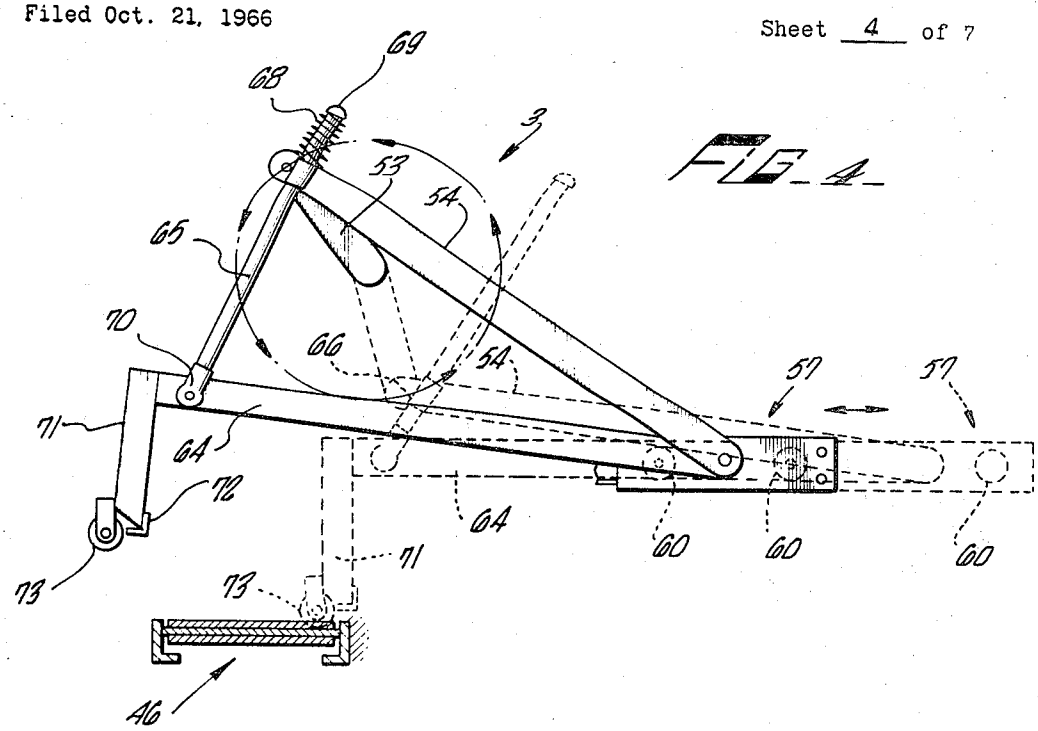



FIG. 4

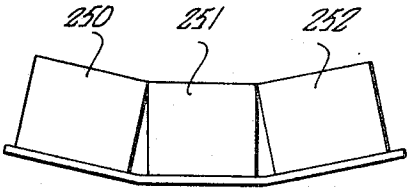



FIG. 9

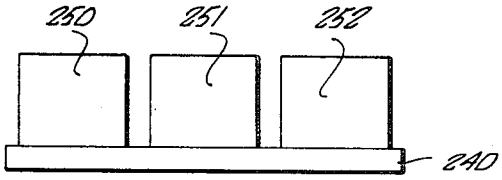



FIG. 10

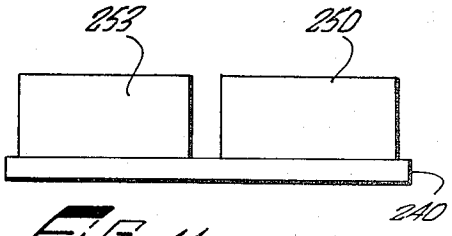



FIG. 11

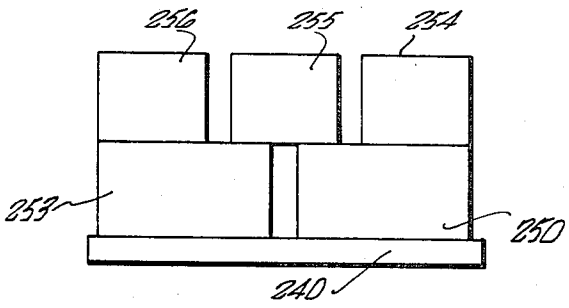



FIG. 8

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Feb. 25, 1969 L. A. PAUL ET AL 3,429,459

PALLETIZER

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FIG. 1

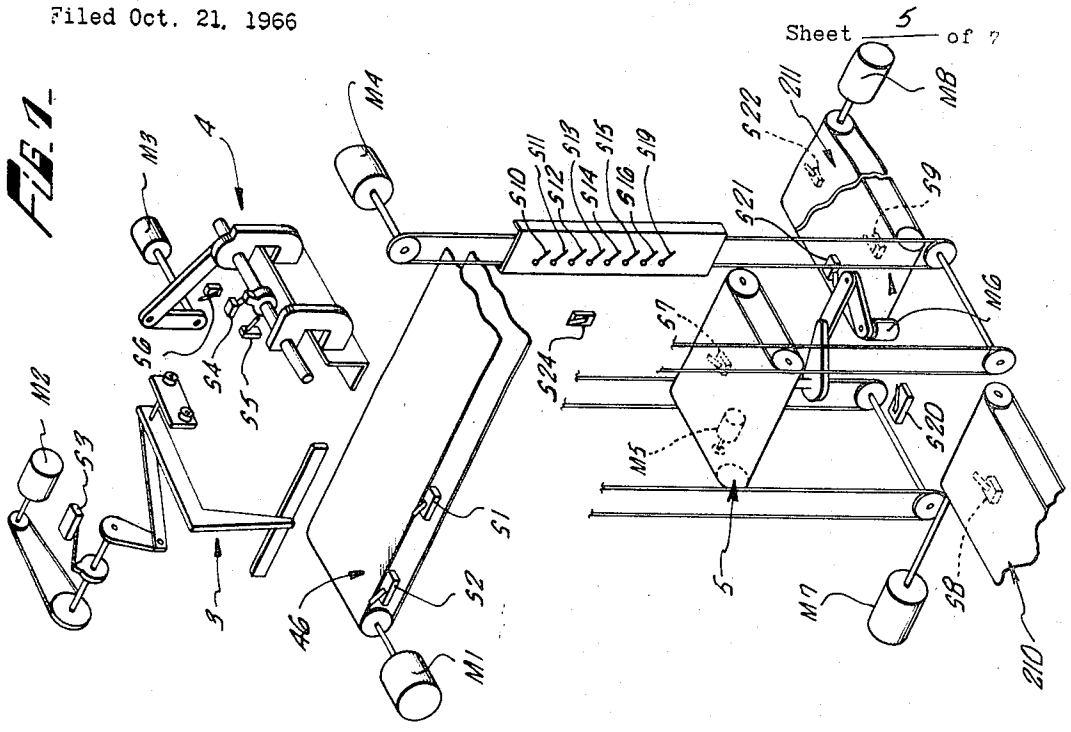
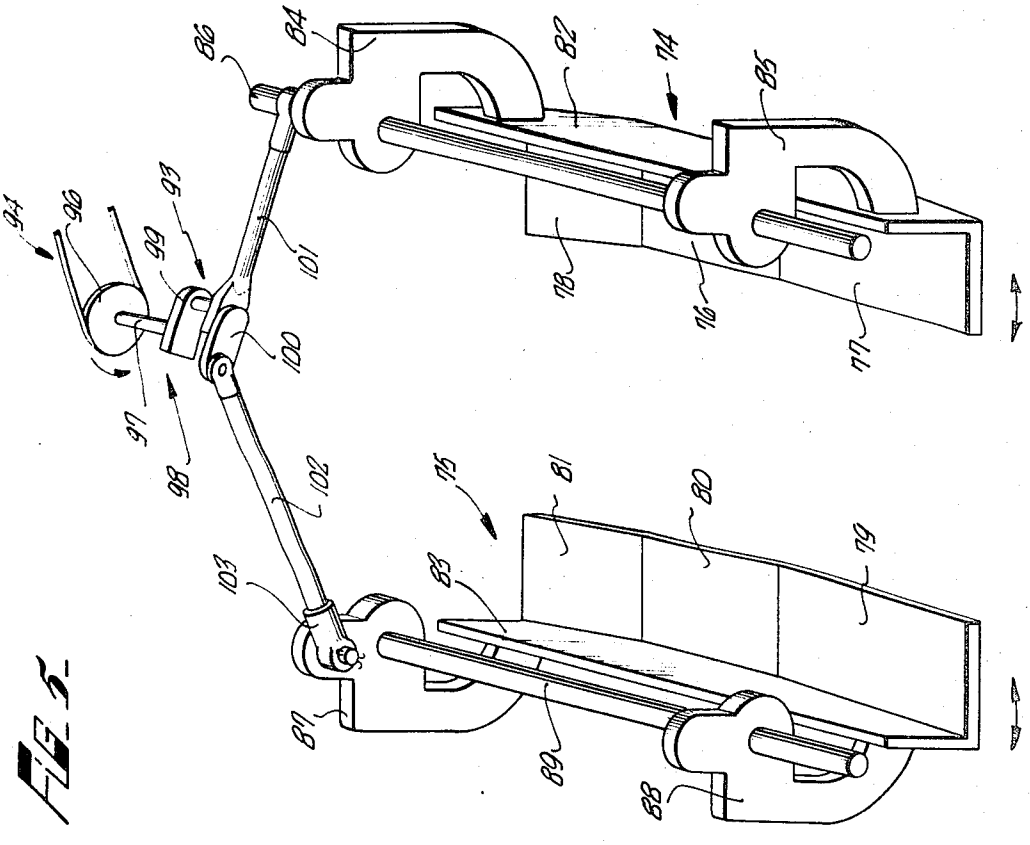



FIG. 2



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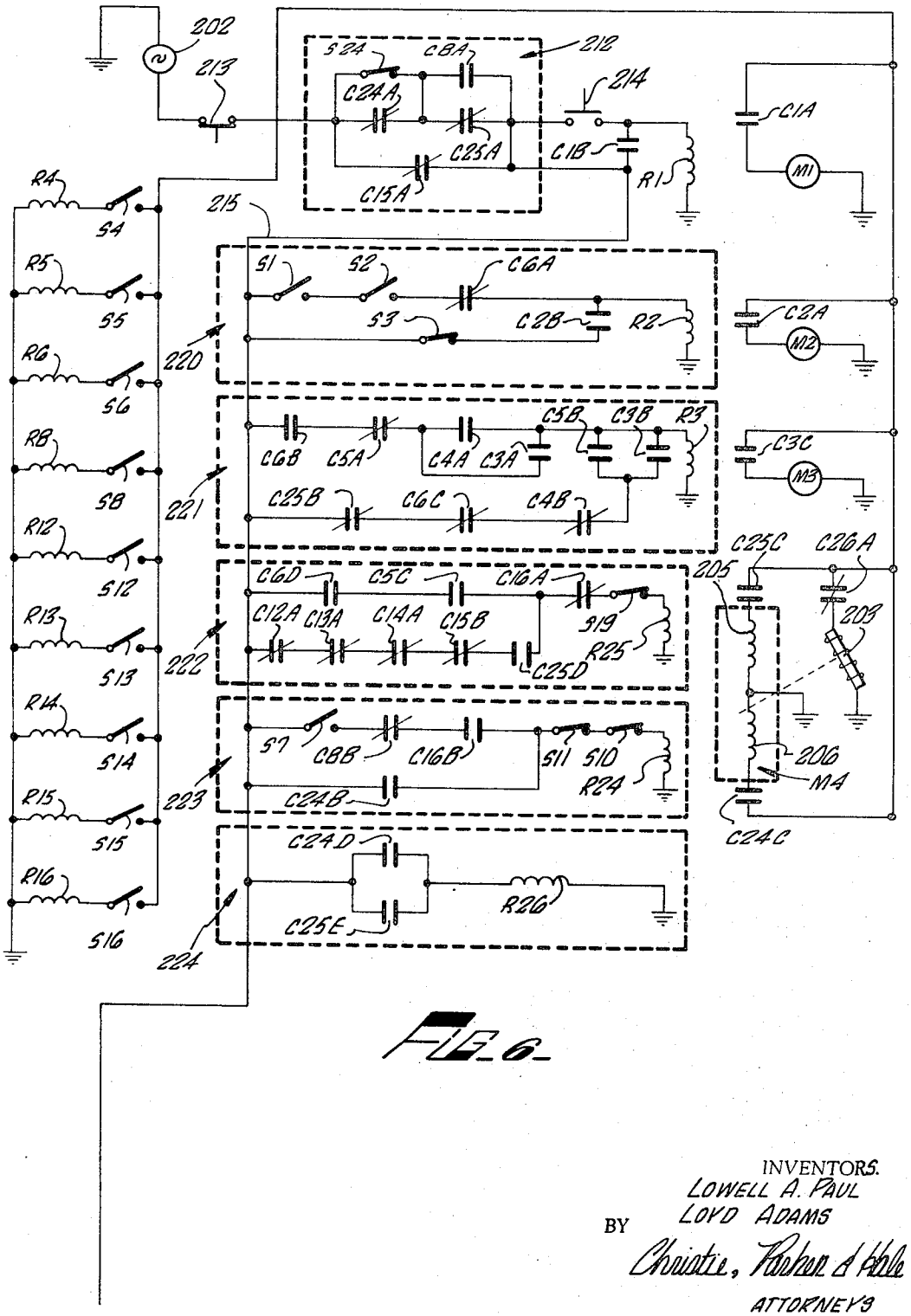



FIG. 6

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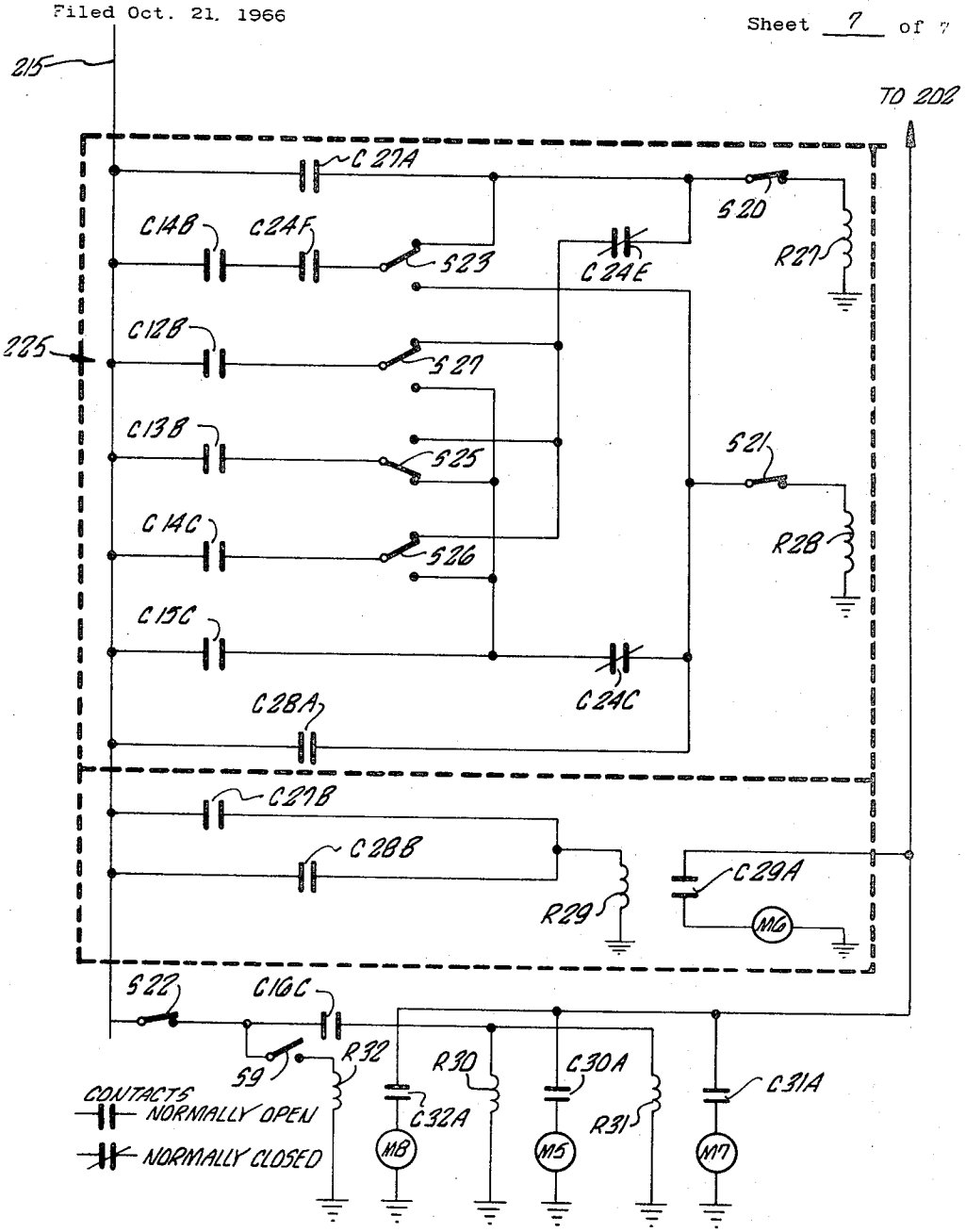



FIG. 6A

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United States Patent Office 3,429,459
Patented Feb. 25, 1969



3,429,459

# PALLETIZER

Lowell A. Paul and Loyd Adams, Pasadena, Calif., assignors to Dakon-Adams Co., Los Angeles, Calif., a partnership

Filed Oct. 21, 1966, Ser. No. 588,494
U.S. Cl. 214—6 27 Claims
Int. Cl. B65g 57/00

## ABSTRACT OF THE DISCLOSURE

The palletizer has a rake operable in an arcuate path to sweep tandemly aligned pairs of cartons into two opposed racks. Each rack has a back and three carton carrying sections. Each of the carton carrying sections is at a slight angle to its adjoining section such that juxtaposed cartons have their upper lateral edges in contact and their lower proximate edges spaced apart. The backs of the racks maintain tandem pairs of cartons in abutting relationship. When a full load of three tandem pairs of cartons is in the racks, the racks open to release the cartons onto a pallet on a turntable. A space for refrigerant is developed between released juxtaposed cartons and tandem carton pairs because of the angle between carton carrying sections and the separation of the cartons of carton pairs caused by the retracting racks. The amount of separation between tandemly aligned cartons is controlled by carton positioning members. Alternate layers of cartons are rotated 90° with respect to each other to develop a locked stack. Means are provided to lower the turntable after each successive loading of cartons. Means are also provided to supply at predetermined times unloaded pallets to the turntable and to remove fully loaded pallets therefrom. Safety means prevent palletizer operation unless the proper sequence of operation is being followed.

This invention relates to the art of material handling and in particular to an improved apparatus for unloading cartons from a conveyor to pallets.

In the handling of cartoned materials, it is often necessary to transfer cartons from one location to another as well as from one elevation to another. This transfer may occasion the stacking of cartons onto a pallet for ease of storage, shipment or further handling. In many applications cartons are placed on an endless conveyor for horizontal relocation with each carton being removed and placed on a pallet at the end of the conveyor. A typical array of cartons on a loaded pallet finds cartons stacked in layers with each horizontal layer having several side-by-side cartons.

A device for removing cartons from an endless conveyor and for stacking them on a pallet in such an array is known as a palletizer. These machines must have the ability to load pallets continuously, reliably and accurately with stacked layers of cartons in proper horizontal position. Unfortunately, the palletizers heretofore employed are marked by their complicated structure and concomitant expense and have little flexibility for special handling requirements.

One such handling requirement is in palletizing cartoned citrus or other perishables. When transported for any appreciable distance or stored for a relatively long



period, these perishables must be refrigerated. However, effective refrigeration of closely packed cartons on pallets is very difficult. Thus space must be left between individual cartons for the passage of cold air in order to avoid spoilage. Heretofore, the required spacing has been provided primarily through arduous hand stacking which is not only time consuming but expensive. Even with such hand developed spacing, stacking must normally be done in such a manner as to result in an interlocked stack, that is, one which resists toppling.

The instant invention provides a simple, rugged and relatively inexpensive palletizer which can be used to develop a pallet stack to suit a broad range of requirements, such as an interlocked stack having spaces between individual cartons for the passage of a refrigerant such as refrigerated air.

Briefly, the invention comprises a palletizer of the type used in unloading tandemly aligned cartons from activated rollers or endless belt type conveyors. A pair of cartons at a time is removed from the conveyor by an unloading assembly onto a pair of receiving racks. These racks are spaced apart from each other and have the facility for movement toward and away from each other. When in closest proximity, the racks are capable of receiving cartons from the unloading assembly and holding them above a pallet. When drawn apart, the racks are capable of releasing cartons onto a pallet. The racks are disposed such that each carton of a pair of tandemly aligned cartons swept from the conveyor is supported along its bottom by one of the racks and by its complementary carton at an abutting surface. That is, two tandemly aligned cartons are positioned on the racks with their proximate surfaces in contact, and with the racks used to maintain this contact. The racks support the bottom rear portion of each carton. Means are also employed, such as drive motors, chain-sprockets, and crank combinations, to operate the unloading assembly and the racks.

In preferred form each rack has at least two carton supporting sections with each section slightly inclined with respect to an adjoining section. When more than one pair of cartons is carried by the racks, each carton supported by one rack will be at a slight angle to its neighbor resulting in the upper lateral edges of adjoining cartons being in contact while a space is present at their lower proximate edges. Upon release of the cartons onto a pallet from the racks, this space will remain because the cartons will pivot along their lower proximate edges. The space can be used for the passage of refrigerated air, or for enhancing the vertical stability of a stack. Preferably, the racks are adapted to swing away from each other in a curved path for the loading of pallets. Upon this movement, the lower front edges of each of a pair of tandemly disposed cartons will contact the pallet first while their rear edges are still being carried by the moving racks. This effect tends to key such cartons and to develop a space between them which, as before, can be used for a refrigerant or to increase stability.

The preferred loading assembly comprises a crank operated pitman assembly consisting of an upper and lower arm connected to a truck at a common point and tied together through a link pivotally connected to the lower arm and slidably connected to the upper arm. The upper arm is driven by the crank. The truck is carried by

the frame and is capable of horizontal translational movement produced by the action of the arms bearing against it as the crank revolves. The lower arm supports an unloading rake which is parallel to the line of movement of cartons on a conveyor. As the crank rotates, the rake will describe an arcuate path sweeping a pair of cartons into the racks, lifting over the placed cartons, and sweeping a subsequent pair into the racks which pushes the first pair away from the conveyor along the racks.

In order to achieve a locked stack, use is preferably made of a turntable and car combination such as is described in U.S. Patent No. 3,233,763 to Lowell A. Paul et al. Briefly, this combination comprises a turntable carried by a car which in turn is supported by a plurality of chains in a frame structure. The car-turntable combination can be elevated in the structure for the proper positioning of a pallet carried by the turntable. The turntable has the facility for 90 degrees rotation with respect to the car and frame. This rotation is used in a preferred form of this invention to position adjoining layers of stacked cartons 90 degrees with respect to each other to produce a locked stack.

A preferred embodiment of the invention embraces a palletizing system with means to automatically control the palletizer with respect to the adjuncts of the system. The system includes a conveyor for feeding empty pallets to the turntable assembly and a conveyor for unloading loaded pallets from the turntable assembly. Means are provided for automatically rotating the turntable between loadings thereof by the rack assembly to develop a locked stack. Means are also used to automatically feed cartons to the unloading assembly and to the rack assembly. Preferably, controls are provided for the proper sequencing of the system's operation.

The instant invention, including its preferred embodiments, offers many advantages over the prior art. One of these advantages resides in its ability to develop a pallet stack with lateral spaces between adjoining cartons to enhance the circulation of a coolant as well as contributing to vertical stack stability. This is accomplished by the inclination of carton supporting sections of the racks as well as the manner for releasing carried cartons by rotating the racks away from each other. In addition, when means are employed to achieve a 90 degree layer-to-layer displacement, an interlock stack is the result. Moreover, these advantages are produced by a simple, automatically controlled, rugged and highly efficient palletizer which can be adapted for producing a closely packed stack, as well as the spaced stack, when required.

These and other features, aspects and advantages of the instant invention will become more apparent from the following description, appended claims and drawings, in which:

FIGURE 1 is a side elevation of the apparatus of the instant invention;

FIGURE 2 is a rear elevation, partly in section, of the apparatus shown in FIGURE 1;

FIGURE 3 is a top plan view of the apparatus shown in FIGURES 1 and 2;

FIGURE 4 is a partial schematic view of the carton loader assembly shown in FIGURES 1 through 3 showing its movement;

FIGURE 5 is a partial perspective of the loading racks of the instant invention;

FIGURES 6 and 6A show schematically the electrical circuitry of the instant invention; and

FIGURE 7 is a schematic depiction of a palletizing system of the instant invention.

FIGURES 8 through 11 are diagrammatic illustrations of a typical carton loading sequence using the apparatus of the instant invention.

Referring now to FIGURES 1 through 3, the improved palletizer **1** generally consists of a frame **2**, a loading assembly **3**, a loading rack assembly **4** and a turntable assembly **5**.

Frame **2** provides for the mounting and positioning of loading assembly **3**, loading rack assembly **4** and turntable assembly **5**, as well as attendant driving and control apparatus. In general, the frame compries a base formed of four beams or members **6**, **7**, and two complementary base beams (not shown) connected in a rectangular array. Urights **8**, **9** and **10**, as well as a fourth upright which is not shown, are connected to the base beam at the corners of the rectangle. The upper portion of frame **2** has horizontal beams **11**, **12** and **13** connected to the uprights to form a rigid box-like structure. A partially open side is provided at the top of frame **2** between parallel beams **11** and **13** for the proper receipt and travel of loading assembly **3**.

Turntable assembly **5** is carried by frame **2** for vertical movement toward and away from loading rack assembly **4**. The turntable assembly preferably is of the type described in U.S. Patent 3,233,763 to Lowell A. Paul et al. In general, the assembly comprises a car **14** which carries a turntable **15**. Turntable **15** is capable of 90 degree rotation back and forth between two positions to provide a convenient means for interlocking stacks of cartons on a pallet located on the turntable, as well as for convenience of removing palletized cartons.

Endless chains **16**, **17** and **18**, as well as a fourth complementary chain (not shown) carry turntable assembly **5** in frame **2**. Lugs **19** connected to car **14** and engaged in the links of the chain provide the carriage. Motor and gear reducer **20** drive the endless chains. Sprockets **21** are driven by motor and gear reducer **20** through shaft **22**. Driving chains **23** and **24** are driven by sprockets **21**. These chains drive sprockets **25** and **26**. Sprocket **25** is secured to shaft **27** which is journaled in frame **2** in complementary uprights **8** and **9**. A pair of sprockets **28** and **29** are secured to shaft **27**. Sprocket **28** drives endless chain **16** which in turn is engaged with idler sprocket **30**. Idler sprocket **30** is mounted on shaft **31** at the base of frame **2**. Similarly, endless chain **17** is driven by sprocket **29** and is engaged in idler sprocket **32** which is mounted on shaft **31**. One of the sprockets **21**, as well, drives chain **23** which in turn drives a driven sprocket **26** secured to a shaft **33**. Shaft **33** is journaled in upright **10** as well as in a complementary upright (not shown). Shaft **33** drives a driven sprocket **34** which in turn drives endless chain **18**. Endless chain **18** is idled around idler sprocket **35** on a transverse shaft **36**. A similar driven chain arrangement is located on the complementary upright (not shown) and is driven by shaft **33**. Thus, turntable assembly **5** is raised and lowered through connection with four endless chains which are all driven by motor and gear reducer **20**.

Turntable assembly **5** will now be described in greater detail with specific reference to FIGURE 2. Car **14** has a pair of transverse braces **37** and **38**. Housing **39** is centrally disposed in car **14**. Shaft **40** is journaled in housing **39**. Turntable **15** is held above car **14** by shaft **40**. Motor **41** is held on brace **37**. Crank **42** is driven by motor **41** on rotation and has a crank pin **42A** engaged with turntable **15** for 90 degree rotation of the latter back and forth between two positions. Turntable **15** has an endless belt **43**. Endless belt **43** is driven through turntable endless belt drive **44**, which consists of a motor and an endless belt or chain which drives endless chain **45** and, in turn, endless belt **43**.

*Loading assembly*

The loading assembly **3** cooperates with energized conveyor **46** to unload tandemly aligned cartons into the loading rack assembly **4**. As seen in FIGURE 3, loading assembly drive motor and gear reducer **47** is in power communication with shaft **48** through sprocket and chain assembly **49**. Sprocket and chain assembly **49** has a sprocket driven by motor **47** which drives a chain engaged with a second sprocket connected to shaft **48**. Shaft **48** is rotatably secured on upper horizontal channel **50**

of frame 2 by journals 51 and 52. Driving crank 53 is secured to shaft 48 for rotation therewith. Upper arm 54 is pivotally mounted through crank pin 55 to crank 53 at one of its ends and to truck pivot shaft 56 (FIGURE 3) at its other end. Truck pivot shaft 56 is held in truck 57 in its vertically disposed side plates 58 and 59. A plurality of wheels 60 are rotatably engaged to the side plates 58 and 59. These wheels track in the recesses of channels 61 and 62 of frame 2. Cross brace 63 provides structural integrity for the truck 57 by rigidly connecting side plates 58 and 59. Lower arm 64 of loading assembly 3 is pivotally connected to truck pivot shaft 56 at one of its ends and slidably connected to upper arm 54 through connecting link 65 at its other end. Connecting link 65 is slidably received in sleeve 66 which is attached to upper arm 54 through pin 67. Compression spring 68 is restrained by keeper 69 at the top of connecting link 65 and by sleeve 66 at its other end. Compression spring 68 serves to maintain the proper position of lower arm 64 with respect to upper arm 54 and the energized rollers 46. Connecting link 65 is rotatably connected to lower arm 64 through pivot pin 70. Rake support member 71 is connected to lower arm 64 at the latter's free end. Horizontally disposed rake 72 is attached to rake support member 71 and serves to sweep cartons from energized roller 46 to loading rack assembly 4. Roller 73 is connected to rake supported member 71 for rolling contact with a plate (not shown) transversely mounted in the bed of energized roller assembly 46. The rolling contact between roller 73 and the plate during a portion of the arcuate path of rake 72 maintains the lower arm 64 and its carried members horizontal as the rake 72 moves towards rack assembly 4.

The kinematics of the loading assembly 3 is illustrated with the aid of a solid and phantom line schematic FIGURE 4. The loading assembly 3 describes an arcuate closed path with each revolution of driving crank 53. As the crank 53 begins to rotate downward to its position shown in phantom, lower arm 64 begins to depress. At a point in this depression, roller 73 contacts the plate disposed in roller assembly 46. The plate maintains lower arm 64 substantially horizontal until crank 53 begins to move up. While arm 64 is traversing its horizontal path, upper arm 54 closes the distance between the two arms by virtue of movement of connecting link 65 in sleeve 66. Connecting link 65, being slidably received in sleeve 66, allows free horizontal movement of lower arm 64. As the upper arm 54 moves in response to crank 53, it forces truck 57 to translate horizontally within channels 61 and 62. Inasmuch as lower arm 64 follows the movement of truck 57, the rake 72 crosses the energized rollers 46 to remove cartons into the carton receiving rack assembly 4.

Further movement of the crank 53 beyond the position shown in phantom rapidly raises upper arm 54. As upward movement of arm 54 progresses, the distance between it and lower arm 64 increases to a point where compression spring 68 urges against keeper 69. At this point, lower arm 64 begins to rise above the cartons deposited in loading rack assembly 4. Thus, the arcuate path described by the lower arm 64 and its dependent rake 72 has a lower, approximately horizontal component, an upward vertical component which is produced when connecting link 65 is picked up by compression spring 68, and a downward vertical component when crank 53 is lowering.

*Rack assembly*

As best seen in FIGURE 5 the rack assembly 4 has a pair of face-to-face carton receiving racks 74 and 75. Each of these racks has a plurality of carton receiving sections disposed to support adjacent cartons such that a slight space is developed between adjacent bottom edges and contact exists along adjacent top edges. Thus, rack 74 has a central horizontal carton receiving section 76 between two end carton receiving sections 77 and 78 which flare slightly upward from the intermediate section 76. Similarly, rack 75 has a first carton receiving section 79 disposed at a slight upward angle to the intermediate carton receiving section 80 and an end or third carton receiving section 81 which is also disposed at a slight angle to section 80. Racks 74 and 75 have backs 82 and 83, respectively, to provide structural rigidity, carton backing and a convenient anchor for the rack crank arms. Rack 74 is secured to a pair of rack crank arms 84 and 85. Each of these arms is in turn secured to rack drive shaft 86. Rack 75, similarly, has a pair of cranks 87 and 88 secured to rack drive shaft 89. Rack drive shaft 86 is journaled in horizontal braces 90 and 91 of frame 2, and rack drive shaft 89 is journaled in horizontal braces 91 and 92 of frame 2. As illustrated in FIGURES 2 and 5, each rack is disposed relative to the other to define an opening between them. In addition, the racks are capable of movement away from each other to swing clear of cartons being loaded on turntable assembly 5. When receiving cartons from loading assembly 3, however, the racks are in the position shown in FIGURE 2, that is, with their carton receiving sections in position to cooperatively receive and support cartons with a space between the racks.

Rack movement is accomplished by rack drive assembly 93. Rack drive assembly 93 is driven through a drive sprocket and chain 94 powered by rack drive motor and gear reducer 95. As seen in FIGURE 5, sprocket 96 forms a part of rack drive sprocket and chain assembly 94 and is keyed to drive shaft 97. Drive shaft 97 is journaled in beam 12 and drives rack crankshaft 98. The crankshaft 98 has a pair of crank throws 99 and 100. Connecting rod 101 is journaled between crank throws 99 and 100 and is connected at its other end to rack crank arm 84. Connecting rod 102 is journaled on throw 100 and is pivotally connected at pin 103 to rack crank arm 87 of rack 75. Thus, rack 75 through its crank 87, and rack 74 through its crank 84, are capable of simultaneous reciprocal movement towards and away from each other.

Back-to-back positioning of cartons in rack assembly 4 is produced by carton backing bars 104 and 105. Backing bar 104 is adjustably secured to bracket 106 in slot 107. Bracket 106 is secured to upright 8. A complementary mounting bracket (not shown) furnishes support for the other end of backing bar 104. In like manner, backing bar 105 is mounted in slot 108 of mounting bracket 109 which is connected to upright 10. A second bracket (not shown) completes the support for backing bar 105. By adjusting the distance between backing bars 104 and 105, the back to back positioning of cartons in rack assembly 4 may be varied to suit different carton sizes and palletizing conditions. The primary function of the backing bars, however, is to develop spacing between cartons.

Closing plates 110 and 111 are positioned above rack assembly 4 to close carton lids which may have been left open and to size bulging cartons. This insures the proper palletizing of cartons on a pallet on turntable assembly 5. Guide or lip 112 on rack 74, as well as a complementary lip on rack 75, direct cartons into rack assembly 4 in the event that the spacing between cartons on conveyor 46 is too large.

*Control*

FIGURES 6 and 6A show schematically the preferred control circuitry used with the palletizer of the instant invention. FIGURE 7 shows schematically the operative parts of the palletizer together with attendant conveyors and control circuitry operating elements. For clarity of illustration, various of the contacts controlled by relays are shown separately from their relays. The following table lists the contacts which are controlled by any given relay.

| Relay | Contacts of the Relay |
|---|---|
| R1 | C1A, C1B. |
| R2 | C2A, C2B. |
| R3 | C3A, C3B, C3C. |
| R4 | C4A, C4B. |
| R5 | C5A, C5B, C5C. |
| R6 | C6A, C6B, C6C, C6D. |
| R8 | C8A, C8B. |
| R12 | C12A, C12B. |
| R13 | C13A, C13B. |
| R14 | C14A, C14B, C14C. |
| R15 | C15A, C15B, C15C. |
| R16 | C16A, C16B, C16C. |
| R24 | C24A, C24B, C24C, C24D, C24E, C24F, C24G. |
| R25 | C25A, C25B, C25C, C25D, C25E. |
| R26 | C26A. |
| R27 | C27A, C27B. |
| R28 | C28A, C28B. |
| R29 | C29A. |
| R30 | C30A. |
| R31 | C31A. |
| R32 | C32A. |

As is illustrated in FIGURE 7 the palletizer of the instant invention is totally automatic. Tandemly lined cartons are fed up to the palletizer on carton infeed conveyor **46**. Loading assembly **3** removes a pair of these tandemly aligned cartons from infeed conveyor **46** and places them in rack assembly **4**. Rack assembly **4** receives a plurality of these pairs. Unloaded pallets are fed onto turntable assembly **5** by pallet feed conveyor **210**. Loaded pallets are removed from turntable assembly **5** by loaded pallet conveyor **211**. The preferred circuitry for the proper sequential operation of the palletizer and attendant conveyors will now be described.

Alternating current source **202** is in series circuit with normally closed off-switch **213**. Switch **213** in turn is in series circuit with operating control circuit **212**.

Operating control circuit **212** functions as the control for the entire automatic operation of the palletizer. If the sequence of operation is wrong, the machine will shut down. Operating control circuit **212** includes normally closed limit switch **S24**. Switch **S24** senses whether cartons are on turntable assembly **5** when it is rising to receive more cartons. If cartons are on turntable assembly **5**, limit witch **S24** opens. Normally open contacts **C8A** of relay **R8** are in series with limit switch **S24**. Relay **R8** is energized to open contacts **C8A** when an unloaded pallet is positioned over switch **S8** on pallet feed conveyor **210**. Normally closed contacts **C24A** of relay **R24** are in parallel with limit switch **S24**. Relay **R24** is energized when turntable assembly **5** is being elevated by motor **M4**. When energized, relay **R24** opens contacts **C24A**. In series with contacts **C24A** are normally closed contacts **C25A** of relay **R25**. Contacts **C25A** open when relay **R25** is energized which occurs when turntable assembly **5** begins to lower. The third parallel branch of operating control circuit **212** has normally closed contacts **C15A** of relay **R15**. Relay **R15** is energized upon the closing of limit switch **S15** which occurs when the raising or lowering turntable assembly **5** reaches a given vertical position in frame **2**.

Thus, when turntable assembly **5** is being elevated and passes limit switch **S15**, contacts **C15A** open. If cartons are on the turntable assembly during elevation **S24** will open. During elevation normally closed contacts **C24A** are open by virtue of the energization of relay **R24**. Thus, no current from alternating current source **202** can pass in through the remaining portions of the control circuitry and the entire machine is turned off. When turntable assembly **5** is being lowered with a load of cartons, contacts **C24A** are closed and contacts **C25A** are opened. When the turntable assembly depresses limit switch **S15**, contacts **C15A** open. If no pallets are on pallet feed conveyor **210**, limit switch **S8** is opened and consequently contacts **C8A** are open. Thus, once again the entire machine is shut down.

Normally open on-switch **214** is in series circuit with operating control circuit **212** and relay **R1**. Normally open contacts **C1B** of relay **R1** are in parallel with on-switch **214**. When on-switch **214** is depressed, current will flow to the coil of relay **R1**, closing contacts **C1B**. Unless current flow through operating control circuit **212** is interrupted, relay contacts **C1B** will remain closed by virtue of their serial connection with the coil of relay **R1**. Thus, relay **R1** will remain energized and current will flow to the remaining portions of the circuitry. Relay **R1** controls contacts **C1A** which are in series with infeed conveyor motor **M1** and alternating current source **202**. When relay **R1** is de-energized, motor **M1** is turned off. Lead **215** is in series circuit with operating control circuit **212** and is thus dependent upon current flowing through the latter.

Loading assembly control circuit **220** includes normally open, serially connected limit switches **S1** and **S2** which are positioned on carton conveyor **46** to be closed when a pair of cartons are in position to be loaded into the palletizer by loading assembly **3**. These switches are in series with relay **R2** and normally closed contacts **C6A** of relay **R6**. Normally open contacts **C2A** and **C2B** are controlled by relay **R2** and closed when the relay is energized. Contacts **C2A** are in serise with rake or loading assembly motor **M2** and alternating current source **202**. Contacts **C2B** are in series with normally closed limit switch **S3**. Limit switch **S6** is in position to sense a full load of cartons in rack assembly **4**. When a full load is in rack assembly **4** limit switch **S6** closes which functions to open contacts **C6A** of relay **R6**. Normally closed limit switch **S3** will not open until rack assembly **4** has completed a full cycle and thus **R2** will remain energized despite the opening of contacts **C6A**. When both contacts **C6A** and limit switch **S3** are open, relay **R2** is de-energized and loading assembly motor **M2** is turned off by virtue of the opening of contacts **C2A**. In the event that no further cartons on conveyor **46** depress limit switches **S1** and **S2**, relay will remain de-energized and the circuits which it controls will remain open.

Rack assembly control circuit **221** includes normally open contacts **C6B**, controlled by relay **R6**, connected in series to lead **215**. Normally closed contacts **C5A** are in series with contacts **C6B** and controlled by relay **R5**. Parallel, normally open contacts **C4A** and **C3A**, controlled respectively by relays **R4** and **R3**, are in series with contacts **C5A**. Normally open contacts **C5B** and **C3B**, controlled respectively by relays **R5** and **R3**, are in series with contacts **C4A** and **C3A**. Relay **R3** is in series with contacts **C5B** and **C3B**. In series with lead **215** and contacts **C5B** and **C3B** are serially connected, normally closed contacts **C25B**, **C6C** and **C4B**. Contacts **C25B**, **C6C** and **C4B** are controlled respectively by relays **R25**, **R6** and **R4**.

The operation of rack assembly control circuit **221** for the control of the rack assembly **4** will now be described. When the racks are empty, limit switch **S6** is open and thus contacts **C6B** of relay **R6** are open because relay **R6** is de-energized. When the racks are empty and in position to receive cartons, limit switch **S5** is open and limit switch **S4** is closed energizing relay **R4** and opening its controlled contacts **C4B**. Thus, no current flows to relay **R3** and motor **M3** is off. When the racks are full, however, limit switch **S6** closes energizing relay **R6** and closing contacts **C6B**. At this time, limit switch **S5** is open and thus relay **R5** is de-energized and contacts **C5A** are closed. Similarly, at this time, limit switch **S4** is closed and relay **R4** is energized, closing contacts **C4A** and establishing a circuit through contacts **C6B**, **C5A** and **C4A** to relay **R3**. Relay **R3** is then energized closing contacts **C3A**, **C3B** and **C3C**. Contacts **C3C** are in series circuit with rack drive motor **M3** and alternating current source **202** and thus, when closed,

energize the rack drive motor M3. When rack drive motor M3 is on, limit switch S4 opens immediately de-energizing relay R4, opening contacts C4A and closing contacts C4B. However, contacts C3A are closed, because of their serial connections with relay R3, and maintain the circuit through relay R3. When the racks of rack assembly 4 reach their open position and their carried cartons are deposited on turntable assembly 5, limit switch S6 opens which open contacts C6B because relay R6 is then out of circuit. At the same time, however, limit switch S5 closes, energizing relay R5 and closing contacts C5B, and contacts C25B, C6C and C4B are closed because the relays that control these contacts are de-energized. Thus a circuit from lead 215 to relay R3 is maintained through closed parallel contacts C5B and C3B as well as closed series contacts C4B, C6C and C25B. This allows rack drive motor M3 to complete its cycle. When the cycle is complete, S4 will close, energizing relay R4 and opening contacts C4B, opening the circuit to relay R3. Because the racks are now empty, limit switch S6 is open and contacts C6B are open and thus contacts C3C open, stopping rack drive motor M3. When turntable assembly 5 begins to lower, relay R25 is energized and the relay contacts C25B of relay R25 open; this is a safety feature to prevent the continued operation of racks 4 when turntable assembly 5 is lowering.

Circuit 222 which controls the lowering of turntable assembly 5 will now be described. Circuit 222 includes serially connected normally open contacts C6D and C5C which are controlled by relays R6 and R5 respectively and connected in series with lead 215 and normally closed contacts C16A. Contacts C16A are controlled by relay R16 and are in series with normally closed limit switch S19 which in turn is in series with relay R25. Normally closed contacts C12A, C13A, C14A and C15B, as well as normally open contacts C25D, comprise a parallel branch with contacts C6D and C5C and are controlled respectively by relays R12, R13, R14, R15 and R25. When rack assembly 4 is full, limit switch S6 will be closed and relay R6 energized. The energization of relay R6 closes contacts C6D. When the rack assembly 4 is fully retracted, limit switch S5 will close closing contacts C5C by virtue of the energization of relay R5. Limit switch S19 is closed because the turntable assembly 5 is above it. Thus, relay R25 is energized which closes contacts C25D and C25C. Contacts C25C are in series circuit with first set of windings 205 of elevator motor M4 and alternating current source 202. When contacts C25C are closed, M4 will be energized and turntable assembly 5 will begin to lower. As the turntable assembly 5 lowers, limit switch S6 will open, opening contacts C6D as soon as cartons pass out of contact with the switch. However, contacts C25D are closed and thus relay R25 remains energized. Turntable assembly 5 will continue to lower until it encounters any selected one of the limit switches S12, S13, S14 or S15. These switches are disposed on the frame 2 of the palletizer at distinct levels to provide control of the down position for turntable assembly 5 by cooperating with limit switch S6 to lower the turntable assembly to a lower level for each layer of cartons deposited. For example, with two layers on the turntable assembly, limit switch S6 remains closed, maintaining the circuit to relay R25 until the cartons pass below the switch whereupon it opens. This position corresponds to the turntable assembly at the level of limit switch S14. In short, limit switches S12, S13 and S14, which control contacts C12A, C13A and C14B through their respective relays, are operative to take relay R25 out of circuit by cooperating with limit switch S6. However, turntable assembly 5 will not be allowed to lower if it occupies a position which results in the opening of limit switch S19 or the closing of limit switch S16. Limit switch S16 is the bottom position switch for turntable assembly 5 and limit switch S19 is a safety switch which operates to prevent the turntable assembly from lowering in the event limit switch S16 fails. Thus, when limit switch S16 is closed relay R16 is energized and its contacts C16A open preventing any further depression of turntable assembly 5.

The elevation of turntable assembly 5 is controlled by circuit 223. Circuit 223 has a first parallel branch consisting of normally open limit switch S7, normally closed contacts C8B and normally open contacts C16B. Contacts C8B and C16B are controlled by relays R8 and R16 respectively. The first branch is in parallel with normally open contacts C24B which are controlled by relay R24. The parallel branches are in series with lead 215 and normally closed limit switches S11 and S10 as well as relay R24. Turntable assembly 5 is elevated upon the sensing of an empty pallet on the turntable assembly which closes limit switch S7. The turntable must as well be in its lowest-most position such that limit switch S16 is closed. In addition, limit switch S8 must be open to indicate that the pallet on turntable assembly 5 came from pallet feed conveyor 210. When limit switch S7 is closed because of a pallet on turntable assembly 5, limit switch S8 is open because of the lack of a pallet on pallet feed conveyor 210. When the turntable assembly 5 is in proper position such that limit switch S16 is closed, relay R24 will be energized closing contacts C24B and C24C. Contacts C24C are in series with the upwindings 206 of motor M4 and alternating current source 106. Thus, when relay R24 is energized, motor M4 operates by virtue of the energization of windings 206. As the turntable assembly 5 raises toward rack assembly 4, limit switch S16 will open resulting in the opening of contacts C16B. However, relay R24 is still energized because contacts C24B are closed. When the turntable assembly 5 reaches its proper position with respect to rack assembly 4, limit switch S11 will open de-energizing relay R24 and turning motor M4 off. In the event that limit switch S11 fails, limit switch S10 will open and thus acts as a safety against turntable assembly 5 rising too far.

Turntable assembly elevating motor M4 is a two-speed motor being faster in elevation than in depression. This necessitates the requirement for the two windings 205 and 206. In addition, of course, the motor is two-directional. In order to rapidly stop rotation of the motor's armature a brake is provided which is controlled by circuit 224. This brake circuit comprises two normally open and parallel relay contacts C24D and C25E which are in series with relay R26 and lead 215. Contacts C24D are controlled by relay R24. Similarly, normally open contacts C25E are controlled by relay R25 and close when relay R25 is energized. Normally closed contacts C26A are controlled by relay R26 and open when the latter is energized. Contacts C26A control the action of solenoid 203 which applies a brake in known manner to the armature of motor M4. Thus at the termination of either its elevation or depression contacts C24D and C25E will be open and relay R26 will be de-energized. When relay R26 is de-energized, the circuit to solenoid 203 is established and the brake is applied.

Circuit 225 is used to rotate the turntable assembly 5 90 degrees with each successive loading of cartons by rack assembly 4. This circuit includes normally open contacts C27A which are connected in series between lead 215, limit switch S20 and relay R27. Limit switch S20 is disposed on turntable assembly 5 to sense one of the turntable positions. Limit switch S21 is also on turntable assembly 5 and senses a position for the turntable 90 degrees to that sensed by limit switch S20. Relay R27 is in circuit with relay R29 through the contacts C27B of relay R27. Relay R29 controls contacts C29A which in turn control the energization of turntable rotating motor M6. Similarly, relay R28, which is in series with limit switch S21, is electrically coupled to relay R29 through contacts C28B. Relay R28's contacts C28B are in parallel with contacts C27B. Thus, if either of the normally open contacts

C27B or C28B are closed by virtue of the energization of their controlling relay, turntable rotating motor M6 will operate.

Normally open contacts C14B of relay R14 and normally open contacts C24F of relay R24 are connected in parallel with contacts C27A through one pole of two-position switch S23. Normally closed contacts C24E of relay R24 are connected between limit switch S20 and contacts C27A and to one pole of two-position switches S25, S26 and S27. Normally open contacts C12B, C13B and C14C are all serially connected to lead 215 and to switches S27, S25 and S26 respectively.

The other pole of switches S25, S26 and S27 are connected between normally open contacts C15C of relay R15 and normally closed contacts C24G of relay R24. The other pole of limit switch S23 is connected to normally closed contacts C24G. Limit switch S21 is connected in series with this other pole and contacts C24G. Normally closed contacts C28A of relay R28 are connected in parallel with contacts C15C and C24G to lead 215 and to limit switch S21 and, hence, relay R28.

The operation of circuit 225 is as follows: Initially, the rotational position or orientation of the turntable of turntable assembly 5 is determined by which of the poles of switches S23, S27, S25 and S26 is in circuit with lead 215. When turntable assembly 5 lowers sufficiently to close limit switch S12, a circuit is established through contacts C24E, which are closed because relay R24 is not energized until the turntable elevates to switch S20. If switch S20 is open, the turntable will not rotate because relay R27 is out of circuit. However, if switch S20 is closed relay R27 is energized which closes contacts C27B. The closing of contacts C27B energizes relay R29 to close contacts C29A. Turntable rotation motor M6 is then in circuit with power source 202 and rotates the turntable of turntable assembly 5 until switch S20 opens. When the turntable assembly lowers sufficiently to close limit switch S13 and hence contacts C13B, the circuit to switch S21 is established because contacts C24G are closed. Limit switch S21 will be closed, because of the prior rotation of the turntable, and relay R28 will be energized. When relay R28 is energized, contacts C28B close to energize relay R29 and establish the circuit to turntable rotating motor M6. The turntable will then rotate another 90 degrees and remain in this orientation until it lowers to a point where limit switch S14 is closed. The closing of limit switch S14 energizes relay R14 and closes contacts C14C to once again establish the circuit to relay R27 through now closed switch S20. The turntable will then rotate another 90 degrees.

If orientation of the turntable of turntable assembly 5 is correct for discharge of a loaded pallet onto loaded pallet conveyor 211, switch S21 is open. If switch S21 is closed when the turntable assembly reaches the position which closes limit switch S15, relay R28 will be energized to rotate the turntable 90 degrees.

The orientation of the turntable in its top position with an empty pallet for receiving cartons is determined by the position of switch S23. In the position shown, with switch S20 closed, a circuit will be established to relay R27 when the turntable assembly is in position to close switch S14. The closing of switch S14 energizes relay R14 and closes contacts C14B. Contacts C24F will be closed because the turntable assembly is elevating and relay R24 is energized. The circuit to relay R27 will be maintained when the turntable assembly elevates above limit switch S14 because contacts C27A are closed when relay R27 is energized. Relay R27 will remain energized until switch S20 opens upon the 90 degree rotation of the turntable. If a different top orientation is desired, the contacts of switch S23 are swung over to establish the circuit to relay R28.

Normally closed contacts C24E and C24G are in circuit to prevent rotation of the turntable when the turntable assembly is elevating.

The conveyor controls will now be described. Normally closed limit switch S22 controls the circuit to the activating relays of loaded pallet conveyor motor M8, turntable conveyor motor M5 and pallet feed conveyor motor M7. When discharge conveyor 211 is full of loaded pallets, limit switch S22 opens to prevent further conveying of unloaded and loaded pallets. The following description assumes that switch S22 is closed. Normally open limit switch S9 closes when a loaded pallet is discharged from turntable assembly 5 to loaded pallet conveyor 211. The closing of switch S9 energizes relay R32 which closes contacts C32A and energizes loaded pallet conveyor motor M8. When the turntable assembly is in position to close limit switch S16, that is, in its discharge position, relay R16 will be energized. Relay R16 then closes contacts C16C and establishes the circuit to relay R30 and relay R31. Relay R30 controls normally open contacts C30A to turntable conveyor motor M5. Contacts C30A are in series with power source 202 and motor M5. Thus, when relay R30 is energized, motor M5 will operate to discharge a loaded pallet onto conveyor 211. In like manner, relay R31, when energized, controls the operation of pallet feed conveyor motor M7 by closing contacts C31A between the motor and power source 202. Thus, an empty pallet is fed onto the turntable assembly while a loaded pallet is being discharged onto conveyor 211.

The stacking of a pallet 240 is shown in sequence in FIGURES 8, 9, 10 and 11. In addition, the angular disposition of typical cartons 250, 251 and 252 each to the other is illustrated in FIGURE 8. The cartons contained by rack 75 are deposited on pallet 240 when rack 75 swings away from its complementary rack 74. The cartons are then deposited on pallet 240 as illustrated in FIGURE 8. A similar row of cartons is of course carried by the complementary rack 74 and is deposited behind the cartons 250, 251 and 252. One of these cartons, carton 253, is shown in FIGURE 10. Upon the deposit of the two rows of three cartons each on pallet 240, turntable 15 lowers one box height and is then rotated 90 degrees on car 14 to achieve the disposition illustrated in FIGURE 10. Immediately after lowering and during the rotation, a second series of cartons 254, 255 and 256, as well as a second row of these cartons (not shown), is deposited by the racks 75 and 74 above the previously deposited cartons as shown in FIGURE 11. This procedure may be repeated to achieve the desired depth of cartons. Thus, through the rotation and the space development characteristics of the palletizer of this invention, an interlock stack is achieved having spaces between each carton for the circulation of a refrigerant. The space between cartons such as 250 and 253 is achieved by virtue of tilting of these cartons as they are being released by their carton racks 74 and 75. As these racks swing away from each other the adjoining edges of cartons 253 and 250 will separate at their bottoms and remain in slight contact at their top. The racks tend to pull the cartons with them but the cartons are restrained by bars 104 and 105. When completely released by the racks, cartons 250 and 253 will wall away from each other onto the pallet 240.

*Operation*

The operation of the individual components of the palletizer has already been discussed. A typical overall operating sequence is as follows. An empty pallet is fed from pallet feed conveyor 210 onto the turntable assembly 5 when the latter is in its lowest position, that is, the position corresponding to a closed limit switch S16. Simultaneously, a loaded pallet will be discharged onto loaded pallet conveyor 211 from turntable assembly 5. The turntable assembly will then rise because limit switch S7 is closed, relay R16 is energized, and relay R8 is out of circuit. Relay R8 is out of circuit because the empty pallet from pallet feed conveyor 210 has already been placed on the turntable assembly. The turntable assembly will elevate until limit switch S11 opens which cor-

responds to the proper position for receiving cartons from rack assembly 4.

Carton infeed conveyor 46 brings tandemly aligned cartons over limit switches S1 and S2 closing the circuit to relay R2 in the event that no cartons are in rack assembly 4 to close limit switch S6. Loading or rake assembly 3 then sweeps two cartons at a time into rack assembly 4 until limit switch S6 closes to indicate a full load of cartons.

The closing of limit switch S6 allows rack assembly 4 to operate. As previously described, the assembly deposits six cartons onto the turntable assembly by swinging racks 74 and 75 apart. After the cartons are deposited, the racks 74 and 75 will draw together if the turntable assembly lowers sufficiently for its carried cartons to pass limit switch S6.

The turntable assembly 5 then begins to lower because limit switch S6 is closed, closing contacts C6B, and contacts C5A and C4A are closed. These latter contacts are closed because racks 74 and 75 are empty. The turntable assembly continues to lower to close limit switch S12. The closing of limit switch S12 establishes the circuit to relay R27 and, hence, turntable rotating motor M6. The turntable then rotates 90 degrees. Further lowering of the turntable assembly will not occur because limit switch S12 is closed, opening the circuit to windings 205 of motor M4.

The rack assembly is then reloaded and cartons deposited on the first layer of cartons on turntable assembly 5. Adjacent layers of cartons will be rotated 90 degrees from each other. Because limit switch S6 is closed, the turntable assembly is lowered one more level, that is, to an elevation where the top layer of cartons passes out of contact with limit switch S6.

The loading of the turntable assembly continues until three layers of cartons are deposited on its pallet. The turntable asembly then lowers until limit switch S16 closes which opens the circuit to windings 205 of motor M4.

What is claimed is:

1. A palletizer for developing a stack of cartons on a pallet comprising:

(a) a frame;

(b) a pair of opposed carton supporting racks carried by the frame for arcuate movement between a spaced apart carton receiving position and a spaced apart carton releasing position, each rack having means for supporting at least two juxtaposed cartons of tandem pairs of cartons along their backs and bottom edges such that the racks in their carton receiving position are operable to support a tandemly aligned pair of cartons by holding the cartons against each other midway between the racks and through the support provided by the supporting means, the racks in their carton releasing position being moved in arcuate paths away from each other to allow tandemly aligned cartons to fall onto a pallet with a space developed between them;

(c) means on the frame for engaging the backs of cartons as such cartons are released from the racks to determine the developed space between released tandemly aligned cartons;

(d) a loading assembly mounted on the frame operable to remove a pair of tandemly aligned cartons at a time from a conveyor and into the carton supporting racks;

(e) means for moving the racks in arcuate paths between their carton receiving position and their carton releasing position; and

(f) means for operating the loading assembly.

2. The palletizer claimed in claim 1, wherein the carton supporting means of each rack includes at least two adjoining carton carrying sections for supporting the bottoms of two juxtaposed cartons, each section being at a slight angle to its adjoining section such that the upper lateral edges of juxtaposed cartons on the same rack are in contact and the lower proximate edges of such cartons are spaced apart, whereby upon release by the racks onto a pallet a space is developed between the juxtaposed cartons.

3. The palletizer claimed in claim 2, wherein the back engaging means includes a pair of adjustable carton positioning members for adjusting the space developed between tendemly aligned cartons as such cartons are released from the racks, the positioning members being mounted on the frame in position to contact the backs of the cartons carried by the racks as such cartons are released.

4. The palletizer claimed in claim 2, including a pair of rack drive shafts rotatably mounted to the frame, each rack being carried by one of the rack drive shafts, a drive member connected to each of the shafts in position to move the racks toward and away from each other in arcuate paths, and wherein the rack moving means is coupled to the drive members.

5. The palletizer claimed in claim 4, including at least one plate mounted to the frame above the racks in position to close loose flaps on the cartons being received by the racks from the loading assembly.

6. The palletizer claim 2 wherein the loading assembly includes an upper arm, a lower arm and a rake, the arms being mounted for translation on the frame, the rake being attached to the lower arm for movement of pairs of tandemly aligned cartons from the conveyor to the racks, and the operating means being coupled to the upper arm for such movement.

7. The palletizer claimed in claim 6, wherein the loading assembly includes a connecting link pivotally secured to the lower arm at one of its ends and slidably engaged to the upper arm at one of its ends, a truck carried by the frame for translation thereon, the other ends of the arms being pivotally connected to the truck, and wherein the operating means includes a crank rotatably connected to the upper arm and operable in rotation to move the rake in an arcuate path.

8. The palletizer claimed in claim 7, including a pair of rack drive shafts rotatably mounted to the frame, each rack being carried by one of the drive shafts, a drive member connected to each of the shafts to move the racks toward and away from each other in arcuate paths, and wherein the rack moving means is coupled to the drive members.

9. The palletizer claimed in claim 8, including at least one plate mounted to the frame above the racks in position to close loose flaps on the cartons being received by the racks from the loading assembly.

10. The palletizer claimed in claim 9, including a turntable carried by the frame, the turntable being operable to receive cartons from the racks and to rotate at least substantially 90 degrees between successive loadings from the rack.

11. A palletizer system comprising:

(a) a carton conveyor;

(b) a palletizer in position to receive pairs of tandemly aligned cartons from the carton conveyor, the palletizer includings:

(i) a frame;

(ii) a pair of spaced apart racks mounted on the frame for arcuate movement between a spaced apart carton receiving position and a spaced apart carton releasing position, each rack having a back portion and a bottom portion with the bottom portion extending inwardly from the back portion towards the bottom portion of the other rack, the bottom portion for each rack having at least two adjoining carton carrying sections, each carton carrying section being at a slight angle to its adjoining section;

whereby tandemly aligned pairs of cartons received in the racks are supported at their op-

posite ends by the carton carrying sections and held together in abutting relation at their proximate meeting ends by the back portions of the racks and juxtaposed cartons on the same rack have their upper lateral edges in contact and their lower proximate edges spaced apart;

(iii) a loading assembly mounted on the frame and operable to remove a pair of tandemly aligned cartons from the carton conveyor onto the spaced apart racks;

(iv) means for operating the loading assembly;

(v) means for moving the racks in an arcuate path between the carton receiving position and the carton releasing position; and

(vi) a turntable assembly carried by the frame for vertical movement thereon between a lowered position and a raised position below the racks, the turntable assembly including a turntable and means for rotating the turntable 90° back and forth from a first position to a second position.

**12.** The palletizing system claimed in claim **11** including means for sensing the presence of two tandemly aligned cartons on the carton conveyor, such sensing means being coupled with the loading assembly operating means to actuate the loading assembly to load the sensed cartons into the racks.

**13.** The palletizing system claimed in claim **12** including means for sensing a full load of at least two tandemly aligned pairs of cartons in the racks, the full load sensing means being coupled with the rack moving means to release a sensed full load of cartons from the racks onto the turntable.

**14.** The palletizing system claimed in claim **13** including means coupled to the turtnable rotating means to rotate the turntable between successive loadings thereof from the racks.

**15.** The palletizing system claimed in claim **14** including means operable to position the turntable assembly with respect to the racks successively lower with each loading of the turntable from the racks.

**16.** The palletizing system claimed in claim **15** including a loaded pallet conveyor, and means for discharging loaded pallets from the turntable onto the loaded pallet conveyor.

**17.** The palletizing system claimed in claim **16** including an empty pallet conveyor operable to load the turntable with an empty pallet after a loaded pallet has been discharged therefrom.

**18.** The palletizing system claimed in claim **17** including means for inactivating the palletizing system when loaded cartons are on the turntable assembly and the latter is raising.

**19.** The palletizing system claimed in claim **18** including means for inactivating the palletizing system when the turntable assembly is being lowered and an unloaded pallet is not in position on the empty pallet conveyor for discharge onto the turtnable.

**20.** The palletizing system claimed in claim **19** including means for lowering the turntable assembly to the lowered position after the loading thereof with a predetermined number of loads of cartons from the racks.

**21.** The palletizing system claimed in claim **20** including means for raising the turntable assembly to the raised position when the turntable assembly is in its lowered position, an empty pallet is on the turntable and an empty pallet is not in position on the empty pallet conveyor for discharge onto the turntable.

**22.** A palletizer comprising:

(a) a frame;

(b) a loading assembly mounted on the frame operable to remove cartons from a conveyor;

(c) a pair of spaced-apart, generally parallel racks mounted on the frame in position to receive cartons from the loading assembly, each rack having a back portion and at least two carton-carrying sections, each carton carrying section being at a slight angle to its adjoining section such that adjacent cartons on each rack will have their upper lateral edges in contact and their lower proximate edges spaced apart;

(d) means for moving the racks toward and away from each other for carrying cartons and discharging cartons onto a pallet, respectively; and

(e) means for operating the loading assembly to remove cartons from the conveyor onto the racks when the racks are in their carton-carrying postion.

**23.** The palletizer claimed in claim **22** including:

a pair of rack drive shafts rotatably mounted on the frame with each rack being carried by one of the rack drive shafts, and a drive member connected to each of the shafts in position to move the racks toward and away from each other, the rack moving means being coupled to the drive members.

**24.** The palletizer claimed in claim **23** wherein the loading assembly includes:

an upper arm, a lower arm and a rake, the arms being mounted for translation on the frame, the rake being attached to the lower arm for movement of cartons from the conveyor to the racks, the operating means being coupled to the upper arm for such movement.

**25.** The palletizer claimed in claim **24** wherein the loading assembly includes a connecting link pivotally secured to the lower arm at one of its ends and slidably engaged to the upper arm at one of its ends, a truck carried by the frame for translation thereon, the other ends of the arms being pivotally connected to the truck, and the operating means includes a crank rotatably connected to the upper arm and operable in rotation to move the rake in an arcuate path over the conveyor to sweep cartons into the racks and lift the rake above cartons deposited in the racks.

**26.** The palletizer claimed in claim **22** including a pair of adjustable carton positioning members for adjusting the space developed between tandemly aligned cartons as such cartons are released from the racks, the positioning members being mounted on the frame in position to contact the backs of cartons as such cartons are released from the racks.

**27.** The palletizer claimed in claim **26** wherein the loading assembly includes:

(a) a truck carried by the frame for translation thereon parallel to the racks;

(b) an upper and a lower arm rotatably secured at first ends thereof to the truck;

(c) a connecting link pivotally secured to the lower arm at its second end and slidably engaged to the uper arm at its second end; and

(d) a rake carried by the lower arm for movement of pairs of tandemly aligned cartons from the conveyor to the racks;

(e) The operating means being coupled to the arms.

**References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 1,551,890 | 9/1925 | Luce | 214—6 |
| 2,331,392 | 10/1943 | Haig | 214—6 X |
| 2,607,501 | 8/1952 | Jeffrey | 214—6 |
| 2,883,074 | 4/1959 | Boehl et al. | 214—6 |
| 3,014,599 | 12/1961 | Lawrence et al. | 214—6 |
| 3,233,763 | 2/1966 | Paul et al. | 214—89 |
| 3,312,357 | 4/1967 | Stephans et al. | 214—6 |

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# UNITED STATES PATENT OFFICE

# CERTIFICATE OF CORRECTION

Patent No. 3,429,459 February 25, 1969

Lowell A. Paul et al.

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 13, line 65, "into" should read -- onto --. Column 14, line 9, "tendemly" should read -- tandemly --; line 25, after "palletizer" insert -- claimed in --. Column 15, line 58, "turtnable" should read -- turntable --. Column 16, line 55, "uper" should read -- upper --; line 59, "The" should read -- the --.

Signed and sealed this 31st day of March 1970.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents