Dec. 27, 1966 M. A. DAVIES ETAL 3,294,257

PACKAGE-HANDLING APPARATUS

Filed Dec. 2, 1963 4 Sheets-Sheet 1

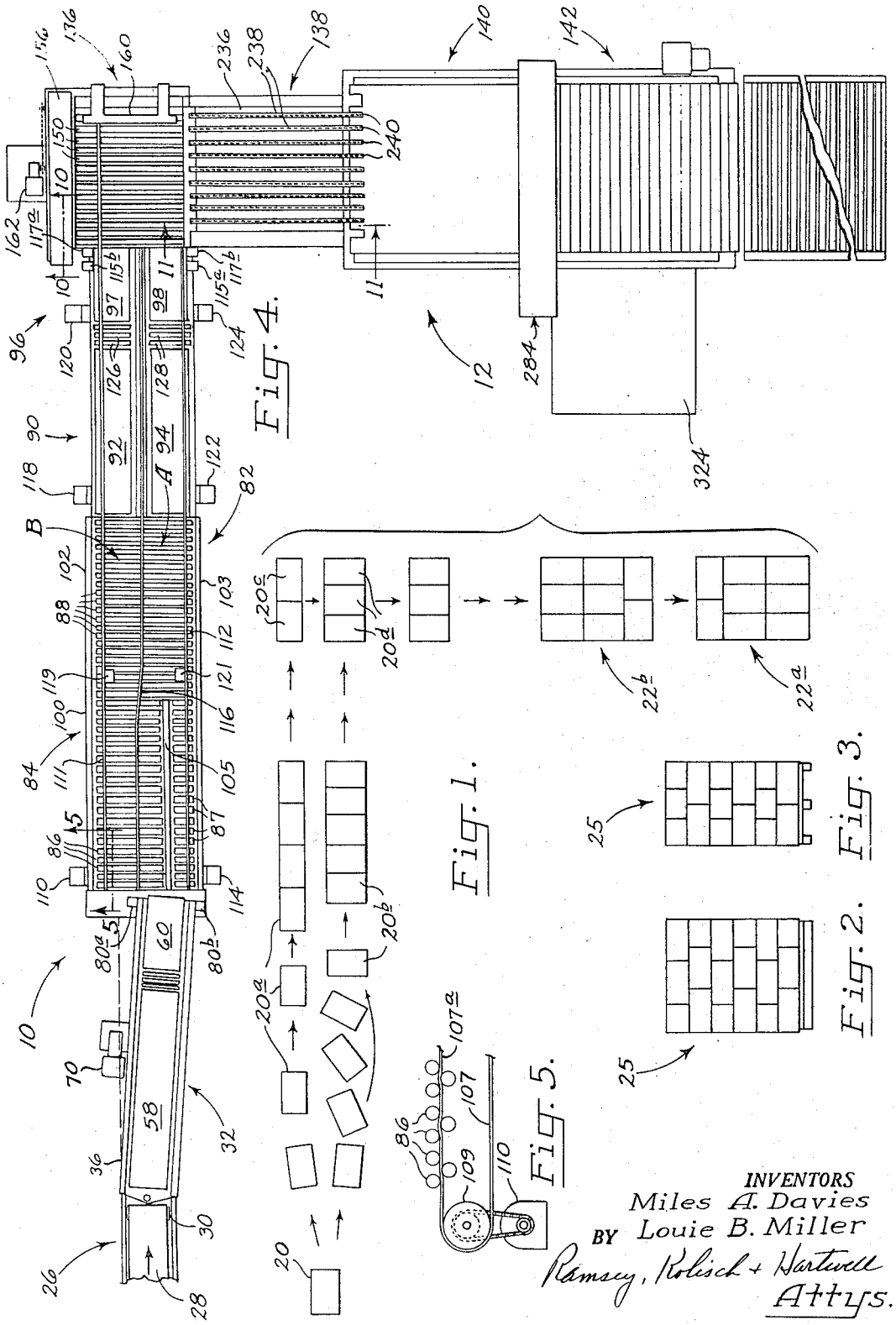

Fig. 4.



Fig. 1.



Fig. 3.



Fig. 2.



Fig. 5.

INVENTORS
Miles A. Davies
BY Louie B. Miller
Ramsey, Rolisch & Hartwell
Attys.

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PACKAGE-HANDLING APPARATUS

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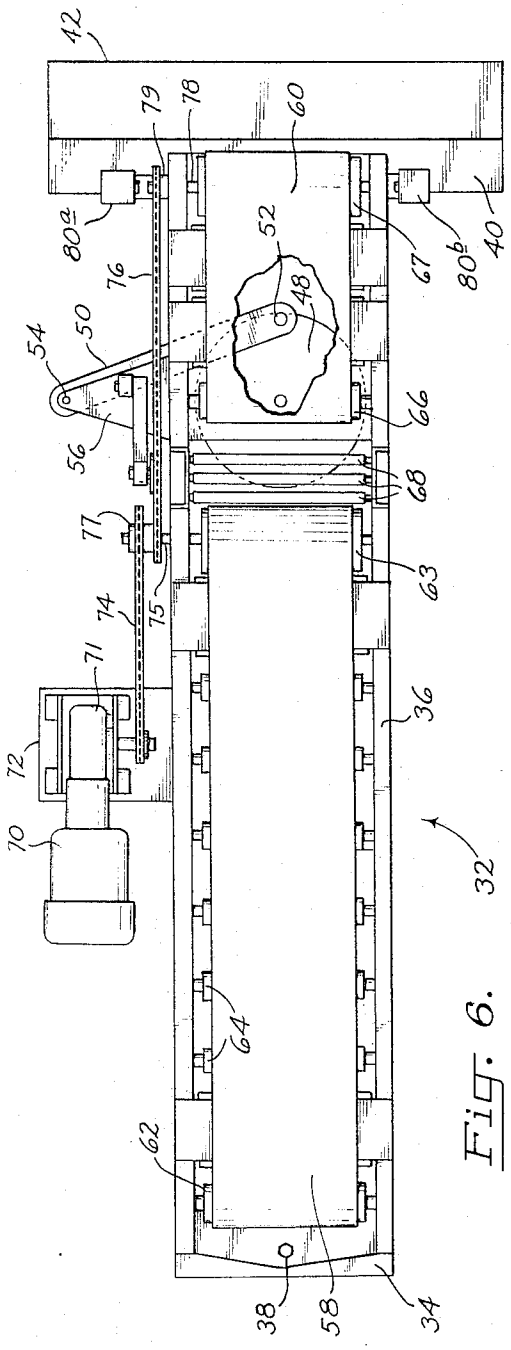


Fig. 6.

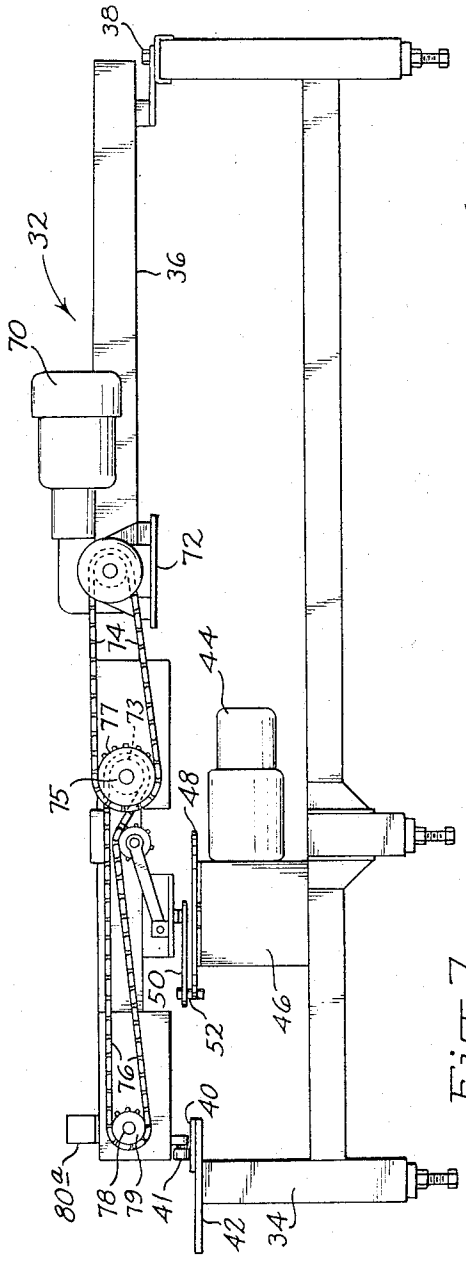


Fig. 7.

INVENTORS
Miles A. Davies
BY Louie B. Miller
Ramsey, Rolisch & Hartwell
Attys.

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PACKAGE-HANDLING APPARATUS

Filed Dec. 2, 1963 4 Sheets-Sheet 3

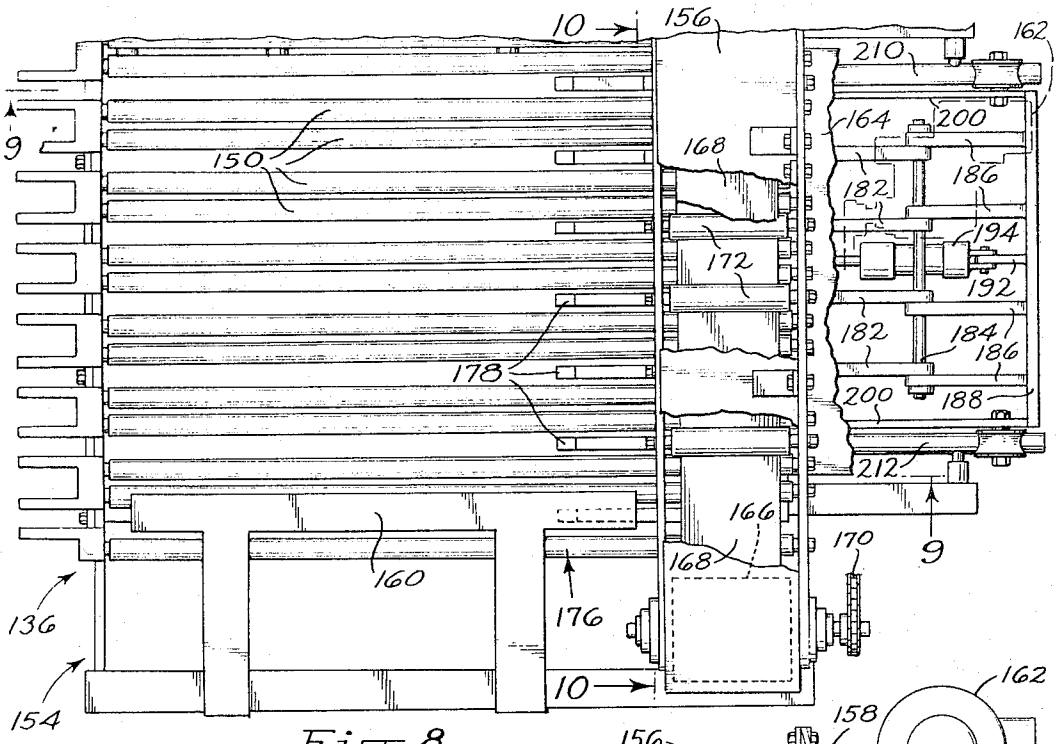


Fig. 8.

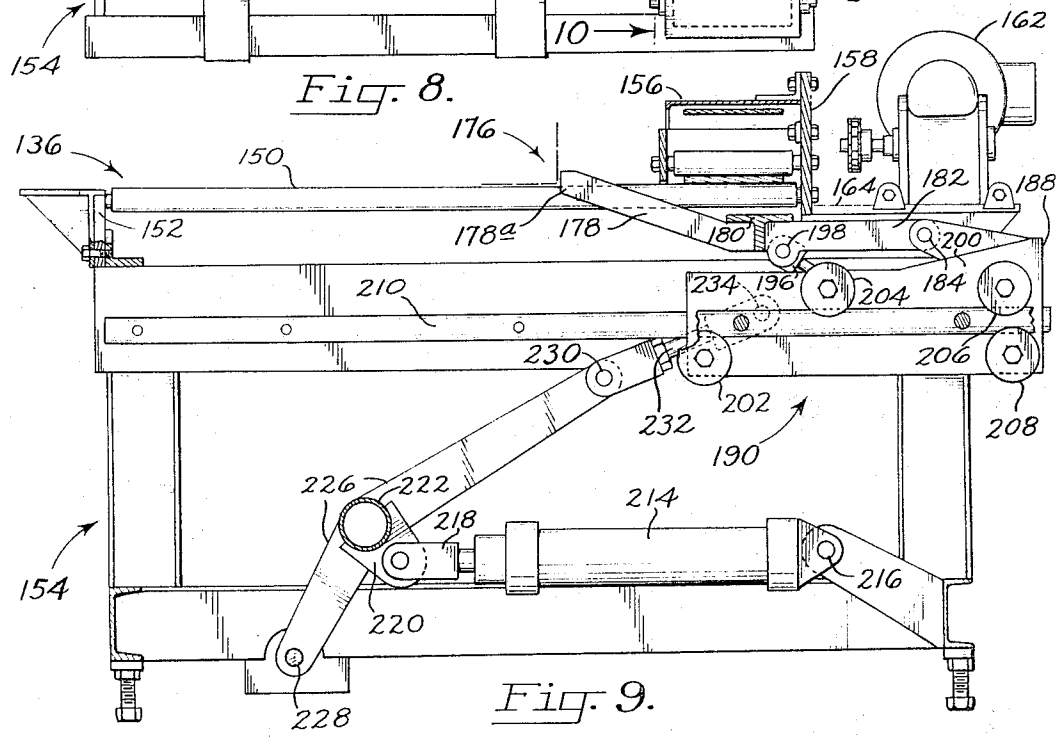


Fig. 9.

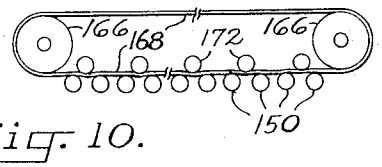


Fig. 10.

INVENTORS
Miles A. Davies
BY Louie B. Miller
Ramsey, Kolisch & Hartwell
Attys.

Dec. 27, 1966 M. A. DAVIES ETAL 3,294,257

PACKAGE-HANDLING APPARATUS

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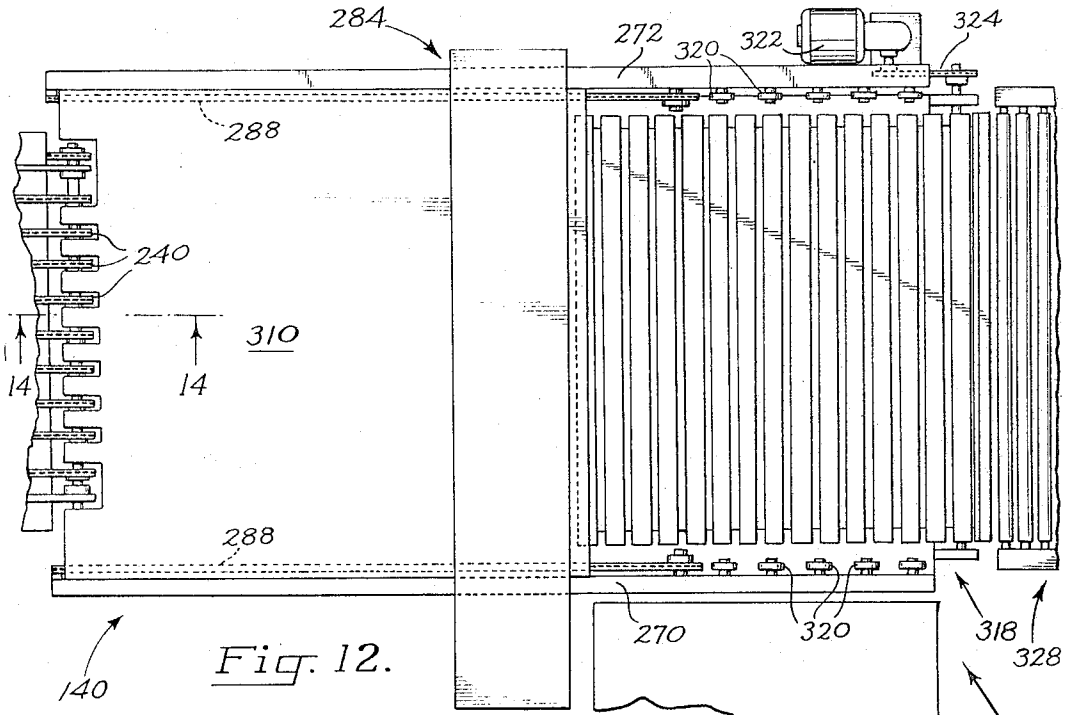


Fig. 12.

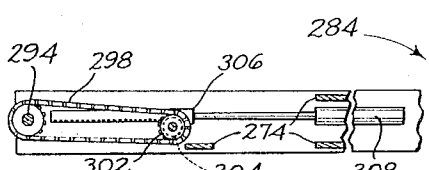


Fig. 14.

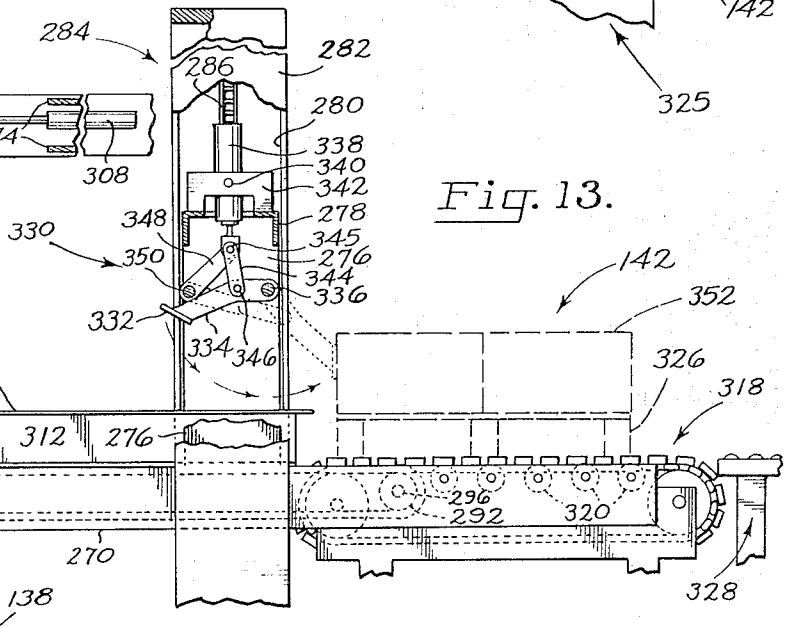


Fig. 13.

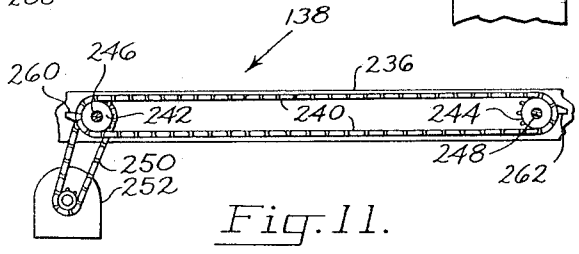


Fig. 11.

INVENTORS
Miles A. Davies
BY Louie B. Miller
Ramsey, Kolisch & Wartwell
Attys.

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# PACKAGE-HANDLING APPARATUS

Miles A. Davies and Louie B. Miller, Vancouver, Wash., assignors to Columbia Machine, Inc., Vancouver, Wash., a corporation of Oregon

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2 Claims. (Cl. 214—6)

This invention relates to package-handling apparatus, and more particularly to apparatus of such a description operable to receive packages traveling from a source, such as a conveyor, and then to arrange such packages in stacked tiers. Such apparatus is sometimes referred to as a "cuber," in that it arranges plural packages in a relatively large, rectangularly shaped stack, roughly corresponding to a cube (such stack however, not always having equal dimensions along all sides).

In forming a stack from a plurality of unit packages, where such packages are rectangular and have greater length than width, it is desirable that packages in adjacent tiers be disposed at angles and be offset relative to each other, rather than be in exact vertical alignment, as such produces an interlocking of the packages in the completed stack. Various patterns for the packages in any given tier are possible, and the pattern selected depends to a certain extent upon the particular dimensions of the unit packages being handled.

A general feature and object of this invention is to provide package-handling apparatus of the above general description, which features novel means whereby packages in successive tiers in a stack are suitably offset and oriented so that an interlocked stack results.

When forming an interlocked stack from rectangular packages, the pattern of packages in one tier is not the same as the pattern of packages in another tier. Further, as already indicated, the package patterns selected for different tiers is subject to change, depending upon particular package dimensions. A further object of the invention, therefore, is to provide package-handling apparatus which is flexible in operation, and can be readily changed to produce different package patterns in a tier of packages.

Many packages contain fragile article, such as glass containers, etc. With fragile articles, breakage results if the packages are subjected to excessive jarring, which obviously is undesirable. A further object of the invention is to provide package-handling apparatus, for producing tiers of interlocked packages, where proper orientation and offset of packages in the tiers is obtained by means which handles the packages smoothly, and with substantially no jarring thereof.

Packages in the usual instance when traveling from a delivery point or source are oriented in the same direction. For example, they may all be traveling end to end. Thus, in forming a tier where packages in different rows have different orientations, some packages may be placed in the tier without changing their relative orientation, while others must be turned so that they lie at right angles to the first-mentioned packages. This invention features novel mechanism for producing such a reorientation of selected packages, which includes a transfer conveyor with means defining two paths of travel for packages moving therealong. Along one of said paths of travel packages move without a change in their orientation or relative angular position. Along the other path of travel, the transfer conveyor engages the bottoms of packages while imparting through the bottoms of the packages forward motion at two different speeds. The speeds are related in such a manner as to produce turning of successive packages about upright axes as they travel forwardly along the conveyor. The mechanism contemplated is fast, operates substantially without jarring, and is entirely reliable.



With the mechanism, two rows of packages may be formed in a make-up station, where one row contains aligned packages oriented in one direction, and the other row contains aligned packages oriented at right angles to the packages in the first-mentioned row.

It has already been indicated that flexibility in operation is desirable. According to this invention, various package patterns may be produced easily, while maintaining an exact total count of the packages handled. It is by counting successive packages that the apparatus of this invention determines the make-up of a tier of packages, more specifically, the orientation of packages in successive rows. The apparatus lends itself to control by automatic means.

In package-handling apparatus, obviously savings in space are important. This invention features means for forming properly arranged rows of packages in successive tiers, which is substantially more compact than many prior known devices.

A further object of the invention is to provide means for stacking packages of the type contemplated, which is fast acting, and capable of handling a substantially continuous flow of packages. More specifically, according to this invention, packages are accumulated to form a tier, and during the time that such accumulation of packages takes place, an already formed tier is stacked on a pallet. During the time that rows of packages are being accumulated in a tier, rows of packages are also being made up. Package rows are made up from a reserve of already properly oriented packages. Thus, many operations are performed concurrently with the performance of other operations in the apparatus.

Other objects and advantages are attained by the invention, and the same is described hereinbelow in conjunction with the accompanying drawings, wherein:

FIG. 1 is a diagrammatic view, illustrating a typical flow of packages such as may be produced in apparatus constructed according to one embodiment of the invention, and how such packages are arranged in different tier patterns;

FIGS. 2 and 3 are side and end elevations of a completed stack containing tiers of packages of the type illustrated in FIG. 1;

FIG. 4 is a simplified plan view, of the package-handling apparatus contemplated, such apparatus including a pair of elongated conveyor legs set at right angles to each other, along which packages travel during the process of their being arranged in a completed stack;

FIG. 5 is a cross-sectional view, taken along the line **5—5** in FIG. 4, and somewhat enlarged;

FIG. 6 is a plan view, somewhat enlarged, of a feed conveyor provided adjacent the feed end of the apparatus illustrated in FIG. 4;

FIG. 7 is a side elevation of the feed conveyor illustrated in FIG. 6;

FIG. 8 is a plan view, on a somewhat enlarged scale, of a collecting station provided in the apparatus shown in FIG. 4;

FIG. 9 is a cross-sectional view taken generally along the line **9—9** in FIG. 8, further illustrating the collecting station;

FIG. 10 is a cross-sectional view, on a somewhat smaller scale than FIG. 8, taken along the line **10—10** in FIG. 8;

FIG. 11 is a cross-sectional view, taken along the line **11—11** in FIG. 4, and on a somewhat larger scale than FIG. 4, showing further details of a make-up station in the apparatus;

FIG. 12 is a plan view, on a somewhat larger scale than FIG. 4, showing a loading platform and palletizing station provided in the apparatus;

FIG. 13 is a side elevation, partly broken away, of the loading platform and palletizing station illustrated in FIG. 12; and

FIG. 14 is a cross-sectional view, along the line 14—14 in FIG. 12.

Referring now to the drawings, and first of all more particularly to FIG. 4, wherein one embodiment of the invention is illustrated, the package-handling apparatus shown comprises an elongated supply-conveyor leg, indicated at **10**, which is operable to transport packages from left to right in the figure. Extending at right angles to the supply-conveyor leg, and adjacent the offbearing end thereof, is an accumulator-conveyor leg, indicated generally at **12**. Packages handled enter the apparatus at the feed end of supply-conveyor leg **10**, which is shown in the upper left hand portion of the figure, and after traveling on the supply-conveyor leg are deposited on accumulator-conveyor leg **12**. Thence the packages travel down the accumulator-conveyor leg where they end up as an interlocked stack on a pallet, as will hereinafter be described.

Referring now to FIG. 1, a package such as may be handled with the apparatus of the invention is represented by the rectangular carton **20** shown at the left of the figure. Such cartons may travel from a supply or source, with successive cartons all oriented in the same direction. In FIG. 1, carton **20** is shown extending longitudinally of the direction of its travel, which is generally from left to right in the upper portion of the figure. For explanation purposes, it will be assumed that all cartons traveling from the supply or source thereof are oriented in this direction, although it should be obvious that they could all be oriented in a different direction, such as a direction extending transversely of their direction of travel.

According to this invention, cartons so oriented travel forwardly from the feed end of supply-conveyor leg **10**, and are thence directed into one of two different paths of travel defined along the supply-conveyor leg. Along one path of travel, the cartons move without any change in their orientation, i.e., they continue to travel endo, as illustrated by cartons **20***a* in FIG. 1. Along the other path of travel, the cartons are turned approximately 90° about upright axes. These cartons, therefore, end up extending transversely of their direction of travel, or at right angles to cartons **20***a*, as illustrated by cartons **20***b*. With such an arrangement of the cartons, a row of cartons may be taken from the supply-conveyor leg and deposited on the feed end of the accumulator-conveyor leg, consisting either of two cartons disposed end-to-end, as indicated by row of cartons **20***c*, or three cartons disposed side-by-side, as indicated by row of cartons **20***d*.

In FIG. 1, a tier of cartons produceable with the apparatus of the invention is indicated at **22***a*, comprising two rows of cartons disposed side-by-side, with the same orientation of cartons **20***d*, and one row of cartons disposed end-to-end, with the orientation of cartons **20***c*, this row being directly above the first-mentioned two rows of cartons in the figure. A tier **22***b* of cartons may also be prepared, to be placed over tier **22***a*, comprising one row of cartons disposed end-to-end nearest the bottom of the page in the figure, and two rows of cartons, each comprising three cartons disposed side-by-side, above this row of end-to-end cartons in the figure.

If a tier of cartons such as tier **22***b* is placed over tier **22***a*, the cartons in adjacent tiers will not be in exact vertical alignment or have uniform orientation. Certain cartons will be offset from and certain cartons will be at right angles to cartons directly below. An interlocked stack may be formed of the type illustrated at **25** in the side and end elevations shown in FIGS. 2 and 3. With the apparatus of the invention, tiers resembling tiers **22***a* and **22***b* may be readily prepared from rows of cartons **20***c*, **20***d*, by feeding the appropriate number of cartons from the two paths of travel defined on the supply-conveyor leg onto accumulator-conveyor leg **12**. The manner in which such is done, and a completed stack is produced, will become more fully apparent with the following more detailed description of supply-conveyor leg **10** and accumulator-conveyor leg **12**.

Considering first of all supply-conveyor leg **10**, and referring again to FIG. 4, in the upper left hand portion of the drawing there is illustrated a conveyor **26**, which transports packages such as cartons **20** to the feed end of the apparatus, and constitutes a source of packages. The conveyor typically may include a belt **28** trained over suitable pulleys such as pulley **30**. The cartons may travel on such a conveyor while oriented in the same direction, for instance, while traveling endo, as described in connection with carton **20**.

Adjacent the offbearing end of conveyor **26** is a feed-conveyor section **32**. Feed-conveyor section **32** is shiftable between the positions indicated in full and dashed outlines in FIG. 4, to change the place at which packages are discharged from the offbearing end thereof. Feed-conveyor section **32** is illustrated in more detail in FIGS. 6 and 7, and reference is now made to these figures.

As can be seen in FIGS. 6 and 7, **34** indicates a frame which supports the feed-conveyor section above the ground. The feed-conveyor section itself comprises an elongated frame **36** which is pivotally mounted at one end, by pivot means **38**, to frame **34**. Journaled on the underside of conveyor-section frame **36**, adjacent the end opposite pivot means **38**, is roller means **41**, which is supported on a bearing plate **40** secured to a plate **42** which is part of frame **34**.

The conveyor section is swung periodically to change the direction of its feed by a motor **44** disposed under conveyor-section frame **36**, said motor being mounted on frame **34** through a clutch and transmission housing **46**. Journaled on the top of housing **46** is a disc **48** driven by motor **44**. A pitman arm **50** pivotally connected at **52** to a margin of disc **48** is pivotally connected adjacent its other end, at **54**, to a bracket **56** which is secured to conveyor-section frame **36**. With the mechanism described, the conveyor-section frame may be swung about pivot means **38**, with the disc and pitman arm constituting eccentric means interconnecting the motor and the conveyor-section frame. With motor **44** energized continuously, movement of the conveyor section occurs upon engagement of the clutch within clutch and transmission housing **44**.

Cartons are moved along the feed-conveyor section by means of a pair of belts **58**, **60**. Belt **58** is trained over pulleys **62**, **63**, and the upper run of the belt is supported between these pulleys on rollers **64** journaled on the conveyor-section frame. Belt **60** is trained over pulleys **66**, **67**. Between pulleys **63**, **66**, and supporting packages as they travel along the feed-conveyor section, are freely rotatable rolls **68** journaled on frame **36**.

A motor **70**, supported on a bracket **72** extending out to one side of conveyor-section frame **36**, is provided for moving belts **58**, **60**. Drive from the motor to the belt is through drive chains **74**, **76**. Chain **74** drives pulley **63** directly, through a sprocket assembly **77** secured to its pulley shaft **75**. Chain **76** connects sprocket assembly **77**, through sprocket **73** (see FIG. 7), to sprocket **79** and pulley shaft **78** of pulley **67**. Sprocket **79** is somewhat smaller than sprocket **73**, and thus belt **60** runs at a slightly faster speed than belt **58**. Belts **58**, **60** are driven intermittently, through engagement of a clutch provided within clutch housing **71**.

Inclusion of the two belts **58**, **60**, and the means whereby belt **60** is driven at a faster speed than belt **58**, is important, since this assures a spacing between any two adjacent packages which travel off of belt **58**. Electric eye devices are shown at **80***a*, **80***b*, and these are connected into the control circuit for the clutch within housing **46**, whereby motor **44** is prevented from swinging the conveyer section whenever a package blocks the passage of light between eye devices **80***a*, **80***b*. In this way, a change in the feed direction of feed-conveyer section **32** when a package is partially beyond but still supported by the

feed-conveyer section is prevented, for such a partially supported package would block light from passing between electric eye devices 80*a*, 80*b*.

Referring again to FIG. 4, supply-conveyer leg **10** includes what is referred to herein as a transfer-conveyer section **82** disposed at the discharge end of feed-conveyer section **32**. Transfer-conveyer section **82** receives packages traveling off the feed-conveyer section, and then transfers these packages to the feed end of accumulator-conveyer leg **12**. Transfer-conveyer section **82** includes means defining two separate paths of travel for packages extending side by side along the conveyer section, and means producing reorientation of packages traveling along one of these paths, as will now be described.

Referring still to FIG. 4, transfer-conveyer section **82** includes a roll-conveyer portion **84**, comprising rolls **86**, **87**, **88**, at the unlit end of this roll-conveyer portion discharging upon a belt-conveyer portion **90**, comprising belts **92**, **94** at the discharge end of this belt-conveyer portion **90** is another belt-conveyer portion **96** comprising belts **97**, **98**.

Roll-conveyer portion **94** of the transfer-conveyer section **84** includes a frame **100** suitably supported in a stationary position above the ground at approximately the level of feed-conveyer section **32**. Rolls **88** of roll-conveyer portion **84**, which may be smooth-surfaced steel rolls, extend substantially entirely across frame **80**, and are suitably journaled at their ends in side members **102**, **103** of frame **100**. Rolls **86** are shorter than rolls **88**, and are disposed in a row along one side of the roll-conveyer portion **84**. These rolls **86** are journaled at their ends between side member **102**, and a longitudinal **105**, which is part of frame **100** and parallels side members **102**, **103**. Rolls **87** are even shorter than rolls **86**, and are disposed in a row along the opposite side of the roll-conveyer portion. Rolls **87** are journaled in the frame between longitudinal **105** and side member **103**. Rolls **86**, **87**, like rolls **88**, may also be smooth-surfaced steel rolls.

Rolls **86** and **88** are rotated under power, by means of a belt **107** (see FIG. 5) which extends substantially the entire length of frame **100**, and which has an upper reach **107***a* contacting the undersides of these rolls. The belt is trained at its ends over pulleys, such as pulley **109**. In FIG. 5, pulley **109** is shown connected to a motor **110** which provides a means for moving belt **109** and rotating the rollers under power. With the motor energized, rolls **86**, **88** (which have substantially the same diameters) are rotated at a uniform speed.

Rolls **87** are also rotated under power, by means of a belt contacting the undersides of these rolls similar to belt **107** discussed in connection with rolls **86**, **88**. This belt is trained at its ends over suitable pulleys, similar to pulley **109**, and is moved under power by a motor **114**. With the apparatus operating ordinarily, motors **110**, **114** are running constantly, with the result that rolls **86**, **87**, **88** are rotated constantly.

Extending along the top of roll-conveyer portion **84**, adjacent either side thereof, are fences **111**, **112**. Dividing the roll-conveyer portion into two separate paths of travel, indicated at A and B, is a fence **116**. Packages traveling off the feed-conveyer section, with the feed-conveyer section in the position shown in solid outline in FIG. 4, travel into path A, whereas packages traveling off the feed-conveyer section, with the latter in the position shown in dashed outline, travel into path B.

Packages upon moving down path B and over rolls **86**, **88** move down the transfer conveyer without any substantial change in their orientation. Thus, with packages traveling endo into the transfer conveyor, such packages leave path B while traveling in the same direction. Packages upon moving down path A and over rolls **86**, **87** are turned about vertical axes, to be reoriented into positions approximately at right angles to their original positions, as indicated diagrammatically in FIG. 1 for packages 20*b*. This reorientation occurs by reason of the fact that rolls **87** are driven at a faster speed than rolls **86**. This results in marginal portions of the bottoms of the packages closer to fence **112** moving forwardly at a faster speed than marginal bottom portions of the packages disposed closer to fence **116**. Roll speeds are selected whereby upon a package in path A reaching rolls **88**, this package then has attained a proper transverse position. It will be noted that packages are turned while moving forwardly, and that turning is without jarring of the packages.

Conveyer belt **92** of belt-conveyer portion **90** occupies a position where it receives packages traveling along the left side of fence **116** in FIG. 4, and thus this conveyer belt constitutes a continuation of path B. Belt **97** of belt-conveyer portion **96** is aligned with belt **92**, and constitutes a further continuation of path B for the packages. Conveyer belt **94** and conveyer belt **98** receive packages traveling along the right side of fence **116**, and constitute a continuation of path A.

Belts **92**, **94**, **97**, **98** may be moved under power, in any suitable manner. In the drawings, motors including clutches **118**, **120** are shown which drive belts **92**, **97**, and motors including clutches **122**, **124** are shown which drive belts **94**, **98**.

In operation of the apparatus, the flow of packages along either path A or path B is not continuous. That is to say, with packages moving out of path B and onto accumulator-conveyer leg **12**, belts **94**, **98** are stopped, as by disengaging the clutches of motors **122**, **124**, and with packages moving out of path A, belts **92**, **97** are stopped, as by disengaging the clutches of motors **118**, **120**. With a continuous feed of packages into the apparatus, packages may accumulate in paths A and B, to produce a backlog extending back into roll-conveyer station **84** and over rolls **88** thereof. With rolls **88** always rotating, this results in tight abutment of packages in both paths A and B where these paths extend over rolls **88**.

The number of packages fed from a given path at any one time onto accumulator-conveyer leg **12** is determined by counting the packages, using electric eye devices **115***a*, **115***b*. This is a factor in obtaining flexibility in operation. Further, with counting of the packages, it is possible to know at all times the total number of packages handled. To insure that proper counting takes place by the electric eye devices, it is important that there be a certain spacing between packages prior to their leaving paths A and B of the transfer-conveyer section. It is for this reason that two belts (belts **92**, **97**) are provided in path B, which are driven by separate motors, and that two belts (belts **94**, **98**) are provided in path A, driven by separate motors. With this construction, and considering for explanation purposes path B, belt **97** may be driven at a somewhat faster speed than belt **92**, with the result that should packages traveling on belt **92** be closely packed, such are spread apart on traveling onto belt **97** (such functioning therefor as a spreader means).

Freely journalled rolls **128** support packages passing between belts **94**, **98**, and freely journalled rolls **126** between belts **92**, **97** support packages flowing between these two belts.

Electric eye devices **115***a*, **115***b* are in control circuits for the clutches of motors **118**, **120**, and motors **122**, **124**. A control circuit is provided whereby if two packages are desired to be fed onto accumulator-conveyor leg **12** from path B, conveyer belts **92**, **97** are driven long enough to deposit such two packages on the accumulator-conveyer leg, after which they stop. If it is next desired to have three packages delivered onto the accumulator-conveyer leg from path A, the control circuit produces movement of belts **94**, **98** until said three packages are deposited on the accumulator-conveyer leg, and then these belts are stopped. It should be obvious that the number of packages delivered from any given path onto the accumulator-conveyer leg, and the sequence with which the respective paths are actuated to produce delivery of the packages, may readily be changed with proper change of programming.

Referring still to FIG. 4, a pair of electric eye devices are indicated at **117***a*, **117***b* which are also in the control circuit for the clutches of motors **118**, **120**, **122**, **124**. These electric eye devices may function to prevent the conveyer belts in a given path from stopping prematurely, as when a package is half supported by a conveyer belt and half supported by the accumulator-conveyer leg fed by the belt.

In FIG. 4, midway between the ends of the roll-conveyer portion **84**, an electric eye device **119** is shown which is spaced above roll-conveyer portion **84** and which cooperates with a mating electric eye device directly below it, and below roll-conveyer portion **84** (such being obscured in the drawing) to determine if the backlog of packages present in the apparatus along path B extends back as far as the electric eye devices. Also shown is a similar electric eye device **121** over path A, which performs the same function for packages in path A. These sets of electric eye devices may be connected to the control circuit for motor and clutch assembly **44**, **46** (which swing feed-conveyer section **32**) and the control circuit for motor and clutch assembly **70**, **71** (producing movement of conveyer belts **58**, **60** in the feed-conveyer section), whereby a suitable backlog is maintained at all times in path A and path B.

Accumulator-conveyer leg **12**, and referring again to FIG. 4, includes a receiving station indicated generally at **136**, where rows of packages from either path A or path B are deposited on the accumulator-conveyer leg, collecting or make-up station, indicated generally at **138**, where successive rows of packages are abutted side by side to form a tier, loading platform or station **140**, where a formed tier of packages is deposited prior to its being placed in a stack, and a palletizing station **142** where successive tiers of packages are placed on a pallet, thus to form a complete stack. These various stations will now be considered in more detail.

That part of the accumulator-conveyer leg which constitutes receiving station **136** is illustrated in more detail in FIGS. 8, 9, and 10, and reference is now made to these figures in addition to FIG. 4.

Receiving station **136** comprises a series of elongated rollers **150** extending transversely of supply-conveyer leg **10** and longitudinally of accumulator-conveyer leg **12**. The rollers are suitably journaled at one set of their ends on brackets **152** supported on receiving-station framework **154**. An elongated, substantially rectangular, hollow casing **156** is secured through one of its side walls **158** to framework **154**, and rollers **150** are journaled at their other set of ends in this side wall of casing **156**. Packages upon leaving the supply-conveyer leg are carried forwardly by rollers **150**, with these packages extending as a row across the rollers. Movement of the packages stops when they come up against a fence **160**.

The rollers are rotated under power, in a direction whereby they move packages deposited thereon away from the supply-conveyer leg and toward fence **160**, by a normally constantly energized motor **162** (removed from the drawing in FIG. 8, and thus shown in this drawing in dashed outline only) supported on a table **164**. A pair of pulleys **166** are journaled within casing **156**, one adjacent each end thereof, and a belt **168** is trained over these pulleys. Motor **162** is connected to one of the pulleys **166** by a drive chain **170**. With the motor energized, belt **168** drives rollers **150** by reason of a lower run thereof moving over the upper surfaces of these rollers, as shown in FIG. 10. Idler rollers **172** journaled in the casing are effective to hold the belt in firm contact with the rollers **150**.

Intermittently operated ejector mechanism **176** is provided for clearing the receiving station, more specifically, rollers **150**, of any row of packages deposited thereon from paths A or B of the supply-conveyer leg.

Further describing mechanism **176**, a series of dog arms are shown at **178** which, in the position shown in FIGS. 8 and 9, have ends **178***a* projecting above the plane defined by the tops of rollers **150**. These dog arms are secured, adjacent their bottom ends, to a bar **180** extending transversely of rollers **150**. Projecting rearwardly of bar **180**, or to the right of this bar in FIGS. 8 and 9, are arms **182**. These arms are pivotally connected at **184** to lugs **186** joined to an upstanding wall **188** which is part of a movable carriage **190**.

Also joined to wall **188** of carriage **190** is a lug **192** which has pivotally connected thereto the cylinder end of a ram **194**. The rod end of ram **194** is connected through a clevis **196**, and pin **198**, to arms **182**. With ram **194** extended as shown, dog arms **178** occupy the raised position shown, i.e., their ends **178***a* project above the plane defined by the tops of rollers **150**. Contraction of ram **194** is effective to swing arms **182** and dog arms **178** downwardly, whereby ends **178***a* of the dog arms move below the plane defined by the top of rollers **150**.

Carriage **190**, already mentioned above, further includes opposed side sections **200** joined to wall **188**. Journaled on each of the side sections are grooved rollers, such as rollers **202**, **204**, **206**, and **208** shown in FIG. 9. A pair of rails **210**, **212** are secured to framework **154** which these grooved rollers ride on, and these rails thus provide a track accommodating the movement of carriage **190** to and fro in a direction paralleling rollers **150**.

Carriage **190** is shifted to and fro under power by an extensible ram **214**. The ram has its cylinder end pivotally connected at **216** to framework **154**. The rod end of ram **214** is pivotally connected, through clevis **218**, to an ear **220** rigidly joined to a tube **222**.

Tube **222** extends transversely of rollers **150**, and interconnects a pair of laterally spaced arms, such as arm **226** shown in FIG. 9 (in FIG. 9 the arm corresponding to arm **226** nearest the viewer has been removed). Each of these arms is pivoted adjacent its lower end, at **228**, to framework **154**. The upper end of each arm is pivotally connected, as at **230**, to a link, such as link **232**. Each link is pivotally connected, as at **234**, to one of the side sections **200** of carriage **190**.

From this it will be seen upon extension of ram **214**, arms **226** are pivoted about pivots **228** in a counterclockwise direction in FIG. 9. With such pivoting of the arms, carriage **190** is shifted to the left, which shifts dog arms **178** to the left. With the dog arms in their raised position, and upon shifting of the carriage to the left, they engage the sides of packages deposited on rollers **150** and slide them off the left end of the rollers, thus to clear the receiving station.

The dog arms are returned by returning carriage **190** to its original position. In order to accommodate the flow of packages into the receiving station during return of the dog arms, the dog arms are lowered prior to their return by contraction of ram **194**. This lowers their ends **178***a*, so that these ends do not impede the flow of other packages onto the receiving station.

Referring to FIGS. 4 and 11, collecting station or make-up station **138**, which is in advance of receiving station **136**, comprises a table **236** suitably supported above the ground at substantially the level of the top of rollers **150** just described. The table is slotted with elongated slots **238** along the length thereof, and these slots expose the upper reaches of a series of chains **240** which extend along the table underneath the table. As can be seen in FIG. 11, each of these chains is trained over sprockets, such as sprockets **242**, **244**, and these sprockets are joined to shafts **246**, **248** extending transversely of table **236**. Shaft **246** is rotated under power, by a chain **250** and motor and clutch assembly **252**.

Each of the chains includes a pair of dogs joined to it adjacent opposite extremities thereof, as shown by dogs **260**, **262** for the chain illustrated in FIG. 10. The dogs for all the chains corresponding to dog **260** are aligned with each other in a direction extending transversely of the chains, and so also are the dogs corresponding to dogs **262**. With the chains having the position of the chain

shown in FIG. 11, successive rows of packages are easily slid onto table **236**, after being ejected from the receiving station by dog arms **178** previously discussed.

During operation of the apparatus, plural rows of packages containing properly oriented packages are collected in the make-up or collecting station, until a complete tier is formed. Motor and clutch assembly **252** may then be actuated, to produce movement of all the chains. Dogs **260** adjacent the feed end of table **236** as a result swing upwardly and engage the rear side of the rearmost row of packages on table **236**. With forward movement of dogs **260**, the tier of packages on table **236** is advanced forwardly, and moved into loading station **140**, with clearing of the make-up station.

Loading station **140** and palletizing station **142** are illustrated in more detail in FIGS. 12, 13 and 14, and reference is now made to these figures, in addition to FIG. 4.

As seen in FIGS. 12 and 13, a pair of elongated, substantially horizontal and laterally spaced, frame side sections are shown at **270** and **272**. These side sections may be rigidly interconnected, as by transverse members **274** extending between and joined to the side sections. Each side section has an upright **276** joined thereto between its ends (the upright for side section **270**, which is nearest the viewer in FIG. 13, having been broken away). Uprights **276** are joined together adjacent their top ends by a transverse beam **278**.

The two uprights are mounted for vertical movement in tracks, such as track **280**, provided in the opposed upright legs **282** of a standard **284**. Standard **284** is part of the frame of the apparatus, and legs **282** thereof extend downwardly on either side of side sections **270**. **272**, and are rigidly mounted in place. A chain **286** connected to each upright **276** is taken up by means (not shown) to raise the two uprights, together with transverse beam **278** connecting the uprights and side sections **270**, **272** connected to the bottom ends of the uprights. Thus, the side sections and uprights constitute an elevatable assembly in the apparatus.

Mounted for movement on each side section **270**, **272**, and extending along the length thereof, is a chain **288**. Chains **288** adjacent the feed end of loading station **140** are trained over sprockets **290**. Opposite extremities of the chains are trained over sprockets **292**. Sprockets **290** are secured to a shaft **294** extending between rear end portions of side sections **270**, **272** and journaled thereon. Sprockets **292** are journaled directly on side sections **270**, **272**.

Referring more particularly to FIG. 14, chains **288** are moved so as to move their upper reaches from left to right in FIGS. 12 and 13 by a chain **298** which extends from a driving connection with shaft **294** over a sprocket **302** journaled on the elevatable assembly between its side sections **270**, **272**. A pinion **304** joined to sprocket **302** is engaged by the teeth of a rack **306**. Rack **306** is joined to the rod of a ram **308** which is also mounted on the elevatable assembly between its side sections. With contraction of the ram, the upper reaches of the chains **288** move from right to left, and upon extension of the ram, the upper chain reaches move in the reverse direction.

Referring again to FIGS. 12 and 13, disposed above the upper reaches of chains **288** is a loading plate or platform **310**. Loading plate **310** is fastened to chains **288** through elongated members **312**, one of which is located beneath and fastened to each side margin of the loading plate. Lower marginal portions of each member **312** are joined to the chain **288** below it by spaced anchoring connections **314**, **316**.

As best illustrated in FIG. 12, side sections **270**, **272** have ends (shown at the right of FIG. 12) which straddle an intermittently-operated conveyer **318**. Journaled on side sections **270**, **272**, on these ends that straddle conveyer **318**, are a series of wheels **320**. These wheels have upper surfaces substantially at the level of the bottoms of members **312** (see FIG. 13). Upon movement of the upper reaches of chains **288** to the right in FIGS. 12 and 13, the loading plate is shifted to the right and over the projecting ends of side sections **270**, **272**. With the loading plate so positioned, wheels **320** serve to support members **312**, and plate **310** which is fastened to the top edges of these members.

Conveyer **318** is driven by a motor **322** and chain **324**. The conveyer is part of palletizing station **142**, and is included for the purpose of supporting a pallet, such as pallet **326** shown in dashed outline in FIG. 13, as tiers of packages are stacked thereon. The conveyer is actuated to move such a pallet, and any packages supported thereon, out of the palletizing station and onto an offbearing conveyer **328**.

Pallets are shifted onto conveyer **318** by means of a pallet loader indicated generally at **325** in FIG. 12. The pallet loader includes mechanism (not illustrated) for depositing a pallet one at a time on conveyer **318**.

Referring again to FIG. 13, holding mechanism is indicated at **330**, which may be actuated to hold a tier of packages in place over a pallet, such as pallet **326**, after such packages have been shifted over the pallet by movement of platform **310** over the pallet. Holding mechanism **330** comprises a bar **332** which extends across the apparatus between uprights **276** of the elevatable assembly. Joined to the bar at locations distributed along the length thereof are arms, such as arm **334**, and these arms are journaled on a shaft **336** extending between and mounted at its ends on uprights **276**.

Bar **332** and arms **334** are swung from the position shown in solid outline in FIG. 13, to the position indicated in dashed outline, by a ram **338** having its cylinder end pivotally mounted at **340** on a bracket **342**, which is mounted on transverse beam **278**. The rod end of ram **338** is connected to an arm **334** by a link **344** pivotally connected at **345** and **346** to the rod and arm, respectively. An arm **348** journaled on a shaft **350**, which is mounted on upright **276** and parallels shaft **336**, is also pivotally connected by pivot means **345** to the rod of ram **338**.

With the linkage described, upon extension of the ram, bar **332** swings downwardly to its holding position, indicated by the dashed outline for the bar in FIG. 13, and upon contraction of the ram, the bar is returned to its original inoperative position, shown in full lines in FIG. 13.

In general terms, the loading and palletizing stations operate as follows: On a tier of packages being collected in make-up or collecting station **138**, such tier is shifted forwardly and onto loading plate **310** of the loading station, by actuation of chains **240**. A set of dogs mounted on chains **240** operate to slide the tier of packages onto the loading plate, with the packages in the tier having the same orientation on the loading plate that they did in the make-up station. With a tier of packages deposited on the loading plate, the tier is deposited on a pallet by shifting the loading plate to the right in FIGS. 12 and 13, to place the loading plate over the pallet. This also places the tier of packages over the pallet. The loading plate may then be withdrawn out from under the tier, with the packages sliding off the plate, by first lowering bar **332** against the back side of the tier of packages, and then shifting the loading plate to the left in the figures. This leaves a tier of packages on the pallet, such as the tier shown in dashed outline at **352**.

The operation may be repeated, to place another tier of packages on top of the tier already resting on the pallet. In this instance, however, before the loading plate is shifted over the pallet, the elevatable assembly (which includes the loading plate) is first raised to place the bottom of the loading plate at a slightly higher elevation than the top of the tier of packages supported on the pallet. With this done, when the loading plate is then shifted to the right, the plate will clear the top of the lower tier. Using this procedure, multiple tiers may be loaded on the pallet, the only limitation being the maximum height to which the elevatable assembly may be raised.

Describing the operation of the apparatus as a whole, packages move into the apparatus with the packages oriented in the same direction on conveyer **26**. Upon moving into feed-conveyer section **32**, the packages are directed into either path A or to path B defined along the transfer-conveyer section, the particular path selected depending upon which path is the most depleted of packages. Packages moving down path B move down the transfer-conveyer section without a change in their orientation, whereas packages moving down path A are turned at right angles. Packages are collected on belt-conveyer portion **90** of the transfer-conveyer section, and on rolls **88** of the roll-conveyer portion, with the packages in each path aligned and in a row.

Upon operation of belt-conveyer portions **90, 96** of the transfer-conveyer section, that is, actuation of either belts **92, 97** or belts **94, 98**, a row of packages is deposited in receiving station **136** of accumulator-conveyer leg **12**. The orientation of the package in the row depends upon which of the two sets of belts is actuated. The packages are spread apart during movement into station **136**, but become tightly abutted upon coming up against fence **160**.

Upon a row of packages being collected in the receiving station, feed into the station is stopped, and the row is then shifted into the collecting or make-up station, where the tier is made up. The orientation of the packages may be changed for successive tiers, to produce an interlocking arrangement, by changing the type of rows fed in succession into the make-up station. Upon a tier being finally completed, the tier is shifted onto the loading platform, which immediately frees the make-up or collecting station for the reception of further rows of packages and the forming of another tier. From the loading platform, tiers are stacked in the palletizing station, as just described.

The particular pattern of packages in a tier may be varied readily. An accurate count is provided on all packages handled. It is through counting of the packages that the number of packages making up a row, and the number of rows making up a tier, is controlled.

The packages are handled with a minimum amount of jarring. The apparatus accommodates substantially a continuous flow of packages into the apparatus.

We claim:

**1.** Package-handling apparatus comprising

feed-conveyer means for feeding packages into the apparatus,

package-transfer means adjacent the offbearing end of said feed-conveyer means for moving packages forwardly from the feed conveyer means,

said package-transfer means including means defining two paths of travel for packages disposed side by side along the package-transfer means,

said package-transfer means along one of said paths of travel including means whereby packages are turned about upright axes conjointly with being moved forwardly,

receiving means adjacent the offbearing end of said package-transfer means operable to receive packages traveling from each of said travel paths with said packages being deposited on the receiving means as rows of packages,

said receiving means including intermittently actuated ejector mechanism operable when actuated to clear a row of packages from the receiving means by shifting the row in a lateral direction,

collecting means adjacent said receiving means in position to receive successive rows of packages shifted from the receiving means with said rows accumulating in side-by-side position on the collecting means to form a tier of packages,

a transfer platform adjacent said collecting means,

said collecting means including clearing means for shifting an accumulated tier of packages from the collecting means to the transfer platform,

a palletizing station adjacent said collecting means including means for supporting a pallet, and

intermittently-operated means for shifting said transfer platform to a position over a pallet supported in said palletizing station and then sliding said platform while loaded with packages out from under any tier of packages deposited thereon.

**2.** Package-handling apparatus comprising

first and second elongated conveyer legs disposed at substantially right angles and with the offbearing end of said first leg in feeding relation to the feed end of said second conveyer leg,

said first conveyer leg including a package-transfer section with means defining two elongated paths of travel for packages extending along the leg,

said package-transfer section along one of said paths of travel being constructed and arranged to move packages forwardly without substantial change in their orientation and along the other of said paths of travel being constructed and arranged to move packages forwardly while applying simultaneously two speeds to the packages so related as to produce turning of successive packages about upright axes and a reorientation of the packages,

said first conveyer leg further including a feed-conveyer section operable selectively to feed packages first into one and then into the other of said paths of travel,

said second conveyer leg including a receiving station directly adjacent the offbearing end of the first conveyer leg where packages are deposited as rows on traveling from said transfer-conveyer section,

a collecting station forwardly in the second conveyer leg from the receiving station,

intermittently-actuated ejector means for shifting successive rows of packages deposited in said receiving station into said collecting station with said rows being stacked side by side to form a tier,

a transfer platform disposed forwardly in said second conveyer leg from said collecting station,

intermittently-operated means for shifting a tier of packages from said collecting station forwardly and onto said transfer platform,

a palletizing station disposed forwardly in said second conveyer leg from said transfer platform having means for supporting a pallet, and

intermittently-operated means for shifting said transfer platform while loaded with packages into said palletizing station and over a pallet supported therein and then sliding said platform out from under any tier of packages deposited thereon.

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GERALD M. FORLENZA, *Primary Examiner.*

MORRIS TEMIN, *Examiner.*

J. E. OLDS, *Assistant Examiner.*