Dec. 10, 1957 W. JONES 2,815,848

PACKAGE METERING AND STACKING MECHANISM

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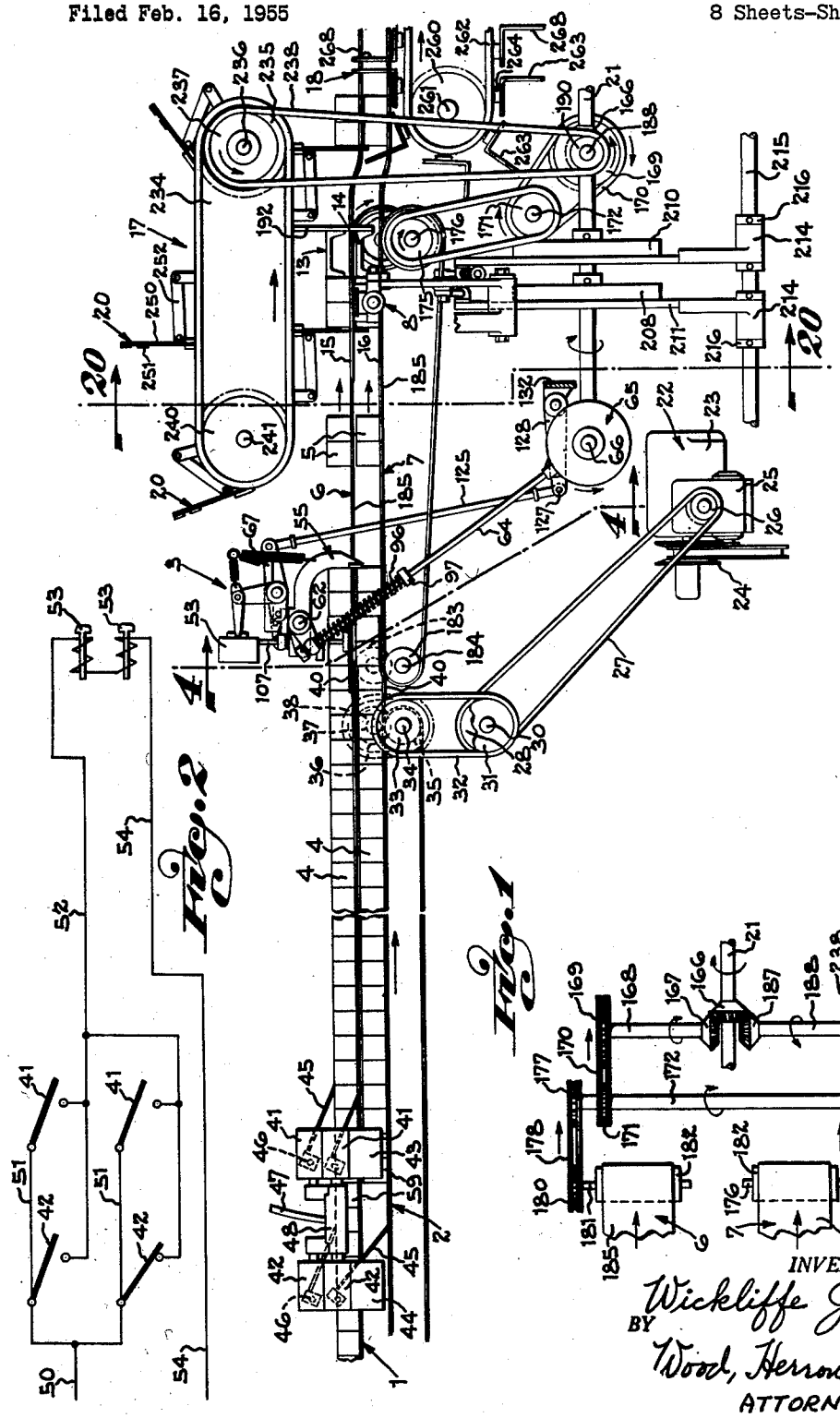


Fig. 2

Fig. 1

Fig. 3

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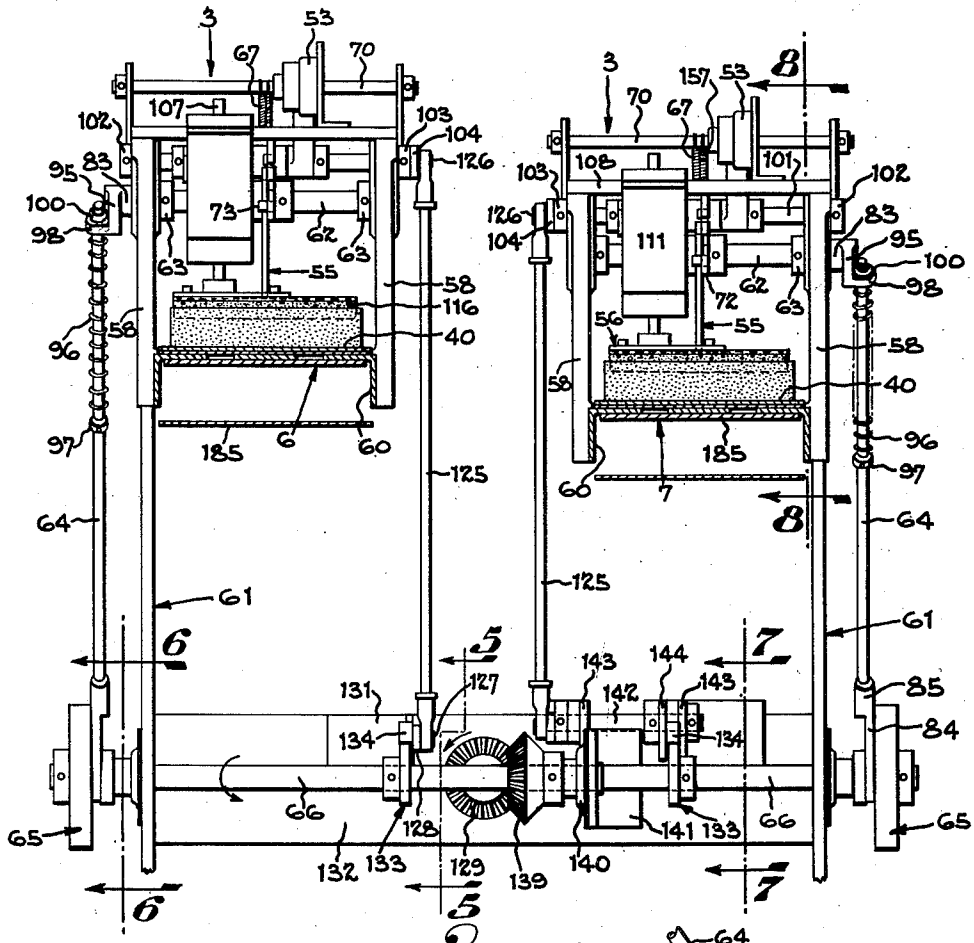


Fig. 4

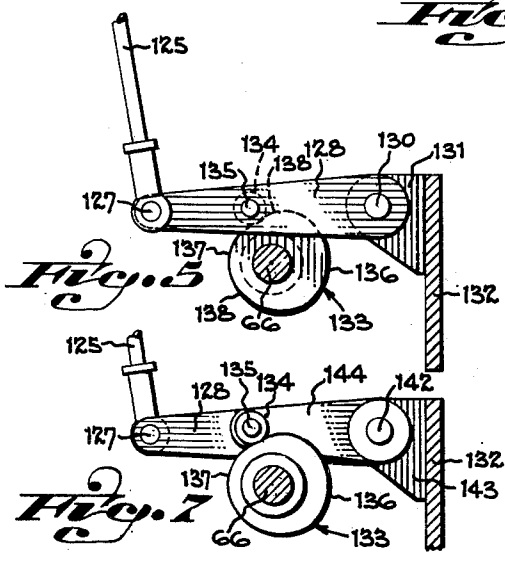


Fig. 5

Fig. 7

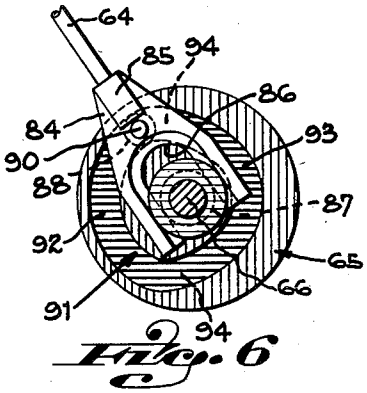


Fig. 6

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PACKAGE METERING AND STACKING MECHANISM

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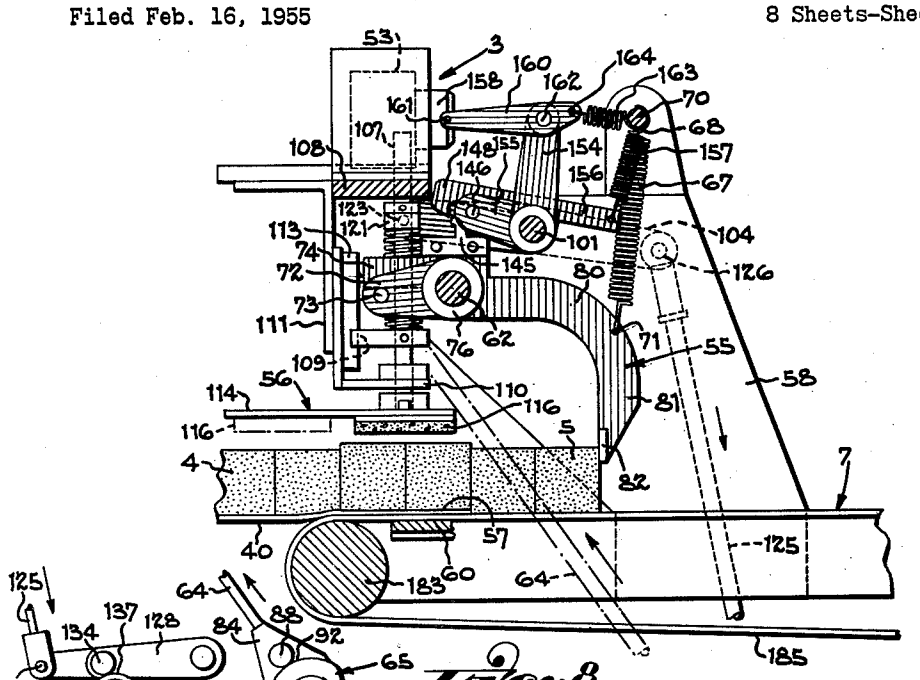


Fig. 8

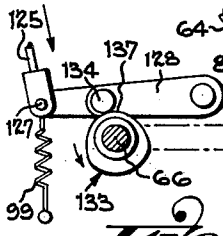


Fig. 9

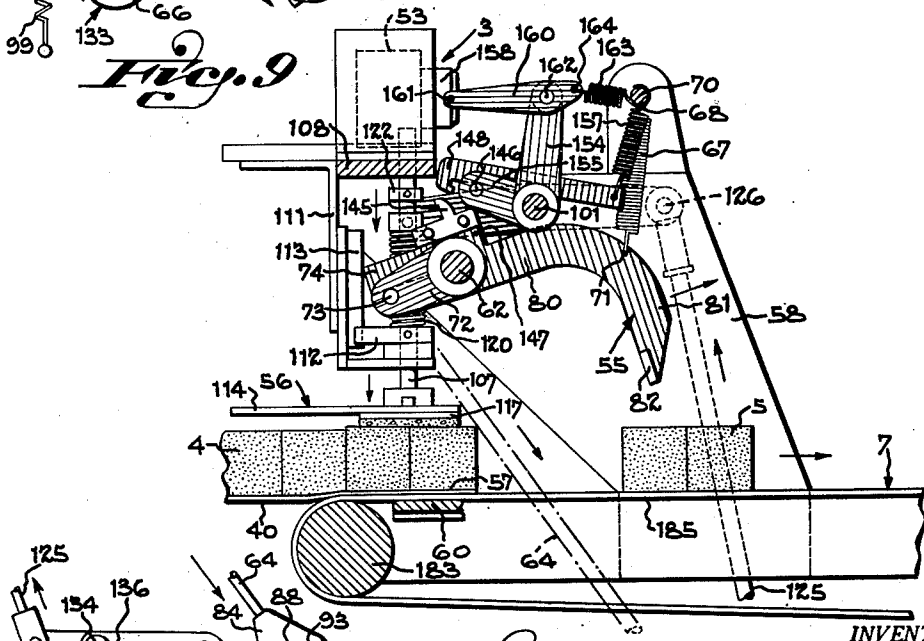


Fig. 10

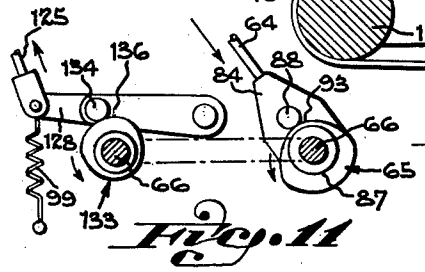


Fig. 11

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PACKAGE METERING AND STACKING MECHANISM

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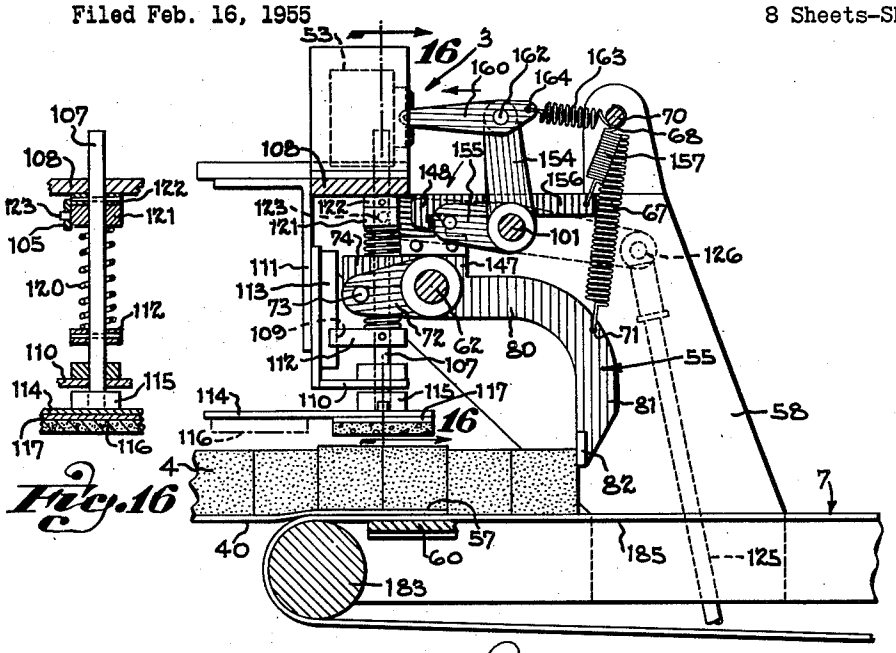


Fig. 16

Fig. 12

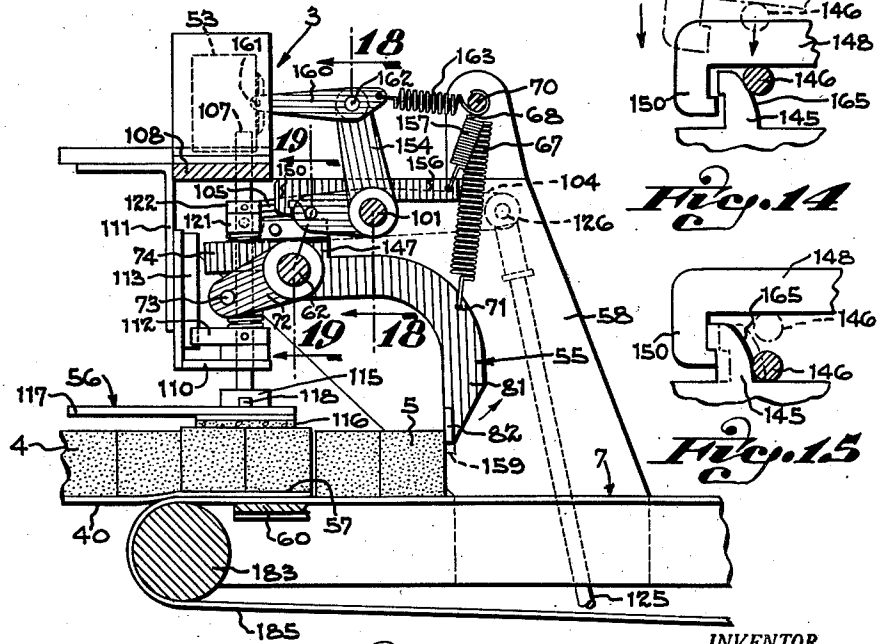


Fig. 13

Fig. 14

Fig. 15

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PACKAGE METERING AND STACKING MECHANISM

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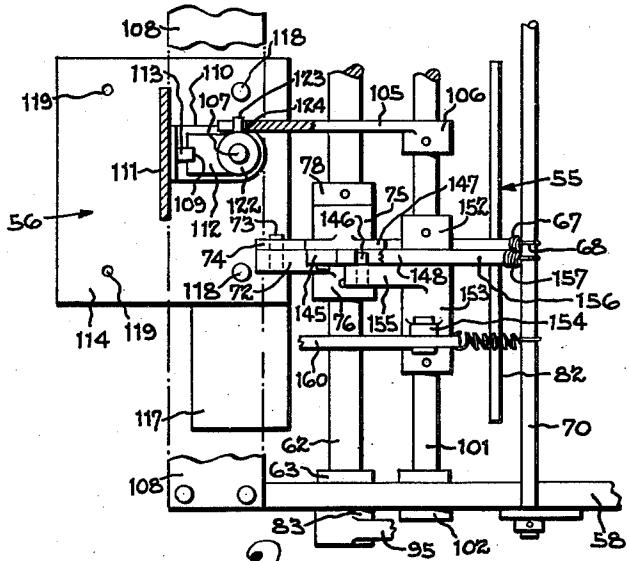


Fig. 17

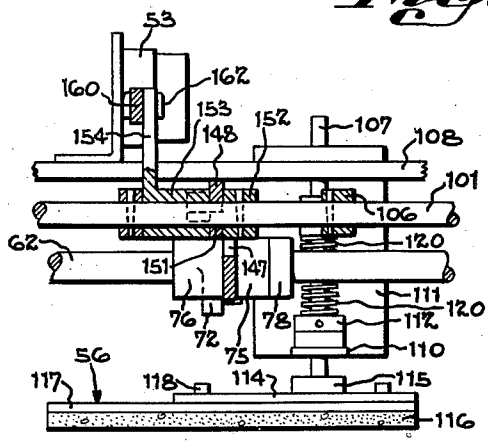


Fig. 18

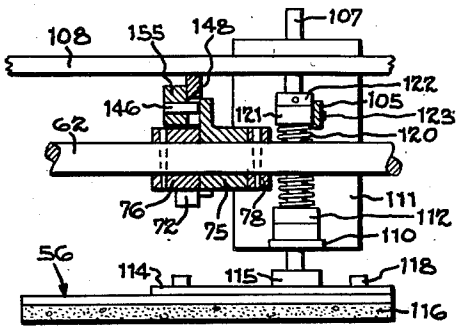


Fig. 19

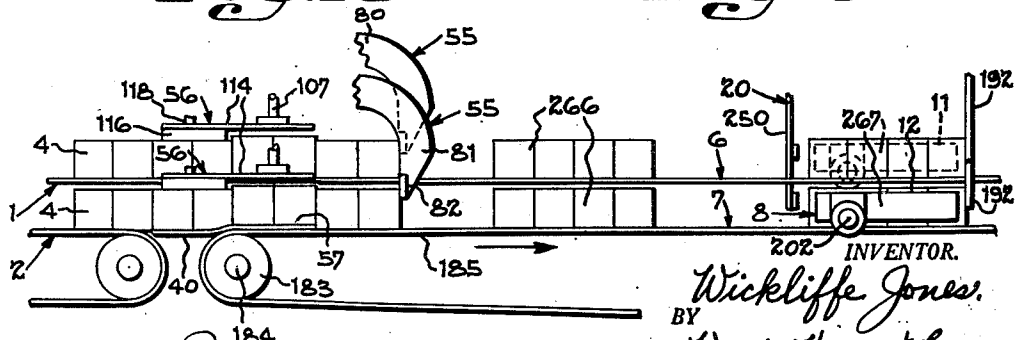


Fig. 25

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PACKAGE METERING AND STACKING MECHANISM

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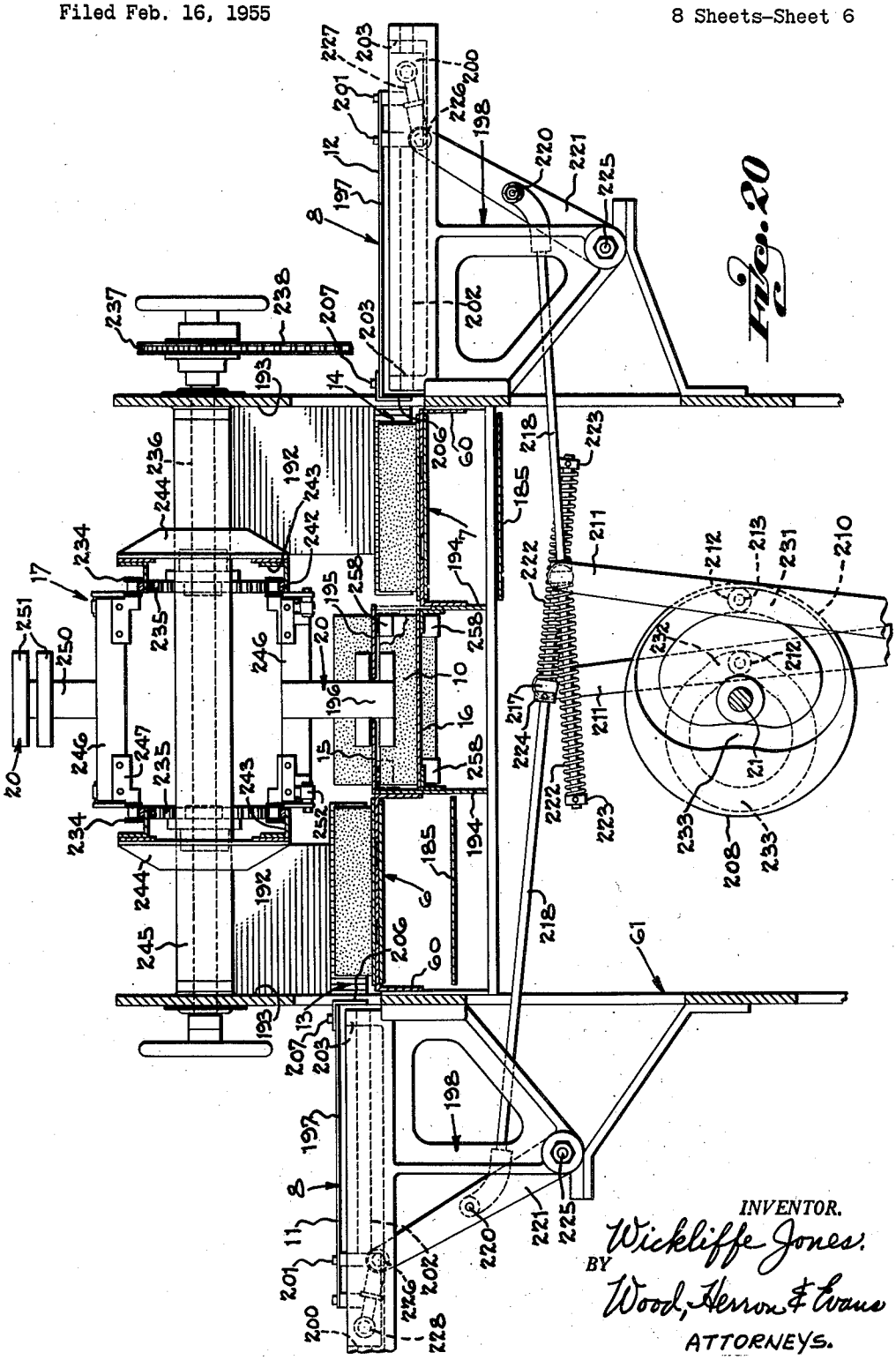


Fig. 20

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PACKAGE METERING AND STACKING MECHANISM

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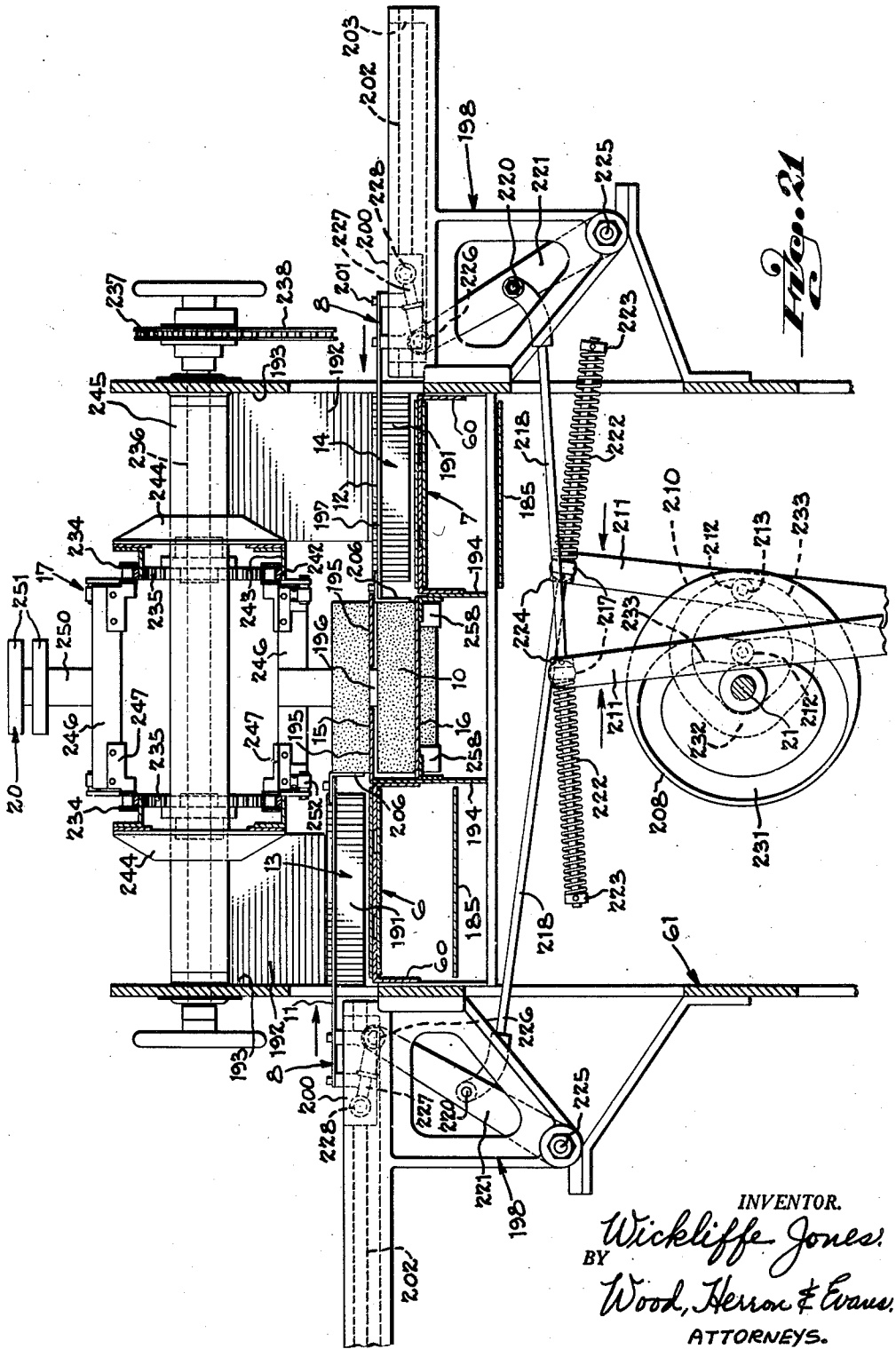


Fig. 21

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PACKAGE METERING AND STACKING MECHANISM

Filed Feb. 16, 1955 8 Sheets-Sheet 8

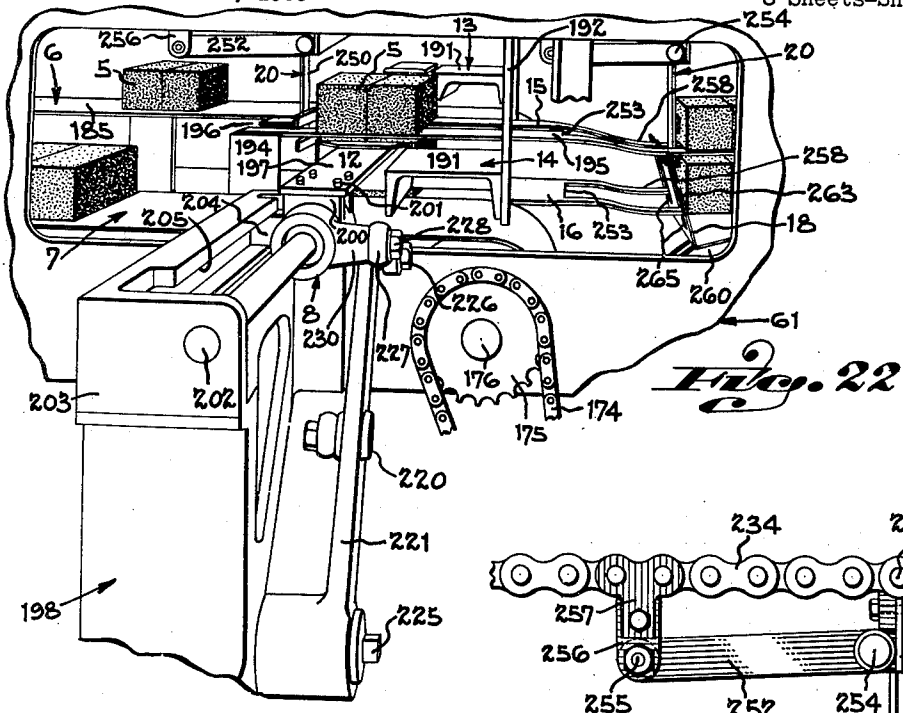


Fig. 22

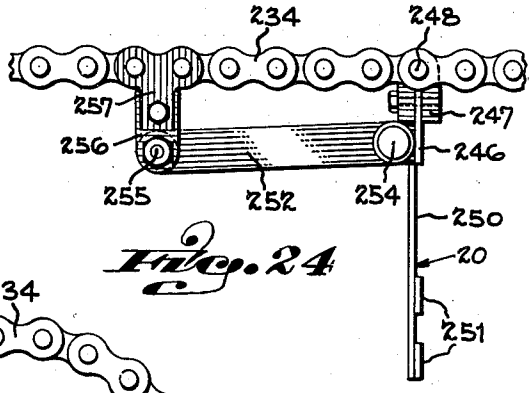


Fig. 24

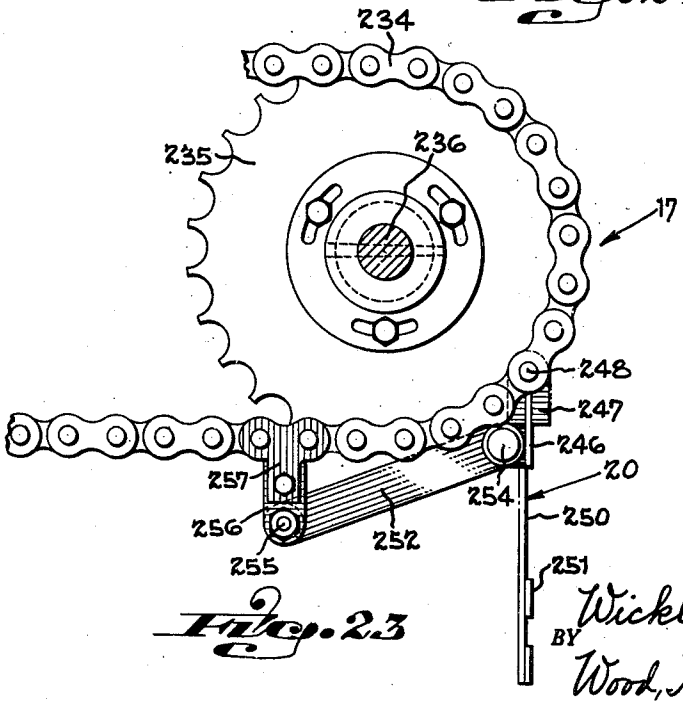


Fig. 23

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Patented Dec. 10, 1957

2,815,848

PACKAGE METERING AND STACKING MECHANISM

Wickliffe Jones, Cincinnati, Ohio, assignor to R. A. Jones and Company, Inc., Covington, Ky., a corporation of Kentucky

Application February 16, 1955, Serial No. 488,659

14 Claims. (Cl. 198—35)

This invention relates to package handling machinery and is directed particularly to a machine which arranges individual articles or packages, especially those of a fragile nature, into orderly stack formation in condition to be inserted into cartons or containers.

A primary object of the invention has been to provide a handling machine which receives packages flowing to the machine in random fashion, meters the packages into groups, advances and reforms the groups into stack formation one above the other, then feeds the stacks to the bucket conveyor of a cartoning machine for endwise insertion into cartons.

The machine is intended for article handling in general; however, it is disclosed, by way of example, in its utility of handling individual wrapped packages of soda crackers, which are naturally fragile and require careful treatment to avoid damaging them. As one example, the machine arranges the packages of crackers into groups of four, one pair of packages residing above the other for insertion in a standard one-pound carton. The packages are square in cross section and have a substantial length; during handling they reside crosswise to their path of advancement for subsequent endwise insertion into the carton.

The invention further contemplates a machine which may be converted readily to the grouping of the same packages into larger stacks, for example, stacks consisting of eight packages for insertion into a standard two-pound carton. In this event the packages are arranged in two layers residing one above the other, each layer consisting of four packages.

Briefly described, the individual packages are advanced into the machine in two separate random streams upon a pair of parallel accumulating conveyors spaced apart laterally and located in planes one above the other corresponding to the planes which the packages occupy when reformed into stack formation. The streams of packages on the two accumulating conveyors are arrested by respective metering stations which accumulate solid rows of packages forming a prime, and release metered groups of packages from the solid row upon a pair of metering conveyors which are located in planes one above the other and axially aligned with the prime conveyors. The metering conveyors preferably operate at a higher lineal speed than the accumulating conveyors and thereby provide distinct benefits which are explained in detail at a later point. Upon release by the metering stations, the two groups of packages are advanced upon the metering conveyors to a transfer station which shifts the two groups endwisely toward one another into stack formation one above the other. From the transfer station the packages in stack formation are advanced in the same direction by a sweep mechanism to the bucket conveyor of a cartoning machine.

The handling machine preferably is interposed between the delivery end of a wrapping machine and the charging end of the cartoning machine and is driven in common with the cartoning machine so as to deliver the stacks in time with the advancement of the bucket conveyor and operations of the cartoning machine.

Another object of the invention has been to provide an electrical control system which decommissions both metering stations in the event that the solid row of prime packages on either accumulating or prime conveyor becomes depleted to a predetermined degree so as to insure the release of the required number of packages upon each metering cycle. The handling and cartoning machines preferably operate at a faster rate than the wrapping machine, hence the metering stations are decommissioned periodically by the control system as the second rows of packages constituting the prime decrease; they are reactivated as the solid rows are restored by additional packages flowing from the wrapping machine.

A further object has been the provision of metering stations operating in time with the transfer station, the two components so arranged that the packages are handled gently but in a positive manner, during the metering and transfer operations to provide reliable operation without danger of injuring the fragile packages.

For this purpose, each metering station includes a gate, which in lowered position, engages and arrests the leading end of the solid accumulated row of packages or prime, with the packages urged against the gate by frictional engagement with the accumulating conveyor which advances continuously. During the metering cycle, a presser foot lightly engages and restrains the row from above, the foot being spaced from the leading end of the row a distance which determines the number of packages to be released. While the presser foot is lowered in restraining position, the gate ascends to release the metered groups of packages, then descends to its arresting position before the presser foot again ascends.

As the metered groups of packages flow from the two metering stations on the metering conveyors toward the transfer station, they are arrested by stops which hold the two laterally spaced groups of packages in vertical alignment with one another and in axial alignment with a pair of opposed plungers of the transfer station. The plungers reciprocate in accordance with the movements of the gates of the metering stations to transfer the groups endwisely to stack formation after they dwell temporarily against the stops. Upon being shifted laterally, the two groups of packages are transferred from the metering conveyors and rest one above another upon a pair of stationary support plates in position to be engaged and advanced by the sweep mechanism which advances in time with the metering and transfer stations.

The invention further contemplates the provision of an improved sweep mechanism comprising a series of pushers advanced by chains in a horizontal loop path and arranged to advance the packages in stack formation along the support plates to the bucket conveyor of the cartoning machine. The pushers are arranged to feather and maintain a perpendicular position as they move in a curved path upwardly out of engagement with the packages at the delivery end of the loop, at which point the packages are transferred to the conveyor buckets. The buckets advance in time with the pushers and the packages are thus transferred gently into the buckets during the feathering movement of the pushers. Thereafter, the packages in stack formation are advanced into the cartoning machine for endwise insertion into the cartons.

Various other features and advantages of the invention will be apparent to those skilled in the art from the following detailed description taken in conjunction with the drawings.

In the drawings:

Figure 1 is a diagrammatic side elevation of the ap-

paratus, showing generally the location and operation of the several components.

Figure 2 is an electrical diagram showing the circuit of the solenoids which regulate operation of the metering stations in response to the flow of packages on the accumulating or prime conveyors.

Figure 3 is a diagrammatic top plan view taken from Figure 1, showing a portion of the driving system of the metering conveyors.

Figure 4 is a sectional view taken on line **4—4**, Figure 1, showing the general arrangement of the metering stations.

Figure 5 is a sectional view taken on line **5—5**, Figure 4, illustrating the cam and lever which actuates the presser foot of one of the metering stations.

Figure 6 is a sectional view taken on line **6—6**, Figure 4, showing the cam and yoke which actuates the gate of one of the metering stations.

Figure 7 is a sectional view taken on line **7—7**, Figure 4, showing the cam and lever which actuates the presser foot of the second metering station.

Figure 8 is an enlarged sectional view taken on line **8—8**, Figure 4, detailing one of the metering stations, the parts being shown in package arresting position.

Figure 9 is a diagrammatic view showing the cams of the metering station in a position corresponding to that shown in Figure 8.

Figure 10 is a sectional view similar to Figure 8 showing the gate of the metering station in open position to release a pair of packages, the presser foot being lowered to restrain the solid row of accumulated packages on the accumulating conveyor.

Figure 11 is a diagrammatic view showing the cams rotated to shift the parts according to Figure 10.

Figure 12 is a view similar to Figure 8, showing the movement of the parts toward gate latching position when the solenoids are energized to decommission the metering stations.

Figure 13 is a view similar to Figure 12 showing the parts in final latched position.

Figure 14 is an enlarged fragmentary view taken from Figure 12, detailing the motion of the parts toward latching position when the solenoid is energized.

Figure 15 is a view similar to Figure 14, showing in full lines the parts in final latching position, and showing in broken lines the motion of the parts toward gate unlatching position when the solenoid is deenergized.

Figure 16 is a sectional view taken on line **16—16**, Figure 12, detailing the presser foot structure.

Figure 17 is a fragmentary top plan view of the metering station in latched position corresponding to Figure 13.

Figure 18 is a fragmentary sectional view taken on line **18—18** of Figure 13, detailing a portion of the gate mechanism.

Figure 19 is a fragmentary sectional view taken on line **19—19** of Figure 13, detailing another portion of the gate mechanism.

Figure 20 is an enlarged cross sectional view taken on line **20—20**, Figure 1, illustrating the transfer plunger mechanism for shifting the pairs of packages laterally to positions one above the other, together with the sweep mechanism for feeding the superposed packages to the buckets of the cartoning machine.

Figure 21 is a view similar to Figure 20, showing the position of the plungers and associated mechanism at the inner stroke limit of the plungers.

Figure 22 is a fragmentary perspective view of the transfer plunger mechanism at one side of the machine, the plunger being shown at its inner stroke limit.

Figure 23 is an enlarged view of a portion of the sweep chain showing the feathering action of the pusher at the delivery end of the sweep mechanism.

Figure 24 is a fragmentary view similar to Figure 23, showing the position of the pusher as it traverses the straight run of the sweep chain.

Figure 25 is a diagrammatic view showing certain parts rearranged to convert the apparatus to the metering of packages into groups of four arranged one above the other in stack formation.

GENERAL ARRANGEMENT

For purposes of illustration, the apparatus is disclosed in its utility of assembling elongated, one-quarter pound packages of crackers into stacks for subsequent insertion into a one-pound carton. As disclosed diagrammatically in Figure 1, the apparatus meters the individual packages in mating pairs disposed in planes one above the other but spaced apart laterally, then shifts the two pairs endwisely toward one another to stack formation with one pair residing above another. The stack of four packages is then advanced into the bucket conveyor of a cartoning machine for endwise insertion into a carton.

As noted earlier, the present apparatus may be converted by a simple rearrangement of the mechanism, to group the packages in larger stacks. The apparatus is shown diagrammatically in Figure 25 with the parts arranged to stack the same one-quarter pound packages into groups of eight packages for insertion into a two-pound carton. When so converted, the apparatus feeds the packages in mating groups of four which are advanced in planes one above the other, then shifted laterally to stack formation for advancement to the bucket conveyor of the cartoning machine.

The individual packages are wrapped usually in waxed paper or sheet plastic material, the wrapping material being suitably folded at the ends of the package and sealed. The wrapping operation is performed by a wrapping machine (not shown) which forms no part of the present invention. The wrapping machine feeds the packages at random upon a pair of accumulating or prime conveyors, indicated generally at **1** and **2** in Figure 1. These conveyors are of the conventional belt type and are located one above the other so as to advance the packages in the two planes which they are to occupy upon being shifted endwisely into stack formation. As best shown in Figure 3, the two prime conveyors are spaced apart laterally a substantial distance and the packages rest in crosswise position upon the upper conveyor runs.

The packages on the accumulating conveyors **1** and **2** are advanced until they reach the metering stations, indicated generally at **3** in Figure 1. As shown in Figure 4, each conveyor includes an associated metering station **3**, both stations being of duplicate construction. The metering stations are arranged to arrest the packages advancing on the accumulating conveyors **1** and **2** so as to accumulate solid rows of packages as indicated at **4—4** (Figure 1) and to release or meter the packages intermittently in groups of two as indicated at **5**.

The two metering stations **3** are driven in synchronism from a common source of power so that the two pairs of packages are released concurrently upon the upper and lower metering conveyors, indicated at **6** and **7**, which advance the two pairs of packages toward the transfer plunger mechanism, indicated generally at **8**. The transfer mechanism is arranged to shift the two groups of packages endwisely into stack formation residing one above the other, as indicated at **10** in Figure 21. As shown in Figures 20 and 21, the transfer mechanism is provided with two plungers **11** and **12** operating from opposite sides of the machine, the two plungers residing in planes corresponding to the two planes of the upper and lower metering conveyers to engage the ends of the packages thereon. The plunger mechanism is actuated in synchronism with the metering stations as described later.

Upon release of the pairs of packages by the metering stations, the pairs are advanced by the metering conveyors to respective stops, indicated generally at **13** and **14** (Figures 1 and 20), which arrest the pairs and hold them in stationary position in alignment with the plungers

11 and 12 for endwise engagement by the plungers. The timing between the metering stations and transfer plungers is so related to the speed of advancement of the metering conveyor that the pairs of packages dwell temporarily against the stops 13 and 14 before being shifted by the plungers to their superposed position. When the lateral transfer takes place, the pairs of packages are shifted from their metering conveyors 6 and 7 to the related support plates 15 and 16 which occupy the same planes as the metering conveyors. Referring to Figure 21, it will be noted that the packages, upon being shifted laterally to their stack formation by the plungers 11 and 12, are clear of the stops 13 and 14 and are free to be advanced by the sweep mechanism 17 to the conveyor buckets 18.

After being transferred to their superposed positions as shown in Figure 21, the groups of packages, which now rest upon the stationary support plates 15 and 16 in stack formation, are engaged by the sweep mechanism 17 which advances the stack to the buckets 18 of the cartoning machine. The sweep mechanism is provided with a series of pushers indicated generally at 20, which, as shown in Figure 20, interfit the upper support plate 15 and engage both the upper and lower pairs of packages. The sweep mechanism thus advances the upper and lower packages in unison along the support plates 15 and 16 to a position for engagement by the buckets 18 of the cartoning machine. After the packages are advanced to the buckets, they are carried into the cartoning machine and are inserted endwisely into the cartons by the mechanism which forms no part of the present invention.

The several components of the apparatus, which operate in synchronism with one another, are driven in common from the main drive shaft 21 which also drives the components of the cartoning machine. Therefore, the apparatus arranges and feeds the grouped packages to the cartoning machine in time with the advancement of the buckets 18 and operations of the cartoning machine. The speed of operation of the package handling apparatus and cartoning machine is related to the rate of operation of the wrapping machine and the prime conveyors 1 and 2 are driven at a rate sufficient to accumulate the solid rows of packages which form a reservoir or prime of packages to be released intermittently in pairs by the metering stations. In order to space the groups of packages as indicated in Figure 1, the metering conveyors are advanced at a faster rate than the accumulating or prime conveyors. Also, by running the metering conveyor faster, the arresting gates of the metering stations, as explained later, may be closed sooner after releasing metered packages; therefore, the long rows of packages on the accumulating conveyors have greater time to advance. Hence shock is decreased.

Accumulating conveyor

As indicated in Figure 1, the accumulating conveyors are driven at the required rate by a variable speed drive unit indicated generally at 22, consisting of a motor 23 connected by the variable speed pulleys 24 to a gear reduction unit 25. The gear reduction unit includes a sprocket 26 connected by a chain 27 to a sprocket 28 mounted on a countershaft 30. A driven sprocket 31 on shaft 30 is connected by a sprocket chain 32 to a sprocket 33 keyed to the shaft 34 of the lower conveyor 2. The conveyor shaft includes a pulley 35, the conveyor belt passing around the pulley in the usual manner.

The upper conveyor 1 includes a similar roller 36 mounted upon a shaft 37 and driven by a sprocket 38. Sprocket 38 is driven by a sprocket (not shown) similar to sprocket 33 which is also mounted upon shaft 34. The shaft 34 extends completely across the machine to drive both conveyors at uniform speed in the same direction.

In order to simplify the drawings, the frame of the machine and bearings for the several shafts have been omitted from Figure 1. It will also be noted that the support structure for the conveyor belts has been omitted; however, it will be understood that the conveyor support structure is similar to that of the metering conveyors as shown in Figure 4. It is to be noted that the accumulating or prime conveyors are in axial alignment with the metering conveyors, such that the packages are transferred in a straight path from the ends of the accumulating conveyors to the metering conveyors. As indicated in Figures 1 and 8, respective stationary plates 40—40 bridge across the adjacent ends of the conveyors to transfer the packages from the prime to the metering conveyors. It will be understood that the prime conveyors are driven constantly; however, since the metering stations release the grouped packages intermittently, the conveyor belts 1 and 2 necessarily slip with respect to the solid rows of packages which are restrained by the metering stations.

In order to provide positive operation of the metering apparatus, the accumulating conveyors are provided with prime control switches which decommission the metering stations when the accumulation or prime of packages becomes depleted beyond a predetermined limit. As explained below, the control switches are interconnected with the metering stations to decommission both stations when the switches of either conveyor are tripped to signal a lack of packages. This prevents the metering stations from feeding until the proper accumulation is restored.

As indicated in Figure 1, the accumulating conveyors are provided with a pair of forward switches indicated at 41—41 and a rearward pair of similar switches indicated at 42—42. The switches are mounted in stationary position upon brackets 43 and 44, which are attached to the frame of the machine (not shown). Each switch includes a feeler arm 45, the arms being mounted upon pivot shafts 46 with the free outer end of each arm resting upon the accumulated row of packages 4 on the upper and lower conveyors 1 and 2. The contacts of the switches are open when their arms are thus elevated. The switches are interconnected by an electrical cable 47 which passes through a junction box 48 to the switch contacts.

The electrical circuit of the switches 41 and 42 is shown diagrammatically in Figure 2. The switches are inserted in the power line 50 in parallel with one another by way of the branch lines 51—51 to the line 52 which leads to both solenoids 53—53. The solenoids 53 form a part of the metering stations and are arranged to decommission the stations upon being energized, as explained in detail later. As shown in the diagram, the solenoids are connected in series with one another and are both energized when one or more of the feeler arms 45 drop downwardly to complete the circuit. The rearward switch 42 for the lower conveyor is shown in this position in the diagram and in Figure 1. The circuit is thus completed from line 50 through the closed switch 42 to line 52 and through the solenoids in series to the other power line 54, thus decommissioning both metering stations as indicated in Figure 1.

Switches 41 and 42 are spaced apart four packages or more, consistent with the number of packages to be assembled into a unit charge. The two sets of switches cause the group of reserve packages 59 to be maintained between the switch arms in addition to the prime row, thus insuring that the prime rows extend back to the switches at all times.

Operating under the conditions shown in Figure 1, the advancement of two additional packages will activate the metering stations and cause the release of two packages from the prime rows during the release cycle, as explained later. As soon as the two packages are released, the arm of switch 42 will again drop to decommission the metering stations until at least two additional packages are advanced to the reserve packages 59 between the switches.

On the other hand, with rearward switches 42 omitted and the prime row depleted, then the solenoid would be

deenergized each time and an additional package advances and elevates the switch arm temporarily. Thus the metering stations would feed two packages upon advancement of a single package, tending to exhaust the prime row. Even if the prime row is never exhausted, the metering stations would be disturbed upon the advancement of each individual package instead of upon the advancement of two packages, thus creating unnecessary starts and stops.

Metering stations

As shown in Figure 4, an individual metering station 3 is provided for the upper and lower prime conveyors 1 and 2, both operating in unison by virtue of a common driving system and the prime control switches. Since both stations are of identical construction, the following detailed description of the station of the lower metering conveyor 6 applies to both stations.

Described generally with reference to Figures 8 to 10, the metering station includes a gate, indicated generally at 55, and a presser foot indicated generally at 56. It is to be noted that the structure shown in Figures 8 to 10 illustrates the metering station in activated condition, with the solenoid deenergized, as distinguished from Figures 1, 12 and 13, in which the station is shown decommissioned with the solenoid energized. The gate and presser foot are actuated in timed relationship with one another by respective cams and linkages to release the grouped packages in time with the reciprocations of the transfer plungers 8. As shown in Figure 8, the gate is in lowered position arresting the prime row of packages 4 on the accumulating conveyor, while the presser foot is in its elevated position.

In order to release two packages intermittently, the presser foot is first lowered into contact with the prime row of packages to restrain the row (Figure 10), then the gate is elevated to release the two forward packages 5 which reside in advance of the presser foot. It will be noted that the stationary plate 40 has a portion 57 overlying the end of the metering conveyor, such that the packages rest upon the stationary plate when engaged by the presser foot. When the gate is elevated, the two packages 5, which rest upon the metering conveyor, are advanced by the conveyor as indicated in Figure 10, and after the packages pass beyond the gate, the gate is again lowered to arresting position. Thereafter, the presser foot is elevated back to the position shown in Figure 8. Since the prime row of packages is resting upon the prime conveyor which advances constantly, the row advances against the gate each time the presser foot rises.

As shown in Figure 4, each metering station includes a pair of side plates 58—58 rising upwardly from the angle iron structure 60 which supports the upper runs of the metering conveyors 6 and 7. The angle iron structure in turn is supported by the frame of the machine which is indicated generally at 61. The side plates 58 provide the supports and bearings for the several components of the metering stations.

Described in detail with reference to Figures 8 and 17, the gate 55 is pivotally mounted upon a rock shaft 62 having its opposite ends rotatably journalled in the side plates 58. The rock shaft is restrained against axial motion by the collars 63—63 which are secured to the shaft and in bearing engagement against the side plates (Figure 4). The gate is shifted to its open and closed positions by a link 64 having an end connected to the rock shaft as described later. The link in turn is reciprocated by a gate actuating cam, indicated generally at 65 mounted upon a cross shaft 66 journalled in the frame 61 of the machine. The gate is loosely mounted upon its rock shaft and is normally urged to its elevated position by a tension spring 67 having its upper end anchored as at 68 upon a cross rod 70 extending between the side plates. The lower end of the spring is anchored as at 71 to the gate. The gate is actuated by a rocker arm 72 pinned to rock shaft 62, the rocker arm having a lateral pin 73 engaging a lever extension 74 which forms a part of the gate 55. The rocker arm 72 thus holds the gate down against the tension of spring 67 which tends to elevate it. Rotary motion of rock shaft 62 in gate opening direction swings the rocker arm downwardly, allowing spring 67 to pull the gate to its elevated position (Figure 10). When the rocker arm 72 swings upwardly toward gate closing position, as shown in Figure 8, its pin 73 engages the lever extension 74, thus forcing the gate downwardly to its closed position against the resistance of spring 67. By operation of the tension spring, the gate follows the movements of the rocker arm but is free to be latched in its lowered position as explained later.

Described in detail with reference to Figures 17 and 19, the gate includes a hub 75 loosely journalled upon rock shaft 62 while the rocker arm 72 includes a hub 76 which is pinned to the shaft. The rocker arm resides adjacent the lever extension 74 of the gate with its pin 73 projecting laterally beneath the lever extension. The hub 75 of the gate is thus loosely confined between hub 76 and a collar 78 which is pinned to rock shaft 62. When the gate is latched in closed position, the rock shaft and rocker arm are free to rock with respect to the lever extension of the gate without imparting movement to the gate.

The gate is formed of flat bar stock and comprises a shank 80 extending horizontally from the hub 75. The shank curves downwardly and includes a vertical portion 81 which carries upon its lower end a stop bar 82. The bar extends transversely of the shank and engages the upper edge portion of the first package, as indicated in Figure 4 when the gate is lowered.

As detailed in Figure 6, link 64, which actuates the rock shaft, includes a yoke 84 attached as at 85 to its lower end. The slotted portion 86 of the yoke slidably embraces the hub 87 of cam 65 to guide the yoke and link during axial reciprocation. Movement is imparted to the yoke and link by a cam roller 88 loosely journalled upon a pin 90 attached to the yoke. The cam roller is confined in the track 91 of the cam which includes portion 92 having a large radius and a portion 93 having a small radius. The two portions of the track are joined by eccentric curves 94—94 which impart the necessary movements to the link as the cam is rotated.

The upper end of link 64 is connected to the rock shaft 62 by an actuating arm 95. For this purpose, the rock shaft 62 projects through the side plate 58 and the actuating arm includes a hub 83 pinned to the rock shaft for imparting movement to it. A yieldable connection is established between the link and actuating arm 95 by a compression spring 96 confined loosely upon the link, with its lower end seated against a collar 97 which is pinned to the link. The upper end of the spring is seated against a lug 98 projecting laterally from actuating arm 95. The upper end of the link passes loosely through the lug. A collar 100, which is pinned to the upper end of the link, confines the lug upon the link against the preload thrust of the spring. The thrust of the link is thus transmitted through the compression spring to the actuating arm 95, and under normal operation, the arm is shifted in unison with the link. The compression spring allows the link to overtravel the arm if the gate is obstructed and also when the station is decommissioned, as described in connection with the latching mechanism of the gate.

As best shown in Figures 4 and 17, the presser foot 56 is actuated by a rock shaft 101 having its opposite end portions journalled in the side plates. The shaft is locked against axial movement by a collar 102 at one end and by the hub 103 of an actuating arm 104 at its opposite end. The actuating arm 104 is rocked by a cam and link as described in detail later. The presser

foot is actuated by a lever **105** having a hub **106** pinned to the shaft **101**.

The presser foot includes a vertical shaft **107** (Figure 16), which is slidably journalled for axial movement in an upper plate **108** and a lower bearing bracket **110**. The upper plate extends transversely across the upper edges of the side plates **58—58** and the bearing bracket **110** is supported by a vertical plate **111** projecting downwardly from plate **108**. The shaft **107** is restrained against rotary movement by a finger **112** (Figure 17) pinned to the shaft, the outer end of the finger having a slot **109** slidably traversing a guide bar **113** which projects inwardly from the bearing bracket **110**.

The presser foot comprises a base plate **114** having a hub **115** attached to the lower end of the vertical shaft **107** (Figures 17 and 18). The presser foot includes a pad **116** formed of foam rubber or the like, attached to a backing plate **117**. The pad assembly is attached to the base plate by screws **118**. The foam rubber pad provides a soft contact area suitable to restrain the packages without damage. As best shown in Figure 4, the pad extends transversely for the full length of the package to distribute the pressure across the entire area.

In the event the machine is set up to feed the packages in groups of four instead of two, the pad **116** is shifted to the position shown in broken lines in Figure 12. To provide this adjustment, the rearward portion of the plate **114** is provided with a second set of holes **119** to receive the screws **118**. This modification is described in greater detail with reference to Figure 25.

The lever **105**, which actuates the presser foot, yieldably urges the presser foot into engagement with the packages. For this purpose the vertical shaft **107** includes a compression spring **120** (Figure 16) having its lower end seated upon the guide finger **112** and its upper end seated against a collar **121** slidably fitted upon the shaft. A stop collar **122** is pinned to the vertical shaft above collar **121**, the spring being slightly preloaded between stop collar **122** and finger **112**. As shown in Figure 17, collar **121** includes a lateral pin **123**, which is confined in the slot **124** formed in the swinging end of lever **105**. The compression spring provides a slight overtravel of the lever **105** to clamp the packages under light predetermined pressure upon the portion **57** of the stationary plate **40**.

Referring to Figures 4 and 8, each presser foot is actuated by a link **125** having an upper end pivotally connected as at **126** to the actuating arm **104**. The lower end of link **125** is pivotally connected as at **127** to the swinging end of a cam lever **128**, as shown in Figures 5 and 7. The cam and lever structure shown in Figure 5 actuates the upper metering station and the structure shown in Figure 7 actuates the lower station. Referring to Figure 5, the cam lever **128** is pivotally connected as at **130** to a bracket **131** attached to the cross plate **132** which forms a part of the machine frame. The lever and link are actuated by a presser foot cam **133** which is pinned to the cross shaft **66** for rotation in unison with the gate actuating cam **65**. A cam roller **134** is journalled as at **135** upon the cam lever **128**, the roller tracking upon the periphery of the cam. To provide the proper movement, the cam includes a portion **136** having a large radius and a portion **137** having a small radius, the two portions joined by the eccentric curves **138—138**.

Referring to Figure 4, the cross shaft **66**, rotatably journalled at opposite ends in the frame **61**, is driven in the direction indicated by a bevel gear **139** which meshes with a bevel gear **129** fixed to the main drive shaft **21**. An intermediate bearing **140** is provided adjacent the bevel gear **139**, the bearing being mounted upon a bracket **141** which is attached to the cross plate **132**.

Because of the location of the bevel gears, the presser foot cam **133** for the lower metering station is offset laterally. For this purpose, the cam lever **128** is pinned to a cross shaft **142** journalled in brackets **143** secured to the cross plate **132** (Figures 4 and 7). A cam lever **144** is pinned to the opposite end of the cross shaft and includes a cam roller **134** tracking against the cam **133**. As indicated diagrammatically in Figures 9 and 11, a tension spring **99** has one end anchored to the end of the cam lever **128** to urge the lever in tracking engagement against the cam.

The cross shaft **66** advances both cams in unison to actuate the presser foot and gate in timed relationship, thereby to release the metered packages **5** intermittently. As indicated diagrammatically in Figure 9, when the mechanism is in package arresting position (Figure 8) the small radius **137** of the presser foot cam **133**, tracks against the cam roller **134**, thus moving the link downwardly and maintaining it in this position for a short interval. This holds the presser foot in elevated position for a sufficient period to allow the packages to advance against the gate. Due to the overtravel provided by the presser foot spring **120**, the foot is elevated only while the small radius **137** traverses the roller.

While the presser foot is elevated, the large radius **92** of the gate cam **65** tracks against its roller **88** (Figure 9) to hold the gate in package arresting position as shown in Figure 8. The gate is maintained in lowered arresting position during the major portion of cam rotation. It will be understood that the presser foot dwells in lowered position when the gate is elevated and remains lowered until the gate is again lowered to arresting position. This allows the two packages **5** to be released upon the metering conveyor while the solid row is restrained by the presser foot and allows the gate to return to arresting position before the row is again released by the presser foot.

Referring to Figures 10 and 11, showing the release position of the mechanism, the presser foot is dwelling in its lowered package restraining position as the large radius **136** of the presser foot cam is tracked against the roller **134**. At the same time, the small radius **93** of the gate cam **65** is traversing the cam roller **88** to shift link **64** downwardly, causing the gate to be shifted to elevated position to release the packages. The small radius maintains the gate in this position until the packages have been advanced by the metering conveyor to a position clear of the gate, then the gate is lowered.

It will be understood that the gate and presser foot cams of both metering stations rotate in unison to release the packages upon both metering conveyors concurrently. Upon release, both groups of packages advance in unison as indicated at **5** in Figure 1.

In some instances, as shown in the present drawing, packages are aligned laterally before being superposed. In other instances the packages may be longitudinally offset and are aligned when engaged by the sweep mechanism.

Latching mechanism

As stated earlier, both metering stations are decommissioned simultaneously by the solenoids **53** in the event one of the metering switches **41** or **42** closes to indicate a depletion in the solid rows of prime of packages on the accumulating conveyors. The latching mechanism, which decommissions the gate of the metering station is in duplicate for both metering stations; therefore, the following detailed description of the latching mechanism with reference to the lower station also applies to the upper station.

As shown in Figures 8 to 15, the gate includes a hook **145** which is secured to an extension **147** of the gate above rock shaft **62**. During normal operation (Figures 8 and 10) the solenoid **53** remains deenergized, such that the hook is free to reciprocate without interference. When one of the switches **41** or **42** is closed to energize the solenoid, a latching lever **148** lowered to engage the hook **145** of the gate and to latch the gate in package arresting position as shown in Figures 13 and 15.

For this purpose, the swinging end of the latching

lever 148 includes a latching hook 150 which engages the hook 145 as shown. Thus, although the rock shaft 62 and rocker arm 72 continue to operate as shown in Figure 13, the latching lever 148 holds the gate in its lowered arresting position against the action of spring 67.

Described in detail with reference to Figure 18, the latching lever 148 includes a bore 151 loosely journalled upon the rock shaft 101. The latching lever 148 resides loosely between a collar 152 and the hub 153 of a bell crank lever 154. The bell crank lever is actuated by the solenoid as described later and its lower arm 155 includes a lateral pin 146 which projects beneath the latching lever 148 to lower the lever when the solenoid is energized (Figures 12 to 15).

Referring to Figures 8 and 10, latching lever 148 includes a tail piece 156 projecting outwardly beyond rock shaft 101. A tension spring 157 has it lower end anchored to the tail piece and has its upper end connected to the cross rod 70. The spring normally urges the hook end of the latching lever downwardly toward latching position. However, so long as the solenoid is deenergized, the pin 146 of bell crank lever 154 holds the latching lever in unlatched position against the tension of spring 157 as shown.

For this purpose, the bell crank lever is connected to the armature 158 of solenoid 53 by a link 160. The link has one end pivotally connected to the solenoid armature as at 161 and its opposite end pivotally connected to the bell crank lever as at 162. A tension spring 163 has one end anchored upon cross bar 70 and has its opposite end connected to the link as at 164, thus urging the bell crank lever constantly in unlatching position as shown in Figure 12. It will be understood that spring 163 provides greater tension than spring 157 so as to normally hold the latching lever 148 in its unlatched position against the force of spring 157.

When the solenoid is energized, as shown in Figure 12, its solenoid shifts the bell crank lever downwardly counter to spring 163, thus allowing latching lever 148 to be shifted to latching position by operation of spring 157.

In the preliminary latching position, shown in Figures 12 and 14, the pin 146 cams against the cam surface 165 of hook 145 and thus limits the movement of the bell crank lever under the influence of the solenoid. It will be noted in these views, that, with the gate in arresting position, the hook 150 of latch 148 clears the hook 145 of the gate. This allows the latch to drop down to latching position without interference. As gate rocker arm 72 swings downwardly as shown in Figure 13, gate spring 67 begins to elevate the gate, thus swinging the gate hook 145 forwardly a slight distance, allowing the pin 146 to cam down the curve 165 of the hook to the final latching position shown in Figures 13 and 15.

It will be noted that the gate rises slightly as indicated at 159 in Figure 13 when it shifts to final latching position. The gate is therefore locked rigidly against upward movement by the engagement of hook 150 and against downward movement by the latch pin 146. This prevents any slight motion of the gate and therefore protects the edge of the package which is engaged against the gate. As the rocker arm 72 continues to rock, the spring 96 of the gate actuating link 64 compresses slightly each time the pin 73 of the rocker arm 72 rises against the lever extension 74 of the gate.

The purpose of the cam surface 165 of the hook and pin 146 is to keep the gate movement timed with its cam when the solenoid is deenergized to release the gate. In other words, if the gate were unlatched immediately when the solenoid is deenergized, then the gate may be elevated out of time with the presser foot. By way of example, should the metering switch open to deenergize the solenoid when the presser foot is elevated (Figure 12), then the gate would release the entire row of packages instead of metering them.

Assuming that the solenoid is deenergized while the rocker arm 72 is in gate elevating position (Figure 13), the latching lever 148 will shift latch pin 146 to the position shown in broken lines in Figure 15, but the gate will remain latched in arresting position by the engagement of the hooks 145 and 150 as indicated. When the gate cam approaches its gate closing position and elevates the rocker arm 72 (Figure 12), the gate is rocked downwardly slightly to its normal arresting position as indicated at 159 in Figure 13. This motion shifts the gate hook 145 to the release position shown in broken lines in Figure 15, allowing the latching lever to rise. The gate is now under control of its cam and swings to open position as the rocker arm 72 rocks downwardly under cam rotation (Figure 10).

It is to be noted that the solenoid can be energized to latch the gate only when the parts are in the arresting position shown in Figures 12 and 13. In other words, the packages are advanced only when the gate is lowered and the presser foot is elevated; consequently the metering control switches 41 and 42 can close only as the row of packages advances against the lowered gate.

It will be understood that while the gate is latched in arresting position, the presser foot continues to reciprocate since this has no effect on the packages. Also, it will be understood from the foregoing, that the latching operation is identical for both stations and that both will resume operation concurrently when the solenoids are deenergized.

Metering conveyors

The metering conveyors 6 and 7 are advanced in unison at a rate greater than the accumulating or prime conveyors in order to space the packages apart as indicated at 5 in Figure 1 as the packages intermittently are released. The accumulating conveyors, as stated earlier, are driven at a speed correlated to the output of the wrapping machine, which may be slightly slower than the operating cycles of the handling apparatus. Thus, the supply of packages on the accumulating conveyors is depleted periodically to decommission the metering stations. The metering stations and transfer plungers are so timed that the metering conveyors advance the packages to the transfer plungers in advance of the cyclic advance of the plungers.

Referring to Figures 1 and 3, the metering conveyors are driven from the main driven shaft 21 by the bevel gear 166 meshing with a bevel gear 167 secured upon a cross shaft 168 which is journalled in bearings (not shown) mounted upon the machine frame. A sprocket 169, attached to the end of shaft 168, is connected by a sprocket chain 170 to a sprocket 171 secured to an intermediate cross shaft 172. The lower metering conveyor 7 is driven by a sprocket 173 secured to an end of cross shaft 172 having a sprocket chain 174 meshing with a sprocket 175 secured upon the drive shaft 176 of the lower metering conveyor. The upper metering conveyor 6 is driven by a sprocket 177 secured upon the opposite end of shaft 172 having a chain 178 meshing with a sprocket 180 secured upon the drive shaft 181 of the upper metering conveyor.

Both metering conveyors include driving rollers 182—182 on drive shafts 176 and 181 and the opposite ends of the conveyors pass around idling rollers 183—183 mounted upon shafts 184—184. The conveyor belts 185 consist of standard fabric belting of the required width as indicated in Figure 3. As shown in Figures 4 and 20, the upper run of each belt is slidably supported upon the angle iron structure 60 which is supported by the frame 61 of the machine. The sweep mechanism, which is described later, is also driven from the bevel gear 166 (Figure 3). As shown by the arrows in Figure 1, the lower run of the sweep mechanism chain travels in the same direction as the metering conveyors; consequently, the direction of its drive must be opposite to the metering conveyors. For this purpose, as shown in Figure 3, a bevel gear 187 which is opposed to bevel gear 167, also meshes with bevel gear 166 and is secured upon shaft 188

which is coaxial with shaft 168. The bevel gear arrangement thus rotates the two shafts in opposite directions as indicated. The sweep mechanism is driven by a sprocket 190 secured upon shaft 188 as described later in detail.

As explained earlier, the metering conveyors advance the pairs of packages until they are arrested by the stops 13 and 14 which are located adjacent the plungers 11 and 12 of the transfer mechanism 8 (Figure 1). Each stop consists of a channel shaped member 191 (Figures 20 and 22) secured upon a vertical mounting plate 192. The mounting plates are attached to the side members 193 of the sweep mechanism, as shown in Figure 20. The channel members 191 preferably are attached to the plates by screws (not shown). This permits the channel members to be removed when the machine is converted to feed groups of four packages, as described later.

As shown in Figure 20, the channel members 191 reside immediately above the upper runs of the metering conveyors in position to engage the packages thereon. The pairs of packages encounter the stops while the transfer plungers 11 and 12 dwell in their retracted positions as indicated, such that the ends of the plungers are clear of the pairs of packages. Since the metering conveyors are driven continuously, the belts slip relative to the arrested packages and maintain the pairs in position against the stops until they are shifted laterally by the transfer plungers.

Transfer mechanism

The packages arrested by the stops 13 and 14 are shifted endwisely by the plungers 11 and 12 of the transfer mechanism directly upon the stationary support plates 15 and 16 for engagement by the pushers 20 of the sweep mechanism. As shown in Figure 20 the support plates 15 and 16 are located between the spaced metering conveyors, the upper plate 15 being aligned horizontally with the upper run of conveyor 6 and the lower support plate 16 being aligned with the lower metering conveyor 7.

The two plates 15 and 16 are mounted upon vertical supports 194 at front and rear (Figures 20 and 22) which are attached to the frame of the machine. As shown in Figure 22, the supports are spaced away from the path of plunger movement in order to provide clearance for the packages as they are transferred from the lower conveyor to plate 16. The upper support plate 15 is in the form of two bars 195—195 which are spaced apart as at 196 to provide clearance for the pushers 20 of the sweep mechanism. The pushers engage both pairs of packages after they are shifted upon the plates 15 and 16. It will be noted in Figure 20, that the stops 13 and 14 are spaced apart laterally a sufficient distance to allow the packages to pass without interference between them as the packages are advanced by the pushers.

Described in detail with reference to Figures 20, 21 and 22, the plungers 11 and 12 each consist of a flat metal bar 197 mounted for axial reciprocation relative to a plunger support frame indicated generally at 198 which is secured to the frame 61. Each bar has its outer end attached to a slide bearing 200 by means of screws 201. Each slide bearing is mounted for reciprocation upon a guide shaft 202 which has its opposite ends secured in the lugs 203—203 at the upper portion of the plunger frame. As best shown in Figure 22, the slide bearing includes a lateral slide block 204 which is slidably engaged in a slideway 205 formed in the plunger frame in parallelism with the guide shaft 202. The slide blocks locks the slide bearing and plunger bar against rotary motion.

The inner end of each bar 197 includes a pusher 206 which is attached by screws 207 to the bar, the pusher having a width sufficient to engage the ends of the pair of packages which are arrested by the stops. When the mechanism is converted to feed the packages in groups of four, a pusher having the required width is substituted for the pusher 206. It will be noted that the frame and plunger structure is in duplicate on opposite sides of the machine, the two structures being mounted at the respective elevations corresponding to the planes of the metering conveyors.

The two plungers 11 and 12 are reciprocated in unison by the cams 208 and 210 (Figures 1 and 20), which are secured upon the main drive shaft 21. Each cam includes a cam lever 211 having a cam roller 212 journalled as at 213 and confined in the track in the cam. The lower end of each lever includes a hub 214 loosely journalled upon a shaft 215 (Figure 1), the levers secured against axial replacement by collars 216 secured to the shaft.

The upper end of each lever includes a lug 217 slidably engaging a link 218, the outer end of each link being pivotally connected as at 220 to a plunger lever 221. In order to provide a yieldable connection, each link includes a compression spring 222 having one end seated against the lug 217 of the cam lever and having its opposite end seated against a collar 223 secured to the end portion of the link. A stop collar 224, secured upon the link, seats against the lug 217, spring 222 being slightly preloaded between the two collars.

Each plunger lever 221 has its lower end pivotally mounted as at 225 upon the frame 198 and the upper end of each lever is pivotally connected as at 226 to a link 227. The opposite end of the link is pivotally connected as at 228 to the slide bearing 200. As shown in Figure 22, the slide bearing includes a lateral boss 230 which spaces the link outwardly from the bearing.

The two plungers are reciprocated in unison by the cams 208 and 210 which are provided with tracks having concentric dwell portions 231 and 232 (Figure 20). The cams 208 and 210 are timed with the presser foot and gate cams of the metering stations to hold the plungers in the retracted dwell position for a predetermined period after the gates of the metering stations have been elevated to release the pairs of packages. The timing between the metering stations and transfer plungers is related to the rate of advancement of the metering conveyors to allow the conveyors to advance the packages to the stops before the plungers are reciprocated inwardly to transfer the pairs of packages (Figure 21).

Since the speed of the metering conveyors is constant and the release movements of the gates are intermittent, the packages are located at a definite spacing upon the conveyors. The spacing between the metering station and transfer plungers and rate of advancement of the conveyors is such that one group of released packages is advanced approximately half way to the stops 13 and 14 while a previously released package is arrested by the stops in position to be transferred as shown in Figure 20. The cams provide a dwell period of substantial duration during each cycle of cam rotation, such that precise timing in the arrival of the pairs of packages is unnecessary.

At the end of the dwell period, the eccentric track portions 233 of the cams begin concurrently to traverse the respective cam rollers, causing the cam levers 211 to be shifted inwardly toward one another as indicated by the arrows in Figure 21. This advances the plungers and transfers the packages to the stationary support plates 15 and 16. Upon reaching the point in the cycle shown in Figure 21, the eccentric cam tracks begin to shift the levers and plungers back to the dwell position (Figure 20), such that the plungers are retracted to clear the next set of packages advancing upon the metering conveyors.

Sweep mechanism

After being transferred laterally, the pairs of packages rest temporarily upon the support plates 15 and 16; thereafter, the packages are engaged by the pushers 20 of the sweep mechanism and advanced lineally along the support plates toward the buckets 18. The sweep mech-

anism, as outlined earlier, is driven in common with the metering conveyors and transfer mechanism and is so timed that one of its pushers engage the upper and lower packages after the plungers are retracted. It will be noted in Figure 21 that the pushers advance along a longitudinal path centrally between the transversely spaced metering conveyors and that the packages are clear of the stops **13** and **14** as they are advanced.

Described with reference to Figures 1 and 20, the sweep mechanism comprises a pair of chain loops indicated at **234—234** passing over a pair of driving sprockets **235—235**. The sprockets are mounted upon a cross shaft **236** which is rotatably journalled in the side members **193** previously indicated. The chains are driven in unison by the driving system shown in Figure 3. For this purpose, a sprocket **237** is secured upon cross shaft **236** of the sweep mechanism and is driven by a chain **238** passing around the sprocket **190** of the driving system as described earlier with reference to Figure 3. The opposite ends of the chain loops **234** pass around the idler sprockets **240** which are mounted upon a cross shaft **241**, also rotatably journalled in the side members **193** (Figure 1).

Referring to Figure 20, the upper and lower runs of the chain loops **234** are supported upon guide bars **242** which are mounted upon angles **243**. The angles in turn are supported by brackets **244** attached to a cross member **245** extending across the side members **193**. The guide rails for the lower runs of the chains guide the pushers **20** at the proper elevation to straddle the upper support plate **15** as shown.

As the pushers pass around the delivery end of the sweep mechanism, they feather as indicated in Figures 1 and 23 and remain in a vertical position as they retract from the packages which are now entering the buckets **18** of the conveyor. For this purpose, each pusher is mounted upon a cross bar **246** (Figure 20) having its opposite ends connected to pivot brackets **247—247** which in turn establish a pivotal connection with the chain runs. As best shown in Figures 23 and 24, the pivot brackets **247** include pins **248** which pivotally connect adjoining chain links.

Each pusher comprises an outwardly projecting shank **250** having a pair of pusher plates **251—251** at its outer end portion. The shank passes through the slot **196** of support plate **15** (Figure 20) as it advances across the lower run of the chain loop, with the pusher plates **251** engaging the upper and lower packages. During this motion, the shank is locked in perpendicular position by the links **252—252**, as described below, causing the pushers to pass in a straight line across the support plates as indicated in Figure 22. After passing beyond the ends **253** of the plates **15** and **16**, the pushers begin to feather upwardly.

As shown in Figures 23 and 24, the link **252** has an end pivotally connected as at **254** to the bracket **247** which pivotally supports the pusher. This structure is in duplicate at opposite ends of the cross bar **246** so as to equalize the pivotal motion of the cross bar at opposite ends. The opposite end of link **252** is pivotally connected as at **255** to a bracket **256** projecting outwardly from the cabin. The bracket is attached to a lug **257** projecting from one of the chain links.

As the pusher is advanced along the lower run of the chain as shown in Figures 1 and 24, link **252** assumes a position generally parallel with the chain. It will be noted in this position that movement of the pusher from its perpendicular position tends to swing pivot point **254** about pivot point **248**; this motion is thus resisted by the link since it opposite end is connected to the rigid bracket **256**. After the pusher traverses the support plates **15** and **16** and begins to pass around the sprockets **235** at the delivery end, as shown in Figure 23, the pin **248** begins to describe a curved path. However, the trailing bracket **256** is traveling in a straight path along the lower run; consequently, the link swings upwardly in an arc as indicated. As the pivot point **254** of the link moves in its arc it gradually swings the pusher about its pivot point **248** to maintain the pusher in perpendicular position generally tangent to the sprocket. The pusher thus remains in this position, advancing the packages into the buckets at it elevates.

After the pusher clears the upper edge of the packages, the bracket **256** begins to travel in a curved path around the sprocket, thus assuming a position radial to the center of the sprocket. The action of the link now causes the pusher to swing to a position generally radial to the sprocket. The pusher remains radial until it is carried to the upper run of the chain loop when it again assumes its perpendicular position. In passing around the idler sprocket **240**, the pusher again swings to its tangent position and is thus advanced in a straight path along the support plates **15** and **16**.

At the time the packages are transferred laterally by the plungers as shown in Figure 22, the pusher approaches and engages them, then advances the packages along the support plates. As the pusher advances to the ends **253** of the support plates, the packages on the support plates pass upon the curved guide rails **258—258** which form a continuation of the plates (Figures 21 and 22). The guide rails engage the endwise portions of the packages to support them but are spaced apart a greater distance than the width of the pusher plates **251** (Figure 20). Accordingly, there is no interference between the pusher plates and guide rails as the pusher traverses the curving portions of the rails and moves upwardly between the rails.

As indicated in Figures 1 and 22, the bucket conveyor, advancing in time with the pushers, includes a pair of sprockets **260** secured on shaft **261** at the delivery end of the sweep mechanism. The buckets **18** are mounted on chain loops **262—262** and each bucket consists of a pair of channel members **263—263** attached individually to the chains as at **264**. As the buckets advance around the sprockets **260**, their channel members assume radial positions relative to one another to a receiving position.

The sweep mechanism is timed to advance the packages to the buckets as the trailing channel of the pair swings in its arc upwardly; thus the trailing channel engages the trailing side of the packages as shown in Figures 1 and 22. Shortly thereafter, the pusher begins to traverse its upwardly curving path and to move out of engagement with the package which is now confined in the bucket. It will be noted in Figure 22 that the channel members **263** are slotted as at **265—265** so as to interfit the curved guide rails **258**. The guide rails **258** terminate above the straight run of the bucket conveyor chain such that the upper pair of packages drops upon the lower pair as the bucket passes beyond the ends of the rails. The stacked packages are thus conveyed into the cartoning machine for insertion into a carton.

Modified arrangement

As shown diagrammatically in Figure 25, each pressure pad **116** is repositioned to meter the packages in groups of four instead of two packages. Thus the groups of four packages, indicated at **266—266** are arrested by the gate **55** are released for insertion into a two-pound carton. When the machine is so converted, its operating cycles are identically the same as described above.

In order to accommodate the four packages, the channel members **191**, which are equal in width to two packages, are removed from their support plates **192—192**. Accordingly, upon each cycle of operation, the two groups of four packages are advanced upon the upper and lower metering conveyors toward the stop plates **192**. Upon reaching the stop plates, the groups are arrested and are then shifted laterally by the transfer mechanism to the support plates **15** and **16**. In order to transfer four packages instead of two, the pusher plates **206** of the plungers

11 and 12 are replaced with the elongated pusher plates 267—267 which have a length sufficient to engage the four packages.

It will be understood that the bucket conveyor and other components of the cartoning machine are also modified as necessary to handle the four package groups. As indicated in Figure 1, the bucket conveyor is provided with idle channel members 268, mounted on the chain runs between the pairs of cooperating channel members 263. When the bucket conveyor is converted to receive the groups of four packages, the trailing channel members 263 are removed from the chains and are replaced with flat support plates. The idle channels 268 then form the trailing ends of the buckets, the converted buckets being of sufficient size to receive the two groups of four packages as they are advanced by the sweep mechanism.

Having described my invention I claim:

1. A machine for grouping individual articles in stack formation one above the other comprising, a plurality of conveyors disposed in generally parallel horizontal planes one above the other and spaced apart laterally for advancing articles at random spacing, a respective shiftable article metering device mounted relative to each conveyor, arresting the articles advanced on the conveyor in one position and releasing the articles in metered group formation in a second position of the metering device, actuating means connected to said metering devices shifting the same alternately to said two positions, a pair of opposed transfer elements mounted on opposite sides of the conveyors and movable generally at right angles to the conveyors, the transfer elements engaging and transferring laterally from the conveyors the metered groups of articles thereon, actuating means connected to said transfer elements reciprocating the same toward one another, and means supporting the metered groups of articles in stack formation upon being transferred laterally by the transfer elements from the conveyors.

2. A machine for grouping individual articles in stack formation one above the other comprising, a plurality of conveyors disposed in parallel horizontal planes one above the other and spaced apart laterally for advancing articles at random spacing, a respective pair of shiftable articles arresting elements mounted in spaced relationship along each conveyor and arresting the articles advanced on the conveyor in one position and releasing the articles in metered groups in a second position of the article arresting elements, actuating means connected to said pairs of arresting elements shifting the same alternately to said two positions, a pair of opposed transfer elements mounted on opposite sides of the conveyors and movable generally at right angles to the conveyors, the transfer elements engaging and transferring laterally from the conveyors the metered groups of articles thereon, actuating means connected to said transfer elements reciprocating the same toward one another, means supporting the metered groups of articles in stack formation upon being transferred laterally by the transfer elements from the conveyors, and common driving means connected to the actuating means of the article arresting elements and transfer elements for releasing and transferring articles in time with one another.

3. A machine for grouping individual articles in stack formation one above the other comprising, a pair of conveyors disposed in parallel horizontal planes one above the other and spaced apart laterally for advancing articles at random spacing, a respective pair of shiftable metering elements mounted relative to each conveyor to arrest the articles on the conveyor in one position and to release metered articles in a second position, actuating means connected to said pairs of metering elements for shifting the same alternately to said two positions, a pair of opposed transfer elements mounted on opposite sides of the conveyors and movable at right angles to the conveyors to engage and transfer laterally the articles thereon, actuating means connected to said transfer elements for reciprocating the same toward one another, support means interposed between the laterally spaced conveyors for supporting the articles in stack formation one above the other upon being transferred laterally by the transfer elements, sweep means disposed along said support means including elements movable along the support means in a path to engage and advance the groups of articles thereon, and common driving means connected to the actuating means of the metering elements and transfer elements for actuating the same in timed relationship for releasing and transferring the articles, said driving means connected to the sweep means for advancing the articles in time with the transfer of articles by the transfer elements to engage and advance the same in stack formation.

4. A machine for grouping individual articles in stack formation one above the other comprising, a pair of conveyors disposed in horizontal planes one above the other and spaced apart laterally for advancing articles at random spacing, respective pairs of shiftable metering elements mounted relative to the discharge end of each conveyor to arrest the articles on the conveyor in one position and to release metered articles in a second position, actuating means connected to said pairs of metering elements for shifting the same alternately to said two positions, a pair of laterally spaced metering conveyors extending in axial alignment with the discharge ends of the said conveyors for advancing the released articles, a pair of opposed movable transfer plungers disposed on opposite sides of the metering conveyors in position to engage and transfer laterally the articles thereon, actuating means connected to said transfer plungers for reciprocating the same toward one another, support means interposed between the laterally spaced metering conveyors for supporting the laterally transferred articles in stack formation one above the other, sweep means disposed along said support means including elements movable along the support means in a path to engage and advance the groups of articles thereon, and common driving means connected to the actuating means of the pairs of metering elements and transfer plungers for actuating the same in timed relationship for releasing and transferring the articles, said driving means connected to the sweep mechanism for advancing the articles in time with the transfer of articles by the transfer plungers to engage and advance the same in stack formation.

5. A machine for grouping individual articles in stack formation one above the other comprising, a pair of conveyors disposed in parallel horizontal planes one above the other and spaced apart laterally for advancing the articles, a respective gate mounted relative to each conveyor for arresting the articles advancing thereon and reforming the same in solid row formation, a respective shiftable presser foot mounted relative to each conveyor in position to engage and arrest the leading portion of each row of articles adjacent said gates, actuating means connected in common to the gates and presser feet for shifting the gates to release position and concurrently shifting the presser feet to article engaging position, whereby the gates release metered articles while the rows are arrested by the presser feet, a pair of opposed transfer plungers residing on opposite sides of the conveyors at right angles thereto in position to engage the articles thereon, actuating means connected to said transfer plungers for reciprocating the same toward one another in unison, whereby the plungers shift the articles laterally from the conveyors to positions residing one above the other, and support means interposed one above the other between the conveyors for supporting the articles in stack formation upon lateral transfer by said plungers.

6. A machine for grouping individual articles in stack formation one above the other comprising, a pair of conveyors disposed in parallel horizontal planes one above the other and spaced apart laterally for advancing the

articles, a respective gate mounted relative to each conveyor for arresting the articles advancing thereon and reforming the same in solid row formation, a respective shiftable presser foot mounted relative to each conveyor in position to engage and arrest the leading portion of each row of articles adjacent said gates, actuating means connected in common to the gates and presser feet for shifting the gates to release position and concurrently shifting the presser feet to article engaging position, whereby the gates release metered articles while the rows are arrested by the presser feet, a pair of opposed transfer plungers residing on opposite sides of the conveyors at right angles thereto in position to engage the articles thereon, actuating means connected to said transfer plungers for reciprocating the same toward one another in unison, whereby the plungers shift the articles laterally from the conveyors to positions residing one above the other, support means interposed one above the other between the conveyors for supporting the articles in stack formation upon lateral transfer by said plungers, and common driving means connected to the actuating means of the gates, presser feet and transfer plungers for actuating the same in time with one another for releasing and transferring the articles.

7. A machine for grouping individual articles in stack formation one above the other comprising, a pair of conveyors disposed in parallel horizontal planes one above the other and spaced apart laterally for advancing articles, a respective gate mounted relative to each conveyor for arresting the articles advancing thereon and reforming the same into solid row formation, a respective shiftable presser foot disposed in position to engage and arrest the leading portion of each row of articles adjacent the gates, actuating means connected in common to the gates and presser feet for shifting the gates to release position and concurrently shifting the presser feet to article engaging position, whereby the gates release the articles disposed between the presser feet and gates while the rows are arrested by the presser feet, a pair of opposed transfer plungers residing on opposite sides of the conveyors in position to engage the articles thereon, actuating means connected to said transfer plungers for reciprocating the same toward one another in unison, whereby the plungers shift the articles laterally from the conveyors to positions residing one above the other, support means interposed one above the other between the conveyors for supporting the articles in stack formation one above the other upon lateral transfer by said plungers, a sweep mechanism disposed along the support means and including elements movable along the support means in a path to engage and advance the articles supported thereon, and a common driving means connected to the actuating means of the gates, presser feet and transfer plungers for actuating the same in time with one another for releasing and transferring the articles, said driving means connected to the sweep mechanism for advancing the same in time with the transfer of articles to engage and advance the same in stack formation.

8. A machine for grouping individual articles in stack formation one above the other comprising, a pair of prime conveyors disposed in horizontal planes one above the other and spaced apart laterally for advancing articles, a respective gate mounted relative to the discharge end of each prime conveyor for arresting the articles and reforming the same into solid row formation, a respective shiftable presser foot disposed in position to engage and arrest the leading portion of each row of articles adjacent the gates, actuating means connected in common to the gates and presser feet for shifting the gates to release position and concurrently shifting the presser feet to article engaging position, whereby the gates release the articles disposed between the presser feet and gates while the rows are arrested by the presser feet, a pair of metering conveyors extending in axial alignment with the discharge ends of the prime conveyors for advancing in unison the articles released by the gates, a pair of opposed transfer plungers residing on opposite sides of said metering conveyors in position to engage the articles thereon, actuating means connected to said transfer plungers for reciprocating the same toward one another in unison, whereby the plungers shift the articles laterally from the metering conveyors to positions residing one above the other, support means interposed one above the other between the metering conveyors for supporting the articles in stack formation one above the other upon lateral transfer by said plungers, a sweep mechanism disposed along the support means and including elements movable along the support means in a path to engage and advance the articles supported thereon, and a common driving means connected to the actuating means of the gates, presser feet and transfer plungers for actuating the same in time with one another for releasing and transferring the articles, said driving means connected to the sweep mechanism for advancing the same in time with the transfer of the articles to engage and advance the same in stack formation.

9. In a machine for grouping articles one above the other in stack formation, a pair of metering conveyors disposed in horizontal planes one above the other and spaced apart laterally to advance two laterally spaced groups of articles in unison, a pair of movable transfer plungers residing on opposite sides of the conveyors and at right angles thereto, the transfer plungers residing one above the other in horizontal planes above the planes of the conveyors in positions to advance laterally across the conveyors, said plungers normally residing in positions retracted from the conveyors, a respective stop member disposed above each conveyor in the path of the articles advancing thereon, said stop members being positioned to the rearward sides of the transfer plungers, in the direction of conveyor advancement, to arrest the groups of articles in positions to be engaged by the transfer plungers, actuating means connected to said transfer plungers for reciprocating the same toward one another to transfer the arrested groups of articles laterally toward one another, and respective support means interposed between the laterally spaced conveyors one above the other substantially in the planes of the conveyors for supporting the laterally transferred articles in stack formation one above the other.

10. In a machine for grouping articles one above the other in stack formation, a pair of metering conveyors disposed in horizontal planes one above the other and spaced apart laterally to advance two laterally spaced groups of articles in unison, a pair of movable transfer plungers residing on opposite sides of the conveyors and at right angles thereto, the transfer plungers residing one above the other in horizontal planes above the planes of the conveyors in positions to advance laterally across the conveyors, said plungers normally residing in positions retracted from sides of the conveyors, a respective stop member disposed above each conveyor in the path of the articles advancing thereon, said stop members being positioned to the rearward sides of the transfer plungers, in the direction of conveyor advancement, to arrest the groups of articles in positions to be engaged by the transfer plungers, actuating means connected to said transfer plungers for reciprocating the same toward one another to transfer the arrested groups of articles laterally toward one another, respective support means interposed between the laterally spaced conveyors one above the other substantially in the planes of the conveyors for supporting the laterally transferred articles in stack formation one above the other, sweep means disposed along said support means, said sweep means including substantially vertical pusher elements movable along the support means in a path to engage and advance both groups of articles, and a common driving means connected to the actuating means of the transfer plungers, said driving means connected to the sweep means for advancing the articles on the support

means in time with the transfer of articles by the transfer plungers.

11. In a machine for grouping articles one above the other in stack formation, a pair of metering conveyors disposed in horizontal planes one above the other and spaced apart laterally to advance two laterally spaced groups of articles in unison, a pair of movable transfer plungers residing on opposite sides of the conveyors and at right angles thereto, the transfer plungers residing one above the other in horizontal planes above the planes of the conveyors in positions to advance laterally across the conveyors, said plungers normally residing in positions retracted from sides of the conveyors, a respective stop member disposed above each conveyor in the path of the articles advancing thereon, said stop members being positioned to the rearward sides of the transfer plungers, in the direction of conveyor advancement, to arrest the groups of articles in position to be engaged by the transfer plungers, actuating means connected to said transfer plungers for reciprocating the same toward one another to transfer the arrested groups of articles laterally toward one another, respective support means interposed between the laterally spaced conveyors one above the other substantially in the planes of the conveyors for supporting the laterally transferred articles in stack formation one above the other, said support means including a passageway extending longitudinally thereof, sweep means disposed along said support means, said sweep means including substantially vertical pusher elements projecting through said passageway and movable along the support means in a path to engage and advance both groups of articles, and a common driving means connected to the actuating means of the transfer plungers, said driving means connected to the sweep means for advancing the articles on the support means in time with the transfer of articles by the transfer plungers.

12. In a machine for grouping and advancing articles in stack formation, respective upper and lower article support elements residing in horizontal planes one above the other, the support elements extending longitudinally for supporting articles during advancement in stack formation from the forward to the rearward ends of the support elements, the upper of said support elements including a longitudinal passageway coextensive therewith, a respective forward and rearward sweep sprocket rotatably mounted above the upper support element, a sweep chain trained over said sprocket and having a straight lower run residing above and parallel with the upper support element, said sprockets located adjacent the opposite ends of the support elements to extend the lower run of the sweep chain beyond the ends of the support elements, driving means connected to one of said sprockets for advancing the lower run of the sweep chain along the support elements from the forward to the rearward ends thereof, and pusher elements projecting outwardly from the sweep chain substantially at right angles thereto, the pusher elements of the lower run of the sweep chain projecting downwardly through the longitudinal passageway of the upper support element to engage and advance the articles on both support elements in stack formation from the forward to the rearward ends of the support elements.

13. A sweep mechanism for advancing articles in stack formation one above another along an upper and lower support structure having forward and rearward ends, the upper support structure having a longitudinal slot coextensive therewith, said sweep mechanism comprising, a respective forward and rearward sweep sprocket rotatably mounted above the support structure, a sweep chain trained over said sprockets having a straight lower run residing above and parallel with the upper support structure and extending beyond the forward and rearward ends thereof, driving means connected to one of said sprockets for advancing the lower run of the sweep chain along the support structure, a pusher element having an end pivotally connected to the sweep chain and projecting outwardly therefrom, a lug element spaced from the pusher element on the trailing side thereof in the direction of chain advancement, said lug element rigidly attached to the chain and projecting outwardly therefrom, a link having its opposite ends pivotally connected to the pusher element and lug, the pivot connections of the link being spaced outwardly from the chain run, said link locking the pusher element in a position substantially at right angles to the chain run during advancement across the lower run of the chain, said pusher element projecting downwardly through the slot of the upper support structure, a plate element mounted on the outer portion of said pusher and extending crosswise of said slot, said plate element having a width greater than said slot and advancing between the upper and lower support structure, said pusher and plate element engaging and advancing the articles disposed one above the other on the upper and lower support structure during advancement along the lower run of the chain, said link pivoting the pusher element to a position generally tangent to the rearward sprocket as the pivotally connected end of the pusher element is advanced by the lower run of the chain beyond the rearward end of the upper support structure and around the lower portion of the rearward sprocket with the link traversing the lower run and approaching the sprocket, the pusher element thereby maintained in a generally perpendicular position by the link as it follows the sprocket in an upwardly curved path beyond the rearward end of the upper support structure relative to the articles on the support structure to disengage the articles without disturbing the stack formation thereof.

14. A sweep mechanism for advancing articles in stack formation one above another along an upper and lower support structure having forward and rearward ends, the upper support structure having a longitudinal slot coextensive therewith, said sweep mechanism comprising, respective pairs of forward and rearward sweep sprockets rotatably mounted above the support structure and spaced apart laterally, a pair of sweep chains trained over said pairs of sprockets having straight lower runs residing above and parallel with the upper support structure and extending beyond the forward and rearward ends thereof, driving means connected to one of said pairs of sprockets for advancing the lower runs of the sweep chain along the support structure, a cross member extending transversely between said sweep chains having opposite ends pivotally connected to the sweep chains, a pusher element connected to the cross member and projecting outwardly therefrom, a pair of lug elements spaced from the cross member on the trailing side thereof in the direction of chain advancement, said lug elements rigidly attached to the chains and projecting outwardly therefrom, a pair of links, each link having one end pivotally connected to the cross member and its opposite end pivotally connected to one of said lugs, the pivot connections of the links being spaced outwardly from the chain runs, said links locking the cross member in a position to sustain the pusher element substantially at right angles to the chain run during advancement across the lower run of the chain, said pusher element projecting downwardly through the slot of the upper support structure, and a plate element mounted on said pusher element and extending crosswise of said slot, said plate element having a lengh greater than the width of said slot and advancing between the upper and lower support structures during advancement along the lower run of the chain, thereby advancing the articles along the upper and lower support structure, said links pivoting the cross member in a direction to shift the pusher element to a position generally tangent to the rearward sprocket as the cross member is advanced by the chains around the lower portion of the rearward sprocket with the plate element advanced beyond the rearward end of the upper support

element and with the link traversing the lower run and approaching the sprocket, the pusher element thereby maintained in a generally perpendicular position by the links as it follows the sprockets in an upwardly curved path relative to the articles on the support elements to disengage the articles without disturbing the stack formation thereof.

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