Nov. 26, 1957 C. R. HOOD 2,814,376

APPARATUS FOR TURNING CARTONS OR THE LIKE

Filed Sept. 28, 1953

2 Sheets-Sheet 1

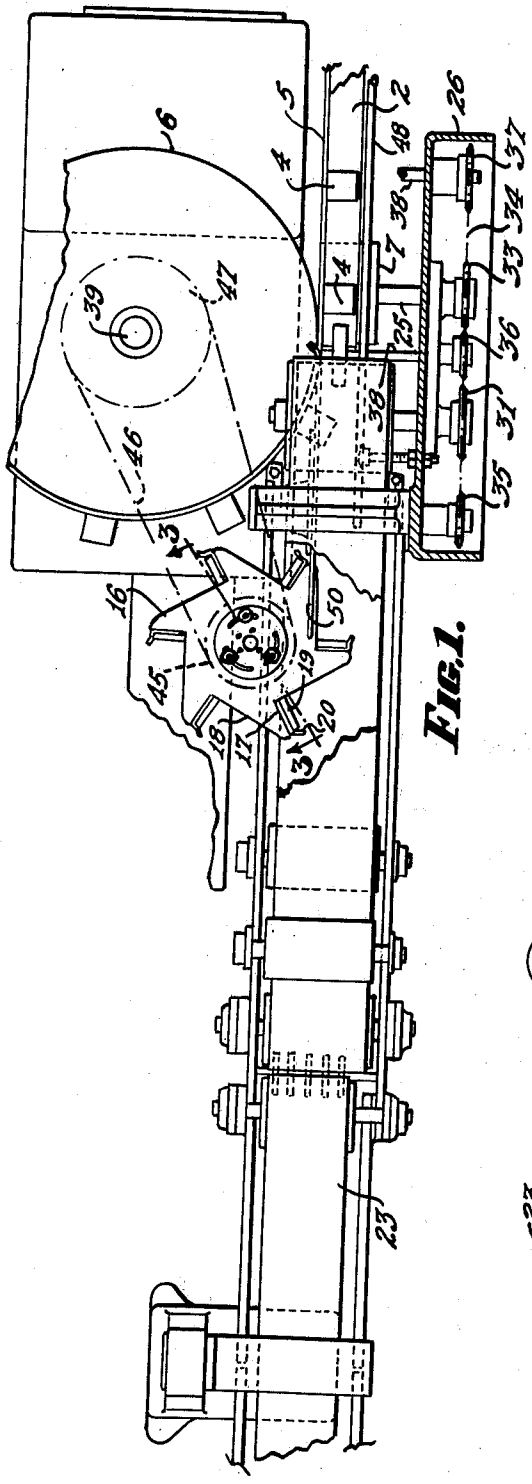


FIG. 1.

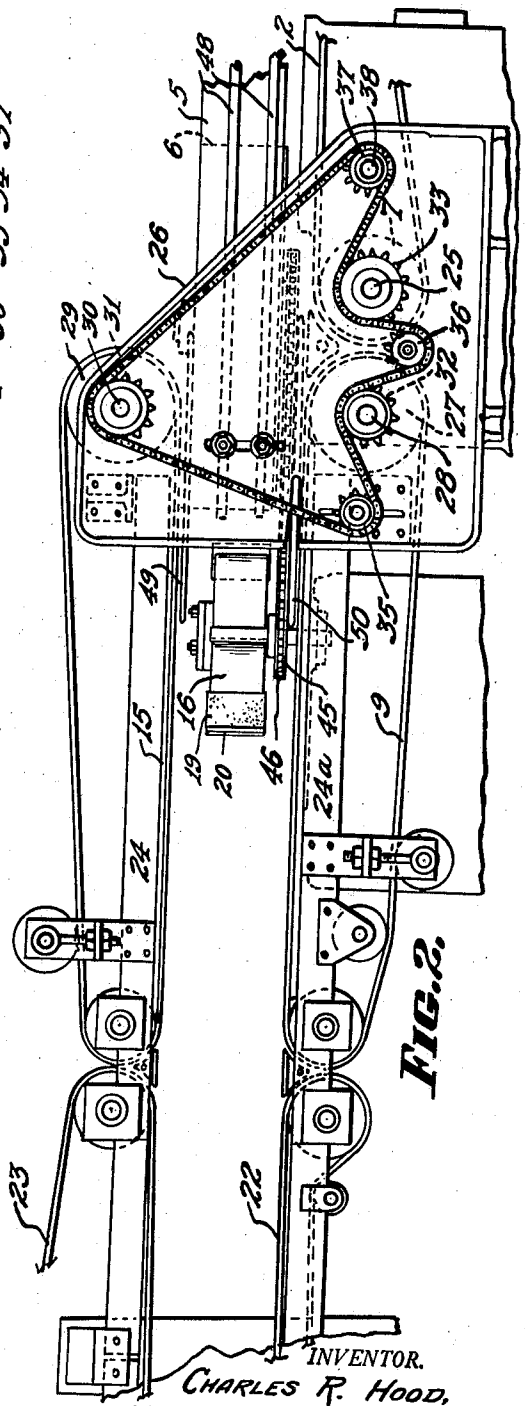


FIG. 2.

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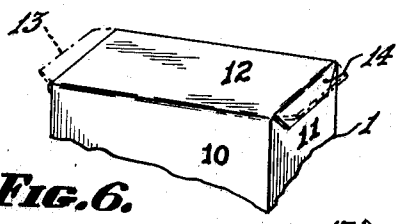


FIG. 6.

FIG. 4.

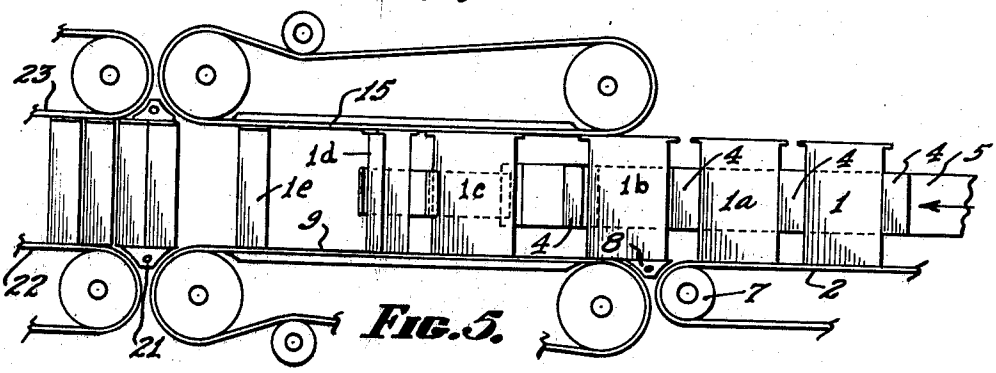


FIG. 5.

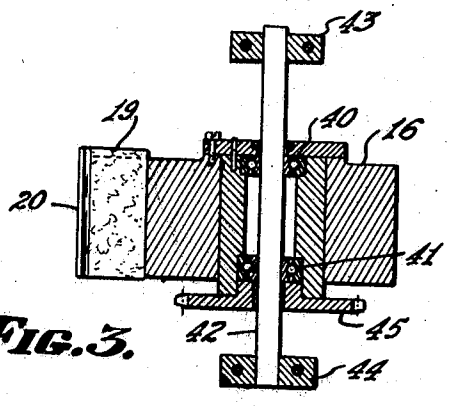


FIG. 3.

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2,814,376

APPARATUS FOR TURNING CARTONS OR THE LIKE

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Application September 28, 1953, Serial No. 382,523

8 Claims. (Cl. 198—33)

Carton filling and closing machines present a problem of turning erected cartons a quarter-revolution about a vertical axis while continuing the motion of the cartons in a rectilinear path. The turning may be desired for various reasons, as, for example, to present certain flaps or foldable members in position to be folded by stationary sweeps or the like. Again, in the operation of such machines, cartons are ordinarily filled with their longer horizontal axes extending in the direction of their motion along a conveyor. After filling, and when the main closure flaps have been glued and folded, it is desirable to turn the cartons so that their shorter horizontal axes lie in the direction of the belt or conveyor along which they are moving. This permits a greater number of cartons to be positioned within the same linear path; hence more time is allowed for the operation of a hold-down belt or equivalent means to maintain the flaps in folded condition while the adhesive is setting. Also, when cartons having the so-called Van Buren ears of U. S. Patent 1,863,260 are being handled, the cartons are brought into suitable position for gluing, folding and holding the ears.

A principal object of the invention is the provision of improved means for turning a moving succession of packages such as cartons on a high speed filling machine.

Hitherto, turn-arounds have been provided by interposing an abutment member to contact the front corner of a carton as it is moving along a belt conveyor, the carton being thus arrested in its forward motion at the corner, pivoted around the abutment as a fixed point under the drag of the belt. Such turn-arounds, however, have a serious disadvantage which renders them impracticable for use on high speed packaging machinery, such as that filling 200 to more than 300 cartons per minute.

In such high speed machinery, the carton hits the abutment with a force so great that it cannot be resisted by the natural stiffness of the board from which the carton is made. The front corner is pushed backwardly, causing the carton to bulge at its sides, and distorting its shape from a rectangle to a parallelogram. Not only does this distortion and bulging interfere with the proper sealing of the flaps and ears, but the cartons are given a bad appearance and they become difficult to fit into shipping containers.

It is an object of my invention to provide a means for turning cartons and particularly filled cartons through approximately 90 degrees without subjecting them to undue shock.

It is another object of the invention to provide means for turning the cartons without the use of guiding slides in the turning operation. Such slides rub the sides of the cartons and frequently cause objectionable marks.

Still another object of the invention is to provide a turn-around mechanism in which the carton, though moving at high speed, strikes an abutment with greatly diminished force because the abutment is moving in the same general direction as the carton, although at reduced speed.

It is an object of my invention to provide an arresting

surface which not only is of large area but can be provided with resilient means, still further reducing creasing and bulging.

Another object of the invention is to provide a turning means which, in the initial stages of the operation, will exercise a direct rotary force on the cartons in such fashion as to avoid buckling and bulging.

These and other objects of my invention, which will be set forth hereinafter or will be apparent to one skilled in the art upon reading these specifications, I accomplish in that mechanism of which I shall now describe certain exemplary embodiments. Reference is made to the accompanying drawings wherein:

Fig. 1 is a partial plan view of my apparatus with parts broken away.

Fig. 2 is a corresponding partial elevational view.

Fig. 3 is a partial sectional view taken along the section line 3—3 of Fig. 1.

Fig. 4 is a simplified plan view illustrating the operation of the mechanism.

Fig. 5 is a correspondingly simplified partial elevation.

Fig. 6 is a perspective view of the upper end portion of an exemplary carton in filled and closed condition.

I have not attempted herein to illustrate the general features of a carton filling and closing machine. Such machines are well-known in the art; my invention is applicable to any of them; and, indeed, my invention can be applied to carton filling and closing machinery or to carton handling machinery wherever it is required to turn cartons through approximately 90 degrees. Hence, the nature of the equipment to which my apparatus assembly is applied does not form a limitation thereon.

I have illustrated and shall describe my invention as applied to a high speed carton filling and closing machine at a point subsequent to the folding of the uppermost flaps after the cartons have been filled, but preceding the application of holding pressure to the top flaps and the folding and gluing of the Van Buren ears. It is immaterial whether the actual top or bottom flaps of the erected carton have been closed first. For brevity herein, I shall refer to those flaps which are uppermost at the point of application of my mechanism as the "top flaps." It may be noted that after cartons have been filled with their contents (usually though not necessarily a material in powdered, flaked or granular form), the problem of turning them through 90 degrees is made more difficult because of the inertia effect of the contents.

Referring first to Figs. 4 and 5, I have shown a series of filled and closed cartons 1, 1*a*, etc. traveling along a belt conveyor 2 with their longer horizontal axes extending in the direction of motion. The cartons are held in spaced relationship by blocks 4 on a traveling belt 5 which is shown as returning over a driven sprocket 6. The conveyor 2 returns over a roll 7, and the cartons are caused by the blocks on the belt 5 to move over a bridge 8 and to be transferred thereby to another belt conveyor, indicated at 9. This conveyor is preferably moving at a speed somewhat greater than the speed of conveyor 2, so that as each carton is transferred to it, it is moved forwardly at a sufficient rate to escape the turning effect of the blocks 4.

It will be noted that the tops of the cartons are in closed condition, i. e. the closure flaps have been glued and folded over. This is illustrated in Fig. 6 where the carton 1 has a side face 10 and an end face 11, and wherein the top closure flap is indicated at 12. This top closure flap may be provided with Van Buren ears, indicated at 13 and 14. Since the flaps at the top of the carton have been folded with the interposition of a suitable adhesive, it is necessary to hold them in the folded condition until the adhesive has suitably set. To this end, a holding belt is located above the belt conveyor 9 and

driven at the same speed so as to engage and hold the tops of the cartons without tilting them.

The actual turning of the cartons is effected by what I have herein termed a star wheel **16**. This star wheel is provided with carton receiving pockets comprising an abutment surface **17** and a turning surface **18** substantially at right angles thereto. A resilient pad **19** may be located on the abutment surface **17**, and an angularly related lip **20** extends beyond the outer edge of the abutment surface. The star wheel **16** is driven continuously at a rate of speed related to the rate of linear travel of the conveyor **9**, as more definitely hereinafter set forth. In operation a carton **1***c* is brought into engagement with the star wheel, as illustrated in Fig. 4. At the time the leading edge wall of the carton **1***c* contacts the abutment surface **17** or the resilient pad **19**, the turning surface **18** will lie substantially along a side wall of the carton. The star wheel is rotating in the direction of the arrow. As a consequence, a positive rotative force is initially applied to the side wall of the carton **1***c* in a direction transverse the direction of motion of the conveyor **9**. The carton is swung through a substantial arc by this positive turning force; and the star wheel has sufficient depth as to minimize buckling and creasing strains on the carton side wall. A leading edge of the carton is engaged by the lip **20** and urged laterally of the conveyor **9**, contributing to the rotative movement of the carton without imposing undue strain on its walls.

As the carton continues to turn, the movement of the belt **9** begins to carry it away from the turning surface, **18**, as illustrated at **1***d*, but the leading edge of the carton is still being engaged by the lip **20**, which progressively holds back a portion of the carton. By the time the lip **20** has turned so as to disengage the carton, the carton itself has come into a position in which its major horizontal axis is normal to the direction of motion of the conveyor **9**, i. e. the carton will have assumed a position similar to that shown at **1***e*. The carton will continue to move under the influence of belts **9** and **15**.

The belts **9** and **15** are preferably of limited extent, as shown. The cartons, therefore, are transferred over a bridge **21** to a second belt conveyor **22** above which is a second holding belt **23**. The conveyor **22** and belt **23** are preferably driven at a slower speed than the conveyor **9** and belt **15**, so that the cartons, moving over the bridge **21**, are brought against each other or into more closely spaced relationship, thus prolonging effectively the time during which their top flaps may be engaged and held by the holding belt **23** to permit the setting of the adhesive. During the time the cartons are moving as shown, in engagement with the conveyor **22** and belt **23**, adhesive may be applied to the Van Buren ears **13** and **14**, and these ears may be folded over by stationary sweeps and held in the folded over condition by suitable guides, belts or the like. Mechanism for gluing and folding the Van Buren ears is well-known and has not herein been illustrated. As explained, when a carton is engaged in a pocket of the star wheel, it is first rotated positively by the surface **18**, but as the star wheel revolves further, a point is reached at which this surface no longer pushes the carton. But the lip **20** now becomes a pivot about which the carton is turned by the action of the belts. As the carton reaches a position transverse the direction of motion of the belts—approximately 90 degrees from its original position—the lip **20** moves away so that it no longer contacts the carton. This effect is secured by the shape of the lip, the distance from the center of the star wheel to the lip, the speed of rotation of the wheel, and the speed of travel of the belts.

The star wheel is driven at a speed such that it presents a pocket for each carton as it arrives in position. In other words, the number of cartons packed per minute, divided by the number of pockets in the star wheel, will give the number of revolutions per minute of the star wheel. After the number of pockets is decided upon,

there are, however, two quantities which may be varied to affect the relative linear speed of the belts and the star wheel at its periphery. These variables are, first, the speed of the belt **9** which can be varied above that speed which is needed to extract the cartons from their engagement with the conveyor **2**, the belt **5**, and blocks **4**, and, second, the radius of the star wheel. My preferred range for the peripheral speed of the star wheel (outer edge of the abutting surface **17**) is 55% to 75% of the linear speed of the belt; but this may be varied.

When a radius for the star wheel and a suitable number of pockets therein have been chosen, the speed of the star wheel for a given rate of cartons per minute is preferably fixed by driving the star wheel in positive timed relationship to the other elements of the machine. It will be understood that since the star wheel is positively connected to the drive of the conveyor system **2**, **4**, **5**, the star wheel will automatically speed up or slow down as the actual filling speed of the machine is changed.

Arrangements can be made if desired for varying the speed of the belts **9** and **15** with respect to that of the star wheel. The belt speed relative to the peripheral speed of the star wheel should not be so high as to cause the cartons to hit the arresting surface with force enough to damage them. On the other hand, the relative belt speed must not be so low as to fail to turn the cartons to final position in the way explained above. While there is thus an opportunity for variation of the belt speed with respect to the peripheral speed of the star wheel, it is quite easy to select a suitable speed and positively interconnect the drives for the conveyor system **2**, **4**, **5**, the star wheel **16** and the belts **9** and **15**. Thereafter changes in the over-all filling speed of the packaging machine itself will not impair the timed relationship of these elements.

While I have indicated top belts **15** and **23** as preferred means for holding the top flaps of the cartons in folded condition, those skilled in the art will understand that other holding means may be employed where desired, such as plates, stationary sweeps or the like. This is especially true where heavy material is being filled into the cartons or especially strong cartons are being handled. Ordinarily, however, it is desired to minimize scuffing and marring of finely printed carton surfaces by providing traveling means which move with the cartons.

In Figs. 1 and 2, I have employed like index numerals to indicate like elements. The main frame of the machine is shown as having upper and lower portions **24** and **24***a*. The belt **2**, as has been indicated, returns over a roller **7** on a shaft **25** journaled at one end in a bracket member **26** on the main frame. The belt **9** returns over a roll **27** on a shaft **28** similarly journaled. The hold-down belt **15** returns over a roll **29** on a shaft **30** similarly journaled. There is a sprocket **31** on the shaft **30**, a sprocket **32** on the shaft **28**, and a sprocket **33** on the shaft **25**. A common chain **34** interconnects all of these sprockets passing over idlers **35** and **36** as may be required, and also over a sprocket **37** on a shaft **38** which is connected, as by bevel gears (not shown), to the shaft **39** of the wheel **6**. Thus, the belts **9** and **15** are driven in timed relationship to the conveyor apparatus **2**, **4**, **5**, the necessary differences in speed being taken care of by the sizes of the various sprockets. Other details of the mounting of belts **9**, **15**, **22** and **23** are not believed to require special description. These belts preferably have tighteners in connection with their mountings, as will be well understood by the skilled worker in the art.

Reference to Fig. 3 will indicate that the star wheel **16** is rotatably mounted by means of ball bearings or the like **40** and **41** on a shaft **42** which is held in vertical position on the main frame elements **24** and **24***a* by means of clamps **43** and **44**. A sprocket **45** is non-rotatably affixed to the star wheel and is connected by means of a chain **46** to a sprocket **47** on the shaft **39**,

so that the star wheel is driven in timed relationship to the other described elements. It will be understood that the shaft 39 is effectively connected to the main drive of the packaging machine in any suitable way.

As they move along the conveyor belt 2, the cartons will be confined between and spaced by the blocks 4 on the belt 5, as has already been explained. They may be engaged at their other sides by stationary, rod-like guides 48. Also, at the point of transfer of the cartons from the conveyor 2, 4, 5 to the belts 9 and 15, I may provide upper and lower guide rods 49 and 50 to insure against a transverse canting of the cartons. These guides may extend, as shown, into the area of engagement of the cartons by the star wheel 16.

Modifications may be made in my invention without departing from the spirit of it. Having thus described my invention in an exemplary embodiment, what I claim as new and desire to protect by Letters Patent is:

1. A turning device for cartons comprising in combination a conveyor along which said cartons are caused to approach and continue beyond a turning point in a certain indexed relationship, and a turning device at said turning point comprising a continuously revolving rotary member having pockets therein, each pocket presenting an abutment surface to receive the leading face of a carton, a turning surface angularly related thereto and at one side of said abutment surface, and an angularly related pivoting lip formed at the opposite side of said abutment surface, and means for rotating said rotary member in timed relationship to the linear speed of said conveyor so that the cartons are turned by co-operative movement of the rotary member and the conveyor.

2. A turning device for cartons comprising in combination a conveyor along which said cartons are caused to approach a turning point in a certain indexed relationship, and a turning device at said turning point comprising a rotary member having pockets therein, each pocket presenting an abutment surface to receive the leading face of a carton, a turning surface angularly related thereto and at one side of said abutment surface, and a lip formed at the opposite side of said abutment surface, and means for rotating said rotary member in timed relationship to the linear speed of said conveyor, said speed being such that said rotating surface initially exerts a force on a carton engaged thereby transverse the said conveyor, after which said conveyor tends to carry said carton away from said rotating surface while a leading edge of said carton is engaged and retarded by said lip, the timing being such as to cause said lip to disengage said carton when it has been turned through substantially 90 degrees.

3. The structure claimed in claim 2, wherein the peripheral speed of said rotary member approaches but is less than the linear speed of said conveyor.

4. Apparatus as claimed in claim 3, in combination with means for delivering a succession of cartons in spaced relationship to the said conveyor with their horizontal major axes in the direction of motion, said conveyor having a linear speed greater than the speed of said last mentioned means.

5. Apparatus as claimed in claim 4, including a second conveyor for receiving said turned cartons from said first mentioned conveyor, said second conveyor having a lower linear speed than said first mentioned conveyor whereby the turned cartons are brought into closer relationship on said second mentioned conveyor.

6. Apparatus as claimed in claim 5, wherein hold-down means are provided in connection with each of the said conveyors.

7. A turning device for use with a belt conveyor delivering rectangular objects past the point of turning, said turning device comprising a star wheel having pockets, each pocket presenting an abutment surface and an angularly arranged rotating surface adjacent one edge thereof and an angularly related pivoting finger adjacent the opposite edge thereof, means for continuously rotating the said rotary element in timed relationship to the movement of the said conveyor said rotating surface and said pivoting finger acting successively on said rectangular objects to turn them while they are being moved by said conveyor.

8. In a turning device for cartons on a moving belt conveyor, a pair of belts to grip the cartons above and below, a star wheel driven in timed relationship to the said belts, the peripheral speed of the said star wheel being less than the linear speed of said belts, said star wheel presenting a series of pockets each having an arresting surface extending substantially radially from the axis of said star wheel, each of said arresting surfaces having a guiding and turning lip at the outer end thereof, and a guiding and turning surface at a right angle to the arresting surface at the inner end thereof, said star wheel having a radius measured from its axis to the said lip, such that the lip will disengage a carton as the said carton, under the combined forces of the belt and lip, reaches a position transverse the said belts.

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