METHOD OF AND APPARATUS FOR FOLDING GABLE ENDS OF PACKAGES

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5 Claims

ABSTRACT OF THE DISCLOSURE

The present invention pertains to packaging machines, and more particularly relates to a method, and apparatus for carrying out the method of folding the projecting gable ends of paper packages against the packages while they are moving between a packaging machine and a casing machine where groups of the packages are placed in cartons.

Various products are wrapped by entubing groups of articles in waxed paper, and by pinching, sealing and severing the tube at each end of the article groups to produce individual, sealed packages. This procedure leaves protruding gable ends on the packages which must be folded against the packages to complete the same. The gable end folding process can be done by various mechanical arrangements, but it can be appreciated that mechanical folding apparatus requires precise timing and can be relatively complex if the folding is done while the package is moving. Further, the wax on the paper can accumulate on mechanical folding mechanisms to the point where the wax will cause malfunctions. The present invention provides both a gable-end folding method, and apparatus for carrying out the method, whereby the folding is accomplished by certain manipulations of the moving packages, and requires no mechanical folding arms or precise timing. An important feature of the invention is that the wax on the packages cannot impair the operation of the apparatus.

An object of the present invention is to provide an improved method of and apparatus for folding the gable ends of packages.

Another object of the invention is to provide a mechanism for folding the gable ends of moving packages without folding arms or the like which must be timed to the movement of the packages.

A further object is to provide a package folding apparatus which can fold the leading and trailing gable ends of a file of packages moving at high speed.

Another object is to provide a package folding apparatus wherein packages in a single moving file are so manipulated that adjacent packages in the file interact to fold the confronting gable end portions of the packages against the bodies of the packages.

Another object is the provision of apparatus according to the preceding object, and further including apparatus which compresses the packages in the file, end to end, so that the folded gable end portions are flattened against their respective packages.

Another object is to provide apparatus for folding the gable ends of waxed packages wherein the wax cannot impair the folding operation by building up on the mechanical elements which contact the packages.

Other objects and advantages of the present invention will become apparent from the following description, and from the accompanying drawings, wherein:

FIGURE 1 is a side elevation of the gable end folding apparatus of the present invention, and of the delivery end of a packaging machine which forms the gable end packages handled by the folding apparatus.

FIGURE 2 is a schematic perspective of a typical gable end package.

FIGURE 3 is a diagrammatic elevation illustrating both the package folding method and the package folding apparatus of the present invention.

FIGURE 4 is a plan of the apparatus shown in FIGURE 1.

FIGURE 5 is an elevation looking in the direction of arrows 5—5 on FIGURE 4 and illustrates an upper conveyor belt assembly.

FIGURE 6 is a horizontal section taken along lines 6—6 on FIGURE 5.

FIGURE 7 is an enlarged central section taken along lines 7—7 on FIGURE 4.

FIGURE 8 is an enlarged central section taken along lines 8—8 on FIGURE 4.

The package folding machine 10 (FIG. 1) is coupled to the delivery end of a packaging machine 12, from which a single file of spaced packages P is delivered; one of the packages P is illustrated in FIGURE 2. The packages P are formed by entubing spaced apart groups of articles, for example soda crackers, in a waxed paper web, and by transversely pinching, sealing and severing the pinched section of the web between the groups of articles. Thus, each package P has a rectangular body portion 14, a leading gable end portion 16, and a trailing gable end portion 18. The sealed portions of the gable ends provide a flat web 19, and each corner portion, as shown at 19a, is folded into underlying relation with the gable ends before the web is sealed. Before groups of the packages P are packed into a carton, the gable ends 16 and 18 and their webs 19 must be folded flat against the body portion 14; the folding operation is carried out in the package folding machine 10 while the packages are moving at relatively high speed.

The package folding machine 10 (FIGS. 1 and 4) includes a floor-supported frame 21 having spaced side rails 20 and 22 which at one end are secured by brackets 23 to side walls 24 and 26 of the delivery end of the packaging machine 12. A cross bar 28 extends between the side walls 24 and 26 and supports the lower end of a flat delivery conveyor belt 30 which carries the completed packages P from the packaging machine 12.

The driven end of the delivery conveyor 30 (FIGS. 4 and 7) includes a drive shaft 32, a drive pulley 33, and a bearing assembly 34 at each end portion of the drive shaft which is supported upon upstanding brackets 35. The brackets 35 are mounted upon a lateral bar 36 which interconnects the conveyor rails 20 and 22. The conveyor belt 30 is guided by a flanged pulley unit 37 (FIG. 7) which prevents lateral drifting of the belt and can be adjusted vertically relative to the bar 36 in order to take up slack by tensioning the lower flight of the conveyor belt.

A chain and sprocket drive 38 (FIG. 4) couples the drive shaft 32 to a jackshaft 40 which is mounted in two bearings 42 that are each secured to the lower face of one of the side rails 20 and 22. One end of the jackshaft 40 projects through an adjustable-ratio V-belt pulley 44 and has a chain and sprocket drive connection 46 to a driven shaft, not shown, of the packaging machine 12. The lineal speed of the conveyor belt 30 is slightly greater than the speed at which the packages P are delivered therefrom. Thus, the packages P are spaced apart about a half inch or so when they are carried by the belt 30.

The drive connection 46 is not required for timing purposes between the packaging machine 12 and the package folding machine 10, but merely serves as a convenient power source. A separate power source will serve as well, the only general requirement being that the delivery conveyor belt 30 moves the packages at a speed at least as
fast as their conveying speed within the packaging machine, and preferably slightly faster to obtain the above described spacing among the packages.

The adjustable-ratio V-belt pulley 44 transmits driving power to a support conveyor belt 50 and a superposed hold-down conveyor belt 52 which travel at the same linear speed, a speed which is slightly slower than the speed of the delivery conveyor belt 30. For this purpose the pulley 44 has separable pulley halves which can be manually adjusted and locked on the shaft 40 when the proper speed is attained for the support conveyor belt 50 and the hold down conveyor belt 52, after which no further adjustment is necessary except to compensate for normal wear factors. The belt 52 includes a relatively soft, sponge rubber outer facing 53 for a purpose which will later become apparent. A V-belt 54 is trained around the pulley 44, around a vertically adjustable idler pulley 56, and around a driven pulley 58, the latter of which is secured to an idler shaft 60. Shaft 60 projects through both the side rail 20 and a bearing 62 at each side of the side rail.

A chain and sprocket drive train 64, and a similar drive train 66 respectively, transmit power to the hold down conveyor belt 52 and to the support conveyor belt 50. Thus, the drive train 66 is connected to a drive pulley 68 (FIG. 4) and the belt 50 is trained around the pulley 68 and around an idler pulley 70 (FIG. 7), with its upper flight supported by a plate 72 in a horizontal plane below the plane of the delivery conveyor belt 30. Means for mounting the support conveyor belt 50 include side rails 74 (FIGS. 4 and 7) that are secured to upright brackets 76 on cross bars 78, 79 that interconnect the side rails 20 and 22.

The lower flight of the hold down conveyor belt 52 (FIGS. 3 and 8) travels in a direction reverse to the lower flight of the support conveyor belt 50. To effect this reverse rotation, the drive train 64 is connected to an interposed reversing gear transmission 80. As indicated in FIGURE 8, the drive train 64 is coupled to a gear 82 which is meshed with a superposed gear 84. Gear 84 has a chain and sprocket drive connection 86 to a pulley 88 that drives the hold down conveyor belt 52.

Accordingly, clockwise rotation of the gear 82, as effected by the drive train 64, causes counterclockwise rotation of the gear 84 and the drive pulley 88, whereby the lower flight of the hold down conveyor belt 52 moves in a downstream direction. The drive trains for the hold down conveyor belt 52 and the support conveyor belt 50 cause the belts to move at the same linear speed, a speed which is slower than the speed of the delivery conveyor belt 30.

The drive pulley 88 (FIGS. 6 and 8) is mounted for vertical adjustment by means including an elongate cast 90 which has a yoke end portion 92 that straddles and rotatably supports the pulley 88. A rib 94 extends between the yoke 92 and a transverse arm 96 which carries two eye bolts 98. An idler shaft and pulley 100 are in turn carried by the eye bolts, and can be adjusted toward or away from the drive pulley 88 by locking the eye bolts with nuts 102 which are threaded on the eye bolts and straddle the arm 96. The lower flight of the belt 52 is held planar by a pressure plate 104 which has upright studs 106 that slide in apertures in the rib 94. Compression springs 107 are mounted on the studs between the confronting surfaces of the rib and the pressure plate to urge the pressure plate toward the lower flight of the belt 52.

The entire casting 90 can pivot about the turning axis of the drive pulley 88, and the free end of the casting is held up by means including a wing arm 108 that is bolted to each end of the transverse arm 96. A long thumb-screw 110 (FIGS. 1 and 4) is threaded through the outer end portion of each wing arm 108 and rests upon the upper surface of the side rail 74.

Means are also provided for adjusting the elevation of the drive pulley 88 to position the belt 52 to the tensioning arrangement 112 (FIGS. 6 and 8) that is rotatable upon a fixed shaft 115. A block 116 is secured to the end portion of the shaft 115 adjacent the side rail 20, and this block is arranged to slide vertically in the ways of an upright guide assembly 117. The adjustment includes a cam-actuated top plate 118 (FIG. 8), through which a bolt 120 extends and is threaded through the shaft 115. A hand wheel 122 is secured to the upper end of the bolt 120 and is supported by the top plate 118. By adjusting the bolts 110 and 120, the lower flight of the belt 52 can be vertically positioned relative to the floor and parallel with, the upper surface of the support belt 50.

Although not essential to the present invention, a convenient feature which facilitates cleaning, inspection or repair is that the entire assembly of the hold-down conveyor belt 52 (FIGS. 5 and 6) can be pivoted upward about the shaft 115. To this end, the rib 94 is provided with a laterally projecting lifting handle 113, and one end portion of the fixed shaft 115 has an upright lug 119. Projecting through the lug 119 is a detach latch 121 which can be manually retracted and inserted into a slot 123 of the yoke 92 after the belt assembly has been pivoted about the shaft 115.

The jackshaft 40 (FIG. 4) is provided with a chain and sprocket drive train connection 124 to the input shaft of an adjustable-speed V-belt transmission 126, a conventional purchased item which can be adjusted by a hand wheel 128 to regulate the distance between the complementary cone shaped pulley halves so that the effective pitch diameter of a V-belt 130 trained thereover can be changed.

An adjustable idler pulley 132 tensions the V-belt, and the belt drives a pulley 134 secured to a jackshaft 136 which is comparable to the jackshaft 40, since it drives a second support conveyor belt 140 and a second hold-down conveyor belt 142. The belts 140 and 142 move at the same linear speed. This speed, however, is slower than the speed of the first described support and hold-down conveyor belts. The belt 142 is of the same construction as the belt 52, i.e., it has a sponge rubber facing 143 (FIG. 8).

Because the components associated with the conveyor belts 140 and 142 are the same as the corresponding parts associated with the conveyor belts 50 and 52, the same reference numbers are used with the suffix a to identify parts already described. Thus, the hold-down conveyor belts 142 (FIGS. 1, 4 and 8) is carried by means including an elongate casting 190a, and can be positioned at a selected distance from the support conveyor belt 140 by adjusting a thumb-screw 110a and turning a hand wheel 125a. A transmission 80a is driven from the jackshaft 136 by a chain and sprocket drive train 64a, and the output drive of the transmission is carried to the hold-down belt 142 by a chain and sprocket drive train 86a. A similar drive train 66a transmits power from the jackshaft 136 to a pulley 144 (FIG. 1) at the discharge end portion of the conveyor belt 140. Although the support and hold-down conveyor belts 140 and 142 incline upward in the direction of conveying movement, the inclination is not critical to the invention, but is for the purpose of meeting the input end of the next processing machine, not shown.

Operation

To place the package folding machine 10 in operation to handle a given size of package, the hold-down conveyors 52 and 142 are adjusted by turning the hand wheels 122 and 122a, and by turning the thumb-screws 110 and 110a so that the hold-down conveyors are parallel to their associated support conveyors, and so that the hold-down conveyors maintain sufficient frictional engagement to positively grip the packages P.

Referring now to FIGURES 3, 7 and 8, the packaging...
machine 12 forms and delivers a single file of successive packages P which are delivered onto the delivery conveyor 30. Because of the conveyor 30 is moving at a slightly higher linear speed than the speed of the packages delivered thereto, a small gap at 150 (FIG. 7) is formed between the flat sealed web portions 19 between adjacent packages. The discharge end of the delivery conveyor 30 (FIG. 7) is about half the height of the packages P above the upper flight of the support conveyor 50. Therefore, when each package progresses to an unbalanced position over the delivery conveyor drive pulley 33, its lower leading edge drops onto the support conveyor belt 50, as shown for the package P1.

Although the package P1 is immediately retarded, due to the slower linear speed of the conveyor belts 50 and 52 relative to the conveyor 30, the succeeding package P2 does not overtake the package P1 until the package P2 is seated flat upon the support conveyor belt 50, and then only to the extent that the flat leading web portion 19 of package P2 overlaps the corresponding portion of the trailing web of the package P1; this latter condition may be seen at the leading end of the package P1 in FIGURE 7 where its web portion 19 overlies the trailing web portion of the package ahead of it. It should be noted that the interengagement of the gable flaps in this manner causes inward buckling at 132 and 134 of the lower gable panel and the upper gable panel, respectively, of the trailing gable end of the leading package and the gable end of the succeeding package P1, and that the sealed web portions 19 are folded toward their respective packages. Thus, as shown in FIGURE 3, all of the packages traversing an intermediate-speed conveying section 160, comprised of the synchronously driven hold-down conveyor 52 and the support conveyor 50, have each been subjected to a folding operation wherein the leading gable end is folded upward, and the trailing gable end is folded downward, both foldings having been effected solely by manipulating the packages in the manner above described.

As the packages are discharged from the end of the intermediate-speed conveying section 160 (FIG. 3), they enter a slower-speed conveying section 162 comprised of the synchronously driven hold-down conveyor 142 and the support conveyor 140. As a result of the relative position of the package P1e (FIG. 8), and just previous to the time the packages P1e and P2a reach their illustrated positions, the package P2a begins to overtake the package P1e whereby the folded, confronting gable ends of these packages, as shown at 164, begin to be compressed. Both two of the packages are fully engaged with the slower speed conveying section 162, their folded, confronting gable ends are compressed as is illustrated at 166. The reason for this is that the package P2a continues to overtake the package P1e until about the time the package P2a engages the hold down conveyor belt 142. It should here be explained that the packages adjacent the folded gable ends shown at 166 have been purposely illustrated in spaced apart relation to depict the folded portions more clearly. In actual practice, the adjustable speed V-belt transmission 126 (FIG. 4) is adjusted so that the slower speed section 162 will retard the packages to the extent that the fully folded gable end portions of the packages are flattened and slightly compressed. Thus, sharp fold lines are produced whereby any inherent resiliency of the waxed paper web will not cause the folded portions to spring open when the packages are subsequently moved out of abutting relation and are placed in cartons.

It will be seen that the completed folds are not interlocked with one another, and that the packages can therefore be handled as individual units rather than as groups of packages. One advantage of the present invention which is very important in apparatus for handling waxed packages, is that the wax remains on the packages, whereas some of the previous folding mechanisms are detrimentally affected by wax which accumulates on the movable parts and impairs their effectiveness. A further advantage is that the apparatus of the present invention requires no elaborate timing mechanism or the like, one reason why the apparatus can be operated at high production speeds. It will be apparent that the invention is not limited to the folding of waxed packages, but can be advantageously employed with other types of packages, such as plain paper and cellophane wraps.

Having thus described the invention, that which is believed to be new, and for which protection by Letters Patent is desired, is:

1. A method of folding the gabled end portions of a line of packages disposed in end-to-end relationship by sequentially reducing the distance between the packages to such an extent so that the gabled ends are constrained to fold, said method comprising initially partially folding the trailing gabled end of a leading package by the forward gabled end of a trailing package, maintaining the partially folded gables in contact, and reducing the distance between the packages to complete folding of the gabled ends.

2. The method according to claim 1 wherein the trailing gabled end of a leading package is folded downwardly by the leading gabled end of a trailing package whose gabled end is folded upwardly.

3. The method according to claim 1 wherein said reduction of the distance between packages is effected by compressing the line of packages.

4. Apparatus for folding the gable end portions of adjacent coplanar packages having projecting and confronting gable end portions, each of said gable end portions including two gable panel extensions of opposed body panels of the package, said gable panel extensions converging into a flat web extending along the apex of the thus formed gable and being bonded together in the area of the web, comprising an elongate frame, and cooperating conveying means on said frame for conveying a single file of packages, said conveying means including a conveyor being arranged to sequentially effect relative movement between two of the packages at a selected point along the conveying path in a direction substantially perpendicular to said webs so that the web portion of one package is displaced from a plane including the web portion of the other package; another conveyor to retard the leading package so that the web of one package contacts one sloping gable panel of the other package and is folded in one direction, and the web of the other package contacts one sloping gable of said one package and is folded in a direction opposite to the direction of folding of the web of said one package; and to restore the former coplanar relation of said two packages.

5. Apparatus according to claim 4 wherein said conveying means is arranged to continue relative movement between the two packages in a direction substantially parallel to the initial orientation of said web portions until the web and gable panel portions of one package compress the web and gable panel portions of the other package, and vice versa.

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