

APPARATUS AND METHOD FOR PACKAGING SETS OF ARTICLES
BY MEANS OF A HELICALLY WOUND WRAPPER

This invention relates to means for wrapping articles.

Our co-pending application No PCT/GB90/00266 (WO90/09316) concerns an invention whereby articles or sets of articles are passed through a gap between in-feed and out-feed conveyors and are wrapped helically in that gap while supported and transported by a band that is moved through the gap and becomes incorporated in the packaging inside the helical wrapping.

In practising that invention, a problem has arisen for multiple article packaging where those articles have round bases and sides, i.e are generally circular cylindrical, and stand side-by-side transversely of as well as along their direction of conveyance. For some such packs, there is a tendency for unwanted relative translation of articles to occur in the direction of conveyance. Resulting packs tend to have articles displaced from transverse registration side-by-side to a staggered relationship with articles on one side resting in cusps between articles on the other side, even forcing each other out of desired article-to-article contact along the direction of conveyance. This unwanted action takes place at helical wrapping, but we find is unrelated to use of the transport band that becomes incorporated into the packaging, as evidenced by it being unpredictable as to which articles effectively advance or regress, and by no measures taken to secure even tension in the transport band across its width making any difference.

It is an object of this invention to solve such problems which are specific to helical wrapping processes.

According to one aspect of this invention, there is provided a method of packaging sets of articles arranged in

side-by-side relation both in one direction and transversely of said one direction, in which said sets are fed successively in said one direction to and through a station at which helical wrapping is performed by using material moving generally transversely of said one direction, the articles being of such non-rectangular sections parallel to their bases as, if the articles lose registration in their transverse side-by-side relation, can lead to the articles becoming staggered in said one direction with some of the articles resting partially between others of the articles, and the articles otherwise adjacent transversely of said one direction having article separating material interposed between them and extending in said one direction, at least during the helical wrapping.

The invention is effective for packaging form-sustaining articles by feeding the articles successively, spaced in sets in the one direction across a gap between two conveyor systems and through a station operative for helical wrapping using a material moving at that gap transversely to said one direction, and wherein the sets of articles adjacent both in the one direction (of feed) and transversely thereof, and articles otherwise adjacent transversely of said feed direction are separated at least during helical wrapping.

According to another aspect of the invention, there is provided apparatus as and when used in helically packaging articles arranged in side-by-side relation both in one direction and transversely of said one direction, which articles are of such non-rectangular sections parallel to their bases as, if the articles lose registration in their side-by-side relation, can lead to the articles becoming staggered in said one direction with some of the articles resting partially between others of the articles; the apparatus comprising first conveyor means for conveying unpackaged articles in said one direction, second conveyor means for articles helically wrapped in flexible sheet material the first and second conveyor means being spaced apart, means for helically wrapping flexible sheet material

about the articles by passing that sheet material between the spaced apart conveyors, and article separating means of a non-conveying nature extending interposed between said articles in said one direction at least during their helical wrapping when those articles would otherwise be adjacent in their transverse side-by-side relation.

Typically, separation of articles otherwise adjacent transversely of the one (conveying) direction involves provision of one or more barrier means between such adjacent articles to reduce the degree of article to article contact. The barrier means may be arranged for insertion between the articles at least just prior to their entry into the helical wrapping station. Other aspects of the invention concern provision of such packages including barrier means between adjacent articles.

In one such aspect, there is provided a package of a set of articles made by the above method aspect further involving inserting said barrier means between said transversely adjacent articles prior to passage of the articles through the helical wrapping station; the set having articles adjacent in one direction and transversely thereof, and the package comprising the barrier means extending longitudinally in the one direction between transversely adjacent articles to reduce article-to-article contact, and helical wrapping material arranged generally transversely to said longitudinal barrier means.

In another such aspect, there is provided a package of a set of articles made by the above method aspect wherein further wrapping material is fed in said one direction to overlies the articles and is wrapped in with the articles at the helical wrapping station, and barrier means as part of said material is interposed between said transversely adjacent articles prior to passage of the articles through the helical wrapping station and serves to provide integral excursions in said further wrapping material as further part of said material interposed and to remain so interposed between the transversely adjacent articles after passage of

the articles through the helical wrapping station; the set having said articles adjacent in one direction and transversely thereof, and the package including the further wrapping material extending longitudinally in said one direction having integral excursions extending between transversely adjacent articles inside helical wrapping material arranged generally transversely to said longitudinal material and said one direction.

In one embodiment of the invention, said barrier means involves use of an article divider extending in the conveying direction between articles otherwise adjacent transversely of the conveying direction, at least during application of helical wrapping. If, transversely of the conveying direction, there are more than two articles in each set, there can be more than one divider.

The shape or form of the article divider(s) may be varied according to the shape of the adjacent articles.

In such embodiment, need for such divider(s) arises specifically at helical wrapping, because that is where transverse compression of the set of articles arises, normally including from intended stretching of the helical wrapping material. However, it is convenient for the or each such divider also to extend the length of the in-feed conveyor, further preferably by securement at or beyond its end so that its extension therefrom and through a helical wrapping gap to the out-feed conveyor is free of any further support apart from its bottom edge perhaps resting upon the out-feed conveyor as can be useful. In the specific embodiment to be described extension of said divider over the out-feed conveyor is for a length equivalent to that of a packaged set

of articles, so the out-feed conveyor can be the effective agency for withdrawing the packaged set of articles from said divider as well as the preferred agency for drawing the band through the packaging system, which band can also conveniently be supplied from beyond the in-feed conveyor.

An alternative that meets minimum requirements for separation at the helical wrapping gap only, or as much upstream or downstream as is desired, would be to have the divider(s) depend from an upper articles guide, typically above and facing a lower said transport band. This allows for in-fed articles to part transversely of the conveying direction at encountering, conveniently by engaging, a forward end edge of the or each said divider. Such upper articles guide can be as disclosed in our co-pending application, namely with a free extent downstream of fixing at or near the end of the in-feed conveyor or start of the helical wrapping gap, so as to be wrapped about by stretched helical wrapping material that contracts into tight packaging engagement of the set of articles as same is drawn off onto the out-feed conveyor. It will be appreciated that such divider(s) can extend upstream or downstream from such upper guide, and/or be secured only at the upstream end of such upper guide so as effectively to float freely downstream through the helical wrapping gap. The divider(s) may even be secured only at or near the end of the in-feed conveyor or start of the helical wrapping gap to be independent of such upper guide, including presence or absence of that guide.

Where there is an upper guide through the helical wrapping gap as in our co pending application (and whether or not associated with support of said divider(s)) extension of the or each said divider beyond such upper guide ensures that each wrapped set of articles is first withdrawn from that guide with a first consequent reduction of stretch in the helical wrapping material, and that stretch reduction in the helical wrapping material at withdrawal of wrapped sets

of articles from said divider(s) takes place as a second and further stretch reduction then exerting less force on the wrapped articles. We believe there can be advantage in that sequence of wrapping shrinkage about wrapped sets of articles by way of reducing ant residual risk of those articles displacing relative to each other due to small departures from exact registration. However, the individual effective gripping taken on the articles by stretch in the helical wrapping material may, of itself, contribute to securing stability of the wrapped set, at least so long as departures from exact registration are not too great.

In general terms, it will be appreciated that practical thickness of said divider(s) presents no difficulties in achieving desired tightness of helical packaging as normal stretch of the helical wrapping material will be well beyond what is required for recovery after withdrawal of such divider(s). We have used 1.5mm thick p.v.c. sheet satisfactorily in experimental development, without any withdrawal problems for a divider extending through article sets with articles two abreast, including the first packaged set on the out-feed conveyor, i.e. even when being gripped by two successive helically wrapped packages. Stiffer material, such as steel, even spring steel, would enable much thinner divider(s), as could be advantageous both in reducing final pucker in the transport band within the packaging and in reducing risk of unwanted displacement as the articles come off the divider(s) whose downstream ends could be finely tapered to help reduce any such effects, at least if not already very thin throughout.

As thus far outlined and particularised, employment of an article divider is actually equally applicable to wrapping sets of articles whether or not a transport band is used as taught in our copending application. For example, support through the helical wrapping gap may be provided by a lower guide of a

conveying nature. Alternatively, if conveying is otherwise achieved over a static lower guide, in which case the alternative divider aforementioned for association with said upper guide could equally well be associated with the lower guide.

However, use of the transport band of our co-pending application is believed to be further advantageous to achieving the purpose of the aforementioned aspects of the present invention as it provides a single continuous transport surface on which sets of articles collected and located together will experience no tendency arising from transport provisions for the articles to become relatively displaced within their sets. Also, stability of location is readily enhanced by the transport band material taking at least slight impressions thereinto of bottoms of the articles, and adhesive for article bottoms.

The longitudinal wrapping material within the helical wrapping material adverted to above as having integral excursions between the articles of a set thereof can, of course, be a transport band, though it need not be. In any event, suitable excursions comprise deviations, such as tucks or folds in the longitudinal wrapping material. The

excursions are conveniently provided in a layer, preferably an upper layer of the wrapping material overlying the articles, before the articles enter the helical wrapping station. Suitable apparatus has barrier means such as an article divider or follower for insertion between articles and/or for following the form of the articles, without causing unsatisfactory extreme displacement or dislodging of the articles. For example, a plate-like divider is appropriate for articles having substantially upright walls, whereas a roller or the like may be more appropriate for articles of more complex shape, such as "necked" containers.

The articles to be packaged may have one or more layers of lower and/or upper longitudinal wrapping material applied, as appropriate, at least one of which layers is arranged between the articles and the apparatus for providing integral excursions in the material and for effecting article separation. Thus, by contacting the longitudinal material with the apparatus, say a divider, and inserting the divider between adjacent articles, thereby to take a length of the material for folding or tucking between the articles, an integral excursion is provided in an extent of that layer of material. The extent, form and direction of the excursions may be varied as appropriate, including according to the form of adjacent articles. Similarly, adjacent articles may be separated by either or both of upwardly and downwardly projecting excursions. In such circumstances, if the upward and downward excursions are to be of different extent, relative linear speed of supply of longitudinal material above and below articles is varied as appropriate.

Particularly satisfactory results are obtained using longitudinal material or a transport band having adhesive on the article engaging side of the band as previously mentioned, such that stability is enhanced by adhesion of the excursions to the article walls.

Specific implementation for this invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of apparatus incorporating a divider according to one embodiment;

Figure 2 is a diagram showing the problem to be overcome; and

Figure 3 is a plan diagram showing the solution of Figure 1;

Figure 4 is a perspective view of apparatus for providing integral excursions in longitudinal wrapping material;

Figure 5 is a diagram showing an application of longitudinal wrapping material having integral excursions;

The apparatus 10 of Figure 1 is basically as in our co-pending application No PCT/GB90/00266, to which reference is further directed. The apparatus provides for applying continuous webs of wrapping material around sets of articles while each set moves through a space 16, defined between the downstream end of a first conveyor 12 and the upstream end of a second conveyor 13, those conveyors being arranged in line and spaced apart from each other in the conveying direction C.

A double ring-type web-applicator device 14 rotates in this space or gap 16 about an axis extending generally parallel to the axis of the first and second conveyors 12, 13 so as to apply from at least one reel 15 at least one helical band 17 of wrapping, see 15A,B,X and 17A,B,X around each of article sets 11.1 to 11.N as it moves through the space 16 from the first conveyor 12 to the second conveyor 13. A transport band 18 is drawn through the space 16 in engagement

with articles of the sets, preferably adhesively engaging them, while the helical band 17 is wrapped around them in turn, and the transport band 18. The latter serving to transfer, or to facilitate the transfer of each article set 11 through the space 16 from the first conveyor 12 to the second conveyor 13.

The transport band 18 is shown coming from a reel 21 of wrapping material placed at the commencement of the process, to supply the band 18 overlying in-feed conveyor 12 and a bracket 19 in the space or gap 16 (thus bridging the space or gap 16) and the conveyor 13 in one continuous unbroken length. This extra wrapping from reel 21 can be of similar material to that of the main wrapping reel(s) 15 or could be of a variety of other types of flexible material. Its purpose is to provide a continuously running surface moving with the conveyors 12 and 13, and preferably in adhesion with the articles 11. The conveyors 12 and 13 may run at the same nominal speed, or it could be advantageous for the out-feed conveyor 13 to have a slightly faster normal speed than the in-feed conveyor 12.

The sets of articles 11 to be wrapped are fed onto the wrapping material 18 with an article-to-article spacing 20. In operation, the sets of articles 11.1 through 11.N-2 together with wrapping material 18 and conveyors 12 and 13 will be, are, or have been, all running effectively at the same linear speed even if the conveyor 13 is driven at a slightly faster speed than the conveyor 12 as can be advantageous.

Because the sets of articles 11.1 through to 11.N-2 are sitting on the wrapping material 18 there is no external force to disturb the articles or their spacings 20 (other than a helical wrapping as will appear). The weight of the articles 11 on the band 18 can serve as the sole agency for drawing the material 18 through the system as at least the conveyor 13 is

driven, and consequent tension in it between conveyors 12 and 13 can be enough satisfactorily to convey the articles across the gap 16. In practice (and particularly for materials such as typical for highly extensible preferred wrapping 17 of cling film type) the bracket 19 is used to support the band 18 across the gap 16, and the band 18 may be of the same material as the helical wrapping 17.

During the wrapping process the helical wrapping material 17 will rotate around both the article 11 to be wrapped and the support wrapping material 18 trapping the support material 18 between the helical wrap 17 and the article 11, with substantially at least partially recovering stretching of the helical wrapping material. It is forces due to such recovery that cause problems with which this invention is concerned.

Figure 2 illustrates such problems arising from unwanted relative translation of articles in the conveying direction, particularly for articles with round bases and sides, i.e. generally circular cylindrical. Specifically, in the distorted set 111, articles (101,102; 103,104; 105,106) that should be in side-by-side registering contact transversely of the conveying direction, i.e. with diameters perpendicular to the conveying direction (shown dashed) aligned through intended points of contact, actually become displaced to rest in cusps of articles adjacent in the conveying direction. In fact, once that condition is reached, the articles can even become forced apart in the conveying direction, and the resulting package becomes a mess.

Whilst specific locational attributes of support and transport bands 18 hereof, whether by adhesion or indentation additional to just friction, can contribute to resisting or limiting such article movement, that is often not enough to prevent dislocation, at least by distortion of the band material as can occur for stretchable materials. Use of two

helical wrapping rings can accentuate problems, including the case where the reels are contra-rotating. Basically, those problems are due to minor misalignment of articles in their sets and relative sliding or rolling on each other under forces F applied by stretched helical wrapping.

Substantial reduction of those problems results from specific provisions hereof, for example, by way of a divider 30, see Figs 1 and 3. The illustrated preferred divider 30 is mounted, 32, at the upstream end of the in-feed conveyor 12. The divider is shown extending as a vertical plate down between the articles of each set through the helical wrapping gap 16 and the first set of wrapped articles on the out-feed conveyor 13. Screw-through or clamp type mounting in jaws depending from a fixed plate at 32 is advantageous, the extent of the divider 30 downstream therefrom then being in a 'floating' state save for any support of its lower free end on the out-feed conveyor 13.

Figure 1 actually illustrates wrapping continuing between articles, which is practical though not essential in principle, and a continuous wrap of articles will result from which each wrapped article is readily individually separated, say (as shown) by cutting through the wrapping materials with either a hot wire 24 or a knife on a reciprocable carriage 25 or any effective cutting agency. The complete wrapped article will then have external helical wraps containing both the article and a single sheet of support wrapping material 18. A heat application system, such as a hot-wire/block/knife assembly, for a synthetic plastics wrapping material 17 of high stretchability and recovery could aid achieving sealing of the finished package at both ends, though that is often not required.

The illustrated arrangement does have an upper bracket 19A, a second transport band 18A over tops of the articles, and upper conveyors 12A, 13A paired with the first and second

conveyors 12, 13, all for improved stability of transport and helical wrapping, particularly for tall thin articles. Further guides (not shown) will also normally be provided along sides of at least the in-feed conveyor 12, typically as parallel walls, see 22A,B in Figure 3.

The brackets 19, 19A each have an operative support limb 22 that extends to a free end in the direction of travel of the articles 11 and will also be wrapped by the helical wrapping material 17, which should thus be stretchable with reasonable recovery so that it will snap back about the articles as they leave the space 16. Low friction material, such as polytetrafluorethylene (PTFE) for at least the surfaces engaged by the helical wrapping material 17 can be useful. However, hollow brackets 19, or at least equivalents to limbs 22, fed with compressed gas (usually air) and perforate through their surfaces have particular advantage and utility as is explained in our co-pending application.

If the wrapping material width 18 exceeds the width of the article to be wrapped, its side edges will be turned up or down round the article by the helical wrapping 17, particularly recovery of highly stretchable cling film type material.

Dividers for necked articles, such as bottles, can have side extensions to engage the necks of the articles and hold them in accurate location during helical wrapping. Similar considerations apply if there is reduction of articles towards their bottoms, then regarding lower side extensions of dividers. In fact, both upper and lower side extensions could be useful for some articles, or even further, up to and including full, conformity of dividers to article side shapes for articles varying from strict right-cylindrical.

Turning now to Figure 4, there is illustrated a modified apparatus, for separation of adjacent articles by providing

integral excursions in the upper layer of wrapping material 18B.

The apparatus comprises a frame 38 on which is mounted a rotatable reel 21B of longitudinal wrapping material 18B. The frame has a base support rod 43 (and its counterpart on the opposite side of the frame 38, not illustrated). The rod 43 and its counterpart are spaced to allow conveyance of sets of articles through the frame 38 on lower longitudinal wrapping material 18, with articles adjacent transversely of the direction of conveyance having a spacing therebetween of the order of a few millimetres, such as about 5 millimetres. Rod 50 (and an opposite counterpart) are provided at the article exit from the frame 38, with a closer spacing than the rods (43 and counterpart) at entry to the frame 38.

Turning to the upper part of the frame, rollers 48 and 49 are rotatably mounted thereon, disposed either side of an adjustable plough or blade 40. The blade 40 projects below the level of the rollers 48, 49 by the order of a few centimetres. In use, the sets of articles 11 are mounted on a lower longitudinal material 18, typically with the material having an article engaging adhesive on its uppermost surface, and the material 18 is advanced through the frame 38 to draw the sets of articles 11 therethrough.

Upper longitudinal material 18B is supplied from reel 21B and under free-running roller 48 to overlies the articles 11. There is a small clearance between the roller 48 and the articles 11, such that, at this point, the material 18B rests loosely on the top surface of the articles 11.

As the articles 11 and longitudinal material 18, 18B advance, to reach blade 40, the upper material 18B is tucked or folded between adjacent articles to provide an integral excursion generally having the form of a "T". On advancing under the roller 49, pressure is applied to the articles 11

and upper material 18B to assist adhesive engagement of the material 18B with the tops of articles 11. Adhesive engagement of the excursions in material 18B with sides of the articles 11 is facilitated as the articles 11 pass between exit guide rod 50 (and counterpart) which is mounted inwardly with respect to entry guide rod 43 to thereby apply an inwardly directed force to the sides of articles 11. Horizontal guide rod 47 also tapers inwardly from entry guide rod 43 to exit guide rod 47 to further assist adhesive engagement of excursions and article sides.

Upon exit from the frame 38, articles and longitudinal material 18, 18B are conveyed to a helical wrapping station 14, such as illustrated in Fig. 1. During the helical wrapping process relative sliding or rolling of adjacent articles under forces applied by stretched helical wrapping is reduced and often substantially eliminated owing to reduction in article-to-article contact by way of the integral excursions in the longitudinal wrapping material.

As previously mentioned, such apparatus is particularly appropriate for applying packaging to articles of more complex shape than straight cylindrical, such as necked bottles or the like. As illustrated in Fig. 5, 3 x 3 arrays of bottles may be packaged with both upper 18A and lower 18 longitudinal wrapping material together with an intermediate layer 18B having integral excursions 18E to counteract nesting and tilting of the bottles during helical wrapping.



CLAIMS

1. A method of packaging sets of articles arranged in side-by-side relation both in one direction and transversely of said one direction, in which said sets are fed successively in said one direction to and through a station at which helical wrapping is performed by using material moving generally transversely of said one direction, the articles being of such non-rectangular sections parallel to their bases as, if the articles lose registration in their transverse side-by-side relation, can lead to the articles becoming staggered in said one direction with some of the articles resting partially between others of the articles, and the articles otherwise adjacent transversely of said one direction having article separating material interposed between them and extending in said one direction, at least during the helical wrapping.
2. A method according to claim 1, wherein further wrapping material is fed in said one direction as an aid to transporting the articles and is wrapped in with the articles at the helical wrapping station.
3. A method according to claim 1 or claim 2, which includes use of barrier means as at least part of said material interposed between said transversely adjacent articles.
4. A method according to claim 3, which comprises feeding said transversely adjacent articles either side of said barrier means prior to passage of articles through the helical wrapping station.
5. A method according to claim 3, which comprises inserting said barrier means between said transversely adjacent articles prior to passage of the articles through the helical wrapping station.
6. A method according to claim 1, wherein further wrapping material is fed in said one direction to overlie the articles and is wrapped in with the articles at the



helical wrapping station, and barrier means as part of said material is interposed between said transversely adjacent articles prior to passage of the articles through the helical wrapping station and serves to provide integral excursions in said further wrapping material as further part of said material interposed and to remain so interposed between the transversely adjacent articles after passage of the articles through the helical wrapping station.

7. Apparatus as and when used in helically packaging articles arranged in side-by-side relation both in one direction and transversely of said one direction, which articles are of such non-rectangular sections parallel to their bases as, if the articles lose registration in their side-by-side relation, can lead to the articles becoming staggered in said one direction with some of the articles resting partially between others of the articles; the apparatus comprising first conveyor means for conveying unpackaged articles in said one direction, second conveyor means for articles helically wrapped in flexible sheet material the first and second conveyor means being spaced apart, means for helically wrapping flexible sheet material about the articles by passing that sheet material between the spaced apart conveyors, and article separating means of a non-conveying nature extending interposed between said articles in said one direction at least during their helical wrapping when those articles would otherwise be adjacent in their transverse side-by-side relation.

8. Apparatus according to claim 7, wherein the means for being interposed between the transversely adjacent articles comprises a barrier means extending in the conveying direction.

9. Apparatus according to claim 8, in which the barrier means extends along the length of the first conveyor means.

10. Apparatus according to claim 7, having means for passing further material in said one direction for incorporation into the helical package, and means for



providing integral excursions in the further material that are thereby interposed between the transversely adjacent articles.

11. Package of a set of articles made by a method according to claim 6, the set having said articles adjacent in one direction and transversely thereof, and the package including longitudinal wrapping material extending in said one direction having integral excursions extending between transversely adjacent articles inside helical wrapping material arranged generally transversely to said longitudinal material and said one direction.

12. Package of a set of articles made by a method according to claim 5, the set having articles adjacent in one direction and transversely thereof, and the package comprising a longitudinal barrier means extending in the one direction between transversely adjacent articles to reduce article-to-article contact and helical wrapping material arranged generally transversely to said longitudinal barrier means.

13. Method of packaging sets of articles substantially as herein described with reference to the accompanying drawings.

14. Apparatus as and when used for packaging sets of articles according to claim 1 arranged and adapted to operate substantially as herein described with reference to and as shown in the accompanying drawings.