METHOD OF JOINING

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References Cited

UNITED STATES PATENTS
3,342,659 9/1967 Baum et al. 156/296
3,263,830 8/1966 Anderson 214/10.5 R

ABSTRACT

A method of protectively joining a succession of elongate articles of a frangible or otherwise damageable material that includes positioning these articles in a non-abutting parallel relationship and applying at least one thin continuous coat of hot flexible plastic-type material over the succession of articles in a direction normal to their longitudinal axes, with this stream removably adhering, upon cooling, to the articles to thereby protectively join the articles. Bond release agents may be utilized, and if the joined articles are stacked in rows, the streams also serve as partitioning means between adjacent rows. Modifications include the uses of substrate member and/or intermittent streams of plastic-type material.

10 Claims, 5 Drawing Figures
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METHOD OF JOINING

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a method of joining a plurality of elongated articles. More specifically, it pertains to an economical and novel method for protectively joining a succession of elongate articles of a frangible or otherwise damageable material having straight longitudinal axes, and for the handling thereof as in storing or shipping.

2. Prior Art

The patent art is replete with methods and apparatus for bundling and packaging cylindrical or tubular objects. Some of these patents, such as U.S. Pat. No. 2,662,649 to Gill et al., teach the method of producing a package wherein the various articles in the package are held in place vertically stacked, and preferably in staggered relation, by a substantially continuous binding element which is interwoven between the articles in such a manner as to lock the ends of the binding element in place as well as to tie the articles together in a unitary structure. While this method successfully separates the various rows of articles it does however permit contact between adjacent articles within each row.

The method of bundling shown in U.S. Pat. No. 3,373,540 to Wisner, which is also assigned to the assignee of this invention, discloses a line of flexible material that is ensheathed about each succeeding one of a succession of frangible articles in a manner so as to form a ladder-like structure enabling the ensheathed articles to be sinusoidally or spirally wound to form a compact bundle thereof without the possibility of physical contact between the articles. While this method is quite useful it does not permit the ready removal therefrom of the articles on a unitary basis since there is no adherence of the articles to the line of flexible material.

Standard, well-known evacuated blood sampling tubes (such as illustrated in U.S. Pat. No. 2,460,641 to Kleinert) are generally packaged for shipment and handling, to physicians and hospitals etc. in corrugated and chipboard cartons, with the tubes being located in stacked tube trays, such as, for example, those shown in U.S. Pat. Nos. 3,272,371 and Des. 205,735 to Weiner. These trays, which are generally made of a flexible plastic material, separate and partition the frangible tubes from each other to minimize or eliminate breakage during shipment and to permit ready dispensing at the point of use. While this packaging system with the tube trays performs satisfactorily, it is also subject to several shortcomings. Not only are the trays themselves relatively expensive, but they also require a considerable amount of space within the container, present a disposal problem, and do not give a ready visual indication of the number of tubes remaining in an opened container.

SUMMARY OF THE INVENTION

The instant invention responds to each of the previously-described prior art shortcomings in a manner so as to completely eliminate any further concern regarding such problems. The method of this invention protectively joins a succession of identical elongate articles, having straight longitudinal axes, of a frangible or otherwise damageable material that includes positioning each of the successions of articles in a non-abutting parallel relationship; and applying at least one thin continuous stream of hot flexible plastic-type material over each of the articles in a direction normal to their longitudinal axes, with said stream removably adhering, upon cooling, to the articles and making at least a partial annular contact and preferably at least 180° surface contact with each of the articles to thereby protectively join the articles. The method may further include the use of bond release agents and rolling the joined articles upon themselves to form a convolute cylindrical structure, with the stream of plastic-type material serving as a partitioning means between the convolutions. In addition, the joined articles may be stacked in parallel rows, with at least one stream serving as a partitioning means between adjacent rows thereof.

Modification of the method of this invention also includes the use of a substrate member and the use of intermittent streams of plastic-type material.

Other advantages and features of the instant invention will be understood from the following description in conjunction with the attached drawings.

BRIEF DRAWING DESCRIPTION

FIG. 1 is a perspective view illustrating the method of this invention wherein a succession of identical elongate articles of frangible or otherwise damageable materials are being protectively joined by a continuous stream of flexible plastic-type material.

FIG. 2 is an end view of two successions of articles, protectively joined by the method of FIG. 1, stacked in parallel adjacent rows.

FIG. 3 is an end view of a modification of the method shown in FIG. 1 wherein said articles are placed on a substrate member.

FIG. 4 is an end view of a further modification of the method shown in FIG. 1 wherein an intermittent stream of flexible plastic-type material is utilized to protectively join said articles.

FIG. 5 is an end view of a modification of the method shown in FIG. 4 wherein said articles are placed on a substrate member.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings in detail, and particularly to FIG. 1, there is shown a plurality or succession of elongate articles 12 of a frangible or otherwise damageable material that are being protectively joined to each other by means of at least one thin continuous stream 14 of hot flexible plastic-type material.

It is believed expedient to note at this point in the description that the phrase "elongate articles of a frangible or otherwise damageable material" is intended to include articles such as tubes or tubing, cylinders, rods, bars, strips, flakes, beakers etc., of glass, plastic or other brittle materials, or articles subject to abrasion or which have coatings that are readily subject to being scratched. This may include, for example, small bottles, ampules, vials, glass piping and the like.

It should also be noted that the phrase "flexible plastic-type material" as employed herein is intended to mean materials such as polyamides, polyethylene, polyethylene-rubber combinations, thermoplastic urethane, polyester-type materials, ethylene-vinyl acetate and the like, i.e., materials that can be utilized in hot-melt systems.
As best seen in FIG. 1, a succession or row 18 of, for example, glass tubes 12 having straight longitudinal axes 16 are positioned in a non-abutting parallel-longitudinal-axis relationship. Each tube 12 is in close proximity to the immediately preceding tube 12 in row 18, without skew and the resultant possibility of physical contact between tubes 12. Exiting from nozzle 20 of any melt source, such as a conventional hot-melt extruder (not shown), is a thin continuous stream 14 of hot flexible plastic-type material that is applied over tubes 12 in a direction normal to tube longitudinal axes 16. Stream 14, which is extruded in the hot state on, between, around and/or partially around the peripheral outer surface 22 of tubes 12 (as best seen in FIG. 2) makes at least a partial annular contact and preferably at least a 180° surface or arc contact with tubes 12. Thus, each tube 12 will be mechanically locked when stream 14 is allowed to droop below tube centerline 24. Stream 14 may be defined as being comprised of alternate, oppositely curved, arcuate tube contacting and tube connecting portions 26 and 28, respectively. Tubes 12 are preferably arranged on a jig or carriage (not shown) in order to obtain the required parallel non-abutting relationship, with at least one of the jig and extruder being movable relative to the other. The jig or carriage may be arcuate if desired so as to allow the tubes to be joined in a curved row. The nozzle configuration, extrusion rates, relative speed of movement, and type of plastic-type material being utilized are such that by proper selection the process is synchronized to provide the desired amount and shape of stream 14 that is applied over tubes 12. If more than one stream 14 of material is desired, then a second extruder could be utilized, or cyclic transfer and indexing of the one extruder and/or jig can be used. In addition, if a second extruder is utilized, then a different type of hot-melt and/or a different amount or shape of stream 14 can also be used, if desired. Furthermore, the hot melts may also be pigmented so as to permit identification by color.

After the application of stream 14 of hot flexible plastic-type material over tubes 12, cooling to a tack-free condition of stream 14 is achieved by radiation, conduction and convection. Depending on the material composition and the amount used, cooling time can range from a few seconds to a few minutes. Forced air can also be used to significantly speed up the cooling cycle.

After sufficient cooling to permit handling, rows 18 may be stacked either horizontally (FIG. 2) or vertically to form adjacent parallel rows, with the tube contacting portions 26 of at least one stream 14 serving as a partitioning means between adjacent rows. If desired, a row 18 may also be rolled upon itself to form a convolute cylindrical body structure (not shown) with tube contacting portions 26 again serving as a partitioning means between the convolutions of this body structure. Furthermore, tubes 12, whether in flat rows, arcuate rows, or rolled-up-themselves cylinders, may be used in dispensing mechanisms (not shown) wherein the tubes may be individually dispensed from the joined row.

The composition of the flexible plastic type material is either selected so as to permit ready physical removal, i.e., peeling, of stream 14 from tubes 12, or tubes 12 are sprayed, prior to the application of stream 14, with a bond release agent such as known silicone lubricants (not shown). In addition, such a release agent could also be readily incorporated into the plastic-type material in order to reduce or eliminate the degree of “tack” relative to the tube surface.

FIG. 3 shows an end view of a modification of the method shown in FIG. 1 wherein tubes 12, prior to being positioned in a non-abutting parallel-longitudinal-axis relationship, are placed on a substrate member 30 of an expendable material such as corrugated board. Stream 14a, which is identical to stream 14 in composition and method of application, removably adheres not only around an arc portion of tube peripheral surface 22 but is also allowed to adhere to substrate member 30 between adjacent ones of tubes 12 thus essentially “tacking” tubes 12 to member 30 at points 32. In addition, the surface contact between tubes 12 and stream 14a need not be in excess of 180° since the use of substrate member 30 eliminates the necessity of having to “mechanically” lock tubes 12 to stream 14a. Stream 14a may be defined as being comprised of alternate, oppositely curved, arcuate tube contacting and substrate contacting portions 34 and 36, respectively. The resulting rows 18c, similar to rows 18, may also be stacked, either horizontally or vertically, with at least one substrate member 30 serving as a partitioning means between adjacent rows. Substrate members 30 may either be flat or arcuate and can extend for the entire axial length of the articles to be joined or may be in strip form parallel to stream 14a.

FIG. 4 shows an end view of a further modification of the method of FIG. 1, wherein an intermittent stream 14b of flexible plastic-like material is utilized to protectively join a plurality of tubes 12 into row 18b. Intermittent stream 14b is comprised of aligned segments 38 that make contact between each of tubes 12 and upon cooling join adjacent ones of tubes 12.

FIG. 5 shows an end view of a modification of the method shown in FIG. 4 wherein tubes 12, prior to being positioned in a non-abutting parallel-longitudinal-axis relationship, are placed on a substrate member 30. Intermittent stream 14c is comprised of aligned segments 38c, with segments 38c, in addition to joining adjacent ones of tubes 12 also being allowed to adhere to substrate member 30. Thus tubes 12 are in effect “tacked” to substrate member 30 at points 42. The resulting rows 18c, may also be stacked in a manner similar to that described with reference to FIG. 3.

The protective joining methods of this invention (especially the method described with reference to FIGS. 1 and 2), are readily used for joining tubular articles such as blood collection tubes. After initially positioning the tubes, the stream of hot plastic-type material is extruded on, between and/or around the tubes. The plastic-type material, upon cooling, removably adheres to the tubes and at the same time separates the adjacent tubes from one another. The joined succession of tubes may then be handled as units and stacked in cartons etc., if desired, with the streams of material between abutting rows acting as partitioning means therebetween. The end user may readily mechanically separate or “peel” the individual tubes from the joined row. As previously noted, the degree of separation force required can be controlled by means of plastic material composition control and/or the use of release agents sprayed on the tubes.
In comparison with presently used packaging or protective joining systems, the method of this invention includes, among others, the following advantages:

A. Reduced overall package size;
B. Visible evidence of number of remaining articles (even when strip substrates are used);
C. Positive Protection from article-to-article contact;
D. Selection of removal, i.e., either easy or difficult;
E. Allow flexibility of product shape;
F. Low cost and high-speed processing; and
G. The plastic-type materials are readily disposable.

While this invention has been described in connection with possible forms or embodiments thereof, it is to be understood that changes or modifications may be resorted to without departing from the spirit of the invention or scope of the claims which follow.

What is claimed is:

1. A method of protectively joining a succession of elongate fragile articles having straight longitudinal axes comprising:
   a. positioning each of said succession of elongate fragile articles in a spaced-apart parallel relationship along their longitudinal axes and in close proximity to an immediately adjacent article of such succession, and without skew or physical contact between such articles; and
   b. extruding at least one thin, continuous stream of hot flexible plastic-type material over said elongate articles and applying such stream to the article in a direction normal to their longitudinal axes, with said at least one stream removably adhering, upon cooling, to said elongate articles and making only a partial annular surface contact with each of said articles, thereby protectively joining said articles.

2. The method of claim 1 further including rolling said joined articles upon themselves to form a convolute cylindrical body structure, with said stream of flexible plastic-type material forming as a partitioning means between the convolutions of said body structure.

3. The method of claim 1 further including applying a bond release agent to said articles prior to applying said flexible plastic-type material in order to permit ready removal of said plastic-type material when desired.

4. The method of claim 1 including the step of forming alternate arcuate article-contacting and article-connecting segments while applying said continuous stream of flexible plastic-type material to said succession of articles with said arcuate article-contacting segments providing only a partial annular surface contact of at least 180° with each of said articles.

5. The method of claim 1 including the steps of individually forming at least two successions of said joined articles, and then stacking said individually formed successions of joined articles to form adjacent parallel rows, with said at least one stream of flexible plastic-type material removably adhering to an individually formed succession of said joined articles serving as a partition means between said stack of successions.

6. The method of protectively joining a succession of elongate articles of a fragile or otherwise damageable material and having straight longitudinal axes, such method comprising:
   a. positioning each of said succession of elongate articles in a non-abutting parallel-longitudinal-axes relationship, with and in close proximity to the immediately preceding article of such succession, without skew and the resultant possibility of physical contact between said articles;
   b. applying at least one thin, continuous, stream of hot flexible plastic-type material over said elongate articles in a direction normal to their longitudinal axes, with said at least one stream removably adhering, upon cooling, to said elongate articles and making at least a partial annular surface contact with each of said articles, thereby protectively joining said articles; and
   c. placing said articles on a substrate member prior to positioning said articles in a non-abutting parallel-longitudinal-axis relationship, with said stream of flexible material also making contact with and removably adhering to said substrate member between adjacent ones of said articles.

7. The method of claim 6 further including stacking at least two successions of said joined articles to form adjacent parallel rows, with the substrate member of at least one of said rows serving as a partitioning means therebetween.

8. The method of protectively joining a plurality of elongate articles of a fragile or otherwise damageable material and having straight longitudinal axes, such method comprising:
   a. juxtapositioning a plurality of elongate articles in a row in non-abutting relationship with longitudinal axes thereof being substantially parallel; and
   b. applying at least one thin intermittent stream of hot flexible plastic-type material over said elongate articles in a direction normal to their longitudinal axes, with said intermittent stream comprising aligned segments making contact between adjacent ones of said elongate articles, with said segments, upon cooling, removably joining said articles.

9. The method of claim 8 further including placing said articles on a substrate member prior to positioning said articles in a non-abutting parallel-longitudinal-axis relationship, with said aligned segments, in addition to joining adjacent ones of said articles, also adhering to said substrate member.

10. The method of claim 9 further including stacking at least two rows of said joined articles to form adjacent parallel rows, with the substrate member of at least one of said rows serving as a partitioning means therebetween.

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