United States Patent — Forman

[15] 3,668,061

[45] June 6, 1972

[54] TEAR STRING FOR SHRINK FILM PACKAGES

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[22] Filed: **Nov. 5, 1970**

[21] Appl. No.: **87,238**

[52] **U.S. Cl.** ....**161/175,** 206/DIG. 4, 229/51 S

[51] **Int. Cl.** **B65d 17/20**

[58] **Field of Search** ....161/99–101, 172, 161/175, 242, 402; 57/144, 149, 152; 206/DIG. 4; 229/66, 86, 51 R, 51 S, 51 AS, 51 TS

[56] **References Cited**

UNITED STATES PATENTS

2,840,882	7/1958	Smith	161/175
3,352,480	11/1967	Forman	229/51 S
3,456,780	7/1969	Forman	229/51 S
3,507,741	4/1970	Aleixo	161/175
3,565,329	2/1971	Wagner, Jr. et al.	57/144

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[57] **ABSTRACT**

A tear string having particular utility in connection with packages overwrapped with heat sealable shrink film comprises an elastic core, one or more textile covers wrapped around the core and an outer coating of a fused thermoplastic synthetic resin. The core is in tension and, additionally, the outer coating may be axially oriented. Thus, when the string is heated to the thermoplastic temperature of the resin coating, the stored tensile forces in the core are released and tend to make the string contract toward its original dimensions. This effect is enhanced if the coating is axially oriented, due to the heat shrinking phenomenon. Such a tear string has various advantages in shrink film wrapped packages.

10 Claims, 3 Drawing Figures

PATENTED JUN 6 1972 3,668,061

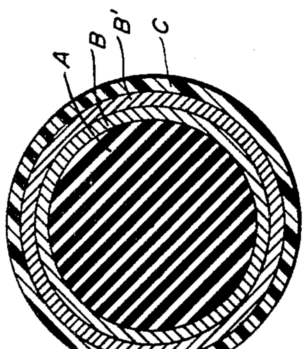

Fig. 1

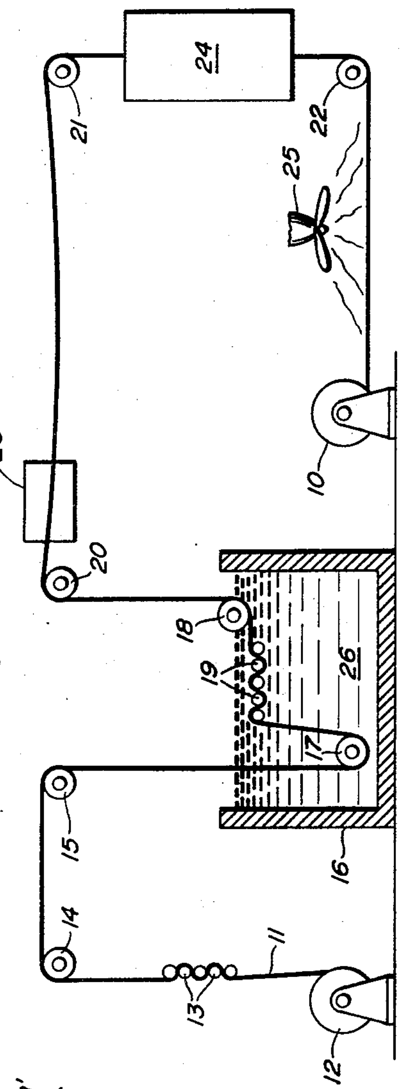

Fig. 2

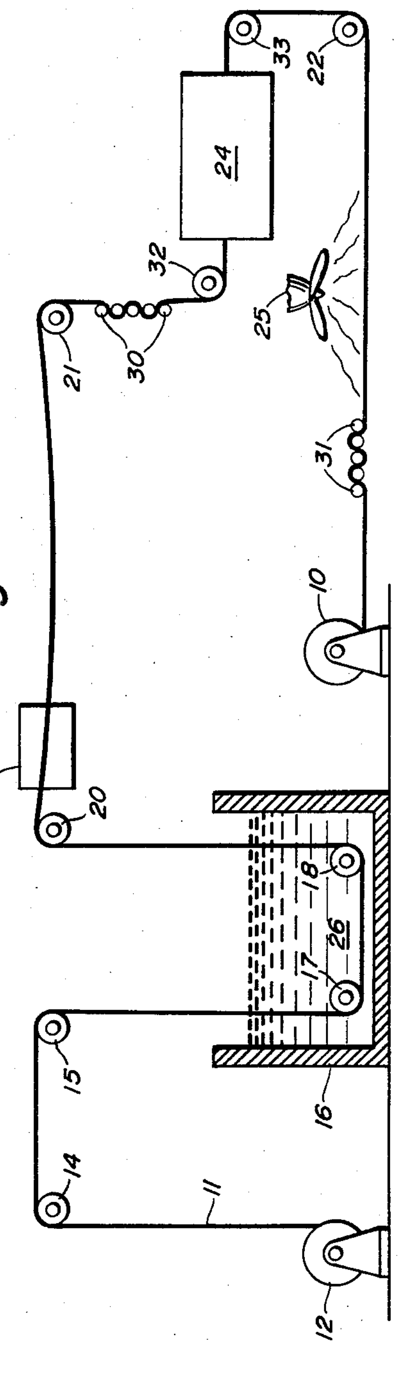

Fig. 3

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TEAR STRING FOR SHRINK FILM PACKAGES

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to strand structures. More particularly, it relates to covered or wrapped strands having an elastic core and coated with a thermoplastic material.

2. Prior Art

The use of tear strings in connection with shrink film packages is exemplified in my own prior U. S. Pats. Nos. 3,352,480; 3,456,780 and 3,499,260. These patents disclose a tear string incorporated in a package which comprises an item overwrapped with shrink film (i.e., axially oriented thermoplastic film). When the package is heated, the film shrinks into tensioned juxtaposition with the item. Suitable shrink films and their characteristics are well known and are described, for example, on pages 196–202 of "Modern Packaging", Encyclopedia Issue, Volume 43 No. 7A, July 1970.

A tear string, which may be a filament or a ribbon, is incorporated within the package between the item and the film. At least one end is brought to the exterior of the package through a sealed (e.g. heat sealed) edge. This end is grasped and used to open the package by progressive tearing of the film.

While simple strings, filaments and ribbons can be used, they do not meet certain desiderata. For example, in connection with the apparatus of U. S. Pat. No. 3,499,260 it is desirable that the tear string have a relatively high density so that it can be easily moved and positioned by fast moving machine elements. Further, since it is necessary in all of these packages to retain a portion of the tear strip within the package, it would be most desirable to be able to anchor the cutter or tear strip without total reliance on either a mechanical anchoring means or frictional detention forces. Finally, during the shrinking of the film (e.g. as in a heating tunnel) it would be desirable to avoid buckling or sagging of the string due to the differential effect of the heat on it vis-a-vis the overwrapping film. Were the string always to remain taut and present a neat linear appearance it would have a better appearance than were slack to appear in the finished package.

SUMMARY OF THE INVENTION

The invention comprises a tear string which utilizes, as a starting material, an elastic core (A) with one or more textile coverings (B, B′, etc.) wrapped about it. Such materials are conventional items of commerce, often referred to as covered elastic thread. They may be supplied, for example, with a core of rubber or spandex, one wrapping of cotton and another outer wrapping of nylon. The core may be multi-stranded or a single elastic strand. Several such materials are described in U. S. Pat. No. 3,091,856 albeit used in another application. Generally, any covered elastic thread is suitable which is capable of being stretched to at least 110 percent of its original length and substantially fully recovering upon release of tension.

In order to be made into a tear string suitable for the instant invention, the elastic thread must be tensioned and, while in its tensioned configuration, provided with a coating of fused thermoplastic material (C) such as polyvinyl chloride. As used henceforth herein, the term is intended to include homopolymers and copolymers with, for example, small quantities of vinyl acetate as well as vinylidene chlorides. Polyethylene is also a suitable coating material as is any thermoplastic resin which is compatible with conventional shrink films and which can be axially oriented. The coating (C) keeps the core of the tear string tensioned and elongated compared to its non-tensioned length. The tear string stays in this elongated condition during storage and while it is being incorporated into a package wherein shrink film is used as an overwrap. During the sealing of an edge of the shrink film package (such as that shown in FIGS. 1 and 2 of U. S. Pat. No. 3,456,780) through which edge the tear string passes, the tear string is welded to the axially oriented film by the same impulse wire which creates the seal and is thus fused or welded in a "sandwich" of shrink film and is anchored thereby. Further, when the package is then subjected to heat (as by being passed through a shrink tunnel) the thermoplastic coating temporarily softens and the stored tensile forces in the core are permitted to tend to restore the tear string to its original length. The effect, within a package of the type described, is to eliminate any slack from the tear string and make it taut and linear. This latter restorative action can be enhanced by coating the core so that the thermoplastic material is axially oriented, just as shrink film is. Then, the heat in the shrink tunnel will cause the coating to shrink and thus reinforce the restorative forces within the core. Finally, by selection of a coating which is compatible with the overwrapping film and the use of appropriate tunnel temperatures, one can achieve a tacking of the taut tear string to the film itself wherever the two are in contact which increases the positive directional nature of the progressive tearing when the package is opened.

Accordingly, it is an object of the invention to provide a tear string for shrink packages which will weld to the shrink film, particularly between heat sealed edges thereof, and which will decrease in length when the package is exposed to conditions adapted to shrink the overwrapping film into heat shrunk tensioned juxtaposition with the item wrapped therein.

It is another object of the invention to provide a tear string having a wrapped elastic core in which tensile forces are stored and which has an outer coating of thermoplastic material which, when heated, will activate length restoring forces including, if desired, forces caused by molecular orientation within the coating itself.

These and other objects of the invention will be apparent to those skilled in the art from a consideration of the description of exemplary embodiments of the invention which follows. Neither that description nor the foregoing abstract and summary is intended to limit or otherwise restrict the scope of the invention. The abstract and summary have been inserted primarily as tools for reader orientation and information retrieval.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing, wherein like reference letters and numerals designate, respectively, like components and like parts:

FIG. 1 represents a cross-section through a tear string embodying the invention.

FIG. 2 illustrates diagrammatically a method which may be used to make a tear string of the invention.

FIG. 3, which is also diagrammatic, illustrates another method which may be used to make a tear string of the invention wherein the thermoplastic coating is axially oriented.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 illustrates the tear string of the invention. As shown it comprises an elastic core A which may be made of rubber, spandex or any other flexible resilient material. The core must be capable of at least 10 percent elongation and, preferably, about 100 percent elongation under tension without destroying its ability to return to its original length or substantially its original length. This core may be provided with one or more textile wrappings. As shown, there is an inner cover of cotton B, wrapped about the core in one direction and an outer cover of nylon B′, wrapped about the inner cover in the other direction. The thermoplastic material C encapsulates the previously described core and wrappings. The presence or absence of tensile forces in the tear string, as discussed above, is not amenable to illustration.

FIG. 2 illustrates one method of making tear string of the invention. As shown therein, a take-up or capstan 10 pulls a supply of covered elastic thread 11 off a feed reel or spool 12. The thread is the untreated material previously described. The thread passes over and under a plurality of tensioner fingers 13, idlers 14 and 15 and into a temperature controlled bath, generally 16. In the bath is a warm solution 26 of the thermoplastic material being utilized as coating C. For example, the bath may contain a solution of polyvinyl chloride in methyl ethyl ketone (MEK) held at a temperature of about 190° F. Where polyethylene is the coating material, toluene is preferred as a solvent. Associated with the bath are idlers **17** and **18** and a plurality of tensioner fingers **19**. The co-action of take-up **10** and tensioners **13** and **19** is such that the thread is substantially fully elongated as it passes through bath **16** and remains tensioned through the balance of the process. The thread, after leaving the bath, is conducted by idlers **20, 21** and **22**, seriatim, through a doctor sleeve or wiper **23** and an oven **24**. The run of thread between idlers **18** and **20** is preferably vertical so that excess coating material drains back into the bath. The doctor **23** also assures even coating and absence of excess. Between idlers **20** and **21** the now coated thread is allowed to air dry and a catenary about 60 feet in length is found to provide adequate drying time when coating with polyvinylchloride in MEK, using a capstan having an effective diameter of about 1 foot, roating at from 75–200 r.p.m.

Following the air drying, the coating is tack free and is then passed through oven **24** which operates at the fusion temperature of the particular resin or thereabout (e.g. 270° F for PVC). Following the fusion, the tear string is air-cooled between idler **22** and take-up **10**. The action may be enhanced by a fan **25**. The controls such as bath heaters, thermostats, agitators, etc. are conventional and a solvent recovery system may be utilized if desired. The take-up reel is preferably driven by a variable speed motor with speed being controlled as a function of tension in the string which may be detected by conventional sensors. Tension can alternatively be created by positively rotating the feed roll **12** at a lower speed than take-up **10**.

The specific nature of the bath, its temperature and solvent as well as the temperature of the oven **24** are all functions of the particular thermoplastic used and can readily be determined by those skilled in the art from data on solubility, fusion temperature, etc. which is found in standard texts and references.

FIG. 3 is generally similar and, accordingly, the parts and their function are identically numbered except where different. The differences have to do with the position and function of the tensioners. As shown in the FIGURE, a plurality of tension fingers **30** are provided on the feed end of the oven **24** and a plurality of fingers **31** are also provided downstream of the discharge end, after the air cool. The coated thread is guided through the oven by idlers **32** and **33**. With this arrangement, the thread is not tensioned until after idler **21**, at which time the coating C has air dried to tack-free condition. However, it is elongated at the time it is fused in oven **24** and stays elongated until it sets during subsequent cooling. Due to the nature of the coating material (e.g. low density polyethylene, polyvinyl chloride, etc.) this stretching during fusion axially orients the molecules in the direction of tension in the same way that film itself is axially oriented. Thus, on reheating (as in a shrink tunnel) the coating will tend to shrink and thus help restore the string to its untensioned length.

Tear strings made in this manner have the advantages indicated above. They can be anchored and welded into heat sealed edges of shrink film overwrapped packages. When the package is heated, the tear string reduces in length to tautly extend about the overwrapped item and, at appropriate tunnel temperatures (e.g. about 300° F) will tack to the film itself. Further, its weight due to the addition of the coating is such as to be easily manipulable during the packaging operation.

While the invention has been illustrated and described in detail, such description is not exhaustive of the possible variants and equivalents. Since it will be apparent to those skilled in the art that numerous changes and modifications may be made, it is not intended that the invention be construed as limited to the specific embodiments discussed above. Rather, its scope is to be limited only by a reasonable interpretation of the appended claims.

I claim:

1. A tear string comprising an elastic core which contains stored tensile forces and is, consequently, elongated compared to its non-tensioned length; at least one textile covering wrapped about said core; and a coating layer of fused thermoplastic heat sealing material encapsulating said covering, which layer keeps said string in tensioned, elongated configuration until said coating layer is heated to its thermoplastic temperature at which time said forces tend to restore said string to its original length.

2. The string of claim **1** wherein said thermoplastic material comprises polyvinyl chloride.

3. The string of claim **1** wherein said thermoplastic material comprises polyethylene.

4. The string of claim **1** wherein said elastic core is rubber.

5. The string of claim **4** wherein said thermoplastic material comprises polyvinyl chloride.

6. The string of claim **4** wherein said thermoplastic material comprises polyethylene.

7. The string of claim **1** wherein said thermoplastic material is axially oriented along the longitudinal axis of said core and heating thereof creates shrink forces which reinforce the length restorative tensile forces in the core.

8. The string of claim **1** wherein said core is rubber and which further includes an inner textile cover wrapped thereabout in one direction and an outer textile cover wrapped over said inner cover in a different direction to minimize unraveling and also to insure that said core will be covered in its elongated position.

9. The string of claim **8** wherein said thermoplastic material comprises polyvinyl chloride.

10. The string of claim **8** wherein said thermoplastic material comprises polyethylene.

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