METHOD OF MAKING POLYPROPYLENE BAGS

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Fig. 1

Fig. 2

Fig. 3
METHOD OF MAKING POLYPROPYLENE BAGS

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5 Claims

ABSTRACT OF THE DISCLOSURE

A unitary industrial bag, which may be used as a sandbag, is woven from a slit film thermoplastic yarn such as polypropylene, which may be fibrillated or non-fibrillated. The fabric is woven in a conventional double fabric manner on a standard loom with a single thickness relatively high-textured strip down the center of the warp. The longitudinal sides or edges of the fabric are woven with any desired selvage construction to prevent raveling and are maintained separately to form the open end of the bag. Filling picks are inserted across the center of the fabric, and the double fabric is woven with a single thickness filling strip of a texture similar to the warp strip. During the weaving of the single thickness strips, the fabric is simultaneously slit down the center of the longitudinal warp strip with a hot knife; the fabric is then cut in the transverse direction along the center of the filling strip. The resulting unitary bag units are reinforced and heat-sealed on three sides, open at the end, and are reinforced on the open end with a fabric selvage. The foregoing abstract is provided only to permit a cursory review of the gist of the invention, and is not intended to define the scope of the invention.

BACKGROUND AND BRIEF DESCRIPTION OF THE INVENTION

This invention relates to a unitary polypropylene bag and a method of weaving the bag. While the sack may be used as an industrial bag in general, it is specially intended to be employed as a sandbag.

In the past, sacks have been traditionally woven from a natural fiber such as jute. Jute, however, suffers from several defects, primarily due to the fact that it tends to rot or mold when it is left in a damp spot. In addition, the fabric is relatively heavy, and has a high water-absorbency level. Moreover, natural fibers such as jute and sisal are always subject to severe price fluctuations, as are all agricultural products.

Consequently, jute is presently being replaced on a wide scale by a synthetic or man-made fiber such as polyethylene or polypropylene (the latter normally being preferable). The transition to synthetic fibers is especially evident where the yarn is of the slit-film type; that is, the polypropylene is extruded in film form and the film is cut longitudinally as it is taken from the extruder by a series of razor or cutting blades into narrow ribbons (for example 0.115 inch wide) which are drawn or orientated in the longitudinal direction. The drawing or stretching step may be of such a nature as to cause the ribbons to fibrillate, that is, to split and form longitudinal fibers, or the yarn may remain in a nonfibrillated form. In either event, the yarn-like ribbons are then collected and used to make woven polypropylene bags.

The man-made or synthetic fibers possess several advantageous characteristics when compared to jute. For example, polypropylene has a tensile strength approximately 2 to 3 times as great as that of jute. Therefore, the woven polypropylene fabric can be much lighter in weight. Also, polypropylene has a low-water absorbency, and possesses excellent anti-mildew or anti-rot characteristics. Thus the fabric may be advantageously employed in the weaving of all sorts of bags, especially bags which are to be used in a damp climate, such as that of Southeast Asia.

Prior attempts to weave a satisfactory polypropylene bag have approached the problem in several ways. One approach has been to weave the bag or sack from a normal flat fabric, by sewing or bonding two or more layers of the fabric along their four edges and then hot-knife cut in the filling direction across the center of the transverse single thickness strip. Another approach has been to weave a plurality of bags from a double cloth and then divide the bags with a hot knife. The open ends of the bags are then individually sewn to prevent raveling.

The present invention represents a significant improvement over prior approaches, both from the standpoint of a simplified method of manufacturing the bags, and from the quality and strength of the bags as such. In essence, the improvement is effected by employing a more expedient method of making a bag which is "totally reinforced"; that is, reinforced on all sides. The fabric is woven in such a manner that the resulting bags are reinforced along all of their sides or edges, and the open end of the bag is woven with an appropriate selvage construction in order to prevent raveling. All of the above features are incorporated into the bag during rather than after the weaving, thus resulting in a more expeditious, higher-volume process which produces more units per given time period compared to prior methods.

Briefly, the method for manufacturing the unitary polypropylene bag is as follows:

The fabric is woven in a conventional double fabric manner on a standard loom. In other words, the bag is woven as an integral or unitary entity by simultaneously weaving two discrete layers or webs of polypropylene yarn above one another. The fabric is woven with a single thickness strip down the center of the warp using the same total number of ends and picks as were used in the two layers of cloth which were adjacent to this center single thickness area. By the term single thickness strip it is meant that the discrete layers of the fabric are interwoven with one another by means of a plurality of warp and filling threads or fibers which interlace or connect the separate layers to one another in accordance with an appropriate predetermined pattern. The width of the fabric is equal to twice the desired depth of the bag, plus the width of the single thickness warp section or strip in order to enable the user to weave at least two adjacent bags simultaneously.

The longitudinal edges of the fabric will be woven with any appropriate selvage construction in order to preclude raveling and are maintained separately in order to constitute the open ends of the finished units. Filling picks in sufficient number to make up the width of the bag are then inserted into the warp in each of the layers of the double fabric. A transverse strip of desired width, which is oriented in a direction perpendicular to that of the warp direction, is then woven as a single thickness in essentially the same manner as was the single thickness warp strip.

As the double fabric with the above-described longitudinal warp strip and transverse filling strip is being woven, it is simultaneously slit with a hot knife down the center of the warp in order to yield two continuous halves of fabric. At this point, due to the action of the heated knife, each of the fabric halves or elements is now heat-sealed on one edge which will ultimately form the bottom of each bag. It also has a double fabric area, and a narrow single fabric area (which is formed by the transverse filling strip), giving the fabric the appearance of a belt with deep pockets. The strips are then hot-knife cut in the filling direction across the center of the transverse single thickness strip which has been de-
This combined cutting and heat-sealing operation effectively results in a unitary bag which is heat sealed on three sides (each side or edge having a specially woven reinforced single thickness portion), open at one end and reinforced on the open end with an appropriate selvage construction. Tie strings for the bag may either be woven in during fabrication of the cloth or inserted in a separate operation as desired.

It is important that an industrial bag possesses an optimum amount of reinforcement or strength, especially in view of the adverse climatic conditions under which it must often be employed. It is equally important that the method for manufacturing a bag of this nature is as uncomplicated and non-time consuming as possible, particularly in view of the ever-growing demand for sacks, the world market for which has been estimated at more than one billion per year.

It is apparent that prior approaches have been less than fully successful in satisfying the aforementioned requirements. The present innovation represents a significant contribution toward total exploitation of the potentialities of polyolefin yarn in the industrial bag field.

The method is expedited by inter weaving a ravel-preventing selvage construction and a "cross" of reinforcing single thickness strips during the weaving of the fabric as such. Moreover, the bag units are simultaneously separated and heat-sealed along their edges to the extent feasible while the weaving occurs, rather than after the fabric has been woven.

The polypropylene bag which is produced is "totally reinforced", as has been previously explained; consequently, it is capable of performing satisfactorily under the most adverse conditions.

In addition to the advantage mentioned above, other advantages of this invention will become apparent in the more detailed description which follows. In the more detailed description of the invention, reference will be made to the accompanying drawings in which:

FIG. 1 is a top plan view of the fabric, including the single thickness warp and filling strips, prior to separation;

FIG. 2 is a top plan view of the unitary bags subsequent to the cutting operation, in which the heat-sealed reinforcing edges are apparent; and

FIG. 3 is an end view of one of the bags of FIG. 2 depicting the fabric selvage which is woven into the open end of the bags to prevent raveling.

**DETAILED DESCRIPTION OF THE INVENTION**

As mentioned previously, bags have historically been made of jute, but these are rapidly being displaced by bags woven of a man-made fiber such as polypropylene yarn. While the polypropylene yarn may be of the split film type, the employment of the slit-film type of polypropylene yarn is preferred. The polypropylene is extruded in film form and the film is cut or severed longitudinally as it is taken from the extruder by a series of razor-type blades or knives into narrow ribbons. The ribbons may have a width in the range of 0.075 inch to 0.150 inch, although the invention is not limited to this range. As an example, ribbons of approximately 0.12 inch width may be drawn, stretched or oriented in the longitudinal direction. The drawing process may be such as to cause the ribbons to fibrillate, that is, split and form longitudinal fibers, or the ribbon may remain non-fibrillated. In any event, the yarn-like ribbons are collected and are then utilized in the weaving of the polypropylene bag.

While this innovation generally pertains to any woven polypropylene bag or sack, it is specifically intended to be used in an industrial environment, and in its preferred embodiment it will be employed as a unitary polypropylene sandbag.

The fabric which will ultimately form the unitary sandbag is woven in a conventional double fabric manner on a standard loom. In other words, referring to the drawings, the double cloth or fabric 2 is composed of two discrete layers of woven fabric, one of which is simultaneously woven on the loom in a plane directly above the other.

The apparatus which is employed in the manufacture of the sandbag is entirely conventional. Thus the loom itself, as well as the associated apparatus such as the hot knives which are used to separate the finished bags, may assume any standard configuration.

Referring once again to the drawings, the fabric 2 is woven with a single thickness strip 4 down the center of the warp using the same total number of ends and picks as are used in the two layers of cloth adjacent to this center thickness area or strip. In other words, the discrete or distinct layers of the double fabric are interwoven with one another by means of this single thickness strip 4. The precise manner in which the single thickness strip interlocks or interlaces the discrete layers with one another is not crucial. What is important is the fact that the respective layers are securely interwoven with one another in order to form a double fabric.

More important, however, is the fact that strip 4 is woven with a relatively high-texture weave compared to the remainder of the fabric 2. The high texture results from using the same total number of ends and picks to weave strip 4 as are utilized to weave the remainder of the relatively low-textured double fabric 2, as mentioned previously. The high-texture weave results in a reinforced central strip or section which will ultimately (together with transverse strip 6 and selvage 8 which are discussed subsequently) form a "totally reinforced" unitary polypropylene bag.

The width of the fabric employed is equal to twice the desired depth of the bag plus the width of the single thickness warp section, so that at least two bag units may be woven simultaneously.

The edges of the fabric are woven with any desired selvage construction 8, and are maintained separately to constitute the open end of the bag as depicted in FIG. 3 of the drawings. Once again, it is not critical that the selvage construction be of any specific pattern; on the contrary, what is important is that the longitudinal edges or ends of the finished bags will be woven with an appropriate ravel-preventing selvage construction during, rather than after, the weaving process. Accordingly, total processing time is shortened in comparison with prior approaches in which the ends of the bags would have to be individually sewn after separation, subsequent to the weaving process.

Returning to FIG. 1, filling picks in sufficient number to make up the width of the bag are inserted into the warp in each of the layers of the double fabric. The double fabric is then woven with a single thickness strip 6 in a direction perpendicular to the warp direction; that is, a transverse strip 6 of desired width is woven in the same manner as warp strip 4, with the total ends and picks of the double fabric being employed to weave the relatively high-texture transverse strip 6. Strip 6 is woven in the same manner as warp strip 4, and is included in the fabric for the same reason as warp strip 4.

As the double fabric with the aforementioned center warp strip 4 and transverse filling strip 6 is being woven, it is simultaneously slit with a hot knife down the center of the warp strip 4 along line A—A in order to yield two continuous halves of fabric. In addition to separating the fabric 2, the hot knife simultaneously heat-seals the reinforced portions of the fabric, which will ultimately form the bottom and side edges of the finished bag. Thus, each fabric half or element has a double fabric area and a narrow reinforced single fabric area or strip which gives it the appearance of a belt with deep pockets. The transverse strips are then hot knife cut in the filling direction along
line B—B across the center of the single thickness strip 6 which has been described above. This effectively results in a unitary bag unit that is sealed on three reinforced sides, open at the end, and reinforced on the open end with an appropriate selvage. At this point, the finished bags are in the configuration which is depicted by FIG. 2 of the drawings. Each bag may be 26½ inches deep by 14½ inches wide. Tie strings may either be woven in during fabrication of the cloth or inserted in a separate operation as desired.

A polypropylene bag which is constructed in accordance with the above-described process possesses all of the advantages of a polypropylene bag, as opposed to a natural fiber bag such as jute or sisal. In addition, the bag which is produced by this specific process is superior to any of the other known methods for producing a polypropylene bag in that the present sandbag is “totally reinforced.” That is, each of the sides or edges are not only heat-sealed, but are also reinforced with a special high-texture single thickness weave. Of course, there are no seams in the sandbag, and the open end of the bag is also reinforced and precluded from raveling by the inclusion of a selvage during the weaving process.

Moreover, the fact that the process employed results in significant time-saving, which has been discussed in detail previously, is a factor not to be overlooked, especially in view of the tremendous number of sacks which are required for world usage.

What is claimed is:

1. A method of manufacturing a unitary polypropylene bag comprising the steps of:
   - weaving at least two discrete webs of polypropylene yarn, one above the other, in order to form a double fabric,
   - interweaving at least two reinforcing strips of polypropylene yarn with said discrete webs so as to form a single fabric layer constituting warp and filling strips which define a bottom and sides of a plurality of bag elements formed by said double fabric, wherein the said strips are woven into a single thickness strip down the center of the warp using the same total number of ends and picks as are used in the two layers of said web which are adjacent to the center of single thickness strip, incorporating a selvage in a longitudinal edge of said discrete webs in order to prevent raveling thereof, separating said double fabric by cutting said warp and filling strips with a hot knife so as to simultaneously separate and seal the cut edges of said reinforcing strips with said hot knife, such that a plurality of unitary bags are formed, each of said bags being reinforced along each side and bottom by the heat sealing and at the open end by said selvage.

2. The method of claim 1 in which:
   - each of said reinforcing strips is formed by weaving a single thickness area into said double fabric, using the same total number of yarns to form said area as are used to form said double fabric.

3. The method of claim 1 in which a slit-film polypropylene yarn is employed.

4. The method of claim 3 wherein said slit-film polypropylene yarn is fibrillated.

5. The method of claim 1 in which the width of said fabric is more than twice the desired depth of one of said unitary bags.

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