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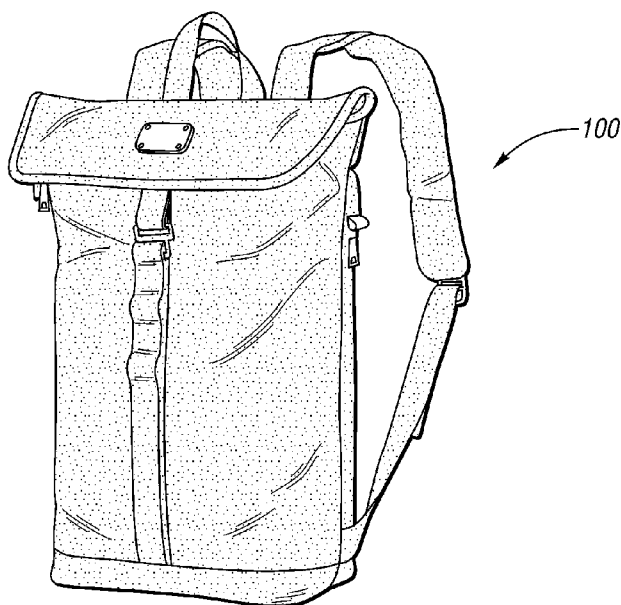


Fig. 3

(57) Abstract: A fabric is provided that comprises at least two different fiber types. The fiber types are chosen from discarded natural or organic fibers and/or recycled material, for example hemp, organic cotton, and RPET, respectively. The fibers are spun into a blended yarn and are then spun or woven into a fabric. The fabric comprises discarded material and/or recycled material and is therefore makes more efficient use of raw materials and reduces waste.

**Declarations under Rule 4.17:**

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- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

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FABRIC AND METHOD OF PRODUCING SAME

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. provisional Application No. 61/585,051 filed January 10, 2012, the disclosure of which is incorporated in its entirety by reference herein.

TECHNICAL FIELD

[0002] The present invention relates to a fabric made of two or more fiber types and a method of making the fabric.

BACKGROUND

[0003] In the production of fibers for use in fabrics, a substantial amount of the fibers are discarded as waste products. The waste products may take various forms, such as fibers that are too short or too inconsistent to be used in certain fabric products. There may also be portions of the fiber that are not used for certain fabrics and are typically discarded. The amount of these waste materials may be significantly increased when the fibers being used are natural or recycled, because the fabrics may not have been engineered or originally intended to be used as fabric fibers. The increased waste products from these natural or recycled fibers may reduce the efficiency and/or increase the costs of producing fabrics from these fibers.

SUMMARY

[0004] In at least one embodiment, a woven fabric is provided that includes a blend of a first type of fiber, and at least one of a second type of fiber and a third type of fiber. In this embodiment, the first type of fiber is a recycled plastic fiber, the second type of fiber is a natural fiber, and the third type of fiber is an organic fiber and a fiber count ratio of the first type of fiber to a total of the second type of fiber and the third type of fiber is in the range of 3:7 to 1:1.

[0005] In another embodiment of the woven fabric, the fiber count ratio of the first type of fiber to the total of the second type of fiber and the third type of fiber is 2:3.

[0006] In another embodiment of the woven fabric, the first fiber type is recycled polyethylene terephthalate (RPET), the second fiber type is hemp, and the third fiber type is organic cotton.

[0007] In another embodiment of the woven fabric, the blend comprises about 40 percent of the first fiber type, about 30 percent of the second fiber type, and about 30 percent of the third fiber type.

[0008] In another embodiment of the woven fabric, the second fiber type and the third fiber type are post-manufacturing scrap.

[0009] In another embodiment of the woven fabric, the woven fabric has a weight of 10 to 15 ounces per square meter.

[0010] In another embodiment of the woven fabric, the warp and weft yarns of the woven fabric have about the same thickness.

[0011] In at least one embodiment, a bag formed of a woven fabric is provided that comprises a blend of a first type of fiber, and at least one of a second type of fiber and a third type of fiber. In this embodiment, the first type of fiber is a recycled plastic fiber, the second type of fiber is a natural fiber, and the third type of fiber is an organic fiber and a fiber count ratio of the first type of fiber to a total of the second type of fiber and the third type of fiber is in the range of 3:7 to 1:1.

[0012] In another embodiment of the bag, the fiber count ratio of the first type of fiber to the total of the second type of fiber and the third type of fiber is 2:3.

[0013] In another embodiment of the bag, the first fiber type is RPET, the second fiber type is hemp, and the third fiber type is organic cotton.

[0014] In another embodiment of the bag, the blend comprises about 40 percent of the first fiber type, about 30 percent of the second fiber type, and about 30 percent of the third fiber type.

[0015] In another embodiment of the bag, the second fiber type and the third fiber type are post-manufacturing scrap.

[0016] In another embodiment of the bag, the warp and weft yarns of the woven fabric have about the same thickness.

[0017] In at least one embodiment, a method of forming a woven fabric is provided that comprises providing a blend of a first type of fiber, and at least one of a second type of fiber and a third type of fiber. In this embodiment, the first type of fiber is a recycled plastic fiber, the second type of fiber is a natural fiber, and the third type of fiber is an organic fiber and a fiber count ratio of the first type of fiber to a total of the second type of fiber and the third type of fiber is in the range of 3:7 to 1:1. The method of this embodiment further includes spinning the first, second, and third types of fiber into a yarn, twisting the yarn into a multiple ply yarn, and weaving the multiple ply yarn into a woven fabric.

[0018] In another embodiment of the method, the first fiber type is RPET, the second fiber type is hemp, and the third fiber type is organic cotton.

[0019] In another embodiment of the method, the second fiber type and the third fiber type are post-manufacturing scrap.

[0020] In another embodiment of the method, the woven fabric has a weight of 10 to 15 ounces per square meter.

[0021] In another embodiment of the method, the first, second, and third type of fiber are spun into a yarn having a thickness of 5S to 15S.

[0022] In another embodiment of the method, the yarn is twisted into a two to five ply yarn.

[0023] In another embodiment of the method, the first, second, and third type of fiber are spun into a yarn having a thickness of 11S, the yarn is twisted into a three-ply yarn, and the weaving has a plain weave pattern to form a canvas.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] Figs. 1A-1D are each a perspective view of a fabric according to at least one embodiment;

[0025] Fig. 2 is a flowchart of an embodiment of a method of producing the fabric of Fig. 1; and

[0026] Fig. 3 is a perspective view of a bag formed from the fabric of Fig. 1.

DETAILED DESCRIPTION

[0027] As required, detailed embodiments of the present invention are disclosed herein; however, it is to be understood that the disclosed embodiments are merely exemplary of the invention that may be embodied in various and alternative forms. The figures are not necessarily to scale; some features may be exaggerated or minimized to show details of particular components. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a representative basis for teaching one skilled in the art to variously employ the present invention.

[0028] Except in the examples, or where otherwise expressly indicated, all numerical quantities in this description indicating amounts of material are to be understood as modified by the word "about" in describing the broadest scope of the invention. Practice within the numerical limits stated is generally preferred. Also, unless expressly stated to the contrary, the description of a group or class of materials as suitable or preferred for a given purpose implies that mixtures of any two or more of the members of the group or class are equally suitable or preferred; and, unless expressly stated to the contrary, measurement of a property is determined by the same technique as previously or later referenced for the same property. The percentages given in this application may be by weight, volume of fiber, or fiber count.

[0029] With reference to Figure 1A-1D, fabrics are illustrated in accordance with one or more embodiments and are generally referenced by numerals 10, 10', 10'', and 10'''. Fabrics 10, 10', and 10'' are dyed different colors (e.g. tan, black, or gray) and fabric 10''' is an un-dyed fabric example. The fabrics 10, 10', 10'', and 10''' are formed of at least two different types of post-consumer, post-manufacturing, discarded, recycled, reused, and/or waste fibers. The fibers may be those that are too short or too inconsistent to be used in an original fabric. The fibers may also be portions of the fiber that are not used for an original fabric and are discarded. In one or more

embodiments, these types of repurposed or reclaimed fibers may be referred to as post-manufacturing scrap. The fibers may be natural fibers, organic fibers, and/or recycled fibers. The natural fibers may be any suitable naturally occurring fiber, for example hemp. The organic fibers may be any suitable organic fiber, for example organic cotton. Similarly, the recycled fibers may be any suitable fiber that includes recycled material. In at least one embodiment, the recycled material is a recycled plastic. An example of a recycled fiber is RPET (recycled polyethylene terephthalate) fibers, which are made from recycled plastic products such as water bottles.

[0030] The discarded or recycled fibers are the result of fibers prepared from their raw materials and processed into fibers using conventional processes. At least two types of the discarded or recycled fibers are then re-spun into a fiber/yarn blend. The blend may be formed of two, three, four, or more different fiber types. The fiber/yarn blend, which is a blend of the at least two fibers, may then be re-spun or weaved into a fabric, which is initially a raw or greige fabric that may be later dyed or otherwise treated (as shown in Figs. 1A-1D).

[0031] In one or more embodiments, the inclusion of the recycled material (e.g. RPET) in the fiber/yarn blend has been found to result in a woven fabric with increased strength compared to fabrics without the recycled material. In some embodiments, this increased strength provides the woven fabric with the requisite strength needed for cutting and sewing operations. In addition to increased strength, in one or more embodiments the inclusion of recycled material provides the woven fabric with increased durability compared to fabrics without the recycled material. Increased strength and durability can be highly beneficial, especially if the fabric is used to form items such as backpacks and bags which undergo daily abuse during, for example, packing and unpacking, dropping, and carrying heavy objects like books.

[0032] In at least one embodiment, the blend is formed of two different types of fiber to form a dual-blend. The fibers may be chosen from any combination of the natural fibers or organic fibers and recycled fibers, e.g., natural-recycled or organic-recycled. The amount of each fiber type in the blend can be varied according to the desired properties of the resulting fabric. For example, the blend may comprise 50% of one fiber type and 50% of another, 60% of one and 40% of another, 70% of one and 30% of another, 80% of one and 20% of another, or 90% of one and 10% of another. As can

be easily understood, the above percentages are exemplary, and any specific combination can be created and is contemplated by one or more embodiments.

[0033] In one or more embodiments, the blend is formed of three fibers, one each of the natural fiber, organic fiber, and recycled fiber to form a tri-blend. In at least one embodiment, the natural fiber is formed of hemp, the organic fiber is formed of organic cotton, and the recycled fiber is formed of RPET. In at least one embodiment, the relative fiber contents are 30% hemp, 30% organic cotton, and 40% RPET. However, similar to the dual-blend, the relative amounts of the fiber can be adjusted in any manner to fit the desired characteristics of the resulting fabric. For example, the tri-blend may comprise the three fibers in equal amounts, or 33.3% of each fiber type. The tri-blend could also have a 30%/30%/40% profile with any combination of the hemp, organic cotton, and RPET. Similarly, a 40%/40%/20% profile is contemplated with any combination of the hemp, organic cotton, and RPET.

[0034] In some embodiments, the natural fiber content and organic fiber content combined may be 50% to 70% of the blend and the recycled fiber content may be 30% to 50% of the blend. In another embodiment, the natural fiber content and organic fiber content combined may be 55% to 65% of the blend and the recycled fiber content may be 35% to 45% of the blend. In another embodiment, the natural fiber content and organic fiber content combined may be about 60% of the blend and the recycled fiber content may be about 40% of the blend.

[0035] In at least one of the above embodiments, the natural fiber content and the organic fiber content each may be about half of the combined natural and organic fiber content. For example, if the combined natural and organic fiber content is 60%, the natural fiber and organic fiber are each about 30%. Due to the nature of using discarded and/or recycled materials, it is difficult to precisely control the exact proportions of each fiber type in the overall blend from batch to batch. For example, if the target composition is 30% natural fiber, 30% organic fiber, and 40% recycled fiber, the final proportions in a given batch may be 27% natural fiber, 33% organic fiber, and 40% recycled fiber. In at least one embodiment, regarding fiber content, the content may be plus or minus five percent of the target content.

[0036] In at least one embodiment, the blend may include four fiber types to form a quad-blend. The blend may be formed of one each of the natural, organic, and recycled fibers, plus an additional fiber type or another, but different, fiber from one of the former three categories. For example, in addition to hemp, there could be an additional natural fiber, such as a flax-based fiber.

[0037] Referring to Figure 2, a flowchart 50 of a method for forming a three-fiber blend fabric is depicted. In at least one embodiment, a mixture of natural fibers and organic fibers include about 60% of the total fiber blend and recycled fibers comprise the remaining about 40%, as depicted in blocks 52 and 54. However, any combination of fiber contents as described above may be utilized in the method. In a spinning step 56, the fibers are spun to form a yarn. In at least one embodiment, an example of which is shown in block 58 of Figure 2, the thickness of the resulting yarn may be 11S (1 pound of yarn with a length of 11*840 yards, or 9,240 yards). However, the yarn produced in the spinning step 56 may have any suitable thickness, for example, in the range of 5S to 15S. A twisting and plying step 60 is then performed to provide a multiple-ply yarn. In at least one embodiment, as shown in Figure 2, the yarn may be turned into a 3-ply yarn, as depicted in block 62 of Figure 2. For the 11S yarn shown in Figure 2, this would result in an 11S/3 yarn. However, the yarn may be twisted into any suitable ply number in the twisting and plying step 60, for example 2-5 ply. In at least one embodiment, the yarn may remain single-ply and not undergo the twisting and plying step 60.

[0038] Following the twisting and plying step 60, a sizing and weaving step 64 is performed to produce a fabric. In at least one embodiment, the weave is a plain weave and may form, for example, a canvas. However, the weave may also be a satin weave, a twill weave, or any other form of weave known in the art. The weight of the fabric may vary depending on the composition of the fibers. In at least one embodiment, the fabric has a weight of 5-20 ounces per square meter. In another embodiment, the fabric has a weight of 10-15 ounces per square meter. In another embodiment, fabric has a weight of 12-14 ounces per square meter. In another embodiment, fabric has a weight of about 13 ounces per square meter. As shown in block 66 of Figure 2, the fabric may be in the form of a canvas having a weight of 13.2 ounces per square meter.

[0039] In at least one embodiment, both the warp and weft yarns have the same thickness. The thicknesses may be any of those described above, for example both yarns may be 11S/3 yarns.

However, the warp and weft yarns may have different thicknesses and each may be any of the thicknesses described above. In at least one embodiment, the density of the warp and weft (i.e. number of warp and weft yarns per square inch) is 30-50 and 15-35, respectively. In another embodiment, the density of the warp and weft is 35-45 and 20-30, respectively. In another embodiment, the density of the warp and weft is about 40 and 25, respectively. In one example, the density of the warp and weft may be 41.5 x 25 (e.g. 41.5 warp and 25 weft yarns per square inch).

[0040] After being woven into a fabric, an optional dyeing and finishing step 68 can be performed to produce a dyed and finished canvas bag, as depicted in block 70. In this step, additional components may be added or processes may be performed, such as adding binders, fillers, and/or dyes or applying chemical treatments, etc. that are typical of fibers, yarns, and fabrics. As illustrated in Figure 1A-1D, which shows a fabric formed of a tri-blend of hemp, organic cotton, and RPET, the different types of fibers give the fabric a unique appearance once it is dyed, at least partially due to the different fibers absorbing the dyes differently and having different reflective properties. Fig. 1A illustrates a fabric 10 dyed tan, Fig. 1B illustrates a fabric 10' dyed black, Fig. 1C illustrates a fabric 10'' dyed grey, and Fig. 1D illustrates an un-dyed fabric 10'''.

[0041] In addition to its unique appearance, the fabric also the positive quality of being efficient and environmentally friendly. The fabric includes mostly waste products of other fiber spinning processes or of recycled materials that would otherwise most likely end up in a landfill. This eco-conscious approach therefore saves money and resources while producing an aesthetically pleasing fabric that can be used in a variety of applications. For example, the fabric may be used in luggage, bags, backpacks, electronic accessory bags, watch bands, etc. The fabric may essentially replace traditional woven fabrics in most applications. An example of a backpack 100 made from the fabric of one or more embodiments is shown in Figure 3.

[0042] While exemplary embodiments are described above, it is not intended that these embodiments describe all possible forms of the invention. Rather, the words used in the specification are words of description rather than limitation, and it is understood that various changes may be made without departing from the spirit and scope of the invention. Additionally, the features of various implementing embodiments may be combined to form further embodiments of the invention.

WHAT IS CLAIMED IS:

1. A woven fabric comprising:
a blend of a first type of fiber, at least one of a second type of fiber and a third type of fiber, the first type of fiber being a recycled plastic fiber, the second type of fiber being a natural fiber, and the third type of fiber being an organic fiber;
wherein a fiber count ratio of the first type of fiber to a total of the second type of fiber and the third type of fiber is in the range of 3:7 to 1:1.
2. The woven fabric of claim 1, wherein the fiber count ratio of the first type of fiber to the total of the second type of fiber and the third type of fiber is 2:3.
3. The woven fabric of claim 1, wherein the first fiber type is recycled polyethylene terephthalate (RPET), the second fiber type is hemp, and the third fiber type is organic cotton.
4. The woven fabric of claim 1, wherein the blend comprises about 40 percent of the first fiber type, about 30 percent of the second fiber type, and about 30 percent of the third fiber type.
5. The woven fabric of claim 1, wherein the second fiber type and the third fiber type are post-manufacturing scrap.
6. The woven fabric of claim 1, wherein the woven fabric has a weight of 10 to 15 ounces per square meter.
7. The woven fabric of claim 1, wherein warp and weft yarns of the woven fabric have about the same thickness.
8. A bag formed of a woven fabric comprising:

a blend of a first type of fiber, at least one of a second type of fiber and a third type of fiber, the first type of fiber being a recycled plastic fiber, the second type of fiber being a natural fiber, and the third type of fiber being an organic fiber;

wherein a fiber count ratio of the first type of fiber to a total of the second type of fiber and the third type of fiber is in the range of 3:7 to 1:1.

9. The bag of claim 8, wherein the fiber count ratio of the first type of fiber to the total of the second type of fiber and the third type of fiber is 2:3.

10. The bag of claim 8, wherein the first fiber type is RPET, the second fiber type is hemp, and the third fiber type is organic cotton.

11. The bag of claim 8, wherein the blend comprises about 40 percent of the first fiber type, about 30 percent of the second fiber type, and about 30 percent of the third fiber type.

12. The bag of claim 8, wherein the second fiber type and the third fiber type are post-manufacturing scrap.

13. The bag of claim 8, wherein warp and weft yarns of the woven fabric have about the same thickness.

14. A method of forming a woven fabric, the method comprising:
providing a blend of a first type of fiber, and at least one of a second type of fiber and a third type of fiber, the first type of fiber being a recycled plastic fiber, the second type of fiber being a natural fiber, and the third type of fiber being an organic fiber, and a fiber count ratio of the first type of fiber to a total of the second type of fiber and the third type of fiber being in the range of 3:7 to 1:1;

spinning the first, second, and third types of fiber into a yarn;

twisting the yarn into a multiple ply yarn; and

weaving the multiple ply yarn into a woven fabric.

15. The method of claim 14, wherein the first fiber type is RPET, the second fiber type is hemp, and the third fiber type is organic cotton.

16. The method of claim 14, wherein the second fiber type and the third fiber type are post-manufacturing scrap.

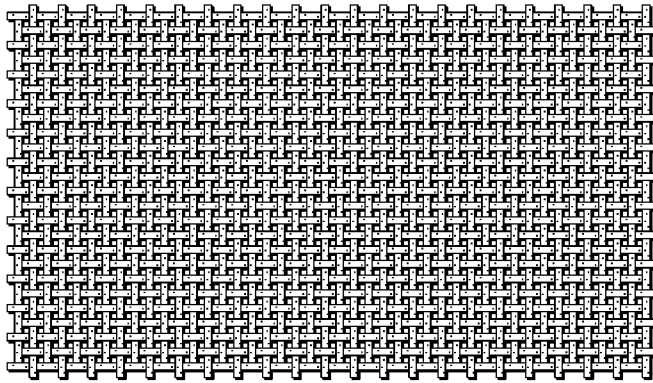
17. The method of claim 14, wherein the woven fabric has a weight of 10 to 15 ounces per square meter.

18. The method of claim 14, wherein the first, second, and third type of fiber are spun into a yarn having a thickness of 5S to 15S.

19. The method of claim 14, wherein the yarn is twisted into a two to five ply yarn.

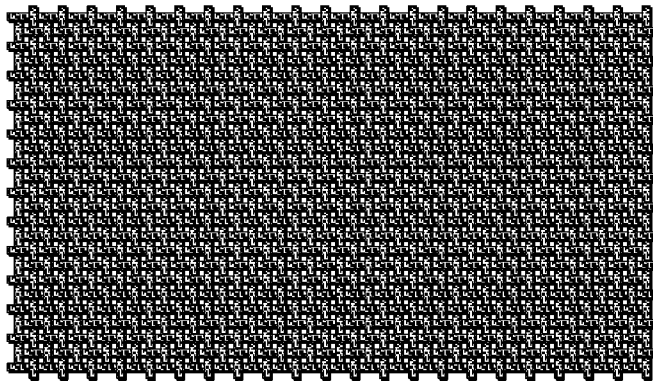
20. The method of claim 14, wherein the first, second, and third type of fiber are spun into a yarn having a thickness of 11S, the yarn is twisted into a three-ply yarn, and the weaving has a plain weave pattern to form a canvas.

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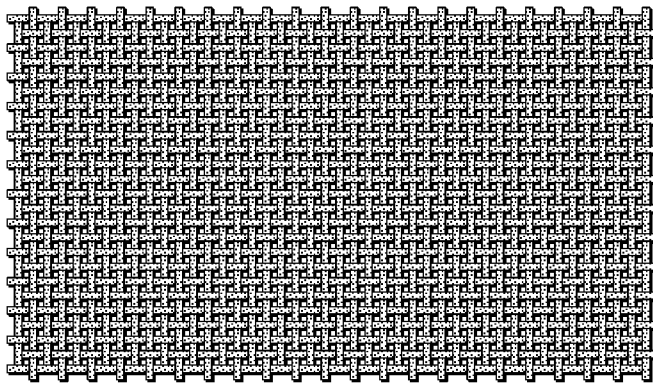
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Fig. 1A.



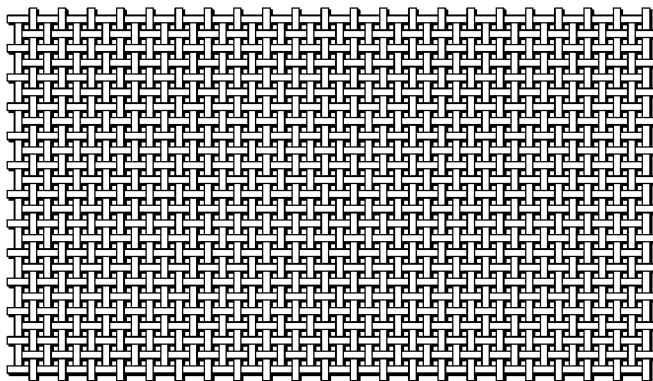
10'

Fig. 1B



10''

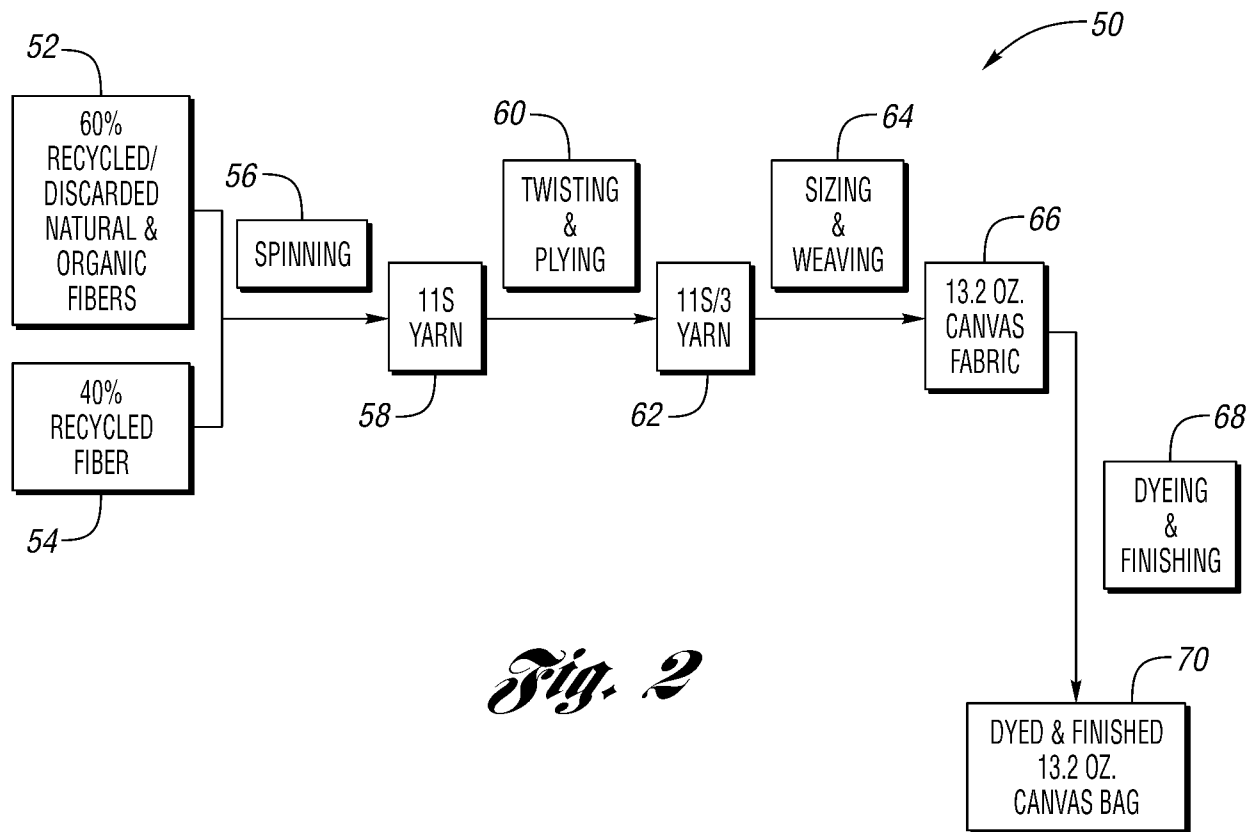
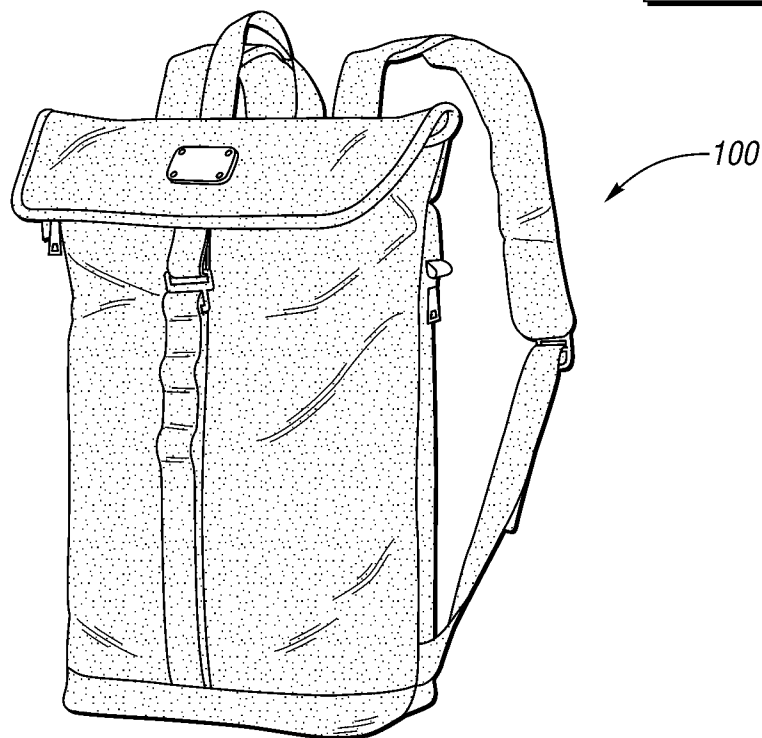
Fig. 1C



10'''

Fig. 1D

2/2

*Fig. 2**Fig. 3*