April 22, 1969 M. I. PORT ET AL 3,439,865

WOVEN PLASTIC BAGS

Filed Dec. 17, 1964

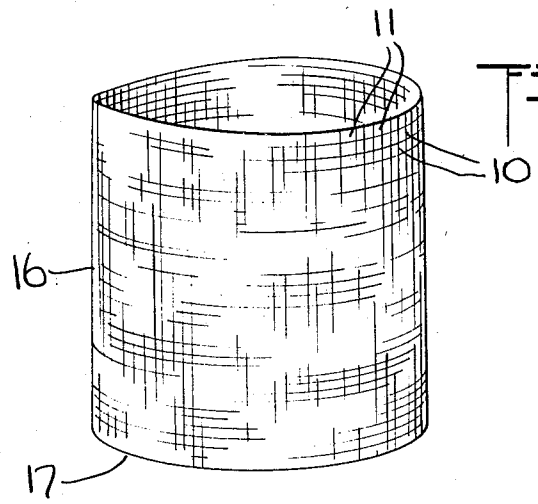

Fig. 1.

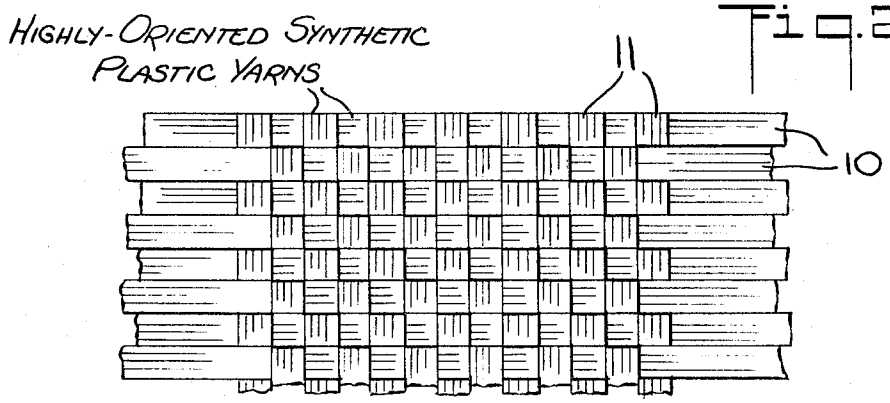

Fig. 2.

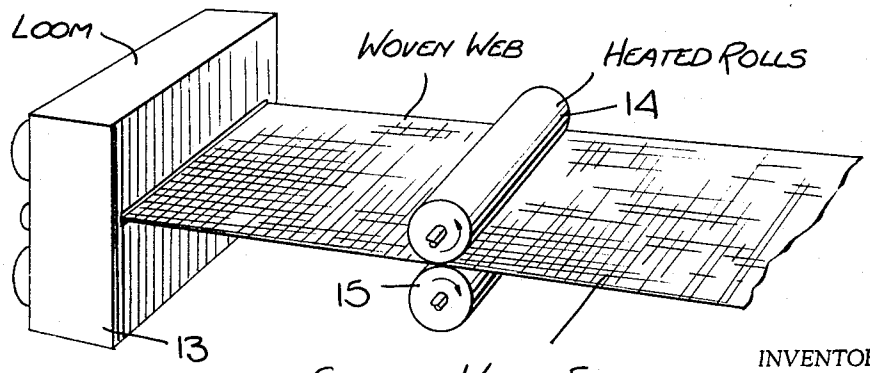

Fig. 3.

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WOVEN PLASTIC BAGS

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U.S. Cl. 229—53 5 Claims

This invention relates generally to plastic sacks and bags, and more particuuarly to sacks fabricated of woven, flat synthetic yarns to produce a light-weight, dimensionally stable sack of exceptional strength which is waterproof and yet permeable to air and vapor.

In the bailing of chemical powders, tobacco, grain, raw wool and cotton, and other bulk materials, the need exists for heavy-duty bags or sacks which not only have sufficient strength for the intended load, but which afford protective cover therefor. Though conventional bags for such purposes made of multi-walled paper or natural fibers such as cotton or jute have the requisite strength when dry, they lose substantial strength when wet, with a resultant failure of the bag. Moreover, bags of conventional design are subject to rot, mildew and attack by insects.

It is also known to fabricate bags of extruded plastic film material. Such bags are generally immune to deterioration, but they lack other important qualities. Thus, while plastic bags are waterproof, they are also impermeable to the air and water vapor. With certain bulk materials such as grain and tobacco, one must avoid hermetically sealing the contents, and while the bag should be waterproof, it nevertheless must allow for the limited flow of air and vapor. Furthermore, bags of plastic film or sheet have limited strength and tend to stretch under heavy loads. On the other hand, where the bag is not of film material, but is of woven construction, the resultant pores not only permit the passage of water, but in the case of fine powders, give rise to spillage of the contents.

Accordingly, it is the main object of this invention to provide a bag formed of woven plastic yarn which has exceptional tensile and tear strength despite its light weight, and which is waterproof, spillproof, and yet permeable to air and vapor. Thus, while the bag is impervious to liquids it is porous to gases.

More specifically, it is an object of this invention to provide a bag of the above-described type wherein the bag walls are composed of closely woven, flat synthetic plastic yarns which are oriented and drawn to high tensile strength.

Also an object of the invention is to provide a fabirc woven of flat, synthetic yarns which afford maximum coverage for a minimum number of yarns, the fabric being heat-stabilized and calendered to produce a light-weight bag which is dimensionally stabilized.

Still another object of the invention is to provide a durable bag of high quality formed of flat yarns of the above-described type, which may be manufactured and sold at very low cost.

Briefly stated, a bag in accordance with the invention is composed of a fabric woven of warp and weft yarns which are of flat monofilament construction and which are longitudinally oriented to maximize their tensile strength, the yarns being woven with sufficient tightness to render the fabric waterproof but permeable to gas flow, the warp and weft yarns being interbonded to prevent slippage thereof and to maintain the dimensional stability of the fabric.

A significant advantage of the invention resides in the fact that the interbonding is effected by sintering the warp and weft yarns rather than by fusion, whereby when

the bag is subjected to a tearing action, the warp and weft yarns break away from each other and shift into bunches affording maximum tear resistance.

For a better understanding of the invention as well as other objects and further features thereof, reference is had to the following detailed description to be read in conjunction with the accompanying drawing, wherein:

FIG. 1 is a perspective view of a bag in accordance with the invention;

FIG. 2 is a plan view of the woven fabric used in making the bag; and

FIG. 3 schematically shows the process by which the fabric is made and stabilized.

Referring now to FIG. 1, the bag or sack, generally designated by numeral **10**, is formed by a fabric composed of horizontally-extending flat warp yarns **11** and transversely-extending flat weft or filler yarns **13**. The warp and weft yarns are tightly woven in any known manner on a textile loom to form a sheetlike material relatively free of interstices.

The yarns used for this purpose are ribbon-like synthetic plastic, monofilament yarns manufactured in various densities and having a rectangular cross-section. Such yarns may be produced from any suitable synthetic plastic material, including polypropylene, polyamides such as nylon, polyester of polyacrylic yarns, as well as vinyl and polyethylene yarns. In practice, yarns of 1 to 2 mils thickness and 50 to 200 mils in width are suitable. A preferred weave is 12 x 9 and higher, although weaves of 8 x 8 are satisfactory.

It will be appreciated that by reasons of the flat yarn, maximum coverage is obtained with the least amount of weaving, for as compared to round yarns, it requires relatively few yarns per inch to cover a given surface.

It is important that the ribbon-like yarns be highly oriented mono-axially in the longitudinal direction. This is usually accomplished by so drawing the flat yarn or the web from which the flat yarn ribbons are slit, as to irreversibly stretch the yarn or web, thereby orienting the molecular structure of the material. In bi-axially oriented yarn or sheeting, the material is stretched both in the transverse and longitudinal directions, but for purposes of the present invention, it is vital that the orientation be carried out only in the longitudinal direction.

When the mono-axially oriented synthetic plastic yarns are interwoven, they cross over in the warp and weft directions, and because of their high tear and tensile strength as well as their hydrophilic properties, the resultant fabric is stable. Thus the bag is capable of supporting unusually heavy loads without sagging or stretching of the walls.

With a close weave, there nevertheless remain minute pores at the points of intersection. Because of surface tension effects, water is unable to pass through these pores and the bag material is effectively waterproof. However these pores permit the passage of gas and vapors which, as indicated previously, is desirable for certain organic bulk materials to prevent mildew and other deleterious effects.

With the use of flat yarns there is a tendency of the yarns to shift one over the other. As shown in FIG. 3, this drawback is obviated by conducting the woven web emerging from the loom **13** into a pair of heat rolls **14** and **15** which subject the overlying warp and weft yarns to pressure and cause a slight interbonding or sintering therebetween.

In practice, the temperature of the rolls may be approximately in the range of 300° F. to 320° F. However, the appropriate temperature will depend on the physical nature of the synthetic plastic being treated. The sintering of the warp and weft yarns may also be carried out by using hot air on infra-red heating elements.

The sintering effect must be carefully controlled so

that under ordinary circumstances the yarns will not shift one over the other and the shape of the sack will be preserved. But if the sack is subjected to a tearing action, the sintered yarns, which are slightly bonded together only by surface fusion, will break apart and the yarns will then tend to shift and bunch. The bunched yarns are difficult to tear for they present maximum tear resistance.

In shaping the fabric into a sack, it is only necessary to cut a suitable rectangle of the material and to fold the same, after which the long end **16** is seamed or heat-sealed to produce a sleeve, and the short end **17** is seamed and possibly reinforced by a marginal fold-over to produce the bottom.

What we claim is:

1. A dimensionally stable, heavy duty waterproof, gas pervious sack of high strength, said sack having an open end and a closed end and being fabricated of a fabric woven of flat, monofilament warp and weft yarns formed of a mono-axially oriented synthetic plastic material, the weave of said fabric being sufficiently tight to render said fabric waterproof but pervious to gas.

2. A dimensionally stable, heavy duty, waterproof, gas pervious sack of high strength, said sack having an open end and a closed end and being fabricated of a fabric woven of flat, monofilament warp and weft yarns formed of a mono-axially oriented synthetic plastic material, the weave of said fabric being sufficiently tight to render said fabric waterproof but pervious to gas, said warp and weft yarns being sintered to prevent shifting thereof in ordinary use.

3. A sack as set forth in claim **1**, wherein said yarns are formed of polyethylene.

4. A sack as set forth in claim **1**, wherein said yarns are formed of polypropylene.

5. A sack as set forth in claim **1**, wherein said yarns are 1 to 2 mils thick and have a width of about 50 to 200 mils.

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99—171; 139—389; 161—71, 89, 92, 402