July 7, 1959 W. L. THOMPSON, JR 2,893,396

BRASSIERE

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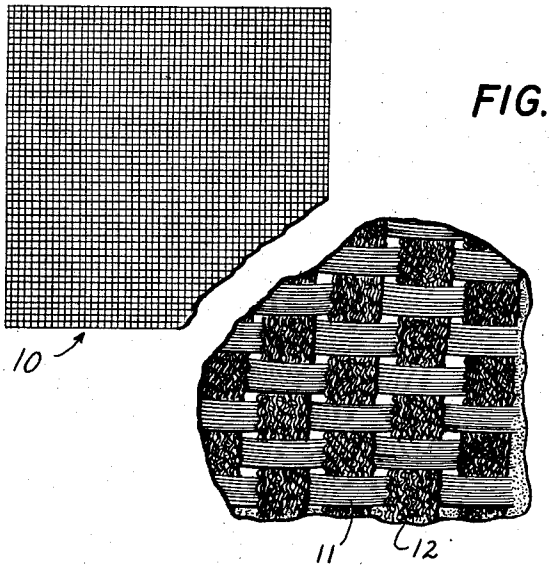


FIG. 1.

FIG. 1A

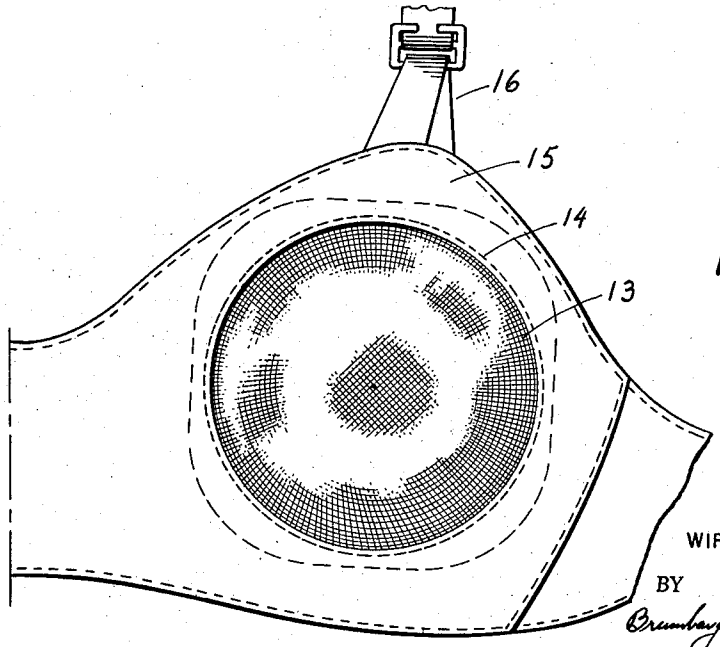


FIG. 2.

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The present invention relates to molded fabric and particularly to brassiere constructions based thereon.

Previous techniques have involved, generally, two methods of converting textile fabrics, which are woven flat, into three dimensional shapes for use, for example, as brassiere cups. The most widely used of these methods in the brassiere art involves the cutting out of a series of fabric pieces which, when fitted and sewn together, results in the desired three dimensional shape. The other method involves the molding or forming of a single piece of a flat woven fabric into the desired shape by changing the relative length of the various yarns in the weave, either by stretching or shrinking certain of the yarns more than others. Each method has its own advantages and disadvantages and neither has proven satisfactory in all respects.

To cut and sew together a number of fabric sections, for example to form the cup portion of a brassiere, is costly in addition to creating rather conspicuous seams and ridges which can be not only uncomfortable to the wearer but also can set up zones of disproportionate shrinking and distortion through use. These factors in the past have stimulated activity in the molding techniques. However, fabrics which have been capable of being molded in the past have had serious disadvantages such as a fusing together of the interlaced yarns making the fabrics stiff and unpleasant to touch. Other fabrics in the past have resulted in plastic flow which, in some cases, can fill the interstices of the weave destroying the porosity and in other cases can enlarge the interstices in an unsightly manner. Still other fabrics woven of thermoplastic yarns which have been molded and seemed to be satisfactory have lost the desired shape in use due to body heat causing the thermoplastic yarn to elongate.

Accordingly, a principal object of the present invention is to overcome the undesirable characteristics mentioned above by providing a means of making a brassiere with seamless bust cups, which cups are made of a single piece of thermosetting fabric molded to the desired shape, which is improved in function and appearance.

It is also an important object of the invention to provide a brassiere construction using one piece molded fabric cups which are improved in function and appearance.

Another object of the invention is to provide a process for making one piece brassiere cups.

Generally, the present invention provides a brassiere cup of approximately paraboloid configuration by molding a fabric composed of weaving yarns to which a crimp has been imparted in the filling, for example, by methods described in U.S. Patents Nos. 2,575,838 and Re. 23,824. The teaching of these prior patents, however, are applied to the multiple filament, continuous filament yarns of the present invention by treating the finished yarns rather than a slubbing of fibers. A brassiere construction in accordance with the present invention, therefore, contemplates the use of a fabric which comprises conventional nylon in the warp and crimped nylon in the filling.

It has been found that this fabric will also mold to the desired shape, and when so molded, it presents certain advantages which will be set forth in detail as the description proceeds.

For a more complete understanding of these and other objects and advantages of the present invention, reference may be had to the description which follows and to the accompanying drawing in which:

Figure 1 is a surface view partly in enlarged scale of a fabric;

Figure 1A is an enlarged view of a portion of the fabric shown in Figure 1; and

Figure 2 is a fragmentary view of one portion of a brassiere construction showing one cup attached to a body portion.

Referring to the drawing, the invention is illustrated as embodied in the generally paraboloid shape of a brassiere cup which is composed of weaving yarns such as, for example, synthetic linear polyamide commonly known as nylon, the fabric being indicated generally by the reference numeral **10**. The plain weave thermosetting fabric is initially woven in conventional loom width and including continuous filament warp yarns **11**, which is 162 ends of 40 denier, 34 filament regular nylon. The filaments of the yarns **12** are formed with 100 picks of 40 denier, 34 filament crimped nylon in the filling. In one representative embodiment of the invention, approximately 64 distortions or crimps per inch were imparted to the filaments.

If fabric woven with conventional nylon in the warp and crimped nylon in the filling is held by suitable means in a manner similar to embroidery hoops, it may be stretched over the paraboloid shape, such as that of a bust or other shape. While the fabric is stretched over the desired shape, it is heat set by suitable means either by dry heat in excess of that used in setting the crimps in the yarn or by steam pressure in an autoclave for the required length of time. After heat setting, the molded fabric will retain the desired shape, unless the setting temperature is exceeded. However, this setting temperature is well in excess of that to which it will be exposed during normal usage.

After the cups have been molded and heat set, the cloth which was held by the hoops or frame is trimmed off and the paraboloid shaped cup is sewn by conventional means into the frame of the garment.

When the flat piece is molded as between complementary die or mold sections, the fabric is formed into the generally paraboloid shape. In one form of molding, the dies are operated at an elevated temperature, in the vicinity of 350° F., for the particular thermosetting material used in the illustrated embodiment, in what amounts to a hot drawing process. While cold drawing can be used, it has been found that hot drawing is somewhat more easily accomplished and in addition serves the purpose of at least starting the heat setting step which must follow the drawing or molding step in order to stabilize the deformed yarns in their new configuration.

The finished cup unit identified by the numeral **13** in Figure 2, is mounted in brassieres by means of stitching **14** joining the edge of each cup unit with the body portion **15**, which body portion includes means such as straps **16** to mount on the body of a wearer. Because the weave of the cup units and the weave of the body portion can be arranged at angles to each other, due to their independent construction, wide flexibility of design results. In this connection, it will be understood that the separate cup units, in which there are but two right angularly disposed yarn directions throughout, affords the maximum latitude in the relative positioning of the cup and body portions. The cup units can be turned, if symmetrical in form at the outset, to any desired

angle without complicating the manufacturing process as, for example, the most frequently preferred angle of 45°.

In accordance with the invention, the cup unit may be molded with the crimp nylon **12** in the vertical direction and the continuous nylon **11** in a horizontal direction, or alternatively, the fabric may be positioned such that these filaments are at any desired angle. An alternative arrangement for a single cup unit having exceptional strength against stretching and distortion in use is provided by nesting one single-layer molded fabric unit within another with their respective weave patterns at angles with respect to each other. The two nested layers can be joined at their edges by the stitching which secures the composite cup unit to the body portion of the brassiere. When stitching is used around the edges of the composite cup unit, it will be understood that the lines of stitching do not constitute seams which would introduce undesirable ridges or joins.

To describe in greater detail this arrangement embodying two nested layers of the fabric, it should be remembered that a force exerted along the axis of the warp or the filling of normal woven fabric does not produce stretch. However, if a force is exerted at an angle as, for example, 45° to the warp or filling, the fabric will stretch. Therefore, to overcome this effect, two layers of fabric are positioned one above the other such that the warp of one layer is approximately 45° with respect to the warp of the second layer and, of course, the filling in the first layer will also be at an angle of approximately 45° with the filling of the second layer.

A preferred, although not exclusive, arrangement is to position the "inside" layer of a cup such that the warp and filling are approximately horizontal and vertical, and the warp and filling of the "outside" layer are at approximately 45°. The "inside" layer, generally, need extend only over the lower portion of the cup to provide the additional support that may be desired. To prevent ravelling across the center of the cup where the "inside" layer terminates, the two layers are fused as, for example, by a hot knife, or the like to avoid a seam which would be formed if the layers are sewn here.

It will be understood that other synthetic yarns can be used in the practice of the invention which are capable of obtaining the optimum physical properties occurring as previously described. Such other yarns may include, for example, polyester yarns made by the condensation of dimethyl, terephthalate and ethylene glycol, and commonly known as Dacron. The use of the term "brassiere" herein is intended to include both isolated brassiere units as well as the various combination garments which incorportate brassieres such as corsets, corselets and the like. It will be understood, therefore, that while the invention has been described herein having reference to particular preferred embodiments thereof, it should not be regarded as limited, except as defined by the following claims.

I claim:

1. In a brassiere construction, a body portion, means to mount the body portion on a wearer, a pair of fabric cup portions each consisting of an integral single piece of molded fabric having generally right angularly disposed warp and filling yarns, at least a portion of which having preformed permanent distortions therein in addition to the distortions normally imparted by the weave, and means mounting the cup units in the body portion with their warp and filling yarns extending respectively along the horizontal and vertical.

2. In a brassiere construction, a body portion, means to mount the body portion on a wearer, a pair of fabric cup portions each consisting of an integral single piece of molded fabric having generally right angularly disposed warp and filling yarns, at least a portion of which having preformed permanent distortions therein in addition to the distortions normally imparted by the weave, and means mounting the cup units in the body portion with their warp and filling yarns forming angles of approximately 45° with the horizontal and vertical.

3. In a brassiere construction, a body portion including fabric having generally right angularly interlaced warp and filling yarns, at least a portion of which include preformed permanent distortions therein in addition to the distortions normally imparted by the weave, means to mount the body portion on a wearer with the weave directions disposed horizontally and vertically, a pair of fabric cup portions each consisting of an integral single piece of molded fabric having generally right angularly disposed warp and filling yarns, and means mounting the cut units in the body portion with their warp and filling yarns extending respectively at angles to the horizontal and vertical.

4. In a brassiere construction, a body portion including fabric having right angularly interlaced warp and filling yarns, means to mount the body portion on the wearer, with the yarns of the weave of said body portion extending generally horizontally and vertically of the wearer, a pair of fabric cup portions, each formed of an integral single piece of molded fabric having a generally right angularly arranged weave pattern of interlaced warp and filling yarns, at least a portion of which include preformed permanent distortions therein in addition to the distortions normally imparted by the weave, and means securing the cup portions in the body portion with the weave pattern disposed at angles to the weave pattern of the body portion, the warp and filling yarns of the cup portions forming approximately 45° with corresponding yarns of the body portion.

5. A brassiere construction as set forth in claim 4, each of said cup units including, interlaced warp and filling yarns of thermosetting plastic molded to achieve optimum strength and toughness.

6. A brassiere construction as set forth in claim 4, each of said cup units including a plurality of rows of warp and a plurality of rows of filling yarns of thermosetting plastic molded to achieve optimum strength and toughness, each row including a group of yarns.

7. A brassiere construction as set forth in claim 6, in which said thermosetting yarns comprises synthetic linear polyamide.

8. In a brassiere construction, a body portion, means to mount the body portion on a wearer, a pair of fabric cup portions each comprising a first piece of molded fabric and a second piece of molded fabric, said first and second pieces having warp and filling yarns at least a portion of which include preformed permanent distortions therein in addition to the distortions normally imparted by the weave, and said warp and filling of said first piece of fabric being disposed at an angle with respect to the warp and filling of said second piece of fabric.

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