

Sept. 9, 1952

H. E. SHEARER

2,609,539

BUST RECEIVING AND SUPPORTING MEMBER

Filed June 3, 1948

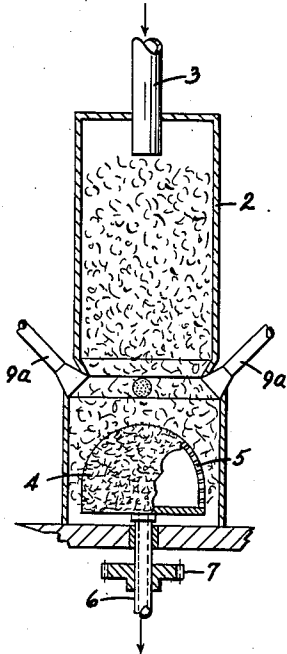


FIG. 1

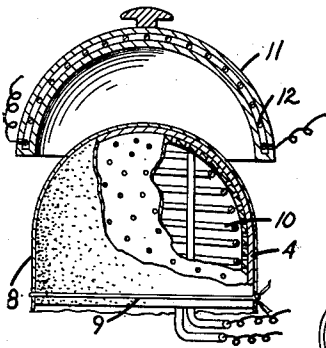


FIG. 2

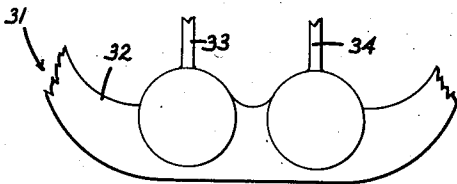


FIG. 3

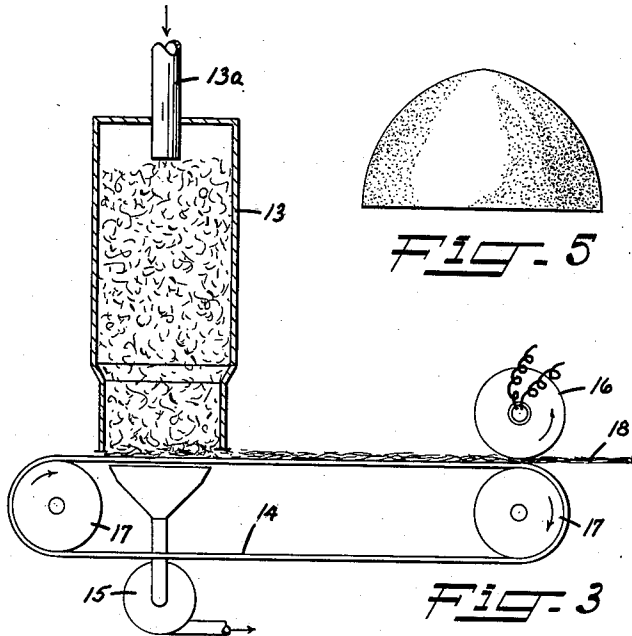


FIG. 5

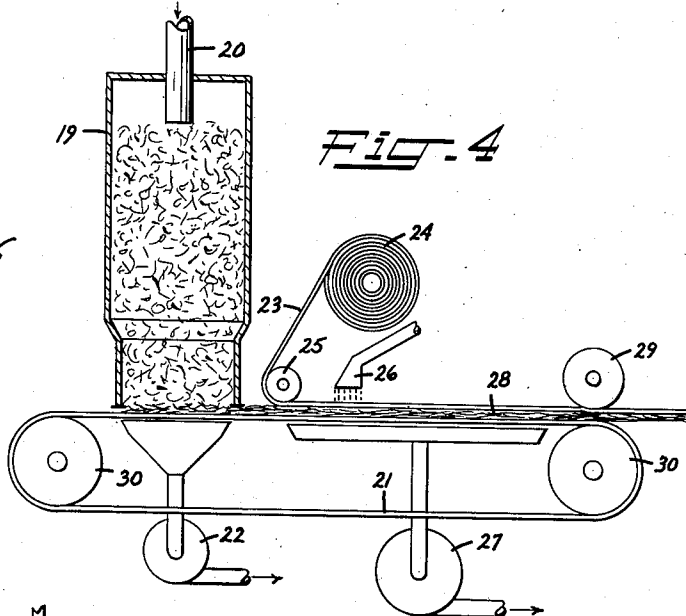


FIG. 4

INVENTOR.
HOWARD E. SHEARER
BY
Carl A. Castellan

UNITED STATES PATENT OFFICE

2,609,539

BUST RECEIVING AND SUPPORTING
MEMBER

Howard E. Shearer, Swarthmore, Pa., assignor to
American Viscose Corporation, Wilmington,
Del., a corporation of Delaware

Application June 3, 1948, Serial No. 30,852

3 Claims. (Cl. 2—42)

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This invention relates to novel bust receiving and supporting pockets for brassières and the like.

Conventionally such pockets are made by cutting a fabric to pieces of predetermined small size and shape and then sewing the pieces together to form the pockets. The seams in the pockets so made have long been considered undesirable, and it has been one of the objectives of the art to eliminate them.

I have found that seamless bust receiving and supporting pockets having very desirable properties can be made by molding a fibrous web, mat, bat, or the like of discontinuous fibers, at least some of which are potentially adhesive fibers, to generally breast shape.

In the preferred embodiment of the invention, the potentially adhesive fibers are thermoplastic fibers which, under heating, first shrink strongly and then soften to a tacky condition. Prior to shaping of the mat, web or the like, the fibers are in relatively loosely associated condition. The fibrous mat is molded to the desired generally breast shape by permanent shrinkage of the heat-shrinkable fibers. The shrunken fibers are autogenously bonded to each other or to other fibers in the product, to set the product permanently in the molded condition. A porous, stabilized, bust receiving and supporting member through which the pores of the body may freely breathe is obtained. The pockets do not comprise slack and are capable of accepting and sustaining the weight of the breast without sagging.

In one embodiment of the invention, fibers, at least some of which are thermoplastic heat-shrinkable fibers, are air-deposited on the surface of a generally breast-shaped mold to provide a layer of uniform thickness comprising a multiplicity of comparatively loosely associated fibers, and the fibrous layer is heated to first shrink and then soften the fibers to tacky condition. As the thermoplastic fibers shrink and, at some sections on the mold, undergo deformation, the fibrous product is drawn down to the contours of the mold with tightening of the structure. Shrinkage of the heat-shrinkable fibers effects shaping of the mat of discontinuous fibers. After the heat-shrinkable fibers have expended their residual shrinkage capacity, and as heating is continued, they soften, and in the softened state, bond autogenously to each other and to other discontinuous fibers which may be present. While the shrunken fibers are in the softened condition, the fibrous layers on the mold are preferably compacted under pressure. The breast-like bust receiving and supporting pocket is stabilized

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against loss of the breast-like shape in use as a result of autogenous bonding of the discontinuous fibers.

The mold on which the fibers are air-deposited may be the mold on which the final shaping is performed, or it may be of a size larger than the final size desired for the bust-receiving and supporting product. In the latter case, the fibrous layer is transferred from the mold on which the fibers are initially deposited, to the final mold.

In another embodiment, the discontinuous fibers are air-deposited on a collecting surface to form a flat, fibrous web or the like. The flat product is then fitted to the contours of the breast-shaped mold and heated to shrink the heat-shrinkable fibers and soften them to the tacky condition to bind fibers in the product.

Alternatively, a carded web, mat, bat, or the like comprising at least some potentially adhesive fibers is fitted to the contours of the breast-shaped mold and heated to stabilize the web in the shape of the mold.

Not all fibers which are potentially adhesive and capable of being activated to a tacky adhesive condition are heat-shrinkable. In some instances, activation of the fibers in the fibrous product is not preceded or accompanied by shrinkage of the fibers as such. For example, fibers of cellulose acetate, in the plasticized condition, are rendered tacky by heat but do not shrink as such prior to their conversion to the tacky state. If it is desired to use such fibers in the manufacture of bust-receiving and supporting members comprising discontinuous fibers, the mat, bat or the like comprising those fibers may be fitted to the contours of the mold and heated under pressure to soften the potentially adhesive fibers to the tacky condition and bond fibers in the product. In that case, the fibrous layer is molded and stabilized in the shape of the mold solely as a result of softening of the potentially adhesive fibers and binding thereof while they are in the activated adhesive condition. Unlike articles of this type which may be obtained by stretching a fabric woven from thermoplastic yarns over a three-dimensional mold and pressing the fabric while the yarns are in the thermoplastic condition, the pockets molded from the discontinuous fibers do not comprise slack and do not sag in use.

Preferably, the fibrous mat, web or the like is molded under heating while it is in a moist condition, steam being generated within the fibrous mass during the molding and shaping step. To this end, the product is treated with warm

water prior to heating it on the mold. Water may be applied directly to the layer of fibers, as by spraying, or the fibrous product may be wrapped or sheathed in a fabric, and then treated with water. For example, the fibers may be deposited from air or other conveying gaseous medium, on the surface of a perforated breast-shaped mold, covered with a thin porous fabric, and sprayed with water which is drawn through the fabric and fibers by suction. Alternatively, the fibers deposited on the perforated mold or other collecting surface may be covered with a wet fabric, the moisture carried by the fabric being drawn through the fibers by suction.

When a flat web of fibers is to be molded, the web may be given a preliminary heating and pressing treatment sufficient to soften or deform the fibers and cause the fibers to interlock at their points of crossing, the fibers being thus set in a crimp-like condition in which they tend to cohere to permit the flat web to be fitted to the contours of the breast-shaped mold without disintegration. Such heating and pressing is not sufficient to activate the potentially adhesive fibers to a tacky condition, and, in the case of heat-shrinkable fibers, is not sufficient to cause those fibers to expend their residual shrinkage capacity. Full shrinkage of the fibers of the web and/or activation of the fibers to the final tacky or adhesive condition is effected only after the web is fitted to the contours of the mold on which it is given the final shaping treatment.

As indicated, in the preferred embodiment, the product comprising the discontinuous fibers is heated to shrink and/or soften the potentially adhesive fibers to tacky or adhesive condition, while in the moist condition, steam being generated at the interior of the web concomitantly with molding of the web to the breast-like shape. When the molding is performed in the presence of steam generated within the web, the breast-receiving and supporting pockets have a more desirable hand or feel, which is important in the case of articles of intimate apparel.

The fabric which is associated with the fibrous web or the like prior to permanent shaping of the web may be peeled or stripped off prior to or after the heating and shaping operation, or it may be autogenously bonded to the felt-like web during the heating and shaping operation. In the latter case, the fabric comprises a permanent integral element of the final bust receiving and supporting pocket. For instance, the fabric may constitute a lining for the pocket. The fabric may comprise yarns formed from or comprising potentially adhesive fibers which are the same as or different from the fibers in the web. In some cases, it may be desirable to provide bust receiving and supporting pockets having a fabric sheath which completely envelopes or encases the pockets. A fabric, such as a thin porous fabric may be fitted over the mold before the fibers are deposited on it, and another fabric, or a different portion of the same fabric, may also be fitted over the fibers after they are deposited on the surface of the mold.

Any porous fabric may be associated with the web, prior to treating the same with water, but if the fabric is to be permanently anchored to the web, the fabric is preferably a thin porous fabric of the type of gauze.

The webs, mats, bats, or the like which are molded to provide the bust receiving and supporting pockets of the invention may comprise any potentially adhesive fibers which are suitable

for use in garments of intimate apparel. In the preferred embodiment, the potentially adhesive fibers are thermoplastic fibers which, on heating, have the capacity to shrink spontaneously before they are softened to a tacky condition. Most desirably, the potentially adhesive fibers comprise resins resulting from the polymerization of one or more substances comprising the vinyl radical. Examples of such materials are the acrylate and alkacrylate resins, polymers of vinyl esters such as vinyl acetate, polymers of vinyl ethers such as vinyl acetals, methacrylate polymers and copolymers or interpolymers of vinyl halides with other polymerizable substances containing the vinyl radical. In a specifically preferred embodiment, the fibers are heat-shrinkable fibers of a copolymer of vinyl chloride with vinyl acetate or vinyl cyanide. Such fibers are obtained by subdivision of continuous filaments of the copolymer which have been subjected to a stretch of from 100% to 1200% or more during their production or subsequently to their production and while in the cooled unsoftened state or in somewhat softened and plastic condition. Generally, the filaments so stretched have a residual shrinkage capacity of at least 50% at temperatures below the melting and decomposition temperatures for the resin. The discontinuous fibers obtained from such stretched continuous filaments have a corresponding residual shrinkage capacity.

The web or the like may be formed entirely of potentially adhesive fibers, specifically thermoplastic heat-shrinkable fibers, or it may comprise a mixture of such fibers with other non-adhesive fibers, that is fibers which are not potentially adhesive at all, or not potentially adhesive under the conditions employed to activate the potentially adhesive fibers. The non-adhesive fibers are of a type suitable for use in garments of intimate apparel and may be natural, artificial, or synthetic fibers. For example, the non-adhesive fibers may be cotton, wool, silk, casein, linen, flax, cellulosic fibers such as regenerated cellulose, cellulose esters such as cellulose acetate or the like, or fibers of a natural or synthetic resin, for instance, nylon. When mixtures of the potentially adhesive and non-adhesive fibers are used, the potentially adhesive fibers are preferably used in an amount of from 25 to 85% by weight of the total fibers. The fibers are preferably of textile making length. However, when the fibers are air-deposited, fibers of less than normal ftable or carding length may be used.

The physical properties, such as the thickness, weight, and stiffness of the bust receiving and supporting members can be controlled as desired. Fibrous webs having a thickness of from $\frac{1}{16}$ " to $\frac{1}{2}$ " or more may be molded to produce bust receiving and supporting pockets having a thickness of from .001" to $\frac{1}{8}$ ". Very thin non-bulky pockets may be produced, or the pockets may have a more pronounced bulk or thickness and may be suitable for padding and body-building purposes.

The stiffness of the bust receiving and supporting pockets depends upon the proportion of potentially adhesive fibers present in the initial fibrous web, and the extent to which those fibers are activated during the molding and shaping step. In the preferred embodiment, the potentially adhesive fibers are activated to a tacky or adhesive condition while remaining intact and in essentially fiber form.

For more detailed description, reference should

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be made to the accompanying drawing in which,
Figure 1 is a front elevation of one embodiment of suitable means for carrying out a preferred form of the invention;

Figure 2 is an elevation of the molding device;

Figure 3 is an elevation of another embodiment of means for carrying out the invention;

Figure 4 is an elevation of a further embodiment of means for carrying out the invention;

Figure 5 is a plan view of a bust receiving and supporting pocket in accordance with the invention; and

Figure 6 is a plan view of a brassière comprising bust receiving and supporting pockets made in accordance with the invention.

When using the apparatus of Figure 1, the fibers, at least some of which are thermoplastic heat-shrinkable fibers, for example, fibers obtained by subdivision of strongly stretched continuous filaments of a copolymer of vinyl chloride and vinyl acetate containing about 90% vinyl chloride in the copolymer molecule, or by subdivision of continuous filaments of a copolymer of vinyl chloride and vinyl cyanide containing about 55% vinyl chloride in the copolymer molecule, are blown into the chamber 2 through pipe 3. The fibers settle out on the surface of a removable breast-shaped mold 4 provided with a multiplicity of small uniformly distributed perforations 5 and adapted to be evacuated through pipe 6. The entire mold is adapted to be slowly rotated by means of a pulley 7 and belt (not shown). The application of suction on the interior of the mold serves to draw the fibers down onto the mold surface and prevents their moving or sliding to the edge of the mold. After a layer of predetermined desired thickness comprising the comparatively loosely associated fibers has been collected on the mold, the introduction of fibers to the chamber 2 is terminated. A fabric, preferably a fabric of gauze type, 8 (Figure 2) is placed over the fibers and secured at the base of the mold by means of a locking cord 9 (Figure 2), or the like. Water is then sprayed on the fabric-covered fibers, from the spray heads 9a, and drawn through the fabric and fibers by suction. If desired, a fabric of gauze type may be drawn over the mold 4 before the fibers are deposited, and such fabric may or may not be bonded to the fibrous web during the subsequent molding operation.

After the water treatment, steam may be introduced into the chamber, to shrink the potentially adhesive fibers, thereby shrinking the layer of fibers to the shape of the mold. Alternatively, the mold 4 carrying the moist layer of fibers, having a fabric covering over at least the surface of the layer away from the surface of the mold, may be removed from chamber 2 and subjected to heat to first shrink the thermoplastic heat-shrinkable fibers, and then soften those fibers to tacky adhesive condition. If the potentially adhesive fibers are thermoplastic heat-shrinkable fibers comprising a copolymer of vinyl chloride and vinyl acetate, or vinyl chloride and vinyl cyanide, as described above, the molding is performed at temperatures of from about 85° C. to 95° C., at which temperatures the copolymeric fibers shrink and contract. Heat may be applied to mold 4 by means of flames, a hot water jacket (not shown) or by means of electrical heating coils 10 imbedded in the mold. The heating is continued until the fibers which first undergo strong shrinkage are finally activated to the tacky or adhesive con-

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dition in which they tend to bond together or with other fibers. Shrinkage of the heat-shrinkable fibers serves to draw the web down tightly to the contours of the mold, the shaping, in this case, being due solely to shrinkage of the heat-shrinkable fibers. The fabric secured on the mold by the locking cord serves to restrain the web and compact the fibers. The pressure exerted on the web by the fabric may be sufficient to effect the desired compaction of the fibers, or further compaction may be obtained by placing a female mold member 11 over the fabric-covered web, after the heat-shrinkable fibers have been shrunk to conform the web to the shape of the mold, and while the heat-shrinkable fibers are in the tacky condition. Mold member 11 may also be heated, if desired, for example by means of an electrical heating coil 12 imbedded therein. The final shaped pocket is cooled on the mold to set the potentially adhesive fibers in the shrunken and bonded condition.

When using the apparatus shown in Figure 3, the fibers are blown into chamber 13 through the pipe 13a and collected on the endless belt 14. The belt is made of flexible material such as textile, metal, leather, or the like, and is preferably positioned in a horizontal plane at the bottom of chamber 13. Belt 14 is provided with a multiplicity of small uniformly distributed perforations. Air is withdrawn from chamber 13 by the action of exhaust blower 15. The fibrous web carried on the surface of the belt is passed between the rollers 16 and 17, which are spaced apart a distance such that the pressure exerted on the web is comparatively light, not more than 30 lbs. per square inch. Roll 16 is electrically heated to a controlled temperature which is just sufficient to warm the fibers and soften them to the extent that they undergo deformation. Both the extent of heating of the web and the extent of compaction thereof by the rollers 16 and 17 are controlled. The potentially adhesive fibers are not softened to the tacky condition at this stage of the process, the heating and pressing to which the web is subjected being merely sufficient to deform the fibers and set them in a crimp-like condition. This improves the handling properties of the web 18 and permits it to be fitted to the contours of the mold 4 without disintegration. If the fibers, or some of them, are thermoplastic, heat-shrinkable fibers and it is desired to effect at least the initial conformation of the web to the contours of the mold by shrinkage of the fibers, the heat and pressure applied to the web by rollers 16 and 17 is controlled so that the fibers do not fully expend their residual shrinkage capacity and remain in relatively loosely associated condition until the web is fitted to the mold and heated on the mold. The comparatively loose association of the fibers in the web formed initially is important to full shrinkage of the heat-shrinkable fibers under heating on the mold.

With reference to Figure 4 there is shown a chamber 19 into which the fibers are blown through the pipe 20. The fibers settle out on the surface of a perforated endless belt 21, air being withdrawn from the chamber by the action of the exhaust member 22. As the layer of fibers is carried from the chamber by the belt, a fabric 23, preferably a thin porous fabric of the type of gauze, is unrolled from the roll 24 and after passing around the guide roll 25 is laid down on the surface of the fiber layer. The fabric and

fibers are then sprayed with water from the spray head 26. The water is drawn downwardly through the fabric and fibers by the action of the exhaust blower 27. The product 28 then passes into the nip of the rolls 29 and 30, between which it is subjected to a light pressure. The fabric covered web is then fitted to the contours of a mold similar to mold 4 (Figure 2) and secured to the mold by any suitable means, as for instance by means of a locking cord similar to cord 9 (Figure 2). If desired, a fabric may be drawn over the mold prior to depositing the product 28 thereon, or a fabric may be placed on the endless belt 21 before the fibers are deposited on the belt. After the product 28 has been fitted to the contours of the mold, it is subjected to heat until the potentially adhesive fibers are converted to a tacky adhesive condition. The pressure exerted on the fibers by the fabric 23 may be sufficient to effect the desired compaction of the web, or the web may be further compacted by placing a female mold member similar to member 11 (Figure 2) over the male mold member. If the product 28 comprises a felt-like layer comprising thermoplastic fibers which are heat-shrinkable, mold member 11 is not placed over the male mold member until after the heat-shrinkable fibers have been shrunk to conform the product to the contours of the mold.

A felt-like bust receiving and supporting pocket made in accordance with the invention is shown in Figure 5.

A brassière 31 comprising bust-receiving and supporting pockets molded from a fibrous product consisting of layers of discontinuous fibers in accordance with the invention is shown in Figure 6, the members being jointed to the body-encircling member 32 and to the straps 33 and 34. The inner and outer surfaces of the pockets may be anchored to a fabric, such anchoring resulting from bonding of the fabric to the potentially adhesive fibers while the latter are in the tacky adhesive condition. Any excess fabric may be trimmed from the periphery of the mold member prior to joining it to the body-encircling member. The bust receiving and supporting pockets of the invention may be hand laundered in warm water, and have the outstanding advantage that the bottom thereof is capable of sustaining the load of the breast without sagging in use. The pockets support the breast in the esthetically desirable uplifted condition without exerting strain or pull on the shoulder straps of the brassière or the like with which they are associated.

As previously indicated, the fibers in the bat, mat or the like, prior to heating thereof on the three-dimensional, mold are in relatively loose association. This relatively loose association of the fibers in the bat is especially important when the potentially adhesive fibers are of the type which shrink when heated at temperatures below their melting and decomposition temperatures. By "relatively loose association" is meant that the potentially adhesive heat-shrinkable fibers are free to move and shrink in the bat, and to

draw any non-adhesive fibers present with them as they shrink, thereby shrinking the fibrous bat as a whole to impart the desired generally breast-like shape to the bat.

Modifications and variations may be made in practicing the invention without departing from the spirit and scope thereof as defined in the appended claims.

I claim:

1. A pre-shrunk bust receiving and supporting pocket comprising a fibrous felt-like product consisting of discontinuous fibers at least some of which are thermoplastic, heat-shrinkable fibers of a copolymer of vinyl chloride and vinyl acetate containing about 90% vinyl chloride in the copolymer molecule and having, initially, a residual shrinkage capacity of at least 50%, the copolymeric fibers in the pocket being shrunk in the pocket to shrink the product as a whole and impart a generally breast-like shape thereto, and fibers in the pocket being autogenously bonded to stabilize the pocket against loss of the breast-like shape in use.

2. A pre-shrunk bust receiving and supporting pocket comprising a fibrous felt-like product consisting of discontinuous fibers at least some of which are fibers of a copolymer of vinyl chloride and vinyl cyanide containing 55% vinyl chloride in the copolymer molecule and having, initially, a residual shrinkage capacity of at least 50%, the copolymeric fibers in the pocket being shrunk to shrink the product as a whole and impart a generally breast-like shape thereto, and fibers in the product being autogenously bonded to stabilize the pocket against loss of the breast-like shape in use.

3. A pre-shrunk bust receiving and supporting pocket comprising a fibrous felt-like product consisting of discontinuous fibers at least some of which are thermoplastic, heat-shrinkable fibers of a fiber-forming vinyl chloride copolymer, selected from the group consisting of copolymers of vinyl chloride and vinyl acetate and copolymers of vinyl chloride and vinyl cyanide, said copolymeric fibers having, initially, a residual shrinkage capacity of at least 50% and being shrunk in the pocket to shrink the product as a whole and impart a generally breast-like shape thereto, fibers in the pocket being autogenously bonded to stabilize the pocket against loss of the breast-like shape in use.

HOWARD E. SHEARER.

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