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REINFORCED RESIN ARCUATE GARMENT STAY

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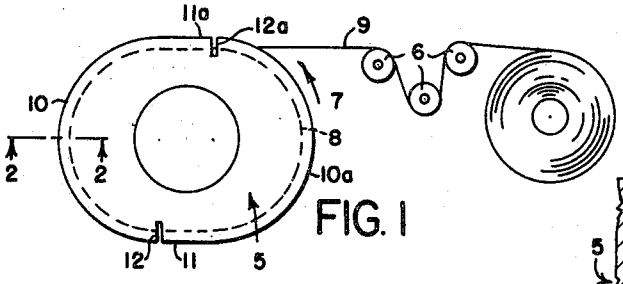


FIG. 1

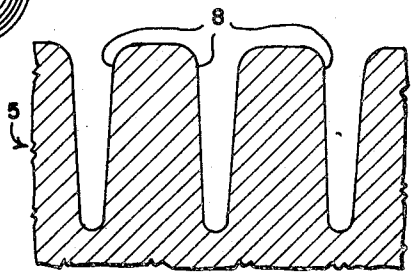


FIG. 2

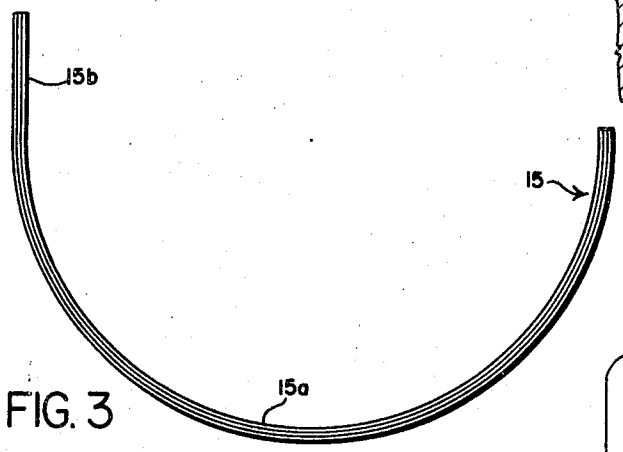


FIG. 3

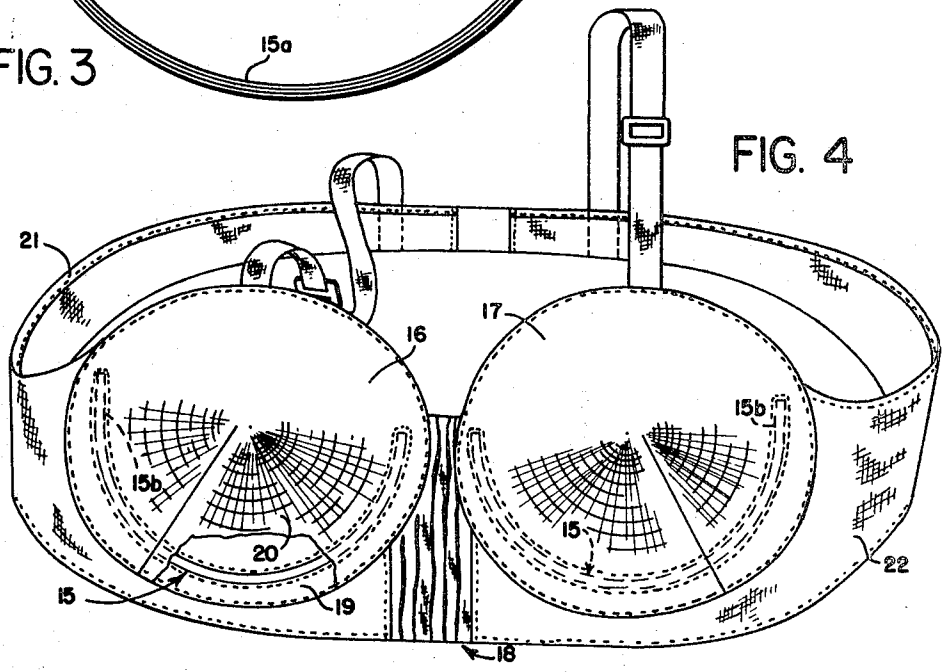


FIG. 4

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REINFORCED RESIN ARCUATE GARMENT STAY

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This invention relates to an improved garment stay or more particularly, an arcuate, reinforced resin garment stay for use in a brassiere and fitted around the lower margin of the breast cup or pocket for supporting the breasts.

For many years, arcuate stays have been sewed into garments having breast receiving cups to hold the cups in the desired shape. Such stays are necessarily quite rigid so that they do not straighten out as the garment is fastened about the wearer or when the wearer moves in a way tending to flatten the breasts. In spite of the discomfort associated with this rigidity, stays have been rather widely used. The garment industry has expended large sums to make these garments more comfortable but has failed in every previous effort to make an effective garment stay which is supple enough to avoid discomfort. Stays as heretofore manufactured, if made sufficiently supple to be comfortable to the wearer, lack shape retention and also tend to be too easily permanently deformed.

It is therefore the general purpose of the present invention to provide an improved arcuate garment stay formed of a reinforced resinous material which is sufficiently rigid in the radial direction to produce the required support for the bust and yet supple in the axial fore and aft direction so that it does not cause discomfort. That is, the stay should have sufficient rigidity to resist straightening which would permit flattening of the breast, but should be supple enough in the axial direction such that it will easily conform to the contour of the body without uncomfortable pressure. Preferably, the stay should resist corrosion to permit it to be sewn permanently in place in the garment.

A further object is the provision of a comfortable garment including a pair of breast supporting and defining cups which are provided with stays which hold the shape of the cups.

These and further objects of the present invention will become more apparent as the following description proceeds, and the accompanying drawings are referred to in which:

FIGURE 1 is a schematic view showing the method of the present invention;

FIGURE 2 is a greatly enlarged fragmentary cross-sectional view taken along line 2—2 of FIGURE 1;

FIGURE 3 is an elevation view of a stay formed in accordance with the present invention; and

FIGURE 4 is a perspective view of a brassiere fitted with a pair of the stays of FIGURE 3.

Referring first to FIGURE 1, a mandrel **5**, generally cylindrical shaped in horizontal section, and of any workable length is adapted to be secured at its opposite ends to the face plate and the tail stock of a lathe (no parts of which are shown). The lathe carriage supports a roll of a reinforced resinous strip material **9** and a set of tensioning rolls **6**. Sufficient braking is applied to the supply roll to furnish traction to the tensioning rolls **6**.

The strip material **9** may consist of roving of nonwoven, lineally-aligned, essentially continuous, fine, high-tensile filaments, e.g., glass filaments, impregnated with a fusible thermosetting resin composition.

The mandrel **5** is formed with a deep narrow uniform helical groove **8** in the peripheral surface thereof. As the mandrel **5** is rotated in the direction of the arrow **7**,

the lathe carriage is moved by a precise lead control in accordance with the pitch of the helical groove to wind the strip material under moderate tension upon the mandrel **5**.

The groove **8** is illustrated in FIGURE 2 and as shown is formed such that the depth of the groove is at least 5 times greater than the median width thereof which may be 0.024 inch. The walls forming the groove in the mandrel **5** diverge slightly from the base of the groove toward the peripheral surface of said mandrel and are rounded at the surface to allow the strip material to be guided into said groove **8** during winding.

As above mentioned, the mandrel **5** is generally cylindrical shaped having a constant cross-section and is formed of a single piece of metal having two semi-cylindrical portions **10** and **10***a* which are joined by flat side surface portions **11** and **11***a*. An axially-extending slot **12** is formed at the juncture of the flat portion **11** with the cylindrical portion **10**. A similar slot **12***a* is formed at the juncture of the flat surface portion **11***a* with the cylindrical portion **10***a* in a position substantially diametrically opposed with respect to the slot **12**. The depth of the slots **12** and **12***a* is slightly greater than the depth of the helical groove **8**.

The strip material **9** is wound into the helical groove **8** to fill said groove to a depth at least 5 times the width thereof. After the winding, the mandrel **5** and the wound strip material are subjected to heat, either by placing the mandrel in an oven or, when using a hollow mandrel, by passing a heated fluid through the core thereof to heat the mandrel to a temperature and for a period of time sufficient to cure the resin composition. The reinforced resin helix formed upon the mandrel **5** is then cut or sliced by drawing a suitable cutting means through the slots **12** and **12***a* to yield a pair of stays **15** from each convolution of the resin helix. The stays **15** are then removed from the mandrel **5**.

FIGURE 3 illustrates one of the stays **15** formed by the amove described method. As shown, the stay includes a semi-circular portion **15***a* and a tangential end portion **15***b*. The stay **15** has a ratio of radial width to axial thickness within the approximate range of 5–10 to 1. A stay having this size and configuration provides a strong spring-like stay which has a substantially greater degree of axial flexibility than radial flexibility.

A stay **15** of the type shown provides the correct radial support for the breast and the proper resiliency and flexibility in the axial direction so that there is no undue pressure against the body of the wearer. In use, the stay **15** forms a frame for the cups or pockets **16** and **17** of a brassiere **18**, as illustrated in FIGURE 4. While the present invention is not concerned with the general construction of the brassiere, the pockets **16** and **17** are illustrated as composed of inner and outer facings, for example an inner facing **19** and an outer facing **20**, which are shaped to give the desired bust contour. The facings are stitched together to enclose the stays **15** between the inner and outer facings and to retain them along the lower marginal portion of each breast pocket. Alternatively, in the pockets are formed of a single sheet of material, the material may have inturned peripheral edges which are stitched together to form a passage for receiving and retaining the stay **15** in a position around the lower margin of the breast pocket.

As noted in FIGURE 4, the end portions **15***b*, of each of the stays **15** providing a frame for the pockets **16** and **17**, are positioned adjacent opposite sides of the brassiere adjacent one end of each of the bands **21** and **22**. This end portion **15***b* provides additional support. The stays **15** are thus positioned to provide a curved frame which resists stresses tending to flatten the pockets **16** and **17**, but are sufficiently resilient in the axial direction such that

they conform to the contour of the body of the wearer and allow sufficient flexibility without causing undue pressure.

By way of example, the stay **15** has been formed by winding two 60-end glass rovings (ECG 140's vinyl silane size) preimpregnated to 18% resin content by weight with a resin composition consisting essentially of 100 parts by weight epoxy resin and 3 parts BF_3-amine complex as the curing agent. After the mandrel was provided with suitable mold release, it was wound with this prepreg roving and then placed in an oven where the resinous material was cured for 4 hours at 325° F. The helix formed was cut, yielding finished stays with a ratio of radial width to axial thickness of almost 6 to 1 to provide a radial-to-axial stiffness ratio of about 35:1.

Instead of applying mold release to the mandrel prior to the winding, the mandrel may be coated with a suitably colored polyvinyl chloride suspension which after curing of the resin composition forms a decorative protective covering for the garment stays.

In an alternative manufacture of the stays, the resin-impregnated strip material may be in the form of a narrow tape formed by drawing through a heated bath of thermosetting resin composition a flat layer of glass roving (e.g., 600 ends per inch of ECB 450's) or alternatively lightly twisted glass yarn (e.g., 200 ends per inch of ECG 150 1/0, one twist per inch). The tape may be joined to a thin oriented film of polyethylene terephthalate and fed through a tape edging die carried by the lathe carriage to fold the tape longitudinally with the oriented film on the outside. This folded tape is then wound in the groove on the mandrel, and the resin composition is fused and hardened, yielding a finished reinforced resinous helix incased in a tough protective film covering.

The stays may be also fabricated using a wet winding technique instead of prepreg material. In this technique, the glass filaments may be impregnated with resin and then wrapped on the mandrel in a continuous operation. A typical resin formulation for wet winding consists of 100 parts liquid polyglycidyl epoxy resin and 40 parts polyamide curing agent.

While epoxy resin compositions are particularly preferred because of excellent adhesion of glass and excellent mechanical and age-resistant properties, other resin compositions are also suitable. For example, thermosetting polyester resins, phenol-formaldehyde resins, and melamine resins may be used. Thermoplastic resins are somewhat less preferred, except that they can often be used without mold release agents and so may find special utility for this reason. Each of these resin materials provides good resistance to salt water, permitting use of the novel garment stays in swimsuits.

While glass is an especially useful reinforcement, other essentially continuous, fine, high-tensile filaments such as nylon, rayon or oriented polyethylene terephthalate fibers may be used. Such variations in the construction of the novel garment stays which will become apparent to those skilled in the art after reading this description, are contemplated as coming within the scope of this invention.

What is claimed is:

1. An arcuate garment stay characterized by its ability to conform to the contour of the body of the wearer allowing freedom of movement without exerting undue pressure against the body of the wearer and yet retaining its arcuate shape to prevent flattening of the bust during movement, comprising non-woven, aligned, essentially continuous, fine, high-tensile filaments extending longitudinally with respect to said stay and embedded in resinous material which bonds the filaments together into a strong spring-like frame having a ratio of radial width to axial thickness within the range of about 5–10 to 1.

2. A generally semi-circular brassiere stay characterized by the feature that said stay is very supple in the axial direction and so comfortably conforms to the contour of the body of the wearer and yet retains its normal curved form to support the breast, comprising a large number of non-woven, aligned, essentially continuous, fine glass filaments extending longitudinally with respect to said stay and embedded in cured resinous material which bonds the filaments together, said stay having a ratio of radial width to axial thickness within the range of about 5–10 to 1.

3. A brassiere stays as defined in claim **2** which consists of a semi-circular portion and a tangential end portion.

4. A garment comprising breast pockets, means for supporting said pockets upon the body of a wearer and means for maintaining the lower margin of each pocket in an arcuate contour without discomfort to the wearer, said means comprising non-woven, aligned, essentially continuous, fine, high-tensile filaments embedded in hard, resinous material which bonds the filaments together into an arcuate frame having a ratio of radial width to axial thickness within the approximate range of 5–10 to 1, said frame being fitted around the lower margin of said breast pockets.

5. A brassiere comprising breast pockets, means for supporting said pockets upon the body of a wearer and a garment stay for maintaining the lower margin of each pocket in an arcuate contour without discomfort to the wearer, said stay comprising non-woven, aligned, essentially continuous, fine, high-tensile filaments embedded in cured resinous material which bonds the filaments together in a generally semi-circular shape, said stay having a ratio of radial width to axial thickness within the approximate range of 5–10 to 1, and means for retaining said stay at the lower margin of said breast pockets.

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