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STIFFENING MEANS

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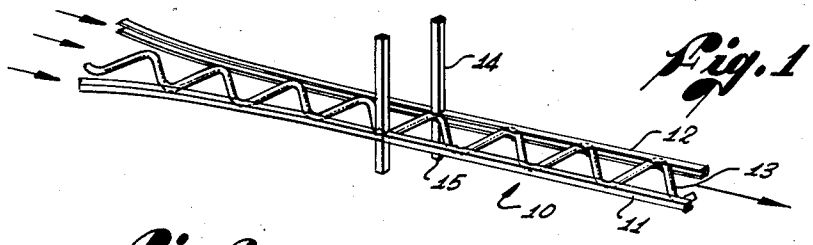
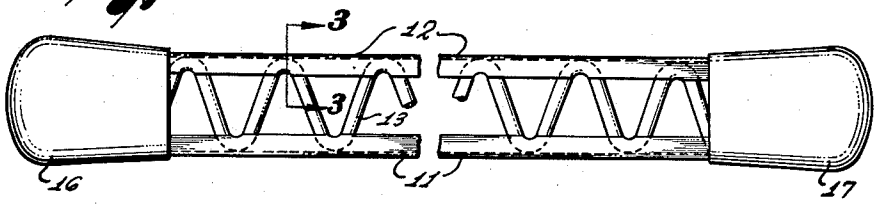


Fig. 1

Fig. 2



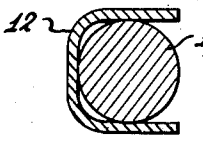


Fig. 3



Fig. 5



Fig. 6

Fig. 4

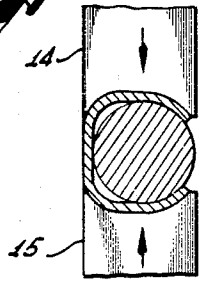


Fig. 7

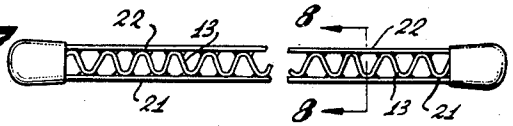


Fig. 8

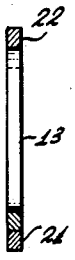


Fig. 9



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STIFFENING MEANS

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This invention relates generally to stiffening means and more particularly to such means that may be used in the construction of garments and similar articles.

For hundreds of years, women have used stiffening means in various articles of clothing, such as undergarments, to reinforce the garments, and to prevent their bending or rolling, or otherwise changing shape. For many years, such stiffening means, a prime example of which was the so-called "corset stay," were made of natural or relatively simple materials, such as whalebone. Later, spring steel strips were used, and more recently, plastic strips have been used. However, all of these various products have had disadvantages and objectionable features, a number of which are overcome by the present invention.

It is thus a major object of the present invention to provide an improved stiffening means of the type described.

Another object of the invention is to provide a stiffening means that is both light in weight and generally open in construction so that the stiffening means will not add appreciably to the weight of the article to which it is applied, and at the same time will permit a maximum circulation of air to increase the comfort of the article such as an undergarment.

It is a further object of the invention to provide a stiffening means that is inexpensive and readily fabricated in quantity, so that it will be competitive costwise with previously used stiffening means.

Still another object of the invention is to provide a stiffening means that may be made in various sizes so that the degree of stiffness may readily be controlled.

It is a still further object of the invention to provide stiffening means that is adaptable to automatic production techniques and machinery so that the product may be manufactured with a minimum of labor and supervision.

These and other objects and advantages of the invention will become apparent from the following description of preferred and modified forms thereof, and from the drawings illustrating those forms in which:

FIGURE 1 is a perspective view indicating generally a preferred form of the completed stiffener, the elements going to make up the stiffener, and the general method of fabrication of this preferred form of stiffener;

FIGURE 2 is a fragmentary plan view, to a larger scale, of a completed section of stiffener of the form shown in FIGURE 1;

FIGURE 3 is a cross-sectional view, to a still larger scale, taken on the line 3—3 of FIGURE 2, showing the various parts before they are clamped together by the method shown in FIGURE 1;

FIGURE 4 is a view similar to FIGURE 3, but showing the actual operation of clamping the parts together as it occurs in FIGURE 1;

FIGURE 5 is a fragmentary plan view of a stiffener in which the spacing member is slightly differently formed to divide the area between the two side members into generally trapezoidal, instead of triangular, spaces;

FIGURE 6 is a fragmentary plan view, similar to FIGURE 5, in which the spacing member has another form, dividing the area between the two side members into generally rectangular spaces;

FIGURE 7 is a plan view to a smaller scale, similar to

FIGURE 2, showing an optional method of construction of such a stiffener;

FIGURE 8 is a cross-sectional view, on an enlarged scale, of the stiffener shown in FIGURE 7; and

FIGURE 9 is a plan view of a stiffener that has been edge-bent.

Referring now to the drawings, and particularly to FIGURE 1 thereof, the stiffener **10** of the present invention is formed in a manner generally resembling that of a girder or similar construction element. Thus, the stiffener **10** has longitudinally extending side members **11** and **12** that are held in spaced relationship by a spacing member **13**. Preferably, the spacing member **13** takes the form of a zig-zag shaped wire or filar member that, with the side members **11** and **12**, forms a series of triangles in the completed stiffener to increase the rigidity of the assembly. It will be recognized that the shape of the spacing member **13** may be varied, as indicated, in FIGURES 5 and 6, but the generally triangular shape, shown in FIGURES 1 and 2 is preferred.

The side members **11** and **12** may take different forms, as will be seen hereinafter, and the spacing member **13** may likewise take different forms. Additionally, the method of connecting the various elements to each other may be varied, various forms having their advantages, but in the preferred form, the side members **11** and **12** take the form of channel members whose cross-sectional form is best seen in FIGURE 3.

As best seen in FIGURES 3 and 4, the depth of the channel **12** should be approximately equal to the diameter of the wire forming the spacing member **13** so that the spacer may be properly held to the side members **11** and **12**. It will be appreciated that the channel-shaped members **11** and **12** may be formed by bending a strip of lightweight sheet metal, by extruding the desired shape, or by any other suitable means. The production of such channel members presents no problem, and the dimensions of such members may be held to very close tolerances. Similarly, the diameter of the wire forming the spacing member **13** may likewise be held to very close tolerances. Under these conditions, it is a very simple matter to insure that the parts all fit together in the manner intended.

It will be appreciated that the wire forming the zig-zag spacing member **13** is essentially conventional wire which is furnished on a reel or spool. Prior to its combination with the side members **11** and **12**, the plain wire must be given the zig-zag shape shown in FIGURES 1 and 2, and this can easily be done by conventional machines that are readily available. Essentially, these machines bend the wire back and forth between two laterally displaced sets of pins or fingers, forming the desired zig-zag shape, and the dimensions of the finished zig-zag spacing member **13** can be held to very close dimensional limits. It will be appreciated, of course, that the wire used to form the spacing member **13** is preferably of the resilient material, though it usually need not be of such resilience or springiness as is usually achieved by heat-treating a wire after it is formed.

After the wire forming the spacer **13** is given its zig-zag shape, it becomes essentially a strip of material, and is then fed between the side members **11** and **12**, which are correspondingly fed at the same rate, with their open sides toward each other. The spacing member **13** is thus fed between the side members and the bights of the spacing member fit within the channel sections, as indicated in FIGURES 1 through 4. It will be understood, of course, that the side members **11** and **12** and the spacing member **13** may be continuously fed from their respective supply reels or forming equipment, so that the stiffening member **10** emerges as a continuous strip or ribbon.

To provide the necessary stiffness, and to prevent the side members **11** and **12** from separating from the spac-

ing member **13**, it is necessary to anchor the side members to the spacing member. In the form shown in FIGURES 1 through 4, this is most conveniently done by bending the arms of the channel sections **11** and **12** around the wire forming the spacing member **13**. Thus, as indicated in FIGURES 3 and 4, the wire forming the spacing member **13** fits snugly into one of the channel sections, such as side member **12**, the arms of the channel section originally being substantially parallel, as shown in FIGURE 3. However, after the side sections **11** and **12** and spacing member **13** are all properly placed together, appropriately shaped jaws or dies **14** and **15** engage the opposite sides of the channel section **12** and bend the edges of the sides around the bight of the spacing member **13**, as indicated in FIGURE 4. The spacer **13** is thus anchored to the side member **12**, and a similar clamping or crimping operation is performed at each bight of the spacing member **13** that fits within the channel or side member **11**.

The crimping action not only holds the spacing member **13** to the side members **11** and **12**, but also acts to prevent any longitudinal shifting of these members with respect to each other. As a result, a stiff but lightweight stiffening means is provided that is very resistant to bending in its plane, but which is flexible in a direction perpendicular to that plane. This, it will be recognized, is one of the characteristics of so-called "boning" or similar stiffening means.

The continuous strip of stiffener **10** is cut into desired lengths, and the ends of the cut length are protected by end pieces or caps **16** and **17**. These end pieces may be formed of any suitable plastic or metal, and serve the purpose of making it easier to insert the stiffener **10** into a pocket that has been provided for it, as well as preventing the relatively sharp edges of the stiffener from wearing through the adjacent fabric. For these reasons, the end caps **16** and **17** are preferably made smooth and rounded, and of only slightly larger size than the stiffener **10** itself.

The stiffener **10**, because of its flexibility in a direction perpendicular to its plane, is capable of conforming smoothly and easily to the contours of the body. Its stiffness or rigidity in its own plane makes it very satisfactory for supporting or stiffening in that direction. However, with proper equipment, it is possible to bend the stiffener **10** in its own plane so that it then has a curved shape, and in this new, curved, shape it will still retain its stiffness. Such a stiffner **10***a* is shown in FIGURE 9.

A strip of material that is bent in its own plane is said to be edge-bent, and one use for an edge-bent stiffener **10***a* is in the manufacture of brassieres, and particularly strapless brassieres, where a frame, including one or more edge-bent stiffeners **10***a*, must be flexible enough in a direction perpendicular to the plane of the stiffener to conform to the shape of the body, and must be sufficiently stiff in the plane of the stiffener to resist tension or other forces tending to straighten the curved section as the brassiere is tightened about the body. While it may sometimes be preferable to bend the side members **11** and **12** and the spacer member **13** before joining all three members, more often it is preferable to form the stiffener **10***a* as a straight ribbon, and then edge-bend the ribbon to the desired shape. In this way, a stiffener having a non-uniform curvature may more easily be produced.

In the process of edge-bending, the strip **10***a* is held flat, and is bent around a form of a shape and size to provide the desired final shape, making due allowance for the "spring back" of the form **10***a* when it is released. In bending the stiffener **10***a*, the inner side member, for example **11**, will normally not be compressed or shortened, but will usually remain the same length or be slightly lengthened. The outer side member, for example **12**, will be considerably lengthened, depending upon the degree of curvature and the width of the stiffener **10***a*, and the stiffening section **13** will be slightly deformed so that the triangular sections whose apices are on the inner side will be wider than those triangles whose apices are on the outer

edge. The resulting edge-bent form, while differing in appearance from the straight stiffener **10**, will nevertheless be immediately recognized as being closely related to the straight form, and the same benefits of high strength and light weight will be obtained.

In FIGURES 7 and 8, there is illustrated an alternate form of construction in which the side members, instead of being channel sections such as the sections **11** and **12** previously described, are formed of solid material such as square or round wires. Since the spacing member **13**, which may be the same as that shown in the first form, cannot fit within the side member **21** and **22**, the three elements are caused to adhere by other means, such as by welding, soldering, or by means of high strength adhesives. Welding may cause a change in the stiffness characteristics of the metal, which may require further heat treatment. However, this is not necessarily required, but depends upon the particular wire used, and its condition. Soldering is less likely to cause a change in the characteristics of the metal, and of course, the adhesive is least likely. By suitable production equipment, the side members **21** and **22** may be held to the stiffener member **13** in a continuous manufacturing process that welds, solders, or cements the three elements together. Such equipment in and of itself forms no part of the present invention, except as its function may be utilized in achieving the described results. The finished stiffener is provided with end pieces or caps **16** and **17**, as the previously described form is, and the stiffener is used in the same manner. It is likewise possible, of course, to bend the welded, soldered, or cemented form of stiffener into edge-bent shapes, as the preferred form is.

It will be appreciated that if desired, the spacing member **13** may be held to the channel-shaped side members **11** and **12** by adhering means, such as welding, soldering, or cementing, instead of, or in addition to the crimping of the side members as previously described. The cementing process may take use of any of a number of adhesives and cements effective to join metal to metal.

From the foregoing, it will be seen that there have been provided a new and improved stiffener fully capable of achieving the objects and securing the advantages heretofore set forth. While there have been shown and described preferred and optional forms of the device, the invention is not to be limited to the particular form or arrangement of parts herein described and shown, except as limited by the claims.

I claim:

1. An apparel garment stiffener which includes: a pair of longitudinally extending, laterally spaced, sheet metal side members; a single, generally longitudinally extending spacing member having a substantially zig-zag shape, contacting the separate side members alternately; means for permanently anchoring said side members and said spacing member together against relative movement where said spacing member contacts said side members; and smooth end surfaces on the stiffener to lessen wear of garment fabric and facilitate insertion of the stiffener into a fabric pocket.

2. An apparel garment stiffener which includes: a pair of longitudinally extending, laterally spaced channel-shaped side members disposed with the channel openings facing each other; a spacing member between said side members, said spacing member having a substantially zig-zag shape with the bights thereof fitting into the open channels of said side members; means for anchoring said side members and said spacing member together against relative movement where said spacing member contacts said side members; and smooth end surfaces on the stiffener to lessen wear of garment fabric and facilitate insertion of the stiffener into a fabric pocket.

3. An apparel garment stiffener which includes: a pair of longitudinally extending, laterally spaced, channel-shaped side members disposed with the channel openings facing each other; a spacing member between said side members, said spacing member having a substantially zig-

zag shape with the bights thereof fitting into the open channels of said side members; means forming a part of said channel-shaped side members and engaging the inner surface of each bight to anchor said side members and said spacing member together against relative movement thereat; and smooth end surfaces on the stiffener to lessen wear of garment fabric and facilitate insertion of the stiffener into a fabric pocket.

4. An apparel garment stiffener which includes: a pair of self-supporting longitudinally extending, laterally spaced side members; a single, generally longitudinally extending spacing member of substantially zig-zag shape having its bights contacting the separate side members alternately; means for permanently anchoring the bights of said spacing member to said side members to prevent relative movement therebetween at their points of engagement; and smooth end surfaces on the stiffener to lessen wear of garment fabric and facilitate insertion of the stiffener into a fabric pocket.

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