Aug. 26, 1969 R. C. HORTON 3,462,803

FASTENER FOR HOLDING FLEXIBLE SHEET MATERIAL
AND METHOD FOR RETAINING SUCH MATERIAL
Filed April 22, 1968

FIG. 1

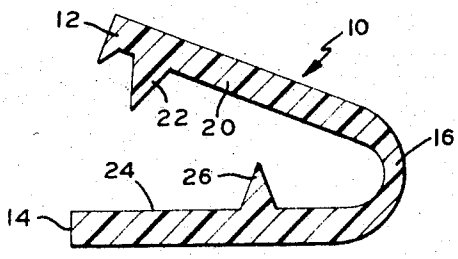


FIG. 2

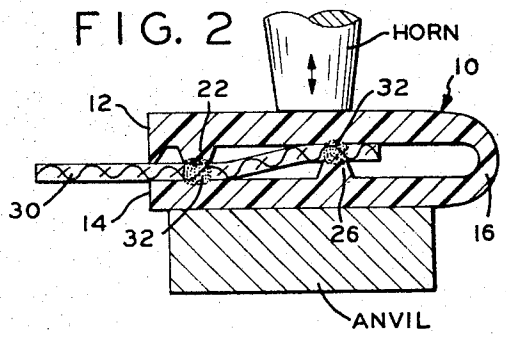


FIG. 3

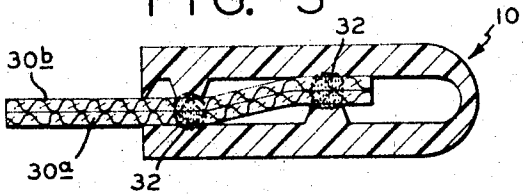


FIG. 4

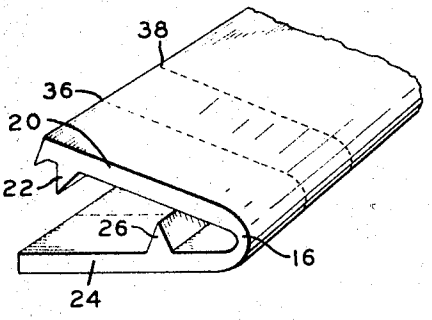


FIG. 5

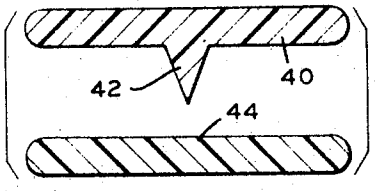


FIG. 6

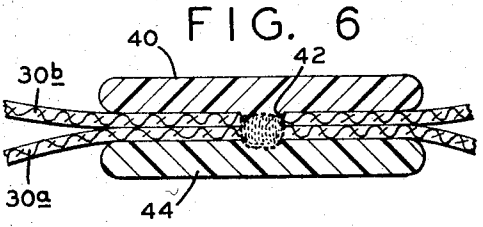


FIG. 7

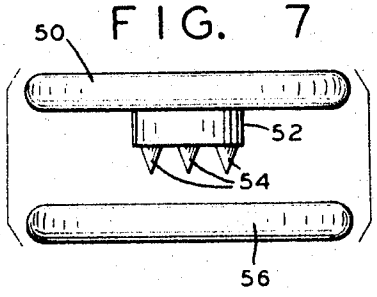
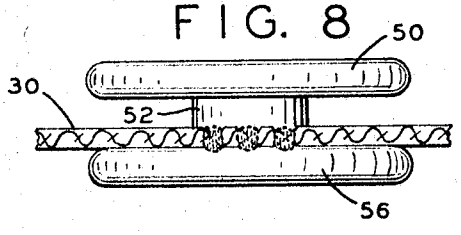


FIG. 8



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United States Patent Office 3,462,803
Patented Aug. 26, 1969

3,462,803

FASTENER FOR HOLDING FLEXIBLE SHEET MATERIAL AND METHOD FOR RETAINING SUCH MATERIAL

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Filed Apr. 22, 1968, Ser. No. 723,200
Int. Cl. A44b 21/00
U.S. Cl. 24—150 4 Claims

ABSTRACT OF THE DISCLOSURE

A thermoplastic fastening means for attachment to or retention of textile material has a projection which is adapted to at least partially pierce the material and fuses responsive to the application of sonic or ultrasonic energy.

This invention refers to a fastener for flexible sheet material and to a method for retaining such material within the fastener. More particularly, this invention refers to a fastener and a method for retaining flexible sheet material using sonic or ultrasonic energy for causing the retention of the material. Quite specifically, this invention is directed toward the construction of a fastening means and the use of energy in the sonic or ultrasonic frequency range to provide for the assembly of the fastening means and for the retention of interposed material, particularly textile material.

In the past some effort has been expended toward the use of sonic and particularly ultrasonic energy for seaming and fastening textile materials. With the advent of synthetic fibers, specifically thermoplastic fibers, the possibility of employing such energy has been greatly enhanced. It long has been felt that using ultrasonic energy for seaming and fastening materials would provide great savings in labor and, thus, reduce the cost of the final product. Generally, processing with ultrasonic energy is very fast, can be performed by persons with a minimum amount of skill, and, most importantly, the material itself is not weakened as is the case when conventional sewing is employed where a needle punctures the fabric at regular intervals. However, the use of ultrasonic energy, particularly when employed in conjunction with textile materials, requires new and unique fastening means.

One of the principal objects of this invention is, therefore, the provision of new and novel fastening means particularly suited for the use of sonic or ultrasonic energy.

Another important object of this invention is the provision of a fastener adapted to retain flexible sheet material whereby such retention is caused responsive to the application of sonic or ultrasonic energy.

A further important object of this invention is the provision of a new method for retaining flexible, sheet-like material within a fastener.

A further and other important object of this invention is the provision of a novel button for textile material which can be attached to the textile material using sonic or ultrasonic energy.

Still further and other objects of this invention will be more clearly apparent by reference to the following description when taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a vertical section through a typical embodiment of a fastener, showing the fastener in its open condition;

FIGURE 2 is a sectional view showing the closing of the fastener and the use of ultrasonic energy while the textile material is retained within the fastener;

FIGURE 3 is a view similar to FIGURE 2 illustrating the retention of two juxtaposed sheet materials;

FIGURE 4 is a perspective view of the fastener per FIGURES 1 through 3 manufactured in strip form;

FIGURE 5 is a sectional view of a typical button assembly construction;

FIGURE 6 shows the button per FIGURE 5 attached to textile material and holding two sheet materials;

FIGURE 7 depicts an alternative button construction, and

FIGURE 8 shows the button construction per FIGURE 7 attached to a textile material.

Referring now to the figures and FIGURE 1 in particular, there is shown a typical embodiment of a fastener **10** which is made of thermoplastic material. The fastener **10** may have a convenient length and width to suit the particular requirement. As shown, the fastener **10** is constructed in the shape of a spread U having a first leg portion **12** and a second leg portion **14**, both leg portions being joined at a base portion **16**. The base portion **16** is sufficiently thin to exhibit flexibility which permits the leg **12** to be moved toward the leg **14** for closing the gap between both leg portions. The leg **12** has an inner surface **20** which is provided with an upstanding projection **22** and, in a similar manner, the leg **14** has an inner surface **24** which is provided with an upstanding projection **26**. Both projections **22** and **26** are shaped to at least partially pierce material disposed in the gap when the legs **12** and **14** are brought toward one another. It will be apparent that while two projections **22** and **26** are shown, in some instances a single projection will suffice and in other cases additional projections extending from one or both surfaces may be desired.

The use of the fastener and the method of confining textile material within the fastener is shown in FIGURE 2. The fastener **10** is set on an anvil, material **30** to be retained, such as drape material, is inserted into the gap between the legs **12** and **14**, and ultrasonic energy is coupled into the projection **22** and projection **26** by means of a mechanical impedance transformer, also known as "horn," applied to the outer surface of the leg **12**. The horn forms a part of a sonic or ultrasonic energy converter which by forced contact urges the leg **12** toward the stationary leg **14** while simultaneously vibrating at a sonic or ultrasonic frequency. Responsive to the pressure applied the projections **22** and **26** at least partially pierce the material **30** and responsive to the dissipation of sonic energy caused by frictional contact, the projections soften and provide a fusion bond with the material **30** and the opposing fastener surface. The softening is achieved generally in one second or less. A small amount of dwell time is necessary after the cessation of sonic energy transfer in order to permit the molten thermoplastic material to harden. Particularly favorable results are achieved with ultrasonic frequency in the order of 16 kHz. or higher and using a welding apparatus as is available from the Branson Sonic Power Company, Danbury, Conn., Model J32. The fastening together of thermoplastic parts by means of sonic or ultrasonic energy is described also in U.S. Patent No. 3,224,916 issued to Robert S. Soloff et al., entitled "Sonic Method of Welding Thermoplastic Parts" dated Dec. 21, 1965. Additional reference may be made to "Ultrasonic Engineering" (book) by Julian R. Frederick, John Wiley & Sons, Inc., New York (1965), pg. 190, "Welding (Sealing) of Plastics."

The fused areas caused by the dissipation of sonic energy are indicated by numerals **32**.

FIGURE 3 shows a design similar to FIGURE 2 except that two juxtaposed sheet materials **30***a* and **30***b* are retained by the fastener.

FIGURE 4 illustrates that the fastener may be manufactured as a strip, for instance by an extrusion process.

The fastener may be used as a strip, for instance for hanging drapes, or the strip may be cut at periodic intervals, such as at lines **36** and **38** for providing individual fastener clips.

FIGURE 5 shows the construction of a thermoplastic button for attachment to a garment. The upper half of the button **40** is made of molded thermoplastic material and is provided at its underside with a projection **42**. The lower button portion **44**, also made of thermoplastic material, is a flat circular disk.

FIGURE 6 shows the button portions fused to each other, holding therebetween two sheets **30***a* and **30***b* of textile material. A button of this type may be attached for instance, to pillows after the pillow is stuffed with the filler material. In response to pressure applied the projection **42** will pierce the material and responsive to the application of sonic energy fuse to the lower button portion **44**. It will be apparent that the button may be provided with ornamentation, either as a part of the construction itself or added, as by an insert.

FIGURES 7 and 8 illustrate a button construction particularly suited for attachment to a garment. The upper button part **50** is of circular shape and is fitted at its underside with a circular extension **52** in order to leave space for buttoning an upper garment layer. The button **50** is provided with three projections **54**. The lower button portion again is a plain circular disk **56**, but it should be understood that it may be constructed similarly with upstanding projections.

FIGURE 8 shows the upper button portion **50** fused to the lower button portion **56** holding therebetween a garment **30**. The extension **52**, as clearly illustrated, provides space for buttoning another overlying portion of the garment such as is the case when buttoning a coat, a jacket or a blouse.

It will be apparent that the constructions shown hereinabove are merely illustrative of a multitude of designs which may be used for fasteners and buttons, all being adapted for attachment to and for retaining sheet-like textile materials, the attachment and retention being effected by the use of sonic or ultrasonic energy. It will be noted that such attachment can be achieved with a minimum of difficulty and without weakening the material. If the material is of the thermoplastic type or contains at least in part thermoplastic fibers, the material itself will fuse to the softened button projection and thereby enhance the strength of attachment. It will be noted, however, that the fusion joint is well concealed within the fastener or button and that the appearance of the final product is as pleasing as is the case with presently known sewing techniques.

What is claimed is:

1. A fastener for firmly holding flexible sheet material comprising: a generally U-shaped clip of plastic material having a flexible bight portion and substantially rigid leg portions; the inner surfaces of the leg portions each having at least one pointed projection extending therefrom towards the opposite inner surface a sufficient distance to piercingly engage sheet material inserted between the said leg portions; said projections being staggered relative to each other and being formed from thermoplastic material which is responsive to the application of sonic energy when forcibly applied thereto to simultaneously soften all the points of the projections to provide fusion bonds with the said sheet material.

2. The method for retaining flexible sheet material comprising:

interposing sheet material to be retained between two opposing thermoplastic surfaces, at least one of said surfaces having a projection adapted to at least partially pierce the interposed material;

urging said surfaces toward each other and simultaneously coupling sonic energy into said projection,

whereby said projection responsive to the dissipation of sonic energy softens and fuses with the opposing surface, causing said interposed material to be retained between said opposing surfaces.

3. The method of retaining flexible material as set forth in claim **2**, said sonic energy being in the ultrasonic frequency range.

4. The method of retaining flexible material as set forth in claim **3**, said energy being coupled into said projection by a vibrating horn which urges also said surfaces toward each other.

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DONALD A. GRIFFIN, Primary Examiner

U.S. Cl. X.R.

24—243; 156—73