Aug. 4, 1970 G. C. BRUMLIK 3,522,637

SELF-GRIPPING FASTENING FILAMENT

Filed March 6, 1968

FIG. 1

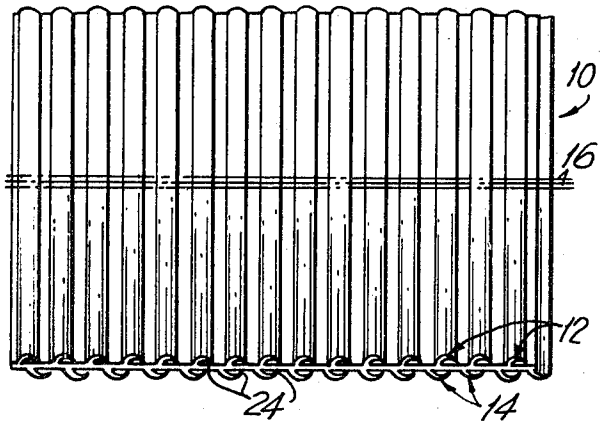


FIG. 3

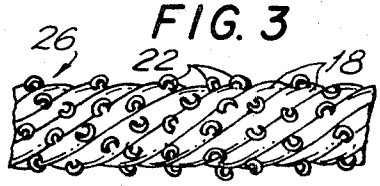


FIG. 3A

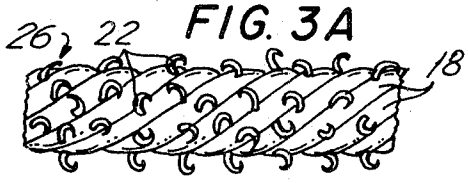


FIG. 2

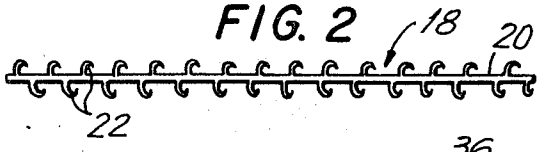


FIG. 4

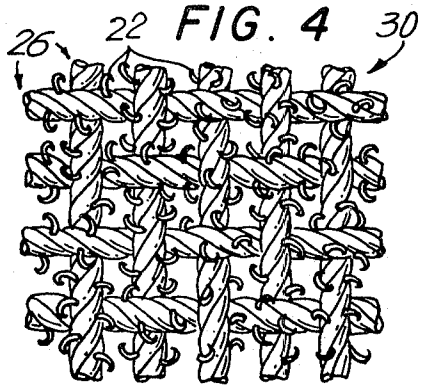


FIG. 6

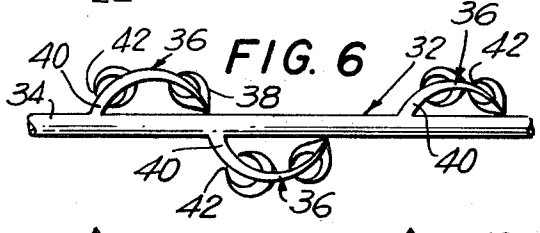


FIG. 7

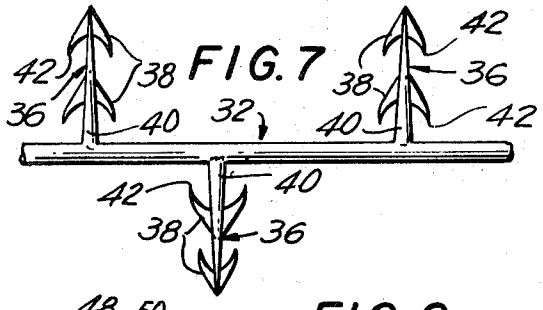


FIG. 5

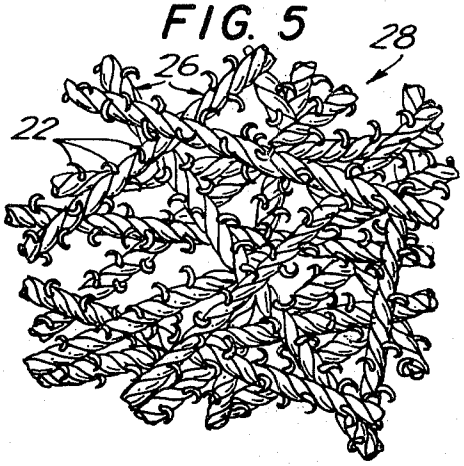


FIG. 8

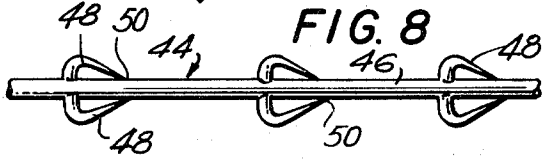
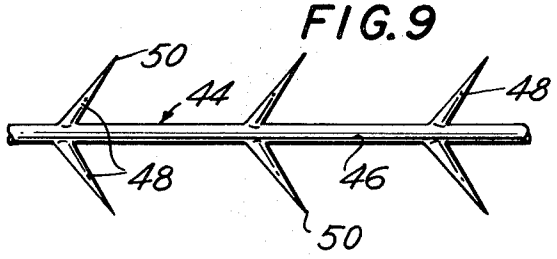


FIG. 9



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SELF-GRIPPING FASTENING FILAMENT

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U.S. Cl. 24—204 6 Claims

ABSTRACT OF THE DISCLOSURE

A self-gripping fastener device is integrally made as part of a thread or filament which is then employed either in filament form or in yarn form to form a fabric, felted surface or the like, the latter being releasably self-adhering by the application of pressure therein. The fastening filament comprises an elongated body having a series of sharp-edged hooks extending therefrom spatially staggered along the length of the filament body. The filament hooks may include pairs of sharp-edged curved barbs extending in opposite directions from the stem portion of each hook.

The present invention relates to fastening devices and in particular to a novel and improved fastening filament which is operative to releasably grip an opposing fabric or other article in a self-adhering action.

Various self-gripping fasteners, particularly suitable for releasably fastening fabrics and the like are presently available. Typical of such fasteners is a self-gripping fastener assembly presently marketed under trademark "Velcro" which is in the form of pairs of fabric strips which are suitable secured to the opposing fabrics to be fastened together. The "Velcro" fastener comprises multiple rows of small vertically-extending open plastic loops secured to the outer surface of one of the matching strips while matching small plastic hooks are secured to the outer surface of the opposite strips. Thus, when the two opposing strips are perss-contacted the hooks link with the opposing loops in an interlocking action, and when pulled apart with sufficient force, the hooks disengage from their corresponding loops.

While the "Velcro" fastener provides an effective gripping action, the cost of manufacture thereof is relatively expensive. Furthermore, the "Velcro" type grip inherently requires that both of the opposing surfaces be provided with matching strips in order to effect an interlocking grip.

It is, therefore, an object of the present invention to provide a fastener device which is integrally made as part of a thread or filament which is then employed either in filament form or in yarn form to form a fabric, felted surface or the like, the latter being self-adhering. The device is relatively inexpensive and simple to manufacture and does not require that an opposing penetrable article to be gripped be provided with any fastening means.

Another object of the present invention is to provide a fastening device of the character described in which fabric or felted surfaces formed by the device may be attached to opposed surfaces by the simple application of pressure thereon and may be released by pulling the surfaces apart with sufficient force.

A further object of the invention is the provision of filaments with self-contained fastening means, the fastening means being so constructed and arranged that they are initially retracted so that the filament may be handled in the normal manner and spun into yarn or otherwise employed for forming fabric or felted surfaces. The fastening means may then be treated to open up, forming a self-adhering surface.

In accordance with the principles of the present invention there is provided a self-gripping fastening filament

for releasably gripping an opposing article. The fastening filament is made of flexible material and comprises an elongated body having a series of sharp-edged hooks, each extending from the elongated body; with the filament hooks being spatially staggered along the length of the filament body. The filament hooks when pressed against an opposing penetrable surface of the article is operative to penetrate and lodge in said article to thereby grip the article in a self-adhering action.

Additional objects and advantages of the invention will become apparent during the course of the following specifications when taken in connection with the accompanying drawings, in which:

FIG. 1 is a perspective view of a sheet of extruded plastic having a suitable profile for forming a plurality of filaments which include integral fastening elements of a releasable fastener type in one embodiment of the present invention;

FIG. 2 is an elevational view of a filament having a plurality of integral releasable type of fastening elements, the filament being formed by chopping or cutting through the profile of the extruded sheet of FIG. 1, and then being treated to cause the filament hooks to partially open;

FIG. 3 is an enlarged elevational view of a length of yarn formed by spinning a plurality of filaments of the type shown in FIG. 2, the filament hooks being shown in closed condition;

FIG. 3A is an enlarged elevational view of a length of yarn similar to FIG. 3, but showing the yarn after treatment to cause the filament hooks to open;

FIG. 4 is a plan view of a piece of fabric formed by weaving a plurality of the yarns shown in FIG. 3, and then treating the fabric to cause the filament hooks to partially open;

FIG. 5 is a plan view of a piece of felted fabric or surface formed by felting the yarns of FIG. 3 and then treating them to cause the filament hooks to partially open;

FIG. 6 is an elevational view, on an enlarged scale, of a modified form of fastening element filament which may be formed by chopping or cutting through the profile of an extruded sheet;

FIG. 7 is an elevational view of the filament of FIG. 6 after having been treated to cause the stem portions thereof to be rendered erect and the hooks extending therefrom to open;

FIG. 8 is an elevational view, on an enlarged scale, of another modified embodiment of fastening element filament which may be formed by chopping or cutting an extruded sheet having a corresponding profile; and

FIG. 9 is an elevational view of the filament of FIG. 8 after having been treated to cause the filament hooks to open.

Referring in detail to the drawings, there is shown in FIG. 1 a sheet fo plastic **10** which is extruded in the profile shown with a pair of series of spaced flutes **12** and **14** each having a truncated and relatively sharp edge **24** extending above and below sheet **10**. As shown in FIG. 1, in a preferred form, the upper series of flutes **12** is spatially staggered with respect to the lower series of flutes **14**, across the width of sheet **10**.

Fastening elements in accordance with the principles of the present invention may be formed by chopping or cutting through a profiled sheet, such as sheet **10**, for example, in very thin sections as indicated by the cut lines **16**, to produce fastening element filaments exemplified by filament **18** shown in FIG. 2. As shown in FIG. 2, filament **18** is initially formed with the profile of extruded sheet **10**, with an leongated body **20** preferably having a width approximately equal to the thickness of sheet **10**, and a series of inwardly curved hooks **22** corresponding to flutes **12** and **14**. These hooks **22**

may be transformed from their closed condition as shown by the profile of sheet **10** in FIG. 1 to the partially open condition as shown in FIG. 2 when subjected to heat, mechanical, or chemical treatment. The degree to which the hooks are opened may be varied by selective control of the heat, mechanical, or chemical treatment to which the hooks are subjected. It is understood that filament **18** is of the usual filament-like thickness, so that stems **20** as well as opened hooks **22** are relatively flexible, whereby a plurality of filaments **18** may be easily spun together to form a yarn to be subsequently interwoven, or felted together as hereinafter described.

With the hooks **22** in closed conditions, the filaments **18** may be spun together to form a yarn **26** (FIG. 3) which may thereafter be subjected to heat mechanical or chemical treatment to cause hooks **22** to open, as shown in FIG. 3A. The yarn **26** may serve various purposes. For example, a single length of the yarn may be woven into regular fabric and its hooks opened to provide a zipper-type closure line in the fabric. In addition, a plurality of yarns **26** having open hooks **22**, may be matted together in a felting operation to form a felt fabric **28** having extending hooks **22**, as shown in FIG. 5, in one embodiment of the present invention. In the felting operation when yarns **26** are pressed together, the flexible hooks **22** engage contiguous yarns to form a skeined array of interlocking yarns as shown in FIG. 5.

In another embodiment of the present invention a plurality of filaments **18** with opened hooks **22** may be matted together in a felting operation causing hooks **22** to engage the bodies **20** of contiguous filaments to form a skeined array of interlocking filaments **18** (not shown) somewhat similar to the skeined array of interlocking yarns shown in FIG. 5. It is also possible to arrange a plurality of yarns or filaments with closed hooks loosely in a skeined array and then to treat them so that the hooks open up and interlock to provide a felted surface.

In yet another embodiment of the present invention, a plurality of yarns **26** with hooks **22** in the closed condition, are interwoven to form a fabric, and the fabric is then subjected to heat or chemical treatment to cause hooks **22** to open or partially open, resulting in a woven fabric **30**, as shown in FIG. 4.

The resulting fastening fabric formed by felting individual filaments **18** (not shown), by felting yarns **26** as shown in FIG. 5, or by weaving yarns **26** as shown in FIG. 4, may be suitably secured such as by stitching, by its own self-gripping action ,or by means of adhesive to one of the article surfaces to be releasably fastened. A particular advantage of the invention is that if the article is of soft or frangible nature, the fastening fabric or single strand of yarn can be attached thereto by its self-adhering action without requiring additional fastening means. If the opposed material to be releasably fastened is made of a fibrous material such as suede, plastic, foam, felt, etc., the fastening fabric of the present invention will grip the opposing material when the opposing materials are pressed together with sufficient pressure to cause the exposed hooks **22** to engage opposing fibers of the material to be fastened. If the articles to be releasably fastened are smooth or impenetrable by the fastening elements, then the fastening fabric of the present invention may be suitably secured to the opposing article surfaces, and when pressed together, the hooks **22** will engage opposing fastening fabric yarns **26** or filament stems **20** as the case may be, in addition to engaging opposing hooks **22**.

The further embodiments of the present invention as shown in FIGS. 6–9, are illustrated by way of example to demonstrate that the filaments for forming the fastening fabric of the present invention may have extending hooks of various shapes.

In the embodiment of the present invention shown in FIG. 6, filaments **32** may be formed by chopping or

cutting through an extruded sheet of plastic (not shown) having a profile or cross-section corresponding to the shape of filament **32**, in a manner similar to that described above with respect to FIGS. 1 and 2. Filament **32** comprises an elongated body **34**, having sharp edged hooks **36** extending from opposite sides thereof in staggered configuration at spaced intervals along the length of body **34**. Each of the hooks **36** has at least one pair of sharp-edged curved barbs **38** extending in opposite directions from the stem portion **40** of hook **36**, with the pointed tip **42** of each barb **38** being curved inwardly toward stem portion **40**.

As described above with respect to filaments **18** of FIG. 2, filaments **32** may be subjected to heat, mechanical or chemical treatment to cause hooks **36** and barbs **38** extending therefrom to open to the erect condition as shown in FIG. 7. Filaments **32** in the erect condition shown in FIG. 7 are particularly suitable to be felted together in a manner similar to that described above with respect to filaments **18**, to produce a felt fastening fabric somewhat similar in overall appearance to the felt fabric **28** of FIG. 5.

In other applications, filaments **32** in the closed condition of FIG. 6 may be spun together to form yarns which may be interwoven and subsequently subjected to heat or chemical treatment to cause hooks **36** and barbs **38** to open, in a manner similar to that described with respect to FIGS. 3 and 4. Similarly, filaments **32** or yarns formed thereof, may be treated to open hooks **36** and barbs **38** and then felted in the manner previously described to form a fastening fabric somewhat similar to that of FIG. 5.

In the embodiment depicted in FIG. 8 filaments exemplified by filament **44** may be formed by chopping or cutting through an extruded sheet of plastic (not shown) having a profile corresponding to the shape of filament **44**, in a manner similar to that described above. Filament **44** comprises an elongated body portion **46** having pairs of sharp-edged hooks **48** extending from opposite sides of stem **46**, with the pointed tip **50** of each hook **48** being curved inwardly toward stem **46**.

In a manner similar to that described above with respect to filaments **18** and **32**, filaments **44** may be subjected to heat or chemical treatment to cause hooks **48** to open to the erect condition shown in FIG. 9, wherein filaments **44** are particularly suitable to be felted together to form a felt fastening fabric somewhat similar to that of FIG. 5. Again, in another embodiment, filaments **44** with hooks **48** in the closed condition of FIG. 8, may be spun to form yarns similar to that shown in FIG. 3, which yarns may subsequently be interwoven and subjected to heat, mechanical or chemical treatment to cause hooks **48** to open, or the yarns may be treated to cause hooks **48** to open with filaments **44** then being felted in the manner of FIG. 5 to form a fastening fabric.

While preferred embodiments of the invention have been shown and described herein, it is obvious that numerous omissions, changes and additions may be made in such embodiments without departing from the spirit and scope of the invention.

What is claimed is:

1. A self-gripping flexible fastening filament for releasably gripping an opposing article comprising an elongated body having a series of sharp-edged hooks integral with and extending from said elongated body, said filament hooks being spatially staggered along the length of said filament body and each extending perpendicularly from said filament body and having a free end portion which curves back toward the axis of said filament body, said filament hooks when pressed against an opposing penetrable surface of said article being operative to penetrate and lodge in said article to thereby grip said article in a self-adhering action.

2. A self-gripping fastening filament according to claim **1** wherein each of said hooks includes sharp-edged curved barbs extending therefrom.

3. A self-gripping fastening fabric for releasably gripping an opposing article comprising a plurality of flexible filaments, each of said filaments comprising an elongated body having a series of sharp-edged hooks integral with and extending from said elongated body, said filament hooks being spatially staggered along the length of said filament body and each extending perpendicularly from said filament body and having a free end portion which curves back toward the axis of said filament body, whereby when said fastening fabric is pressed against an opposing penetrable surface of said article, said filament hooks are operative to penetrate and lodge in said article to thereby grip said article in a self-adhering action.

4. A self-gripping fastening fabric according to claim 3 wherein said fabric is formed by weaving yarns formed by said filaments.

5. A self-gripping fastening fabric according to claim 3 wherein said fabric is formed by felting yarns formed by said filaments.

6. A self-gripping fastening fabric according to claim 3 wherein said fabric is formed by felting said filament.

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BERNARD A. GELAK, Primary Examiner

U.S. Cl. X.R.

24—73, 87; 57—140