United States Patent [19]

Brumlik

[11] **3,710,425**

[45] **Jan. 16, 1973**

[54] **GRIPPING FASTENING SURFACE**

[76] Inventor: **George C. Brumlik,** 154 Upper Mountain Avenue, Montclair, N.J. 07042

[22] Filed: **Sept. 11, 1969**

[21] Appl. No.: **857,075**

[52] **U.S. Cl.** **24/204,** 24/86, 85/11, 85/29

[51] **Int. Cl.** **A44b 17/00**

[58] **Field of Search** 24/204; 85/29, 11, 28; 248/71

[56] **References Cited**

UNITED STATES PATENTS

911,877	2/1909	Iwan	248/71
1,914,256	6/1933	Holmes	248/71
2,106,260	1/1938	Thumm	85/11
2,314,481	3/1943	Crooks	85/29
2,496,820	2/1950	Smith	24/204
3,546,754	12/1970	Erb	24/204
920,808	5/1909	Alcott	85/21 UX
2,806,476	9/1957	Thompson	24/204 X
3,124,894	3/1964	Via	24/204 UX
3,130,111	4/1964	Izumi	24/204 X
3,192,589	7/1965	Pearson	24/204
3,280,241	10/1966	Scragg	161/179 X
3,405,430	10/1968	Sidelman	24/204

FOREIGN PATENTS OR APPLICATIONS

251,013	4/1926	Great Britain	248/71

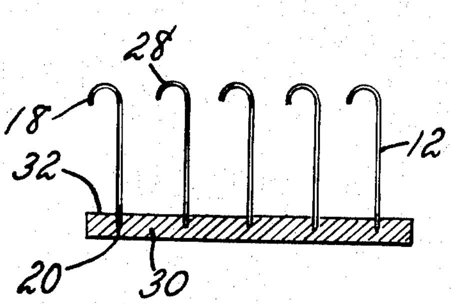
Primary Examiner—Bernard A. Gelak

Attorney—Edward F. Levy

[57] **ABSTRACT**

In making a self-gripping fastening surface of the type in which two articles are capable of gripping one another with a self-adhering action but which are releasable upon being forcibly pulled apart and separated, a plurality of elongated filament-like elements or fibrils are cut from a sheet of flexible material and mounted in upstanding position on at least one of the articles to be attached. The free ends of the mounted fibrils are subjected to a treatment, for example by applying a source of heat thereto, capable of causing each of said free ends to bend and curl back on itself to form a terminal hook thereon, whereby when two like articles are pressed together, the hooks on one article will grip the hooks on the other article and vice versa to cause the two articles to become tightly fastened to one another, or the hooks on one article are caused to penetrate and grip the surface of a frangible article.

4 Claims, 7 Drawing Figures



PATENTED JAN 16 1973 3,710,425

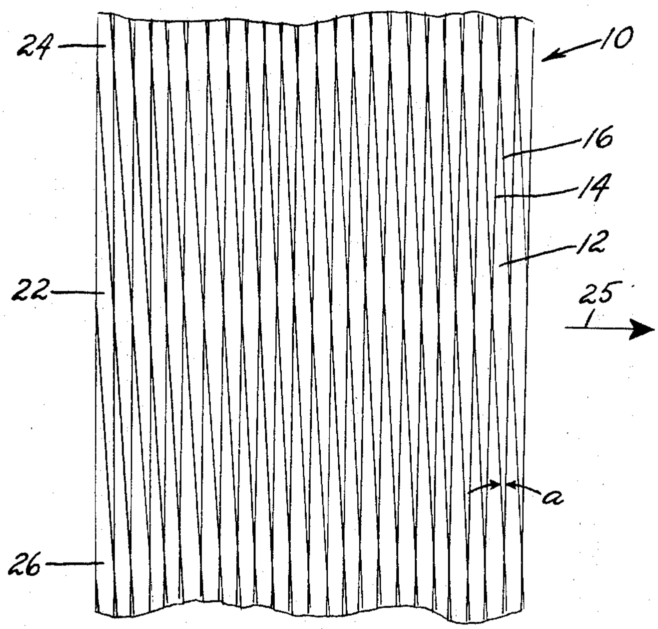


Fig.1

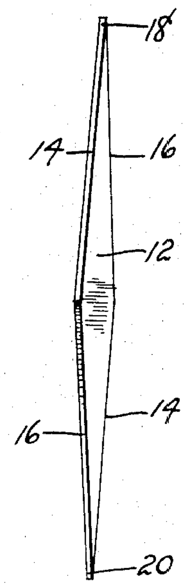


Fig.2

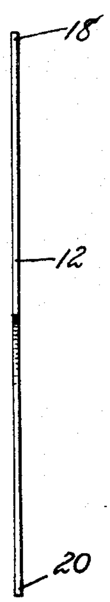


Fig.3

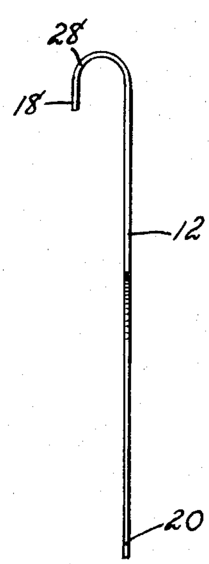


Fig.4

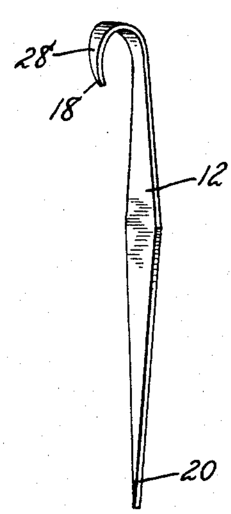


Fig.5

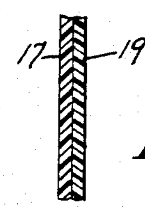
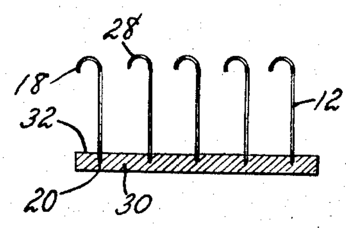


Fig.7

Fig.6



INVENTOR.
GEORGE C. BRUMLIK
BY
Edward F. Levy
ATTORNEY

GRIPPING FASTENING SURFACE

BACKGROUND OF THE INVENTION

The present invention relates to a self-gripping fastening device attachable to one surface and capable of gripping an opposed surface in a self-adhering action for releasably fastening said surfaces to one another.

A self-gripping fastening assembly is presently marketed under the trademark "Velcro" and is employed for releasably fastening fabrics or other articles to each other. Such fastening assembly is commercially provided in the form of pairs of fabric strips which are sewn or otherwise secured to the opposed surfaces of the fabrics or other articles to be attached to each other. The outer surface of one of the strips is covered with rows of upstanding, relatively small, closed loops while the outer surface of the other strip is provided with rows of upstanding fiber-like elements having their ends formed in the shape of hooks. When the two surfaces are pressed together, the hooks on one strip engage and grip the loops on the opposite strip so that the strip surfaces grip one another and the attached fabric or articles are releasably secured to each other.

While such conventional fastening assemblies provide convenient and effective gripping action, they are subject to the disadvantage of being relatively expensive since the formation of the loops and hooks and the mounting thereof on the fabric strips involve costly manufacturing operations. Since the fastening assembly is made up of two different elements, one in the form of closed loops and the other in the form of hooks, it will be appreciated that different manufacturing procedures are required for each of the two different types of elements. Further, since two different elements make up a mating assembly, problems could arise in attempting to replace one part of an assembly made by one manufacturer, for example a part having an adhering strip made up of hooks, with a similar part made by a different manufacturer who might ordinarily supply the desired part with an adhering strip made up of closed loops. It will be apparent that two parts made up of closed loops will not adhere to one another. Thus, it will be appreciated that it is desirable to provide a fastening assembly which is made of two like parts, thereby avoiding the requirement of having to manufacture two different types of fastener elements and avoiding problems associated with insuring that two different types of mating elements are included on the two parts to be attached.

Accordingly, an object of the present invention is to provide a novel and improved method of making a self-gripping fastening assembly which involves an inexpensive manufacturing operation and which is adaptable to present day mass production techniques.

A further object is to provide a method of making a fastening assembly which utilizes relatively inexpensive filament-like elements which are readily cut from a sheet of plastic material and which are adapted to be secured to an article in an upright fashion so that the free ends of the elements may be treated, for example by the application of heat, to form hooks thereon, whereby said article is adapted to self-adhere to another like article.

Additional objects and advantages if the invention will become apparent during the course of the following specification when taken in connection with the accompanying drawings.

SUMMARY OF THE INVENTION

A method of making a self-gripping fastening assembly for releasably attaching one article to another comprises initially providing a sheet of flexible material and cutting the sheet into a plurality of elongated filament-like elements or fibrils. A plurality of these fibrils are mounted in an upstanding position on at least one of the articles to be attached with the fibrils projecting substantially perpendicularly from the article. After the fibrils are mounted, their free ends are subjected to a treatment, for examply by applying a source of heat thereto, capable of causing each free end to bend and curl back on itself to form a terminal hook thereon, whereby when the two articles are pressed together, the hooks on one article will grip the other article. To effect formation of the hooks, the sheet of plastic may be provided with different coefficients of expansions on opposite sides thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a partial plan view of a sheet of plastic material showing vertical and diagonal cutlines by which small fibrils are cut from the plastic sheet.

FIG. **2** is a perspective view of one of the fibrils cut from the plastic sheet shown in FIG. **1**.

FIG. **3** is an elevational view of the fibril shown in FIG. **2**.

FIG. **4** is an elevational view of the fibril after the end has been treated so as to form a hook thereon.

FIG. **5** is a perspective view of the fibril shown in FIG. **4**.

FIG. **6** is an elevational view showing a plurality of fibrils mounted on the surface of an article.

FIG. **7** is a fragmentary, enlarged sectional view of a sheet of laminated plastic from which the fibrils may be made.

DETAILED DESCRIPTION

Referring to the drawing, FIG. **1** shows a section of a sheet of plastic material **10** from which a plurality of small filaments or fibrils **12** are adapted to be cut. Each fibril **12** has the configuration of a narrow and elongated parallelogram appearing somewhat diamond shaped as best shown in FIG. **2**. The diamond shaped fibrils **12** are obtained from the plastic sheet **10** by cutting the latter along two sets of parallel cut lines disposed at an acute angle relative to one another. In FIG. **1**, one set of equally spaced, parallel cut lines **14** are vertically disposed and another set of equally spaced, diagonal parallel cut lines **16** are inclined at an acute angle *a* relative to the vertical cut lines **14**. The two sets of cut lines **14** and **16** intersect one another to form the aforementioned fibrils **12**, the angle *a* between the two sets of cut lines **14** and **16** being selected so as to produce elongated fibrils **12** having pointed ends **18** and **20**. Although only a fragmentary section of a plastic sheet **10** is shown in FIG. **1**, it will be appreciated that the sheet **10** may be much wider, in a vertical direction as viewed in FIG. **1**, so that any number of rows of fibrils **12** may be formed merely by continuing both sets of cut lines **14**, **16** linearly in one or both directions. Thus, FIG. **1** shows one horizontal row **22** and the top and lower halfs of a top and lower horizontal row **24** and **26** respectively of fibrils **12**. It will be apparent that common cut lines **14**, **16** separate adjacent fibrils **12** both in a horizontal and vertical direction so that there is no waste of plastic material between adjacent fibrils **12** as they are cut from the plastic sheet **10**.

The plastic sheet **10** may be formed by extrusion into a continuous web. Preferably, the cut lines **14** are disposed generally parallel to the general direction at which the plastic sheet or web exits from the extruder die. Thus in FIG. **1**, the illustrated fragmentary section **1** of plastic sheet **10** may be part of a continuous web of a predetermined width in which the web exits from the extruder die in a direction running from top to bottom perpendicular to the arrow **25**.

It is desirable that the cut lines **14, 16** be disposed generally parallel to the longitudinal axis of the plastic web as described above so that the molecules of the plastic material will be most favorably aligned to achieve the highest degree of resiliency along the longitudinal axis of the fibril **12** for reasons which will become apparent. In this regard, it is observed that the plastic material selected is of the type having long linear molecules which can readily form fibers and that as such plastic is extruded, the longitudinal axes of the molecules will be oriented in a particular direction relative to the general direction of extrusion flow. In the illustrated embodiment, the molecules will be oriented with their longitudinal axes disposed transversely or generally perpendicular to the direction of arrow **25**. The linear orientation of the molecules is such that the extruded plastic web tends to have greater resiliency in a direction parallel to the longitudinal axis of the web. Accordingly, upon cutting the fibrils **12** in the manner heretofore described, it will be seen that each fibril **12** will have a greater resiliency along its longitudinal axis, i.e., the vertical axis in FIG. **2**, than would be the case if the fibrils **12** were cut with their longitudinal axes transverse to the direction of extrusion flow.

It is desirable to have the greatest resiliency along the longitudinal axis of the fibril **12** so that when a hook **28** is ultimately formed on one longitudinal end of the fibril, as will be described, such hook **28** will tend to retain its shape and return to its hooked configuration, as shown in FIGS. **4** and **5**, after any temporary bending tending to open up the hook. It is also advantageous to have the molecules of the plastic material linearly oriented as aforesaid so as to achieve the most favorable tensile strength, elastic modulus, and other mechanical properties for the fibril **12**.

As previously indicated, the plastic is selected from that group of plastic materials having long linear molecules which can form fibers. Examples of plastic materials which meet this criteria are nylons, polyacetals, polyesters, cellulose, polyolefins, polyethers, polysulfones and polycarbonates.

As an alternate method of forming the fibrils, a single set of parallel cut lines may be made in the plastic sheet. In such a case, the fibrils would have parallel sides and a substantial constant cross section throughout their longitudinal lengths. The ends of the fibrils may be pointed as desired. Forming the fibrils in this manner would permit production of longer fibrils, thereby making them more readily adaptible for weaving to a fabric or article to which they are ultimately attached as will be explained.

In order to facilitate formation of the hook **28** on one of the pointed ends **18** or **20** of the fibril, for reasons which will be described, the two opposite surfaces of the plastic wheel **10** have different coefficients of expansion and contraction so that when one of the pointed ends of the fibril **21**, for example the pointed end **18** in the illustrated embodiment, is treated by heat, flame, chemicals, steam, hot gas jets or the like, the plastic material will curl or curve back on itself at the point of treatment to form the hook **28**.

Different coefficients of expansion or contraction on the two sides of the plastic sheet **10** may be obtained in various ways. For example, two plastic sheets **17** and **19** (FIG. **7**) of the same or different material but having different coefficients of expansion may be laminated to one another.

Another example of a procedure for obtaining the aforementioned properties in the plastic sheet would be to induce different stresses on one side by treating the latter either chemically or physically. Accordingly, one side of the plastic sheet may be exposed to a source of gas (e.g., cold air or the like) which would result in a different arrangement of molecules on the exposed surface. It will be appreciated that various other treatment procedures may be utilized on one side of the plastic sheet to cause a different arrangement of molecules in crystalline or amorphous regions or to alter the chemical nature of one surface relative to the other so as to achieve the desired difference in the coefficients of expansion or contraction on the two opposed surfaces.

Each of the fibrils **12**, upon being cut from the plastic sheet **10**, appear as shown in FIG. **2**. A large number of substantially identical fibrils can be readily obtained from a web of plastic material by cutting the latter along the cut lines **14, 16** as previously described. As apparent in FIG. **2**, each fibril is in the nature of a small filament having pointed ends **18** and **20**.

The fibrils **12** are mounted in upstanding position and in relatively thick profusion on the surface of an article to be fastened. In FIG. **6** there is shown an article **30** which may be a piece of fabric for example, and which has an upper surface **32**. The fibrils **12** are applied to the article **30** by embedding or otherwise securing one of the ends of the fibrils **12** in the article as shown in FIG. **6**. Accordingly, the fibrils **12** may be applied to the article surface **32** by flocking methods, weaving processes, tufting, knotting, or other securing methods. The application procedure is such that the fibrils **12** are mounted so that they cover the selected surface area of the article **30** in closely spaced random fashion and so that each fibril **12** stands substantially upright from the surface **32** of the article **30**. Although the aforementioned description indicated by way of example that the article **30** may be a fabric, it will be understood that the fibrils may be applied to any other material capable of supporting such fibrils by the application method employed.

After the fibrils **12** are mounted on the article **30**, as described above, the outer free ends thereof are treated to cause the latter to bend over to form the hooks **28**. It will be recalled that the opposed flat surfaces of the fibrils **12** may have different coefficients of expansion. Accordingly, it will be readily understood that subjecting the outer free ends **18** of the mounted fibrils to a source of heat, for example by passing a flame thereover, will cause each end **18** to curl or curve back on itself to form the hook **28**. The reason for this is, of course, that the applied heat causes one side of the free end **18** to expand more than the other side resulting in a physical deformation not unlike that which occurs in a bimetal strip used in a temperature measuring device. It will be appreciated that instead of applying a flame to the free ends **18** of the fibrils **12** to form the hooks **28**, heat may be applied by various other means, for example, by applying steam thereto or dipping the free ends in a heated liquid. Alternatively, the free ends **18** may be subjected to chemical treatment to effect formation of the hooks **28**. For example, the free ends of the mounted fibrils **12** may be dipped in an appropriate chemical until the desired physical deformation required to form the hook is achieved.

It is also possible to form the hooks where the fibril surfaces do not have different coefficients of expansion but are uniform. In this case, the top ends of the fibrils are softened by heat treating or the like, and the softened top ends are bent into hooks, as by applying a strong jet of air thereto.

The finished fastening assembly is thus illustrated in FIG. **6** as comprising a plurality of fastening members or fibrils **12** mounted in closely spaced relationship upon the surface **32** of the article **30** in an upstanding position substantially normal to the surface **32**. Each of the fastening elements **12** comprises a generally straight filament like body member having one end **20** embedded or otherwise secured in the article **30** and its other free end terminating in a hook **28** having a free end generally depending back toward the surface **32** of the article **30**.

The surface **32** of the article **30** may now be pressed into engagement with the surface of another like article or with the surface of a frangible article, and the two articles will releasably adhere to one another. When two like articles are pressed together, the hooks **28** of one article will grip the hooks of the opposed article and vice versa so that the combined gripping action of the multitude of hooks will cause the articles to become tightly fastened to each other until they are forcibly pulled apart or separated. The surface of article **30** can also be made to adhere to the surface of a frangible article which can be penetrated by the hooks **28**. Frangible surfaces which can be engaged and gripped by said hooks are felt, woven and non-woven fabric paper, leather, hair, fur, etc.

In this regard, it will be apparent that the hooks **28** will tend to open up momentarily to release the articles when the latter are pulled apart. However, it will be recalled, the molecules of the plastic material are oriented to effect greater resiliency along the longitudinal axis of the fibrils so that this greater resiliency is utilized to facilitate return of the hooks to their normal, unopened, configuration. This, of course, facilitates continued reuse of the fastening assembly.

From the above description it will be seen that there has been described a self-gripping fastening assembly which may be inexpensively manufactured and which utilizes relatively inexpensive fibrils cut from a sheet of flexible material in a manner designed to obtain the most favorable mechanical properties attendent the use of the fibrils in the particular orientation heretofore described.

In the foregoing detailed description, the filaments are described, by way of example. as being made of plastic and cut from a plastic sheet. It is to be understood that the filaments may also be formed of other flexible materials and cut from sheets of thin metal, glass, or other suitable material.

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

What is claimed is:

1. A multi-element self-gripping fastening surface for releasably connecting together a pair of articles, said fastening surface comprising a plurality of resilient separately formed fastening elements individually secured to a surface of at least one of said articles in a two-dimensional pattern thereon, each of said fastening elements comprising an elongated flat filament secured at one end to said article surface and projecting perpendicularly from said surface of said article, and having opposed flat surfaces, each filament also having a terminal hook at the free end thereof, said hooks being bent perpendicularly to the plane of said flat surfaces, the elongated body of each of said filaments having a molecular alignment in a direction parallel to the longitudinal axis of said body, said terminal hooks on said filaments being exposed above said surface of said article to form said self-gripping fastening surface and positioned to engage and grip a confronting surface of the other of said articles when the latter is pressed against said self-gripping fastening surface.

2. A self-gripping fastening surface according to claim **1** in which the flat body of each of said filaments has sharp points at its opposite ends, one of said ends being bent to form said terminal hook with a sharp point at the end thereof.

3. a self-gripping fastening surface according to claim **1** in which the flat body of each of said filaments has the form of a narrow and elongated parallelogram defining sharp points at its opposite ends, one of said ends being bent to form said terminal hook with a sharp point at the end thereof.

4. A self-gripping fastening surface according to claim **1** in which the flat body of each of said filaments comprises a lamination of two plastic materials having different mechanical properties.

* * * * *