Dec. 24, 1963 G. DE MESTRAL 3,114,951

DEVICE FOR JOINING TWO FLEXIBLE ELEMENTS

Filed June 16, 1961

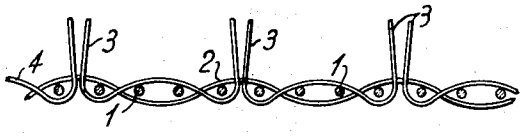



FIG. 1

FIG. 2

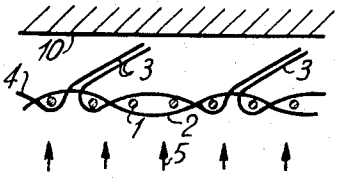



FIG. 5

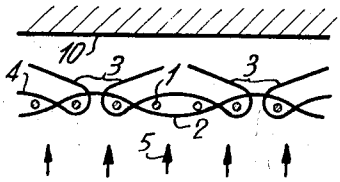



FIG. 3

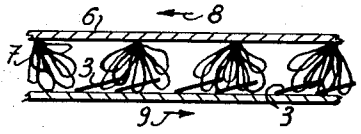



FIG. 6

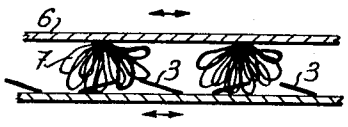



FIG. 4

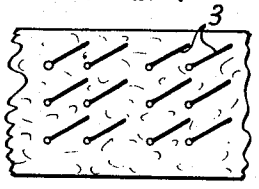
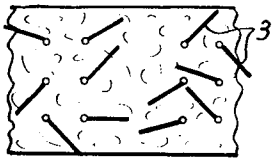



FIG. 7



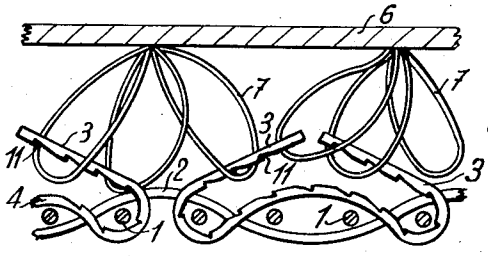




FIG. 8

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# DEVICE FOR JOINING TWO FLEXIBLE ELEMENTS

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1 Claim. (Cl. 24—204)

Swiss Patents Nos. 295,638 and 399,155 disclose a joining device employing two supports, in this case two sheets of a valvet kind of fabric, each of these sheets being provided, on at least one of its faces, with a number of hooking members. These hooking members may be formed either of loops, or of hooks obtained by cutting a leg of a loop.

It will readily be understood that by applying two sheets of this kind of fabric one against the other, their hooks and their loops engage one within the other, and the two sheets remain hooked. Their separation requires that a certain force be applied to the two sheets to withdraw them one from the other. Such hooking or joining devices are designed to be utilized in particular as closing devices for clothes, curtains or other articles, as a substitute for slide closing devices, buttons and other attachments of this kind, everywhere where a flexible, invisible and easily opened closure offers advantages.

The invention relates to a joining device of the kind described in the two above mentioned patents, but of simplified construction. The joining device according to the invention comprises two supports in the shape of strips provided, on at least one of their faces, with a number of hooking members, these supports being designed to be applied one against the other, the hooking members of one of the supports being constituted by loops. This device is characterized by the fact that the hooking members of the other support are constituted by hairs folded back towards the corresponding face of the support.

The invention also has for object a method of manufacture of this device, characterized in that, after having formed a support provided with standing up hairs, these are subjected to pressure, simultaneously to a heat treatment, so as to cause them to fold back against the corresponding face of the support and to remain fixed in the folded over position.

The accompanying drawing shows, diagrammatically and by way of example several embodiments of the joining device according to the invention.

FIG. 1 shows, very diagrammatically a section parallel to the warp through an uncut, or velvet, fabric, in the course of manufacture.

FIG. 2 shows a step of the method of manufacture of the joining device.

FIG. 3 shows, in section, how the hooking devices of the two supports of the joining device engage one within the other.

FIG. 4 is a plan view of the support showing the hairs folded back.

FIG. 5 shows a modified embodiment of the method of manufacture shown in FIG. 2.

FIG. 6 is a section showing how the hooking members of a joining device engage one within the other, according to a modified method of manufacture.

FIG. 7 is a plan view of the support with the folded back hairs, according to this modified method.

FIG. 8 is a diagrammatical view in section of another embodiment of the joining device in the hooking position.

Referring to FIG. 1, the uncut velvet kind of fabric shown is manufactured by forming a base which comprises several weft threads 1 and several warp threads 2.



The hairs 3 of this fabric are formed by means of additional warp threads 4 which have been passed over metallic bars, not shown, in the shape of spikes. Once they have been passed around these bars, the additional warp threads 4 constitute loops which are then cut so as to produce, each one, two hairs 3.

Another method of manufacture of a velvet kind of fabric, of the same kind as that shown in FIG. 1, may also be obtained by weaving simultaneously two strips each formed of a base comprising several weft threads 1 and several warp threads 2, additional warp threads being disposed, during a same weaving operation, between the two strips, so as to joint the same. Once the weaving of these two strips is finished, it is sufficient to cut the additional warp threads, disposed substantially perpendicular to their base and joining them together, in order to obtain two independent strips of fabric each provided with the hairs 3.

Preferably, these additional warp threads 4 are of artificial material, for example themoplastic material, so as to be able to preserve, after a heat treatment, the form which has been given to them. These additional warp threads may be either single-ply or multi-ply.

The following step in the method of manufacture of the joining device consists in folding back the locking elements or hairs 3 at an acute angle relative to the fabric base 1, 2. That is to say, the hairs 3 are folded back toward the related face of the fabric throughout their full length from the point of their emergence from their weft and warp threads to their tips. This operation may be carried out by applying a flat object 10 against the hairs 3 of the fabric in order to fold them back, for example all of them simultaneously to a same side, as shown in FIG. 2. In order that the hairs 3, once they have been folded back, may retain their position, the fabric may be subjected, near its base 1, 2, to a heat treatment, for example by means of infra-red ray lamps, by means of a vapour jet or a heated air jet directed as shown by the arrows 5 of FIG. 2. Thus, the foot of each of the hairs 3 assumes the shape shown in the drawing and retains the same after cooling and polymerization of the material forming the hair. In order to increase the resistance to tearing of the hairs 3 out of the fabric 1, 2, the fabric may be subjected to impregnation, for example with gluing products.

When a fabric of the kind shown in FIG. 2, having all hairs 3 folded back on the same side, is applied against a strip of fabric 6 of the uncut kind provided on one of its faces with a number of small loops 7, the hairs 3 grip the small loops 7 and offer a strong resistance to a shearing or separating force exerted in the direction of the arrows 8 and 9 (FIG. 3). In the direction which is the reverse of that of the arrows, the resistance is practically non-existent. As regards the separation of the fabric 6 from the fabric 1, 2, in a direction transversal to the latter, the necessary effort for such a separation is relatively small. Such a fabric, according to FIG. 2, is therefore only applicable under certain particular circumstances, in which the force to separate the two objects to be joined is always exerted in a definite direction and by cutting.

It is however possible to manufacture a fabric of the kind shown in FIG. 2 which offers a higher resistance to separation than the latter in all cutting directions, when it is applied against a fabric of the uncut kind, such as the fabric 6. FIG. 5 shows, as it happens, a modification of the method of manufacture of the joining device, according to which the hairs 3, instead of all being folded back in the same direction, are folded back in various directions. To that end, it is sufficient to apply a flat object, such as the object 10, against the fabric 1, 2, carrying out if necessary a reciprocating movement, so as to

produce a spreading of the hairs 3 in all directions. Thereafter, the heat treatment applied against the base of the fabric holds the hairs 3 in their folded back position. The fabric may then be subjected to an impregnation operation in order to improve the anchoring qualities of the hairs 3 in the base of the fabric 1, 2.

FIG. 6 shows how the hairs 3 of the fabric according to this modified embodiment engage in the small loops 7 of an uncut fabric 6. It will be seen from this illustration that the joining device will resist the separation of the two strips of fabric, by cutting, in whatever direction the cutting efforts are made.

FIG. 7 shows diagrammatically, in plan, how a fabric may present itself according to this embodiment.

FIG. 8 shows another embodiment of the joining device, in which the additional warp threads 4 forming the hairs 3 are constituted by threads of thermoplastic material, for example of the nylon kind, provided with notches 11 forming hooks. These additional warp threads 4 are therefore formed with these notches 11 before the weaving operation. The presence of these notches 11 on the folded back hairs 3 appreciably increases the resistance to separation of the hooking device, when these hairs 3 engage in the small loops 7 of an uncut fabric 6.

Preferably, this fabric with folded back hairs 3, according to the embodiment shown in FIG. 8, is produced as a result of the same operations already described above with reference to FIGS. 2 and 5 in particular.

Obviously, the notches 11 may have any shape, they may be serrated or in the shape of cells the edges of which would form two oppositely placed teeth.

As a modification of the embodiment according to FIG. 8, the notches 11 could be formed on the standing up hairs after the weaving operation, these standing up hairs 3 being then folded back against the base of the fabric.

In the preceding embodiments, it has always been questioned of forming the support for the hooking members by a weaving operation. However, it is obvious that one could employ as a support for the hooking members any strip or plate of plastic material, for example, on which the hooking members would have been applied afterwards by electrostatic dispersion and gluing.

The standing up hairs 3 could also be obtained as one with the plate forming the support by extrusion of plastic material through a screen during the molding of the supporting plate, so as to form the hairs 3.



I claim:

A fastening device comprising a first pliable support member, a plurality of closed loops operatively connected to said first pliable support member, and a second pliable support member, said loops extending from the plane of its support member towards said second support member, said second pliable support member being woven and including a plurality of weft threads, a plurality of warp threads and a plurality of auxiliary warp threads, said auxiliary warp threads being in the form of raised pile threads of upstanding straight-lined elements directed towards said loops operatively connected to said first pliable support member in a plurality of directions each at an acute angle to said second support member, said upstanding straight-lined elements being of thermoplastic material, and a plurality of roughened means on said upstanding straight-lined elements for ensuring the positive engagement of said elements with said loops, whereby said plurality of said upstanding straight-lined elements directed in different directions positively engage said outwardly extending loops of said first support member.


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