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(54) METHOD OF FORMING SPHERICALLY HEADED TERMINAL STRUCTURES FOR A SEPARABLE FABRIC FASTENING DEVICE

(71) I, YOSHIO CHIBA, a Japanese subject, residing at 1/8, Kita 2-chome, Tennoji-machi, Abeno-ku, Osaka City, Japan, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

THE PRESENT INVENTION relates to a method of forming spherically swollen headed terminal structures in separable fastening devices in particular of the kind in which such structures engage loops formed upon the surface of a fabric and the spherically swollen headed terminal structures are formed upon the surface of another fabric.

The conventional forming method of this kind, such as described for instance in U.S. Patent Specification 3,138,841, consists of direct heating and melting of the terminal structures of pile filaments of thermoplastic resin. The pile filaments are woven into the fabric when it is woven. However, the spherically swollen headed terminal structures made according to the said conventional art have the following defects:—

The filaments forming the pile upon the surface of the said fabric consist of extremely slender fibres having diameters about 0.1 mm—0.2 mm, and the length of the pile projecting out of the cloth is about 2 mm—3 mm. Consequently the melting of these filaments is extremely difficult. For instance, if the melting heat is excessively high, the filaments will melt and flow off, while the surface of the fabric will be damaged. If the heating is insufficient, the spherically swollen headed terminal structures will be too small or absent. Besides, when excessively heated, the filaments will be easily carbonized, while the inner structure of the filaments will be fragile and the spherically swollen headed terminal structure will be easily torn off. Also, close observation shows that the melted part will flow and coagulate in a malformed condition like a melting candle and consequently malformed spherically

headed terminal structures will be formed, their engagement with the loops of the other fabric will be too strong and, when the fabrics are separated the loops will often be broken, while the spherically swollen headed terminal structures will be damaged.

The present invention provides a method of forming spherically swollen headed terminal structures on thermoplastic pile filaments of a base fabric for use in a separable fastening device, wherein a liquid layer is present upon the surface of the base fabric during heating of the tips of the pile filaments, said heating melting the said tips to form the said structures.

The invention illustrated in the accompanying drawings, wherein:—

Figures 1 to 5 are sectional views showing how the spherically swollen headed terminal structures are gradually formed;

Figure 6 is a partially enlarged view of the two fabrics, showing the engagement of the separable fastening device;

Figure 7 is a side view of apparatus for forming the spherical swollen headed terminal structures; and

Figure 8 is the side view of alternative apparatus for forming the said structures.

The base fabric 1 provided with the said spherically swollen headed terminal structures is derived from the fabric shown in Figure 1, wherein into the very common plain fabric woven with the weft 1A and the warp 2A is woven thermoplastic filament 3A such as a polypropylene in a loop-shape to form numerous pile loops 3B. The tops of these loops 3B are cut open by a blade arranged on the edge of a loop-forming molding-bar K, which is used, as well-known, to form the said loops 3B, so that the filament 3A is cut into pile filaments 3C as shown by Figure 2. The tips of the said pile filaments are then made into spherically swollen headed terminal structures 3D by heating and melting them.

At least during the said heating, a viscous liquid film 5 made of pasty material is present over the pile surface of the base fabric 1 as shown by Figure 3. For example,

a long and narrow strip of fabric 1 may as illustrated in Figure 7 be moved over a plurality of rollers 10, its path passing through the viscous liquid 5A in a tank 11, so that the viscous liquid film 5 will be retained by surface tension among the pile filaments 3C as shown in Figure 3. Consequently, the depth of film 5 will correspond to the length of the pile filaments 3C. Further along the path of base fabric 1, the pile is heated by a heat source element M to form spherically swollen headed terminal structures on the filaments 3C. As shown by Figure 4, the moisture contained in the liquid film 5 will be gradually evaporated by the heat coming from the heat source element M and the tips of the pile filaments 3C will project from liquid film 5 to the extent of its evaporation, the projecting parts only will be melted to form the spherically swollen headed terminal structures 3D. In this way, many spherically swollen headed terminal structures 3 will be formed upon the surface of the base fabric as shown by Figure 5. The viscosity of the liquid film 5 will increase as its moisture evaporates, while the rate of evaporation volume of the moisture will gradually decrease until an almost dry pasty layer is formed on the surface of the base fabric 1. As a result, no harmful influence of heat will ever be seen upon the base fabric 1. Besides, since the pasty layer will prevent the pile filaments from melting where the legs of the filament are protected by the said pasty layer, the length or the height of the said legs will be substantially almost fixed, and all the spherically swollen headed terminal structures 3 will have substantially the same height.

The viscous liquid may for example be water containing starch to a density of 6/7 Baume, so that the pasty layer will consist essentially of starch and can be removed by washing with water. The size of the structures 3 depends on the density of the liquid, and will decrease with increasing density.

In an alternative arrangement, illustrated by Figure 8, the base fabric 1 is moved by rollers 10 over the surface of the heating liquid 5B, which can be less viscous than the heating liquid 5A, the liquid being at a temperature of e.g. 70°C-80°C and is slid over a support plate H so arranged that the tips of the pile filaments 3C project out of the heating liquid 5B by a certain fixed length and are heated from above by the heating source element M, so that the spherically swollen headed terminal structures are formed on these tips. Since the pile filaments 3C are suitably preheated by the heating liquid 5B, they can reach their melting point soon and the said spherically swollen headed terminal structure can

be quickly formed on the tips of the pile filaments. The harmful influence of the heat source element M upon the base fabric 1 can be precluded by the said liquid and, since the lower parts of the pile filaments are protected by the liquid, while their tips are gradually melted, no carbonization of these tips will ever take place. Consequently, the said lower part, i.e. the leg of the completed spherically swollen headed terminal structure 3, will remain flexible. Furthermore, since the said tips of the pile filaments 3C are supported from below by the liquid layer and are cooled by the liquid, they will never be deformed like the melted part of a candle. They will have a globular shape as required for engagement with the loops 4 of the other fabric 2 of the fastening device (Figure 6). When the two completed fabrics 1 and 2 are separated, therefore, no spherically swollen headed terminal structures will ever be broken, which is a great advantage over such structures formed by conventional methods.

WHAT I CLAIM IS:—

1. A method of forming spherically swollen headed terminal structures on thermoplastic pile filaments of a base fabric for use in a separable fastening device, wherein a liquid layer is present upon the surface of the base fabric during heating of the tips of the pile filaments, said heating melting the said tips to form the said structures.

2. A method as claimed in claim 1, in which the said base fabric is passed through a viscous liquid to form the liquid layer upon the surface of the base fabric.

3. A method as claimed in claim 2, in which the liquid is pasty.

4. A method as claimed in claim 1, in which the base fabric is passed through a heating liquid to form the liquid layer upon the surface of the base fabric.

5. A method as claimed in claim 4, in which the fabric is supported during heating by a plate so arranged that the pile filaments are partly immersed in the liquid.

6. A method of forming spherical terminal structures on pile filaments, substantially as herein described and illustrated in Figure 7 of the accompanying drawings.

7. A method of forming spherical terminal structures on pile filaments substantially as herein described and illustrated in Figure 8 of the accompanying drawings.

8. A fabric having pile filaments with spherical terminal structures formed by the method claimed in any one of claims 1 to 7.

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4. A method as claimed in claim 1, in which the base fabric is passed through a heating liquid to form the liquid layer upon the surface of the base fabric.

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