United States Patent

[11] **3,607,995**

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[54] **METHOD FOR PRODUCING TERMINAL STRUCTURES**
3 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **264/15,** 264/243, 264/322
[51] **Int. Cl.** **B29d 21/00,** B29c 23/00
[50] **Field of Search** 264/322, 324, 293, 15, 243; 24/204

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ABSTRACT: A method for forming spherically swollen headed filaments on a base fabric in a fabric fastener, comprising the steps of forming a number of projecting filaments of thermoplastic resinous material on one surface of a base fabric, soaking the base fabric in viscous liquid in a container, removing the base fabric from the liquid thereby forming a liquid layer among the projecting filaments, and then passing the base fabric along a heater, heating in such a manner that the one surface having the projecting filaments with liquid layer faces against the heater and is subjected to heat of the heater whereby exposed terminals of the filaments caused by evaporation of the liquid are melted and swelled by surface extension, thereby forming spherically swollen headed filaments on the base fabric.

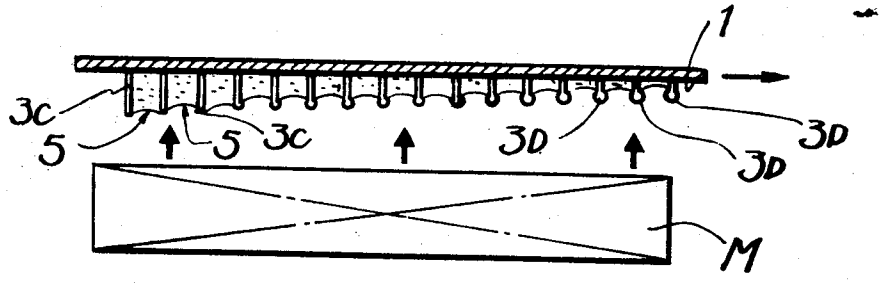


Fig. 1

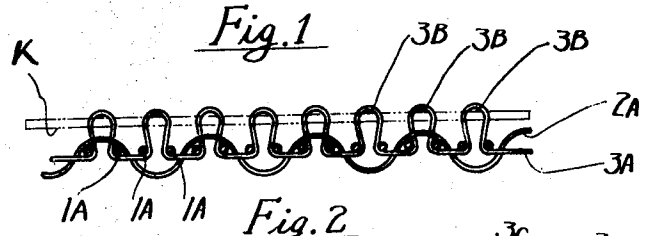


Fig. 2

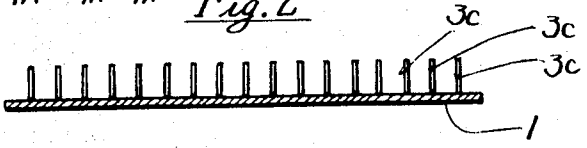


Fig. 3

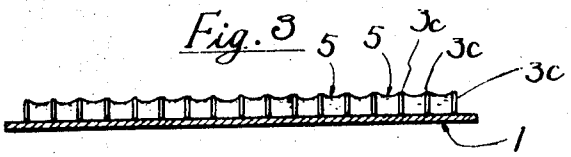


Fig. 4

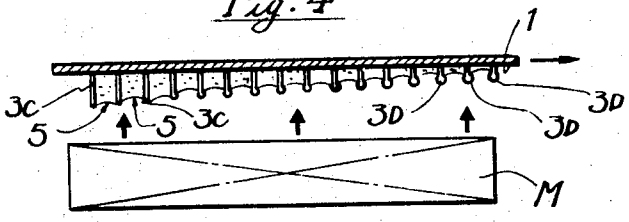


Fig. 5

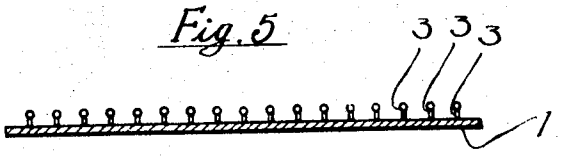


Fig. 6

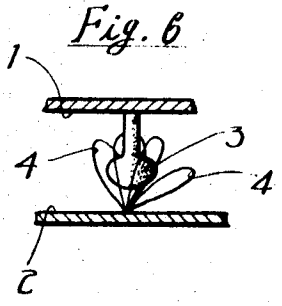


Fig. 7

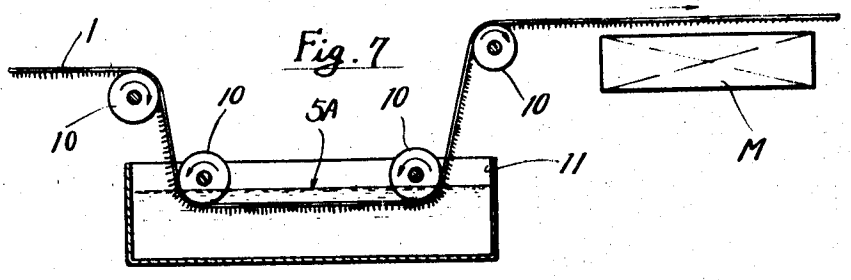
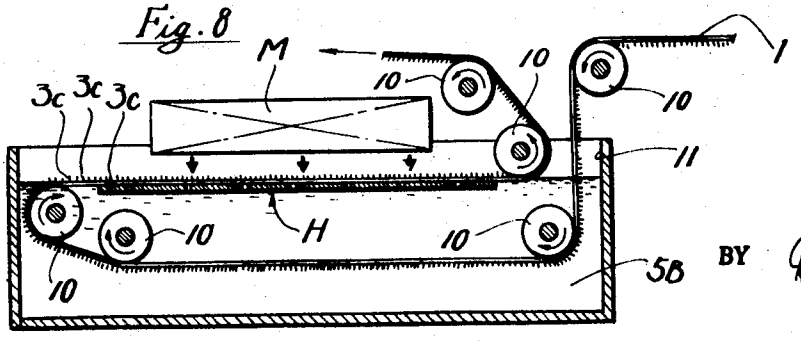


Fig. 8



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METHOD FOR PRODUCING TERMINAL STRUCTURES

The present invention relates to an improved forming method of spherically swollen headed terminal structures in a separable fastening device of cloths, and more particularly an improved forming method of spherically swollen headed terminal structures in the separable fastening fabrics engaging the loops formed upon the surface of one of two cloths and the spherically swollen headed terminal structures formed upon the surface of the other cloth.

The conventional forming method of this kind such as, for instance, U.S. Pat. No. 3,138,841, consists of a direct heating and melting of the terminal structures of the plurality of piled filaments of thermal plastic resin. These terminal structures are formed upon the surface of one of the base cloths by weaving the plurality of piled filaments into the base cloth, when it is woven. However, the spherically swollen headed terminal structures made according to the conventional art have the following defects:

The filaments formed to have piles upon the surface of the base fabric consist of the extremely slender thermal plastic fiber having diameters about 0.1 mm.–0.2 mm., and the length of the piles projecting out of the cloth is about 2 mm.–3 mm. Consequently, the melting technique 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 defects: cloth will be hurt. Reversely, when the heating is insufficient, the spherically swollen headed terminal structures which must fit for engagement, cannot be obtained. Besides, when they are 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 become easily torn off. On the other hand, if the melting conditions of the filaments are closely observed, it will become evident that, because the melted part will flow and coagulate in a malformed condition like the melting candle and consequently the malformed spherically swollen headed terminal structure will be formed, its engagement with the loops of the the other cloth becomes too strong and, when separating, the loops often will be cut off, while the spherically swollen headed terminal structures will be damaged.

It is an object of the present invention to provide an improved method of forming the spherically swollen headed terminal structure which maintains a perfect form and good structure of the filaments without damaging the engaging loops and the spherically swollen headed terminal structures, when the two cloths are separated.

With the above and other objects in view which will become apparent in the following detailed description, the present invention will be clearly understood in connection with the accompanying drawing, in which:

FIGS. 1–5, respectively, are sectional elevational views showing how the spherically swollen headed terminal structures are gradually formed, in accordance with the present invention.

FIG. 6 is a partially enlarged view of the said two cloths showing the engagement of the separable fastening device;

FIG. 7 is a side view of the apparatus for forming the spherically swollen headed terminal structures;

FIG. 8 is a side view of another apparatus.

Referring now to the drawings, a base fabric 1 provided with the spherically swollen headed terminal structures comprises a fabric shown in FIG. 1, wherein into a very common plain fabric woven with web 1A and warp 2A, a thermal plastic filament 3A such as polypropylene is woven in a loop-shape to form a plurality of loops 3B. After that, the top end of these loops 3A is cut open by the blade arranged on the tip of a loop-forming molding-bar K which is used, as commonly known, when forming the loops 3B, so that the loops 3A may be separated into the respective loops 3B, and the plurality of piled filaments will be formed on the surface of the base fabric 1 as shown in FIG. 2. The tips of the piled filaments are made into spherically swollen headed terminal structures by heating and melting them. But, according to the present invention, a viscous liquid film made of pasty material or the like is formed

over the surface of the base fabric 1, especially when heating as shown in FIG. 3. In this case, a long and narrow fabric 1 as illustrated in FIG. 7 is moved over a plurality of rollers 10, and on its way of advance, it is passed through viscous liquid filled in a tank or container 11, so that a viscous liquid film 5 is formed by surface tension among the piled filaments 3C, as shown in FIG. 3. Consequently, the viscous liquid film 5 corresponding to the length of the piled filaments 3C will be formed on the surface of the base 1. While the base fabric 1 is moved by the rollers 10, it is heated by a heat source element M to form the spherically swollen headed terminal structure. But, as shown by FIG. 4, the moisture contained in the viscous liquid film 5 which is stretched among the piled filaments 3C is gradually evaporated by the heat coming from the heat source element M and, since the tips of the piled filaments 3C will project out of the viscous liquid film 5 to the extent of its evaporation, its projecting part only will be melted soon to form the spherically swollen headed terminal structure 3D. In this way, many spherically swollen headed terminal structures 3 are formed upon the surface of the base fabric as shown by FIG. 5. In that case, however, the viscosity of the liquid film 5 increases as the evaporation of its moisture advances, while the evaporating volume of the moisture will gradually decrease until an almost dried pasty layer is formed on the surface of the base fabric 1. As a result, no harmful influence on the base fabric 1 will ever be seen. Besides, since the pasty layer prevents the piled filament from melting at the position where the leg of the said piled filament has a length corresponding to the thickness of the pasty layer, the length or the height of the leg will be practically fixed, and all spherically swollen headed terminal structures 3 will have a nearly fixed height.

Referring now to the drawing, and more particularly to FIG. 8, in the other embodiment example of the invention, in which the spherically swollen headed terminal structure is also formed by the of the liquid, the base fabric 1 is moved by rollers 10, while the base fabric 1 is pulled over the surface of the comparatively less viscous heating liquid or a similar liquid 5B, in which case, the base fabric 1 will slide over the support plate H while the tips of the piled filaments 3C project out of the heating liquid 5B by a certain fixed length, and it is heated from above by the heating source element M, so that the spherically swollen headed terminal structures are formed on these tips. Since the piled filaments 3C are suitably preheated by the heating liquid 5B, they can reach their melting point soon and the spherically swollen headed terminal structure can be quickly formed on the tips of the piled filaments. Besides, the harmful influence of the heat source element M upon the base fabric 1 can be precluded by the liquid and, since the lower parts of the piled filaments are protected by the liquid, while their tips are gradually melted, no carbonization of these tips will ever be seen. Consequently, the lower parts, i.e., the legs of the completed spherically swollen headed terminal structures 3 will be kept flexible. Furthermore, since the tips of the piled filaments 3C are supported from below by the liquid layer and are cooled by the liquid, they will never be deformed, like a melted part of a candle. They will have the globular shape which is required for engagement with the loops. When the two completed base cloths are separated, therefore, no spherically swollen headed terminal structure is ever broken, which no doubt is a great advantage over the conventional method.

While I have disclosed several embodiments of the present invention, it is to be understood that these embodiments are given by example only and not in a limiting sense.

What I claim is:

1. A method for forming spherically swollen headed filaments on a base fabric of a fabric fastener, comprising the steps of:

forming a number of projecting filaments having free ends and made of thermoplastic resinous material on one surface of a base fabric,

soaking said base fabric in viscous liquid in a container,

removing said base fabric from said container thereby forming a liquid layer on said base fabric among said projecting filaments, and

then passing said base fabric along a heater and heating same in such a manner that said one surface of said base fabric having said projecting filaments with liquid layer faces said heater and subjecting said projecting filaments and liquid layer to heat of the heater such that said liquid layer evaporates to expose free ends of said filaments and to the extent of said evaporation of said liquid layer the exposed free ends of said filaments are melted and swelled by surface extension to spherically swollen headed filaments on said base fabric.

2. The method, as set forth is claim 1, wherein said projecting filaments are made of polypropylene.

3. The method, as set forth in claim 1, wherein:

said base fabric having said projecting filaments constitutes an elongated strip.