

SPECIFICATION

Methods of manufacturing assemblages of fasteners

5 This invention relates to the manufacture of assemblages of fasteners and more particularly but not exclusively assemblages of fasteners which are dispensable by machine for
10 the tagging and attachment of articles.

Many different types of fasteners have been used for the tagging and attachment of articles. One construction is described in our Patent Specification No. 950402. These fasteners were produced by moulding an assemblage of individual fasteners, each with a thin filament interconnecting a cross bar with a head, and joined together by necks to a common runner bar. These fasteners can be dispensed using a gun as described in United States Patent Specification No. 3103666.

After the development of the fastener described in Specification No. 950402 it was discovered that these fasteners could be significantly and unexpectedly improved by being stretched as described in our Patent Specification No. 1145455 which also describes the stretching of the individual fasteners of an assemblage simultaneously. Various methods for producing stretched fasteners are described in our Patent Specifications Nos. 1115750, 1145455 and 1225841. As described in those specifications, the assemblages of fasteners are moulded with slight
35 tapers in a portion of their filaments in order to ensure that the stretching will extend substantially to the junctions of the filaments with the cross bars. While these methods are eminently suitable for easily stretchable crystalline materials, such as nylon, they are less suitable for relatively rigid crystalline materials such as polypropylene.

According to the present invention, a method of manufacturing an assemblage of individual filamentary fasteners each of which includes a filament and cross-bar at one end of the filament comprises:

- (a) moulding the assemblage as a set of connected individual fasteners from a crystalline plastics material whose molecules are orientatable by stretching;
- (b) feeding the assemblage into a stretching machine with jaws which hold the fasteners adjacent their opposite ends; and thereafter
- 55 (c) subjecting the filaments to a controlled heating effect while simultaneously separating the jaws to stretch the filaments of the individual fasteners.

The controlled heating is desirably achieved using an infra-red radiator, which has its heating effect directed to the junctions of the filaments with their end members.

Each of the filaments desirably has a taper over a portion of its length in order to ensure
65 that the stretching extends to the junctions

with the cross bars. However, the filaments may be of other configuration, including a generally cylindrical configuration.

The fasteners are of a crystalline material whose molecules are reoriented by stretching and are desirably selected from nylon, polyethylene, polypropylene and polyester and acetal resins.

The invention may be carried into practice in various ways but a number of examples will now be described with reference to the accompanying drawings, in which:

Figure 1A is a perspective view of an assemblage of fasteners;

80 Figure 1B is an enlargement of a portion of an individual fastener from the assemblage of Fig. 1A;

Figure 2A is a plan view of stretching apparatus used to manufacture the assemblage shown in Figs. 1A and 1B;

Figure 2B is a plan view of an alternative stretching apparatus;

Figure 3 is a perspective view of a heating member used in the machines shown in Figs. 90 2A and 2B;

Figures 4A and 4B are views illustrating an alternative method of manufacture;

Figure 5 is a perspective view of a further assemblage of fasteners; and

95 Figures 6A to 6C are perspective views of alternative assemblages prior to stretching.

Turning now to the drawings, Fig. 1A shows an assemblage 10 of individual fasteners 20-1 to 20-n of which each individual fastener, for example the first fastener 20-1, includes a cross bar 20c which is joined to a head 20h by a filament 20f. The fasteners 20-1 to 20-n are collectively joined to a runner bar 11 by individual necks 20n which
100 extend from the cross bars 20c.

Although the filaments 20f of the fasteners 20-1 to 20-n appear to be cylindrical over the major portion of their length beginning at the cross bars 20c, they typically display a region of slight taper. This is illustrated in the enlarged fragment of an individual fastener 20-1 shown in Fig. 1B. In the illustrative fastener 20-1 of Fig. 1B there is a minimum diameter of approximately 5.59mm at position A, located approximately 16.76mm from the junction 20j of the fastener 20-1 with the cross bar 20c. The diameter of the filament 20f gradually increases to 6.10mm at position B, then to 6.35mm at position C and
115 further to 6.60mm at position D.

The fastener assembly shown in Fig. 1A and 1B was stretched in a machine 30 of the construction shown in Fig. 2A. The machine 30 includes an outer jaw 31 and an inner jaw 32. The outer jaw has an interior region 31r for receiving one end of the product to be stretched and the inner jaw 32 has a similar interior region 32r for the other end of the product.

130 In the case of an assemblage of unstretched

fasteners, of which only the first member 20-1 is visible in Fig. 2B, the head of the fastener 20h is within the interior region 31r of the outer jaw 30 and the runner bar 11 is within the interior region 32r of the inner jaw 32.

The outer jaw 31 has a channel 31c to accommodate the portion of the filament 20f near the head 20h. A similar channel 32c is included in the inner jaw 32.

In the particular embodiment of Fig. 2A, the inner jaw 32 is stationary and the outer jaw 31 is separable away from the inner jaw by, for example, a hydraulic mechanism.

Only one-half of the machine 30 is illustrated in Fig. 2A and a similar half is used for the concurrent stretching of another set of blanks which is joined to the set within the jaws 31 and 32 by a connector 22 constituted by a gating sprue.

After the assemblages of fasteners, as joined by the de-gatable connector or sprue 22, are fed to the machine 30 with, for example, the illustrated fastener 20-1' positioned between the jaws 31 and 32, the outer jaws, for example the jaw 31, are operated to take up slack in the fastener and move from an initial position 31a to an intermediate position 31b.

In the general case stretching could proceed by moving the outer jaw 31 to the position 31f. To accelerate the stretching and to facilitate the stretching of stretch resistant crystallised plastics materials such as polypropylene, a controlled heat source 40 is used.

The controlled heat source 40 includes a holder 41 and a quartz infra-red lamp 42 which is described in detail below. The heat from the lamp 42 is initially applied when the outer jaw is in its position 31a. The heat effect continues to be applied as the jaw 31 moves to its final position 31f which results in the production of the fastener shown in Fig. 1A. After stretching is completed, the jaw 31 is relaxed to permit removal of the stretched fasteners from the machine 30.

The channel 32c of the inner jaw 32 shields the neck 20'n of the fasteners so that the gripping action of the jaw 32 is against the runner bar 11'. The shielding of the neck 20'n prevents it from being inadvertently stretched, while the gripping of the runner bar 11' prevents inadvertent damage to the cross bar 20'c.

In the modified apparatus shown in Fig. 2B, which is otherwise the same as that shown in Fig. 2A, the lamp 42 is positioned in an adjustable end mount 43 in order to direct the heating to the desired portion of the filament 20f.

The end mount 43 is adjustable in any standard way to control the direction of the infra-red radiation from the lamp 42.

A perspective view of a portion of the lamp 42 shown in Fig. 2A (or of the lamp 42

shown in Fig. 2B) is shown in Fig. 3. A quartz tube 42g encloses a resistor coil 42c which has terminal tabs 42t-1 and 42t-2. Above the coil 42c there is an internal reflector 42r which orthogonally directs the infra-red radiation. The lamp 42 may be that known as a Unit Tube Infra-Red Heater available from Hugo N. Cahnman, Associates, Inc., 125-10 Queens Boulevard, Kew Gardens, New York 11415, United States of America. It has an infra-red emission range of 2 to 5 microns and provides a temperature between 315 and 1100°C.

The temperature H of the heat source 42 and the time T during which the fasteners are exposed to the heating effect is desirably optimised so that the product of the heating effect and the temperature is below the value which would cause melting of the fasteners.

The internal reflector 42r of the heat source 42 can cause about 85% of the radiated energy to be directed at the product.

An alternative form of fastener is shown in the jaw 35 in Fig. 4A. For the individual fastener 24-1 of Fig. 4A the filament 24f is substantially cylindrical throughout the major portion of its length. Because of the heat effect H, stretching takes place as illustrated in Fig. 4B. Since the filament is of cylindrical cross section its stretched counterpart is also substantially cylindrical. However, there is a slight region of taper t near the head 24h. The cylindrical filament 24f, although more difficult to control, does not require as great a mould expense and avoids the possibility of having a region of excessive thickness which could lead to inadvertent fracture during stretching.

Fig. 5 shows an assemblage 50 of fasteners each of which is stretched and has two cylindrical filaments 51 and cross bars 50c-1 and 50c-2 at opposite ends and runner bars 11-1 and 11-2 associated with the respective cross bar. Either of the runner bars 11-1 or 11-2 can be used for feeding purposes in a gun as described in, for example, United States Patent Specification No. 3103666 mentioned above. The other runner bar 11-2 or 11-1 gives stiffness to the assemblage 50 and facilitates their being handled during stretching operations where controlled heating is employed. One of the runner bars can be removed by degating at the completion of the stretching operation. It will be apparent that an auxiliary runner bar to facilitate handling in stretcher operations which employ controlled heating can be used for other kinds of fasteners and devices.

Other kinds of blanks which can be subjected to stretching in the manner described are shown in Figs. 6A to 6C. In Fig. 6A the unstretched fastener 25 has its minimum diameter 25d a short distance from the cross bar 25c. In Fig. 6B the fastener 26 has a substantially cylindrical filament with a minimum dia-

meter in an intermediate position 26*d*. In Fig. 6C the minimum diameter 27*d* is at the junction of a decreasing taper 27*t*-1 (beginning at the cross bar 27*c*) and a forward taper 27*t*-2.

- 5 When uniform heating is applied to the filaments 25*f*, 26*f* and 27*f* in Figs. 6A to 6C stretching begins at the minimum diameter positions 25*d*, 26*d* and 27*d* and progresses in the direction of the succeeding minima. Thus in the case of Fig. 6C, since the second taper 27*t*-2 has a higher shoulder than the first taper 27*t*-1, stretching takes place to the junction with the cross bar before there is any significant stretching in the region of the forward taper 27*t*-2.

CLAIMS

1. A method of manufacturing an assemblage of individual filamentary fasteners each of which includes a filament and a cross-bar at one end of the filament, the method comprising:

- 20 (a) moulding the assemblage as a set of connected individual fasteners from a crystalline plastics material whose molecules are orientatable by stretching;
(b) feeding the assemblage into a stretching machine with jaws which hold the fasteners adjacent their opposite ends; and thereafter
30 (c) subjecting the filaments to a controlled heating effect while simultaneously separating the jaws to stretch the filaments of the individual fasteners.

- 35 2. A method as claimed in Claim 1 in which each filament includes a taper over a portion of the length.

3. A method as claimed in Claim 1 or Claim 2 in which the fasteners are connected at one end by a common member and one of the jaw grasps the common members.

4. A method as claimed in Claim 1 or Claim 2 or Claim 3 in which the fasteners are joined at opposite ends by common members and the stretching is accomplished by the jaws grasping the common members.

5. A method as claimed in any of the preceding claims in which the controlled heating is provided by infra-red radiation.

- 50 6. A method as claimed in any of the preceding claims in which the material is selected from nylon, polyethylene, polypropylene and polyester and acetal resins.

7. A method of manufacturing an assemblage of fasteners substantially as described herein with reference to the accompanying drawings.



meter in an intermediate position 26d. In Fig. 6C the minimum diameter 27d is at the junction of a decreasing taper 27t-1 (beginning at the cross bar 27c) and a forward taper 27t-2.

When uniform heating is applied to the filaments 25f, 26f and 27f in Figs. 6A to 6C stretching begins at the minimum diameter positions 25d, 26d and 27d and progresses in the direction of the succeeding minima. Thus in the case of Fig. 6C, since the second taper 27t-2 has a higher shoulder than the first taper 27t-1, stretching takes place to the junction with the cross bar before there is any significant stretching in the region of the forward taper 27t-2.

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2. A method as claimed in Claim 1 in which each filament includes a taper over a portion of the length.

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5. A method as claimed in any of the preceding claims in which the controlled heating is provided by infra-red radiation.

6. A method as claimed in any of the preceding claims in which the material is selected from nylon, polyethylene, polypropylene and polyester and acetal resins.

7. A method of manufacturing an assemblage of fasteners substantially as described herein with reference to the accompanying drawings.