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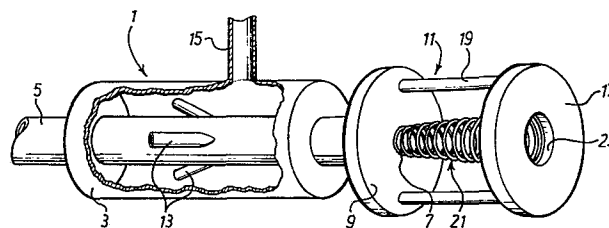
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⑤④ **Yarn crimping by means of a stuffer-box.**

⑤⑦ The present specification relates to a method and apparatus for use in the texturising of single or multi-filament thermoplastic yarns. The apparatus comprises a stuffer chamber defined by a loaded, coiled spring (21) which tapers from its inlet end (7) to its wider outlet end (23). In use the filament or filaments are fed at a constant rate by a gaseous fluid flow to the stuffer chamber which is maintained at an elevated temperature, wherein the filaments fold transversely to the longitudinal axis of the spring (21) to form a plug of filaments which is continuously disgorged from the stuffer chamber, the filaments being heat set in all different directions about said longitudinal axis.



DESCRIPTION"IMPROVEMENTS RELATING TO THE TEXTURISING OF YARN"

The present invention relates to apparatus and a method for use in the texturising of single or multi-filament yarn.

5 In particular the present invention relates to the texturising of yarn manufactured from a thermoplastic material.

Yarn manufactured from a thermoplastic material can be texturised to bulk the yarn, in a number of
10 known ways. However, the bulking of the yarn is usually only in a two-dimensional plane e.g. the yarn takes on a saw-tooth configuration. Thus the yarn does not necessarily provide a uniform bulking, i.e. texturising in all possible directions transverse to the yarn.

15 The aim of the present invention is to provide a method and apparatus for producing a yarn which is more aesthetically pleasing than prior art 2-dimensional yarns as referred to hereabove, the method and apparatus being less capital intensive than previous arrangements.

20 According to the present invention there is provided texturising apparatus for use in providing a three-dimensionally-bulked yarn, comprising a stuffer chamber to which one or more filaments of a thermoplastics material can be continuously fed, the stuffer chamber
25 being formed by a tapered spring which is fixedly secured at each end thereof and loaded, the spring being widest at its outlet end.

The apparatus of the present invention utilises a transporter for the continuous filament or filaments,
30 which connects with the narrow end of the spring, the spring being preferably tensioned between its ends. Alternatively the spring may be an open wound spring which is compressed. The transporter preferably utilises

2.

a stream of gaseous fluid to carry the filament or filaments continuously forward into the stuffer chamber formed by the tapered spring. The gaseous fluid is preferably air which is preferably dry and fed at a
5 desired substantially constant speed. The temperature of the air should be adjusted to supply the requisite additional heat required for setting the filament or filaments, the filaments having been preheated before reaching the stuffer chamber.

10 In use the filament or bundle of filaments is fed into the narrow end of the coiled spring forming the stuffer chamber, the filament or filaments being folded within the chamber due to their rate of feed e.g. 1000 m/min, and forming a plug of filament at
15 the outlet end of the spring, the temperature of the filament being sufficient to allow the filaments to set in the folded position. The folding of the filament is randomly in all directions transverse to the axis of the spring so that a three-dimensional bulking of the
20 filament is achieved. In the event that the plug does not initially form, the wider outlet end of the spring may be blocked off at slow speeds, for a short period of time to prevent the egress of yarn and cause the plug to form.

25 The initially formed plug will continue to grow and extend back towards the inlet end of the spring. As the plug grows so it covers the gaps between adjacent coils of the spring reducing the area through which the air from the transporter can escape. Thus the air
30 pressure on the plug increases tensioning and stretching the inlet end of the spring further and simultaneously closing the coils together at the outlet end so as to reduce the frictional grip of the spring coils, until the air pressure is able to overcome the frictional
35 grip of the spring coils on the plug and the bulked

3.

filaments are forced out of the spring. At this point the area through which transporter air can escape is increased so that the pressure on the plug decreases allowing the spring to contract. The process continues
5 the plug being continuously formed, so that the bulked yarn is ejected continually, the spring oscillating back and forth. This is a continuous operation with the bulked yarn merely being collected from the outlet of the stuffer chamber, it being unnecessary to draw
10 the yarn therefrom.

The maximum possible speed of operation is determined by the taper of the spring, speeds of several thousand metres/minute being possible. However, a speed of 1000 metres/minute is preferably required with
15 a minimum of 600 metres/minute.

For the yarn to be forced from the stuffer chamber the frictional grip of the spring on the plug is important and this can be rendered substantially constant for different filaments e.g. for different
20 colours of filament wherein the pigment can alter the surface friction characteristic, by the addition of a fibre lubricating agent e.g. Limanol P811 a proprietary product manufactured by Schill Scheillacher. The use of such a fibre lubricating agent provides for sub-
25 stantially uniform bulking of the yarns, this being clearly desirable.

If the speed and/or friction of the spring/filament interface, are too great then the plug within the spring will increase in size and back into the
30 transporter blocking further operation. The taper and other characteristics of the spring are therefore important for the continuous operation of the apparatus as desired. The precise action of the spring is dependent upon the taper, the diameter of the wire or

other material forming the spring, its length and pitch. Variation in these parameters will produce a variation of the effect of the spring on the filaments and they should be so chosen as to produce the optimum action
5 on the filaments.

The filament or filaments may have any desired cross-section. Thus in addition to being round, the cross-section may be delta-shaped, rectangular, triangular or polynodal or may have three or more branches forming
10 for example an X or Y configuration. Furthermore, when more than one filament is present in the yarn, filaments of different cross-sections may be used. The filaments may also be hollow.

The continuous filament or filaments may be
15 composed of any thermoplastic synthetic plastics material capable of being formed into a foldable filament and filaments of different synthetic plastics materials may be present in the yarn. Preferably the synthetic thermoplastic material is a homopolymer or copolymer of
20 polypropylene.

According to a further feature of the present invention there is provided a method of texturising yarn formed from one or more filaments of a thermoplastics material, said method comprising the steps of feeding
25 one or more continuous filaments into a stuffer chamber formed by a loaded tapered, coiled spring, which chamber is maintained at an elevated temperature, and continuously folding said filament or filaments within said chamber whereby to fill at least a portion of the length
30 of the chamber, maintaining said folded filament or filaments within said chamber for a time and at a temperature which sets the filament or filaments in the folded state, and allowing the yarn to spill out of the wider end of the tapered spring.

35 The present invention will now be further described, by way of example, with reference to the

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accompanying drawing in which one embodiment of the apparatus of the present invention is shown in partially cutaway perspective.

Referring to the drawing a transporter 1 is
5 constructed of a hollow cylindrical body 3 through which a filament inlet pipe 5 extends, one end of pipe 5 connecting with a hole 7 in circular flange 9 of texturiser 11. Within body 3 which is sealed at each end
10 to inlet pipe 5 are three angled air nozzle pipes 13 which connect with the interior of pipe 5. Thus by feeding heated air into body 3 via inlet 15, the air is passed via nozzle pipes 13 into pipe 5, the angled air jets thus formed, drawing the or each filament along inlet pipe 5 towards texturiser 11.

15 The texturiser 11 basically comprises two circular flanges 9 and 17, coaxially secured together by support rod 19. A tapered spring 21 is tensioned between flanges 9 and 17 and communicates with holes 7 and 23 in flanges 9 and 17 respectively. The tapered
20 spring has its narrower end secured to flange 9 around inlet hole 7. Alternatively an open wound spring can be substituted for tensioned spring 21, the open wound spring being loaded under compression between flanges 9 and 17.

25 In use a filament or bundle of filaments is fed from a spool or spools (not shown) mounted on a creel if desired, through appropriate nip or guide rollers (not shown) both to maintain the desired rate of feed and to control the infeed tension of the filaments.
30 Alternatively one or more bobbins of orientated yarns could serve as the feedstock, or the apparatus could draw the yarn or yarns into the texturiser. Various yarns e.g. different material and/or colour, could be fed simultaneously to the texturiser.

The filament or bundle of filaments is drawn through the transporter 1 by the air jets from nozzle pipes 13, and is fed into a stuffer chamber of texturiser 11, which is defined by tensioned tapered spring 21.

- 5 The filament or filaments are preheated and the air drawing the filaments through the transporter is also at an elevated temperature which is sufficient to supply requisite heat for just setting the filaments. The filaments, due to their speed, fold across the inside
10 of the spring in randomly orientated transverse directions and form a plug of filament. The filaments are thus compressed and heat set in the folded position. If the speed of the filaments is not sufficient to initially form the plug, the outlet of the texturiser
15 can be closed off for an initial period of time to prevent the egress of yarn and allow the plug to form. Once started, the plug continues to extend backwards along the spring covering the interstices between the coils as it goes and thus restricting the area of the
20 interstices through which the air from transporter 1 can escape. This increases the pressure on the plug and stretches the narrower inlet end of spring 21, and when this pressure reaches the level of the frictional forces holding the plug in place in the spring, part of the
25 plug is ejected as bulked yarn, from the spring 21. This increases the total area between the coils of the spring through which air from the transporter 1 can escape, reduces the pressure on the plug and allows the spring to contract - the spring stretching again as the
30 plug is formed. The spring thus oscillates back and forth as the plug is continuously formed and ejected. The diameter of the spring also oscillates as the plug is formed and ejected. Bulkied yarn is thus continuously ejected from the spring and is preferably collected via
35 a relaxation roller which allows the filaments to cool

7.

sufficiently to set the crimp so that subsequent winding tension does not pull the crimp out. The relaxation roller also acts as a reservoir to allow compensation for tension control. Due to the folding
5 of the filaments in randomly orientated directions transverse to the longitudinal axis of spring 21, a three-dimensional bulking of the filaments is achieved.

A plug of filament thus remains at all times in the spring, an equilibrium being set up between the
10 air pressure build up on the one hand, and the frictional forces between the spring coils and the plug. Critical parameters in this operation to produce desired output speeds for the bulked yarn of 1000 metres/minute with a minimum of 600 metres/minute, are the degree of
15 taper of the spring i.e. the difference between the diameter of the spring ends relative to the spring length, the nature of the spring surface, the material of the spring and the filament material.

Having selected the above parameters to provide
20 a given performance with a particular filament material, the bulking of that filament material and thus the performance of the apparatus, can be affected by changes in the nature of the filament. For example the addition of different pigments to the same basic filament
25 material can result in different bulking, the surface friction coefficients changing due to the addition of pigment. Such variations can be minimised to produce substantially constant bulking by the use of a fibre lubricant e.g. Limanol P811 manufactured by Schill
30 Scheillacher.

The invention will be further illustrated with reference to the following example:-

EXAMPLE 1.

The procedure described above was carried out
35 using a tow of polypropylene filaments and a transporter

8.

as illustrated in the drawing, with an air temperature of 165°C and at a pressure of 154 p.s.i. The tow has 120 filaments and the polypropylene had an m.f.i. of 10 and a denier per filament of 16.6. The dimensions of the tapered spring forming the texturiser were as follows:-

Inch rate = 0.22 lbs

wire diameter = 0.025"

free length = 2"

10 extended or working length = 2.5"

Spring diameter tapers uniformly during its length from 0.1875" to 0.25".

The product produced was a bulked yarn, the denier of which had increased over 20%, the bulking being three-dimensional.

15

CLAIMS

1. A texturising apparatus for use in producing a three-dimensionally bulked yarn, comprising a stuffer chamber (21) to which one or more filaments of a thermoplastics material can be continuously fed, characterised in that the stuffer chamber (21) is formed by a tapered spring (21) which is fixedly secured at each end thereof and loaded, the spring (21) being widest at its outlet end (23).

2. Apparatus as claimed in claim 1, characterised in that the spring (21) is tensioned between its ends.

3. Apparatus as claimed in claim 1, characterised in that the spring (21) is an open wound spring which is compressed.

4. Apparatus as claimed in any one of claims 1 to 3, characterised in that the tapered spring (21) is fixed between two planar flanges (9,17) which are arranged parallel to each other, support rods (19) interconnecting said flanges (9,17) and maintaining the flanges (9,17) in spaced apart relationship, the ends of the spring (21) being secured to said flanges (9,17) over coaxially aligned apertures (7,23) in said flanges (9,17).

5. Apparatus as claimed in any one of the preceding claims, characterised in that the narrower end (7) of the tapered spring (21) forming the stuffer chamber, is connected to a transporter (1) for the continuous filament or filaments.

6. Apparatus as claimed in claim 5, characterised in that the transporter (1) utilises a stream of gaseous fluid to carry the filament or filaments continuously forward.

7. Apparatus as claimed in claim 6, characterised in that the gaseous fluid is dry air fed at a

desired substantially constant speed.

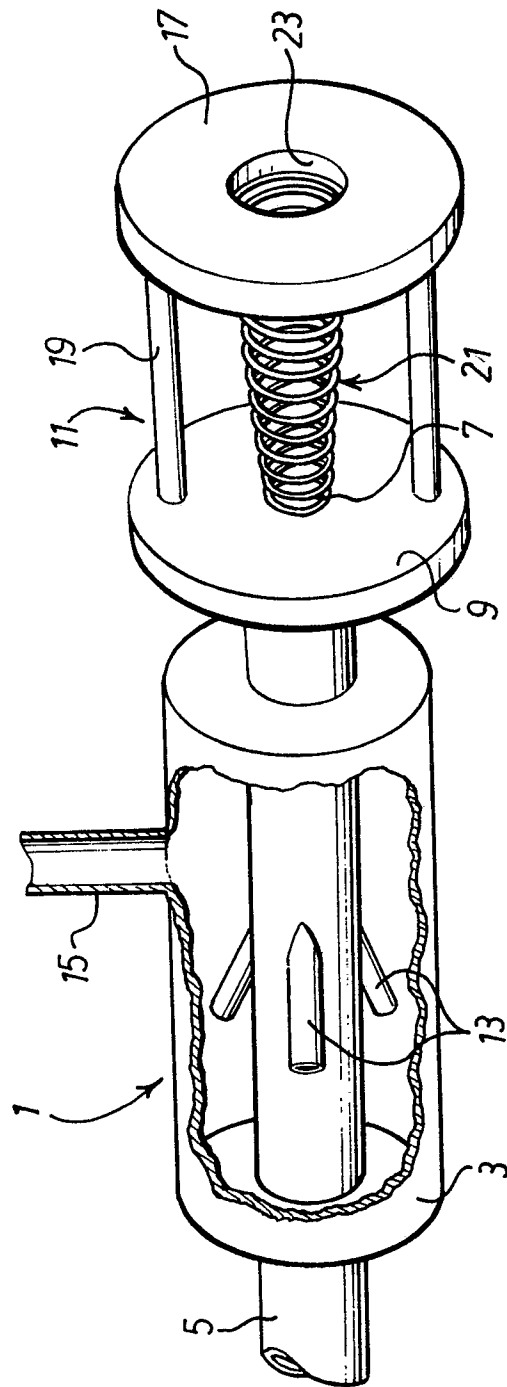
8. A method of texturising yarn formed from one or more filaments of a thermoplastic material, characterised by the steps of feeding one or more
5 continuous filaments into a stuffer chamber formed by a loaded tapered, coiled spring (21), which chamber is maintained at an elevated temperature, and continuously folding said filament or filaments within said chamber whereby to fill at least a portion of the
10 length of the chamber, maintaining said folded filament or filaments within said chamber for a period of time and at a temperature which sets the filament or filaments in the folded state, and allowing the yarn to spill out of the wider end (23) of the tapered spring
15 (21).

9. A method as claimed in claim 8, characterised in that the filament or filaments are treated with a lubricating agent before being fed to the stuffer chamber (21).

20 10. A method as claimed in claim 8 or 9, characterised in that the filament or filaments are fed to the stuffer chamber (21) by a flow of gaseous fluid.

11. A method as claimed in claim 10, characterised in that the gaseous fluid is dry air which is fed
25 at a substantially constant speed, the temperature of the air being sufficient to supply the requisite additional heat required to set the filament or filaments, the filaments having been preheated before reaching the stuffer chamber (21).

30 12. A method as claimed in any one of claims 8 to 11, characterised in that the filament or filaments are fed to the stuffer chamber (21) at 1000 metres/min.





European Patent
Office

EUROPEAN SEARCH REPORT

0049052

Application number

EP 81 30 3978

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	<u>US - A - 3 482 294</u> (RHODIACETA) * Claims 1,2,4 * --	1,6,8, 10	D 02 G 1/12
A	<u>US - A - 3 978 560</u> (TECHNISERVICE) * Claims 1,4 * --	1,6,8, 10	
A	<u>FR - A - 2 327 335</u> (BAYER) * Claims 1,9; page 3, line 28 - page 4, line 7; page 6, lines 25-27; page 5, lines 23-31 * & GB - A - 1 567 311 ----	1,6-8, 10,11	TECHNICAL FIELDS SEARCHED (Int. Cl. ³) D 02 G 1/12 1/16
			CATEGORY OF CITED DOCUMENTS X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
			&: member of the same patent family, corresponding document
☒ The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
The Hague	11-12-1981	CATTOIRE	