

The present invention relates to a method of spinning fibres and to an apparatus for spinning fibres.

It has so far not been possible to produce thermoplastics fibres intended for absorption of hydrophobic liquids at a high rate of production. This is due to the fact that the fibres are apt to fuse together when brought in contact with each other. This is not acceptable, since a fibre product having fused fibres has a lesser ability to absorb due to the fact that the surface area of the product is less than that of a fibre product free from fused fibres, i.e. a product in which the fibres are separated from each other.

The object of the present invention is to provide a simple method of spinning fibres in which fusion of the fibres is counteracted or prevented.

According to the invention there is provided a method of spinning thermoplastics fibres, consisting in the steps of:

melting a thermoplastics stock material;
extruding the melted thermoplastics material, radially outwards, through at least one rotating spinneret, to form fibres of melted thermoplastics material around the periphery of the spinneret; and

providing cooling medium moving axially with respect to and through the spinneret at a central portion of the spinneret for flowing between and cooling the fibres of melted thermoplastics material.

According to another aspect of the invention there is provided apparatus for carrying out the method, the apparatus comprising means for supplying molten thermoplastics material; a spinneret, receiving the molten thermoplastics material, for spinningly extruding fibres of the molten thermoplastics material in a radial direction, the fibres extending from the periphery of the spinneret, the spinneret having an axis of rotation and the fibres being gathered toward the axis; and

means for providing cooling medium along the axis of the spinneret, such that the cooling medium flows along the axis of rotation.

To help understanding of the invention a specific embodiment thereof, with variants, will now be described with reference to the accompanying drawings, in which:—

Figure 1 is a schematic side view of spinning apparatus in accordance with the invention,

Figure 2 is a side view of a part of the apparatus fitted with a deflector,

Figure 3 is a side view of the same part of the apparatus with a blower fan in place of the deflector,

Figure 4 is a side view of the same part of the apparatus with a guiding means for cooling medium and

Figure 5 is a side view of the same part of the apparatus with an alternative spinneret.

The spinning apparatus schematically

is journalled in two bearing blocks 3 and 4. A spinneret 5 is provided at the free end of the shaft 2 in such a way that it rotates with the shaft. The apparatus includes a container 6 for melted thermoplastics material, which is pumped by a pump 7 from the container 6 through a conduit 8 to a channel 9 which extends axially along the shaft 2 towards the spinneret 5. The channel 9 communicates with a great number of channels 10 (for example 180 rows with seven channels in each row) which extend in the spinneret 5 from the channel 9 radially outwards and end in the outer edge 11 of the spinneret 5.

The fibres are formed by pumping melted thermoplastics material 12, preferably consisting of paraffin wax and polyethylene, having the ability to absorb hydrophobic liquids, from the container 6 via the conduit 8, the channel 9 in the rotating spinneret 5. The thermoplastics material leaves the channels 10 in a liquid condition with a temperature normally amounting to 200—210°C, but due to the fact that the thermoplastics material is rapidly cooled by the ambient air, the temperature of which is considerably lower, thin thermoplastics fibres 13 are formed, which are collected at the free side 14 of the spinneret 5 in order not to adhere to the spinneret 5. To accelerate the cooling of the thermoplastic fibres 13 and to guarantee that these deviate towards the free side 14 of the spinneret 5, air streams 15 are generated and directed to flow past the spinneret 5 at the outer side thereof. These air streams 15 are generated for example by a blower fan (not shown) and are guided by guiding means 16 schematically shown on the drawings.

The thermoplastics fibres 13 form a space 17 near the spinneret 5 before they are collected and in this space 17 a vacuum is created in relation to the ambient air. Due to this vacuum, whirling air streams are formed within the space 17 and immediately inside the thermoplastics fibres, the stream being directed towards the spinneret 5. As a result of the vacuum in the space 17 and due to the direction of the air streams formed therein, the thermoplastics fibres 13 are brought together close to the spinneret 5. As long as the rate of formation of thermoplastics fibres by the spinning means 5 is low, there is only a slight vacuum and weak air streams in the space 17 and consequently the thermoplastics fibres 13 are collected at such a distance from the spinneret 5 that they have time to cool to such an extent that they will not fuse together if they contact each other. The greater the rate of formation of thermoplastics fibres the greater is the vacuum and the whirling within the space 17, and the greater is the effect on fibres 13 tending to concentrate them near to the spinneret 5. This can result in the fibres 13 fusing together since they have no time to cool sufficiently before they come into contact with each other.

To eliminate this problem in a simple way and by simple means, streams of cooling medium 18

solidifying thermoplastics fibres 13 through at least one orifice in the spinneret, two such orifices 19, 20 being shown in Figure 1. If need be similar orifices may be provided in the shaft 2 or the bearing block 4. Owing to this several effects are obtained, viz. cooling of the fibre 13 "from inside" the space 17 in addition to the cooling from the air stream 15, a "separating" effect on the fibres 13 in such a way that they are not concentrated close to the spinneret 5 even if fibres are formed at a high rate. Instead, the cooling and the separating effects can be increased by increasing the speed of the cooling medium streams 18 when increasing the rate of formation of the thermoplastic fibres. This means that the capacity of given apparatus for producing the fibres can be substantially increased.

When required, the cooling medium streams 18 can be increased, decreased or guided in an appropriate way. The increase and the decrease are effected by simply varying the speed of the cooling medium blower fan, and the guiding step is effected, for example by guiding the streams 18 outwardly towards the fibres 13 closest to the spinneret 5 with the aid of a deflector 21 mounted on the spinneret 5, as shown in Figure 2.

Optionally, the deflector 21 can be journaled in movable bearings in the spinneret 5 such that the direction of the streams 18 can be changed.

The streams 18 can be generated and/or increased by the spinneret 5 itself by making this function as a fan, which sucks in air through the orifices 19, 20 and blows in the air into the space 17. This fan effect can be attained by various arrangements on the spinneret 5 and/or its shaft 2, for example with the aid of blades 22 schematically shown in Figure 3. The blades can be adjustable as to their angle and/or distance to the spinneret 5 and due thereto the fan effect can be varied when required.

It is possible to provide openings for the cooling medium 18 in the shaft 2, but it is more advantageous to provide the openings outside the shaft 2, since space is required in the shaft 2 for the channel 9 and optionally other channels (not shown) for heated medium intended to keep a required high temperature of the thermoplastics material when this passes through the channel 9.

Ambient air is usually of room temperature, which means, that it is substantially cooler than the thermoplastics material when the latter leaves the spinneret 5. In consequence, the ambient air can be used as cooling medium without lowering its temperature beforehand. The air having room temperature can be blown towards the spinneret 5 and can be guided partly towards the orifices 19, 20 in the spinneret 5, partly past the outer side 11 (see Figure 4) of the spinning means 5 by guiding plates 16 and 23 schematically shown in the drawings.

The complete product consisting of great amounts of separate thermoplastic fibres 13 is collected in a convenient place and is passed to a machine, in which the fibres are torn to pieces

be spread out in great amounts on oil polluted water, the fibres absorbing the oil present in the water.

Various embodiments of the spinneret 5 are possible. For example, the spinneret can comprise one or several discs having one or several holes for the cooling medium 18. The size of the holes can be adjustable and at least one of the holes can be sealable. In an alternative embodiment, the spinneret 5 consists of a number of arms 24 (see Figure 5) projecting radially from the shaft 2, the arms 24 having channels 25 for the thermoplastics material. Between these arms 24 there are spaces, through which the cooling medium 18 is passed. Each arm 24 can be provided with fan blades or can be formed as a fan blade to make the spinneret 5 function as a fan and to provide it with a fanlike appearance.

The process of the invention is applicable to the production of fibres of all types of thermoplastics, and in particular polyolefins, which have the ability to absorb hydrophobic liquids, for example the oil in oil polluted water. A thermoplastics material having particularly good absorbing properties consists of paraffin wax and polyethylene, and this material is produced by melting paraffin wax, adding finely divided polyethylene granulate and heating the mixture to about 200°C during stirring, the polyethylene being dissolved in the paraffin wax. The syrupy liquid thus obtained is now ready for use, i.e. to be pumped from the container 6 to the spinneret 5.

Ambient air can be used as the cooling medium 18, but other gases, in a cooled or uncooled condition, can of course also be used. Thus, in certain cases, it can be appropriate to use steam or even liquids to obtain the desired effect. In other words, the invention is not restricted to that described in the above specific description, but modifications and variations can be made.

CLAIMS

1. A method of spinning thermoplastics fibres, consisting in the steps of:
 - 110 melting a thermoplastics stock material;
 - extruding the melted thermoplastics material, radially outwards, through at least one rotating spinneret, to form fibres of melted thermoplastics material around the periphery of the spinneret;
 - 115 and
 - providing cooling medium moving axially with respect to and through the spinneret at a central portion of the spinneret for flowing between and cooling the fibres of melted thermoplastics material.
 - 120

2. A method as claimed in Claim 1 wherein the cooling medium is forced through the fibres of melted thermoplastic material at a rate which keeps the fibres apart until they have solidified.

- 125 3. A method as claimed in Claim 2 wherein the cooling medium is at least partially deflected radially outwards towards the portions of the fibres which have just been forced out of the rotating spinneret.



are caused to flow into the space 17 between the solidifying thermoplastics fibres 13 through at least one orifice in the spinneret, two such orifices 19, 20 being shown in Figure 1. If need be similar orifices may be provided in the shaft 2 or the bearing block 4. Owing to this several effects are obtained, viz. cooling of the fibre 13 "from inside" the space 17 in addition to the cooling from the air stream 15, a "separating" effect on the fibres 13 in such a way that they are not concentrated close to the spinneret 5 even if fibres are formed at a high rate. Instead, the cooling and the separating effects can be increased by increasing the speed of the cooling medium streams 18 when increasing the rate of formation of the thermoplastic fibres. This means that the capacity of given apparatus for producing the fibres can be substantially increased.

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(pellets) of desired size. These wadlike pellets can be spread out in great amounts on oil polluted water, the fibres absorbing the oil present in the water.

Various embodiments of the spinneret 5 are possible. For example, the spinneret can comprise one or several discs having one or several holes for the cooling medium 18. The size of the holes can be adjustable and at least one of the holes can be sealable. In an alternative embodiment, the spinneret 5 consists of a number of arms 24 (see Figure 5) projecting radially from the shaft 2, the arms 24 having channels 25 for the thermoplastics material. Between these arms 24 there are spaces, through which the cooling medium 18 is passed. Each arm 24 can be provided with fan blades or can be formed as a fan blade to make the spinneret 5 function as a fan and to provide it with a fanlike appearance.

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2. A method as claimed in Claim 1 wherein the cooling medium is forced through the fibres of melted thermoplastic material at a rate which keeps the fibres apart until they have solidified.

3. A method as claimed in Claim 2 wherein the cooling medium is at least partially deflected radially outwards towards the portions of the fibres which have just been forced out of the rotating spinneret.

cooling medium is provided as a cone of flowing gases at a temperature below the molten thermoplastics material.

5 5. A method as claimed in any preceding claim wherein the cooling medium is ambient air.

6. Apparatus for spinning thermoplastics fibres according to any one of the preceding claims, the apparatus comprising:

10 means for supplying molten thermoplastics material;

a spinneret receiving the molten thermoplastics material, for spinningly extruding fibres of the molten thermoplastics material in a radial

15 direction, the fibres extending from the periphery of the spinneret, the spinneret having an axis of rotation and the fibres being gathered toward the axis; and

20 means for providing cooling medium along the axis of the spinneret, such that the cooling

7. Apparatus as claimed in Claim 6, wherein the cooling medium providing means includes means for deflecting the cooling medium at least partially radially outwards from the said axis toward the fibres at the said periphery.

8. Apparatus as claimed in Claim 6 or Claim 7, wherein the spinneret includes a fan for circulating the cooling medium through the fibres.

30 9. Apparatus as claimed in Claim 6, Claim 7 or Claim 8, wherein the spinneret includes means defining axial apertures therein, the apparatus including means for guiding the cooling medium toward the axial apertures.

35 10. A method of spinning thermoplastics fibres substantially as hereinbefore described with reference to the accompanying drawings.

40 11. Apparatus for spinning thermoplastics fibres substantially as hereinbefore described with reference to the accompanying drawings.

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