Aug. 14, 1973 R. B. COATES 3,752,874
PROCESS FOR MELT SPINNING
Filed July 26, 1971

Fig. 1.

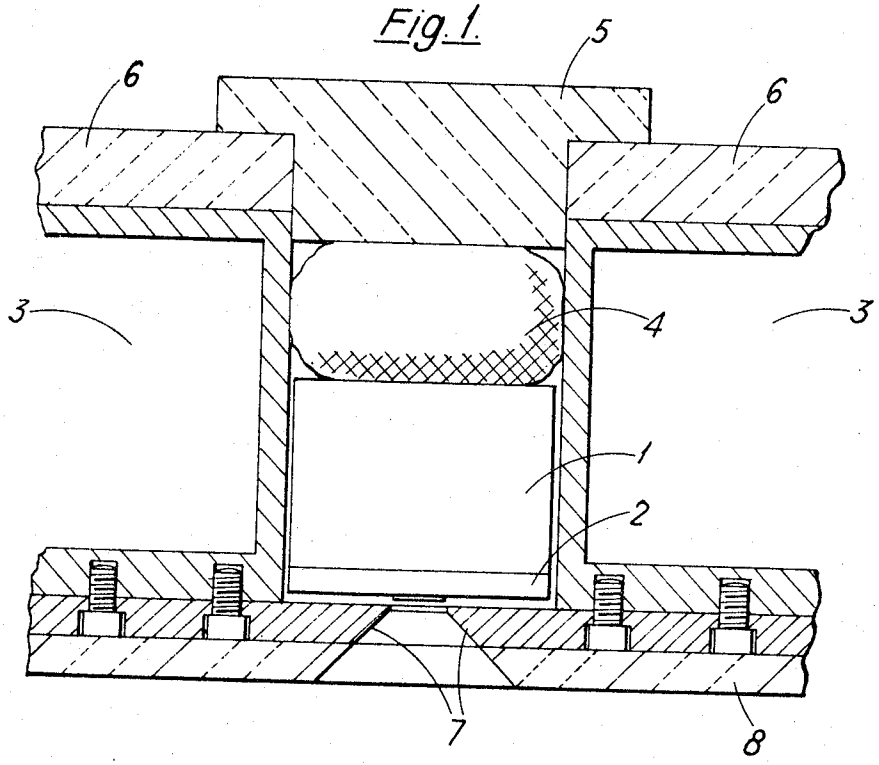
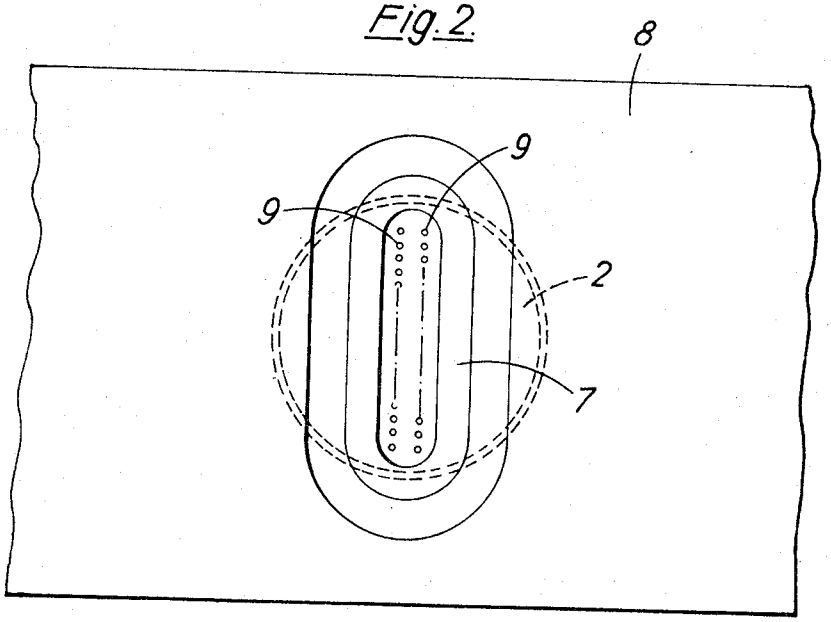


Fig. 2.



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PROCESS FOR MELT SPINNING

Ronald Bell Coates, Harrogate, England, assignor to Imperial Chemical Industries, London, England

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U.S. Cl. 264—176 F 21 Claims

ABSTRACT OF THE DISCLOSURE

Filaments by melt-spinning through plurality of packs with variation of heat losses from free faces of packs minimized by shields in close proximity with substantially identical temperatures.

The present invention relates to the melt-spinning of fibre-forming polymers, more particularly to the minimizing of variability in performance between the members of a set of spinnerets producing a single type of filament.

According to the present invention we provide a process for the manufacture of filaments by the melt-spinning of a fibre-forming polymer through a plurality of spinning packs each having a spinneret with a face exposed to the ambient atmosphere, wherein variation between the rates of loss of heat from the exposed faces of the various spinnerets is minimized by the close proximity to the exposed spinneret face of a shield of substantially the same size and shape as the exposed spinneret face, at least the faces of said shields directed towards said exposed spinneret faces being maintained at substantially constant and substantially identical temperatures.

According to our invention we also provide a spinneret with a face exposed to ambient atmosphere and associated therewith in close proximity a shield of substantially the same size and shape as the spinneret.

Normally a spinneret for melt-spinning derives its heat indirectly from a heat transfer medium which is conveniently a fluid but may also be a metallic block heated by, for example, electrical means. Since the heat transfer medium is normally kept at a constant temperature throughout a bank of spinning units, it is preferable that the shield of our invention shares the same source of heat. Preferably the temperature of the shield should differ from that of the heat transfer medium by no more than 50° C., and more desirably by no more than 10° C.

The shield should be of such form that the threadline or threadlines do not contact it in passing. Thus, for example, a hole, or holes are provided in the shield opposite the spinneret orifices. the edges of said hole, or holes, being at least one sixteenth of an inch away from the nearest filament.

The shield may be fixed or it may be movable or removable to permit wiping of the spinneret face.

A shield may be in more than one part. For example in the case wherein the pattern of spinneret holes constitues a straight line the shield may be in two parts one each side of the straight line, the two parts of the shield delineating a narrow band free from shielding and in which the spinneret holes are situated.

The shield should preferably not be in contact with the spinneret face, since extent and intimacy of contact are not subject to accurate control. We have found it advantageous to arrange for the shield at no point to be distant from the spinneret face by less than one thirty second of an inch. On the other hand, the shield should not be distant by more than one inch from the spinneret face. We have found particularly good results when the shield is substantially uniformly distant from the spinneret face

throughout its area and the distance apart is one eighth of an inch.

The facility for temporarily moving or removing the shield from its proximity with the spinneret face implies flexibility in, or the ability temporarily to disconnect, the means for conveying heat to or removing heat from the shield.

Since uniformity of heat loss from the spinnerets is aimed at, actual heat losses should be minimized, thus the face of the shield directed towards the spinneret face should preferably be polished, for example it may be chrome plated. Since controlling the temperature of the shield at the desired level is facilitated by minimizing heat losses from it, its face directed away from the spinneret face should also preferably be polished. Whilst it is advantageous that the material of construction of the shield should be of high thermal conductivity so that heat is freely passed between the face of the shield directed towards the spinneret face and the heat conveying means, the side of the shield directed away from the spinneret face may be provided with a layer of low conductivity with advantage. The material of high conductivity may, for example, be copper, aluminium or silver; the layer of low conductivity may for example, be a layer of asbestos or a chamber which contains air or which is evacuated.

By the use of the process of our invention, variation in heat losses from the exposed face of the various spinnerets can be reduced, thereby reducing the variation in temperature from one spinneret to another and thus producing fibre of more uniform properties, for example a more uniform dye uptake. Moreover, by the use of our invention it is possible, in view of the minimizing of heat losses, to ensure the desired extrusion temperature with a lower temperature of the molten polymer within the pack, with consequent minimizing of thermal degradation.

A specific embodiment of our invention will now be described with particular reference to FIGS. 1 and 2 in which

FIG. 1 shows a vertical section through a spinning pack and shield and

FIG. 2 shows a view from below the spinneret of FIG. 1.

Referring to FIGS. 1 and 2, a spinning pack **1** has spinneret **2** at its lower part. The spinning pack **1** is heated by a vapour jacket **3** and the pack **1** and vapour jacket **3** are insulated by a muff **4**, an insulating lid **5** and insulation **6**. Below the spinneret **2** there is situated a spinneret shield **7** of copper 0.75 inch thick and distant from the lower, free face of the spinneret **2** by ⅛ inch. The shield **7** is insulated by insulation **8**. The shield **7** is in good metallic contact with wall of the vapour jacket **3**. The lower face of the spinneret **2**, which without the shield **7** would be exposed to the ambient atmosphere, is circular and of diameter 5 inches. The proportion of the face of the spinneret **2** which is shielded by the shield **7** is 75%. The spinneret **2** bears two rows of spinneret holes **9**. Filaments extending downwards from the spinneret holes are distant from the nearest point of the shield **7** by 0.25 inch.

What I claim is:

1. In a process for the manufacture of filaments by the melt-spinning of a fibre-forming polymer through a plurality of spinning packs each having a spinneret with a face exposed to the ambient atmosphere and heating the spinneret, the step of minimizing variation between the rates of loss of heat from the exposed faces of the various spinnerets by disposing in close proximity to the exposed spinneret face a shield of substantially the same size and shape as the exposed spinneret face, and maintaining at least the faces of said shields directed towards said exposed spinneret faces at substantially constant and substantially identical temperatures.

2. A process for the manufacture of filaments according to claim 1 wherein the heating of the spinneret also heats said shield.

3. A process for the manufacture of filaments according to claim 2 wherein the spinneret and shield are heated with a heat transfer fluid.

4. A process for the manufacture of filaments according to claim 1 wherein the temperature of the shield differs from that of the heat transfer medium by no more than 50° C.

5. A process for the manufacture of filaments according to claim 1 wherein the temperature of the shield differs from that of the heat transfer medium by no more than 10° C.

6. A process for the manufacture of filaments according to claim 1 wherein no part of the shield lies nearer than one-sixteenth of an inch away from the nearest filament.

7. A process for the manufacture of filaments according to claim 1 wherein the shield is not in contact with the spinneret face.

8. A process for the manufacture of filaments according to claim 1 wherein the shield is at no point distant from the spinneret face by less than one-thirty-second of of an inch and the shield is not distant from the spinneret face by more than 1 inch.

9. A process according to claim 8 wherein the shield is uniformly distant from the spinneret face throughout its area and the distance apart is one-eighth of an inch.

10. A process for the manufacture of filaments according to claim 1 wherein the side of the shield directed away from the spinneret face is provided with a layer of low conductivity.

11. Apparatus for the manufacture of filaments by melt-spinning comprising: a plurality of spinning packs each having a spinneret plate with a face exposed to ambient atmosphere; means for heating the spinneret packs; a shield for minimizing variations between the rates of loss of heat from the exposed faces of the spinnerets, said shield having a size and shape substantially the same as the exposed spinneret face and having faces directed toward said exposed faces, said shield faces being closely spaced to but not in contact with said exposed faces; and means for maintaining at least said faces of said shield at a substantially constant temperature which is substantially the same as the temperature of said spinneret faces.

12. Apparatus as in claim 11 wherein the shield is at no point distant from the spinneret face by less than one-thirty-second of an inch nor more than one inch.

13. Apparatus as in claim 11 wherein the proportion of the face of the spinneret which is shielded by said shield is at least about 75%.

14. Apparatus as in claim 11 wherein said shield includes a metal plate disposed parallel to said spinneret plate, said metal plate having at least one aperture through which at least one filament passes from the spinneret plate, the wall of said aperture being spaced from the moving filament.

15. Apparatus as in claim 14 wherein the means for heating the spinneret packs includes a jacket for passing a heated fluid in heat transmission relationship with the packs, and wherein said shield is disposed in heat transmission relationship with said jacket.

16. Apparatus as in claim 11 wherein no part of the shield lies nearer than one-sixteenth of an inch away from the nearest filament.

17. Apparatus as in claim 11 wherein said shield is movable so as to permit wiping of the spinneret face.

18. Apparatus as in claim 11 wherein the face of said shield directed towards the spinneret face is polished.

19. Apparatus as in claim 11 wherein the face of said shield directed towards the spinneret face is chrome plated.

20. Apparatus as in claim 11 wherein said shield is constructed of a metal selected from the group consisting of copper, aluminum and silver.

21. Apparatus as in claim 11 including a layer of low thermal conductivity on the side of the shield directed away from the spinneret face.

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JAY H. WOO, Primary Examiner

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264—234; 425—72, 174