United States Patent [19]

Cheetham

[11] **3,787,162**

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[54] **CONJUGATE FILAMENTS APPARATUS**

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[73] Assignee: **Imperial Chemical Industries Limited,** London, England

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[52] **U.S. Cl.** **425/463,** 264/171, 425/133

[51] **Int. Cl.** **D01d 3/00**

[58] **Field of Search** 161/177; 264/171–174; 425/463, 133, 198

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Primary Examiner—Jay H. Woo

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[57] **ABSTRACT**

Process and apparatus for sheath/core conjugate filaments in which a jet of a first fiber-forming polymer is forced into confined space, second fibre-forming polymer is forced around first polymer from one side and polymers are extruded to form filaments. Preferably the ducts for first and second polymers are formed in part by appropriate apertures in metal shims.

1 Claim, 9 Drawing Figures

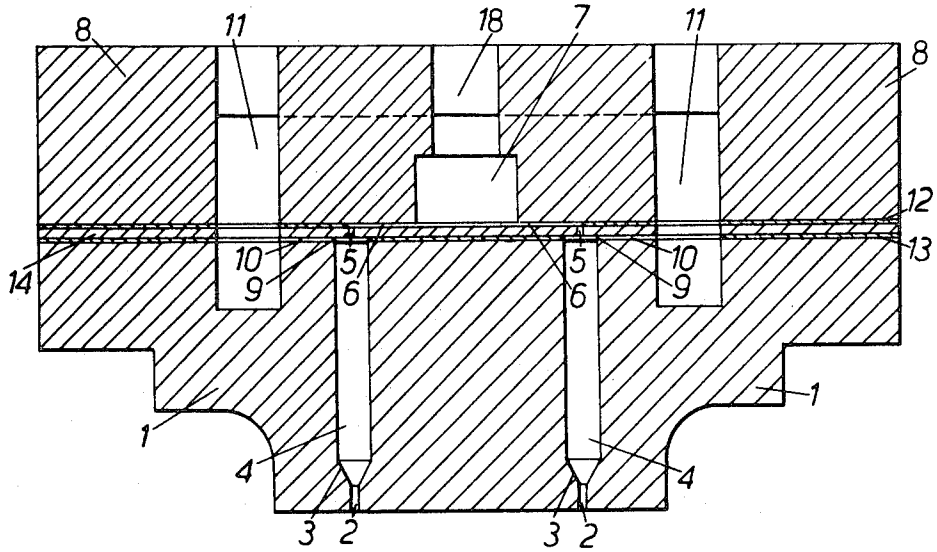


FIG 1

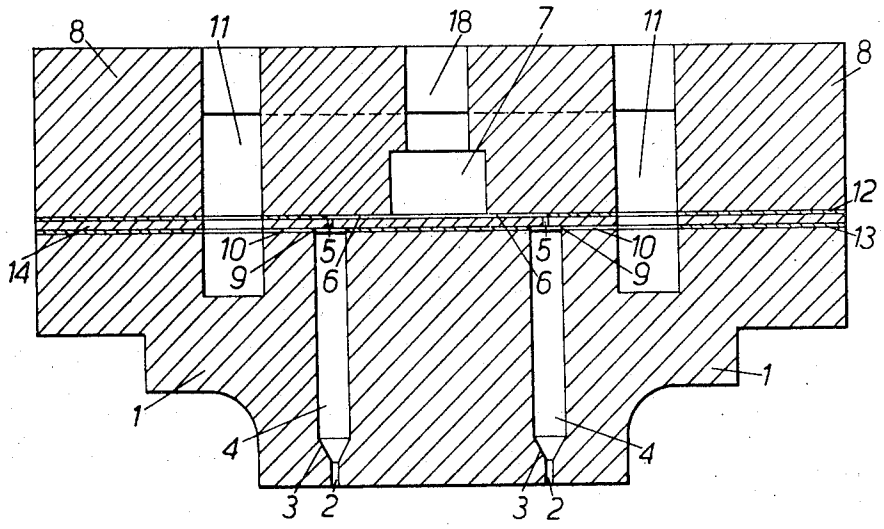


FIG 2

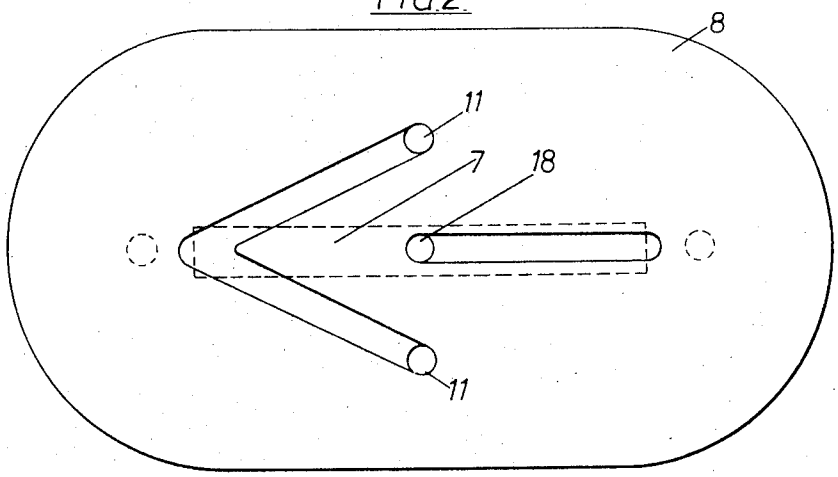


FIG.3

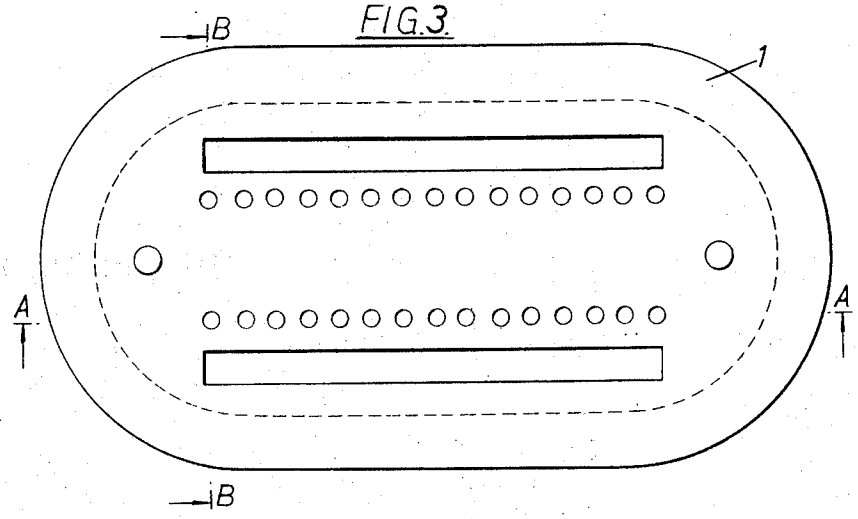


FIG.4

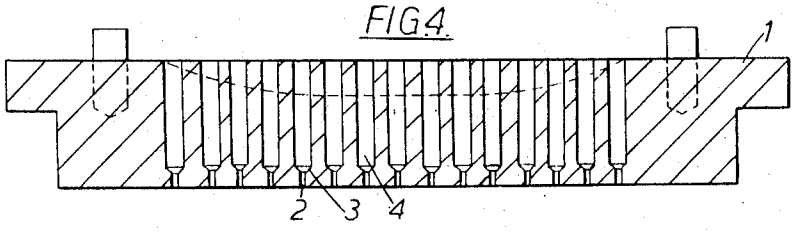


FIG.5

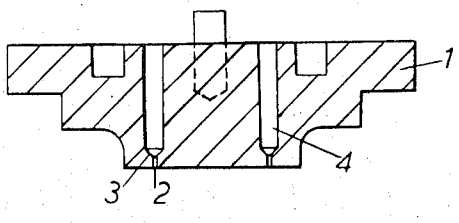


FIG.6

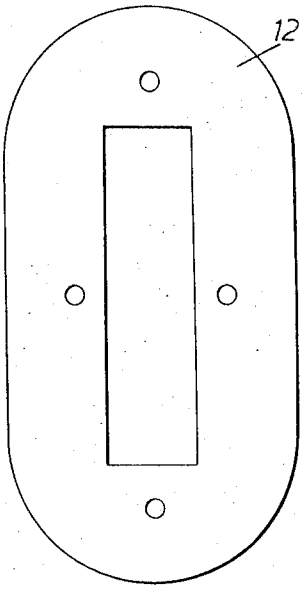


FIG.7

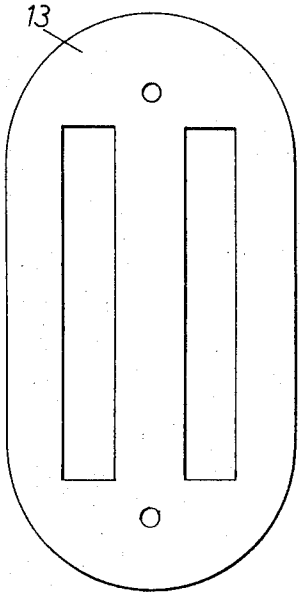


FIG.8

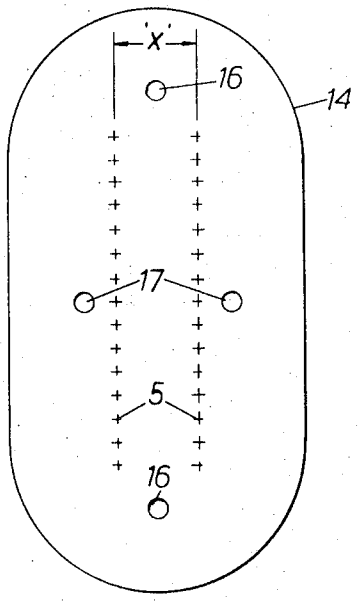
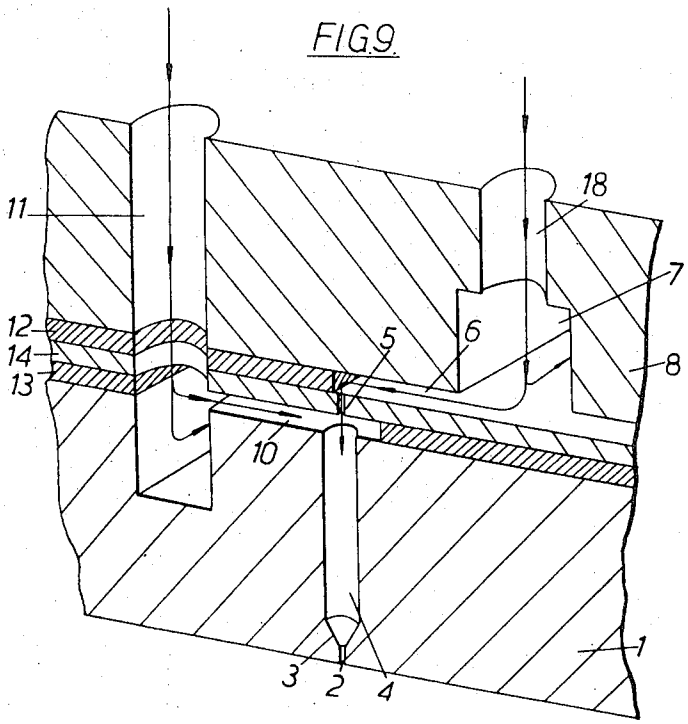


FIG 9



CONJUGATE FILAMENTS APPARATUS

The present invention relates to the manufacture of sheath/core conjugate filaments.

According to the present invention we provide a process for the manufacture of a sheath/core conjugate filament wherein a jet of a first fiber-forming polymer is forced into a confined space communicating with a spinning orifice, a second fiber-forming polymer is forced into said confined space from one side of said jet of said first fiber-forming polymer and said first and second polymers are allowed to flow in sheath/core relationship through said spinning orifice with formation of a sheath/core filament.

Preferably said confined space is elongated, with the entry points for the first and second polymers at one end and the communication with said spinning orifice at the other end. Conveniently said confined space is essentially cylindrical with length greater than its diameter.

Preferably the second fiber-forming polymer is forced into said confined space in the form of a thin sheet of flow, the width of the sheet being greater than the width of the confined space at the level of entry of the second fiber-forming polymer. Preferably the confined space is elongated in the direction at right angles to the plane of the thin sheet of flow of the second polymer.

Although the second fiber-forming polymer is forced into the confined space from one side, it should be free to surround the jet of the first fiber-forming polymer at an early stage in its transit through the confined space. This may be facilitated by the provision of a widening of the confined space at the point of entry of the second polymer. Such widening should preferably be at the upstream end of the confined space.

According to our invention we also provide an apparatus suitable for carrying out the process of our invention, comprising a confined space with exit to a spinneret aperture at one end, a first entry aperture substantiably at the end distant from the exit, and a second entry aperture to one side of the first entry aperture.

Preferably the confined space is elongated in the direction from entry aperture to spinneret aperture. Conveniently the confined space if essentially cylindrical with length greater than its diameter. Preferably the second entry aperture is in communication with the confined space by way of a radially enlarged portion of the confined space near the end of the confined space preferably where the first entry aperture is situated.

A plurality of confined spaces with apurtenances according to our invention may be combined in a single apparatus and this may be used to produce simultaneously a plurality of conjugate filaments.

The apparatus according to our invention may advantageously comprise a spinneret plate having a plurality of spinning orifices each with its own confined space, separated from an orifice plate bearing an orifice for each spinning orifice, by a first metal shim and the orifice plate being separated from a pack body by a second metal shim, said spinneret plate being urged towards said pack body so as to compress said shims and the orifice plate into good contact with each other and with said spinneret plate and said pack body, said shims and said orifice plate having appropriate apertures cut through their thickness in order to form when assembled the desired distributive ducts for each of the polymeric constituents of the conjugate filaments from a common source for each of the polymeric constituents to each of the confined spaces. The distributive ducts may be formed in the faces of the spinneret plate or in the face of the pack body or partly in each, and may be fed by feed passages entering the pack body from the side distance from the spinneret plate.

A specific embodiment of our invention will now be described with particular reference to FIGS. **1, 2, 3, 4, 5, 6, 7** and **8** wherein

FIG. **1** shows a vertical section of a multiple spinneret,

FIG. **2** shows a plan of a distributor, shown at (**8**) in FIG. **1**,

FIG. **3** shows a plan of a spinneret, shown as (**1**) in FIG. **1**,

FIG. **4** shows a section of FIG. **3** through A — A,

FIG. **5** shows a section of FIG. **3** through B — B,

FIG. **6** shows a plan of a shim, shown as (**12**) in FIG. **1**,

FIG. **7** shows a plan of a shim, shown as (**13**) in FIG. **1**,

FIG. **8** shows a plan of an orifice plate, shown as (**14**) in FIG. **1**,

FIG. **9** shows a detail of FIG. **1**, not strictly to scale, showing direction of flow, and including the widening of the confined space at the point of entry of the second polymer, referred to hereinbefore.

Referring to FIG. **1**, a spinneret plate **1** has spinneret apertures **2**, communicating by way of a lead-in cone **3** with a confined space **4**. A first entry aperture **5** communicates with the confined space **4** and, by way of a connecting passageway **6**, with a central molten polymer feed duct **7**, formed in a distributor **8** and fed by a feed pipe **18** of 0.125 inches diameter, to which the spinneret plate **1** is urged when the apparatus is assembled. A second feed aperture **9**, situated to one side of the first aperture **5**, communicates with the confined space **4** and, by way of a connecting passageway **10**, with one of two outer molten polymer feed ducts **11**, formed partly from the spinneret plate **1** and partly from the distributor **8**. The connecting passageways **6** and **10** serve as metering passageways for the molten polymers.

In a particular embodiment of the apparatus according to FIG. **1**, the first and second entry apertures are formed by an orifice plate **14**, of length 3.122 inches, width 1.62 inches and thickness 0.020 inches, of stainless steel, and shims **12** and **13** of aluminium, and each of thickness 0.005 inches. The apparatus is assembled as shown in FIG. **1** and the spinneret plate **1** urged (by means not shown) towards the pack body (not shown), which lies above the distributor **8** and in face contact with it, with formation of a liquid tight joint between the contacting faces of spinneret plate **1** and shim **13**, between shim **13** and orifice plate **14**, between orifice plate **14** and shim **12**, between shim **12** and the distributor **8** and between the distributor **8** and the pack body (not shown).

In the orifice plate **14** (and also FIG. **8**) the distance x between rows of orifices is 0.437 inches. The orifices **5** are each of 0.009 inches diameter. The alignment holes **16** are each of 0.125 inches diameter and with centres 2.25 inches apart. The molten polymer feed holes **17** are each of diameter 0.125 inches and with centres 0.808 inches apart.

In FIG. 1, taken together with FIG. 8, the first entry aperture 5 is shown as circular and centrally disposed with respect to the cross-section of the confined space 4. The first entry aperture 5 may, however, be of non-circular cross-section and may further be eccentrically disposed with respect to the cross-section of the confined space 4. By such variation of the disposition of the first entry aperture 5 in relation to the centre line of the confined space 4, the cross-section of the core of the filament produced by the apparatus and the relative disposition of the cross-section of the core with relation to the cross-section of the filament produced can be varied.

The apparatus depicted in FIG. 1, taken together with FIG. 8 in general leads to the production of very eccentric sheath/core filaments.

Our invention is particularly applicable to the manufacture of sheath/core conjugate filaments of which each of the components is a polyester, a polyamide or a polyolefine.

The apparatus according to the particular embodiment was used for the melt-spinning of sheath/core filaments of poly(ethylene terephthalate), the central polymer feed duct 7 being fed with molten poly(ethylene terephthalate) of intrinsic viscosity 0.47 as measured on a 1 g. per 100 ml solution in orthochlorophenol at 25°C and the second feed aperture 9 being fed with poly(ethylene terephthalate) of intrinsic viscosity 0.67. The resultant molten threadlines showed no significant tendency towards kneeing. The filaments were very eccentric sheath/core filaments which after drawing and heat relaxing showed marked crimp formation.

We claim:

1. An apparatus for spinning a plurality of eccentric sheath/core conjugate filaments comprising a spinneret plate having a plurality of spinning orifices each with its own confined space, separated from an orifice plate bearing an orifice for each spinning orifice, by a first metal shim, and the orifice plate is separated from a pack body by a second metal shim, said spinneret plate being urged towards said pack body so as to compress said shims and the orifice plate into good contact with each other and with said spinneret plate and said pack body, said shims and said orifice plate having appropriate apertures cut through their thickness in order to form when assembled the desired distributive ducts for each of the polymeric constituents to each of the confined spaces.

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