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(54) **TETE DE BOUDINEUSE**
(54) **EXTRUDER DIE HEAD**

(57) An extruder die head comprises an internal cylindrical mandrel and a shell, which encloses the mandrel concentrically. Between the mandrel and shell an annular channel is formed, which is connected to an annular die slit. A polymer melt is fed through a line to the annular channel. To prevent the polymer melt in the area of the start of the annular channel from penetrating into any spaces that form between the mandrel and the shell due to differential thermal expansion, a ring is located between the mandrel and the shell. The material of the ring is chosen to have a coefficient of thermal expansion such that when the die head is heated up due to the polymer melt, the ring seals any spaces between the shell and the mandrel. In an alternative arrangement, the materials of the mandrel and the shell are chosen such that the seat, which connects the mandrel to the shell and is located below the annular channel, becomes more tightly sealed on heating.

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Abstract

An extruder die head comprises an internal cylindrical mandrel and a shell, which encloses the mandrel concentrically. Between the mandrel and shell an annular channel is formed, which is connected to an annular die slit. A polymer melt is fed through a line to the annular channel. To prevent the polymer melt in the area of the start of the annular channel from penetrating into any spaces that form between the mandrel and the shell due to differential thermal expansion, a ring is located between the mandrel and the shell. The material of the ring is chosen to have a coefficient of thermal expansion such that when the die head is heated up due to the polymer melt, the ring seals any spaces between the shell and the mandrel. In an alternative arrangement, the materials of the mandrel and the shell are chosen such that the seat, which connects the mandrel to the shell and is located below the annular channel, becomes more tightly sealed on heating.

EXTRUDER DIE HEAD

The invention relates to an extruder die head, preferably a blown film extruder die head, for monoextrusion of a single molten plastic, or for coextrusion of at least two molten plastics. The extruder die head comprises at least one internal cylindrical mandrel and an outer concentric shell, which encloses the mandrel and thus provides an annular die slit through which molten polymer is extruded. Between the mandrel and shell an annular channel is provided that is connected to the die slit. The extruder die head also includes at least one feed line, through which a polymer melt is fed, and which empties into the annular channel in an area remote from the die slit.

This type of blown film head is well-known. Usually the mandrel includes one or several spiral grooves, whose depth tapers toward the die slit starting from the feed channel(s), so that the polymer melt overflows more and more the spider legs defining the channels and assumes uniform flow in the axial direction of the die head. One particular problem associated with these prior art extruder die heads lies in the fact that the mandrel, adjacent the start of the annular channel, is fitted sealingly into a cylindrical borehole of the shell. If, however, the extruder die head heats up due to the polymer melt flowing through it, the shell expands more, due to its larger diameter, than the central mandrel, so that between both mandrel and shell a space is formed due to differential thermal expansion, into which the polymer melt flows under the influence of the feed pressure. Since the polymer melt that collects in the region of this space decomposes in the hot die head due to its long residence time in the space, particles of the decomposed polymer melt can be entrained into the flowing polymer melt. These particles appear again as defective spots in the extruded film blown tube, or the inflated tubular bubble.

The present invention seeks to provide an extruder die head of the this general type, in which, during the heating process, a space cannot form between the central mandrel and the shell which encloses it. This prevents molten polymer from accumulating in the die head.

In a first embodiment of this invention, in the region of the start of the tapered annular channel between the mandrel and the shell, the die head includes a ring the material for which is chosen to have such a coefficient of thermal expansion γ that during the heating process it seals the space between the shell and the ring.

The material of the ring of this invention is chosen to have a different coefficient of thermal expansion γ than the material of the mandrel and the material of the shell, so that as the shell expands on heating the ring seals the space between mandrel and shell just like a press fit packing.

Preferably a ring of a material whose coefficient of thermal expansion is greater than that of the material of the shell is mounted on the outside wall of the mandrel.

Alternatively a ring of a material whose coefficient of thermal expansion is smaller than that of the material of the shell, is mounted on the inside wall of the shell.

Preferably, the ring is retained by an annular shoulder on the mandrel and/or on the shell. In order to slide the ring into place, the shell can be provided with a borehole of larger inside diameter than the ring, or the mandrel can be provided with a smaller outside diameter than the ring, up to the step shaped shoulder. The ring is located in the recess with one face against the face of the annular shoulder, and either with its outer circumference against the shell or its inner circumference against the mandrel.

If the mandrel and the shell are made of steel or a steel alloy, the ring is made preferably of copper, a copper alloy, bronze, brass or a brass alloy.

In a second embodiment of the invention the materials of the mandrel and of the shell enclosing it, are selected to have different coefficients of thermal expansion so that the engagement between the mandrel and the shell located below the annular channel, becomes more tightly sealed on heating. In this second embodiment, the force fit between the mandrel and shell is made tighter on heating, so that any spaces that might still be present in the seal area are closed.

In a third embodiment of the invention, the material of a pipe piece which connects the mandrel to the shell is chosen to have a coefficient of thermal expansion such that the engagement which connects the mandrel to the shell and is located below the annular channel, becomes more tightly sealed with heating, and is shrunk into the shell.

In a fourth embodiment of the invention, the material of a pipe piece has a coefficient of thermal expansion such that the engagement, which connects the mandrel to the shell and is located below the annular channel, becomes more tightly sealed with heating, and is shrunk on the mandrel. In this case, too, the press fit becomes tighter so that spaces due to differential thermal expansion are prevented.

One, or several, helical groove(s) having a depth that tapers toward the die slit can be milled into the pipe piece or through the pipe piece into the mandrel.

One embodiment of the invention is described in detail below with reference to Fig. 1, which is a perspective view of the blown film head. In this drawing part of the outer shell is cut away.

The blown film extrusion die head 1 includes an internal central mandrel 2, which is enclosed concentrically by an outer shell 3. The mandrel outside diameter and the shell internal diameter are chosen to provide an annular slit 4 between the mandrel 2 and the shell 3. The outer cylindrical surface of the mandrel 2 includes several spiral grooves 3, whose depth tapers toward the die slit 5 starting from the other end of the mandrel. The grooves 3 terminate at a distance from the annular exit slit 5. The die head 1 is provided with an axial feed channel for the polymer melt, which is fed in the direction of arrow A through the feed channel. The feed channel is connected to the start area of the spiral grooves 3 so that the melt is fed into the spiral grooves and toward the exit slit 5. As the groove tapers in the direction of the arrow, the melt is deflected in the axial direction over the areas separating the grooves.

In the starting area of the annular channel 4 a sealing ring 6 is inserted into a recess of the inside wall of the shell 3. Alternatively the sealing ring 6 is inserted into a recess of the mandrel 2. The material of the sealing ring is chosen to have a different coefficient of thermal expansion γ than the mandrel 2 and the shell 3. The material of the ring is chosen so that its coefficient of thermal expansion is matched to that of the mandrel 2, or that of the shell 3, so that the ring forms a sealing packing when, as the blown film head heats up, the shell 3 expands more than the mandrel 2 due to the larger diameter of the shell.

What is claimed is:

1. An extruder die head, for monoextrusion of a single molten plastic, or for coextrusion of at least two molten plastics, including at least one internal cylindrical mandrel within a concentric shell which encloses the mandrel to provide an annular channel between mandrel and shell that ends with a die slit, the extruder die head also including at least one molten polymer feed line, which feeds a polymer melt into the annular channel remote from the die slit, wherein in the area of the start of the annular channel, a ring is included between the mandrel and the shell of a material chosen to have a coefficient of thermal expansion γ such that during the heating of the extruder die head the ring seals the end of the annular channel remote from the die slit between the shell and the mandrel.

2. An extruder die head as claimed in claim 1 wherein the material of the ring is chosen to have a higher coefficient of thermal expansion than the shell, and the ring is mounted on the outside surface the mandrel.

3. An extruder die head as claimed in claim 1 wherein the material of the ring is chosen to have a smaller coefficient of thermal expansion than the shell, and the ring is mounted on the inside surface of the shell.

4. An extruder die head as claimed in claims 1, 2 or 3 wherein the ring is held in annular shoulders provided in either the mandrel, or the shell, or in both the mandrel and the shell.

5. An extruder die head as claimed in claims 1, 2, 3 or 4 wherein the mandrel and the shell are made of steel or a steel alloy, and the ring is made of copper, a copper alloy, bronze, brass or a brass alloy.

6. An extruder die head as claimed in claim 1 wherein the materials of the mandrel and the shell enclosing are chosen to have thermal coefficients of expansion such that the seat, which connects the mandrel to the shell and is located below the annular channel, becomes more tightly sealed on heating.

7. An extruder die head as claimed in claim 1 wherein a pipe piece is shrink fitted into the shell, and the materials of the mandrel and the shell enclosing are chosen to have thermal coefficients of expansion such that the seat, which connects the mandrel to the shell and is located below the annular channel, becomes more tightly sealed on heating.

8. An extruder die head as claimed in claim 1 wherein a pipe piece is shrink fitted onto the mandrel, and the materials of the mandrel and the shell enclosing are chosen to have thermal coefficients of expansion such that the seat, which connects the mandrel to the shell and is located below the annular channel, becomes more tightly sealed on heating.

9. An extruder die head as claimed in claim 8 wherein at least one helical groove having a depth that tapers in the direction toward the die slit is milled into the shrunk on pipe piece or through the pipe piece into the mandrel.

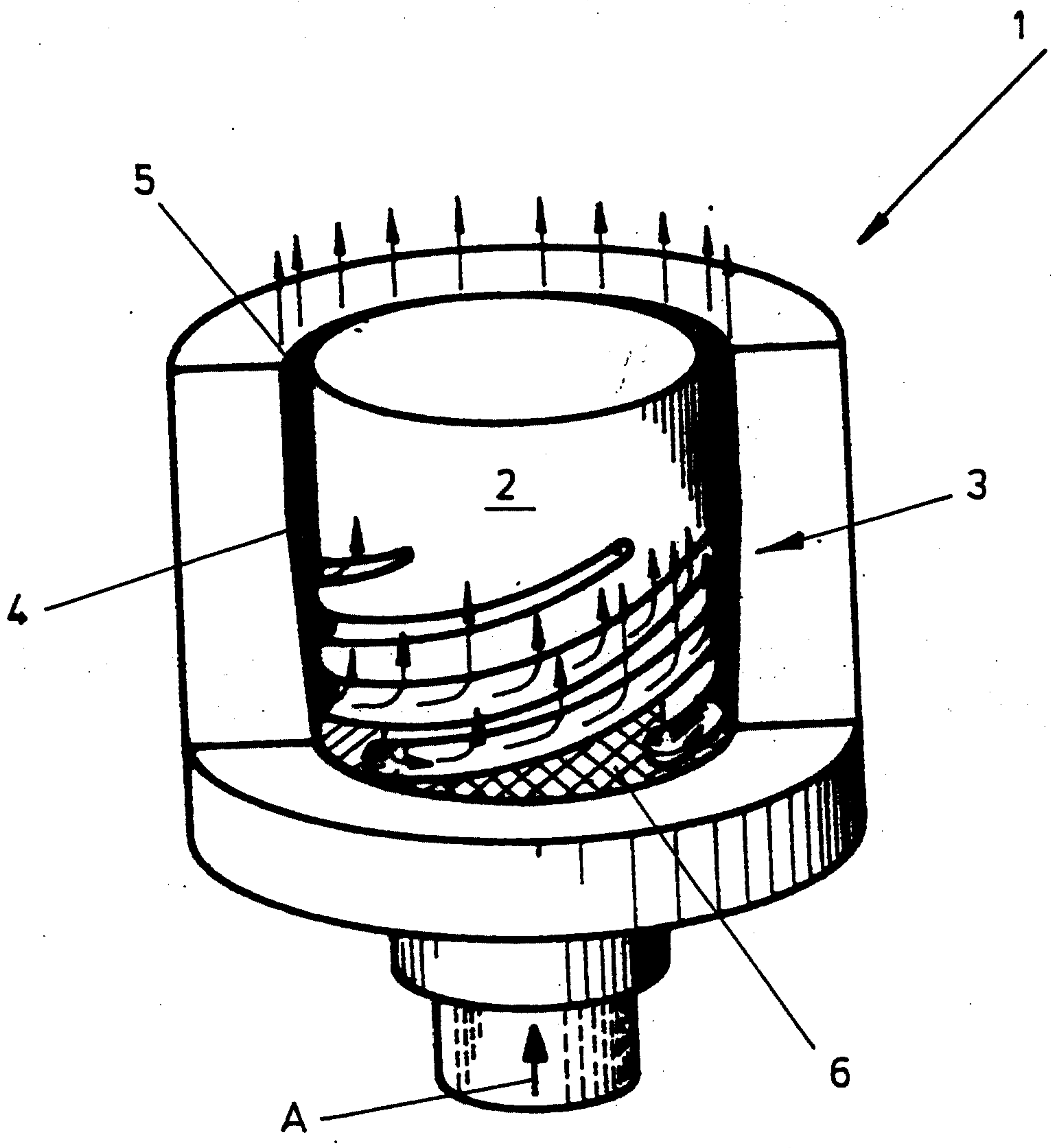

Fig. 1.