June 14, 1966 H. NIEUWENHUYSEN 3,255,487

SPINNERET PLATE

Filed April 9, 1964

FIG. 1

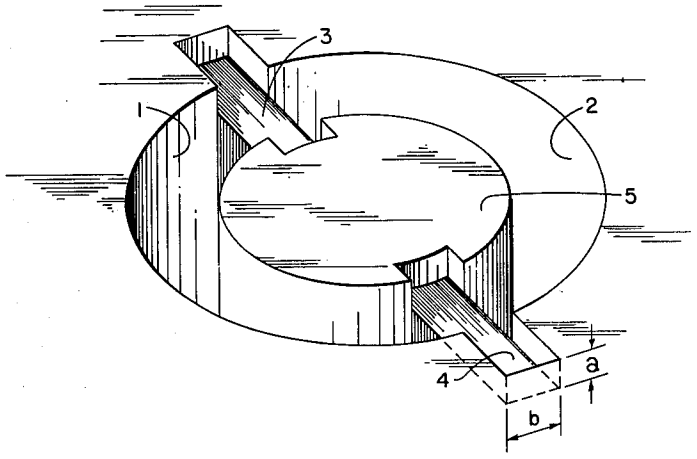
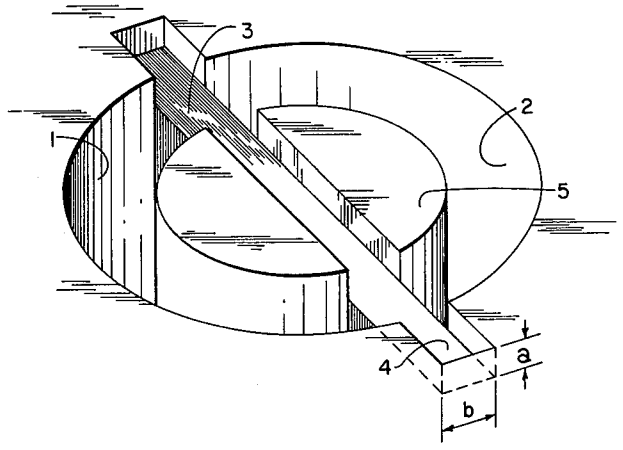


FIG. 2



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SPINNERET PLATE

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5 Claims. (Cl. 18—8)

This invention relates generally to spinneret plates used for the melt spinning of hollow filaments, threads, and fibers from thermoplastic materials such as polyamides, polyesters, polyolefins, and polyvinyl chlorides or glass. More particularly the invention relates to novel spinneret orifices specifically designed to facilitate hollow filament production.

In the melt spinning of synthetic hollow filaments, it is known to use a spinneret plate provided with one or more filament forming orifices, each spinning orifice consisting of two or more arcuate slots separated by narrow bridges such that upon spinning a hollow thread is obtained. As is known the streams of extruded polymer issuing from the slots coalesce with each other immediately upon extrusion thus forming the hollow filament. One disadvantage of such spinneret orifices is that after spinning has proceeded for some time, the melt streams no longer coalesce thus producing ribbon-shaped filaments rather than the desired hollow threads.

To eliminate this difficulty it has been proposed to have the ends of adjacent slots overlap or lie in parallel relationship. By this means coalescence is assured and only hollow filaments are produced. However, since the ends of adjacent slots run parallel to one another and may bend outwards, the threads produced sometimes have a somewhat serrated cross-section. If the parallel sections of adjacent slots are bent inward, the cross-sectional area of the hollow space is reduced.

Accordingly, it is an object of this invention to provide a spinneret plate for producing hollow filaments not having aforementioned disadvantages.

Another object of this invention is to provide a spinneret plate having orifices for producing hollow filaments in which coalescence of adjacent sections forming each hollow filament is assured without requiring overlapping of the ends.

Still another object of this invention is to provide a novel spinneret orifice designed for spinning hollow filaments in which the segments of each filament coalesce and the filaments do not have a serrated cross-section.

These and other objects will become apparent from the following detailed description taken in conjunction with the accompanying drawing.

In accordance with the present invention, a spinneret plate is provided for producing hollow filaments by melt spinning thermoplastic materials comprising one or more hollow filament forming spinning orifices. Each spinning orifice consists of two or more arcuate slots separated by a narrow bridging section with the bridge portion being sunk relative to the outer surface or face of the spinneret plate. To promote air supply to the hollow space of the thread, the depression over each bridge is extended slightly beyond the width of the adjacent slots.

As used herein, the term "arcuate" includes any arch-shaped structure including circular segments as well as polygonal segments.

The bridges between slots should be recessed in the face of the spinneret a minimum of 50 microns and preferably at least 75 microns deep. Best results are obtained if the recessions range from 100 to 200 microns deep. The bridge width between each slot should range from 90 to 400 microns.

When a spinneret plate made according to the invention is used for producing hollow filaments from melts of synthetic thermoplastic linear polycondensation or polymerization products, the surface area of the plate circumscribed by adjacent slots of each spinning orifice generally ranges from .01 to 7 mm.^{2}, and the width of the slots ranges from 15 to 400 microns. When hollow filaments are spun from molten glass, the surface area surrounded by the slots may be as high as 50 mm.^{2}. Likewise the width of the slots may also be greater and range up to 1 mm.

If desired the arcuate slots of each spinning orifice may have additional side slots joining the main slot and disposed at an acute angle or perpendicular thereto making it possible to spin filaments having a lobed cross-section. Filaments produced by such spinning orifices have a higher covering power than non-lobed filaments and thus reflect light differently producing a special effect when woven or knitted into fabrics. In addition, they have a very soft hand making their use in certain applications very desirable.

The arcuate slots of each spinning orifice may comprise segments of a circle or an ellipse or may be parts of various geometrical shapes such as squares, triangles, polygons, etc. In addition, two or more of the spinning orifices may be inter-connected.

For purposes of illustration and not by way of limitation, the invention will now be described in conjunction with the accompanying drawing wherein:

FIGURE 1 is a perspective view of a spinning orifice at the face of the spinneret plate showing one embodiment of the recessed bridge portions according to the invention; and

FIGURE 2 is a similar view in perspective of another embodiment of the spinneret orifice of the invention.

In the figures the spinning orifice consists of two adjacent slots **1** and **2** which are separated from each other by bridges **3** and **4**. Bridges **3** and **4** are recessed relative to the face **5** of the spinneret plate. The depth is represented by the letter *a*. Each recess over the bridge is extended at the ends beyond the edges of the slots and in FIGURE 2 extends completely through that section of the plate bounded by the slots **1** and **2**. The width of the bridges is indicated by the letter *b*.

Spinneret plates having orifices made according to the invention do not have the disadvantages associated with the prior art slot-shaped spinning orifices, and their use assures coalescence of the extruded segments resulting in the production of better hollow threads than heretofore thought possible. The threads produced by the spinneret plates of this invention have a hollow space with a larger cross-sectional area than do threads produced by prior art spinning apparatus. Furthermore, because adjacent streams issuing from the arcuate slots coalesce better, the width of the bridge between adjacent slots may be larger than is the case with prior art spinning orifices. Because of this the supply of air into the hollow space of the thread is promoted. Another advantage is that the greater bridge width results in stronger spinneret orifices. Finally, hollow threads produced by the apparatus of this invention are uniform in cross-section, have a high covering power and when woven or knitted into the fabrics, possess a high heat retention, bulkiness and good elastic properties.

Many modifications, changes, and embodiments within the scope of this invention will be apparent to those skilled in the art. It is therefore intended that the invention be limited only to the extent set forth in the following claims.

What is claimed is:

1. A spinneret plate for use in the melt spinning of hollow filaments from thermoplastic resins having at least

one spinning orifice comprising a plurality of arcuate slots circumscribing a small portion of the plate, said slots separated at their terminal ends by bridges which are recessed relative to the face of the spinneret plate and means facilitating air flow to the hollow portion of the filament during spinning.

2. A spinneret plate for use in the melt spinning of hollow filaments from thermoplastic resins having at least one spinning orifice comprising a plurality of arcuate slots circumscribing a small portion of the plate, said slots separated at their terminal ends by bridging sections which are recessed relative to the face of the plate, said recessed portions extended at least on one end slightly beyond the edge of the slots.

3. The spinneret plate of claim 2 in which the recessed portions extend slightly at either end beyond the edges of the slots.

4. The spinneret plate of claim 2 in which the bridges are recessed at least 75 microns.

5. The spinneret plate of claim 2 in which the bridging sections range in width from 90 to 400 microns.

References Cited by the Examiner

UNITED STATES PATENTS

3,131,427	5/1964	Mika et al.	18—8
3,174,364	3/1965	Sims	18—8 X

FOREIGN PATENTS

909,536	10/1962	Great Britain.
1,125,112	3/1962	Germany.

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