March 13, 1956 W. L. WEBB 2,737,831

PROCESS FOR MAKING A SPINNERET

Original Filed June 2, 1950

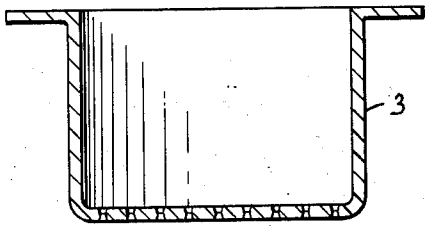


Fig. 1

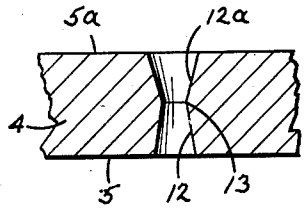


Fig. 4

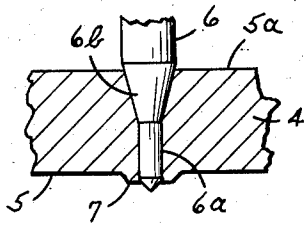


Fig. 2

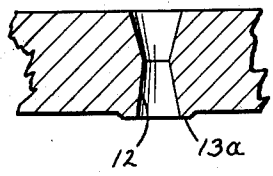


Fig. 5

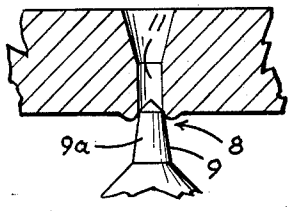


Fig. 3

United States Patent Office 2,737,831 Patented Mar. 13, 1956

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PROCESS FOR MAKING A SPINNERET

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Original application June 2, 1950, Serial No. 165,785, now Patent No. 2,677,148, dated May 4, 1954. Divided and this application November 1, 1952, Serial No. 318,157

7 Claims. (Cl. 76—107)

This invention relates to the manufacture of artificial filaments, and in particular, to new and improved spinnerets for the manufacture of artificial filaments and to a process for making the same.

This application is a division of copending application, Serial No. 165,785, filed June 2, 1950, now Patent No. 2,677,148, granted May 4, 1954.

In spinning artificial filaments, it is known that the quality of the filaments is closely connected with the nature, form and dimensions of the holes in the spinneret, no matter whether they are made by dry spinning or wet spinning.

The known and presently used spinnerets are in the form of a cup formed from a non-corrosive metal, or non-corrosive non-metallic material such as glass, plastic, and the like, in the base of which are a number of extrusion orifices of the order to approximately 0.0015 to 0.0100 inch in diameter, through which the filament-forming material is extruded. The orifice of a commonly used type has a conical or curved funnel shape at the top and a cylindrical shape at the bottom, that is, adjacent the face.

The production of superior filaments requires the maintenance of a constant cross section of the extrusion orifices and of an extremely smooth and highly polished flow surface of definite configuration.

Spinnerets for making artificial filaments of types heretofore used are often characterized by having a small annular ridge or flashing of metal around the opening on the face of the jet wall. This flashing is extremely minute and can only be seen with a microscope. Because of its roughnes it forms an excellent place for the building of annular rings or deposits of materials such as sulfur, zinc salts, and sodium salts in the opening at the face of the jet. These deposits greatly constrict the diameter of the orifice and may ultimately close the orifice. These deposits result in greatly increasing the per cent of abnormally small filaments in multi-filament yarn spun with jets of the known type described.

Moreover, in jets of conventional type heretofore used, the orifices adjacent the face of the spinneret have conventionally been cylindrical in cross section, so that any deposit in this cylindrical capillary invariably resulted in the production of small-sized filaments. This also resulted in an increase in the back pressure developed by the spinneret. The cylindrical orifice is also very difficult to clean after such deposits have formed thereon.

It is an object of the present invention to produce a spinneret with orifices having smooth flow surfaces, with a decreased tendency to clog after long and continued use.

Another object of this invention is to produce a new and improved spinneret which overcomes the disadvantages and difficulties of the presently used spinnerets.

Other objects and advantages of the present invention will be obvious from the description thereof hereinafter.

Figure 1 is a side elevation in section of a spinneret constructed in accordance with the invention,

Figure 2 is a sectional view of an orifice and a tool illustrating one step in a method of making the spinneret extrusion orifice,

Figure 3 is a fragmentary sectional view of the spinneret face and a tool illustrating a second step in forming the extrusion orifice shown in Figure 2,

Figure 4 is a fragmentary view in section of the extrusion orifice of the spinneret shown in Figure 1, and

Figure 5 is a fragmentary view in section of another embodiment of the extrusion orifice.

The spinneret of the invention may be formed of any non-corrosive metal such as nickel, platinum, silver, or alloys thereof, or non-metallic material such as plastic or glass; and the spinneret may be cup-shaped, conical, or plate type. The orifice may be formed in accordance with the invention by any suitable means, e. g., by punching, grinding, drilling, or a combination of these methods. The invention is not to be limited by the following detained description of one method of making the spinneret.

In the first step, the base of the spinneret is operated upon by a suitable tool to form an opening or orifice having a truncated conical upper part converging in the direction of flow and a substantial cylindrical remaining part adjacent the face of the jet. In the second step, the cylindrical portion of the orifice is enlarged and shaped so that it will be diverging in the direction of flow. The resulting orifice has the configuration shown in Figure 4, in which the opening comprises two truncated cones with their narrow parts adjacent resulting in a constricted area intermediate the open ends of the orifice, e. g., reverting to Figure 2 the spinneret base **4** is punched by means of a tool **6**, the tool having a cylindrical section **6***a* and a conical section **6***b*. This results in a hole having the same configuration, and also results in the production of a small annular burr **7** around the opening on the face **5**. In the next step the burr **7** is removed by suitable means such as grinding, cutting, polishing and the like. In the next step shown in Figure 3, a tool **9** having a uniform tapered portion **9***a* is inserted from the face of the jet into the cylindrical section **11** of the orifice, and the tool is worked upward in this section **11** until this section is also given a conical shape such as the orifice portion **12** seen in Figure 4.

Since the upper section **12***a* of this orifice is already conical, the completed orifice comprises two truncated cone shaped sections having their narrow ends adjacent, the constriction **13** being located at a point intermediate the lower or outer face **5** and inner face **5***a* of the spinneret wall **4**. The taper of the conical section **12** of the orifice in Figure 4 is preferably between 1–10%. The upper portion **12***a* may be conical in shape or have curved sides. The constriction **13** may be spaced equidistant between the faces but is preferably below the center-line between the two faces. The per cent taper is determined by taking the difference in the diameters between the top and the bottom of the cone and dividing this by the distance between the top and bottom of the cone and multiplying by 100.

The tapered surface **9** of the punch **8** presses evenly against the entire flow surface **12** of the lower cylindrical portion of the extrusion orifice (see Figure 4). Due to this even pressure over the entire flow surface no one part or section of it can spring back. With some metals the tool **9** may produce an annular ripple **13***a* on the spinneret face **5** surrounding the extrusion orifice **12** (see Figure 5). This ripple will in no way interfere with the filament forming operation and is not conducive to the formation of annular ring deposits.

Thus by means of the present invention there is produced a Venturi throat spinneret which can be used for

much longer periods of time than conventional spinnerets without danger of the extrusion orifices becoming clogged.

By means of the present invention, there is produced a new and improved spinneret which shows a decreased tendency to clog up due to the formation of annular deposits in the extrusion orifices. When the spinnerets of the present invention are compared to conventional spinnerets they show substantially less tendency to clog even though the conventional spinnerets are employed with a spinning bath and/or spinning solution containing an incrustation inhibitor or anti-clogging agent, while the spinnerets of the present invention can be employed without the aid of such assistants. When, however, the spinnerets of the present invention are employed in connection with a spinning solution and/or bath containing a anti-clogging agent, the results are much superior to conventional spinnerets.

To illustrate the superiority of the spinneret of the present invention, it was compared with a spinneret having a cylindrical orifice adjacent a face in the following test: both the present spinneret and the conventional spinneret were placed on the same spinning machine spinning viscose in a conventional viscose coagulating bath, which contained no spinning assistant or anti-clogging agent. The results were as follows:

Spinneret	Percent Abnormally Small Filaments	Percent Extra Large Filaments
3 Day Run:		
Venturi (present)	9	7
Cylindrical (conventional)	22	14
7 Day Run:		
Venturi (present)	9	30
Cylindrical (conventional)	25	57

The above table shows that the present spinneret produced less than half as many abnormally small filaments and about half as many abnormally large filaments than the conventional cylindrical shaped jet orifice. It appears that the viscose solution streaming through the present jet is able to dislodge deposits from the orifice because the orifice diverges outwardly. Further, it was found that the present jets are easier to clean either by back washing or forward washing because of the diverting of the orifice adjacent each face. It is obvious that any material which passes the constricted area will certainly not clog or lodge at any point beyond this area in the present jet. Thus the process decreases the cost of production, and gives more uniformity to the product when making a multi-filament yarn.

By use of the spinnerets of the present invention considerable saving in the cost of production is realized since spinneret cleaning is facilitated.

It is to be understood that changes and variations may be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. A process for making a spinneret comprising the steps of punching a hole in a metal sheet with a punch having converging sides terminating in a cylindrical extension, grinding off the metal burr produced by the said punching, and subsequently shaping said punched hole by inserting a conical punch into the previously punched hole from the opposite direction to form a central constriction, and double outwardly diverging conical walls extending in opposite directions from said constriction.

2. A process for making a spinneret comprising the steps of displacing a limited amount of metal in a unitary spinneret blank to form a truncated conical aperture therein, displacing a limited amount of metal in the blank to form a cylindrical concentric extension of said aperture extending through the opposite side of said blank, forming a burr from said displaced metal on said opposite side of the blank, removing said burr, and enlarging the cylindrical extension by further displacing metal to form a second truncated conical aperture concentric with said first conical aperture.

3. A process in accordance with claim 2 in which the first two displacing steps and the burr-forming step are performed simultaneously.

4. A process in accordance with claim 2 in which the first two displacing steps and the burr-forming step are performed by punching.

5. A process for making a spinneret comprising the steps of displacing a limited amount of metal in a unitary spinneret blank to form a truncated conical aperture extending from substantially the mid-point between opposite sides of the blank to one side of said blank, displacing a limited amount of metal in the blank to form a cylindrical concentric extension of said aperture extending from said mid-point through the opposite side of said blank, forming a burr from said displaced metal on said opposite side of the blank, removing said burr, and enlarging the cylindrical extension by further displacing metal to form a second truncated conical aperture concentric with said first conical aperture and extending from said mid-point to the opposite side of the blank.

6. A process in accordance with claim 5 in which the first two displacing steps and the burr-forming step are performed simultaneously.

7. A process in accordance with claim 5 in which the first two displacing steps and the burr-forming step are performed by punching.

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