Oct. 31, 1961 W. MARTIN ET AL 3,006,026

SPINNERET WITH ORIFICE INSERT

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FIG. 1

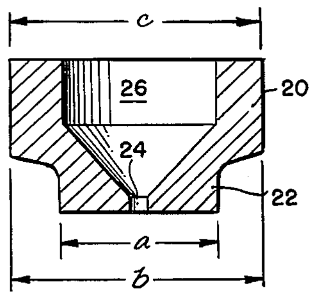

FIG. 2

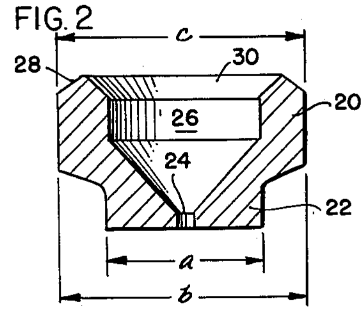

FIG. 3

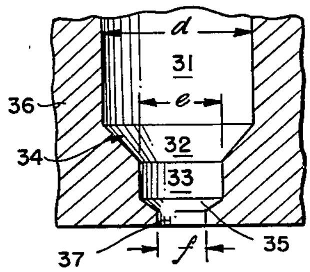

FIG. 4

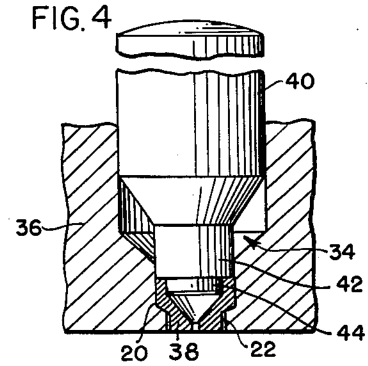

FIG. 5

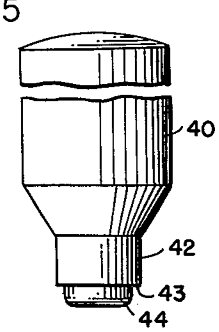

FIG. 6

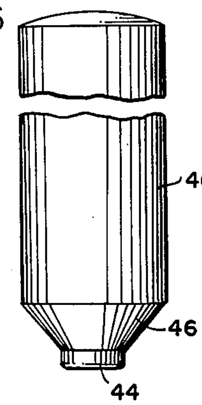

FIG. 7

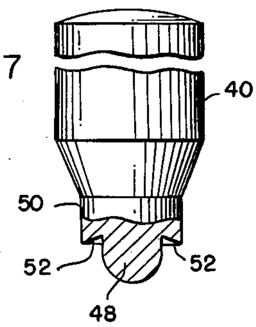

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FIG. 8

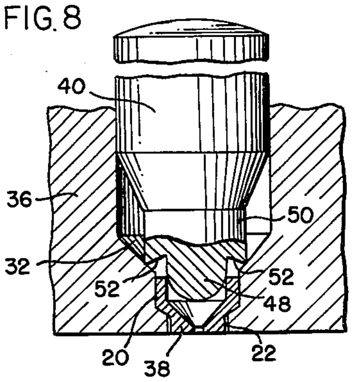


FIG. 9

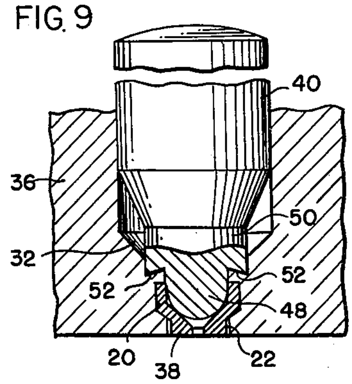


FIG. 10

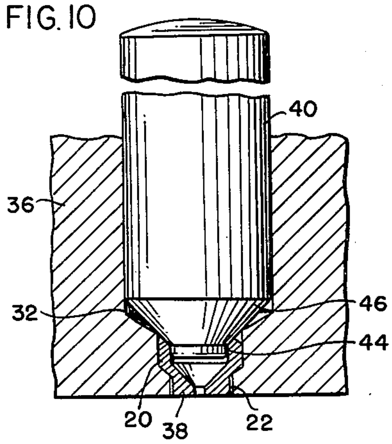


FIG. 11

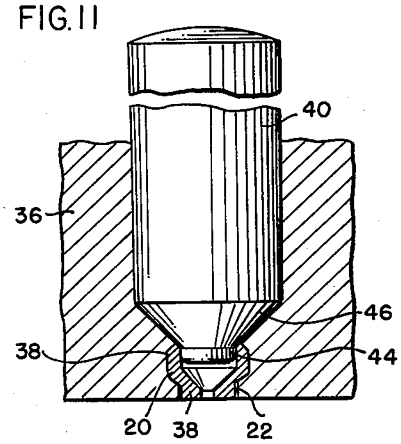
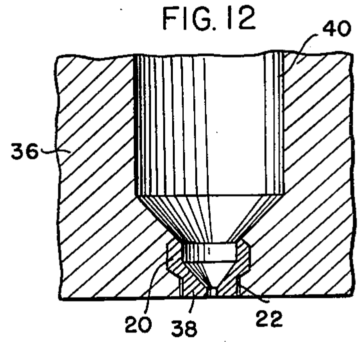


FIG. 12



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SPINNERET WITH ORIFICE INSERT

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Claims priority, application Germany Mar. 2, 1957
4 Claims. (Cl. 18—8)

This invention relates to spinnerettes composed of inserts having predrilled spinning orifices, said inserts being mounted in predrilled, apertured spinning faces.

It is a known practice to produce spinnerettes for the production of synthetic threads by pressing inserts into predrilled, apertured spinning faces. These inserts may be provided with spinning orifices prior to their mounting in said faces as long as the inserts can be set in from the outer side of the face. This type of mounting is satisfactory for certain spinning processes. For example, these spinnerettes are satisfactory for use in the viscose industry, because relatively low spinning pressures are employed. If, however, higher pressures prevail in the spinning head, viz., in the fluid spinning of synthetic filament-forming polymers, then the inserts have to be forced in from the inside. In these cases, it has heretofore been impossible to bore the spinning openings in the inserts in advance of their mounting in the spinnerettes because spinning openings are easily deformed while the inserts are being forced into place.

In accordance with our invention, it was found that it is possible to press into position inserts having predrilled spinning apertures or passages polished to high brilliancy into the predrilled, apertured spinnerette face from the inside of the spinnerette, without deforming the spinning passages, if the inserts, the drilling of the apertures in spinnerette face and the press die with which the insert is pressed into the spinnerette apertures have shapes and size interrelationships which will be described in detail in the following.

It is, accordingly, an object of this invention to provide spinnerette having inserts with predrilled spinning openings mounted in apertured spinnerette faces.

Another object is to provide novel mountings for apertured inserts in spinnerettes.

A further object is to provide spinning nozzles having apertured inserts mounted in the spinnerette faces from the inside of the spinnerette.

A still further object is to provide improvements in spinnerettes for high pressure spinning.

Other objects will occur to those skilled in the art.

In the drawings:

FIGS. 1 and 2 show diametrical cross-sections of two embodiments of predrilled inserts which can be used in the practice of the invention.

FIG. 3 is a partial cross-sectional view of a spinnerette across a diameter of a predrilled aperture therein.

FIG. 4 illustrates one embodiment of a process for press-fitting an insert in the spinnerette with the press die of FIG. 5.

FIGS. 5–7 are side views of three embodiments of press dies which may be used to mount the inserts of FIGS. 1 and 2 in the spinnerettes.

FIGS. 8 and 9 illustrate two steps in the process of mounting an insert in a predrilled spinnerette aperture with the die of FIG. 7.

FIGS. 10 and 11 illustrate two steps in a process for mounting the insert of FIG. 2 in a predrilled aperture of the spinnerette with the die of FIG. 6.

FIG. 12 is a cross-section of a part of a spinnerette with the apertured insert securely mounted therein by the process illustrated in FIGS. 10 and 11.

The inserts of FIGS. 1 and 2 comprise an upper segment **20** and a lower segment **22**—both having cylindrical exterior surfaces. The interior of the inserts is a hollow cavity having a cylindrical wall **26** and a tapering, conical wall terminating in a spinning orifice or passage **24** at the apex thereof. In the embodiment of FIG. 2, the upper edge of the cylindrical wall **26** is interiorly beveled at **28**, **30** for a purpose later described. By way of illustration, the approximate dimensions of the inserts may be: diameter *a*, 1.00 mm.; diameter at *b*, the lower end of segment **20**, 1.60 mm.; and diameter at *c*, the upper end of segment **20**, 1.65 mm. It is to be noted that the exterior wall of segment **20** has a slight taper.

The spinnerette face **36** of FIG. 3 has a predrilled aperture designated generally at **34**. The aperture constitutes three cylindrical cavities, **31**, **33**, **37** connected by tapered, conical walls **32**, **35**. In the example previously stated, the diameters of the cylindrical walls of the aperture **34** would be: *d*, 3.0 mm.; *e*, 1.625 mm.; and *f*, 1.05 mm. Because the diameter *e* is somewhat larger diameter than diameter *b* of the insert and diameter *f* is larger than diameter *a*, these portions have a sliding fit. In this manner a deformation of the nozzle opening **24** is avoided during the pressing in of the insert. However, a good sealing fit is assured because the diameter *e* corresponds to the mean diameter of the tapered wall of segment **20** of the insert.

For the pressing of the inserts into place, it is neecssary to use special press dies, embodiments of which are shown in FIGURES 5, 6 and 7. FIG. 5 shows a form of a press die, whose part **40** fits into and is of equal or slightly smaller diameter than the cavity **31** of the predrilled spinnerette bore **31** of FIG. 3 and whose cylindrical guide **44** fits into the cylindrical cavity **26** of the insert of FIG. 1. By this conformation, the insert does not become canted as it is pressed into place by the shoulder **43** of cylindrical segment **42** of the press die pressed against the upper edge of the insert. The parts **40** and **44** of the die of FIG. 6 bear a similar relationship to the cavities **31** and **26**. However, segments **40** and **44** are connected by a tapered, conical segment **46** having a predetermined taper, later described in detail.

FIG. 7 shows a third form of a press die, by which, according to the invention, an additional insurance of a tight mounting of the insert is achieved. The guide **48**, in this instance, is not cylindrical as is guide **44** in FIGS. 5 and 6, but is terminally hemispherical, and the adjoining shoulder **52** of segment **50** is not diametrically planar, but rather has an angular, sloping surface. Also, the diameter of segment **50** is not equal to or slightly smaller than the outer diameter *c* of segment **20** of the insert of FIG. 1, but is somewhat larger, as, for example, 2.0 mm. for the former and 1.65 mm. for the latter.

In FIG. 8, the press die of FIG. 7 is shown in the starting position of operation. It is apparent that the angular, sloping shoulder **52** is seated against the tapered wall **32** of the aperture in the spinnerette face **36**, while the rounded guide **48** contacts the wall of cavity **26** of the insert **20**, **22**. The flanging-in of the insert is accomplished by further travel of the die to the position of FIG. 9 where the nozzle plate metal is deformed and pressed inwardly over the upper edge of the insert by the angular, sloping shoulder **52**—giving an additional sealing and more securely holding the insert in the spinnerette as is shown in FIG. 9.

FIGS. 10 to 12 illustrate the corresponding operations if the insert of FIG. 2 and the press die of FIG. 6 are used. Here, too, as is apparent from the illustrations, with the complete pressing-in of the die, material of the spinnerette is pressed over the bevel of the insert for additional sealing as a result of the differences in taper between segment **46** of the die and segment **32** of the spinnerette predrilled aperture.

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The nozzle according to the invention assumes a special importance for nozzle openings with extremely small diameters under 125μ. With the previous drilling process it was impossible to drill such fine holes, because, with the depth of the spinnerette faces being 8 to 35 mm., the fine drills, of necessity, were too long. The small depth of the insert according to this invention, maximum 3 mm. and preferably 1 mm., made possible the necessary shortening of the tools, in order to achieve the stability necessary for the production of accurately drilled, extremely fine bores. Furthermore, the invention allows an optical observation of the individual drilling operations, while in the drilling of plates with the 8–35 mm. depth mentioned it is only possible to drill blindly and by feel, without optical observation.

The invention is hereby claimed as follows:

1. A spinnerette having an apertured spinning face, the walls of each of the apertures in said face defining a plurality of cylindrical cavities of progressively decreasing diameter in a given direction, and hollow inserts mounted in said apertures, said inserts having a spinning orifice in one end thereof and the other end thereof having an opening of greater diameter than said spinning orifice, the outer surface of said inserts being in the form of a slightly tapered, substantially cylindrical section at the end adjacent said last-mentioned opening with the largest diameter of the taper at said end and a cylindrical portion at the end adjacent said spinning orifice, said cylindrical portion having a slightly smaller diameter than the cylindrical cavity of the smallest diameter and being positioned therein in coaxial relationship, the slightly tapered, substantially cylindrical section being press-fitted in a second hollow cavity adjacent the cavity of smallest diameter in tight frictional engagement with the walls thereof, the smallest diameter of said tapered section being slightly smaller than the diameter of said second hollow cavity.

2. The spinnerette of claim 1 wherein the depth of the inserts is not greater than 3 mm.

3. The spinnerette of claim 1 wherein the walls of succeeding cylindrical cavities are joined by tapered walls and the outer cylindrical surface and tapered surface of the inserts are joined by tapered walls.

4. The spinnerette of claim 3 wherein a portion of an internal, tapered wall immediately adjacent the rearward edge of the insert is deformed and pressed over the rearward edge of the insert.

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