

United States Patent

Lavinder

[15] 3,668,948

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[54] **METHOD**

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2,148,221 2/1939 Schneider76/107 S UX
 3,017,789 1/1962 Cobb76/107 S

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- [52] U.S. Cl.76/107 S, 83/55, 83/685
- [51] Int. Cl.B21k 5/20
- [58] Field of Search83/684, 685, 691, 55;
 76/107 S

[57] **ABSTRACT**

A spinneret fabrication process that includes the steps of forming a countersink in the bottom of previously formed counterbores of a spinneret plate then punching through the countersinks to form capillaries is improved by supporting the immediate area of each counterbore with a flat-head pin anvil during the forming and punching steps.

[56] **References Cited**

UNITED STATES PATENTS

- 1,939,478 12/1933 Whistler83/685

2 Claims, 2 Drawing Figures

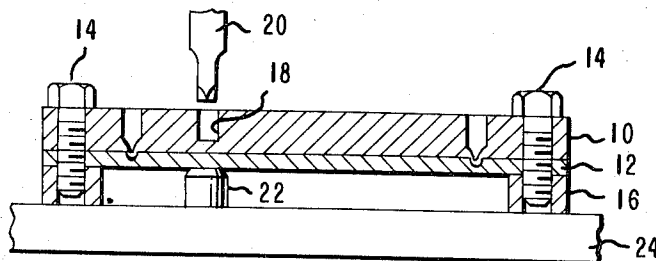


FIG. 1

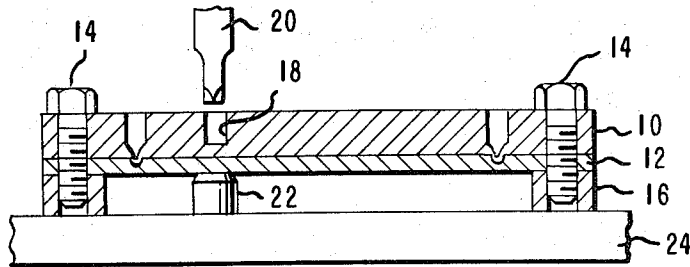
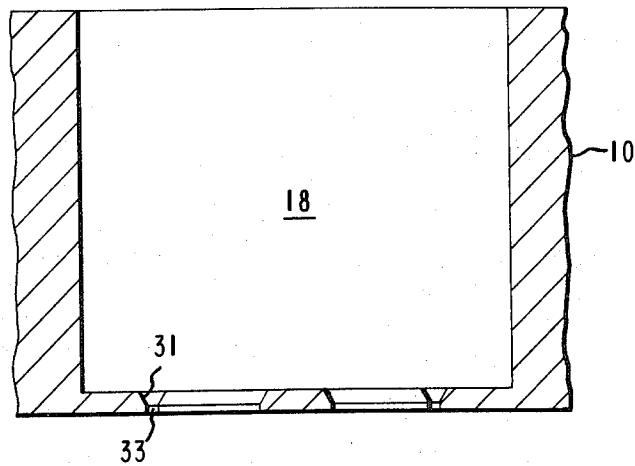


FIG. 2



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METHOD

BACKGROUND OF THE INVENTION

This invention concerns fabrication of spinnerets for the shaping of textile filaments. More specifically, it concerns the fabrication of spinnerets for the spinning of odd cross section filaments and concerns an improved method of shaping the spinneret capillary.

Increasing percentages of total textile fiber production are being made in nonround cross section shapes. These include trilobal and hexalobal and multiple void hollow filaments. Aesthetics of these new filament shapes are critically dependent on dimensional relationships, profiles and uniformity of the spinneret capillaries through which the filaments are spun. These complex capillaries consisting of narrow webs and arcs such as disclosed by Krummeck in U.S. Pat. No. 3,187,607 have imposed greater stresses on the punches used to shape the capillaries. The capillary length, that is, the length of the last parallel sided passage in the spinneret which shapes melt exiting the spinneret, has been shortened to reduce punch stress but the shorter capillary length has imposed narrower dimensional tolerances to obtain acceptable filament-to-filament uniformity.

Typical capillary lengths for these complex spinneret orifices are 0.005 inch and this tolerance must be held within ±0.0005 inch to produce acceptable filaments from all holes in a spinneret — a tolerance not attainable by previously used spinneret fabricating techniques.

Conventional male punch and female die assemblies require precise orientation of the punch to the die recess for complex capillary shapes and result in distorted capillaries when the punch forces the thin capillary web into the female die recess. Techniques described by Cobb in U.S. Pat. No. 3,017,789 and U.S. Defensive Publication No. T 866,021 using a deformable backup material, e.g., soft aluminum or a strip of polyester film under the spinneret have made fabricating complex capillaries feasible but have not completely avoided spinneret plate bowing noted in Schneider's U.S. Pat. No. 2,148,221 and the attendant capillary distortion problems. Schneider discloses (page 4, column 2, lines 22-47) that as successive capillaries are punched across the plate, the projections which are stamped against the soft backup metal plate supporting the entire spinneret face against a table cause buckling upward of the center of the spinneret. This bowing of the spinneret has not been satisfactorily overcome by known stamping techniques such as by clamping the spinneret adjacent the hole being punched or by punching into a relieved anvil. As a result of this bowing, capillary length variation from hole-to-hole may be as much as ±40 percent which is unacceptable for producing filaments of uniform properties.

It is an object of this invention to produce complex spinneret capillaries of improved capillary-to-capillary length uniformity over those methods previously used. It is further an object to produce this improved spinneret in an inexpensive and reproducible way.

SUMMARY OF THE INVENTION

These objects are accomplished by punching the spinneret countersink and capillary against a flat-head pin anvil supporting only the immediate area of the spinneret to be punched. Preferably, an area approximately twice the area of a circle having a diameter of the capillary is supported by the anvil as each spinning orifice is shaped.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a spinneret positioned for punching according to this invention.

FIG. 2 is a cross sectioned elevation of a multilobed capillary shaped according to the method of this invention.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

FIG. 1 shows a spinneret assembly mounted for punching by the method of this invention. A spinneret plate 10 and backup layer 12 are secured with bolts 14 to ring 16 with an open area exposing the lower face of the spinneret in the area of the spinneret orifices. Counterbore hole 18 is shown in position under the punch 20 ready for countersink forming. Located directly under the counterbore hole 18, a pin 22 hardened to Rockwell C 60-62 and ground flat has been positioned to support layer 12 and spinneret 10 in the immediate area of punch 20. This pin 22 is mounted on base plate 24 fixed to the body of the punch press and with appropriate punches is used to form the countersink and capillary passage lengths as described in Defensive Publication No. T 866,021. More particularly, the countersink 31 is formed using a tapered punch having an end configuration of the same pattern as capillary 33 (FIG. 2). During this operation, plate 10 is clamped to ring 16 over a hard backup material. Protuberances formed at the location of each countersink are removed by lapping. The plate 10 is clamped to ring 16 over deformable backup layer 12, then capillary 33 is formed by punching through countersink 31. This is the same forming procedure used in prior art methods except the ring 16 and pin 22 mounted on base plate 24 replace supporting the entire spinneret plate. Pin 22, nominally two times the capillary diameter, serves to localize stresses in the spinneret and prevent bowing. Using the method of this invention, capillary length variation from hole-to-hole is less than ±15 percent and acceptable filament uniformity results.

The isolating effect of pin anvil 22 versus supporting the entire spinneret permits punching loads limited only by punch breaking strength. These loads were formerly limited by the spinneret bowing which produced capillary-to-capillary nonuniformity as previously explained. Where the punch breaking load allows, harder shim materials such as steel can now be used instead of polyester or aluminum, resulting in better shape definition and more uniform countersink and capillary depth across each spinning orifice.

A punch such as described in U.S. Pat. No. 3,525,282 may be used to shape the countersink and capillary. The deformable backup sheet 12 should exceed the combined depth of countersink and capillary and may be two to three times such depth. A presser foot or a hold-down means may be positioned against the top of the spinneret to hold it securely during the countersink and capillary forming steps. This reduces punch breakage when the punch is withdrawn from the capillary depression.

What is claimed is:

1. In a spinneret fabrication process that includes the steps of forming a plurality of counterbores in one side of a spinneret plate; forming a countersink in the bottom of each counterbore and punching through the countersink to form a capillary the improvement comprising, positioning each of said counterbores over a flat head pin-anvil and supporting the immediate area of each counterbore with said anvil during said forming and punching steps.

2. The process of claim 1, said immediate area being about twice the area formed by a circle having a diameter of said capillary.

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