Nov. 20, 1956 J. A. CUPLER, II 2,770,987

SPINNERETTE MANUFACTURE

Filed Dec. 31, 1953

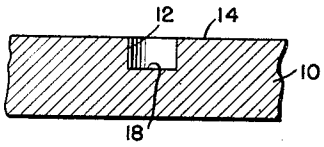



FIG. 1.

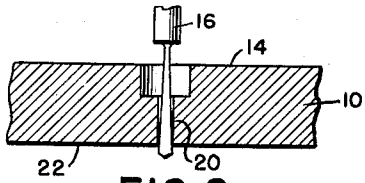



FIG. 2.

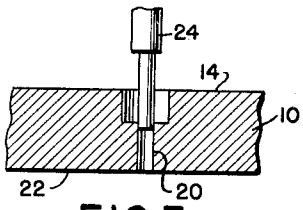



FIG. 3.

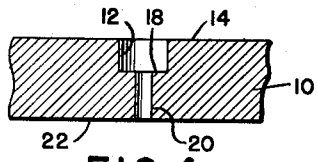



FIG. 4.

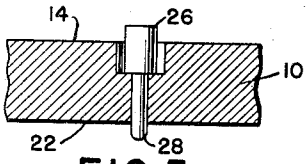



FIG. 5.

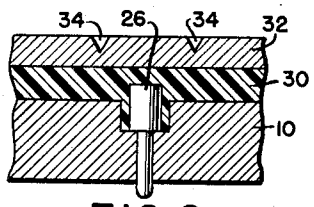



FIG. 6.

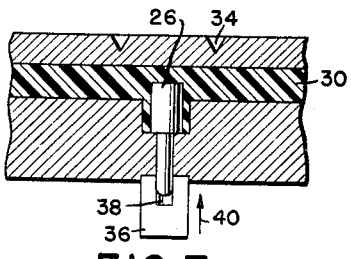



FIG. 7.

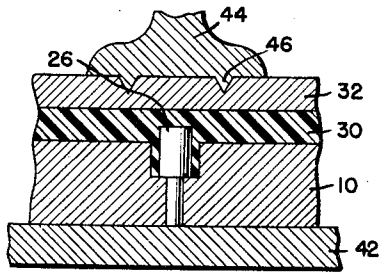



FIG. 8.

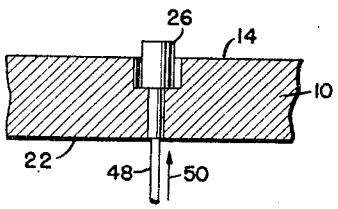



FIG. 9.

*INVENTOR.*
John A. Cupler II

*BY*
Raymond W. Cotton
*ATTORNEY*

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# SPINNERETTE MANUFACTURE

John A. Cupler II, Cumberland, Md.

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7 Claims. (Cl. 76—107)

The present invention relates to improvements in the manufacture of spinnerettes and is particularly related to improvements over the procedures set forth in U. S. Letters Patent No. 2,618,989, dated November 25, 1952, issued to John A. Cupler II.

Here again, it is of fundamental importance that the intersection of the capillary portion of the extrusion orifice with the discharge surface of the spinnerette be as sharp as possible. It is also important that the finish of the wall of the capillary portion be relatively smooth, that the length of all elements of the cylinder defined by the capillary portion be the same and it becomes increasingly important that the length of the capillary portion with respect to its diameter be large.

The present method of finishing the discharge surface of a spinnerette containing an orifice comprises inserting a plug having a complementary cross section through the orifice to project beyond the surface, applying a compacting force to the surface contiguous to the plug, abrading the plug and surface contiguous thereto until they become substantially coplanar, and mechanically removing the plug from a surface opposed to the discharge surface. The composition of the spinnerette is preferably an austenitic ferrous alloy capable of cold working so that the grain size of the spinnerette contiguous to the plug is reduced before the abrading operation. This becomes important since it has been found that the sharpness of the intersection between the capillary portion of the orifice and the discharge surface is a function of the grain size at that intersection. This reduction of the grain size can be achieved effectively by a cold working or coining operation in the area involved.

Removal of the plugs following the abrading operation is preferably effected by applying pressure to only a portion of the area of the abraded end of the plug to remove it from a surface opposed to the discharge surface. It has been found that this method of removal avoids distortion of the material which might otherwise be produced. As a matter of fact, it has been found that by chemically etching the abraded end of the plug prior to the application of pressure, removal of the plug is greatly simplified and damage to the spinerette minimized. Various acids are well suited for the purpose.

A more complete understanding of the invention will follow from a description of the accompanying drawing wherein:

Fig. 1 is a fragmentary sectional elevation of a blank which has received a counterbore;

Fig. 2 is a fragmentary sectional elevation of the same blank after it has been drilled to receive the capillary portion of the orifice;

Fig. 3 is a fragmentary sectional elevation depicting a combined broaching and coining operation;

Fig. 4 is a fragmentary sectional elevation of the blank following the operation of Fig. 3;

Fig. 5 is a fragmentary sectional elevation of the blank with a plug inserted through the orifice;

Fig. 6 is a fragmentary sectional elevation showing the use of a thermoplastic material to secure the plug in place and showing a fixture in position;

Fig. 7 is a fragmentary sectional elevation showing a compacting operation;

Fig. 8 is a fragmentary sectional elevation depicting an abrading operation; and

Fig. 9 is a fragmentary sectional elevation depicting the removal of the plug from the blank.



The blank **10** of Fig. 1 has received a countersink or counterbore **12** from the inlet surface **14**. By the next operation, a drill **16** is applied to the bottom wall **18** of the counterbore to produce the capillary portion **20** intersecting the discharge surface **22**. This may be followed by a combined operation by means of a tool **24** which is forced completely through the capillary portion **20** to impart relative smoothness to the wall of the capillary portion and if desired, a very slight radius at the intersection of the capillary portion and the bottom of the counterbore. Incidentally, it will be noted that the bottom of the counterbore has been depicted as perpendicular to the axis thereof which permits the elements of the cylinder defining the capillary portion to be of equal length even though the axis of the capillary portion may be somewhat eccentric with respect to the axis of the counterbore. It is preferred that the angle defined by the slope of the bottom wall of the counterbore adjacent its intersection with the capillary portion and the axis of the capillary portion have a value between 65° and 90° so that the lengths of the elements of the cylinder defining the capillary portion will always be substantially equal. Where the wall of the counterbore is inclined to a greater degree sufficient to provide an uninterrupted flow, the danger of distortion of the capillary portion becomes serious.

After the tool **24** has been retracted from the blank, the semi-finished article assumes the form such as that depicted in Fig. 4. A suitable plug **26** is now introduced from the inlet surface **14** so that its end **28** projects beyond the discharge surface **22**. If desired, this plug may perform the broaching and coining operation rendering it possible to eliminate one of the manufacturing steps already described. The plug is secured in position by its frictional engagement alone, and/or by the application of a thermoplastic body **30** to the inlet surface of the blank, filling the portion of the counterbore surrounding the plug as shown in Fig. 6. A suitable fixture **32** has been indicated as superimposed upon the thermoplastic material and containing recesses **34** for reception of a driving tool.

The next operation, depicted in Fig. 7 may be accomplished by means of a compacting tool **36** containing a bore **38** longer than the projecting end of the plug **26** but closely complementing its cross section. By the application of pressure or compacting force to the tool **36** in the direction of the arrow **40**, the grain size of the blank contiguous to the plug is reduced. This result follows naturally from the cold working of austenitic ferrous alloys of well known types.

Compositions of the blanks preferred for the purposes contemplated herein include:

8 to 20% nickel
17 to 35% chromium
2 to 3% molybdenum
Not more than 2% manganese
Not more than 0.1% carbon
Balance essentially iron

Higher corrosion resistance will be obtained with alloys of the type:

8 to 14% nickel
17 to 19% chromium

2 to 3% molybdenum
Balance essentially iron

Higher heat resistance characteristics will result with an alloy of the type:

20% nickel
25% chromium
Balance essentially iron

After the reduction of grain size by compacting or cold working as depicted in Fig. 7, the abrading operation is performed against a lapping and/or polishing surface **42** by means of a driving head **44** providing pins **46** received in the recesses **34**. The abrading operation is continued until the discharge surface and plug are substantially coplanar whereupon the driving head **44**, fixture **32** and thermoplastic material **30** are removed. The only remaining operation is the removal of the plug from the orifice. The actual physical removal may be preceded by the application of a suitable acid to the abraded end of the plug momentarily and then washing the acid away, thus performing an etching operation which removes a small amount of the material from the end of the plug without apparently affecting the surface of the blank itself. This permits an operator to locate the end of the plug more readily and thereby facilitate its removal from the blank. A minimum of distortion of the product is observed when the plug is pushed from the blank rather than pulled from it. Accordingly, as depicted in Fig. 9, a punch **48**, of somewhat smaller cross section than that of the plug itself is applied to the abraded end of the plug and moved in the direction of the arrow **50** to push the plug out of the blank at the inlet surface **14**.

The resulting product, which would appear substantially as that depicted in Fig. 4, achieves a linearity of intersection between the capillary portion **20** and the discharge surface **22** never before achieved in this art. The elements defining the cylinder of the capillary portion **20** are equal because of the configuration of the bottom of the counterbore. The multiple extrusion orifices almost invariably formed in such blanks can be controlled by this method so as to have capillary portions which are substantially identical. All of these features contribute to the great improvement in the filaments produced with these spinnerettes.

Although the drawings have depicted a rather specific sequence of operations, and whereas many variations contemplated have not been discussed, the breadth of the invention should not be restricted beyond the scope of the appended claims.

I claim:

1. A method of finishing the discharge surface of a spinnerette containing an orifice and having a composition whose grain size is reduced by cold working, comprising inserting a plug having a complementary cross section through said orifice to project beyond said surface, applying a compacting force to said surface contiguous to said plug sufficient to deform said surface, abrading said plug and said surface contiguous thereto until they become substantially coplanar, and mechanically removing said plug from a surface opposed to the discharge surface.

2. A method of finishing the discharge surface of an austenitic ferrous alloy spinnerette containing an orifice, comprising inserting a plug having a complementary cross section through said orifice to project beyond said surface, reducing the grain size of said spinnerette by deforming said surface contiguous to said plug, abrading said plug and said surface contiguous thereto until they become substantially coplanar, and mechanically removing said plug from a surface opposed to the discharge surface.

3. A method of finishing the discharge surface of a spinnerette containing an orifice, comprising inserting a plug having a complementary cross section through said orifice to project beyond said surface, cold working and deforming said surface contiguous to said plug, abrading said plug and said surface contiguous thereto until they become substantially coplanar, and mechanically removing said plug from a surface opposed to the discharge surface.

4. A method of finishing the discharge surface of a spinnerette containing an orifice, comprising inserting a plug having a complementary cross section through said orifice to project beyond said surface, abrading said plug and said surface contiguous thereto until they become substantially coplanar, and applying pressure to only a portion of the area of the abraded end smaller than the area of the end of said plug to displace said plug, and removing said plug from a surface opposed to the discharge surface.

5. A method of finishing the discharge surface of a spinnerette containing an orifice, comprising inserting a plug having a complementary cross section through said orifice to project beyond said surface, abrading said plug and said surface contiguous thereto until they become substantially coplanar, chemically etching only the abraded end of said plug, applying pressure to a portion of said end smaller than the area of the end of said plug, and removing said plug from a surface opposed to the discharge surface.

6. A method of making a spinnerette comprising drilling a blank of an austenitic ferrous alloy to form an orifice, polishing said orifice adjacent the discharge surface of the blank, inserting a plug having a complementary cross section through said orifice to project beyond said surface, reducing the grain structure of said blank by deformation of said surface contiguous to said plug, abrading said plug and said surface contiguous thereto until they become substantially coplanar, and mechanically removing said plug.

7. A method of making a spinnerette comprising drilling a blank of an austenitic ferrous alloy to form an orifice, polishing said orifice adjacent the discharge surface of the blank, inserting a plug having a complementary cross section through said orifice to project beyond said surface, compacting said blank contiguous to said plug sufficient to deform said surface, abrading said plug and said surface contiguous thereto until they become substantially coplanar and pushing said plug from said discharge surface towards an opposed surface.

**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 902,322 | Porter | Oct. 27, 1908 |
| 915,762 | Grivolas | Mar. 23, 1909 |
| 2,618,989 | Cupler | Nov. 25, 1952 |