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2,618,989

METHOD OF MANUFACTURING ORIFICED MEMBERS

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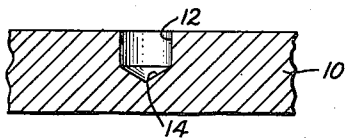


Fig. 1.

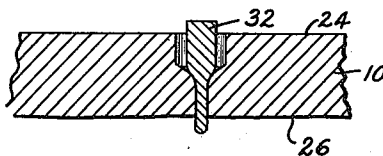


Fig. 5.

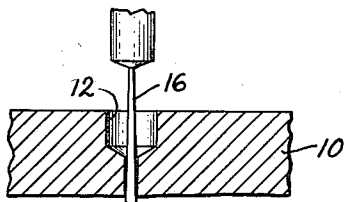


Fig. 2.

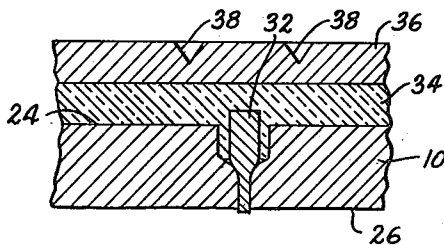


Fig. 6.

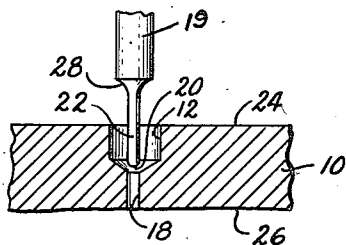


Fig. 3.

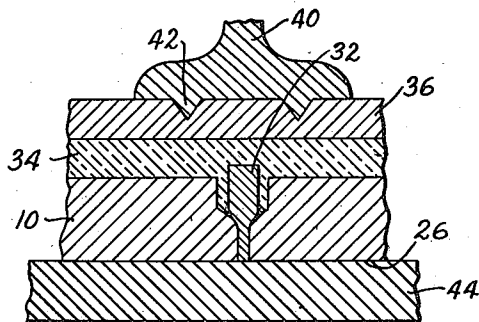


Fig. 7.

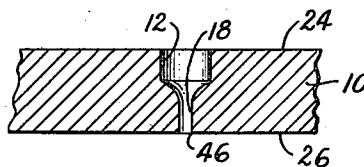


Fig. 8.

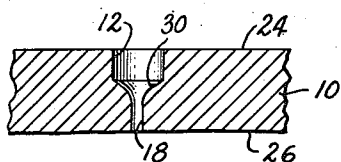


Fig. 4.

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METHOD OF MANUFACTURING ORIFICED MEMBERS

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In the production of spinnerettes and nozzles of precision types, it has been customary to impart a high polish to the discharge surface of the product in an effort to obtain a sharp linear edge where the orifice intersects the discharge surface. Microscopic examination of some of the best articles of this type heretofore produced has revealed the presence of rounded corners in lieu of sharp edges and depressions in the adjacent areas of the discharge surfaces. The adverse effects of these malformations are well known in the artificial silk and kindred industries, a rather frequent result being the failure of the plastic material to assume the intended filamentary form.

Accordingly, it is an object of the present invention to produce a sharp substantially linear intersection between an orifice and a discharge surface, by inserting the reduced end of a plug through the orifice to prevent the penetration of abrading material into the orifice while the desired conformation is being produced.

In making a spinnerette for example, a blank or body may be drilled to form a desired number of orifices, each orifice may then be polished adjacent a surface of the body, a plug is then inserted through the orifice to project beyond the surface, the surface and plug rendered substantially coplanar, and the plug removed. Where the body is sufficiently thick, a countersink may be preliminarily formed partially therethrough so that the calibrated portion of the orifice need not extend entirely through the work.

The orifice drilling operation may be followed by a burnishing step which may be accompanied by or followed by a coining operation. By burnishing the cylindrical portion of the orifice adjacent to the discharge surface, a high polish will be imparted to the orifice wall; and by coining the inlet end of the orifice, a rounded convergence will be imparted to improve the flow characteristics of the fluid to be expressed therethrough. The plug received by the orifice is preferably substantially a counterpart of the active portion of the broaching tool to the extent that it will exactly complement the effective portion of the orifice. The plug will preferably project beyond the inlet and discharge surfaces of the body, its projection beyond the inlet surface permitting engagement for insertion and removal and further serving as a means to secure the plug in the body while performing abrading or other desired operations at the discharge surface of the body. The plug or plugs may be secured against undesired displacement

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with respect to the body by the application of a thermoplastic bonding material to the inlet surface of the body to embed the plug or plugs, the thermoplastic material also serving to secure a jig or tool to the assembly for assistance in performing desired finishing operations. A thermoplastic wax of the nature of sealing wax, soluble in mineral spirits, has produced highly satisfactory results in this connection. After the plugs have been secured in the body, their ends projecting beyond the discharge surface can be removed, and by abrading operations such as lapping and/or polishing, the discharge surface of the body and the plugs will be rendered substantially coplanar. Then the bond will be released in a suitable manner as by means of a solvent and the plug or plugs removed by engaging their ends still projecting beyond the inlet surface of the body and withdrawing them, thus avoiding any contact with the orifice edge at the discharge surface.

In the event that a spinnerette, for example, already contains an orifice, the drilling operation will be omitted in practicing the present invention. The material constituting the plug is preferably at least as hard as that constituting the body and the cross section of the plug is preferably at least as great as that of the orifice in order that the plug will complement the orifice to prevent the penetration of undesired particles.

A more complete understanding of the invention will follow from a detailed description illustrated by the attached drawings wherein:

Fig. 1 is a fragmentary sectional elevation of a body provided with a countersink;

Fig. 2 is a fragmentary sectional elevation of the body penetrated by a drill to form an orifice;

Fig. 3 is a fragmentary sectional elevation of the body about to receive a combined broaching and coining tool;

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

Fig. 5 is a fragmentary sectional elevation of the body of Fig. 4 receiving a plug;

Fig. 6 is a fragmentary sectional elevation of the body thermoplastically bonded to the plug and a tool;

Figure 7 is a fragmentary sectional elevation depicting an abrading operation to which the assembly of Fig. 6 is subjected; and

Fig. 8 is a fragmentary sectional elevation of a completed article.

Where it is desired to produce a spinnerette or other form of nozzle, a blank or body 10 may re-

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ceive a relatively large aperture or countersink 12 having a convergent base portion 14 into which a drill 16 will be introduced as shown in Fig. 2 to produce an orifice 18 as shown in Fig. 3. The drill is depicted as of the pivot type, and for the requirements of spinnerettes as now produced, would have an effective diameter of from .001 to .025 inch.

At this point, a burnishing tool 19 providing a tapered tip 20 and a cylindrical intermediate portion 22 will be forced through the orifice 18 from the inlet surface 24 to penetrate the discharge surface 26, and by virtue of its slight degree of oversize as compared with the drilled orifice, will produce a highly polished wall. The tool may provide a coining surface 28 at its upper working portion to impart the desired curvature at the upper edge 30 of the orifice as shown in Fig. 4.

A plug 32 which is substantially a counterpart of the active portion of the burnishing tool is inserted into the orifice as depicted in Fig. 5 to project beyond the opposed inlet and discharge surfaces 24 and 26 respectively. This plug substantially complements the cylindrical and coined portions of the orifice, and may even impart a finishing polishing action where it is given a slight degree of oversize, of the order of, say, .0001 inch. These plugs may be made from drill rod or other suitable material which is at least as hard as the material through which the orifice is formed, so that there will be no galling action nor affinity between the plugs and the bodies into which they are introduced.

A suitable thermoplastic body 34, such as sealing wax or the like, soluble in gasoline or other available solvent, is applied to the inlet surface 24 of the body to embed the projecting portion of the plug 32 and adhesively secure to this assembly a tool or fixture 36 provided with sockets 38. Having secured the plugs in the body in this manner, their ends projecting beyond the discharge surface can be removed to render them substantially flush, whereupon a driving head 40 of a lapping or polishing machine, whose pins 42 are received in the sockets 38 of the fixture 36, will subject the discharge surface 26 to an abrading action against a lapping and/or polishing surface 44.

A lapping operation in accordance with this invention may proceed until a microfinish is produced on the discharge surface, whereupon the lapping compound can be removed by means of a suitable solvent. The surface can then be polished with a suitable composition, such as fine diamond dust in an oleaginous suspension, until it possesses a mirror finish. A microfinish known in the trade as "No. 8" has been achieved by the lapping operation, and a mirror finish has been produced that will reveal no scratches when magnified from 36 to 180 times.

A solvent is then employed to soften and remove the thermoplastic bonding agent 34, whereupon the plugs 32 can be gripped at their enlarged ends adjacent the inlet surface of the body and withdrawn from the orifices, resulting in the finished article depicted in Fig. 8 wherein the edge 46 defined by the intersection of the orifice 18 with the discharge surface 26 will be sharp and the discharge surface itself substantially planar.

By thus providing a sharp circular edge 46 at the intersection of the internally polished orifice 18 and the polished discharge surface 26, vastly

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superior flow characteristics and resulting products will be attained.

Whereas the invention has been exemplified by a highly satisfactory method, the present disclosure will suggest many variations of those skilled in the art, just as they have already occurred to the inventor, and accordingly, the invention should not be restricted beyond the scope of the appended claims.

I claim:

1. A method of finishing a 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 mechanically removing said plug from a surface opposed to the first said surface.

2. A method of finishing a surface of a spinnerette containing an orifice, comprising inserting a plug having a complementary cross section of material at least as hard as that constituting said spinnerette through said orifice to project beyond said surface, abrading said plug and said surface contiguous thereto until they become substantially coplanar, and mechanically removing said relatively hard plug from a surface opposed to the first said surface.

3. A method of finishing a surface of a spinnerette containing an orifice, comprising inserting a plug having a similar cross section at least as great as that of said orifice through said orifice to project beyond 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 first said surface.

4. A method of finishing a surface of a spinnerette containing an orifice, comprising inserting a plug complementing said orifice through said orifice to project beyond 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 first said surface.

5. A method of finishing a surface of a spinnerette containing an orifice, comprising inserting a relatively hard plug having a complementary cross section through said orifice to project beyond said surface, abrading said plug and said surface contiguous thereto to render them substantially coplanar, and mechanically removing said plug from a surface opposed to the first said surface.

6. 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 and an opposed surface, abrading said plug and said discharge surface contiguous thereto until they become substantially coplanar, and withdrawing said plug at said opposed surface.

7. A method of finishing a surface of a spinnerette containing an orifice, comprising inserting a plug having a complementary cross section through said orifice to project beyond said surface, positively securing said plug remote from said surface, abrading said plug and said surface contiguous thereto until they become substantially coplanar, releasing said plug, and withdrawing said plug from said orifice.

8. A method of finishing a surface of a spinnerette containing an orifice, comprising inserting a plug having a complementary cross section

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through said orifice to project beyond said surface, thermoplastically securing said plug to the spinnerette, abrading said plug and said surface contiguous thereto until they become substantially coplanar, releasing the bond between said plug and spinnerette and withdrawing said plug from said orifice.

9. A method of making a spinnerette comprising drilling a blank to form an orifice, polishing said orifice adjacent a surface of the blank, 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 mechanically removing said plug.

10. A method of making a spinnerette comprising drilling a blank to form a countersink and an orifice, burnishing said orifice to size, inserting a plug having a complementary cross section through said orifice to project beyond a surface of said blank, abrading said plug and said surface contiguous thereto until they become substantially coplanar, and mechanically removing said plug.

11. A method of making a spinnerette comprising drilling a body to form an orifice, modifying said orifice to form a convergent inlet end and a cylindrical discharge end, inserting a plug having a complementary cross section into said convergent end and through said orifice to project beyond a surface of said body at said discharge end, abrading said plug and said surface contiguous thereto until they become substantially coplanar, and mechanically removing said plug.

12. A method of making a spinnerette comprising drilling a body to form an orifice, polishing said orifice, inserting a plug having a complementary cross section through said orifice to project beyond opposed surfaces of said body, securing a projecting end of said plug to said body, abrading the other end of said plug and a surface of said body contiguous thereto until they become substantially coplanar, and mechanically removing said plug.

13. A method of manufacture comprising drilling a body to form an orifice, inserting a plug having a complementary cross section through said orifice to project beyond a surface of said body, abrading the projecting end of said plug and said surface contiguous thereto and thereby producing a substantially linear intersection between said surface and orifice, and mechanically removing said plug from a surface opposed to the first said surface.

14. A method of making a spinnerette comprising drilling a body to form an orifice, inserting a plug having a complementary cross section through said orifice to project beyond opposed surfaces of said body, producing a thermoplastic

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bond between a projecting end of said plug and said body, abrading the other end of said plug and a surface of said body contiguous thereto until they become substantially coplanar, releasing said bond, and mechanically removing said plug.

15. A method of making a spinnerette comprising drilling a body to form an orifice, inserting a plug through said orifice to project beyond opposed surfaces of said body, producing a thermoplastic bond between a projecting end of said plug, said body and a tool, abrading the other end of said plug and one of the surfaces of said body contiguous thereto until they become substantially coplanar by operation of said tool, releasing said bond, and mechanically removing said plug.

16. A method of making a spinnerette comprising drilling a body to form an orifice having inlet and discharge ends, polishing the wall of said orifice, inserting a plug having a complementary cross section through said orifice to project beyond a discharge surface of said body, abrading said plug and said surface contiguous thereto until said surface and orifice define a sharp continuous edge, and mechanically removing said plug.

17. A method of finishing a discharge surface of a nozzle containing an orifice, comprising introducing a plug having a complementary cross section into said orifice to project beyond said surface, abrading said plug and said surface contiguous thereto until the intersection of said surface and said orifice is substantially linear, and mechanically removing said plug from a surface opposed to the first said surface.

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