

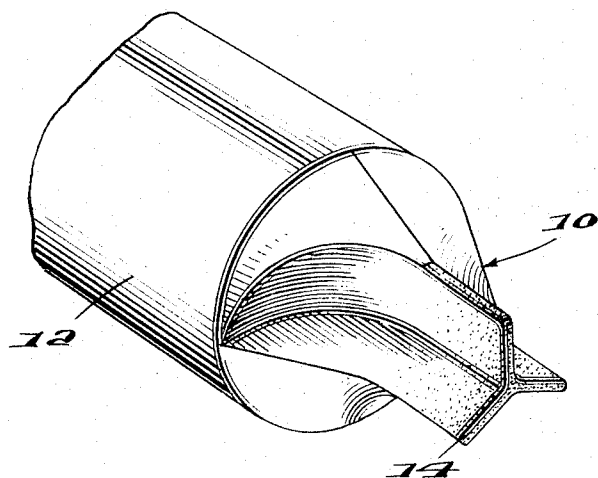
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LOW FRICTION PUNCH TOOL

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## LOW FRICTION PUNCH TOOL

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4 Claims. (Cl. 83—686)

This invention relates generally to spinnerets and more particularly to fabrication of the small bore holes or capillaries through which viscous organic materials are spun as filaments.

In the manufacture of spinneret plates, blanks of stainless steel or other suitable material are usually machined to present a counterbore or countersink for each capillary. The capillary itself can be fabricated in successive punching and finishing steps.

Typically, round filaments are spun through capillaries having a diameter of only 0.009 inch and trilobal filaments through a capillary having three arms (0.003 inch in width and 0.015 inch in length) radiating from a central opening. To obtain uniform yarn product, all capillaries must be substantially identical. Consequently, the punches used to manufacture a group of spinnerets must be held to extremely close tolerances. A very smooth surface is left on the punches as a result of the machining techniques used to maintain the requisite tolerances. The very smooth surface causes high friction and sticking in a punching operation.

Another important parameter is the length-to-diameter ratio of the capillaries. With odd cross section capillaries, this is the ratio of depth to width of an arm. In most cases, the ratio is one or slightly greater. Although higher ratios are desirable from the standpoint of improved yarn product, capillary depths have been limited by punch breakage due in part to punch rigidity. Also, as greater depths are attempted, irregularities such as torn metal appear on the capillary walls. The extent of such irregularities has been reduced somewhat by beveling the usually sharp working edges of the punch with a hand stone. Because of the minute size of the punches, this is not only an expensive and time-consuming operation but also one which is difficult to achieve both reliably and uniformly.

The object of this invention is to provide an improved punch with which odd-shaped spinneret capillaries having an increased depth-to-width ratio and a smooth finish on the capillary walls can be fabricated more reliably and at less expense.

Such a worthwhile objective has been achieved with a punch of the desired shape or cross-sectional configuration which terminates in a rounded working edge and is provided with a matte finish.

Other objectives will be apparent from a reference to the accompanying illustration of a trilobal shaped punch 10 on a tool shank 12. Punch 10 is machined on one end of a tungsten tool steel rod in milling, shaving and grinding steps which leave sharp leading edges. The punch is finished with an abrasive treatment to provide not only a rounded working edge 14 but also the illustrated matte finish.

The preferred abrasive treatment is basically a micro-grit-blasting technique achieved with an "Airbasive" unit

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marketed by the S. S. White Company. Such a unit forces an air-grit mixture through a jet or nozzle. The punch is held in a collet and rotated in front of the jet while the unit is held and moved by an operator as required.

In the fabrication of spinneret capillaries, a punching machine of the type disclosed by Thomas et al. in U.S. 2,709,492 can be used. Shank 12 is adapted for reception by a holder on the machine spindle. As such, punch 10 has utility in a spinneret fabrication procedure which includes the preliminary step of drilling an entrance hole into one surface of a blank, drilling or punching to shape the bottom of the entrance hole, punching a countersink into the shaped bottom leaving a protuberance on the reverse or second surface of the blank, removing the protuberance, punching again to shape and size the capillary wall and finishing the orifice presented in the second surface. With thin blanks, the preliminary drilling step is not required. The usual surface-finishing and burr-removal techniques are employed to provide a highly polished finish on the second surface and a sharp edge between the capillary walls and the second surface. Punch 10 has particular utility as the final shaping and sizing tool for odd-shaped capillaries. In addition to the fact that fewer punch breakages are experienced, microscopic examinations reveal a smooth capillary wall which is substantially free from irregularities. As a consequence of the improved punching action, it is now practicable to increase the capillary depth-to-width ratio and to thereby obtain an improved yarn product.

It is believed that the abrasive treatment leaves a rounded leading edge differing from that obtained by beveling with a hand stone in that it is tangential to the adjoining side of the punch. This rounding of the leading edge causes a smooth transition of the forces from shear to compression and reduces the tendency of the metal to tear during a punching operation. At the same time, the rounding reduces the points of stress concentration. Furthermore, the abrasive treatment provides a matte finish on all surfaces which contact the plate being punched. The matte finish has peaks and valleys so that less of the surface actually contacts the capillary walls. In addition, the matte finish by comparison with a highly polished finish, helps retain a lubricant at the working surfaces. Consequently, there is less friction between the punch and capillary walls, i.e., the tendency of the punch to stick, weld or freeze is greatly reduced.

Instead of the trilobal configuration, the punch may be of a different multilobal configuration, round or of any other useful shape. Although the micro-grit-blasting technique has been disclosed as preferred, the punches can be finished by similar techniques such as by vapor-blasting. Other changes and modifications will occur to those skilled in the art without departure from the spirit of the invention which is therefore intended to be limited only by the scope of the appended claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A tool comprising a shank terminating in a punch with a flat end surface and a rounded leading edge, said punch also being provided with a matte finish on all of its working surfaces.

2. The tool of claim 1 wherein said rounded leading edge and said matte finish are the effects of an abrasive treatment.

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3. A tool comprising a shank terminating in a punch having a rounded leading edge; a multilobal cross section and a matte finish on all of its working surfaces.

4. The tool of claim 3 wherein said punch is trilobal in cross section.

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