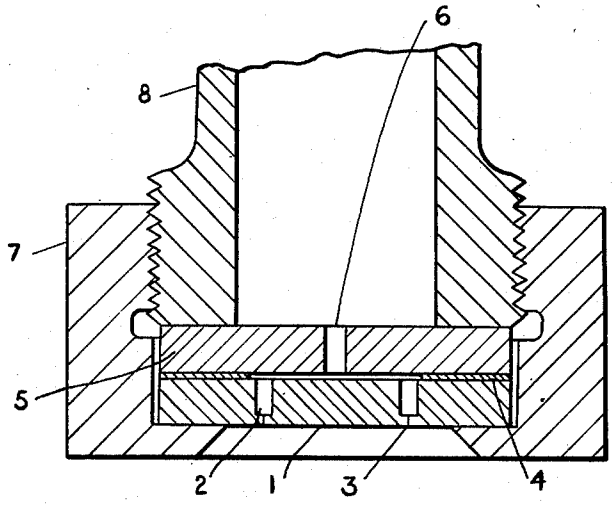
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PRODUCTION OF ARTIFICIAL MATERIALS

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PRODUCTION OF ARTIFICIAL MATERIALS

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1

This invention relates to the production of artificial materials and particularly to the spinning by extrusion of artificial filaments and like products, and is especially concerned with the spinning jets and jet assemblies by means of which filament-forming materials are extruded to form such products.

In the spinning of certain materials into filamentary form, and particularly of organic materials that require to be extruded at high temperatures, bubbles are liable to form in the material being extruded, giving rise to weak and irregular filaments and to frequent stoppages of spinning by the lodgment of bubbles in the extrusion orifices. In such cases it is desirable to maintain the pressure of the material on its way to the spinning jet high enough to inhibit as far as possible the formation of bubbles in the material in spite of the fact that so high a pressure is more than is necessary, at the rates of flow of the material usually met with in practice, to force the material through the extrusion orifices. This may be done in some measure by the insertion of filters immediately before the jet which, apart from their function of preventing the passage of any solid particles contained in the material, are designed to offer such a resistance to the flow of the material as to ensure a high pressure in the material being extruded, up to a point shortly before the jet is reached. This pressure, however, gradually falls off across each filter and this gives an opportunity for bubble-formation, both in the later stages of filtering and between the last filter and the jet. It is the object of the present invention to provide a jet assembly in which a high pressure is maintained right up to the jet itself, whereby this disadvantage is overcome or substantially reduced.

According to the present invention a jet assembly for the extrusion of artificial filaments and like products comprises a jet having extrusion orifices therein, and a plate finely spaced from the inner surface of said jet, said plate being perforated at a distance across the face of the plate from any of said orifices for the passage of material to be extruded to the inner surface of said jet. By these means the extrusion material reaches the inner surface of the jet at a point removed from the extrusion orifices and, in order to reach the extrusion orifices, is forced to pass through a very thin flat space, the conformation of which offers a high resistance to its passage and gives rise to a high pressure in the material reaching and passing across the inner face of the jet.

2

The jet is conveniently in the form of a flat circular disc with a concentric circle of extrusion orifices, the plate behind the jet then being a circular plate coextensive with the jet and having a single central perforation, which is thus equally spaced from each of the extrusion orifices. A thin spacing washer can be interposed between the jet and the plate in order to space them accurately apart, the washer being exchangeable with other washers of different thickness in order to vary or adjust the pressure developed in the material being extruded. Alternatively, the spacing of the faces of the jet and plate may be effected by integral projections on one or other of said faces. The jet itself must, of course, be of a thickness sufficient to withstand the pressure developed on its inner surface, and since the thickness thus necessitated may be substantial the inner surface of the jet may be recessed at the points where the extrusion orifices are formed in order to reduce the length of the fine holes constituting the orifices.

The jet assembly according to the invention is applicable generally to the extrusion of filament-forming materials which are liable to bubble-formation under the conditions of extrusion, and is particularly well suited for the spinning of molten material in the form of filaments which harden by cooling after extrusion. Thus, for example, it may be employed in the melt-spinning of synthetic linear polyamides made, for instance, by the condensation of diamines with dicarboxylic acids.

By way of example one form of jet assembly in accordance with the invention and particularly adapted for the melt-spinning of such materials will now be described in greater detail with reference to the accompanying drawing which is a section through the jet assembly.

The assembly comprises a die steel disc 1 of 1¾" outside diameter, 4 mm. thick, drilled with six holes 2 each 3.5 mm. deep and $\frac{1}{16}$" diameter, on centres equally spaced round the disc at a distance of $\frac{5}{32}$" from the centre thereof. At the bottom of each hole, and coaxial therewith, is formed a spinning orifice 3 of 0.2 mm. diameter, 0.5 mm. long. After the formation of the orifices 3 the disc 1 is hardened, ground and lapped flat. Over the disc is placed a washer 4, 0.003" thick, 1¾" outside diameter and ⅜" inside diameter, and above the washer 4 is a hardened and ground die steel disc 5, 1⅜" diameter and 4 mm. thick, having a central hole 6 of $\frac{1}{16}$" diameter. The three members 1, 4 and 5 are clamped together by means of a heavy internally flanged nut 7 against the end of a flanged and screw-threaded

pipe 8 by which the spinning material is supplied to the assembly. The spinning material so supplied is constrained to pass through the central hole 6 in the upper plate 5, and radially across from centre to edge of the flat space, 0.003'' deep, enclosed between the jet 1, the plate 5, and the separating washer 4. By these means a pressure of the order of 800 to 900 lbs./sq. inch can readily be built up in the material reaching the jet assembly. By changing the washer 4 for one of different thickness, the pressure may be altered when required.

Having described our invention, what we desire to secure by Letters Patent is:

1. A jet assembly for the extrusion of artificial filaments and other shaped products, which comprises a jet having extrusion orifices therein, and behind and finely spaced therefrom a plate adapted to cause a viscous filament-forming material to travel, laterally across and substantially parallel to the inner surface of the jet under a considerable pressure gradient, said plate having a perforation therein, the arrangement of the extrusion orifices in the jet in relation to the perforation in the plate being such that each orifice is at substantially the same distance normally to and laterally across the jet face from the perforation in the plate.

2. A jet assembly according to claim 1, wherein the perforated plate is spaced from the inner surface of the jet by means of a thin spacing washer.

3. A jet assembly for the extrusion of artificial filaments and other shaped products, which comprises a jet consisting of a flat disc provided with a number of extrusion orifices arranged in a circle concentric with the circumference of the disc, behind the jet a plate of substantially the same diameter as the jet having a single central perforation of diameter substantially less than that of the circle of extrusion orifices, the arrangement of the extrusion orifices in the jet in relation to the perforation in the plate being such that each orifice is at substantially the same distance normally to and laterally across the jet face from the perforation in the plate, and between the jet and the plate and in contact with both a spacing washer, the combination being adapted to cause a viscous filament-forming material to travel laterally across and substantially parallel to the inner surface of the jet under a considerable pressure gradient.

4. A jet assembly according to claim 1, wherein the inner surface of the jet is recessed at the points where the extrusion orifices are formed so as to reduce the length of the fine holes constituting the orifices.

5. A jet assembly according to claim 3, wherein the inner surface of the jet is recessed at the points where the extrusion orifices are formed so as to reduce the length of the fine holes constituting the orifices.

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