Oct. 1, 1946. W. L. WEBB 2,408,713

EXTRUSION DEVICE

Filed Feb. 5, 1944

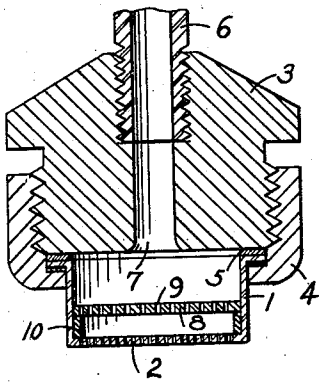



Fig. 1

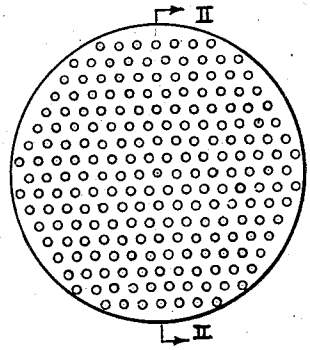



Fig. 2



Fig. 2a

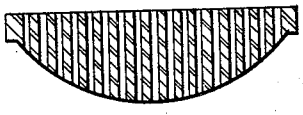


Fig. 2b

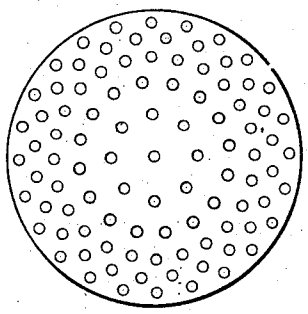


Fig. 3

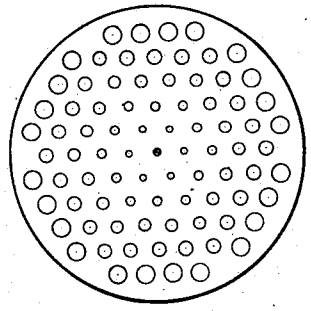


Fig. 4

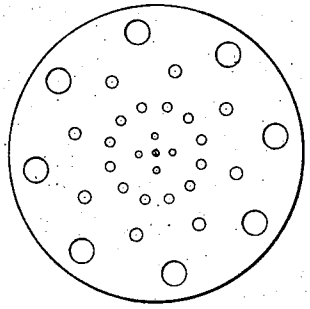


Fig. 5

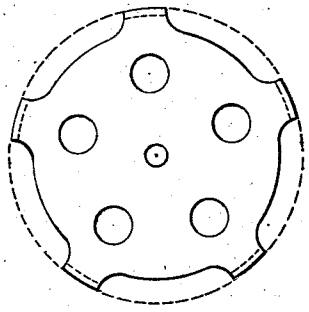


Fig. 6

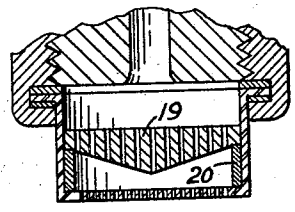



Fig. 7

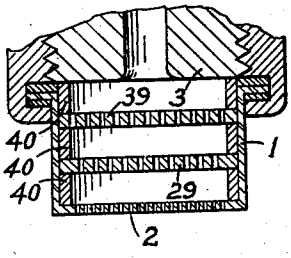



Fig. 8

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# UNITED STATES PATENT OFFICE

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## EXTRUSION DEVICE

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Application February 5, 1944, Serial No. 521,221

5 Claims. (Cl. 18—8)

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This invention relates to extrusion devices for simultaneously forming a plurality of filaments and the like.

When forming filaments by extruding the filament-forming material through a plurality of orifices in a common spinneret in which the orifices are disposed in an area which is considerably larger than the cross-section of the supply duct for the filament-forming material, there is a tendency for the filaments issuing from the central orifices directly opposite the end of the duct to be somewhat larger than those which issue from the orifices toward the outer periphery of the spinneret. The reduction in the rate of flow through the outer orifices gives rise to an increased tendency of such orifices to become clogged. There is a growing demand for the use of larger spinnerets having a greater number of orifices, but this tendency has been somewhat hampered by the tendency of such spinnerets to favor the centrally disposed orifices.

It has heretofore been proposed to alleviate this difficulty by introducing the filament-forming material tangentially into the side wall of the spinneret so that it is caused to swirl first about the outer portions and then into the central portions of the spinneret, but this has the tendency in large spinnerets to favor one side of the spinneret, near the entrance of the filament-forming material.

In accordance with the present invention, a distribution controlling means comprising an apertured member is inserted in the extrusion device between the spinneret orifices and the supply duct for introducing the filament-forming material. This means for controlling the distribution may comprise a member arranged to fit within the spinneret proper, spaced back of the face thereof, and provided with apertures which are much larger in cross-sectional area than the passages of any filter that may be associated with the spinneret and larger even than the orifices of the spinneret and which serve to impart a back pressure or flow resistance to the stream of filament-forming material which increases from an outer annulus of the member to the central portion thereof and thereby compensates for the normal tendency of the central orifices of the extrusion device to be favored.

The invention will be explained more particularly with reference to the drawing which is illustrative of preferred embodiments on an enlarged scale and in which—

Figure 1 is a cross-sectional view through an extrusion device showing the general arrangement of a simple form of the invention;

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Figure 2 is a face view of one form of apertured member of the invention;

Figure 2*a* is a cross-section taken on line II—II of Figure 2;

Figure 2*b* is a cross-section of a modification of the apertured member of Figure 2;

Figures 3 to 6 are face views of other modifications of apertured members;

Figure 7 is a view similar to Figure 1, showing a modified general arrangement; and

Figure 8 is a view similar to Figure 1, showing another general arrangement.

In Figure 1, a spinneret **1** provided with a plurality of orifices **2** (greatly exaggerated in diameter) is shown secured in conventional manner to a supply head **3** by means of a coupling **4**, a gasket **5** being provided to seal the structure. The supply head **3** has a threaded recess for receiving a conduit **6** connected to a source of supply of filament-forming material through a pump, not shown. A passage or duct **7** in the head **3** communicates with the conduit **6** and the space within the spinneret proper. Arranged within this space there is provided a means for controlling the distribution of the filament-forming material in the form of a rigid plate **8** having apertures **9**, a ring **10** serves to space the plate a short distance back of the inside face of the spinneret, but preferably not so far back that this distance is greater than the distance between the plate **8** and the inside face of the head **3**.

The size, spacing and arrangement of the apertures **9** in the distributor **8** may take various forms. In Figures 2 and 2*a*, the apertures are of the same size and are substantially uniformly distributed throughout the area of the member **9**. A further refinement giving improved results is shown in Figure 3, in which all the holes are of the same size, but the number of holes per unit area of member **9** increases with increasing distances from the center. In Figure 4, a modification is provided in which the holes increase in size with increase in distance from the center while the number of holes per unit area is the same throughout. Figure 5 shows a modification in which the holes increase in size to a greater extent than in Figure 4 with increase in distance from the center, but the number of holes per unit area decreases with increasing distance from the center. Figure 6 shows a form in which the distributor member is cut out at portions about its periphery to form a scalloped outline. A central hole is surrounded by a plurality of somewhat larger holes.

Figure 2*b* shows a still further modification, in which a distributor having a substantially uni-

form distribution of holes of the same size (and having the same face view as shown in Figure 2), has a decreasing thickness from the center to the periphery thereof. This increases the resistance of the holes in proportion to their distance from the periphery.

Figure 7 shows an assembly in which a distributor **19** having a conical base is spaced from the spinneret face by a ring **20**. This is a modification of the distributor shown in Figure 2*b*, and it may have a uniform distribution of holes of the same size or the holes may become more or less numerous per unit area and/or they may become of larger or smaller diameters as well. In other words, distributors may be designed which utilize a combination of all of these variations and serve to produce more uniform distribution of flow through all of the orifices of the spinneret regardless of position.

In Figure 8, there is shown an extrusion device comprising a spinneret **2**, extrusion head **3**, and two distributor members **29** and **39** spaced from each other, from the head and from the spinneret face by rings **40** each of which are of approximately the same thickness. The distributors may be the same or different. In the latter case any two of the varieties shown in Figures 2 to 7 may be associated together. For example, distributor **39** may take the form shown in Fig. 6 while **29** may take the form shown in Fig. 2.

While the drawing shows only a single duct associated with a spinneret, the invention contemplates the design of distributor means which serve in the same advantageous fashion with a multiple-duct supply. In such cases, consideration is taken of the positions of ducts with respect to the face of the spinneret and the need to reduce the resistance to flow through the distributor at the various regions thereof in proportion to the distance such regions are offset from the direct lines of flow from the ducts.

The apertures in the distributor may vary widely in size. They should in no event be as small as the interstices of filters that are sometimes associated with the spinneret nor should they be as small as the spinneret orifices since holes of such size would build up pressures to a needless extent. Holes much larger than spinneret orifices and filter interstices are used in the present invention, and preferably the smallest of such holes should not be less than 0.03 inch in diameter. The holes may be square, rectangular, elliptical or of any other cross-section, but are preferably circular. The thickness of the distributor plate may vary widely, such as from $\frac{1}{32}$ to ¼ inch, more or less.

The distance of the distributor means back of the spinneret may vary widely from as low as about $\frac{1}{16}$ of an inch up to ¼ inch or more. It is preferable that the distance between the supply head and the distributor be at least as large as and, most advantageously, considerably larger than the distance between the spinneret face and distributor plate.

The present invention is applicable to spinnerets which are intended for all types of spinning, whether wet-, dry-, or fusion-spinning.

In the claims the term "row" is intended to refer to a group of orifices disposed along a line which may be straight or curved whether the space in between orifices along such line be strictly uniform or somewhat irregular.

While preferred embodiments of the invention have been disclosed, it is to be understood that changes and variations may be made without departing from the spirit and the scope of the invention as defined by the appended claims.



I claim:

1. An extrusion device for simultaneously forming a plurality of filaments comprising a supply duct, a spinneret arranged to receive filament-forming material from the duct and having a plurality of rows of orifices disposed generally throughout an area considerably larger than the cross-section of the duct, and means comprising a rigid member having a plurality of apertures each larger than any one of the spinneret orifices disposed between and being spaced from each of the spinneret and the duct, said apertures facing the orificed area of the spinneret and being disposed over an area substantially co-extensive with that occupied by said plurality of rows of orifices, said member being constructed and arranged to provide for substantially the same rate of flow through each of the several orifices independent of location with respect to the duct whereby the pressure and distribution of the material to the spinneret is controlled.

2. An extrusion device for simultaneously forming a plurality of filaments comprising a supply duct, a spinneret arranged to receive filament-forming material from the duct and having a plurality of rows of orifices disposed generally throughout an area considerably larger than the cross-section of the duct, and means comprising a rigid member having a plurality of apertures each larger than any one of the spinneret orifices disposed between and being spaced from each of the spinneret and the duct, said apertures facing the orificed area of the spinneret and being substantially uniformly distributed over an area substantially co-extensive with that occupied by said plurality of rows of orifices, said member being constructed and arranged to provide for substantially the same rate of flow through each of the several orifices independent of location with respect to the duct whereby the pressure and distribution of the material to the spinneret is controlled.

3. An extrusion device for simultaneously forming a plurality of filaments comprising a supply duct, a spinneret arranged to receive filament-forming material from the duct and having a plurality of rows of orifices disposed generally throughout an area considerably larger than the cross-section of the duct, and means comprising a rigid member having a plurality of apertures each larger than any one of the spinneret orifices disposed between and being spaced from each of the spinneret and the duct, said apertures facing the orificed area of the spinnert and being substantially uniformly distributed over an area substantially co-extensive with that occupied by said plurality of rows of orifices, said apertures generally having larger diameters at greater distances from a portion of the member directly in line with the duct and said member being constructed and arranged to provide for substantially the same rate of flow through each of the several orifices independent of location with respect to the duct whereby the pressure and distribution of the material to the spinneret is controlled.

4. An extrusion device for simultaneously forming a plurality of filaments comprising a supply duct, a spinneret arranged to receive filament-forming material from the duct and having a plurality of rows of orifices disposed generally throughout an area considerably larger than the cross-section of the duct, and means comprising

a rigid member having a plurality of apertures each larger than any one of the spinneret orifices disposed between and being spaced from each of the spinneret and the duct, said apertures facing the orificed area of the spinneret and being substantially uniformly distributed over an area substantially co-extensive with that occupied by said plurality of rows of orifices, all of said apertures being of the same size and said member being constructed and arranged to provide for substantially the same rate of flow through each of the several orifices independent of location with respect to the duct whereby the pressure and distribution of the material to the spinneret is controlled.

5. An extrusion device for simultaneously forming a plurality of filaments comprising a supply duct, a spinneret arranged to receive filament-forming material from the duct and having a plurality of rows of orifices disposed generally throughout an area considerably larger than the



cross-section of the duct, and means comprising a rigid member having a plurality of apertures each larger than any one of the spinneret orifices disposed between and being spaced from each of the spinneret and the duct, said apertures facing the orificed area of the spinneret and being disposed over an area substantially co-extensive with that occupied by said plurality of rows of orifices, the distribution of apertures being such that there are generally fewer thereof per unit area at greater distances from a portion of the member directly in line with the duct, said apertures generally having larger diameters at greater distances from said aligned portion of the member, and said member being constructed and arranged to provide for substantially the same rate of flow through each of the several orifices independent of location with respect to the duct whereby the pressure and distribution of the material to the spinneret is controlled.

WESLEY L. WEBB.