Apr. 24, 1923. 1,453,048

F. G. KRAFT ET AL

SPINNERET

Filed Feb. 14, 1920

Fig. 1.

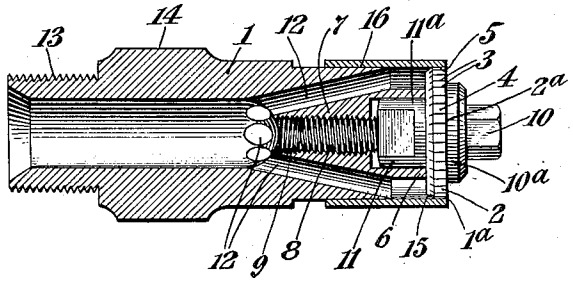


Fig. 2.

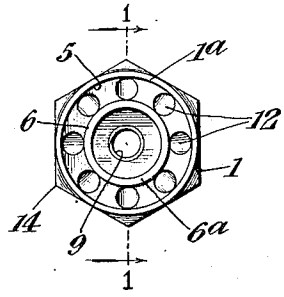
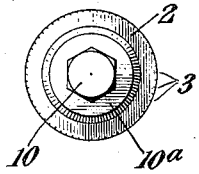


Fig. 3.



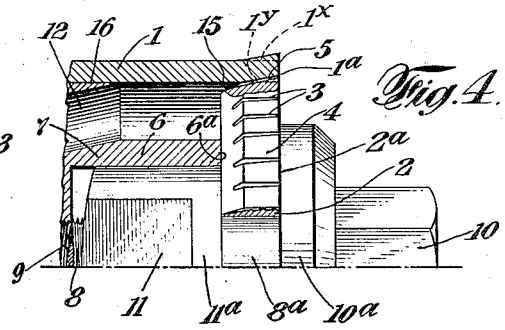
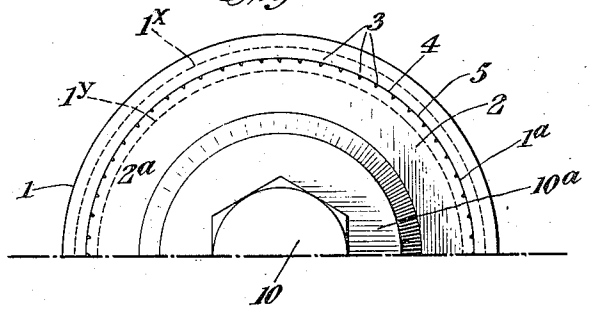


Fig. 4.

Fig. 5.



Inventor
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By their Attorney H. R. Squair.

Patented Apr. 24, 1923. 1,453,048

UNITED STATES PATENT OFFICE.

FREDERICK G. KRAFT AND CHARLES J. BACON, OF WILMINGTON, DELAWARE, ASSIGNORS TO E. I. DU PONT DE NEMOURS & COMPANY, OF WILMINGTON, DELAWARE, A CORPORATION OF DELAWARE.

SPINNERET.

Application filed February 14, 1920. Serial No. 358,731.

To all whom it may concern:

Be it known that we, FREDERICK G. KRAFT and CHARLES J. BACON, both citizens of the United States, and residents of Wilmington, in the county of New Castle and State of Delaware, have invented a certain new and useful Spinneret, of which the following is a specification.

This invention is in the art of artificial silk manufacture and relates to a spinneret for dividing the generally cellulosic solution, from which the silk is made, into small streams. In practice such streams are coagulated to form filaments and the latter united to form a thread.

In the dividing of the solution into streams it is highly important that the streams should issue from the spinneret in such a way that each stream is separate and distinct from the rest; if the streams are not so separate they run together at the spinneret and trouble and difficulties follow, making it extremely difficult, if not impossible, to produce the filaments, and thread, necessary to a proper product. We have devised a spinneret with which the solution can be readily and properly divided.

One object of our invention is to provide a spinneret which will accurately and effectively divide the solution.

Another object is to provide a spinneret which is simple in character, easily cleaned, and can be manufactured comparatively inexpensively and readily assembled and disassembled.

To these ends, and also to improve generally upon devices of the character indicated, our invention consists in the various matters hereinafter described and claimed.

In the accompanying drawings illustrating, to a considerably enlarged scale, a spinneret embodying our invention:—

Figure 1 is a longitudinal section of the device, substantially on the line 1—1 of Figure 2, with the orifice disc in place;

Figure 2 is an end view of the cylinder or nozzle of the device, with the orifice disc removed;

Figure 3 is a front view of the orifice disc;

Figure 4 is a fragmental radial sectional view of the orifice disc and the cooperating end of the nozzle, illustrating the taper of the disc and the manner in which the disc fits into the end of the nozzle with the nozzle expanding to receive it, and also illustrating the form of the orifices, with these features exaggerated the better to illustrate them, and

Figure 5 is a face view of the disc and the cooperating end of the nozzle, the expansion of the nozzle and the taper of the disc being exaggerated to substantially correspond with Figure 4, and one half of the disc being omitted to economize space.

Referring now to the drawings:—The illustrated device comprises a cylindrical tube, nozzle member or body, 1 and an orifice member, or circular disc, 2 for insertion in the end of the nozzle member. This disc is provided in its periphery with a series of small transverse orifices, or fluid channel grooves, 3 extending, as here illustrated, directly crosswise of the periphery and parallel to the axis of the disc. In use, the solution from which the filaments are to be made is forced through the grooves and so separated and divided into streams.

According to our invention the disc 2 is fitted into the end of the nozzle very closely and also in such a way that each passage, formed by a groove and the overlying or bridging portion of the nozzle wall, has its discharge end absolutely true, the groove not projecting beyond the end of the nozzle wall, nor the nozzle wall projecting beyond the groove. With the periphery of the disc in close contact with the nozzle wall there is no opportunity for the solution to leak peripherally along the disc over the "land" between the grooves, and so fail to be properly divided by the grooves; and with the ends of the passages true there is no opportunity for an issuing stream to depart from its proper form, tend to "curl up" or form a drop, or in any other manner fail to be discharged as a fully separated and properly formed stream of proper size. To the end of thus locating and positioning the disc we, in the illustrated device, use the following construction:

The portion 4 of the periphery of the disc which contacts the inside surface 5 of the end of the nozzle 1 is tapered very slightly, say at an angle of about 1/2° to the axis of the disc (Figure 4), the smaller diameter

of the taper being substantially equal to, e. g. .0002 of an inch less than, the internal diameter of the end of the nozzle and the larger diameter being somewhat greater, e. g. .001 of an inch greater, than the internal diameter of the nozzle. The end of the nozzle is a true cylinder and without taper, but, although unitary, is sufficiently resilient and expansible, as illustrated in Figures 4 and 5 by the dotted lines 1^x, 1^y, to provide for the insertion of the disc therein, far enough to bring the outer face of the disc in alignment and flush with the end of the nozzle, and also to provide for contact of the nozzle wall with the portion 4 of the periphery of the disc throughout the circumference thereof and substantially fully across the same. With this construction it will be seen that the disc is received tightly in the nozzle and all possibility of leakage avoided; yet the disc is easily put in place or removed. Also, with this construction, when the disc is being inserted the end of the nozzle slides over the periphery of the disc in intimate contact therewith and so removes any particles of dirt which may be lodged on the periphery and which, if not removed, would interfere with the accurate and fluid-tight fitting of the disc.

To place the outer ends of the grooves flush with, and in exact alignment with, the end of the nozzle, the edge 1^a of the end of the nozzle and the face 2^a of the disc are brought to the same plane, as by machining, the plain surface extending radially outward and inward from the orifices sufficiently to insure an uninterrupted and "clean" emergence of the filaments; conveniently, substantially the entire face of the disc and the end of the nozzle are brought to a plane. Also, a stop 6 is provided for locating the disc with its face 2^a in exact register with the edge 1^a. In the illustrated device this abutment is an upstanding annular wall carried by the bridge 7 and having its edge 6^a so positioned with respect to the end of the nozzle that, when the disc abuts such edge, the faces 1^a and 2^a are in alignment and the ends of the passages are true. Also, the annulus 6 serves to assist in holding the disc true (uncanted) in the nozzle and to the better serve this purpose is desirably, and as shown, of comparatively large diameter.

The disc 2 is conveniently held in the nozzle by a pin or spindle 8 which also serve as a convenient means for moving the disc into the nozzle and withdrawing it therefrom. This spindle is threaded into the tapped hole 9 concentrically located in the bridge 7. The disc 2 is carried on the spindle between the nut-like head 10 and the nut 11 threaded thereon, the head and nut preferably having circular portions 10^a and 11^a respectively for contact with, and support of, the disc. Desirably, and as shown, the disc is rotatably mounted on the spindle, the spindle having an unthreaded cylindrical portion 8^a forming a bearing for the disc. Thus the disc can be readily forced into the end of the nozzle, since rotation of the disc with respect to the nozzle is avoided.

The bridge 7 is provided with a circular series of passages 12 in addition to the hole 9, which provide means for the flow of the solution through the bridge. Desirably the nozzle is exteriorly threaded adjacent its rear end, as at 13, to provide for its connection with a suitable solution-supplying element, as a pipe (not shown) and is conveniently provided with a nut-like flange 14. As previously indicated the inner periphery of the open end of the nozzle is unitary, that is, the nozzle has no slits extending therethrough as does the usual "expanding sleeve." This gives the inner periphery an uninterrupted surface, and obviates what would be a source of leakage. The entire device is preferably of metal.

Desirably the grooves are of round-bottomed "V" form (Figure 5), and, to afford an easy entrance for the fluid are somewhat deeper (Figure 4) at the entrance end than at the exit end. The grooves may be of any suitable size; we have found satisfactory a groove about .002 of an inch deep at the shallow end, about .0025 of an inch wide at the top, and having its bottom inclined downward at about 12° to the horizontal from the exit end to the entrance end. A disc may conveniently be about 3/8 of an inch in maximum diameter and about 3/64 of an inch thick, with the contacting portion 4 of the periphery about 1/32 of an inch wide and the beveled portion 15 at an angle of about 45°, and may be provided with about sixty substantially equally spaced grooves of the size mentioned.

It will be seen that the present construction readily lends itself to the proper making and location of the minute orifices, so that these orifices can be made with great accuracy, of uniform size, and without burrs or other obstructions.

For definiteness we have described our invention with more particular reference to the artificial silk art, but we do not restrict it thereto as devices embodying it may be used in various arts where it is important to maintain uniformity, and exactness in the size of streams of fluid issuing from an apparatus. Neither do we restrict the invention to the illustrated embodiment.

Desirably, and as shown more particularly in Figure 1, the expansible end portion of the nozzle member 1 is a separate sleeve tightly forced upon the body proper of the nozzle, as indicated at 16, permitting more convenient manufacture and, should it be

advisable, the use of a metal having different qualities of resiliency and so forth than that used for the body proper. It is to be noted that the use of the cylindrical end, rather than an end formed, as manufactured, with a female taper to receive an orifice member having a substantial male taper, is a fundamentally different construction than the male-and-female type, and, by it the very great difficulty inherent in the latter type, of obtaining an accurate fit and close contact over the whole surface of both tapers and, at the same time, bringing the end of the nozzle and the face of the orifice member into register, is avoided, the present assembly being basicly of the cylinder-and-cylinder type, rather than of the taper-and-taper type. With the present cylinder-and-cylinder type the accurate and close peripheral fit of the end of the nozzle and the disc, particularly, and very importantly, along the exterior ends of the fluid passages, is conveniently obtained, the nozzle end closely contacting the periphery of the disc over all the "land" presented by the surface 4.

We claim:

1. In a spinneret, in combination, a nozzle member having an expansible open end, and an orifice member provided in its periphery with a transverse fluid channel and adapted to fit in said end, said orifice member being larger than the interior size of said end when unexpanded, whereby when said orifice member is fitted in said end, and said end expands to receive it, the wall of said end closely contacts the periphery of said orifice member at the sides of said channel and prevents side-leakage from said channel along said periphery, and whereby upon insertion of said orifice member in said open end, said end will slide transversely of said periphery in contact therewith to clean the same.

2. In a spinneret, in combination, a nozzle member having a cylindrical expansible open end, and an orifice member provided in its periphery with a transverse fluid channel and adapted to fit in said end, said orifice member being in the character of a tapered circular disc with its larger diameter greater than the interior diameter of said open end when unexpanded, whereby when said disc is fitted in said end, and said end expands to receive it, the wall of said end colsely contacts the periphery of said disc at the sides of said channel and prevents side-leakage from said channel along said periphery, and whereby, upon insertion of said disc in said open end, said end will slide transversely of said periphery in contact therewith to clean the same.

3. In a spinneret, in combination, a nozzle member having an open end, an orifice member adapted to fit in said open end and having a transverse fluid channel in its periphery, and means for moving said orifice member into said open end.

4. In a spinneret, in combination, a nozzle member having an open end and also having a threaded aperture communicating with the opening in said end, an orifice member adapted to fit in said end and having a transverse fluid channel in its periphery, and means for moving said orifice member into said open end, said means comprising a threaded pin for reception in said aperture and carrying said orifice member.

5. In a spinneret, in combination, a nozzle member having an open end and also having a threaded aperture communicating with the opening in said end, an orifice member adapted to fit in said end and having a transverse fluid channel in its periphery, and means for moving said orifice member into said open end, said means comprising a threaded pin for reception in said aperture and carrying said orifice member rotatably mounted thereon.

6. In a spinneret, in combination, a nozzle member having an open end and presenting an orifice-member abutment in the character of a projection positioned to positively limit the travel of the hereinafter named orifice member, and an orifice member having a transverse fluid channel in its periphery and adapted to fit in said open end and also adapted to contact said abutment, said abutment positively limiting the travel of said orifice member and thus positively locating said orifice member, and the exterior end of its channel, with respect to the edge of said open end.

7. In a spinneret, in combination, a nozzle member having an open end and presenting an orifice member abutment, and an orifice member having a transverse fluid channel in its periphery and adapted to fit in said open end and also adapted to contact said abutment, said abutment being so located with respect to the edge of said open end as to position the orifice member in the said open end with the exterior end of said channel in register with said edge.

8. In a spinneret, in combination, a nozzle member having an open end and presenting an orifice-member abutment, and an orifice member having a transverse fluid channel in its periphery and adapted to fit in said open end to bottom upon said abutment, said abutment being so located with respect to the edge of said open end as to position the orifice member in the said open end with the exterior end of said channel in register with said edge.

9. In a spinneret, in combination, a nozzle member provided interiorly with a bridge intermediate its length; said member having an open end projecting beyond said bridge and said bridge being provided

with a fluid passage therethrough and also being provided with an abutment extending from said bridge toward the edge of said open end; and a disc-like orifice member adapted to be closely received in said open end to bottom upon said abutment and provided in its periphery with a series of groove-like transverse channels.

10. In a spinneret, in combination, a nozzle member provided interiorly with a bridge intermediate its length; said member having an open end projecting beyond said bridge and said bridge being provided with a fluid passage therethrough and also being provided with an abutment extending from said bridge toward the edge of said open end; a disc-like orifice member adapted to be closely received in said open end to bottom upon said abutment and provided in its periphery with a series of groove-like transverse fluid channels, and means for connecting said orifice member to said nozzle member.

11. In a spinneret, in combination, a nozzle member provided interiorly with a bridge intermediate its length; said member having an open end projecting beyond said bridge and said bridge being provided with a fluid passage therethrough and also being provided with an abutment extending from said bridge toward the edge of said open end; a disc-like orifice member adapted to be closely received in said open end to bottom upon said abutment and provided in its periphery with a series of groove-like transverse fluid channels, and means for connecting said orifice member to said bridge.

12. In a spinneret, in combination, a nozzle member provided interiorly with a bridge intermediate its length and having a threaded aperture; said member having an open end projecting beyond said bridge and said bridge being provided with a fluid passage therethrough and also being provided with an abutment extending from said bridge toward the edge of said open end; a disc-like orifice member adapted to be closely received in said open end to bottom upon said abutment and provided in its periphery with a series of groove-like transverse channels, and means for connecting said orifice member to said bridge, such means comprising a stud rotatably carrying said orifice member and adapted to be threaded into said aperture of the bridge.

13. In a spinneret, in combination, a tube-like nozzle member provided interiorly with a bridge intermediate its length; said member having an open end, interiorly cylindrical and projecting beyond said bridge, and said bridge being provided with a threaded aperture substantially concentric with said open end, also being provided with an eccentric fluid passage through the bridge, and also being provided with an upstanding annular wall surrounding said central aperture with its edge lying within the interior of said open end and spaced, longitudinally of the nozzle, from the edge of said end; a circular orifice disc adapted to closely fit in said open end and bottom upon said annular wall, said disc being provided in its periphery with a series of transverse fluid grooves, and means for connecting said nozzle member and said disc, such means comprising a stud threaded into said central aperture of the bridge and connected with said disc.

In testimony whereof we affix our signatures.

FREDERICK G. KRAFT.
CHARLES J. BACON.