Jan. 11, 1955 H. J. McDERMOTT 2,698,963

WET-SPINNING APPARATUS

Filed Aug. 15, 1952

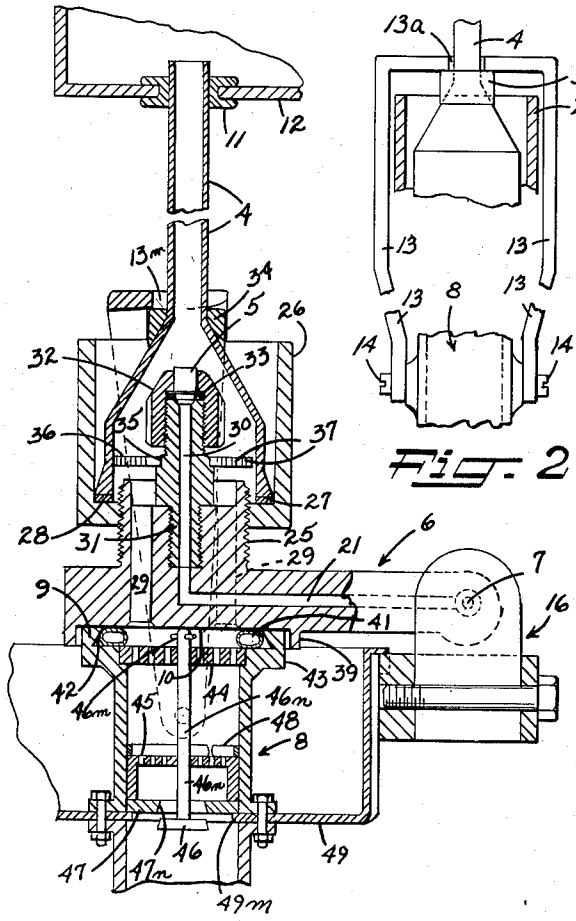


Fig. 1

Fig. 2

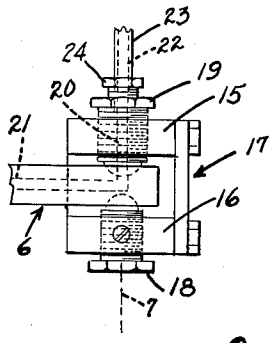


Fig. 3

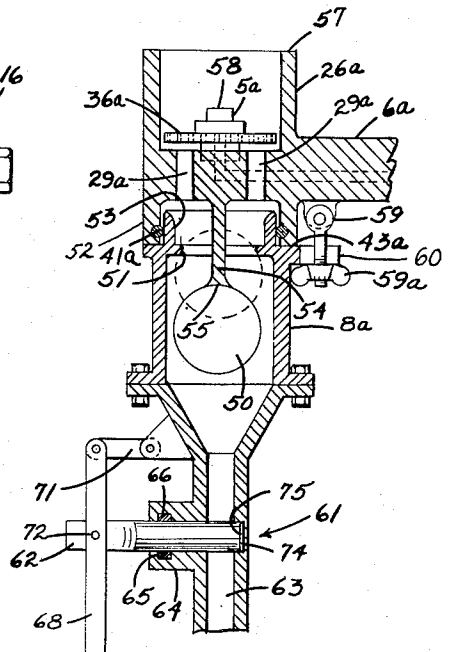


Fig. 4

INVENTOR.
HENRY J. McDERMOTT
BY
Thomas R. O'Malley
ATTORNEY.

United States Patent Office 2,698,963 Patented Jan. 11, 1955

2,698,963

WET-SPINNING APPARATUS

Henry J. McDermott, Collingdale, Pa., assignor to American Viscose Corporation, Philadelphia, Pa., a corporation of Delaware

Application August 15, 1952, Serial No. 304,542

13 Claims. (Cl. 18—8)

The present invention relates to spinning apparatus in which a filament-forming material is extruded into a stream of liquid coagulant or other filament-setting liquid, and particularly to a system for spinning yarns comprising filaments of regenerated cellulose.

It is an object of the invention to provide spinning apparatus of the type in which extruded filament-forming material and a liquid filament-setting material, such as a coagulant or a coagulating and regenerating liquid, are passed concurrently from a region adjacent the spinneret or extrusion plate thereof, such apparatus being adapted to be readily assembled and quickly placed in operation, or taken apart, for example, for cleaning. It is another object to provide apparatus of the general type indicated above which may be put into operation without fouling the face of the spinneret. Still another object is to provide apparatus in which the flow of the filament-setting liquid is controlled as a result of movement of parts of the apparatus from an inoperative position to an operative position and vice-versa. It is also an object to provide wet-spinning apparatus in which gas bubbles carried by the filament-setting liquid will not be trapped adjacent the spinneret or carried in such a manner as to interfere with the conversion of the extruded filament-forming liquid into filaments. Other objects, features, and advantages will be apparent from the following description of the invention and the drawing relating thereto in which

Fig. 1 is an elevation, partially in section, of an apparatus constituting one embodiment of the invention;

Fig. 2 is a fragmentary view of the apparatus shown in Fig. 1 provided for further illustration of the system for securing the major portions of the apparatus together;

Fig. 3 is a plan view of a portion of the apparatus as shown in Fig. 1; and

Fig. 4 is an elevation with portions thereof shown in section of a modified spinning apparatus.

One embodiment of the invention may be constructed in accordance with that illustrated in Figs. 1, 2, and 3. The apparatus shown therein comprises as basic portions thereof, a tube 4 having a flared end-portion, a spinneret 5, a spinneret-holding support 6 pivotally supported with respect to a stationary axis 7, and a conduit 8 having a surface 9 which engages a surface 10 of the support 6 and limits the motion of the support with respect to the axis 7. The tube 4 is movable away from its seat on the support 6 in a direction parallel to its length with respect to a grommet 11 or other member adapted for providing lateral support. The grommet 11 is secured as shown, by flange portions which fit around an edge of a container 12 defining an aperture through the bottom of the container. As illustrated, the lengthwise direction of the tube 4 is approximately vertical; the spinneret 5 faces upwardly and is approximately centered with respect to the axis of the tube. The conduit 8 extends in a vertical direction but may take any other upward alignment which approximates seating relationship with the arms 6 substantially as shown. It is readily apparent from Fig. 1 that, since the end surfaces of the tube 4 and the conduit 8 which engage the support 6 are separated by the support, they face toward a single plane which extends through the support transversely with respect to the axes of the tube and the conduit.

Since a liquid coagulant or filament-setting liquid is supplied to the apparatus at such a pressure as to cause the liquid to flow through the tube 4 at a rate substantially that at which the filament-forming material is discharged from the spinneret 5, such pressure is substantial and tends to force principal portions of the apparatus, i. e., the tube 4, the arm 6, and the conduit 8, apart from

the relationship illustrated in Fig. 1. One arrangement, for example, that may be used to hold the apparatus together against pressure comprises a latch 13 anchored by screws 14 along the exterior of the conduit 8. The latch 13 is bifurcate and has a slot 13*m* in the portion thereof which joins its legs. The slot permits the latch to be moved into engagement with a collar 34. The surface of the latch 13 adjacent the slot 13*m* is preferably inclined in a direction lengthwise of the slot and with respect to the surface of the collar which it engages so as to provide a cam surface which is readily forced into tight engagement with the collar 34 as the latch is pushed toward the right as viewed in Fig. 1.

The arm 6 is pivotable between spaced elements 15 and 16 of a support 17 whereby the portion of the arm in engagement with the conduit 4 is guided along an arcuate path as the arm is swung in a clockwise direction from the position thereof shown in Fig. 1. To allow such movement, the tube 4 is, of course, shifted in the manner described above in a longitudinal direction out of the path traversed by the arm and other elements fixed thereto. The arm is secured along the axis 7 by a bolt 18 and a bushing 19. The latter has a passageway 20 contiguous with a passageway 22 of a tube 23. These passageways are portions of a duct system for conducting a filament-forming liquid to the spinneret 5. The end portion of the tube 23 is secured within the bushing 19 by another bushing 24.

The support 6 comprises an exteriorly threaded surface 25 and a flanged coupling member 26 in threaded relation with the surface 25. An end surface 27 of the tube 4 seats upon a washer 28 supported on an inner radially extending surface of the flange member 26. The washer 28 comprises a resilient material such as a vulcanized product containing a polymer of chlorobutadiene, or a copolymer of butadiene and acrylonitrile known as GR–N. The end portion of the tube 4 is flared to provide a region surrounding the spinneret through which a filament-setting liquid may be conducted into contact with the filament-forming material extruded through the spinneret. A filament-setting liquid is supplied to the tube 4 from the conduit 8 through a plurality of passageways 29 arranged concentrically within the member 6 about the axis of the spinneret and a passageway 30 which extends between the spinneret and the passageway 21. The arm 6 comprises a nipple 31 through which the passageway 30 extends which has one end portion extending in threaded relationship within a threaded bore therefor in the arm; the other end portion of the nipple 31 is exteriorly threaded for receiving a coupling 32 which secures the spinneret to the arm. A resilient washer 33 is provided between the flange of the spinneret and the end surface of the nipple. The nipple has an annular shoulder surface 35 for receiving a flow-equalizing ring 36.

The ring 36 has a large plurality of small apertures 37 through which the liquid discharged from the passageways 29 passes before coming into contact with the material extruded through the spinneret 5. The substantially plane surface 10 is aligned within a flange 39 for seating against a tubular washer 41 supported within an annular recess 42 of an enlarged terminal portion 43 of the conduit 8. The washer 41 is preferably of a structure such as illustrated comprising an endless hollow tube extending in a circle. The shape of the cross-section of any tubular portion taken in a plane normal to the axis of the washer is preferably circular when the washer is relaxed. When the arm 6 seats against the surface 9 of the conduit portion 43, the washer 21, of course, is flattened as shown. The flange 39 is provided primarily for the purpose of deflecting liquid discharged through the conduit 8 downwardly away from contact with an operator when the arm 6 is being swung into position shown in Fig. 1.

So that fluid does not escape in substantial quantity from a conduit 8 while the arm 6 is moved out of its seating relationship therewith, a valve mechanism is provided within the conduit which may be actuated by the arm 6 or some member attached thereto. Such a mechanism may be of the lift-valve type and comprise, as shown in Fig. 1, annular valve guides 44 and 45, a valve 46, and an apertured disc 47 having a tapered annular

surface 47*n* for seating the valve. The guides 44 and 45 are centrally apertured to receive the valve stem 46*n*. A pin 46*m* extending through the stem of the valve may be provided as shown to limit the longitudinal movement of the valve-stem through the guides. The pressure of liquid tending to flow through the valve opening will tend to keep the valve 47 seated when the arm 6 is swung out of operating position. However, if desired, a spring (not shown) surrounding the stem is readily provided between the pin 46*m* and the guide 44. The valve is openend by engagement of the surface 10 of the support with the end of the valve stem adjacent the pin 46*m*. The guides 44 and 45 are extensively apertured to obtain an unrestricted and well distributed current of liquid flowing toward the passageways 29. The conduit 8 has a shallow annular recess for receiving and positioning the guide 44. The guide 45 and the disc 47 for seating the valve are positioned between a spring-ring 48 and the annular portion 49*m* defining an aperture in the floor of a container 49 between adjacent ends of connected sections of the conduit 8. The split spring-ring 48 holds the elements 45 and 47 against the current of liquid passing therethrough.

Fig. 4 illustrates a modified apparatus having the same general arrangement of the basic parts analogous to the conduit 8 and the arm 6 illustrated in Fig. 1. In the modified system illustrated in Fig. 4, an arm 6*a* may be provided, as shown in Fig. 1 with respect to arm 6, with a pivotal mounting which guides the arm along a fixed path into and out of engagement with the upper portion of a conduit 8*a*, and discharge of liquid from the conduit 8*a* (during periods in which the arm 6*a* is moved out of engagement with the conduit) is prevented by a valve arrangement comprising a ball 50 which is preferably buoyant within the liquid passed through the conduit. If the ball lacks substantial buoyancy within the liquid, it will be forced against its seat along the annular surface 51 by a current of the liquid and the supply pressure therefor. The arm 6*a* is constructed with a flange 52 which moves into telescoping relationship with a flange 53 of the conduit 8*a*. The arm 6*a* is also constructed with a tongue or extension 54 which engages the ball 50 and forces it from its seat 51 as the arm 6*a* is swung into the position shown. The inner surface of the flange 52 is grooved to receive a seal ring 41*a*, the inner circumference of which is stretched slightly as it is carried down over the exterior surface of the flange 53. Seating relationship of the arm 6*a* with the conduit 8*a* is obtained as the flange 52 engages the shoulder 43*a*. When this happens, the ball is moved away from its seating surface 51 to the position thereof illustrated. The surface 55 of the extension 54 which engages the ball is preferably dished or concave to hold the ball from rolling to one side or the other of the interior of the conduit and to maintain substantially centered clearance with the surrounding inner surface of the conduit. In this manner more uniform flow of liquid through the passageways 29*a* of the arm 6*a* is obtained. An element 36*a* analogous to the member 36 of the first described embodiment is provided for equalizing the current of liquid issuing from the passageways 29*a* to all portions of the region surrounding the spinneret 5*a*. The arm 6*a* is fabricated with an integral flange 26*a* having an end surface 57 which is entirely disposed at a level higher than the face 58 of the spinneret 5*a*.

To prevent the arm 6*a* from being forced out of engagement with the conduit 8*a* by hydraulic pressure of the filament setting liquid passing therethrough, the arm and the conduit are held together by means such as the eyebolt 59 attached pivotally to the arm with the nut 59*a* screwed tightly against a pair of spaced lugs 60 extending from the flange 43*a* of the conduit.

The conduit 8*a* may also comprise a manually operable valve 61 constructed from materials that are chemically resistant to the filament-setting liquid. An essential feature of the valve 61 is to maintain the passageway of the valve when open, without material obstruction to the flow of liquid therethrough. Accordingly, the valve comprises a sliding piston 62 having approximately the same diameter as the passageway 63 of the conduit, and a cylindrical extension 64 of the valve casing having a bore complementary to the external surface of the piston. The extension also has an annular recess 65 for receiving a seal ring 66 comprising a resilient material. The piston may be worked laterally of the passageway 63 by any convenient means such as a lever 68. The lever 68 pivots on a pin 72 extending through the piston 62. The lever is pivotably connected to the valve casing by a link 71. The end surface 74 may be flat and the wall of the valve provided with a recess 75 to receive the end portion of the piston 62 adjacent the surface 74. If desired, the recess 75 may be omitted and the end surface of the piston formed semi-circularly to fit the cylindrical surface defining the passageway 63. The cross-sectional shape of a member analogous to the piston 62 need not be necessarily circular but may be polygonal.

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

I claim:

1. In spinning apparatus, a spinneret, an open-end conduit, movable means for supporting the spinneret having a seating surface adapted to engage a continuous surface of the conduit adjacent its open end surrounding its passageway, means for guiding the supporting means into and out of a position for operation in which the seating surface engages the entire length of the continuous surface, the supporting means having a passageway extending therethrough from the inner surface of the spinneret into connection with a supply of filament-forming liquid, said supporting means also having duct means extending therethrough from an area immediately adjacent to, and surrounding, the spinneret to an area encircled by the seating surface, and means extending from the conduit for clamping the supporting means to the conduit with the seating surface in registry with said continuous surface.

2. In spinning apparatus, a spinneret, a tube member, a conduit member, each member having an open end portion and a continuous surface adjacent thereto encircling the passageway of the member in spaced facing relation with respect to a plane extending between said end portions of the members, movable means for supporting the spinneret having seating surfaces facing in the opposite directions and being spaced and arranged to be engaged by said surfaces of the members, means for guiding the supporting means into and out of a position for normal operation, the supporting means having duct means extending therethrough between surfaces surrounded by said seating surfaces, means for attaching the spinneret to a surface encircled by the seating surface engaged by the tube, a passageway extending through the support to the inner surface of the spinneret for supplying a filament-forming liquid thereto, means for moving one member in a direction extending toward, and away from, the other to clamp the supporting means in, or to release it from, a position between the members wherein each of the seating surfaces is engaged by one of the oppositely facing surfaces of the members, and means anchored on one member extending into readily detachable relationship with the other member for clamping the members and the supporting means together.

3. Apparatus as defined in claim 2 comprising flow controlling means movably supported within an end portion of the conduit member adjacent the supporting means, and means carried by the supporting means for engaging and actuating the flow-controlling means to let liquid pass from the conduit through the duct of the supporting means to the tube member when the member and the supporting means are clamped together.

4. In spinning apparatus, a spinneret, a conduit member, movable means for supporting the spinneret having a seating surface adapted to engage a continuous surface of the conduit surrounding its passageway, the supporting means having a passageway extending therethrough from the inner surface of the spinneret into connection with a supply of filament-forming liquid, said supporting means also having duct means extending from an area immediately adjacent to, and surrounding, the spinneret to an area within said seating surface, flow-controlling means supported within the end portion of the conduit member engaged by the supporting means, and means carried by the supporting means for engaging and actuating the flow-controlling means to let liquid through the conduit and the duct means as the seating

surface moves into engagement with said continuous surface of the conduit.

5. Apparatus as defined in claim 4 comprising means for clamping the supporting means and the conduit together.

6. Apparatus as defined in claim 4 wherein the flow-controlling means comprises a lift valve, and the actuating means comprises a surface of the supporting means surrounded by the seating surface.

7. Apparatus as defined in claim 4 wherein the flow-controlling means comprises a floating ball valve and the actuating means comprises a projection of the supporting means extending from an area thereof surrounded by the seating surface.

8. In spinning apparatus, a spinneret, a tube member, a conduit member, each member having an open end portion and a continuous surface adjacent thereto encircling the passageway of the member in spaced facing relation with respect to a plane extending between said end portions of the members, movable means for supporting the spinneret having seating surfaces facing in opposite directions and being spaced and arranged to be engaged by said surfaces of the members, means for attaching the spinneret to a surface encircled by the seating surface engaged by the tube, the support having a passageway extending through it to the inner surface of the spinneret, and means for adjustably supporting one member for movement relative to the other whereby the support may be clamped to or released from a position between the members wherein the seating surfaces are engaged by respective surfaces of the members, said support having a passageway extending therethrough from an area thereof surrounded by the seating surface for the conduit member to an area of the support surrounded by the seating surface for the tube member but disposed exteriorly of the spinneret.

9. In spinning apparatus, a spinneret, a tube member, a conduit member each member having an open end portion and a continuous surface adjacent thereto encircling the passageway of the member in spaced facing relation with respect to a plane extending between said end portions of the members, means for supporting the spinneret having seating surfaces facing in opposite directions and arranged to be engaged by said surfaces of the members, each seating surface being complementary to one of said surfaces of the members, duct means extending through the support between areas surrounded by the seating surfaces, means for attaching the spinneret to a surface encircled by the seating surface engaged by the tube, a passageway extending through the support to the inner surface of the spinneret, a continuous flange which encircles the spinneret and the adjacent seating surface with the entire end surface of the flange being disposed outwardly from the support beyond the face of the spinneret, and means for supporting one of the members for movement along a path extending toward and away from its position of engagement with the support, said support having another passageway extending from the area thereof surrounded by the seating surface for the conduit member to an area surrounded by the seating surface for the tube member and surrounding the spinneret.

10. In spinning apparatus, a spinneret, a tube member, a conduit member, each member having an open end portion and a continuous surface adjacent thereto encircling the passageway of the member in spaced facing relation with respect to a plane extending between said end portions of the members, movable means for supporting the spinneret having seating surfaces facing in opposite directions and being spaced and arranged to be engaged by said surfaces of the members, the supporting means having duct means extending therethrough between the surfaces surrounded by said seating surface, means for attaching the spinneret to a surface encircled by the seating surface engaged by said surface of the tube member, a passageway extending through the support to said surface to which the spinneret is attached, means for moving one member in a direction extending toward, and away from, the other to clamp the support in, or to release it from, a position between the members wherein each of the seating surfaces are engaged by one of the oppositely-facing surfaces, flow-controlling means movably supported within an end portion of the conduit member adjacent the supporting means, and means carried by the supporting means for engaging the flow-controlling means thereof whereby liquid is discharged from the conduit member through the duct means.

11. In spinning apparatus, a spinneret, a movable support for the spinneret, means for fastening the spinneret to the support, a passageway extending through the support into communication with the spinneret, a flange surrounding the spinneret extending outwardly from the support with all of its end surface disposed beyond the spinneret, a continuous seating surface on said support, duct means extending between an area enclosed by the seating surface and an area within the flange, an open-end conduit having a terminal surface complementary to said seating surface, valve means disposed within the end portion of the conduit adjacent said terminal surface, and means carried by the support for actuating the valve means to an open position as the seating surface and the terminal surface are brought into complementary engaging relationship.

12. In spinning apparatus, a spinneret, a movable support for the spinneret, means for guiding the movement of the support into and out of its operating position, means for fastening the spinneret to the support, a passageway extending through the support into communication with the spinneret, a continuous flange surrounding the spinneret extending outwardly from the support with all of its end surface disposed beyond the spinneret, a continuous seating surface on the support facing in a direction generally opposed to that in which the spinneret faces, an open-end conduit having an end surface complementary to the seating surface, means for guiding the support into and out of engagement with the conduit, duct means extending through the support between an area enclosed by said seating surface to an area within the flange and having openings in said areas, the support having a continuous seating surface disposed with respect to the end surface of the flange inwardly toward the spinneret, the second seating surface encircling the spinneret and any opening of the duct means encircled by the flange, a tube having an open end portion comprising a continuous end surface complementary to, and adapted to engage the seating surface within the flange, and means for supporting the tube with its passageway extending away from the face of the spinneret, said tube being movable in an endwise direction relative to the supporting means to guide the continuous surface thereof into and out of engagement with its respective seating surface on the support.

13. In spinning apparatus, a tube member, a conduit member, each member having an end surface facing a plane extending therebetween, at least one of said members being movable in a direction generally parallel to that in which its end surface faces, a spinneret, means for supporting the spinneret having seating surfaces complementary to the end surfaces arranged and adapted for engaging both of said end surfaces simultaneously, means for urging said movable member in the direction in which said end surface thereof faces, said support being disposed between the members and said movable member bearing on the support during the normal operation of the apparatus to secure the seating surfaces in engagement with the end surfaces, means for securing the spinneret to an area of the supporting means encircled by the seating surface engaged by the tube member, a passageway extending through the supporting means to the inner surface of the spinneret, a plurality of ducts disposed in a circle with respect to the spinneret and a portion of the passageway adjacent thereto and extending through the supporting means between areas encircled by the seating surfaces, a continuous flange extending around the spinneret and the adjacent seating surface for the tube member and extending outwardly from the supporting means in the direction in which the spinneret faces with its entire end surface disposed beyond the spinneret, and means for pivotably supporting the supporting means for the spinneret on an axis spaced laterally from the region between said end surfaces, said axis extending transversely with respect to the directions of movement for said movable member.

References Cited in the file of this patent

UNITED STATES PATENTS

2,255,594	Berndt	Sept. 9, 1941
2,536,092	Roberts	Jan. 2, 1951