

Aug. 24, 1948.

A. LODGE

2,447,984

APPARATUS FOR SPINNING ARTIFICIAL STAPLE FIBERS

Filed Feb. 22, 1944

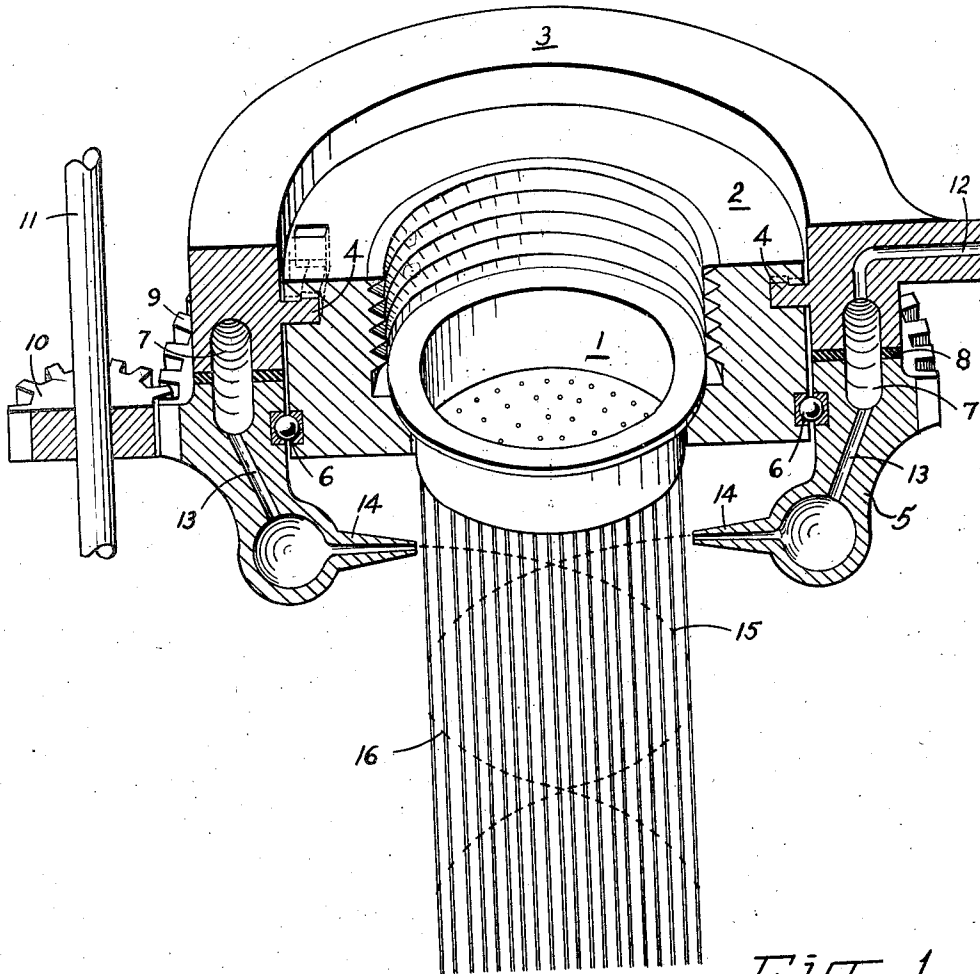


Fig. 1

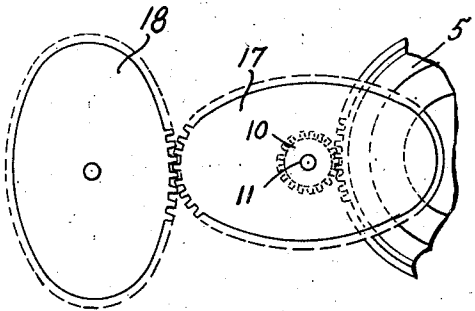


Fig. 2

INVENTOR.
Alvin Lodge
BY
Carl A. Castellan
ATTORNEY

UNITED STATES PATENT OFFICE

2,447,984

APPARATUS FOR SPINNING ARTIFICIAL STAPLE FIBERS

Alvin Lodge, Detroit, Mich., assignor to American Viscose Corporation, Wilmington, Del., a corporation of Delaware

Application February 22, 1944, Serial No. 523,392

4 Claims. (Cl. 18-8)

1

This invention relates to an apparatus for the production of artificial fibers; and more particularly for the production of artificial staple fibers.

The conventional method of producing staple fibers is to cut continuous filaments into short lengths. With the apparatus of this invention, staple fibers are produced during the stretching or textile working of continuous filaments, without the necessity of submitting the latter to a special cutting operation.

According to the invention, continuous filaments are provided, during production thereof, with weakened sections at spaced points along their length. The portions which undergo weakening are less resistant to tensile stress, than the remaining portions of the filaments, and when the latter are stretched, as by drawing in a drawing frame, or between godets revolving at different peripheral speeds, they readily break at their weakened points, to produce staple fibers which may be of substantially uniform length, or of varying non-uniform lengths, depending upon the regularity or irregularity of occurrence of the weakened portions along the length of the continuous filaments.

In accordance with the invention, a bundle of filaments being extruded through the orifices of a spinneret or other extruding device, into a suitable setting medium, which may be a cooling, evaporative or liquid medium, is subjected to the movement of a stream, blast or jet of fluid, gaseous or liquid, relative thereto, said movement comprising a transverse component, as the filaments pass progressively away from the face of the extruding device. The fluid jet moving relatively to the bundle strikes against at least some of the filaments comprising it, while the filaments, are sufficiently plastic to ensure that the portions thereof which receive the fluid jet are susceptible to weakening, which may be due to a change in cross-section, such as flattening, or to a reduction in denier, or both, in response to the impact of the fluid jet thereagainst.

The invention will be better understood by reference to the accompanying drawing in which

Fig. 1 is a view, partly in vertical cross-section of apparatus which may be utilized in carrying out one embodiment of the invention; and

Fig. 2 illustrates a modification of the device shown in Fig. 1.

Referring to Fig. 1, there is shown a spinneret 1 having connections with a supply of spinning solution (not shown), said spinneret being held in a conventional spinning head comprising a coupling member 2. An annular sleeve member

2

3 is detachably secured to coupling 2 by a bayonet joint 4. A ring member 5 is rotatably supported by a ball bearing 6 upon the coupling member 2. The adjacent surfaces of the members 3 and 5 are grooved to form an annular duct 7 which is sealed by a packing 8. The periphery of the ring member is provided with teeth 9 for meshing with pinion 10 driven by shaft 11, which is in turn driven by suitable means (not shown). The member 3 has a passage 12 connected to an outside source of fluid (not shown) for introducing a stream thereof to duct 7 and thence through the passages 13 to one or more nozzles or projecting jets 14 (two being shown).

As the selected spinning solution is extruded through the orifices of spinneret 1, fluid is introduced under pressure to duct 7, and then to nozzles 14, in the manner described, and the ring member is caused to revolve about the bundle of filaments. The pressure under which the fluid issues from nozzles 14 may be such that the fluid stream has sufficient force to penetrate to the center of the bundle comprising a multiplicity of filaments or the pressure may be such that all of the individual filaments are not affected by the fluid and the jet exerts its force against only the outer filaments of the bundle, leaving a central group of continuous filaments within the bundle which are not affected thereby.

The apparatus shown in Fig. 1 is designed to direct the fluid stream or the like against the filaments to effect weakening thereof at substantially equidistantly spaced points along the length thereof.

By suitable adjustment of the speed at which the revolving fluid delivery means is rotated, with respect to the velocity of extrusion of the spinning solution, the distance between the regularly occurring weakened portions along the filament length may be varied, within limits defined by the condition of plasticity of the filaments, and thus the length of the staple fibers may be varied all of the fibers obtained from any given bundle of filaments being substantially uniform in length, however.

The revolving nozzles 14 may be caused to move relatively to the bundle of filaments emerging from the spinneret in such manner that the streams or jets of fluid strike the plastic filaments at irregularly spaced points along the length thereof. This may be accomplished by driving the gear 10, which in turn drives ring-member 5, by means of elliptical gears 17 and 18 (see Figure 2) which gears may be mounted above gear 10 on shaft 11. Continuous filaments

provided with such irregularly spaced weakened sections readily break, upon stretching, to produce staple fibers of non-uniform length such as are preferred for use in many textile operations.

The effect of the fluid stream on the filaments may also be varied by directing the same against the filaments from a fluid delivery means adapted for revolution eccentrically about the bundle of filaments.

In the practice of my invention, there may be obtained bundles of filaments in which some or all of the filaments comprising the bundle are provided with weakened portions evenly or unevenly spaced along the length thereof. Such bundles of filaments are directly useful for textile working into staple yarn.

Thus, a single bundle of such filaments, as for example, a bundle of filaments from one spinneret, can be worked on drafting equipment to produce spun yarn. Alternatively, a number of such bundles can be combined into a sliver-like form which can then be converted into spun yarn.

In the simplest case, as where the filaments are extruded through a spinneret having a single circular row of orifices, when a stream or jet of fluid is revolved about said filaments, the weakened sections occur at staggered points throughout the bundle. Bundles of filaments having such staggered weakened sections have advantages in subsequent textile working. For example, numerous such bundles can be worked into a sliver of substantially parallelized fibers without having to undergo opening, carding, combing, etc.

My invention may be practiced in connection with the production of artificial fibers in accordance with the dry, wet, or fusion spinning methods and may be applied to fibers consisting of regenerated cellulose from viscose of cuprammonium cellulose; cellulose derivatives such as cellulose esters including cellulose acetate, propionate, butyrate, cellulose acetate-butyrate, etc.; or cellulose ethers such as ethyl cellulose; resinous materials, particularly of high molecular weight linear polymers or linear condensation polymers, as for instance polyvinyl resins such as polyvinyl chloride, copolymers of vinyl chloride and vinyl acetate, after-chlorinated polyvinyl chloride, and after-chlorinated copolymers of vinyl chloride and vinyl acetate; nylon, and proteinaceous materials, such as casein.

The particular type of fluid, whether gaseous or liquid, to be directed against the plastic filaments may depend upon the material being spun, and the spinning method employed. When a solution of the fiber-forming material in a volatile organic solvent, as for example, a solution of cellulose acetate in acetone, is extruded through the orifices of the spinneret into an evaporative atmosphere in accordance with the dry spinning method, the fluid directed against the filaments through the nozzles carried by the revolving duct may simply be air or steam. When the invention is practiced in connection with the wet spinning method, according to which the fiber-forming material is extruded into a liquid coagulating bath, the fluid directed against the filaments is preferably though not necessarily in the liquid phase, and may have any suitable composition compatible with the composition of the coagulating bath; advantageously, the fluid stream directed against the filaments emerging from the spinneret may have the same or substantially the same composition as the coagulating bath it-

self. Thus, when viscose is extruded into a coagulating bath comprising an aqueous solution of sulfuric acid, sodium sulfate, and zinc sulfate, in conventional or modified amounts, a stream

or jet of the same solution may be directed against the filaments from a nozzle positioned about the spinneret in the coagulating bath, and the force exerted by the stream of liquid against the plastic filaments will cause the portions thereof which receive it to undergo weakening as compared with the remaining filamentary portions. As another example, when solutions of certain fiber-forming resinous materials, such as copolymers of vinyl acetate and vinyl chloride or the like are extruded into a coagulating bath comprising a lower aliphatic alcohol, as, for instance, isopropanol, a stream or jet of isopropanol may be moved relatively to the filaments, as the filaments move progressively away from the spinneret face, to effect weakening or reduction in strength at predetermined points along the length thereof. In fusion or melt spinning, where the operation of setting consists in simply cooling the extruded materials below their point of fusion, as for example, in the spinning of nylon, a stream, blast, or jet of steam may be directed against the extruded filaments to effect the desired reduction in strength.

Since it is obvious that many modifications and changes may be made in the process described herein and in the form, construction, and arrangement of the various parts of the apparatus specifically shown, it is to be understood that the invention is not to be limited except as set forth in the appended claims.

I claim:

1. Apparatus for the production of artificial filaments having weakened sections at spaced points along the length thereof which comprises means for extruding a plurality of filaments in the form of a bundle, fluid delivery means disposed outside the bundle of filaments for directing a stream of fluid inwardly against at least some of the filaments comprising the bundle, and means for moving said fluid delivery means to effect movement of the fluid stream circumferentially about said bundle.

2. Apparatus for the production of artificial filaments having sections of reduced strength at spaced points along the length thereof which comprises means for extruding a plurality of filaments in the form of a bundle, a ring member adapted to revolve about said bundle, said ring member having a channel therein for reception of a stream of fluid and being provided with at least one nozzle, means for permitting the escape of fluid from said channel through said nozzle during revolution of said ring member, and means for revolving said ring member about said bundle.

3. Apparatus for the production of artificial filaments having sections of reduced strength at spaced points along the length thereof comprising a spinneret, a coupling member about said spinneret, a stationary annular sleeve member positioned about said coupling, a ring member rotatably supported upon said coupling member and provided with at least one inwardly projecting nozzle, an annular channel formed within said sleeve member and said ring member for receiving a supply of fluid, means for permitting the escape of fluid from said channel through said nozzle, and means for revolving said ring member to direct a stream of fluid through the nozzle against at least some of the filaments comprising the bundle of filaments emerging from the spinneret.

4. Apparatus for the production of artificial filaments having sections of reduced strength at spaced points along the length thereof which comprises means for extruding a plurality of filaments in the form of a cylindrical bundle, revolvable fluid delivery means disposed outside the bundle of filaments and provided with at least one inwardly directed nozzle, said fluid delivery means being positioned concentrically with respect to the bundle of filaments, and means for revolving the fluid delivery means concentrically about the periphery of the bundle of filaments emerging from the extruding means to direct a stream of fluid thereagainst through the nozzle at spaced points along the length thereof.

ALVIN LODGE.

REFERENCES CITED

The following references are of record in the file of this patent:

Number
1,926,111
2,244,281
2,273,105
2,285,245
2,336,743
10
Number
299,291
431,681
443,413
15
619,841

UNITED STATES PATENTS

Name	Date
Roberts -----	Sept. 12, 1933
Alibert -----	June 3, 1941
Heckert -----	Feb. 17, 1942
Williams -----	June 2, 1942
Manning -----	Dec. 14, 1943

FOREIGN PATENTS

Country	Date
Great Britain -----	Oct. 25, 1928
France -----	Sept. 18, 1911
Germany -----	Feb. 7, 1925
France -----	Jan. 6, 1927