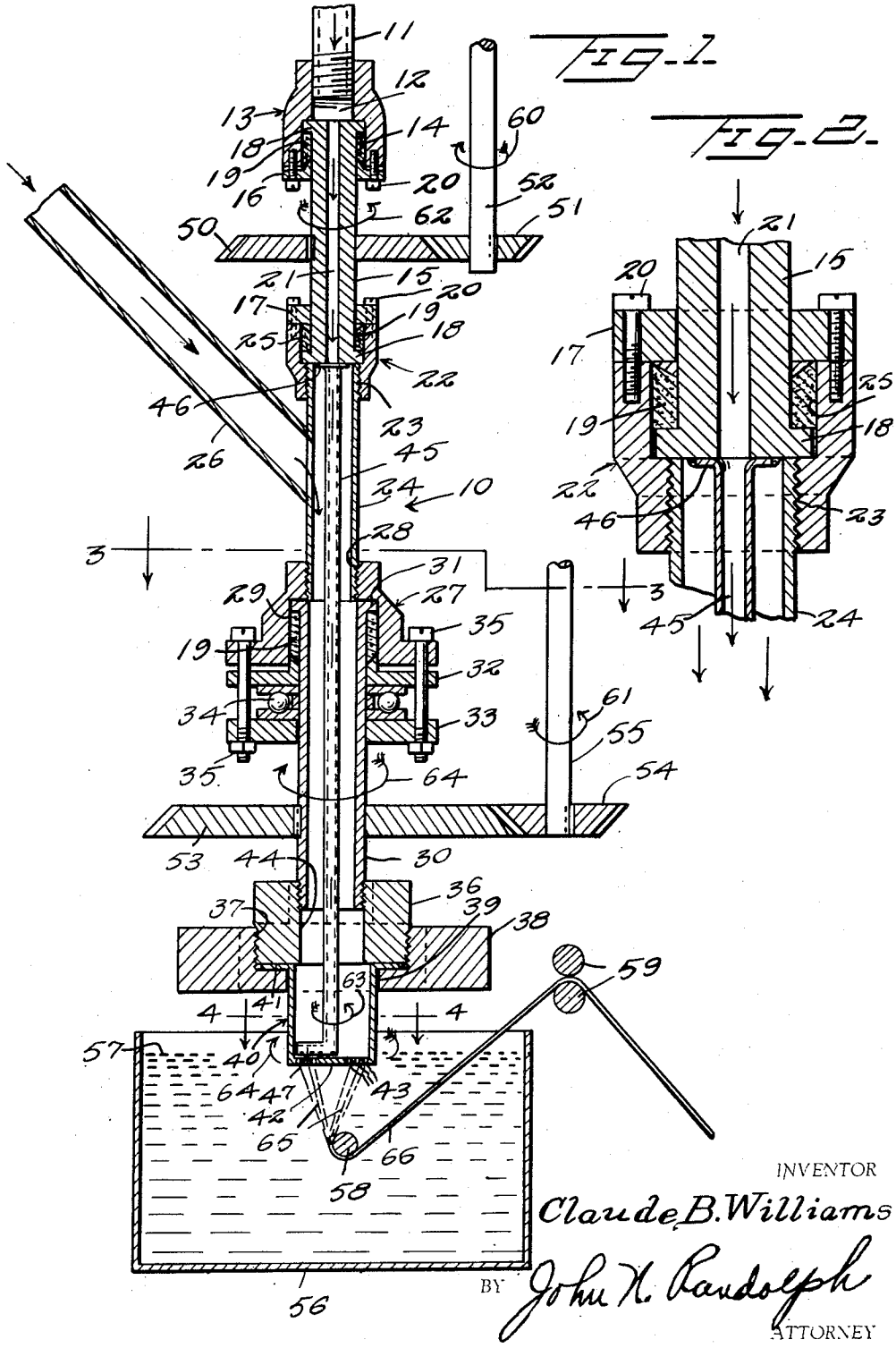
Nov. 20, 1956 C. B. WILLIAMS 2,770,835

APPARATUS AND METHOD FOR THE MANUFACTURE OF SPUN SYNTHETIC THREADS AND/OR YARNS

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Fig. 1

Fig. 2



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FIG. 3.

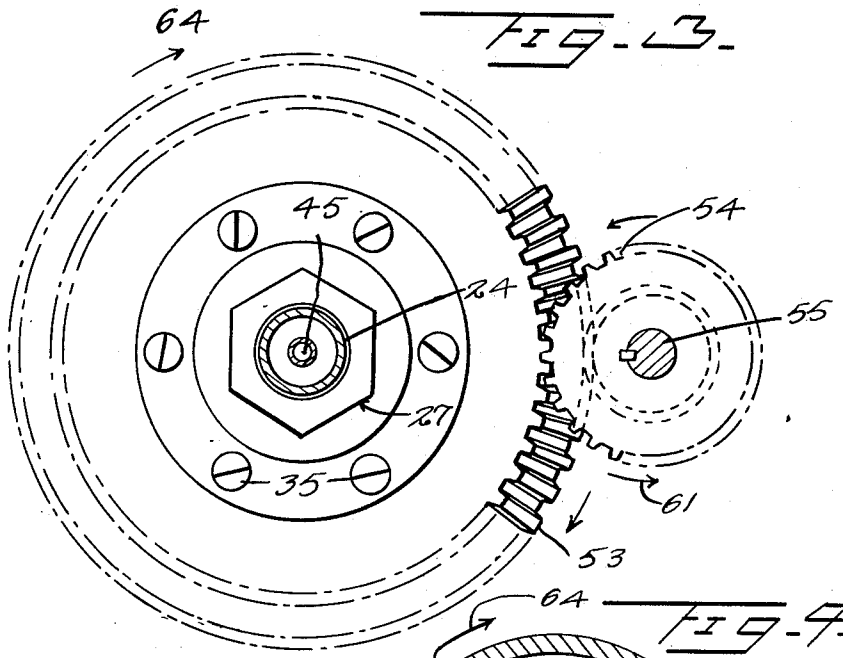


FIG. 4.

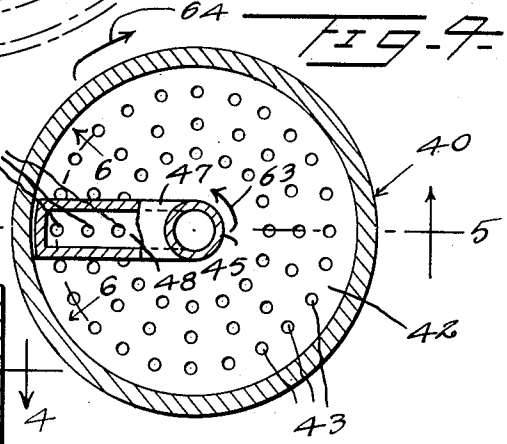


FIG. 5.

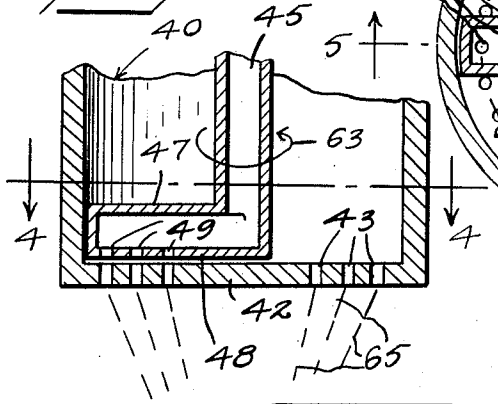
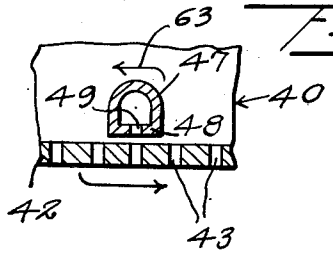


FIG. 6.



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United States Patent Office 2,770,835 Patented Nov. 20, 1956

2,770,835

APPARATUS AND METHOD FOR THE MANUFACTURE OF SPUN SYNTHETIC THREADS AND/OR YARNS

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Application March 6, 1953, Serial No. 340,805

8 Claims. (Cl. 18—8)

This invention relates to a novel apparatus and method for producing spun synthetic threads and/or yarns, slivers and rovings.

It is conventional to cut continuous fibers into short staple lengths in producing staple fibers. This is generally accomplished by gathering a large number of continuous fibers into a bundle or sliver, commonly known as "tow" which is run through a staple cutting machine for cutting staple lengths for use on cotton carding and spinning system or other greater staple lengths for use on the woolen or worsted system of carding and spinning. Such processes are long, costly and require considerable skill. Further, waste is involved and the risk of damaging the fibers during processing exists.

By means of the present invention, the aforementioned conventional processes are eliminated in making slivers and rovings. In producing finished yarn with the present invention, not only the pickering and carding are eliminated but likewise the processes of drawing fly frames and spinning are eliminated and the slivers and rovings produced are capable of use on subsequent processes of cotton, woolen and worsted system and is useful in blending synthetic fibers with natural fibers.

A further object of the invention is to provide an apparatus and system through which twist is inserted into the staple fiber yarns produced for holding the fibers together and for adding strength to the yarn. Additionally, the amount of twist per unit of length may be varied depending upon the length of the fibers, and the twist may be either a more usual right-hand twist, generally referred to as S twist or a less frequently used reverse twist, a left-hand twist known as Z twist.

A further important object of the invention is to provide an apparatus and method whereby the beginning and ending of the staple fibers relatively to one another in the finished thread, yarn, slivers or rovings is strictly controlled and possesses a definite regularity in the overlapping of each staple fiber with a minimum of beginnings and endings in a cross section of the finished product, which is most desirable since the resulting yarn and/or thread is of uniform cross sectional size without thick or thin portions and is smoother and also stronger, and thus approaches the characteristics of natural fibers.

A further object of the invention is to provide an apparatus and method wherein the ends of the staple fibers are not cut sharply or bluntly but rather are rounded and tapered at each end due to the fact that the breaks in the filament is accomplished prior to coagulation, and the sliver or roving thus produced possesses better drafting qualities.

Various other objects and advantages of the invention will hereinafter become more fully apparent from the following description of the drawings, illustrating a presently preferred embodiment thereof, and wherein:

Figure 1 is a diagrammatic longitudinal vertical sectional view, partly in elevation, illustrating a preferred embodiment of the apparatus;

Figure 2 is an enlarged fragmentary vertical sectional view of a portion thereof;

Figure 3 is an enlarged cross sectional view taken substantially along a plane as indicated by the line 3—3 of Figure 1;

Figure 4 is an enlarged horizontal or cross sectional view of the lower discharge portion of the apparatus taken substantially along a plane as indicated by the line 4—4 of Figure 1;

Figure 5 is a central vertical sectional view thereof taken substantially along a plane as indicated by the line 5—5 of Figure 4, and

Figure 6 is a vertical sectional view taken substantially along a plane as indicated by the line 6—6 of Figure 4.

Referring more specifically to the drawings, a preferred form of the apparatus for use in forming or the manufacture of spun synthetic threads and/or yarns, slivers and rovings is illustrated in Figure 1 and designated generally 10. The apparatus 10 includes a pipe or conduit leading from a source of supply of air under pressure, not shown, having an externally threaded outlet end 11 which is threaded into an upper bore portion 12 of an upper bearing 13. The bearing 13 has an enlarged lower bore portion 14, communicating with the inner end of the upper bore portion 12 and opening outwardly of the lower end of said bearing. A relatively thick walled conduit or pipe 15 has an upper packing gland 16 and a lower packing gland 17 slidably disposed thereon between externally enlarged or flanged ends 18 of said conduit 15. The upper flanged end 18 seats in the inner end of the bore portion 14 which contains a suitable packing 19 around the upper portion of the conduit 15 and below its upper flange 18. The upper gland 16 is secured to the lower end of the bearing 13 by fastenings 20 for compressing the packing 19 of the bore portion 14. A bore 21 of the conduit 15 is of substantially smaller cross sectional size than the bore of the pipe 11 and the upper end of said restricted bore 21 communicates with the discharge end of the pipe 11 through the bore portion 12.

An intermediate bearing housing 22 has an internally threaded lower bore portion 23 which threadedly receives the upper end of a conduit or pipe section 24, the internal diameter of which is substantially greater than that of the bore 21. The lower end of the conduit 15 is journalled in the inner end of an enlarged upper bore portion 25 of the bearing member 22 which communicates with the inner end of the bore portion 23. The bore portion 25 likewise contains a packing 19 around the lower portion of the conduit 15 and above its flanged end 18 which is held compressed therein by the lower packing gland 17 which is secured to the upper end of the bearing member 22 by additional fastenings 20. The conduit 24 has a branch portion extending upwardly at an angle from an intermediate part thereof, the bore of which communicates with the bore of said conduit or conduit section 24. The lower end of the branch portion 26 constitutes the outlet end thereof. The conduit 26 leads from a source of supply under pressure of a filament forming material which is fed, usually by pumping, to the conduit 24 through said branch conduit 26.

A lower bearing member 27 has an upper bore portion 28 in which the lower end of the conduit section 24 is threadedly connected and is provided with an enlarged lower bore portion 29 which communicates therewith. A conduit section 30 has an externally enlarged or flanged upper end 31 which seats in the inner upper end of the bore portion 29. A packing 19 is disposed in the bore portion 29 beneath said flange 31 and around the upper portion of the conduit section 30 and is retained compressed therein by a packing gland 32 which is slidably disposed on the conduit section 30. A ring 33 is slidably

disposed on the conduit section 30 beneath the gland 32 to support an annular thrust bearing 34 which is disposed around the conduit section 30 between said ring and the gland 32. The ring and gland are supported by adjustable fastenings 35 which are suspended from the lower bearing member 27 and which are adapted to be tightened for compressing the packing 19 of said bearing.

The upper end of a nut 36 is threaded onto the lower end of the conduit section 30. The lower end of the nut 36 is threaded into an upwardly opening socket 37 of a supporting member 38 which has a bore 39 of smaller diameter than the socket 37 opening through an underside of said member 38 and into the socket 37. A hollow discharge head 40 has an outturned flange 41 at its upper end which is clamped between the nut 36 and the bottom of the socket 37 around the bore 39. The discharge head 40 extends downwardly through said bore 39 and has a bottom wall 42 which is provided with a plurality of extrusion orifices 43. As illustrated in Figure 4, the orifices 43 are arranged in the form of concentric rings or annular series. However, the number of said rings or annular series or orifices could vary and could constitute only a single ring or series, rather than a plurality as illustrated.

A bore 44 of the nut 36 connects the bore of the conduit section 30 to the discharge head 40. A relatively small tube 45 is provided with a flared upper end 46, as best seen in Figure 2, which is suitably secured against the lower end of the conduit 15 around the lower end of its bore 21, so that said bore is in registration with the bore of the tube 45. The tube 45 is thus supported by the conduit 15 and extends downwardly through the conduit section 24, conduit section 30, bore 44 and into the hollow interior of the discharge head 40. The lower end of the tube 45 is turned laterally to provide a foot portion 47 which is disposed radially within the bottom portion of the discharge head 40 and with its axis substantially parallel to the bottom 42 and with its bottommost portion spaced only slightly therefrom. As best illustrated in Figures 5 and 6, said foot portion 47 is closed at its distal end and has a bottom part 48 provided with discharge openings 49 radially spaced from the axis of the head 40 to correspond with the spacing of the openings or orifices of each of the annular series of orifices 43. Thus, as three annular series of orifices 43 are provided as illustrated, the bottom 48, as illustrated, will be provided with three radially spaced outlet openings 49.

A relatively large beveled gear 50 is keyed to the intermediate portion of the conduit 15 and meshes with a smaller beveled gear 51 which is keyed in turn to a drive shaft 52. A relatively large beveled gear 53 is keyed to the conduit section 30, below the ring 33 and above the nut 36, and meshes with a small beveled gear 54 which is keyed to a drive shaft 55.

The lower portion of the discharge head 40 extends into an open top tank or container 56 containing a coagulating bath material 57 in which the bottom 42 thereof is submerged. A collecting roll 58 extends across the tank 56 beneath and spaced from the bottom 42. A pair of take-up rolls 59 are disposed externally of the tank 56 above and adjacent a portion of the open top thereof.

Assuming that air is being supplied under pressure through the pipe 11 to the foot member 47 through the conduit 15 and tube 45 and that a filament forming material is being supplied under pressure downwardly through the branch pipe 26, this filament forming material will fill the conduit sections 24 and 30, the bore 44 and the discharge head 40 around the tube 45 and foot 47. For the purpose of manufacturing spun synthetic threads, yarns, slivers and rovings having a right-hand or S twist, the shaft 52 is driven clockwise, as viewed from above and indicated by the arrow 60 and the shaft 55 is driven in the opposite direction or counterclockwise, as indicated by the arrow 61 (Figure 1). Consequently, the gear 51

will turn clockwise with its shaft 52 and the gear 50 will turn counterclockwise, as indicated by the arrow 62. The conduit 15 will rotate in the bearings 13 and 22 with the gear 50 and relatively to said bearings and to the air supply pipe 11 and the stationary conduit section 24. The tube 45 will likewise rotate with the conduit 15 and relatively to the portions in which said tube is disposed, as illustrated by the arows 63 in Figures 1, 4, 5 and 6. The gear 54 will turn counterclockwise with its shaft 55 to drive the gear 53 in a clockwise direction, as illustrated by the arrows 64 in Figures 1 and 3. The conduit section 30 will turn with the gear 53 to which it is secured relatively to the stationary conduit section 24 and in the lower bearing member 27, and the parts 36, 38 and 40, which are supported by the conduit section 30, will rotate therewith and in the opposite direction to the tube 45.

Accordingly, as the discharge head 40 revolves clockwise filament forming material is extruded therefrom through the orifices 43 into the coagulating bath 57 in the form of slender fibers 65 which are twisted by the rotation of the head 40 to make up the single strand 66 of thread, yarn, sliver or roving which passes under the collecting roll 58 thence upwardly between the take-up rolls 59 which rotate in opposite directions for drawing the strand 66 therethrough and away from the coagulating bath 57.

As the foot member 47 is revolving in the opposite direction to the head 40, and as the openings 49 thereof move into registry with the orifices 43, the pressure of the air ejected from these openings 49 into such orifices 43 cuts off the flow of the filament forming material momentarily and until the openings 49 have moved out of registration with said orifices and thereafter into registration with other of the orifices 43. As soon as the openings 49 thus move out of registration with the different orifices 43, the filament forming material again commences to flow or be extruded outwardly through such orifices. This causes a break in the particular fiber or filament of each orifice 43 each time that the foot member 47 passes thereover so that these filament or fiber breaks are at regular intervals in each filament or fiber and in staggered relationship relatively to the different fibers or filaments.

The speed of rotation of the head 40 and foot 47 determines the length of the fibers delivered to make up the single strand 66 and the length of the component fibers can thus be regulated to any predetermined lengths. Thus, by means of the apparatus 10 the beginning and ending of the staple fibers in relation to each other and the finished strand can be accurately controlled with a definite regularity in the overlapping of each staple fiber and with a minimum of beginning and ending in the finished product. Thus, a yarn or thread is formed of uniform cross sectional size which is smoother and stronger than yarn or thread produced by other methods, since it is devoid of thick and thin portions. Also, the ends of the fibers are not cut sharply or bluntly but are rounded or tapered similar to natural fibers and which is accomplished due to the fact that the break is produced in the filament or fiber before it is coagulated.

Should it be desired to produce a reverse or Z twist, instead of the right-hand or S twist, as previously described, this may readily be acomplished by merely reversing the direction of rotation of the shafts 52 and 55 to cause the rotatable parts to revolve in the opposite directions to the directions as previously described.

The number of turns of twist imparted to the strand or thread 66 is controlled by the speed of rotation of the head 40 in relation to the number of inches of fibers or filaments 65 delivered from the orifices 43 which in turn is controlled by the pressure of the filament forming material in the head 40, the viscosity thereof and the denier per filament or fiber.

Various modifications and changes are contemplated and may obviously be resorted to, without departing from the

spirit or scope of the invention as hereinafter defined by the appended claims.

I claim as my invention:

1. A process for the manufacture of spun synthetic threads and yarns, consisting in simultaneously extruding a plurality of fibers through extrusion orifices of a rotating member into a coagulating bath while intermittently and successively, at regulated intervals, interrupting the extrusion of the fibers momentarily through the different extrusion orifices for accomplishing breaks in the different filaments in regulated spaced sequence prior to coagulation thereof to produce a yarn or thread of uniform cross sectional size and which is devoid of thick and thin portions.

2. The method or process of forming spun synthetic threads or yarns, wherein a multiplicity of fibers or filaments are simultaneously extruded outwardly through extrusion orifices of a rotating member into a coagulating bath, characterized by the step whereby the different individual fibers are broken successively and intermittently prior to extrusion and coagulation by intermittently and successively shutting off the different extrusion orifices.

3. The method or process of forming spun synthetic threads or yarns, wherein a multiplicity of fibers or filaments are simultaneously extruded outwardly through revolving extrusion orifices of a rotating member into a coagulating bath, characterized by the step of breaking the different individual fibers successively and intermittently prior to extrusion and coagulation by intermittently and successively shutting off the different extrusion orifices in a regulated sequence by a jet of air ejected under pressure outwardly successively through the different orifices.

4. An apparatus for the manufacture of spun synthetic threads and yarns, comprising a hollow conduit including a stationary section and a rotatable section, means through which a filament forming material under pressure is supplied to said hollow conduit through the stationary section thereof, an extrusion head having an end wall provided with annularly arranged extrusion orifices, said head constituting a part of the rotatable conduit section, a tube containing air under pressure loosely disposed in said conduit having a discharged end disposed in said extrusion head and provided with a discharge port radically spaced from the longitudinal axis of said rotatable conduit section a distance corresponding to the spacing of the extrusion orifices from said axis and disposed to open toward said extrusion orifices, and means for rotating said rotatable conduit section about its longitudinal axis and relatively to said tube whereby the flow of filament forming material through said extrusion orifices under pressure will be intermittently and successively interrupted as said orifices move into registration with the discharge port of the tube.

5. An apparatus as in claim 4, a conduit member rotatably connected to an end of said stationary conduit section and remote from said rotatable conduit section and

to which an inlet end of said tube is secured, said conduit member supporting said tube in the rotatable and stationary conduit sections and having a bore in registration with the tube bore for supplying air under pressure thereto, and means for revolving said conduit member and tube in the opposite direction to the direction of rotation of said rotatable conduit section.

6. An apparatus as in claim 5, said tube having an elongated portion extending from said conduit member into said extrusion head and which is disposed axially of said conduit section and radically spaced from said discharge port of the tube.

7. An apparatus for use in the manufacture of spun synthetic threads and yarns, comprising an elongated hollow member including a stationary end section and a rotatable end section, means for supplying a filament forming material under pressure to said hollow member through said stationary section, said rotatable section having a distal end defining an extrusion head having an end wall provided with an annular series of extrusion orifices through which the filament forming material is extruded under pressure in the form of a multiplicity of staple fibers, a tube containing air under pressure extending loosely through said hollow member and having a discharge port disposed within said extrusion head and opening adjacent said end wall thereof and spaced from the axis of said rotatable section a distance corresponding to the spacing of said extrusion orifices from the axis of the rotatable section, an air supply member connected to the distal end of said stationary section and to an inlet end of said tube for supporting the tube in the hollow member and for supplying air under pressure thereto, means for revolving said rotatable section about its longitudinal axis so that the individual extrusion orifices will move successively into registration with the air tube discharge port whereby the jet of air from said discharge port will successively interrupt momentarily the flow of filament forming material through the different orifices for successively breaking the individual filaments or fibers at regular intervals prior to extrusion and coagulation.

8. An apparatus as in claim 7, said air supply member including a rotatable section supporting said tube and swivelly connected to said stationary section, and means for rotating said rotatable section of the air supply member in the opposite direction to the direction of rotation of the extrusion head.

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