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PRODUCTION OF ARTIFICIAL FILAMENTS

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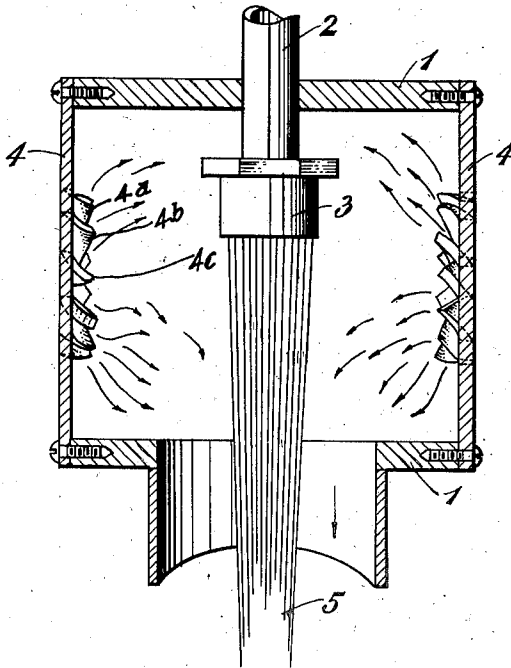


Fig. 1

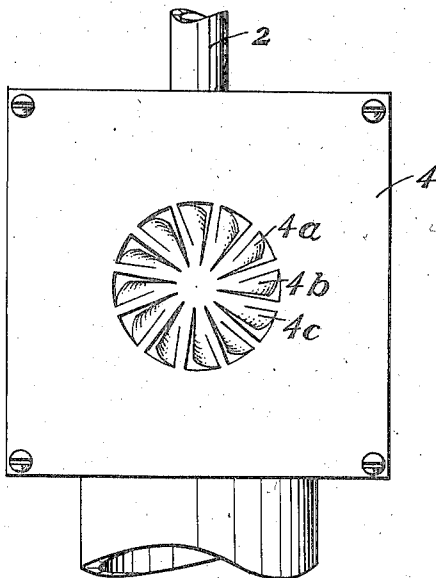


Fig. 2

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PRODUCTION OF ARTIFICIAL FILAMENTS

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3 Claims. (Cl. 18—8)

This invention relates to the production of artificial filaments or the like by the dry or evaporative spinning method. More particularly, the invention relates to a new and improved method and apparatus for introducing air or other evaporative medium into the filament bundle close to the face of the spinneret.

The manner in which solvent is removed from gel filaments of cellulose acetate yarn or the like formed by the evaporative spinning method within the first few inches of travel from the spinneret face is all important in determining the characteristics of the yarn formed. In a modern cellulose acetate spinning plant, spinning speeds are relatively high and the yarn travels through this critical distance in about one one-hundredth of a second. Furthermore, in order to get uniformity of results and continuity of spinning, each and every filament comprising the yarn should be subjected to the same conditions of initial drying of evaporation of solvent. Moreover, for economy of operation, it is important that the evaporative medium exhausted from the spinning cell and passed to the solvent recovery system be rich in solvent vapors. Yet on the other hand, air heavily laden with solvent vapors is of little value in evaporating more solvent from the yarn. It is, therefore, important to present evaporative medium relatively free from solvent vapors to each of the filaments issuing from the spinneret and at the same time to use this evaporative medium in a highly efficient manner, that is, use a relatively small quantity to pick up the maximum allowable amount of solvent.

Previously known methods and apparatus for passing an evaporative medium into contact with the filament bundle which is in close proximity to the spinneret have not functioned satisfactorily to uniformly and efficiently circulate the air or other evaporative medium about the various filaments of the bundle.

It is, therefore, an object of this invention to provide a new and improved method of introducing evaporative medium about the freshly extruded filaments formed in the head of a dry spinning cell.

Another object of this invention is to provide a suitable means for directing air or other evaporative medium into the head of a dry spinning cell so as to gently and uniformly distribute the medium around each of the filaments immediately after extrusion from the spinneret.

Other objects of the invention will be apparent from the description that follows.

The objects of this invention are accomplished by introducing substantially solvent-free evaporative medium with an extremely turbulent motion into the immediate vicinity of each of the filaments as they issue from the spinneret, and moving said evaporative medium through at least a portion of the spinning cell concurrently with the travel of the filament bundle. This may be accomplished by positioning, across one or more openings in the head of a spinning cell a plurality of radially directed louvers.

The details of the present invention will be more clearly apparent by reference to the following description when taken in connection with the accompanying illustrations, in which:

Figure 1 is a side elevational view, with parts shown in section, of a spinning cell head provided with a means for introducing an evaporative medium into the cell head with a whirling motion.

Figure 2 is a front elevational view of the apparatus shown in Figure 1.

Referring to the drawing, reference numeral 1 designates the head or the upper portion of a spinning cell of the type used in the "dry" or "evaporative" spinning process. A spinning solution conduit 2 projects through the top of the head and connects to a spinneret 3, containing a plurality of extrusion orifices. The spinning solution is extruded through the spinneret orifices, and the bundle of filaments 5 so formed is drawn through the spinning cell for the evaporation of volatile solvent therefrom. One or more of the side walls 4 of the spinning cell head 1 are provided with a plurality of inwardly projecting angular ears 4a, 4b, 4c, etc., through which air or other evaporative medium may be passed into the cell and into contact with the bundle of filaments as the filaments are formed by the spinneret.

The ears 4a, 4b, 4c, etc. are preferably formed by a plurality of connected arcuate and radial cuts within a circular outline as shown in Figure 2 of the drawing. Obviously, the cuts connecting with the radial cuts may be straight instead of arcuate. It is only necessary that the two cuts connect each other with a sufficient angle to permit the formation of an ear. Furthermore, the ears need not be bent inwardly from the side walls, as illustrated, but they may be bent outwardly from the side walls. The points of juncture between cuts are curved by bending the same from the plane of the walls 4. The several inwardly, or outwardly, projecting angular ears 4a, 4b, 4c, etc. are herein designated

as radial louvers. The radial louvers cause the air passing therebetween to be broken up into a plurality of whirling or swirling streams causing extreme turbulence of the air around the freshly extruded filaments. This swirling motion of the air causes it to be uniformly distributed about the individual filaments, and as a consequence, evenly and uniformly evaporating solvent from the several filaments.

The air or other evaporative medium may be passed through the side walls 4, between the ears 4a, 4b, 4c, etc. in any desired manner. Preferably, however, the air is caused to pass through these openings between ears by creating a slight sub-atmospheric pressure within the cell as a result of withdrawing the solvent-laden air from the cell. The air may be withdrawn from the cell at any point below the cell head and, preferably, it is withdrawn at a point intermediate the head and the bottom of the cell.

By adjusting the sub-atmospheric pressure in the cell and the size, number, and angle of the ears, or louver elements, the amount of air drawn through the side walls of the cell can be controlled.

The size, number, and angle of the louver elements may be varied widely. For instance, as many as 20 or more elements may be formed in one circular outline, or as few as 3. The circle circumscribing the radial louver elements may be of any reasonable size, such as 2, 3, or 4 inches in diameter, or more or less. The angle at which the elements are bent from the plane from which they are cut may also be varied widely, but for optimum results it is preferred that this angle be in the neighborhood of 30° to 40°. However, good results may be obtained when this angle is as little as 15°, or as much as 60°.

It is believed that the number and angle at which the louver elements are located determine to a large extent the path taken by the many currents of air in the head of the cell. The number and size of the elements, and the size of the openings between elements will, of course, determine the velocity of air flow therethrough for any fixed rate of air withdrawal from the cell. The air velocity between the louver elements should preferably be between about 100 and 500 feet per minute, depending upon the spinning speed and denier of the filaments and yarn being spun.

Although the construction specifically described is preferred, it is to be understood that the louvered openings may be arranged otherwise with reference to the spinneret. Use may be made of a single louvered opening, or 2, 3, 4 or more of such openings may be used, and they may or may not be directly opposed, or they may be in planes other than vertical, for example, in planes inclined to the axis of the cell or to each other.

Furthermore, other forms of construction which will break up the air entering the spinning cell head into a plurality of whirling or swirling streams whereby to induce an extremely turbulent flow around the freshly extruded filaments immediately below the face of the spinneret so that no stagnation of air currents around the

filaments at this point takes place and each and every filament is subjected to uniform solvent evaporation may be used to advantage in accordance with the present invention.

This invention has particular utility in the spinning of cellulose acetate dissolved in a volatile solvent such as acetone, but it is also applicable to the evaporative spinning of any filament-forming material dissolved in a volatile solvent. The filament-forming material may, of course, contain modifying agents such as luster-modifying agents, plasticizers, pigments, dyes, resins, etc.

By means of this invention, yarn may be produced without interruptions for longer periods of time than heretofore. Yarn produced in accordance with the present invention will have an improved uniformity. The invention has been especially advantageous in the spinning of relatively small denier yarn, such as 200 denier and less, from the standpoint of greater uniformity and continuity of spinning even at high draw-off speeds, such as 400 yards per minute and more.

Since it is obvious that many changes and modifications can be made in the above-described details without departing from the nature and spirit of the invention, it is to be understood that the invention is not to be limited to the details above described except as it is so limited by the appended claims.

I claim:

1. In an evaporative spinning apparatus, a spinning cell, a spinneret within the upper portion of said cell, a plurality of stationary air deflecting members having openings therebetween in the side of said spinning cell adjacent said spinneret, said air deflecting members being so constructed and arranged as to impart to air flowing therebetween a whirling motion, and means to cause air to flow through said openings and over said deflecting means into said cell.

2. In an evaporative spinning apparatus, a spinning cell, a spinneret within the upper portion of said cell, a plurality of stationary air deflecting members having openings therebetween in the side of said spinning cell adjacent said spinneret, said air deflecting members comprising a plurality of projecting angular ears being so constructed and arranged as to impart to air flowing therebetween a whirling motion, and means to cause air to flow through said openings and over said deflecting means into said cell.

3. In an evaporative spinning apparatus, a spinning cell, a spinneret within the upper portion of said cell, a plurality of stationary air deflecting members having openings therebetween in the side of said spinning cell adjacent said spinneret, said air deflecting members comprising a plurality of inwardly projecting angular ears, each ear being formed from a set of connecting angularly disposed cuts, one cut of each set extending radially from a point common to the corresponding cut of each of the other sets of cuts, and means to cause air to flow through said openings and over said deflecting members into said cell.

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