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PRODUCTION OF FILAMENTS, THREADS, AND THE LIKE BY THE WET SPINNING PROCESS

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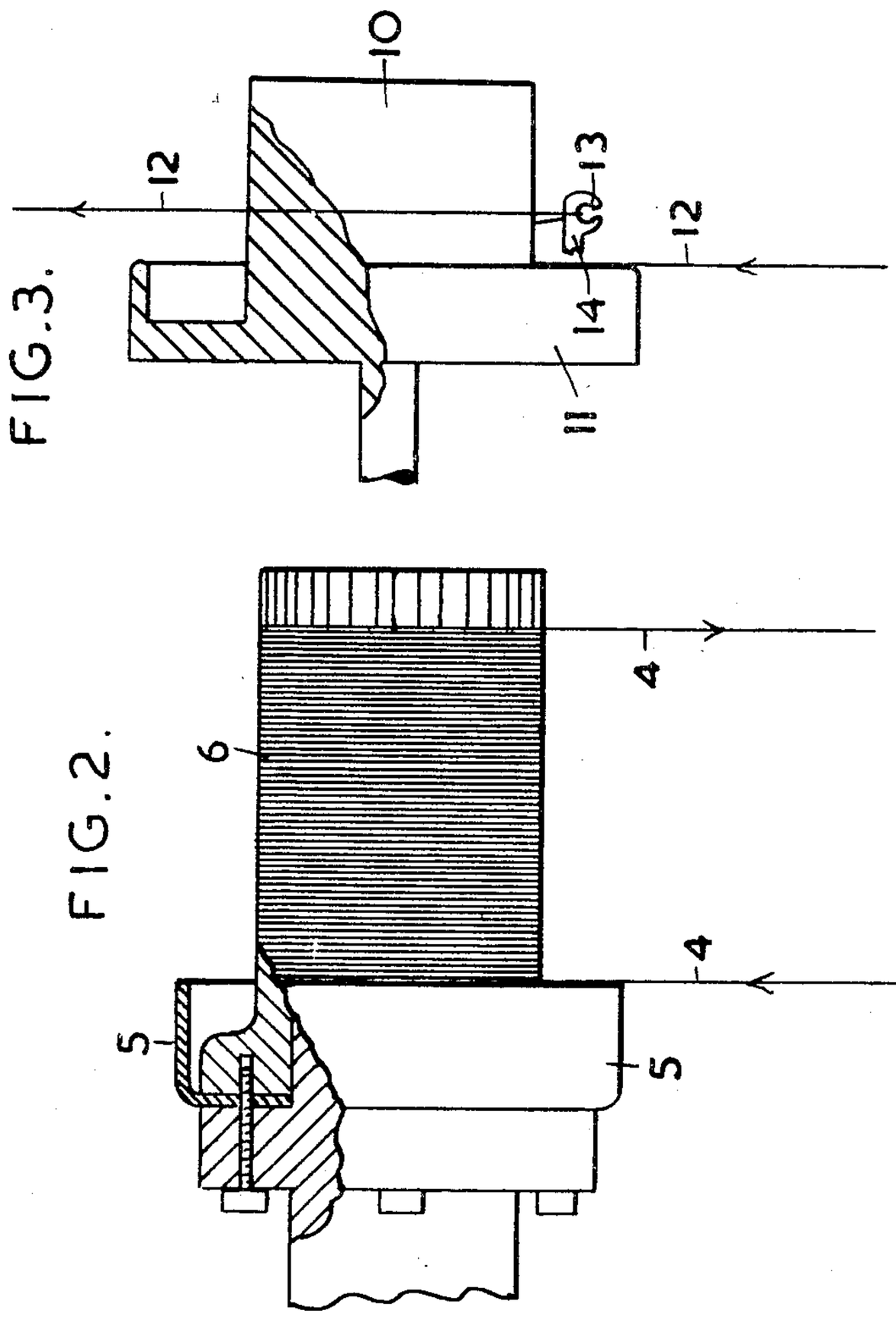

FIG. 3.

FIG. 2.

FIG. 1.

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PRODUCTION OF FILAMENTS, THREADS, AND THE LIKE BY THE WET SPINNING PROCESS

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7 Claims. (Cl. 18—54)

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This invention relates to the production of filaments, threads, fibres and the like hereinafter referred to generally as "threads," by a wet spinning process.

In known wet spinning processes the fibre-forming solution, for example viscose, is extruded through a jet into a coagulating bath and the resulting thread is withdrawn from the coagulating bath for example in an inclined or a vertically upwards direction by means of a rotating thread storage device such as a godet, reel or rollers. In such processes it is customary to provide a thread guide, for example a V-shaped guide, in order to direct the thread on to the thread storage device. On emerging from the coagulating bath the thread consisting of a bundle of filaments carries coagulating liquid with it, with the result that an irregular column of liquid forms on the thread between the surface of the bath and the thread guide. This column of liquid gives rise to a number of disadvantages, for example a frictional drag is imposed on the freshly spun thread, liquid is permanently removed from the coagulating bath and is not recovered so that a substantial loss of the chemicals used in the coagulating bath occurs, and also there is a tendency for liquid to splash on to the neighbouring machinery parts, or even on to the operators.

The object of the present invention is to avoid the disadvantages arising from the column of liquid carried up by the thread in wet spinning.

The present invention provides a process for the production of threads by wet spinning comprising extruding a fibre-forming solution through a jet into a coagulating bath and withdrawing the thread upwards from the bath on to a rotating thread storage device wherein the thread is led directly from the coagulating bath against the edge of a smooth annular guide rotating at a peripheral speed greater than the peripheral speed of the thread storage device. In the preferred form of the invention, the smooth annular guide surrounds and rotates with the thread storage device. The thread storage device may consist of a thread advancing reel, a pair of thread advancing rollers or a godet.

In carrying out the process according to the invention, it is essential that the smooth annular guide should be the only surface making frictional contact with the thread before it reaches the thread storage device; that is to say, the normal thread guide hitherto employed to direct the thread to the thread storage device is eliminated. The smooth annular guide should also

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be constructed of material which is resistant to corrosion by the coagulating bath so that it will remain smooth when in use and will not become rough or pitted; porcelain or material of similar hardness is preferred.

The smooth annular guide may conveniently take the form of a cowl which is fitted to and surrounds the delivery end of the thread storage device. The diameter of the cowl may conveniently be about 1 inch more than the diameter of the thread storage device, but this figure is not critical.

In carrying out the process according to the invention, a thin film of coagulating bath liquor is carried away by the thread, a proportion of this liquid is removed by the annular guide and when using a cowl as the annular guide, the liquid runs down into the cowl where it may be collected.

In an alternative form the smooth annular guide may consist of a smooth roller situated above the coagulating bath and rotating at a peripheral speed greater than the peripheral speed of the thread storage device. The thread may pass tangentially or for only a short distance in contact with the surface of the smooth annular guide.

In the process of the present invention the thread leaves the coagulating bath in an inclined or vertically upwards direction.

The present invention is illustrated by the accompanying drawings in which

Figure 1 shows part of a continuous spinning machine,

Figure 2 shows, partly in section and on a larger scale, the thread storage device shown in Figure 1 and

Figure 3 shows, partly in section, a godet.

Referring to Figures 1 and 2, a fibre-forming solution supplied through a pipe 1 is extruded through a jet 2 into a coagulating bath 3 to form a multi-filament thread 4. The thread 4 leaves the coagulating bath without disturbing the surface of the bath and passes in contact with a cowl 5 which surrounds and rotates with a thread storage device 6. The thread 4 is guided by the cowl 5 on to the thread storage device 6 along which it advances in a number of advancing helical turns. On reaching the discharge end of the device 6 the thread 4 passes vertically downwards to the first of a series of thread advancing devices not shown. The thread advancing device 6 is of cantilever construction and may be of the type described in British Patent Specifications Nos. 413,413 and 413,414.

The thread advancing device 6 may be replaced by a pair of thread advancing rollers arranged with their axes at an angle and a cowl may be arranged on the delivery end of the roller on to which the thread passes from the coagulating bath.

In Figure 3 a godet 10 is shown provided with a cowl 11 which surrounds and rotates with the godet. A thread 12 coming directly from a coagulating bath (not shown) passes in contact with the cowl 11 on to the godet 10. The thread passes once round the godet and then under a hook 13 of a thread guide 14 and then passes upwards to a second godet (not shown) and thence to a rapidly rotating box (not shown) in which the thread is collected.

The process of the invention differs from previous processes in that, surprisingly, the thread is seen to rise from the surface of the coagulating bath with practically no disturbance of the surface, whereas with previous processes there is a marked surface disturbance and what appears to be a cone of liquid forms at the point of emergence. In addition, in the process of the invention the thread carries a thin film of liquid, whereas with previous processes an irregular, loosely-held column of liquid is seen around the rising thread all the way up to the thread guide normally employed in such processes.

The use of a smooth annular guide in accordance with the present invention has the advantages that little or no frictional drag is imposed on the thread, that the splashing of the liquid is substantially reduced or completely eliminated and that a considerable saving of the chemicals used in the coagulating bath is obtained, for example in the viscose process a considerable saving of sulphuric acid results.

Tests made in carrying out the production of threads from viscose according to the present invention indicate that the total quantity of liquid removed permanently from the coagulating bath and not recovered does not differ materially from the total quantity removed in previous processes but it is found that the amount of sulphuric acid contained in the liquid removed is less. This is probably due to the fact that the thread rises from the coagulating bath without disturbance taking with it the liquid from the immediate vicinity of the thread only and owing to the regeneration of the cellulose this liquid contains a lower proportion of sulphuric acid than the liquid from other parts of the bath so that the quantity of sulphuric acid removed from the bath by the thread is less than that in previous processes in which a marked disturbance of the surface of the coagulating bath occurs.

The process of the present invention is particularly useful when applied to a so-called continuous spinning process in which a fibre-forming solution is extruded through a jet into a coagulating bath and the thread thus formed is subjected without any break to a series of treatments and to drying and winding on to a package. In such a process it is usual to pass the thread leaving the coagulating bath on to a thread storage device in order to allow the regeneration of the cellulose to proceed and in carrying out the process of the present invention the thread is brought into contact with the smooth annular guide during its passage from the coagulating bath to the thread storage device. The smooth annular guide is preferably fitted to the thread storage device and surrounds and rotates with the device. The continuous spinning machine may be equipped with any type of thread storage, thread advancing devices. For example it may consist of a number of cantilever thread advancing reels arranged in endwise stepped relation as described in British Patent Specification No. 474,973 or it may consist of a number of pairs of thread advancing rollers.

The process of the present invention is also applicable to a box spinning process in which the thread leaving the coagulating bath is passed round one or more godets and is then collected in a rapidly rotating box in the form of a cake. The smooth annular guide is provided between the coagulating bath and the first godet.

The process of the present invention is also applicable to a bobbin spinning process in which the thread leaving the coagulating bath is passed round one or more godets and is collected on a bobbin. In such a process the thread is brought into contact with the smooth annular guide during the passage from the coagulating bath to the first godet.

The process according to the invention is particularly useful for high-speed spinning that is spinning at the rate of 100 metres or more per minute.

The fibre-forming solution used in carrying out the process of the present invention is preferably viscose. The process is also applicable to the spinning of cuprammonium cellulose solution, casein solution or to the wet spinning of cellulose acetate.

The present invention is illustrated by the following example; the parts and percentages are by weight:

Example

Viscose containing 8 per cent of cellulose, 6 per cent of caustic soda, at a salt-point of 5.5 was extruded through a jet containing 36 holes each of $\frac{1}{10}$ of a millimetre in diameter into a coagulating bath containing 10 per cent of sulphuric acid, 20 per cent of sodium sulphate and 1 per cent of zinc sulphate at 55° centigrade, to form a thread of 150 denier. The thread was withdrawn from the coagulating bath after a vertical passage of 18 inches upwards on to a thread advancing reel having a peripheral speed of 70 metres per minute situated 24 inches above the level of the coagulating bath. Surrounding and rotating with the reel was a smooth annular guide of porcelain in the shape of a cowl, having a diameter 1½ inches more than that of the reel. The thread in its passage from the coagulating bath to the reel made its first frictional contact with the edge of the rotating cowl, over which it slid nearly tangentially. The thread was seen to rise from the surface of the coagulating bath without greatly disturbing the surface, and to carry with it only a thin film of coagulating bath. From the first thread advancing reel, the thread was stretched 15 per cent and was then passed to a series of thread advancing storage reels on which it was processed in known manner.

When this example was carried out without the use of the annular guide, or when a normal V-shaped guide was allowed to act on the thread before the thread reached the annular guide, the thread rising from the bath caused great turbulence, and was seen to carry with it coagulating liquid which formed a long cone reaching up to the V-shaped guide.

A substantial economy in the amount of sulphuric acid removed from the coagulating bath was obtained by employing the annular guide as

shown by the following data in which the measurements were made on the thread running on to the thread storage reel.

	Total weight of coagulating bath removed from system per pound of yarn spun	Percentage of acid in thread
	Pounds	*Per cent*
Example without the annular guide	4.75	7.13
Example with the annular guide	4.80	3.95

These figures show that although the total amount of coagulating bath removed per pound of yarn was substantially the same, the quantity of acid removed when using the annular guide in accordance with the invention was substantially less.

What we claim is:

1. A process for the production of threads by wet spinning comprising extruding a fibre-forming solution through a jet into a coagulating bath and withdrawing the threads upwards from the bath on to a rotating thread storage device wherein the thread is led directly from the coagulating bath against the edge of a smooth annular guide rotating at a peripheral speed greater than the peripheral speed of the thread storage device, the smooth annular guide being the only surface with which the thread makes frictional contact during its passage from the jet to the thread storage device.

2. A process for the production of threads by wet spinning comprising extruding a fibre-forming solution through a jet into a coagulating bath and withdrawing the thread upwards from the bath on to a rotating thread storage device wherein the thread is led directly from the coagulating bath against the edge of a smooth annular guide surrounding and rotating with the thread storage device, the smooth annular guide being the only surface with which the thread makes frictional contact during its passage from the jet to the thread storage device.

3. A process for the production of threads by wet spinning comprising extruding a fibre forming solution through a jet into a coagulating bath and withdrawing the thread upwards from the bath on to a rotating thread advancing reel wherein the thread is led directly from the coagulating bath against the edge of a smooth annular guide surrounding and rotating with the thread advancing reel, the smooth annular guide being the only surface with which the thread makes frictional contact during its passage from the jet to the thread-advancing reel.

4. A process for the production of threads by wet spinning comprising extruding a fibre-forming solution through a jet into a coagulating bath and withdrawing the thread upwards from the bath on to a rotating godet wherein the thread is led directly from the coagulating bath against the edge of a smooth annular guide surrounding and rotating with the godet, the smooth annular guide being the only surface with which the thread makes frictional contact during its passage from the jet to the godet.

5. A continuous process for the production of threads by wet spinning comprising extruding a fibre-forming solution through a jet into a coagulating bath and subjecting the thread thus formed without any break to a series of treatments on rotating thread storage devices and to drying and winding onto a package wherein the thread is led directly from the coagulating bath against the edge of a smooth annular guide rotating at a peripheral speed greater than the speed of the first of the thread storage devices, the smooth annular guide being the only surface with which the thread makes frictional contact during its passage from the jet to the first of the thread storage devices.

6. A continuous process for the production of threads by wet spinning comprising extruding a fibre forming solution through a jet into a coagulating bath and subjecting the thread thus formed without any break to a series of treatments on rotating thread advancing reels and to drying and winding onto a package wherein the thread is led directly from the coagulating bath against the edge of a smooth annular guide surrounding and rotating with the first of the thread advancing reels, the smooth annular guide being the only surface with which the thread makes frictional contact during its passage from the jet to the first of the thread-advancing reels.

7. A process for the production of threads by wet spinning comprising extruding viscose through a jet into a coagulating bath and withdrawing the regenerated cellulose thread upwards from the bath onto a rotating thread storage device wherein the thread is led directly from the coagulating bath against the edge of a smooth annular guide rotating at a peripheral speed greater than the peripheral speed of the thread storage device, the smooth annular guide being the only surface with which the thread makes frictional contact during its passage from the jet to the thread storage device.

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