

[54] TREATMENT OF YARNS

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Related U.S. Application Data

[62] Division of Ser. No. 889,518, Dec. 31, 1969, Pat. No. 3,644,968.

[30] **Foreign Application Priority Data**

Dec. 31, 1968 Great Britain 61962/68

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[51] Int. Cl. D02g 1/16

[58] Field of Search 28/1.4, 59, 62, 72.12, 28/72 HR; 432/59, 60

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Primary Examiner—Louis K. Rimrodt

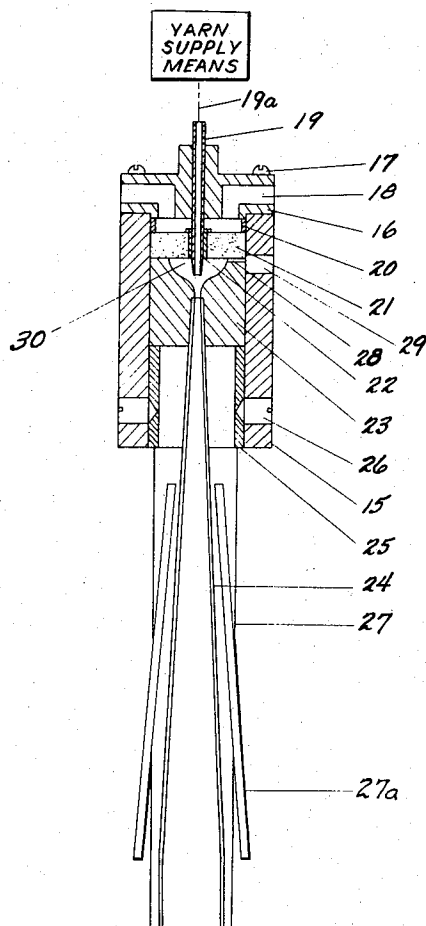
Attorney, Agent, or Firm—Cushman, Darby & Cushman

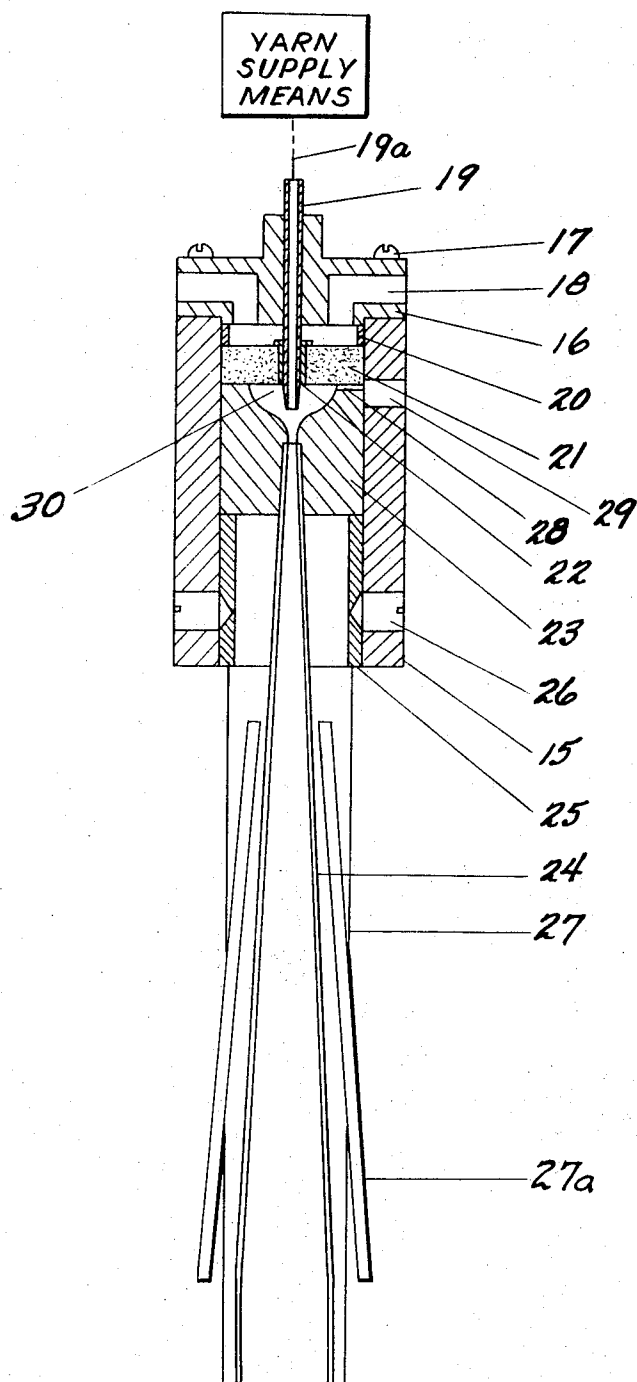
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ABSTRACT

Apparatus for relaxing a running yarn composed of thermoplastic polymer material comprising a yarn supply means, a fluid tension device having a yarn passageway, means for introducing a gaseous fluid under pressure to the fluid tensioning device and a heating zone comprising an externally heated divergent passageway of a cross section steadily increasing from that of the yarn passageway.

5 Claims, 1 Drawing Figure





TREATMENT OF YARNS

This is a division of application Ser. No. 889,518 filed Dec. 31, 1969, now U.S. Pat. No. 3,644,968.

This invention relates to the treatment of yarns and in particular to a device for the relaxation of yarns composed of thermoplastic polymeric material.

In the production of artificial or synthetic thermoplastic continuous filamentary yarns they are subjected to a drawing or stretching process under tension, following which it is usually required to relax the yarn partially or completely either to produce the desired physical properties, such as a reduced shrinkage propensity in the processed yarn or to produce some other effect, such as bulking or crimping of the filaments comprising the yarn when these have an inherent tendency to retract into a crimped form under low tension, optionally assisted by heat.

Hitherto such relaxation, has been carried out either by a batch process, wherein the yarn is temporarily collected in some form of package which allows a degree of contraction to take place or by continuously subjecting the running yarn to treatment with a hot fluid in some form of jet device. These methods, in particular the latter one, suffer from the disadvantage that the yarn properties produced fall short of the ideal particularly for materials subject to crystallisation under the influence of heat.

According to the present invention we provide apparatus for relaxing a running yarn composed of thermoplastic polymeric material, comprising a yarn supply means, a fluid tensioning device having a yarn passageway, means for introducing a gaseous fluid under pressure to the fluid tensioning device and a heating zone which includes an externally heated divergent passageway of a cross section steadily increasing from that of the yarn passageway.

Yarn may be supplied to a fluid tensioning device in the present invention direct from the draw roll of a drawing machine or the drawn yarn may be temporarily packaged under tension from which package it is supplied to the fluid tensioning device by way of a tension gate or feed roll/nip combination. The former continuous method of operation is preferred.

A fluid tensioning device for use in the invention comprises an aspirator or ejector jet which may have any of several forms. One such form comprises a yarn entry passageway of narrow bore into which yarn is drawn by the suction developed therein by entry into the passageway of an unheated or a heated gaseous fluid under pressure downstream of the point of entry of the yarn, said fluid proceeding through the passageway is generally downstream direction. A fluid pressure is used such as to provide the required tension to draw the yarn from the supply means into the yarn passageway and forward it to a heating zone.

In another form of fluid tensioning device the yarn entry tube or passageway is quite short and its lower end is surrounded by the open end of a slightly larger tube. The junction of the two tubes is enclosed in a chamber to which gaseous fluid under pressure is supplied. The fluid enters the larger tube through the space between the two tubes and in passing through the larger tube induces a reduced pressure in the yarn passageway which draws a yarn thereinto tensioning and forwarding it through the larger tube to the heating zone. Gaseous fluid supplied to the chamber surrounding the junction

of the two tubes, may be unheated or heated and in the latter case the fluid may be supplied at a pressure sufficient to draw enough unheated ambient air into the yarn tube with the yarn so that the yarn, while under tension before passing into the heating zone where tension is reduced, is not subject to heat. When heat crystallisable yarns such as polyethylene terephthalate are treated it is preferred to operate apparatus according to the invention either with unheated air or with heated air as in the latter described way.

In the preferred form of heating zone the diverging heated passageway has a taper of not greater than 10° . In apparatus of this form the velocity and pressure of the entering fluid carrying a yarn steadily decreases thereby allowing yarn tension to decay and relax under the influence of the heat. The length of the heating zone is selected to allow the required amount of relaxation which is also influenced by the heating zone temperature. Threading up a fluid tensioning device with a running yarn which is handled by a temporary collecting means as for example a suction gun, may be facilitated by providing a narrow longitudinal slot in the tensioning device and the relax zone.

Air is the most convenient fluid for use in this invention but other gases not having any harmful effect on thermoplastic polymeric substances may be used.

Yarn emerging from the heating zone is collected in any way which does not allow collecting tension to run back to the relaxation zone. For example a pair of rolls pressed into close contact with each other and preferably with one surface covered by a resilient material (that is a roll/nip combination) may be used to take-up the yarn emerging from the relax zone and to forward it to any suitable yarn packaging apparatus. By this means the amount of relaxation occurring may be controlled by adjusting the relative speeds of this roll combination and that of the supply of yarn to the relax process.

The invention is illustrated in the sole FIGURE which is a longitudinal sectional view of a relaxation apparatus wherein relaxation is effected in a uniformly divergent enclosure.

Referring to the drawing a cylindrical casing 15 carries the parts of the apparatus in easily demountable form. A cap 16 spigotted into the upper end of casing 15 and retained in place by screws 17 carries symmetrically a number of holes 18 for entry of the working fluid. A yarn entry tube 19 is inserted through a central hole in cap 16 protruding some distance into the casing 15. Inside the casing 15 spaced a small distance from the lower side of cap 16 by a spacing ring 20 is a diffusing plate 21, of, for example, sintered metal, through a bush 22 in which the exit end of the yarn tube 19 protrudes into a cavity 30 formed at the upper end of a block 23 which carries the upper end of a divergent yarn passageway 24 in communication with cavity 30 and is positioned within the casing 15 by means of a tubular spacer 25 retained which protrudes from the lower end of casing 15, is supported by brackets 27 attached to casing 15 and is surrounded by heating means 27a. A small groove 28 in the top of block 23 allows a pressure or other measuring instrument to be attached through a tapping 29 in the casing 15.

In operation compressed fluid entering holes 18 passes through the diffusing plate 21 into cavity 30 and thence into passageway 24 thereby inducing a suction in tube 19 which draws in a yarn 19a tensioning it

within the tube 19 and forwarding it through passage 24 at a reducing fluid velocity and under increasing relaxation conditions. The relaxed yarn leaving the lower end of passage 24 may be taken up and collected into a package as in the foregoing description.

Yarns composed of filaments or fibres of any thermoplastic polymeric material or materials may be relaxed in apparatus according to the present invention, as for example polyesters, polyamides, polyolefines or copolymers within or between these classes.

Yarns composed of conjugate filaments, that is of two or more components arranged in contiguous fashion, either side-by-side or as sheath and core, along the length of each filaments, will have an inherent tendency to contract into crimped form on relaxation if the two components have a different shrinkage tendency. Likewise filaments which by the preceding treatments to which they have been subjected, as for example, asymmetric cooling or asymmetric heating, will also have an inherent retraction tendency. Both those types of yarn may be advantageously relaxed in a method according to the invention when a good bulk and crimping effect is obtained in a continuous process.

What we claim is:

1. Apparatus for relaxing a running yarn composed of thermoplastic polymeric material comprising a yarn supply means, a fluid tension device having a yarn passageway, means for introducing a gaseous fluid under pressure to the fluid tensioning device and a heating zone comprising an externally heated divergent passageway of a cross section steadily increasing from that

of the yarn passageway, the taper of said divergent passageway being not greater than 10°.

2. Apparatus according to claim 1 wherein the fluid tensioning device comprises a yarn passageway and means permitting entry therinto of fluid under pressure and for directing it in the desired direction of yarn movement.

3. Apparatus according to claim 2 wherein the fluid entry means comprises a passageway connected to a supply of fluid under pressure opening into the yarn passageway.

4. Apparatus according to claim 2 wherein the fluid entry means comprises a second passageway positioned below the yarn passageway, substantially coaxial therewith and of larger bore into which the yarn passageway enters and which forms a continuation thereof, the junction of the two passageways being connected to a supply of fluid under pressure.

5. Apparatus for relaxing a running yarn composed of thermoplastic polymeric material comprising: means defining an externally heated, uniformly diverging passageway having an inlet and a concentric outlet of greater cross-section than the inlet; a fluid-operated yarn tension device which includes a stationary yarn passageway having a stationary discharge end in communication with the inlet of said diverging passageway; means for introducing gaseous fluid under pressure to the tension device; and yarn supply means for continuously supplying yarn to the yarn passageway in the yarn tension device.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,808,652

Dated May 7, 1974

Inventor(s) David R. ELLIOTT; John M. GREENWAY

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the front page format, in paragraph [76], after
"of Harrogate, Yorkshire, England", insert --assignors to
Imperial Chemical Industries Limited, London, England--

Signed and sealed this 1st day of July 1975.

(SEAL)

Attest:

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