

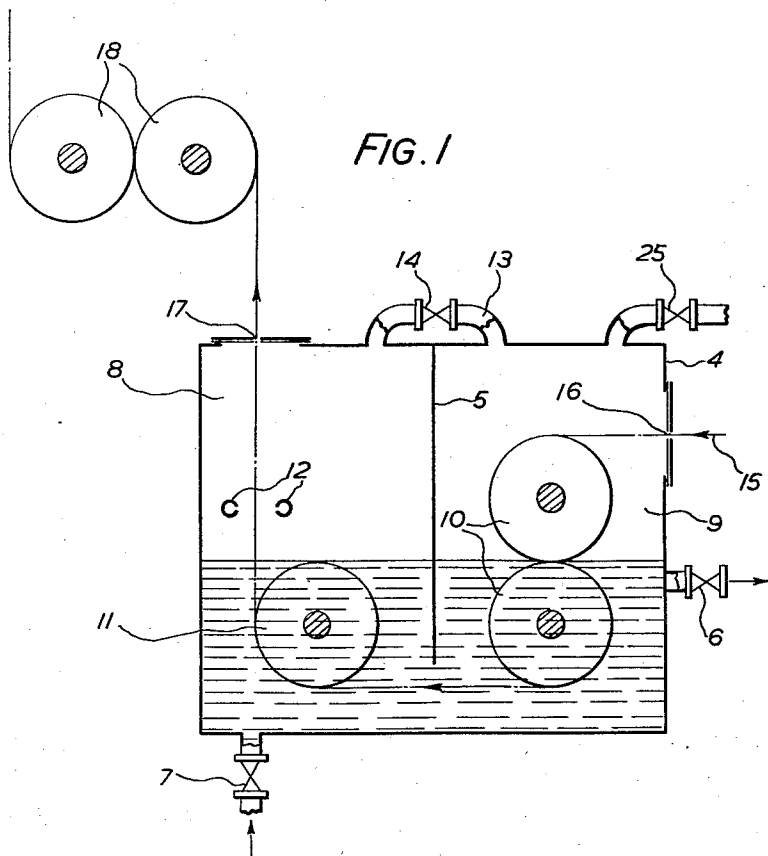
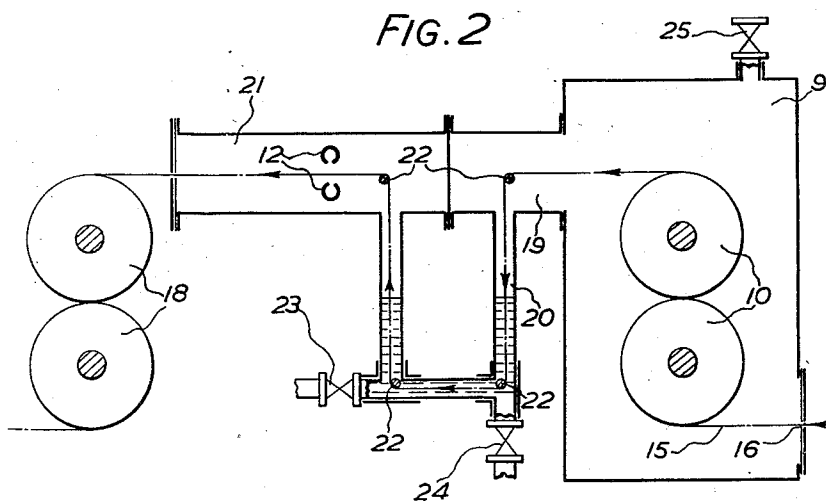
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TREATMENT OF FILAMENTS, FOILS, AND THE LIKE

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TREATMENT OF FILAMENTS, FOILS, AND
THE LIKE

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This invention relates to improvements in the treatment of textile and other materials, and particularly to improvements in processes wherein filaments, yarns, foils and similar materials are subjected to stretching operations or other operations in fluid media under super-atmospheric pressure.

U. S. application S. No. 69,282, filed March 17, 1936, describes apparatus for subjecting filaments, foils and similar materials to stretching and other operations in steam and other fluid media under super-atmospheric pressure. The apparatus described comprises a pressure treatment chamber and one or more end pressure chambers for compressed air or other inert fluid which may contain feed devices for the materials. The presence of the compressed fluid in the end pressure chamber or chambers reduces or prevents any drag on the materials in the pressure treatment chamber due to flow of treatment agent through the orifices through which the materials enter and/or leave the treatment chamber.

The present application is concerned with processes and apparatus by which this reduction or prevention of tension can be achieved without the use of the separate chambers communicating by fine orifices for passage of the materials which are described in the above specification.

The absence of the fine orifices between the end chamber and treatment chamber facilitates threading up and the passage through the machine of knots where one end is joined to another. It also facilitates the recovery of broken ends by tying a broken thread to an unbroken one before it enters the apparatus and separating the threads after they have passed through it.

According to the present invention filaments, yarns, foils and similar materials, particularly such materials made of cellulose acetate and other organic derivatives of cellulose, are subjected to stretching and other treatments with treatment fluids at super-atmospheric pressures by passing the materials into a body of inert liquid under super-atmospheric pressure and having a free surface in contact with the treatment fluid, from said liquid into said fluid and from said fluid to a take-up device.

The apparatus employed may comprise a single chamber having means for circulating water or other inert liquid through the bottom portion, which contains a feed device, and means for introducing steam or other treatment fluid at a position above the water level, and the mate-

rials may pass upward through the water and treatment fluid, either vertically or in a path making a substantial angle with the horizontal, e. g., 45°.

Preferably, however, the apparatus employed is the novel apparatus forming a part of the present invention, which is substantially closed and comprises a treatment chamber provided with an inlet for treatment fluid and with an outlet for the materials, a second chamber provided with an inlet for the materials and communicating with the treatment chamber by a passage of substantial dimensions between said chambers, means for circulating inert liquid through said passage so as to prevent passage of treatment fluid into the second chamber, and means for passing the materials successively through the second chamber and the treatment chamber. Preferably, the second chamber contains a positively driven feed device for the materials.

The term "free surface" as used above and elsewhere in this specification means a surface of substantial area as compared with the cross-sectional area of the materials being treated, and the term "passage of substantial dimensions" as employed above and elsewhere in this specification means a passage of substantial cross-sectional area as compared with the cross-sectional area of the materials to be treated.

Examples of such apparatus are illustrated in Figures 1 and 2 of the accompanying drawing, wherein—

Figure 1 shows a vertical cross-section of an apparatus in which the materials pass into the liquid seal during their passage round the nip rollers, while

Figure 2 shows a vertical cross-section of an apparatus in which the passage round the nip rollers is completed before the materials come into contact with the liquid seal.

Referring to Figure 1 the apparatus comprises a chamber 4 containing a partition 5 which extends downwards below the outlet 6 for the water or other liquid employed to seal off the compartment 8 from the other compartment 9. An inlet 7 for water or other liquid is provided. Nip rollers 10 are contained in the compartment 9, which is also provided with an inlet 25 for inert gas, and a guide roller 11 is provided in the compartment 8 which also contains steam jets 12. A pipe 13 provided with a valve 14 connects the two chambers so that they can be put into communication if desired in order to equalize the pressure. The filaments or other materials 15 enter the

compartment 9 through the orifices 16 and pass around the nip rollers 10 and under the partition 5 into the compartment 8. They then pass round the roller 11 between the steam jets 12 and out through the outlet 17 to nip rollers 18 which apply the stretching tension. They then pass to a suitable take-up device (not shown).

Instead of having air in the upper portion of the chamber 9 the liquid may be allowed to fill the whole of the chamber and issue through the air inlet 25, the valve 6 being shut and the pressure in the two chambers being such that the liquid level in chamber 8 is below the steam jets 12.

The apparatus illustrated in Figure 2 comprises a chamber 9 containing nip rollers 10 and communicating by means of a channel 19 with a U shaped vessel 20, the other end of which communicates with a stretching chamber 21 containing steam jets 12. Guides 22 are provided to conduct the materials through the chamber 20. An inlet 23 and outlet 24, both of which are valve controlled, are provided for the liquid seal. Air or other inert gas can be introduced into the chamber 9 through the valve controlled inlet 25. In operation the filaments or other materials 15 enter the chamber 9 through the inlet 16, pass round the nip rollers 10, thence through the channel 19 and the chamber 20 round the guides 22 and finally through the stretching chamber 21 to nip rollers 18 by means of which they are stretched. The materials then pass to a suitable take-up device (not shown).

If required a third chamber containing inert fluid may be provided which communicates with the treatment chamber by a passage containing a liquid seal, so that the materials pass from the treatment chamber through the third chamber before emerging into the air. This chamber may contain a feed device for stretching the materials. The water or other liquid is preferably circulated continuously through the bottom of the chamber or chambers in order that it may be maintained at a constant temperature. Preferably the liquid is at room temperature, and in any case its temperature should not be so high as to bring the materials into a condition such that stretching takes place prior to their entering the steam.

Saturated or wet steam may be employed for stretching at a temperature of, for example, 110, 125 or 135° C. or more. In order to increase the wetness of the steam the steam chamber may contain a water spray. On the other hand, good results may be obtained without the use of a spray.

The materials may be sprayed with cold water immediately on issuing from the stretching chamber in order that the action of the steam may be sharply confined to the materials during their passage through the stretching chamber.

The properties of the materials, and particularly their tenacity and extensibility, may be varied considerably by variation of the stretching conditions, for example the temperature of the steam employed, the degree of stretch, the size and number of the steam inlets and the length of the stretching chamber. For example, by suitable variation of the conditions cellulose acetate yarns having a tenacity of 2, 4 or 5 grams per denier or even more may be obtained.

The general conditions for the treatment of filaments and other materials using the apparatus described in the present application may be similar to those described in U. S. application S. No. 69,282.

The process and apparatus described in the present application are particularly valuable for the stretching of materials made of cellulose acetate and other organic derivatives of cellulose in steam, but they are also applicable to the stretching of other materials and also to other treatments of cellulose derivative and other materials, for example saponification carried out with gaseous saponifying agents. Further, stretching, saponification and other treatments in the presence of hot water or other liquid treatment agents may be effected by using as the seal a liquid which is immiscible with the treatment agent and does not react with it and has a sufficiently low vapour pressure at the treatment temperature. Such a liquid may, for example, be mercury or an organic liquid. In such a case the treatment agent may be introduced into the chamber 8 of Fig. 1 or the chamber 21 of Fig. 2 through the jets 12 and an outlet orifice may be provided. The chamber may also be provided with a heating coil to maintain the agent at the required temperature.

Having described our invention what we desire to secure by Letters Patent is:

1. Apparatus for subjecting filaments, foils and similar materials to treatment with fluid media under super-atmospheric pressure during their travel from one point to another, which is substantially closed and which comprises a treatment chamber provided with an inlet for treatment fluid and with an outlet for the materials, a second chamber provided with an inlet for the materials and communicating with the treatment chamber by a passage of substantial dimensions, means for maintaining a body of inert liquid in said passage so as to prevent treatment fluid passing into the second chamber, and means for passing the materials successively through the second chamber, the passage and the treatment chamber.

2. Apparatus according to claim 1, wherein the second chamber contains a positively driven feed device for the materials.

3. Apparatus for subjecting filaments, foils and similar materials to treatment with fluid media under superatmospheric pressure during their travel from one point to another, which is substantially closed and is provided with inlet and outlet orifices for the materials and which comprises a treatment chamber provided with an inlet for treatment fluid, a second chamber communicating with the treatment chamber by a passage of substantial dimensions and containing a positively driven feed device for the materials, means for maintaining a body of inert liquid in said passage so as to prevent treatment fluid passing into the second chamber, and means for passing the materials successively through the second chamber, the passage and the treatment chamber.

4. Apparatus for subjecting filaments, foils and similar materials to treatment with fluid media under superatmospheric pressure during their travel from one point to another, which is substantially closed and is provided with inlet and outlet orifices for the materials and which comprises a treatment chamber provided with an inlet for treatment fluid, a second chamber communicating with the treatment chamber by a passage of substantial dimensions and containing a positively driven feed device for the materials, means for circulating inert liquid through said passage so as to prevent treatment fluid passing into the second chamber, and means for passing

the materials successively through the second chamber, the passage and the treatment chamber.

5 5. Apparatus for subjecting filaments, foils and similar materials to treatment with fluid media under superatmospheric pressure during their travel from one point to another, which is substantially closed and is provided with inlet and outlet orifices for the materials and which comprises a treatment chamber provided with an inlet for treatment fluid, a second chamber communicating with the treatment chamber by a passage of substantial dimensions and containing a positively driven feed device and provided with an inlet for inert fluid, means for circulating inert liquid through said passage so as to prevent treatment fluid passing into the second chamber, and means for passing the materials successively through the second chamber, the passage and the treatment chamber.

6. Process for the treatment of filaments, foils and similar materials in a substantially closed apparatus with treatment fluids under superatmospheric pressure, which comprises passing the materials into a body of inert liquid contained in the apparatus under superatmospheric pressure and having a free surface in contact with a treatment fluid under superatmospheric pressure, and from said liquid into said fluid.

7. Process for the treatment of filaments, foils and similar materials in a substantially closed apparatus with treatment fluids under superatmospheric pressure, which comprises passing the materials into an inert fluid contained in the apparatus under superatmospheric pressure and from said fluid through an inert liquid into a treatment fluid which is under superatmospheric pressure and which is separated from the inert fluid by the inert liquid, said inert liquid having free surfaces in contact with the inert fluid and treatment fluid respectively.

8. Process for stretching artificial filaments, foils and similar materials in a substantially closed apparatus with stretch-assisting fluids under superatmospheric pressure, which comprises passing the materials in contact with a positively driven feed device immersed in a body of inert liquid contained in the apparatus under superatmospheric pressure and having a free surface in contact with a stretch-assisting fluid under superatmospheric pressure and from said liquid through said fluid and stretching the materials during their passage through the stretch-assisting fluid.

9. Process for stretching artificial filaments, foils and similar materials in a substantially closed apparatus with stretch-assisting fluids under superatmospheric pressure, which comprises passing the materials into an inert gas which is under superatmospheric pressure, in contact with a positively driven feed device contained in the apparatus, and from said gas through an inert liquid into a stretch-assisting fluid which is under superatmospheric pressure and which is separated from the inert gas by the inert liquid, and stretching the materials during their travel through the stretch-assisting fluid, said inert liquid having free surfaces in contact with the inert gas and the stretch-assisting fluid respectively.

10. Process for stretching artificial filaments, foils and similar materials in a substantially closed apparatus with stretch-assisting fluids under superatmospheric pressure, which comprises passing artificial filaments, foils and similar materials

having a basis of an organic derivative of cellulose in contact with a positively driven feed device immersed in a body of inert liquid contained in the apparatus under superatmospheric pressure and having a free surface in contact with a stretch-assisting fluid under superatmospheric pressure and from said liquid through said fluid and stretching the materials during their passage through the stretch-assisting fluid.

11. Process for stretching artificial filaments, foils and similar materials in a substantially closed apparatus with stretch-assisting fluids under superatmospheric pressure, which comprises passing artificial filaments, foils and similar materials having a basis of an organic derivative of cellulose into an inert gas which is under superatmospheric pressure, in contact with a positively driven feed device contained in the apparatus, and from said gas through an inert liquid into a stretch-assisting fluid which is under superatmospheric pressure and which is separated from the inert gas by the inert liquid, and stretching the materials during their travel through the stretch-assisting fluid, said inert liquid having free surfaces in contact with the inert gas and the stretch-assisting fluid respectively.

12. Process for stretching artificial filaments, foils and similar materials in a substantially closed apparatus with stretch-assisting fluids under superatmospheric pressure, which comprises passing artificial filaments, foils and similar materials having a basis of an organic derivative of cellulose in contact with a positively driven feed device immersed in a body of inert liquid contained in the apparatus under superatmospheric pressure and having a free surface in contact with a stretch-assisting fluid under superatmospheric pressure and selected from the group consisting of wet steam and hot water at a temperature above 100° C. and from said liquid through said fluid and stretching the materials during their passage through the stretch-assisting fluid.

13. Process for stretching artificial filaments, foils and similar materials in a substantially closed apparatus with stretch-assisting fluids under superatmospheric pressure, which comprises passing artificial filaments, foils and similar materials having a basis of an organic derivative of cellulose into an inert gas which is under superatmospheric pressure, in contact with a positively driven feed device contained in the apparatus, and from said gas through an inert liquid into a stretch-assisting fluid which is under superatmospheric pressure and is selected from the group consisting of wet steam and hot water at a temperature above 100° C. and which is separated from the inert gas by the inert liquid, and stretching the materials during their travel through the stretch-assisting fluid, said inert liquid having free surfaces in contact with the inert gas and the stretch-assisting fluid respectively.

14. Process for stretching artificial filaments, foils and similar materials in a substantially closed apparatus with stretch-assisting fluids under superatmospheric pressure, which comprises passing artificial filaments, foils and similar materials having a basis of cellulose acetate in contact with a positively driven feed device immersed in a body of inert liquid contained in the apparatus under superatmospheric pressure and having a free surface in contact with wet steam at a temperature above 100° C. and from said liquid through the steam, directing a current of

wet steam at a temperature above 100° C. on to the materials immediately after they issue from the inert liquid, and stretching the materials during their passage through the steam.

- 5 15. Process for stretching artificial filaments, foils and similar materials in a substantially closed apparatus with stretch-assisting fluids under superatmospheric pressure, which comprises passing artificial filaments, foils and similar materials
10 having a basis of cellulose acetate into an inert gas which is under superatmospheric pressure, in contact with a positively driven feed device con-

tained in the apparatus, and from said gas through an inert liquid into wet steam at a temperature above 100° C. which is separated from the inert gas by the inert liquid, directing a current of wet steam at a temperature above 100° C. 5 on to the materials immediately after they issue from the inert liquid, and stretching the materials during their travel through the steam, said inert liquid having free surfaces in contact with the inert gas and the steam respectively. 10

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