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W. I. TAYLOR ET AL

2,216,142

CRIMPING OF FILAMENTS, FIBERS, YARNS, AND THE LIKE

Filed Dec. 14, 1938

2 Sheets-Sheet 1

FIG. 1

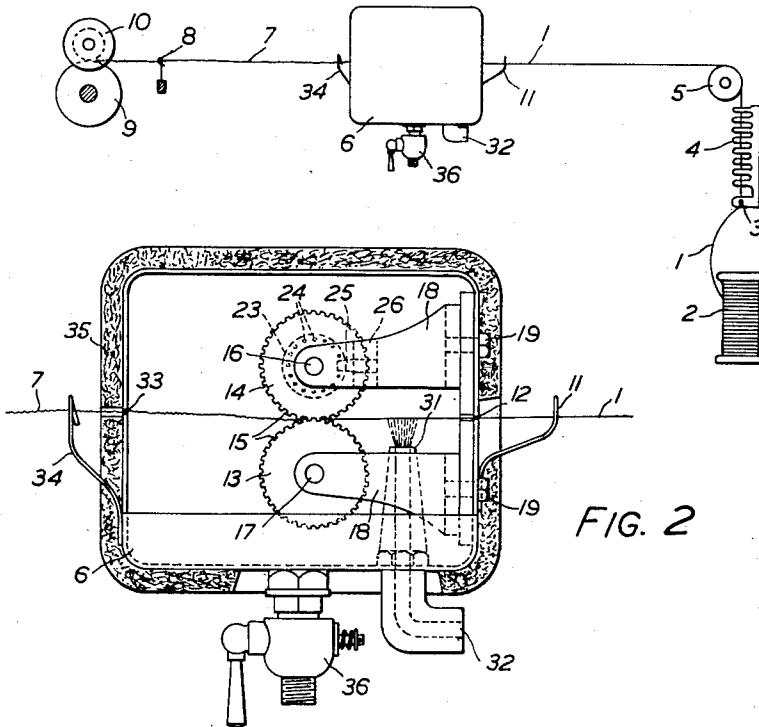


FIG. 2

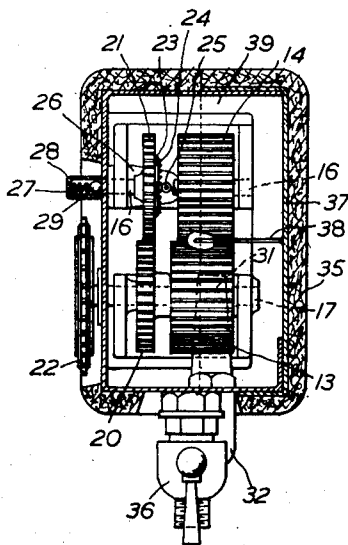
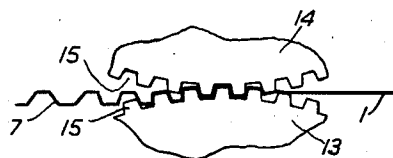


FIG. 3

FIG. 4



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FIG. 5

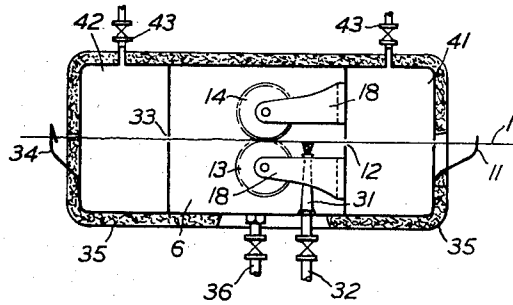


FIG. 6

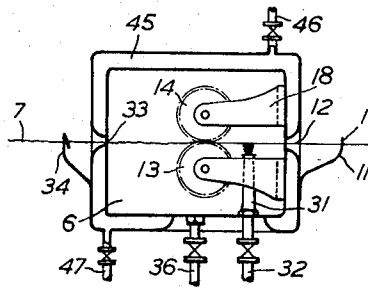
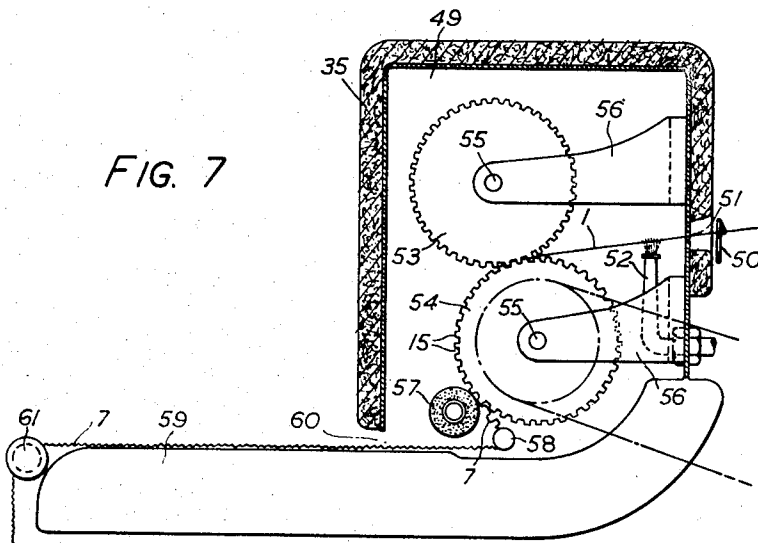


FIG. 7



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2,216,142

CRIMPING OF FILAMENTS, FIBERS, YARNS,
AND THE LIKE

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Application December 14, 1938, Serial No. 245,668
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15 Claims. (Cl. 28—1)

This invention relates to the treatment of textile materials, and particularly to the treatment of filaments, fibers, yarns and the like for the purpose of producing a crimped effect therein.

According to the present invention the filaments, fibers, yarns or like materials are deformed by lateral pressure locally applied in the presence of an agent adapted to soften the substance of the materials, and the deformed materials are then removed from the influence of said softening agent, so as to set the deformities therein. The softening agent present, which is preferably a hot aqueous medium, e. g., wet steam or hot water, makes easier the deformation required to produce crimps in the materials, and at the same time renders the crimp permanent when the softness introduced in the material by the steam or hot water has passed off.

A convenient way of carrying out the invention consists of passing the filaments, yarns, fibers or the like (hereinafter generally referred to as "filaments" or "materials") between crimping rollers operating in a steam chamber. The surfaces of the crimping rollers are provided with intermeshing corrugations of the form of the crimp desired in the final product, and the rollers are held together, preferably with a small clearance sufficient only for the passage of the materials between them, so as to impose the required deformation upon the said materials. The crimping effect may be enhanced by rubbing the materials in a direction transverse to the direction of application of lateral pressure, e. g., by shifting the rollers to and fro in an axial direction so as to produce a rubbing motion between them. This not only causes the material to take up the imposed deformation, but also alters the direction in which the deformation takes place in any given filament. In this way the crimps produced in a given filament may not lie all in the same plane but may lie in different planes, whereby the crimping effect is greatly enhanced.

The hot aqueous medium may be employed at a temperature of, say, 95° to 100° C. or more. Where wet steam is employed, it may be at atmospheric pressure, or the operation may be carried out in steam at a superatmospheric pressure. Further, the materials may be pretreated with a liquid adapted to facilitate softening, e. g., in the case of cellulose acetate materials, an aqueous solution of ethyl alcohol, which solution will exert a softening action on the materials at the temperature of the steam employed.

Or again, the steam may contain vapours of an-

other softening agent for the substance of the materials or such vapours may be used without steam, e. g., in a diluent such as hot air. Where the softening agent is supplied under superatmospheric pressure, it may be desirable, in order to avoid undue stretching of the materials, to lead the materials into, and/or out of the steam chamber through a chamber supplied with compressed air or the like, as described in U. S. applications S. Nos. 17,242, filed April 19, 1935, and 69,282, filed March 17, 1936.

The invention is applicable to continuous filaments whether intended for use as such or for conversion into staple fibers. The invention may also be applied to staple fibers, whether natural or artificial, in which case the fibers are preferably treated in the form of a continuous product, i. e., a yarn or roving.

The invention is particularly applicable to continuous filaments or staple fibers of cellulose acetate or other thermoplastic derivative of cellulose, i. e., other cellulose esters such as cellulose formate, propionate or butyrate, and cellulose ethers, such as ethyl and benzyl cellulose. The invention may also be applied, however, to continuous filaments or staple fibers of other materials, e. g., silk and wool.

By way of example some forms of apparatus according to the present invention will now be described in greater detail with reference to the accompanying drawings in which

Fig. 1 is a diagrammatic side elevation of an assembly for crimping a yarn;

Fig. 2 is a side elevation of the crimping apparatus of Fig. 1, shown with the side plate removed;

Fig. 3 is a cross-sectional front elevation of the mechanism shown in Fig. 2;

Fig. 4 shows a detail of Figs. 2 and 3 on a larger scale;

Fig. 5 is a diagrammatic side elevation with the cover plate removed of a modification of the apparatus shown in Figs. 1-4;

Fig. 6 is a diagrammatic sectional side elevation of a further modification; and

Fig. 7 is a side elevation similar to Fig. 2 of a further modification of the crimping apparatus.

Referring to Fig. 1, a yarn 1 consisting of continuous filaments of cellulose acetate is drawn over the end of a bobbin 2, through a guide 3 and through a tension device 4. The yarn 1 then passes over a roller 5 and proceeds to the crimping apparatus indicated generally at 6 and shown in greater detail in Figs. 2, 3 and 4. The yarn

leaves the crimping apparatus 6 in the form of a crimped yarn indicated at 7 and proceeds through a traverse guide 8 to a winding device 9 by means of which it is wound into a package 10.

As is shown in Figs. 2 and 3 the yarn 1 is guided into the crimping chamber 6 by means of a guide 11 and enters through an aperture 12. From the aperture 12 the yarn proceeds between a pair of crimping rolls 13, 14 having intermeshing corrugations indicated at 15 and shown in greater detail in Fig. 4. The rolls 13, 14 are mounted on shafts 16, 17 carried in brackets 18 secured to the wall of the chamber 6 by means of bolts 19. The shafts 16, 17 carry a pair of accurately cut intermeshing gears 20, 21 and the shaft 17 extends through the wall of the chamber 6 and is provided with a driving sprocket 22 by means of which it is driven, the shaft 16 being driven from the shaft 17 by means of the gears 20, 21. As shown in Fig. 3, the gear 21 carries a boss 23 having a series of projections 24 all round it, the projections engaging with a stud 25 carried in a lug 26 on the upper bracket 18. The shaft 16 is provided at one end with a spring 27 contained in an extension 28 from the wall of the chamber 6, the spring 27 acting on a ball 29 which presses against the end of the shaft 16, whereby the gear 21 and the boss 23 and projections 24 carried thereon are held in engagement with the stud 25. By these means as the shafts 16, 17 are driven by means of the sprocket 22 the shaft 16 is caused to reciprocate axially by the engagement of the projections 23 with the stud 25 so that the yarn 1 passing between the rolls 13, 14 is rubbed in a direction at right angles both to the direction of its passage between the rolls and to the direction of the pressure locally applied to it by the corrugations 15.

On its way from the aperture 12 to the rolls 13, 14 the yarn 1 passes directly over the mouth of a steam jet 31 supplied by a pipe 32. The steam from the jet 31 fills the chamber 6 and acts particularly on the yarn 1 immediately before it enters between the rolls 13, 14 so that the yarn is softened and is able to take up the distortions imparted by the corrugations 15. The corrugated yarn 7 leaves the chamber 6 by an aperture 33 and guide 34 and proceeds to the take-up device 9 whose rate of collection is adjusted so that no undue tension is imparted to the crimped yarn 7 whereby the crimps might be pulled out of it.

The chamber 6 is surrounded as far as possible with lagging 35 and is provided at the bottom with a drain cock 36 for the removal of condensed moisture. As is shown in Fig. 3 one side 37 of the chamber 6 is removable for the purpose of threading the yarn, and the apertures 12 and 33 are formed by long slots, one of which is shown at 38 in Fig. 3, into which the yarn can be slipped. These slots are largely covered by the overlapping side wall 39 of the side plate 37 so that only a small aperture is left and undue escape of steam is prevented.

Means are shown in Fig. 5 whereby escape of steam may be further prevented and moreover any undue stretching of the yarn by the drag of an escaping steam jet is avoided. For this purpose auxiliary chambers 41, 42 are provided, covering the entrance and exit apertures 12 and 33 respectively, and the auxiliary chambers 41, 42 are provided with compressed air through connections 43. The compressed air in the chambers 41, 42 substantially prevents escape of steam

through the apertures 12 and 33 and prevents drag being applied to the softened portion of the yarn being crimped.

In Fig. 6 the chamber 6 is shown provided with a steam jacket 45 supplied with steam through an inlet 46 and an outlet 47, the steam jacket serving in place of the lagging 35 shown in Figs. 2 and 3. This form of apparatus is particularly convenient where the softening medium applied to the yarn is a mixture of air and solvent vapour having no substantial supply of latent heat to maintain the required temperature within the chamber 6.

In Fig. 7 is shown a side elevation with the side cover removed of a form of apparatus provided with a drying plate. This apparatus comprises a chamber 49 provided with lagging 35 into which the yarn enters through a guide 50 and an aperture 51. The yarn passes over a steam jet 52 and then to a pair of rolls 53, 54 having intermeshing corrugations 15 and carried on shafts 55 mounted in brackets 56. The rolls 53, 54 are driven by means of gears similar to the gears 20, 21 shown in Fig. 3 and these gears may, if desired, be provided with means for reciprocating the rolls 53, 54 axially as illustrated in Fig. 3.

The yarn 1 remains in contact with the lower roll 54 after it has passed through the nip between the rolls and is held in position by means of a rubber nip roll 57 pressing against the crests of the corrugations 15 on the roll 54. After passing the rubber nip roll 57 the yarn leaves the roll 54 as a crimped yarn 7 and passes round a freely rotatable bar 58 which guides it over the surface of a heating element 59. The heating element 59 is formed hollow and is fed with steam. As it passes over the surface of the element 59 the yarn 7 leaves the chamber 6 by the aperture 60 and proceeds over a guide roll 61 to a take-up device of the kind shown in Fig. 1.

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

1. A method of crimping filaments, fibers, yarns and like materials, said method comprising deforming the materials by applying lateral pressure locally to the materials in the presence of an agent adapted to soften the substance of the materials and simultaneously rubbing the materials in a direction transverse to the direction of application of said pressure and then removing the deformed materials from the influence of said softening agent so as to set the deformations therein.

2. A method of crimping filaments, fibers, yarns and like materials, said method comprising deforming the materials by applying lateral pressure locally to the materials in the presence of wet steam and simultaneously rubbing the materials in a direction transverse to the direction of application of said pressure and then removing the deformed materials from the influence of said steam so as to set the deformations therein.

3. A method of crimping filaments, fibers, yarns and like materials, said method comprising deforming the materials by applying lateral pressure locally to the materials in the presence of wet steam and the vapors of another agent adapted to soften the substance of the materials and simultaneously rubbing the materials in a direction transverse to the direction of application of said pressure and then removing the deformed materials from the influence of said steam so as to set the deformations therein.

4. A method of crimping filaments, fibers, yarns and like materials, said method comprising

deforming the materials by applying lateral pressure locally to the materials in the presence of hot water and simultaneously rubbing the materials in a direction transverse to the direction of application of said pressure and then removing the deformed materials from the influence of said hot water so as to set the deformations therein.

5. A method of crimping filaments, fibers, yarns and like materials, said method comprising applying to the materials a liquid adapted to facilitate the softening of the materials, deforming the materials by applying lateral pressure locally to the materials in the presence of an additional agent adapted to soften the substance of the materials and simultaneously rubbing the materials in a direction transverse to the direction of application of said pressure and then removing the deformed materials from the influence of said softening agent so as to set the deformations therein.

6. A method of crimping filaments, fibers, yarns and like materials, said method comprising deforming the materials by applying lateral pressure locally to the materials in the presence of an agent adapted to soften the substance of the materials and simultaneously rubbing the materials in a direction transverse to the direction of application of said pressure and then removing the deformed materials from the influence of said softening agent and heating the materials so as to set the deformations therein.

7. A method of crimping filaments, fibers, yarns and the like of an organic derivative of cellulose, said method comprising deforming the materials by applying lateral pressure locally to the materials in the presence of an agent adapted to soften the substance of the materials and simultaneously rubbing the materials in a direction transverse to the direction of application of said pressure and then removing the deformed materials from the influence of said softening agent so as to set the deformations therein.

8. A method of crimping filaments, fibers, yarns and the like of cellulose acetate, said method comprising deforming the materials by applying lateral pressure locally to the materials in the presence of an agent adapted to soften the substance of the materials and simultaneously rubbing the materials in a direction transverse to the direction of application of said pressure and then removing the deformed materials from the influence of said softening agent so as to set the deformations therein.

9. A method of crimping filaments, fibers, yarns and the like of cellulose acetate, said method comprising deforming the materials by applying lateral pressure locally to the materials in the pressure of wet steam and simultaneously rubbing the materials in a direction transverse to the direction of application of said pressure and then removing the deformed materials from the influence of said steam so as to set the deformations therein.

10. A method of crimping filaments, fibers, yarns and the like of cellulose acetate, said method comprising deforming the materials by applying lateral pressure locally to the materials in the presence of wet steam and the vapors of a

softening agent for the cellulose acetate and simultaneously rubbing the materials in a direction transverse to the direction of application of said pressure and then removing the deformed materials from the influence of said steam so as to set the deformations therein.

11. Apparatus for the crimping of filaments, fibers, yarns and like materials, said apparatus comprising a chamber for the reception of a softening agent, at least a pair of crimping elements within said chamber adapted to apply lateral pressure locally to materials passing between them in the presence of the softening agent and means for shifting the crimping elements to and fro relative to one another in a direction across the direction of passage of the materials between them.

12. Apparatus for the crimping of filaments, fibers, yarns and like materials, said apparatus comprising a chamber for the reception of a softening agent, a pair of rollers within said chamber having intermeshing corrugations extending along their length and adapted to apply lateral pressure locally to materials passing between them in the presence of the softening agent and means for shifting said rollers axially to and fro relative to one another.

13. Apparatus for crimping of filaments, fibers, yarns and like materials, said apparatus comprising a chamber for the reception of a softening agent, a jacket surrounding said chamber for the reception of a heating medium, a pair of rollers within said chamber having intermeshing corrugations extending along their length and adapted to apply lateral pressure locally to materials passing between them in the presence of the softening agent and means for shifting said rollers axially to and fro relative to one another.

14. Apparatus for the crimping of filaments, fibers, yarns and like materials, said apparatus comprising a chamber for the reception of a softening agent, apertures in the wall of said chamber for the passage of the material, at least one auxiliary chamber surrounding an aperture outside the main chamber, connections to said auxiliary chamber for the supply of compressed air thereto, a pair of rollers within said chamber having intermeshing corrugations extending along their length and adapted to apply lateral pressure locally to materials passing between them in the presence of the softening agent and means for shifting said rollers axially to and fro relative to one another.

15. Apparatus for the crimping of filaments, fibers, yarns and like materials, said apparatus comprising a chamber for the reception of a softening agent, a pair of rollers within said chamber having intermeshing corrugations extending along their length and adapted to apply lateral pressure locally to materials passing between them in the presence of the softening agent, means for shifting said rollers axially to and fro relative to one another, a drying plate over which the materials are caused to pass on leaving said chamber, and means for heating said drying plate.

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CERTIFICATE OF CORRECTION.

Patent No. 2,216,142.

October 1, 1940.

WILLIAM IVAN TAYLOR, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 46, claim 1, for the word "present" read --presence--; page 3, first column, line 59, claim 9, for "pressure" read --presence--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 29th day of October, A. D. 1940.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.