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DEVICE FOR THE TWISTING AND HEAT SETTING OF THREADS OR YARNS OF SYNTHETIC MATERIAL, CONSTITUTED PREFERABLY OF NUMEROUS ELEMENTARY FILAMENTS OR FIBERS

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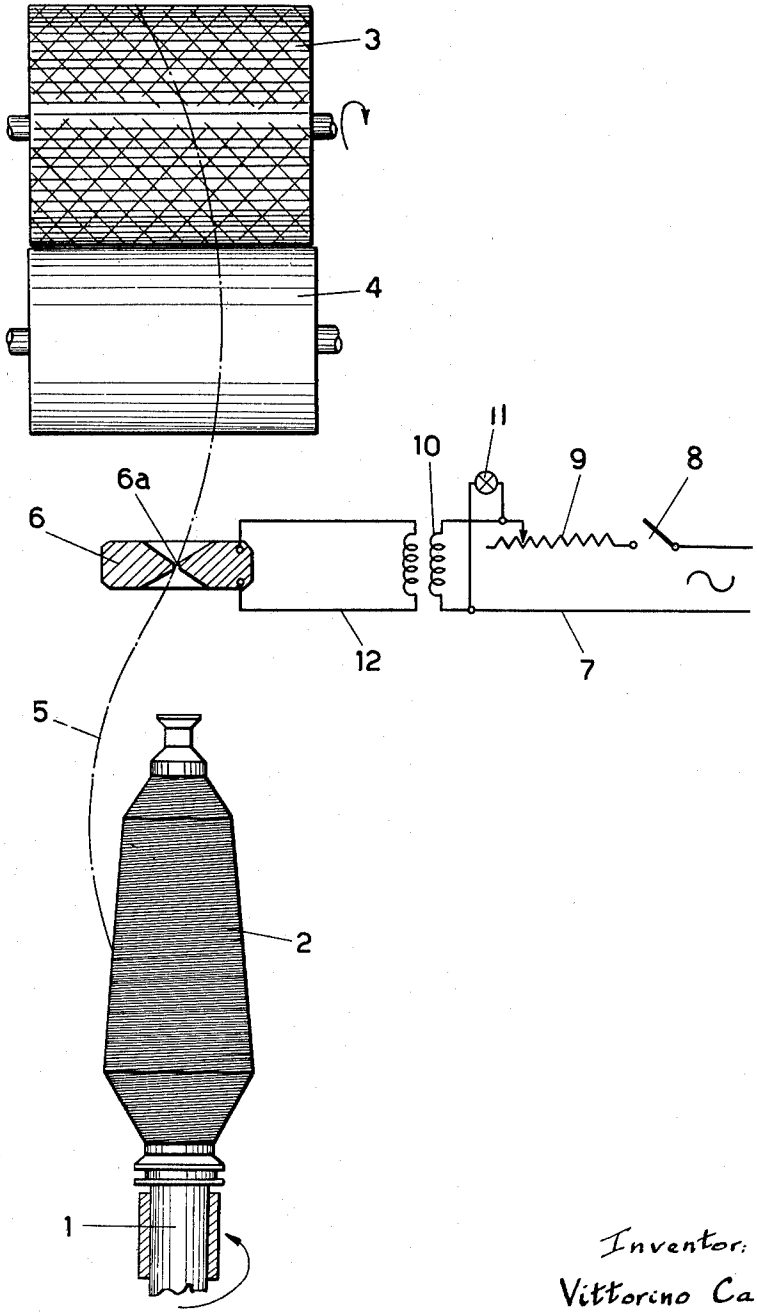

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DEVICE FOR THE TWISTING AND HEAT SETTING OF THREADS OR YARNS OF SYNTHETIC MATERIAL, CONSTITUTED PREFERABLY OF NUMEROUS ELEMENTARY FILAMENTS OR FIBERS

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The present invention relates to a process and to a device for twisting threads or yarns of synthetic material, constituted preferably of numerous elementary filaments or fibers, such as those formed of polyamides or of derivatives of polyacrylic acid, and also of other polymers such as poly-glycol terephthalates or of polyvinylic derivatives and the like.

It is known that with conventional twisting processes for threads of synthetic thermoplastic materials, only rarely a twisting effect is obtained that is of unitary magnitude and is imparted in uniform manner throughout the longitudinal extent of the thread.

The non-uniform distribution of the twisting effect is a result of the fact that threads of thermoplastic material, particularly those obtained by spinning, possess non-uniform resistance to torsional stress along their lengths.

Now it has been found that it is possible to impart to the thread of synthetic material a uniform twist throughout its entire length, if one heats said thread over a short portion thereof during the twisting operation while the thread is traveling from the feeding member to the receiving member thereby bringing said thread to a condition of higher plasticity in a short heating zone.

The results of the process of the present invention are particularly favorable, as experience has shown, if the thread is heated successively only along very short portions of its length, during its passage, to bring it instantaneously along only a short portion of its length to plastic condition, and then the successively heated portions of the thread are allowed to cool and harden again.

The new process for the twisting of threads or yarns of synthetic material, constituted preferably of numerous elementary filaments or fibers, such as those formed of polyamides or of derivatives of polyacrylic acid and the like, is characterized in that the threads or yarns, in the twisting operation, in the passage from the feeding member to the receiving member, are heated and brought to a more elevated temperature in a short zone so that the twisting of said yarn takes place exclusively in the short zone in which the yarn possesses higher plasticity.

Bringing the thread to the plastic state by means of heating in the short restricted zone can be effected with any source of heat, provided said source be adapted to limit the heating effect to a short length of the thread during its passage.

The length of the zone, in which the thread is actually heated, should be as short as possible, and it may amount, for instance, to a few millimeters only. The necessary rapid cooling generally takes place, in the case of a normal textile thread, with sufficient rapidity in the open air; however, in exceptional cases, it may be convenient to provide for cooling of the thread by additional means, in order that the state of greater plasticity of said thread be maintained only for the desired short portion.

Since the twisting of the thread occurs, where the torsional stress meets minimal resistance, the twisting effect is produced, locally speaking, so to say always in the same position and consequently a predetermined length of thread always receives the same twisting effect.

By this operative procedure the elementary filaments

and the fibers undergo the necessary effect of inflexion and torsion under the action of a small torque, thanks to the heating, and thereafter regain rapidly their original rigidity thanks to the cooling, and in this latter condition they cannot any longer be deformed by the torque.

As a consequence of the simultaneity of the transformation of the thread into the plastic condition and of the torsion, in the twisted threads there remain less residual internal torsional stresses as compared with threads twisted by other processes.

The temperature necessary to effect the heating of the thread in the required manner and to impart thereto sufficient plasticity, depends on various circumstances, such as the chemical character of the material of which said thread is constituted, namely the softening point of said material, the speed of passage of the thread through the heating element, and the effectiveness of heat transfer from said heating element to the thread, for example.

In accordance with the present process, the thread or yarn is heated over a short portion of its length during the passage from the feeding member to the receiving member, and it is brought to a state of greater plasticity, and in that state it is twisted, but the thread or yarn is not stretched.

As has been found experimentally, with the new process neither the elasticity nor the elongation, nor other particular characteristics of the material, of which the thread or yarn is constituted, are varied by any substantial amount.

The apparatus for carrying out the present process is characterized by a feeding device or unwinder, and by a receiving device or winder for the thread or yarn, and by a heating device, which is arranged along the path thereof between said feeding and receiving device, and which is adapted to heat the thread or yarn during its passage, over a short portion or zone.

In this arrangement the feeding or winding device may be the twisting device for a monofilament thread, or the twisting member for a thread or yarn consisting of many elementary filaments or fibers, and the receiving device may be only the collecting member. However, in front of the feeding device or unwinder there may be provided a receiving member, which, in that case, can effect the torsioning or twisting.

The heating element which acts upon the section of thread may have, in accordance with the present invention, the form of a thin plate or a thin disc, provided with a narrow aperture through which the thread can be guided to undergo the heating. The heating element may be brought to the necessary temperature in any manner whatsoever.

The heating effect may be obtained advantageously with electric means, as experience has taught, with the aid of resistors or by induction.

So the heating disc may carry externally a multiple winding (coil) through which an alternating current is passed in a manner known per se, thereby originating in the heating disc, made of metallic material, an induction current of elevated intensity and heating power, which can be conveniently adjusted in a manner known per se.

Also, the heating disc may be provided with an electric resistor which can be brought to the necessary temperature by means of an appropriate source of current, thereby heating the said disc in an indirect manner.

Another embodiment of the heating element may involve a thread-like electric resistor (wire) coiled in such a way as to form a narrow eyelet through which the thread to be heated can be passed, and which can be brought to the desired temperature by means of an appropriate adjustable source of current.

Moreover, the heating element can be heated with

other means instead of electric ones, for instance, by means of hot gaseous or liquid substances. To that end, it is possible, as has been found, to make the heating disc hollow and to circulate therethrough a hot liquid such as water, oil, etc.

Finally, it is equally possible, as also has been found, to utilize for the heating of the thread in the short operative zone infrared radiations.

The passage of the thread through the heating element, such as the heating disc, can be effected in such a way that the thread contacts the element transmitting heat, that is, in such a way as to provide immediate heat transfer from said disc to said thread.

Also, an arrangement may be provided in which the thread does not contact the heating disc during its passage therethrough, and the heat is transferred from said disc to said thread only indirectly by radiation or convection. In this latter case it is advisable to provide, respectively, before and after the passage aperture of said disc, a guide and centering member for the thread.

The short period of heating of the thread can be effected with the device described until any desired temperature admissible for the thread is attained. Experience has taught that the heating can be effected, in the case of the usual textile threads of synthetic material, such as polyamide threads, in accordance with the purpose for which it is destined, up to temperatures of between about 50° C. and 120° C.

Operation of the whole device is generally independent of the magnitude of the torsioning or twisting effect in itself, which may involve from less than 100 turns per metre up to more than 1,000 turns per metre. Instead, operation depends to a considerable extent on the speed of movement of the thread and on the details of structure of the heating element, and equally, on the width of the aperture or passageway through the heating element, that has for instance, the shape of a plate or disc.

In a complete twisting machine with many twisting stations, it is rational to provide every individual station with an individual heating element, through which the individual monofilament thread to be twisted, or the assembly of threads or yarn to be twisted, is made to pass.

Where heating is effected by electric means, a plurality of heating elements, or even the entire assembly, may be arranged in series and fed by one single circuit.

The FIGURE illustrates the twisting device of the present invention.

The feeding member or unwinder is in the form of a twisting spindle **1** with the thread **2** conically wound thereupon. The receiving member or winder comprises the bobbin **3** proper and the roller **4** which is driven positively, the winding-up bobbin **3** being driven by contact with the roller **4** so as to withdraw the thread uniformly.

Between the feeding member and the receiving member there is arranged the heating element, which has the shape of a disc **6**, with an aperture **6***a* for passage of the thread **5** from said feeding member through this aperture to the receiving member. The thread thus is heated only over a very short portion, equal to the length of the walls which define said hole **6***a*, at a time and is subsequently cooled in the open air.

Said heating disc is connected with a primary and secondary electric circuit **7**, **12**. The primary circuit **7**, which can be connected to the normal distributing line, not represented in the drawing, is provided with a switch **8**, with a variable resistor **9**, and with a control lamp **11**. The transformer **10** isolates the circuit **7** from the circuit **12** and offers, moreover, the possibility of adjusting and registering the alternating voltage in the circuit **12** at will, for instance by reducing it with respect to that of the circuit **7**, thereby making it non-dangerous to the personnel serving the twisting machine.

In the arrangement considered, the power of the distributing line can be transmitted to the heating disc either by the direct heating of resistors, or by the effect of induction (this system is not represented in the drawing).

I claim:

1. Apparatus for twisting a thread of thermoplastic material, comprising a rotary uptwister on which the thread is helically wound, a rotary take-up spool spaced from said uptwister and rotatable about an axis inclined to the axis of said uptwister, means for rotating said take-up spool to wind thread continuously from said uptwister onto said take-up spool while maintaining slack between said uptwister and said take-up spool, a single ring-shaped disc disposed between said uptwister and said take-up spool and having a single orifice therethrough through which the thread passes as it travels from said uptwister to said take-up spool, and means for heating said disc thereby to provide a short, localized heating zone at said orifice of only a few millimeters in length to heat at any one time only the short portion of the length of thread in said orifice and to progressively heat and twist successive short lengths of the thread only as the thread progresses through the heating zone.

2. Apparatus for twisting a thread of thermoplastic material, comprising a rotary uptwister, a rotary take-up spool spaced from said uptwister, means for rotating said spool about an axis inclined to the axis of said uptwister to wind thread continuously onto said spool from said uptwister while maintaining slack between said uptwister and said spool, a heating member positioned intermediate said uptwister and said spool along the path of travel of the thread, said heating member comprising a single solid annular disc which has an aperture therethrough and which is dished inwardly around said aperture from opposed sides thereby to provide a single aperture through said disc through which the thread travels, and means for heating said disc to heat the thread as it passes through said aperture along a short localized portion, a few millimeters in length only, at a time, sufficiently to decrease the resistance of the thread to torque adjacent the aperture only, thereby causing the twisting of the thread to occur at any one time only adjacent said aperture as the thread travels progressively through said aperture.

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