May 15, 1962 H. RICHTER 3,034,277

DEVICE FOR CRIMPING SYNTHETIC FILAMENTS

Filed Sept. 18, 1957

4 Sheets-Sheet 1

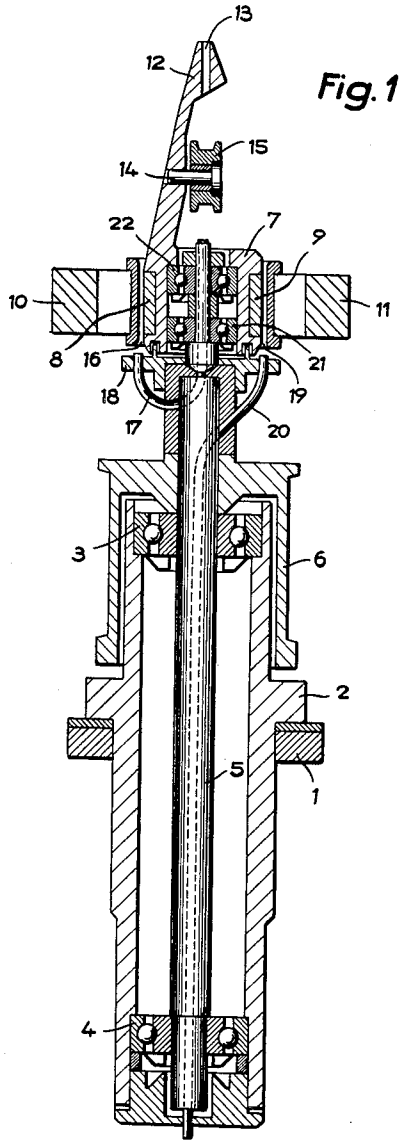


Fig. 1

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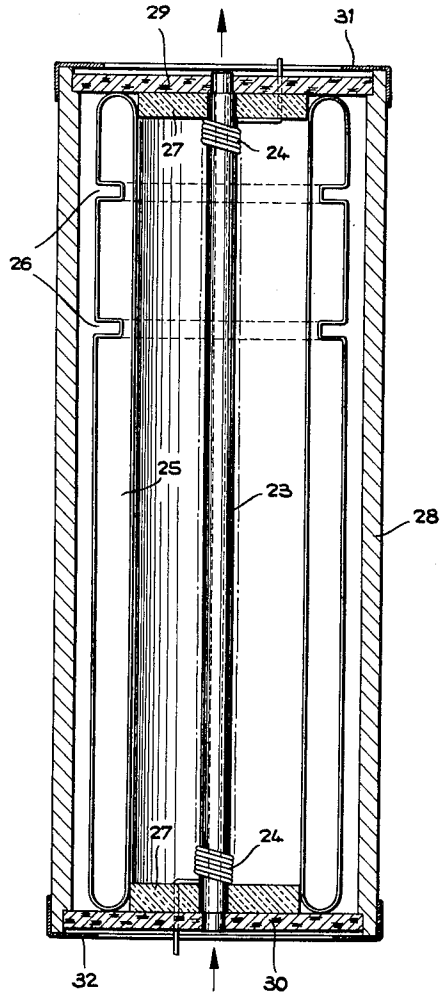
By Stevens, Davis, Miller & Mosher
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DEVICE FOR CRIMPING SYNTHETIC FILAMENTS

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Fig. 2



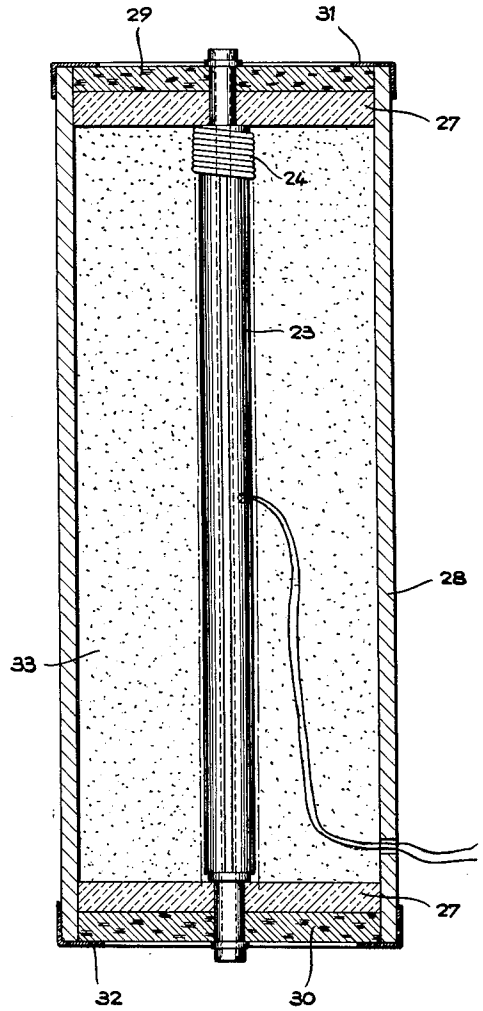
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DEVICE FOR CRIMPING SYNTHETIC FILAMENTS

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Fig. 3



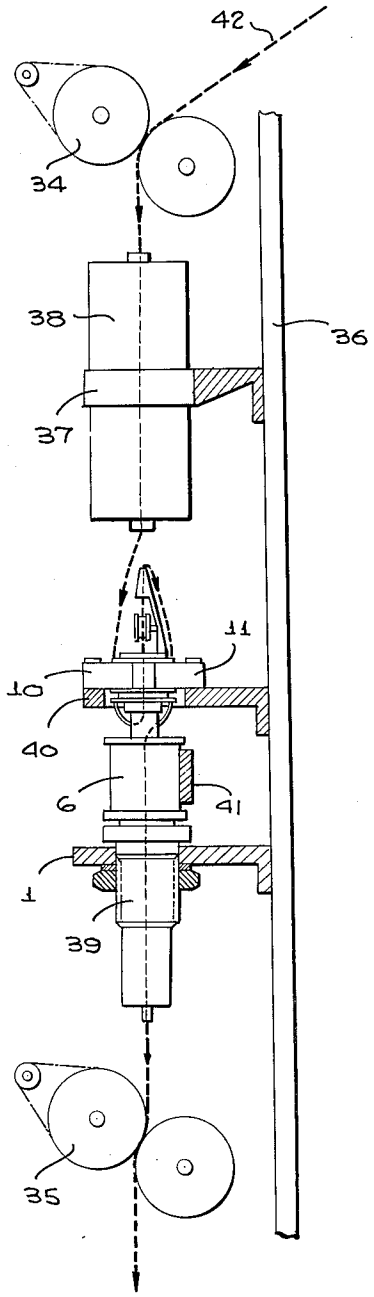
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DEVICE FOR CRIMPING SYNTHETIC FILAMENTS

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Fig. 4



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3,034,277
DEVICE FOR CRIMPING SYNTHETIC FILAMENTS

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6 Claims. (Cl. 57—77.45)

The present invention is a continuation-in-part of our our parent patent application Ser. No. 583,747, now Patent No. 2,959,906, relating to a method of crimping fully synthetic filaments or bunches or strands of fully synthetic filaments or of a yarn spun from synthetic staple fibre material which may or may not be mixed with natural fibres. The method of the parent patent provides for the filament or strand of filaments to be treated in a continuous operation by introducing the filament or yarn into a two-for-one twister which imparts a high degree of twist to the filament or yarn, by fixing the filament or yarn in the said two-for-one twister, and by finally withdrawing the filament or yarn from the two-for-one twister while at the same time removing the twist just imparted by an untwisting action. It is possible, with the aid of the method according to the parent patent, while using the same rotary speeds as are customarily applied in conventional methods, which latter make use of a so-called false twisting device, considerably to reduce the operating time per revolution of twist. Nevertheless, the method of the said parent patent permits twisting effects and satisfactory crimped filaments or yarns to be obtained which are equal in quality to crimped filaments or yarns as produced by conventional methods.

The present invention relates to an improvement and simplification of the method of the parent patent. More specifically, the present invention resides in a method of crimping fully synthetic filaments or strands of filaments or a yarn spun from synthetic staple fibres which may or may not be mixed with natural fibres. The method provides for the filament or filaments or yarn to be treated in a continuous operation by introducing the filament or yarn into a two-for-one twister which imparts a high degree of twist to the material, by fixing the material within the range of the double twist, and by finally withdrawing the filament or yarn from the two-for-one twister while at the same time removing the twist just imparted by an untwisting action. The method of the present invention is particularly characterised by the fact that the filament or thread is already heated while it is passed from the feed mechanism to the two-for-one twister. In the method according of the parent patent, a twist is imparted to the thread even before the thread enters into the two-for-one twister. The range of the double twist begins already at the point at which the thread leaves the feed mechanism. The fixing action which is provided by successively heating and cooling the thread has an effect on the thread which is the more satisfactory the higher the rate of cooling to which the thread is subjected. This advantage is made use of to a particularly high degree where the method of the invention is applied, since the heated thread is cooled at an early time, i.e. while it is passing the balloon through which it enters the twister. Since the heating of the thread or yarn is not carried out within the two-for-one twister, it is possible to use a more compactly constructed spindle and one that is of considerably simpler design. Furthermore, the spindle bearings are no longer affected by the heating unit, the result being that the method of the present invention permits the rotary speed of the spindle to be doubled in comparison to the method of the parent patent.

It is another object of the present invention to provide a device for carrying into practice the method of the

invention, the instant device being characterized by the fact that the base member and the head member of the device are disposed immediately upon one another. In a preferred embodiment of the invention the base member and the head member of the device may be in a single piece. Furthermore, in a preferred embodiment, gently curved small-diameter tubes are provided in the device, these tubes serving to guide the thread or yarn. These tubes afford an advantage in that they facilitate the threading-up operations and that they eliminate any sharp corners which might cause injury to the thread or yarn and which might hinder the propagation of the twist therealong.

As regards the quality of the crimping effect, the proper fixing of the highly twisted thread is a critical factor. This fixing action is carried out after the thread has been twisted by heating it to a predetermined temperature while still twisted, this heating being followed by cooling the thread, the cooling being carried out as rapidly as possible. The amount or rate of heat radiation from the heating elements used in fixing the twist in the thread has to be kept as low as possible in order to minimize the expenditure of energy and to affect the ambient room temperature in the least possible measure in view of the fact that for reasons of textile technology as well as with due consideration of the comfort of the operating personnel a predetermined room temperature must not be exceeded. Conventional devices for fixing the twist in the highly twisted thread include a helical heating element which is surrounded by a lagging made of glass wool, this lagging being in turn surrounded by a tube made of mica. This mica tube is again surrounded by another mica tube having a larger diameter so that an air space is provided between the two mica tubes. The larger mica tube is surrounded by a second layer of glass wool lagging the external surface of which is in contact with the inner wall of the casing of the fixing device. The construction of such a known fixing device, of which a crimping machine incorporates a large number (up to 640), involves the use of numerous layers of material, the use of a variety of expensive materials, and the use of bodies that are expensive to manufacture, the result being that such known fixing devices are uneconomical. Another drawback of these known fixing devices is to be seen in the fact that it is impossible to avoid differences in the rate of heat radiation, such differences in heat radiation, however, resulting in variations in the degree of fixing of the high twist which, in turn, may result in thread breakage. The resulting differences in temperature have to be compensated for by means of relatively large compensating resistors, the use of such resistors involving a great deal of work.

Therefore, it is still another object of the present invention to provide a device for fixing the twist in highly twisted fully synthetic filaments or strands of filaments or of yarns spun from synthetic staple fibers which may or may not be mixed with natural fibers. This device comprises a heater element having a hollow core for the thread or yarn to be passed through, and further comprises heat insulating means for the said heater element, the said device being characterized by the fact that the necessary heat insulation is provided by a hollow double-walled glass member the inside of which is evacuated and the inner surfaces of which are coated with a reflective silvering material. In a preferred embodiment of the device of the present invention, the outer wall of the said glass member or hollow body is provided with one or more formations resembling corrugations. The twist fixing device of the invention provides a heat insulating effect that meets all requirements. Whereas the power consumption of conventional devices of the type in question ranges from 50 to 60 watts, the power consumption of the instant device

is as low as 8 to 15 watts per unit. The corrugation-like formations in the outer wall of the glass vessel enable the differences in thermal expansion between the inner wall and the outer wall to be absorbed or compensated for, these differences in thermal expansion being due to the fact that the inner wall of the vessel assumes a temperature which is for all practical purposes identical with the temperature of the heating element, whereas the temperature of the outer wall is only by about 5° C. (9° F.) higher than the ambient temperature.

A satisfactory twist fixing effect may be obtained in an even more advantageous manner by providing the crimping device with a fixing unit in which, also according to the invention, the space existing between the heating element and a housing surrounding the heating element is filled with siliceous marl. The siliceous marl, while in the device, may be subjected to a vibrating operation. An advantageous composition of the filling material is 85.35% SiO_2, 3.29% Fe_2O_3, 1.16% Al_2O_3 and 1.3% CaO, a loss on ignition of approximately 9% having to be taken into account.

These and other objectives and advantages of the invention will be apparent during the course of the following specification, when read in connection with the accompanying drawings, in which:

FIG. 1 is a central vertical section of the crimping device;

FIG. 2 is a central longitudinal section of one embodiment of the twist fixing device of the invention; and

FIG. 3 is a longitudinal section of another embodiment.

FIG. 4 is a diagrammatic view illustrating the mutual arrangement of a double-twist spindle according to the present invention in relation to a feed mechanism, a twist fixing or setting device, and a take-off mechanism.

As will be seen in FIG. 1, a spindle rail 1 supports a bearing housing 2. Mounted in the upper and lower ends of the housing 2 are the antifriction bearings 3 and 4. The two antifriction bearings 3 and 4 support the rotatable hollow spindle shaft 5 which extends through and projects from either end of the bearing unit. The upper end of the hollow spindle shaft carries a whorl 6 and a base member 7 of compact design. The base member 7 includes an annular stationary part and an inner hollow core. The continuous hollow core is driven by the whorl and turns with the inner rings of the anti-friction bearings 21, 22. The outer rings of the anti-friction bearings are stationary. In order that the annular outer part of the base member 7 does not also rotate due to the unavoidable friction in the anti-friction bearings, a magnetic brake is provided which consists of the stationary magnets 10, 11 and, on the other side of the ring gap, of the soft-iron segments 8, 9 which are seated in the annular stationary part of the base member 7. The manner of operation of the magnets and of the soft-iron segments is that of a magnetic brake preventing undesired rotation of the outer annular part of the base member 7 while permitting the inner hollow core to be rotated by the whorl. Mounted immediately above the base member 7 is a head member 12 which may also be formed integrally with the base member. The upper tip of the head member 12 has a vertical bore 13 formed therein. At a distance below the bore 13 a grooved roller 15 is mounted for rotation on an axle 14 fastened to the head member. The point at which the threads or yarns is introduced is indicated at 16. For the purpose of changing the direction of travel of the thread or yarn in order to introduce the latter into the hollow spindle there is provided a smoothly curved tube of small diameter, this tube 17 being made of brass and fastened to a disc member 18 which is movable together with the whorl 6. The small tube 17 guides the thread or yarn along a continuous path through the base member 7, the thread emerging at the upper end of the base member and then being wrapped around the roller 15. From the roller, the thread continues through the tip of the head member 12 and back to the base member into

which it is introduced at 19. From that point, the thread continues through another smoothly curved small-diameter tube 20 which is also supported by the rotatable disc 18 and extends through the hollow spindle shaft. In view of the compact design of the base and head members 7 and 12, ball bearings 21 and 22 of small dimensions may be used.

The heating unit, which does not appear in FIG. 1, is arranged in the path of the thread or yarn at a point immediately behind the feed mechanism, the heating unit being held in position by suitable means, e.g. a link structure.

The feed mechanism 34, the take-off mechanism 35 and the bearing block 37 supporting the fixing device 38 are secured on the machine chassis 36. The double twist spindle is mounted in a bore of the spindle rail 1 fixedly secured to the chassis 36. The holder 40 of the magnets 10, 11 is likewise secured to the chassis 36. The drive of the double twist spindle 39 is provided by a tangential belt 41 which drives the whorl 6 of the double twist spindle 39.

By the feed mechanism 34 the crimping filament 42 is unwound from a supply spool, not shown. The filament 42 is passed through the fixing device 38 and is led to the double twist spindle 39. The filament 42 emerging from the double twist spindle passes through the take-off mechanism 35 and is led to a take-up roller, not shown.

The twist fixing or setting device shown in FIG. 2 comprises a heating unit consisting of a small-diameter steel tube 23 around which is wrapped a helical heating wire 24. The thread in which the twist is to be fixed is passed through the heating unit in the direction of the arrows in FIG. 2. It will be understood that the helical heating wire 24 will give off heat to the steel tube.

The heating unit is surrounded by a double-walled glass vessel 25 which is evacuated, the inner surfaces of the vessel being coated with silvering. This glass vessel serves as a heat insulating means.

The outer wall of the glass vessel 25 is provided with formations 26 resembling corrugations. These formations function to compensate for differences in the longitudinal thermal expansion of the inner and outer walls of the vessel. The heating unit is held in position in relation to the inner wall of the glass vessel by a pair of asbestos discs 27, one each of these discs being disposed on either end of the heating unit.

The assembly comprising the heating unit and the glass vessel are arranged within a housing 28 the constructional details of which may vary within wide limits, a cylindrical shape for the housing being very convenient. Placed on either end of the steel tube are cork discs 29, 30 which serve to hold the heating unit as well as the glass vessel in position in the housing 28. The housing 28, which is of cylindrical shape in the instant embodiment, is closed by bottom plate members 31, 32 each of which is conveniently provided with a circular aperture permitting unobstructed passage of the thread through the bore of the steel tube.

FIG. 3 illustrates a modified embodiment of a twist fixing device according to the invention, this embodiment, except for the fact that the glass vessel has been omitted, being of a construction which is substantially identical with the construction of FIG. 2. However, the asbestos discs 27 have the same diameter as the cork discs 29, 30, as due to the omission of the glass vessel it is no longer necessary to give the asbestos discs a diameter differing from that of the cork discs in order to hold the glass vessel in position. The space remaining between the heating unit and the surrounding housing is filled with siliceous marl powder.

After the siliceous marl filling has been introduced into the housing, the entire device is subjected to vibration in a suitable vibrator so as to compact the fine siliceous marl particles. The siliceous marl shell 33 thus produced provides for a degree of heat insulation that cannot be ob-

tained with any of the known twist fixing devices. Finally the housing is closed at both ends in the manner described in connection with FIG. 2.

It will be understood that modifications and variations may be effected without departing from the spirit and scope of the novel concepts of the present invention.

What is claimed is:

1. In a device for crimping yarns and other textile materials moving in a predetermined path, comprising a spindle rail, a bearing housing fixed to said spindle rail, a rotatable hollow spindle shaft coaxially mounted within said bearing housing and having an axial bore extending throughout its length and being supported by said housing, a whorl operatively connected to said spindle shaft, a base member having an outer stationary annular part and an inner hollow core, said core being fixed to said whorl and said annular part being provided on its cylindrical periphery with soft-iron segments, a number of stationary magnets radially spaced from said base member to coact with said soft-iron segments, a head member mounted immediately above said base member and integral with the outer annular part, said head member having an upper tip formed with a vertical bore therein, a grooved roller rotatably mounted on said head member below said vertical bore, means for introducing thread adjacent the periphery of said base member, a smoothly curved tube rotatable with said whorl for receiving the yarn therein and directing it along a continuous path through the core of said base member, the yarn emerging at the upper end of said base member and wrapped around said roller to continue through said vertical bore and back to the periphery of said base member, thereafter, the yarn continuing through a second curved small diameter tube rotatably mounted with said whorl and extending through said hollow spindle shaft.

2. A crimping device for yarn and other textile materials moving in a predetermined path, comprising a bearing housing, a spindle shaft rotatably mounted within said housing and having an axial bore extending throughout its length and being supported by said housing, a base member having a hollow core operatively coupled to said spindle shaft for rotation therewith, a whorl operatively coupled to said core of the base member and connected to said spindle shaft, whereby to connect the whorl to said core of the base member to impart rotational movement thereto, whereby said yarn while moving through said axial bore has a crimp imparted thereto upon rotation of said base member said core of the base member being provided with a head member having a vertical bore in axial alignment with the core of said base member, and a grooved roller mounted on said head member in the yarn path between said vertical bore and the core of said base member, to thereby define a yarn path for movement from a supply source into said spindle shaft.

3. A crimping device for yarns and other textile materials moving in a predetermined path, comprising a bearing housing, a rotatable hollow spindle shaft mounted within said housing for rotation therein, one end of said shaft carrying a whorl, a base member having a core mounted on said whorl for rotation therewith, whereby to connect the whorl to said core of the base member to impart rotational movement thereto, a head member secured to said base member and having a vertical bore provided therein in axial alignment with the core of the base member, means guiding the yarn for movement from the periphery of said base member through the core thereof and through said vertical bore, and means thereafter guiding the movement of said yarn along the periphery of said base member into said hollow spindle shaft, to thereby define a pasageway for movement of said yarn from a supply source through the crimping device.

4. A device for crimping yarns and other textile materials supplied from a source, and moving in a predetermined path, comprising a bearing housing, a rotatable spindle supported by said bearing housing and having a longitudinal extending bore, twisting means operatively coupled to said rotatable spindle for rotation therewith, a driving whorl operatively coupled to said twisting means and connected to said rotatable spindle, whereby to impart rotational movement to the twisting means, a disc member supported by said whorl and rotatable with said spindle, a head member fixed to said twisting means and having a vertical bore lying contiguous said predetermined path of movement of said yarn, said twisting means being provided with a rotatable core, and means connecting said core to said longitudinal bore of said spindle to define a passageway for movement of said yarn from said source to said spindle.

5. A device according to claim 4, said head member being provided with a recess communicating with said vertical bore, and rotatable roller means disposed in said recess and lying in the path of movement of said yarn.

6. A crimping device for yarns and other textile materials supplied from a source and moving in a predetermined path, comprising a spindle rail, a bearing housing supported on said spindle rail, a rotatable hollow spindle shaft mounted within said housing for rotation therein and projecting from the upper end thereof, the upper end of said hollow spindle shaft supporting a whorl, a base member having a rotatable core mounted on said whorl, said whorl driving the core of said base member, a head member mounted immediately above said base member and integral therewith, said head member having an upper tip provided with a vertical bore, said head member being provided with a recess below said vertical bore, a grooved roller mounted in said recess for rotation, means adjacent the peripheral surface of said base member for introducing the yarn, a curved tube mounted on said whorl for rotation therewith and communicating with the point of yarn introduction to change the direction of travel of the yarn to guide it toward the hollow spindle shaft, yarn guide means through the core of said base member communicating with said curved tube to provide a pasageway for the yarn to said grooved roller and through said vertical bore and back to said base member adjacent the peripheral surface thereof, and a second curved tube operatively connected to said whorl for rotation therewith and extending from a point adjacent the peripheral surface of said base member through the extent of said hollow spindle shaft.

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