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APPARATUS FOR PRODUCING CRIMPED THERMOPLASTIC SYNTHETIC YARNS

Filed March 15, 1960

FIG. 1.

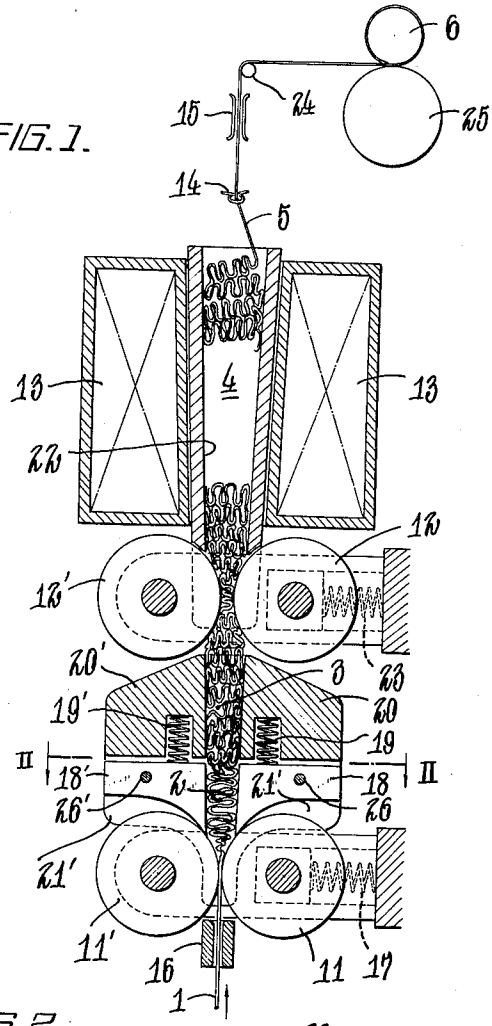
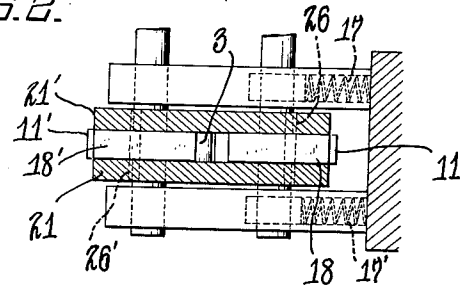


FIG. 2.



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APPARATUS FOR PRODUCING CRIMPED THERMOPLASTIC SYNTHETIC YARNS

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1 Claim. (Cl. 28—1)

The present invention relates to apparatus for producing crimped thermoplastic synthetic yarns. More particularly the invention relates to apparatus which comprises a pair of feeding rollers positively driven, means defining a crimping chamber adjacent the delivery side of said feeding rollers, a pair of rollers of heat insulating material adjacent the outlet of the crimping chamber and rotated at a surface speed much slower than that of the feeding rollers, a crimp fixing chamber of a capacity much greater than that of the crimping chamber and located in succession to the rollers of heat insulating material and a heating device surrounding the fixing chamber.

It is known to give crimps to thermoplastic synthetic yarns by introducing yarns into a practically enclosed zone by means of a pair of feeding rollers to force said yarns to be folded and bent to form crimps and then introducing a fixing agent such as hot water into said zone to fix the crimps while said yarns are maintained in crimped condition under the influence of the pressure maintained in said zone.

In the above apparatus, however, crimping and fixing are performed in the same zone and the construction of said zone becomes complicated. Furthermore, the requisites for forming crimps and for fixing crimps are not the same and to satisfy all the required conditions for both operations is not easy to achieve. As the result, the product obtained is not quite satisfactory despite the use of complicated and costly apparatus.

It is an object of the invention to provide apparatus which is simple and economical and which can produce excellent synthetic yarns which have uniform and fine crimps.

It is a further object of the invention to provide separate zones for crimping the yarn and for fixing the crimped yarn.

The features and the advantages of the present invention will be made clear from the following detailed explanation in conjunction with the accompanying drawings in which:

FIG. 1 is a schematic front sectional view of an embodiment according to the invention; and

FIG. 2 is a sectional plan view taken along the line II—II of the apparatus of FIG. 1.

In FIG. 1, a thermoplastic synthetic yarn **1** is passed through a pair of feeding rollers **11** and **11'** and is introduced into a crimping chamber **3** of a relatively small capacity located closely above said pair of rollers **11, 11'**. A pair of rollers **12, 12'** of heat insulating material are located close to the outlet of crimping chamber **3**. The rollers **12, 12'** are rotated at a speed much slower than that of rollers **11, 11'** and hence the yarn introduced in the chamber **3** is accumulated therein and bent and folded to form a mass of folded yarn.

Above the rollers **12, 12'**, is a fixing chamber **4** of a capacity greater than that of the crimping chamber **3**. The fixing chamber **4** is surrounded by a heating device **13**.

When the crimping chamber **3** is filled, the yarn is forced to pass between the rollers **12, 12'** because of the increased pressure in the crimping chamber caused by the further introduction of yarn by the feeding rollers

11, 11', and the crimps of said yarn are permanently fixed therein under the influence of heat supplied by a heater **13** surrounding the setting chamber **4**.

The feeding rollers **11, 11'** are positively driven by a motor through a gear system (not shown) and one of the rollers **11** is pressed against the roller **11'** by means of a spring **17** which is adjustable to give sufficient pressure so that the yarn **1** is effectively gripped by the rollers and advanced into the crimping chamber **3**. It is preferable to provide a guide **16** at the entrance of the rollers **11, 11'** to faciliate the introduction of the yarn between the rollers.

The crimping chamber **3** is defined by lower side block members **18, 18'**, upper side block members **20, 20'**, a front side wall **21** and a back side wall **21'**. The lower side block members **18, 18'** have a bottom surface which is of a greater curvature than that of the feeding rollers. The block members **18, 18'** are rotatable about fixed pins **26, 26'** and are urged downwardly by springs **19, 19'** fixed in the upper side block members **20, 20'**. The block members are arranged so that their inside front ends are in contact with the feeding rollers **11, 11'** under the action of spring **19, 19'**. The space between the inside surfaces of the lower side block members **18, 18'** and that between the upper side block members **20, 20'** are continuous and constitute a crimping chamber **3** in cooperation with the front and the back wall plates **21, 21'** which are located outside the rollers **11, 11'** as shown in FIG. 2. It is preferable to taper the side block members **18, 18', 20, 20'** to diverge slightly upwardly and it is important to make the capacity of the crimping chamber small so that the yarn introduced into said chamber is crammed whereby crimps are formed due to bending and folding the yarn. For this purpose, it is also preferable to make the cross section of said chamber rectangular and of small area, the length of the rectangle in the direction of the axis of the feeding rollers being a little shorter than the length in the direction perpendicular to said axis.

Guide rollers **12, 12'** of heat insulating material are provided closely to the end outlet opening of the crimping chamber **3**. These rollers are rotated through a gear system (not shown) at a speed slower than that of the feeding rollers **11, 11'** and one of the rollers **12** is pressed against the other roller **12'** by a spring **23** which is much weaker than the spring **17** of the feeding roller **11** to allow roller **12** to be displaced away from the roller **12'** to widen the passage between the rollers when the pressure of the mass of folded yarn in the crimping chamber increases.

The ratio of the surface speed of the rollers **12, 12'** to that of the rollers **11, 11'** may be varied in a wide range according to the nature of the yarn being treated, the capacity of the crimping chamber **3**, and the degree of crimping desired. It has been found that satisfactory results can be obtained generally when the ratio is from 1:500 to 1:1000.

The pressure of the spring **23** can also be varied depending on the crimps, the speeds of the feeding rollers **11, 11'** and the delivery rollers **12, 12'** and the nature of the yarn under treatment. However, the pressure of the spring **23** should be weak enough to widen the clearance between the two rollers **12, 12'** when the pressure of the mass of the yarn in the crimping chamber **3** increases so that the pressure in the crimping chamber **3** may be maintained substantially constant despite the constant surface speed of the rollers **12, 12'**.

A fixing chamber **4** formed by a member **22** which is a hollow column of a rectangular cross section is arranged adjacent the discharge side of the guide rollers **12, 12'**. Fixing chamber **4** has a capacity much greater than that of the crimping chamber **3**, and may be di-

vergent in the direction of advancement of the yarn, the side wall being diverged out. The fixing chamber is surrounded by a heater **13** and the yarn in crimped condition is advanced from the crimping chamber and the crimps are permanently fixed in the fixing chamber under the influence of the heat generated by heater **13**. The temperature of heating and the time required for setting are varied in accordance with the characteristics of the thermoplastic material of which the yarn is made and it will be unnecessary to dwell upon them since they are well known in the art. However, the longer the time required for heat setting, the larger the fixing chamber must be, but in most cases the ratio of the fixing chamber to the crimping chamber will be from 20:1 to 30:1 and the temperature will be in the range of 150° C.–250° C. Although the temperature in the fixing chamber **4** is higher than 150° C. yet the temperature in the crimping chamber **3** is maintained lower than 40° C. since these two chambers are separated from each other by the heat insulating rollers **12, 12'**.

The yarn **5** having fixed crimps is led from the fixing chamber through a guide **14** and a device **15** adapted to bring the yarn in the form of a mass of folded yarn into unfolded yarn. Then the yarn is led through a guide roller **24** to bobbin **6** rotated by a driving drum **25** to be wound on said bobbin **6**. The surface speed of the bobbin **6** is such that the yarn supplied by the feeding rollers **11, 11'** will be wound on the bobbin at the same rate. However, since the yarn **5** to be wound on the bobbin **6** is crimped and consequently is shorter than the length of the uncrimped yarn **1**, the surface speed of the bobbin **6** is made slower than that of the feeding rollers **11, 11'** and is generally within the range of 65%–80% of the latter depending on the degree of crimping.

It is important to maintain the pressure of the mass of folded yarn in the crimping chamber substantially constant in order to obtain uniform crimps in the yarn and said pressure is caused by the difference of the force introducing the yarn into the crimping chamber **3** by the frictional force of the feeding rollers **11, 11'** applied on the yarn **1** and the force preventing the discharge of the mass of folded yarn **2** from the outlet of said chamber caused by the rollers **12, 12'**, and this pressure is one of the important factors in determining the fineness of crimps of the yarn.

According to the present invention, the rollers **12, 12'** are rotated at a constant speed, but the clearance between the two rollers can be automatically adjusted depending on the pressure of the mass of the yarn in the crimping chamber **3**. Accordingly the discharge of the yarn from the crimping chamber **3** is automatically increased when the pressure in the crimping chamber **3** is high and is decreased when said pressure is low, and thus the pressure of the mass of the yarn is maintained substantially constant.

In the following, an example of the application of the present invention will be described.

A yarn of multifilaments (30 filaments) of nylon (110 denier) is drawn from a package through the guide **16** to the feeding rollers **11, 11'**. The rollers **11, 11'** are rotated to provide a surface speed of 200 m./minute and the roller **11** is pressed by the spring **17** against the associated roller **11'**.

The rollers **12, 12'** are rotated to provide a surface speed of 0.27 m./minute. Accordingly, the yarn introduced into the crimping chamber is bent and folded and accumulated therein to fill the chamber with a mass of folded yarn **2**.

The yarn **1** continues to be introduced and the pressure of the mass of folded yarn **2** in the crimping chamber **3** becomes increased until it is sufficient to push the roller **12** against the spring **23**. The mass of folded yarn is then allowed to proceed into the fixing chamber **4** which has a capacity about 25 times as great as that of the crimping chamber **3**. The mass of folded yarn is retained in the fixing chamber **4** for about 4.5 minutes and is heated at 170°–180° C. to have the crimps permanently fixed.

The yarn **5** in the crimped condition is withdrawn through a guide **14**, a longitudinal passage **15** and a guide roller **24** by a bobbin **6** which is rotated at the surface speed of about 140 m./minute by means of the driving drum **25**.

The yarn obtained has fine crimps which are distributed uniformly.

The above example is described merely for illustrating one example of the application of the apparatus of the present invention and does not limit the scope of the present invention. The speeds of rotation of the rollers, the temperature in the fixing chamber, the sizes of the crimping chamber and the fixing chamber, the pressures of the springs and other details may of course be varied according to the yarn to be processed and the nature of the desired crimps of the final product.

Accordingly it should be understood that the present invention is not limited by specific values described in the above which are illustrative but not limitative to the present invention.

It is further to be understood that the word "yarn" used in the present specification and appended claim covers monofilament, yarns of multi-filaments, spun yarns, twisted yarns and any other kinds of filaments, yarns and threads.

What is claimed is:

Apparatus for crimping yarn comprising a pair of feed rollers for advancing said yarn, a spring operatively associated with said feed rollers for urging the same together, means defining a crimping chamber adjacent said rollers and including a pair of spaced opposed block members each being adjacent one of the feed rollers and adapted to contact the same, a side wall member on either side of the block members and adjacent the same, each block member being pivotally connected to the side wall members, a further pair of spaced block members coextensive with the first said block members and positioned between said side wall members, and elastic means between both said pairs of block members to urge the first said block members against the feed rollers, the apparatus further comprising a pair of heat insulating rollers adjacent said crimping chamber for further advancing said yarn therefrom, means for driving said pairs of rollers at different peripheral speeds, the heat insulating rollers having a slower peripheral speed than the feed rollers whereby said yarn is accumulated and crimped in the crimping chamber, a spring weaker than the first said spring urging said heat insulating rollers together, means defining a crimp fixing chamber having an end adjacent said heat insulating rollers and including sides divergently extending therefrom for accumulating the further advanced yarn, and a source of heat in heat exchangeable relationship with the latter said means.

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