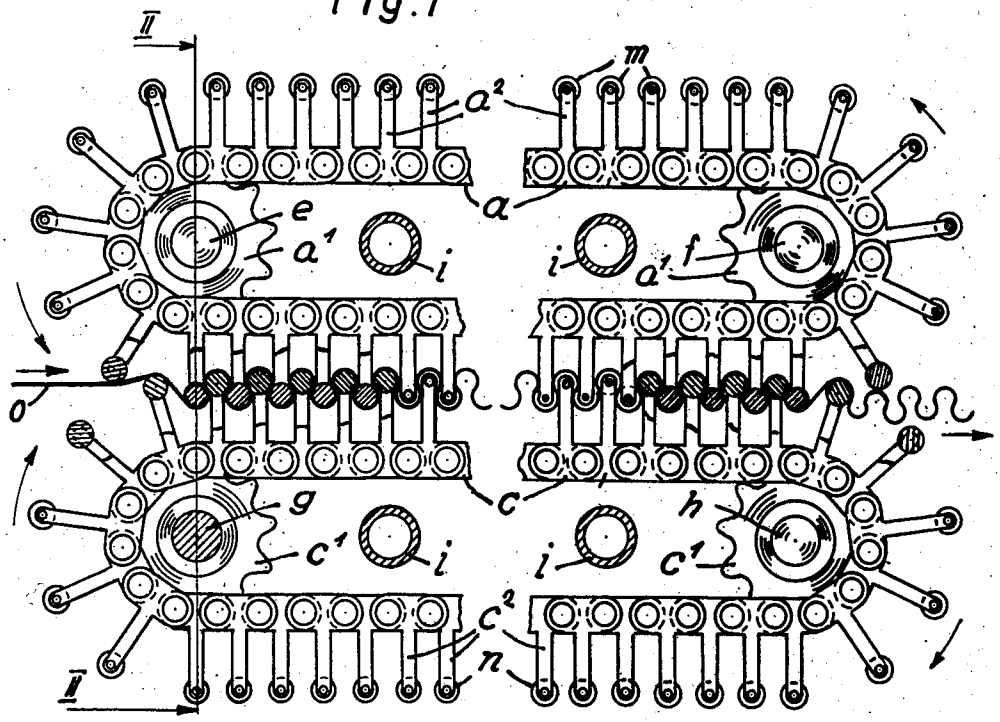
April 28, 1953 H. M. HEMMI 2,636,250

PROCESS FOR THE PRODUCTION OF CRIMPED FIBERS, FILAMENTS, AND THREADS

Filed Nov. 23, 1946 2 SHEETS—SHEET 1

Fig. 1



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Fig. 2

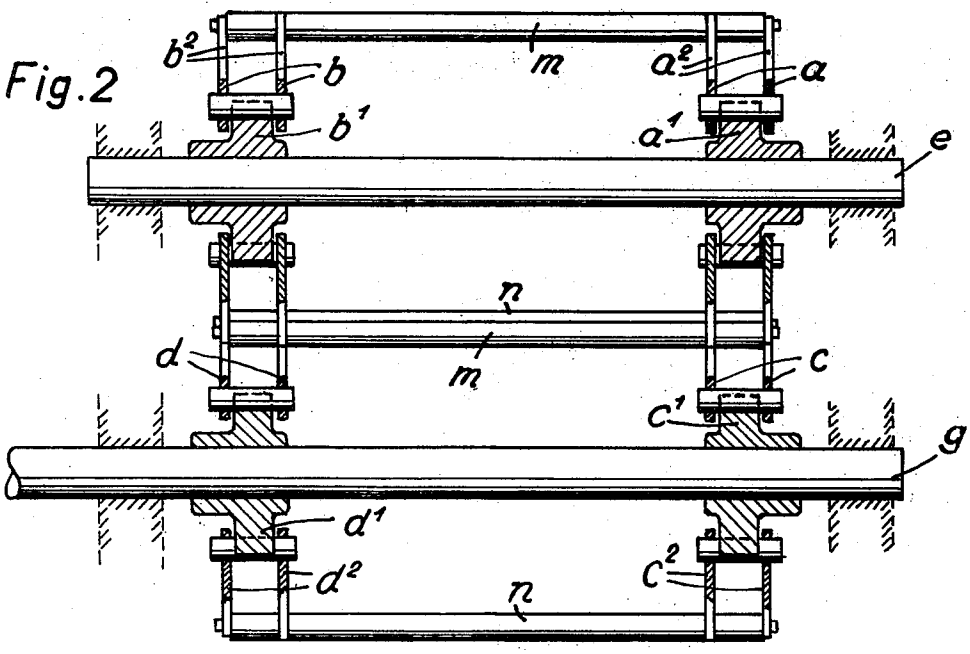
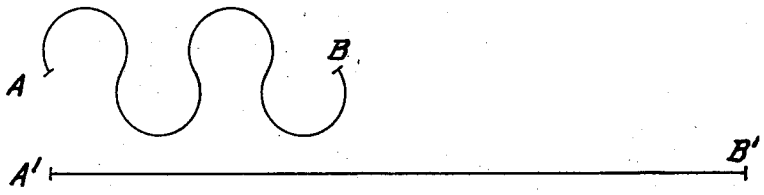


Fig. 3



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PROCESS FOR THE PRODUCTION OF CRIMPED FIBERS, FILAMENTS, AND THREADS

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5 Claims. (Cl. 28—74)

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This application is a continuation-in-part application of my patent application Ser. No. 514,178 of December 13, 1943 (now abandoned).

The present invention relates to a process for the manufacture of crimped fibres, of all kinds and of any suitable material as stated below having a high crimping degree and which may be destined for further use in view of producing an association of fibres.

With the expression "fibres" reference is also made to filaments, threads and association of "fibres." The materials, of which such fibres are made, may be natural ones, for instance hair or synthetic fibres such as for instance cellulose or regenerated cellulose, proteinic fibres, such as lanital, a synthetic high polymeric substance, a thermoplastic material, glass, silicon, metals, natural or artificial silk, cotton, etc., these fibres assuming a crimped set by virtue of the presence of a heat-settable ingredient either in the fibre per se, or associated with the fibre during processing to permit the crimping operation to be conducted by the process of the present invention.

The fibres hitherto known which were crimped in a mechanical manner and which are used as such for the production of an association of fibres always possess sinusoid or spiraloid crimpings. However, it has been found that fibres having a meander-like crimping have a much more wool-like character than fibres with sinusoid or spiraloid crimpings.

The expression "crimping" has a well known technical signification and is determined by the crimping number and crimping degree. The crimping number indicates the number of crimpings present in a length of 1 cm. and is determined on a fibre in unstretched condition by counting the crimping arcs. The crimping degree indicates the relation between the length of a fibre in stretched form and the length of a fibre in unstretched form.

With the expression "meander-like" reference is made to a periodically curved line consisting substantially of circular or nearly circular line portions corresponding to more than half a circle but less than a complete circle and which are put together in such a manner that there will be turning points between two consecutive circle portions which can lie in the same or in different planes.

The primary object of the present invention is to impart to the fibres or the like to be treated a meander-like crimping by means of an apparatus which is fit for this purpose, whereby crimped

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fibres or the like can be stabilized in their form during or after the crimping operation for instance by means of hardening agents, such as formaldehyde, or by agents to be hardened, for instance watersoluble synthetic resin precondensation products, such as phenoplasts, aminoplasts or alkylol carbamindes, like mono- or dimethylol urea, according to the material of which the fibres are made.

Another object of the invention is to realize a process for imparting to the fibres or the like a meander-like crimping.

Another object of the invention is to realize a crimping apparatus with which it is possible to impart to the fibres or the like a meander-like crimping.

Still another object is to realize fibres or the like having a meander-like crimping and being stable to boiling in alkaline soap solutions.

Other objects and advantages of this invention will become apparent from the following description taken in connection with the accompanying drawings, in which:

Figure 1 is a longitudinal section of a crimping apparatus of which the middle part is broken out;

Figure 2 is a sectional view taken on the line II—II in Figure 1, and

Figure 3 shows, on an enlarged scale, a meander-like fibre produced on the apparatus shown in Figures 1 and 2.

The crimping apparatus according to Figures 1 and 2 has two superposed pairs of link chains a, b and c, d, the sprocket wheels a^1, b^1 and c^1, d^1 of which are fixed on four correspondingly arranged shafts e, f, g and h, one of which is extended to one side and forms at the same time the driving shaft of the apparatus. The chain locks of all the link chains are provided with exteriorly projecting supporting arms a^2, b^2, c^2, d^2, respectively, which for corresponding chain locks axially aligned of the chains a, b or c, d are interconnected by means of cross bars m or n of circular cross section. Thus, as can be taken from Figures 1 and 2, the apparatus shown therein, comprises two superposed caterpillar-like chain assemblies the cross bars m and n of which engage each other from opposite sides when the apparatus is running. In this manner two opposed movable inter-engaged rows or sets of adjacent cylindrical crimping members or crimping bars are formed, the outer peripheral portions of which determine a meander-like forming path on which the fibres to be crimped are forced to pass when supplied to the apparatus. The diameter of the cross bars can vary according to the desired crimping num-

ber and can for instance be 1.7 mm. It is also possible to vary the depth of the reciprocal engagement of the cross bars by arranging the upper or the lower shafts of the apparatus so that they can be adjusted in vertical direction. The fibres or the like which are to be crimped are supplied to the apparatus from one frontal side of the latter as shown in Figure 1 and are forced to pass through the whole assembly as soon as they are gripped by the first cooperating cross bars *m* and *n*. On their way through the apparatus the fibres will be submitted to the opposite action of the cross bars *m* and *n* which will impart to them a meander-like crimping form as is shown in Figure 1.

It will be evident from the foregoing that the distance between the axes of two adjacent cylinders or bars *m* or *n* of the same set in the crimping zone is less than twice the diameter of such cylinders, whereby the effective crimping surface of the interengaged cylinders is in cross-section more than a half circle but less than a complete circle so that a corresponding cross-sectional configuration is imparted to an elongated member interposed between the interengaged cylinders in said crimping zone.

The fibres can be natural or synthetic fibres. If it is desired to stabilize the produced crimping, the fibres may be impregnated for instance before passing through the apparatus with a hardening agent or an agent capable to be hardened, the material being hardened either during the passage of the fibres through the apparatus by a heat treatment effected by means of perforated heating tubes *i* (Figure 1) or after having passed the apparatus. If the fibres are made of thermoplastic material, the part of the apparatus through which the fibres enter is heated to the necessary temperature, while the exit part thereof may be cooled, if necessary. The length of the apparatus is so chosen that the fibres are heated during a sufficiently long period and then cooled. For impregnated fibres, which are to be heat-treated during the crimping operation, the apparatus must be so dimensioned that the fibres will leave the apparatus in a hardened condition.

Fibres with meander-like crimpings have in comparison with fibres having a sinusoid or spiraloid crimping the great advantage of having a much more wool-like character and to lose this property to a much smaller extent when washed.

The above used expression "wool-like" should not limit the invention to meander-like crimped fibres which are used for textile purposes. Such fibres can be used in all fields where such an effect is desired.

By the expression "association of fibres" is meant fabrics formed for instance by weaving or knitting. The meander-like crimping of the fibres prepared according to the present invention is characterised by the fact that it possesses turning points or changes in the direction of the fibres set by crimping and further by the relation existing between the distance of the ends of the fibres in crimped and in stretched form. When measured in unstretched condition, the said distance between the ends of the crimped fibres and/or filaments must be less than ⅔ of the distance of the fibres ends measured in stretched condition.

In order to fix the meander-like crimping of the fibres the same may be treated in a well-known manner as such or in form of associated fibres with hardening agents, like formaldehyde,

or with agents to be hardened, for instance water-soluble synthetic resin precondensation products, such as phenoplasts, aminoplasts or alkylol carbamides, like mono- or dimethylol urea, preferably in presence of catalysts. The material thus treated is then subjected to a heating operation, e. g. to 100°–150° C., whereby the hardening takes place. After such a treatment the meander-like crimping of the fibres is fixed and becomes stable to boiling.

Figure 3 shows a meander-like crimped fibre produced according to the present invention and obtained by redissolving the treated knitted goods. The distance A to A′ is less than ⅔ of the distance B to B′. The distance B to B′ will be obtained, if the curled fibre is measured under stretching.

What I claim is:

1. A process for the manufacture of a crimped elongated element containing a heat-settable ingredient which comprises subjecting an uncrimped elongated fibrous element, which is to be crimped, to the action of two sets of crimping members consisting of interengaged cylinders disposed so that the distance between the axes of two adjacent cylinders of the same set is less than twice the diameter of the said cylinders, the diameter of all the cylinders being the same, whereby an effective crimping surface is formed which in cross-section is, for each cylinder, more than half a circle but less than a complete circle so that a corresponding cross-sectional configuration is imparted to the elongated element in contact with such crimping surface and heating the fibrous element.

2. A process according to claim 1, wherein the elongated element is alternately in contact with opposite crimping surfaces of successive cylinders so that the crimping of the element is meander-like in cross-section and consists of arcuate portions extending over more than half a circle but less than a complete circle, which arcuate portions are interconnected by connecting points which are also turning points.

3. A process according to claim 2, comprising the further step of treating the said element with a water-soluble synthetic resin precondensation product.

4. A process according to claim 1, wherein the elongated element is alternately in contact with opposite crimping surfaces of successive cylinders so that the crimping of the element is meander-like in cross-section and consists of arcuate portions extending over more than half a circle but less than a complete circle, which arcuate portions are interconnected by connecting points which are also turning points, and comprising the further step of coating the said element with a water-soluble synthetic resin precondensation product.

5. A process according to claim 1, wherein the elongated element is alternately in contact with opposite crimping surfaces of successive cylinders so that the crimping of the element is meander-like in cross-section and consists of arcuate portions extending over more than half a circle but less than a complete circle, which arcuate portions are interconnected by connecting points which are also turning points, and comprising the further steps heating the element being crimped and of fixing the same in crimped state by subjecting it to the action of a water-soluble urea-formaldehyde condensation product.

HANS MARTIN HEMMI.

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