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[11] **3,917,140**

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[54] **PROCESS FOR TRANSFORMING CONTINUOUS SYNTHETIC FIBRE STRIP INTO CUT STRIP AND APPARATUS FOR CARRYING OUT THE PROCESS**

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[52] **U.S. Cl.** **225/100;** 225/96

[51] **Int. Cl.²** **B26F 3/00**

[58] **Field of Search** 225/2, 4, 100, 96, 94

[56] **References Cited**

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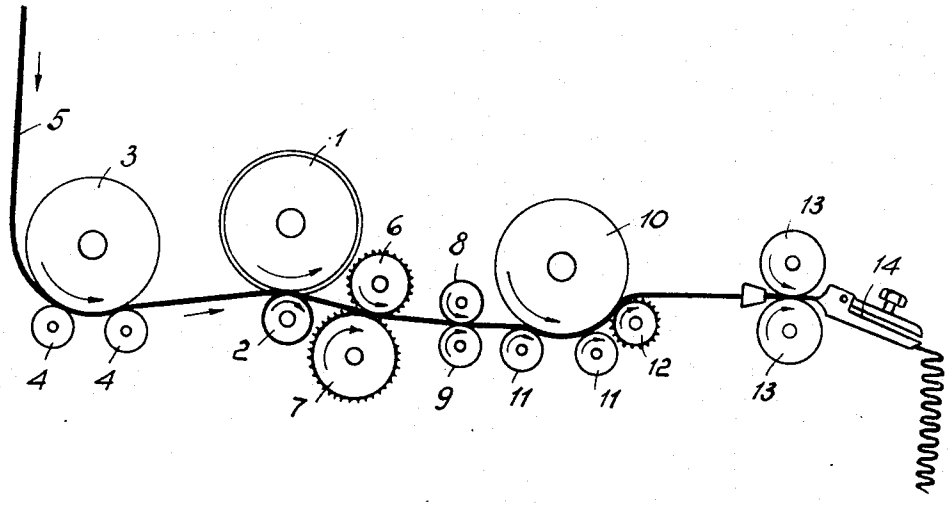
[57] **ABSTRACT**

A process for transforming continuous synthetic fibre strip into cut strip suitable for feeding spinning machines of the wool or cotton type, consisting of subjecting the fibre strip to a first stage of continuous transverse incision and then to a second stage of longitudinal tearing.

The apparatus carrying out this process comprises a helical knife followed by a plurality of rollers.

6 Claims, 6 Drawing Figures



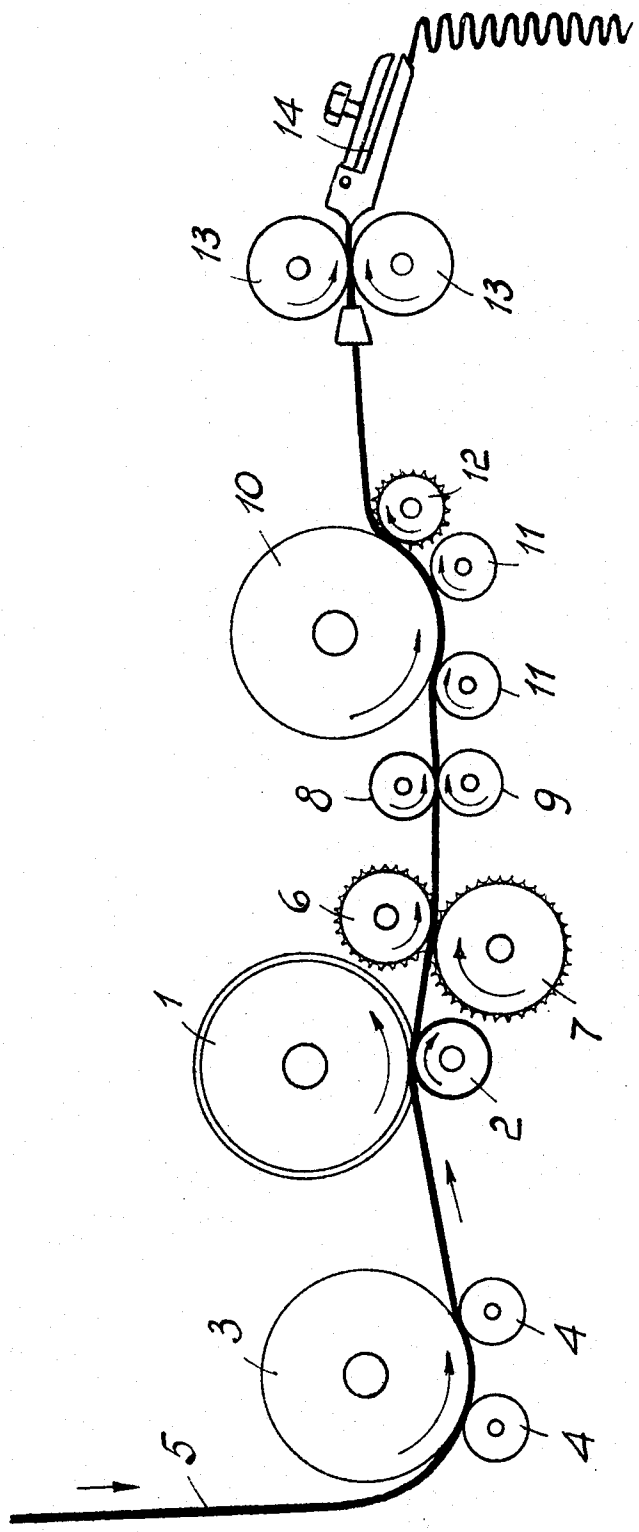


Fig. 1

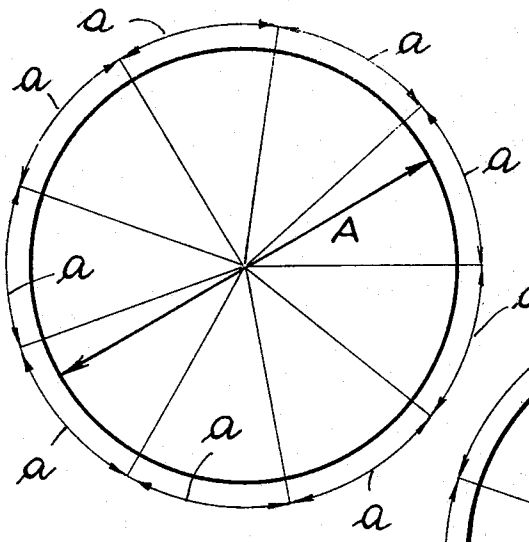


Fig. 3a

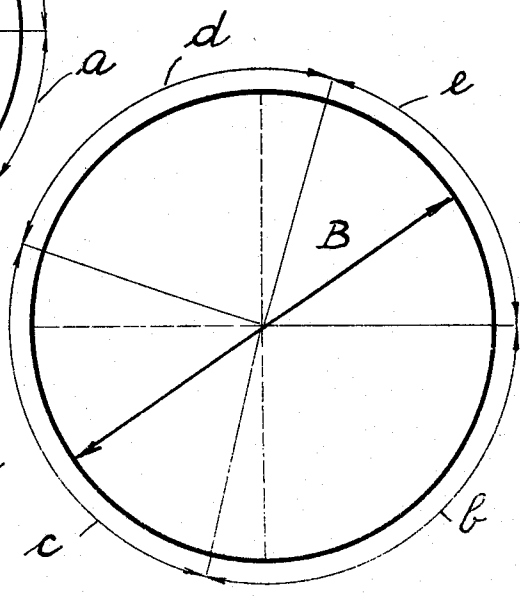
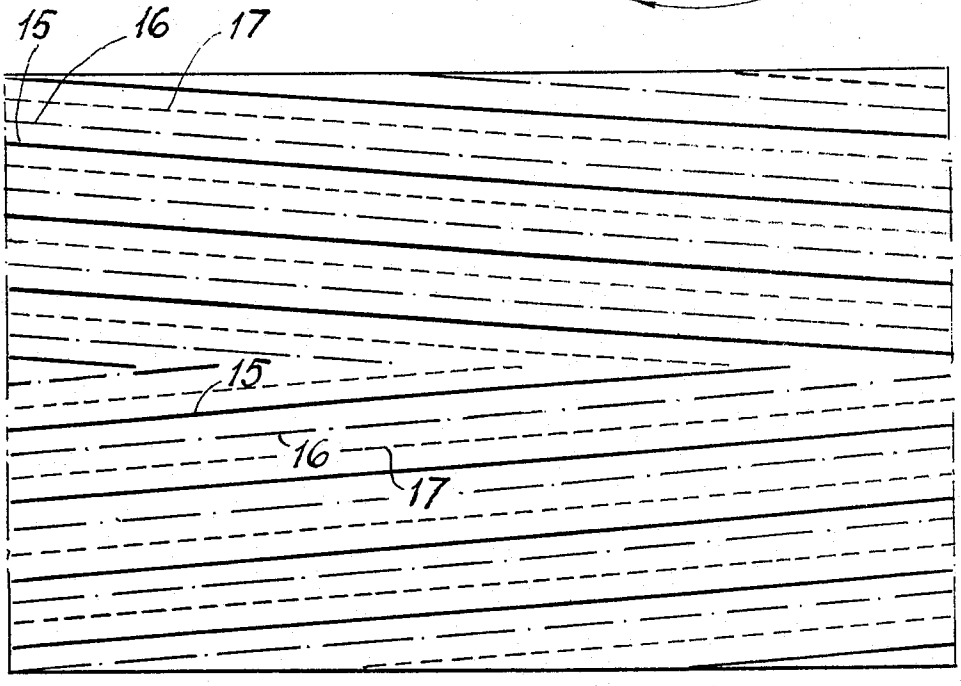


Fig. 4a

Fig. 2



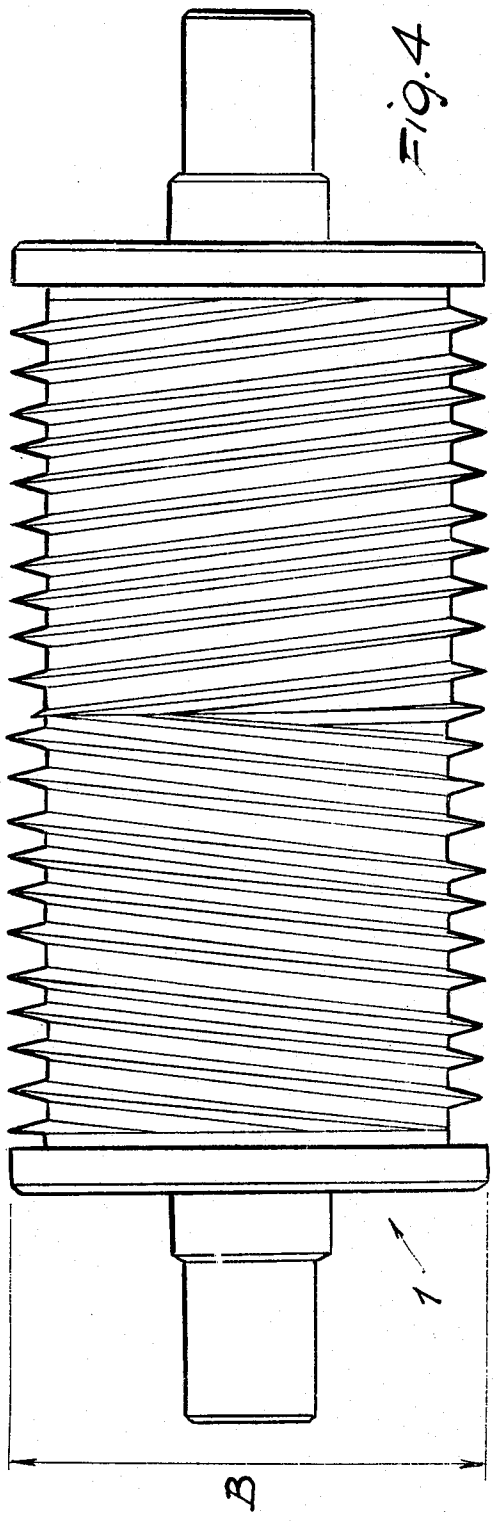


Fig. 4

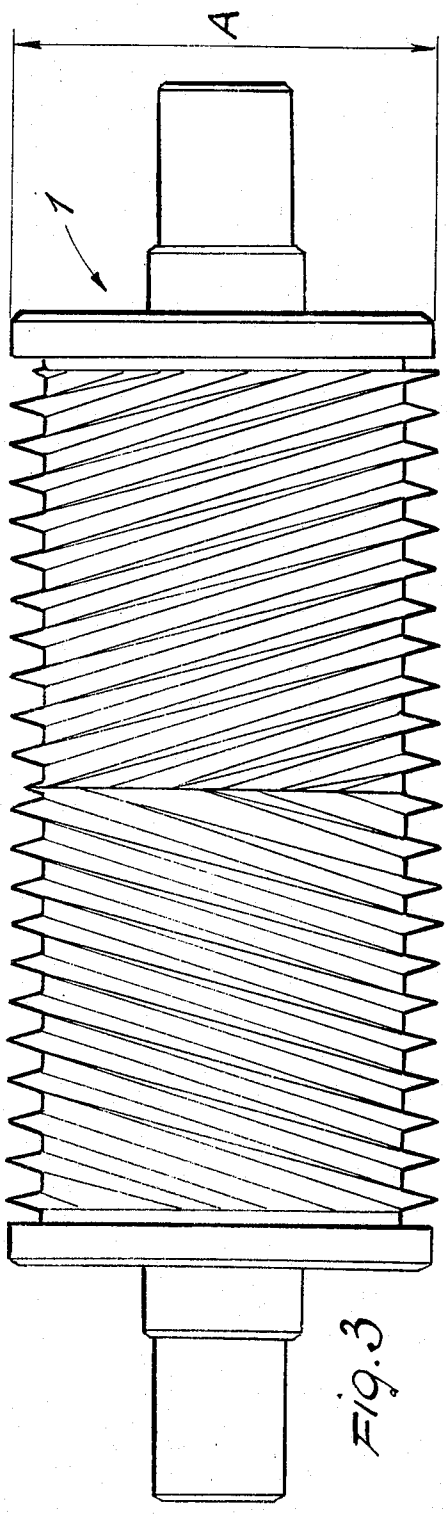


Fig. 3

PROCESS FOR TRANSFORMING CONTINUOUS SYNTHETIC FIBRE STRIP INTO CUT STRIP AND APPARATUS FOR CARRYING OUT THE PROCESS

BACKGROUND OF THE INVENTION

The present invention relates to a process for transforming continuous synthetic fibre strip into cut strip suitable for feeding spinning machines of the wool or cotton type. The invention refers also to the apparatus for carrying out the process.

The aforementioned transformation of continuous synthetic fibre strip into cut strip suitable for feeding spinning machines of the wool or cotton type, commonly known as tow-tops transformation, is at present obtained by various types of machines which treat the fibres in different manners.

One type of machine is a tearing converter by means of which the continuous synthetic fibre strip (tow) passes through a series of cylinders which progressively stretch the strip until the fibres break in various points.

Another type of machine is the cutting converter in which the tow is cut by helical knives formed on a rotating cylinder.

Another machine used is a combined cutting and tearing converted in which the tow is incised by two opposing stellar cylinders while the fibres are simultaneously stretched in order to tear them.

These known types of machines however give rise to various disadvantages.

In the tearing converter a large quantity of powder is developed because of the progressive tearing of the fibres followed by strain relieving and the consequent partial pulverising of the fibres.

In the aforementioned cutting converter, the product is damaged because of the squeezing of the fibres between the cutting cylinder and the anvil; moreover the helical knife has a fairly limited life.

In the combined cutting and tearing converter, there is the disadvantage that during tearing, as the incised fibres slide between the cutting parts of the stellar knives, they are damaged by scraping, with the simultaneous formation of powder.

Furthermore, the known machines for the aforementioned transformation also give rise to bunches of fibres because of the lack of mutual sliding (this disadvantage is particularly evident in cutting converters), because of which numerous combing or intersecting passages are often required after tearing, in order to make the strip regular.

SUMMARY OF THE INVENTION

The main object of the present invention is to largely obviate the aforementioned disadvantgages relative to transforming machines of known type, by providing a process by means of which the tow-tops transformation can take place with the minimum formation of powder, a reduced squashing of the fibres, and a better distribution and sliding of the fibres, and a better distribution and sliding of the fibres with the consequent obtaining of satisfactory diagrams of fitness for spinning.

A further important object of the invention is to provide a process which may be carried out by apparatus of simple construction, of reliable operation and long lasting, and able to give a much higher production than that obtainable by apparatus of known type.

A further important object of the invention is to provide an apparatus which does not require combing devices for regularising the strip, as in the case of cutting converters and combined cutting and tearing converters of known type.

These and further objects are attained by the process according to the invention for transforming continuous synthetic fibre strip into cut strip suitable for feeding spinning machines of the wool or cotton type, said process consisting of subjecting the continuous synthetic fibre strip to a first stage of continuous transverse incision and then to a second successive stage of longitudinal tearing arranged to form said cut strip.

BRIEF DESCRIPTION OF THE DRAWING

Further characteristics and advantages of the invention will be more evident from the detailed description of a preferred but not exclusive embodiment of an apparatus for carrying out the process according to the invention, illustrated by way of non-limiting example with reference to the accompanying drawing in which:

FIG. **1** is a diagrammatic longitudinal sectional view of the apparatus according to the invention showing the processing line;

FIG. **2** is a diagrammatic development of the helical knife forming part of the apparatus shown in FIG. **1**, in a triple-thread construction;

FIG. **3** is a lateral view of the helical knife in a nine-thread construction;

FIG. **3***a* is a diagram relative to FIG. **3** illustrating the distribution of the varous thread starts;

FIG. **4** is a lateral view of the helical knife, in a four-thread construction, with irregular distribution;

FIG. **4***a* is a diagram relative to FIG. **4** showing the distribution of the thread starts.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to FIG. **1**, the apparatus for carrying out the process according to the invention comprises in a cutting zone of the processing line shown in FIG. **1** a helical knife **1** associated with a counter roller or anvil **2** and situated downstream of a first driving roller **3** associated with respective counter rollers **4** and arranged in a feeding zone for the continuous strip **5**. The knife **1** is provided for making a simple incision in the fibres of the continuous strip **5**, contrary to that provided in cuttng converters of known type in which the helical knife cuts the fibres.

The counter roller or anvil **2**, of smooth steel, has a diameter equal to 40% of the diameter of the helical knife **1**.

Both the helical knife **1** and anvil **2** are connected to drive means and are rotated with a speed such as to cause slight stretching of the fibres (equal to about 1%) in that pprtion of the path between them and the roller **3** thereby providing there a first stretching zone in the processing line.

Downstream of the helical knife **1**, which will be described in greater detail hereinafter, is disposed a roller **6** with a knurled surface for relieving of the knife **1**, the roller **6** opposing a further roller **7** also of knurled surface for relieving of the anvil **2**. The rollers **6** and **7** are also driving or motive, with a peripheral speed such as to determine between them and the knife **1** a slight stretching equal to about 1–1.5 times thereby providing there a second stretching zone in the processing line.

These are followed by a pair of accompanying rollers **8** and **9**, of which roller **8** is idle and roller **9** is driven, downstream of which is provided a motive roller **10** as-

sociated with two counter rollers **11**, also motive.

The roller **10** and counter rollers **11** are rotated at a speed such as to determine between them and the rollers **6–7** the true stretching of the fibres, by 3 to 15 times. In this zone the fibres are torn at the incisions made by the helical knife **1** thereby providing there a tearing zone in the processing line.

Downstream of the roller **10** is provided an idle roller **12** with a knurled surface driven by friction by the roller **10**, which serves to accompany the fibre.

Finally at the end there is a transfer zone of the processing line including pair of rollers **13** followed by a curling device **14** of known type. As is clearly shown in FIGS. **2, 3** and **4**, the helical knife is constituted according to the invention by a roller having a surface of circular cross-section which carries helical cutting projections disposed in two portions or areas with opposite inclinations so as to determine a cusp convergence towards the centre.

In the solution shown in diagrammatic development in FIG. **2**, the helical knife **1** used in the apparatus is provided with cutting threads distributed uniformly in two converging sections or areas, with a three-thread disposition, indicated by continuous lines **15**, dashed and dotted lines **16** and dashed lines **17** the cutting threads of each area having the same pitch angle and converge as a cusp towards a center area.

In FIGS. **3** and **3***a*, according to a further solution, a helical knife is provided with cutting projections of nine threads distributed uniformly over two adjacent zones or areas of opposing inclination.

For example, is the external diameter A of the helical knife shown in FIG. **3** is 144 mm, the beginning points of the threads are distributed uniformly at a constant distance equal to a peripheral development a (FIG. **3***a*) of 50.24 mm.

In the solution shown in FIGS. **4** and **4***a*, a helical knife **1** is provided with cutting projections of four threads distributed, in a non-uniform manner, again over two zones or areas in which said projections are inclined in opposite directions.

For example, for an external diameter B equal to 160 mm, the beginning points of the four threads may be identified by developing on the external circumference the portions *b*, *c*, *d*, *e* (FIG. **4***a*) equal respectively to 140 mm, 130 mm, 120 mm, and 112.4 mm.

The non-uniform distribution of the cutting threads in the solution shown in FIGS. **4** and **4***a* enables very satisfactory diagrams relative to fitness for spinning to be obtained.

From the aforegoing description, the operation of the apparatus described is evident.

The continuous synthetic fibre strip (tow) **5** is guided by the rollers **3** and **4** to the helical knife **1** where is passes between it and the anvil **2**. Here the strip **5** undergoes a continuous incision by the cutting projections of the knife **1**. The particular cusp disposition of the cutting threads of the knife **1** gives rise to various advantages with respect to known machines using helical knives with a normal spiral.

These knives with a normal spiral, because of the rotation of the thread, thrust the strip **5** towards one end so that there is an accumulation of material towards that end with consequent irregularities of cutting, squashings and breakages. With the cusp knife **1** according to the invention, this thrust is divided in half with the conveying of the material towards the centre, and a consequently very regular incision of the strip **5**, a smaller production of powder, a smaller formation of waste, better operation of the machine and no formation of bent fibres.

It should be also noted that as the process according to the invention gives a simple incision instead of the cutting of the fibres, the pressure required is considerably less than that necessary in cutting machines of known type (as stated, the diameter of the anvil **2** is approximately 40% of the diameter of the knife **1**, whereas in known machines it is almost equal).

Evidently the smaller pressure required increases the life of the helical knife **1**.

After incision by the knife **1**, the strip **5** passes between the take-up rollers **6** and **7** which avoid the fibre winding on the rollers **1** and **2**. In the portion between the rollers **6** and **7** and the rollers **10** and **11**, the tape **5** is stretched in the direction of its length by 3 to 15 times so that the fibres are torn at the incisions.

At this point the strip has been transformed and only the final stage of curling by the curler **14** remains.

As can be seen, by making the incision and tearing of the fibres in successive stages, the apparatus heretofore described gives a very rational treatment to the fibres and a transformation process which is regular and continuous.

Moreover the particular configuration of the knife **1** avoids the formation of bunches (accumulations of fibres which have not undergone mutual slipping).

Finally a considerably greater production rate is obtained than that obtainable by machines of known type, in that the speed of the strip **5** may be considerably greater (for example double) as the presence of an intersecting comb section is not necessary.

The invention so conceived is susceptible to numerous modifications all of which fall within the scope of the inventive idea.

Thus the threads of the helical knife **1** may have a progressive pitch angle or inclination so as to reduce the thrust towards the centre, with a consequently smaller displacement of the fibres in the transverse direction.

In practice the materials and dimensions may be chosen at will according to requirements and all elements may be replaced by other technically equivalent means.

We claim:

1. An apparatus for transforming continuous synthetic fiber strip into cut strip suitable for feeding spinning machines of the wool or cotton type, comprising a processing line for the strip including a feeding zone, for the strip, a cutting zone therefor, a stretching and tearing zone for the strip and a transfer zone therefor, wherein the cutting zone for the strip has a helical knife for the continuous incision of the fibers, said helical knife consisting of an incisions making roller cooperating with anvil means and having a surface of circular cross-section, said surface having a central area and two areas adjacent to said central area, said roller comprising helical cutting projections disposed in said two adjacent areas in which said projections are of opposite inclination and converge as a cusp towards said center area, thereby to provide continuously in the strip fibers differently oriented incisions with a transverse inclination thereof and to provide stretching and tearing actions in the zones subsequent to the cutting zone.

2. An apparatus according to claim **1**, wherein said helical cutting projections are helical cutting threads of multiple thread type.

3. An apparatus according to claim 1, wherein said helical cutting projections are helical cutting threads of multiple thread type wherein all cutting threads of each of said adjacent areas have the same pitch angle.

4. An apparatus according to claim 1, wherein said helical cutting projections are helical cutting threads of multiple thread type, wherein the helical cutting threads have a progressive pitch angle.

5. An apparatus according to claim 1, wherein said helical cutting projections are helical cutting threads of multiple thread type, and wherein the threads are distributed in a non uniform manner over said adjacent areas.

6. An apparatus according to claim 1, wherein said stretching and tearing zone has a stretching position extending before said entry zone and comprises after said incisions making roller a pair of knurled rollers having a peripheral speed greater than the peripheral speed of said incisions making roller thereby to stretch the incised strip, and after said pair of knurled rollers a group of driving rollers having a peripheral speed greater than the peripheral speed of said knurled rollers thereby to provide a tearing action on said incised and stretched strip.

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