Oct. 27, 1964 H. SCHIPPERS ETAL 3,153,837

DEVICE FOR CRIMPING SYNTHETIC THREADS

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FIG. 1

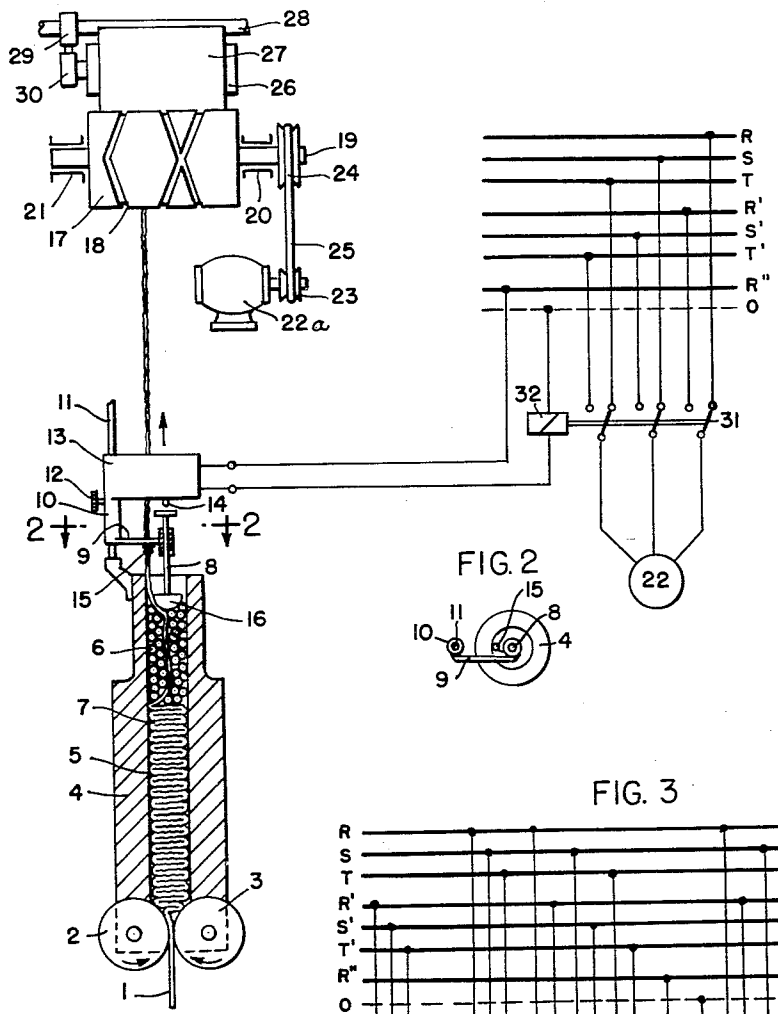

FIG. 2

FIG. 3

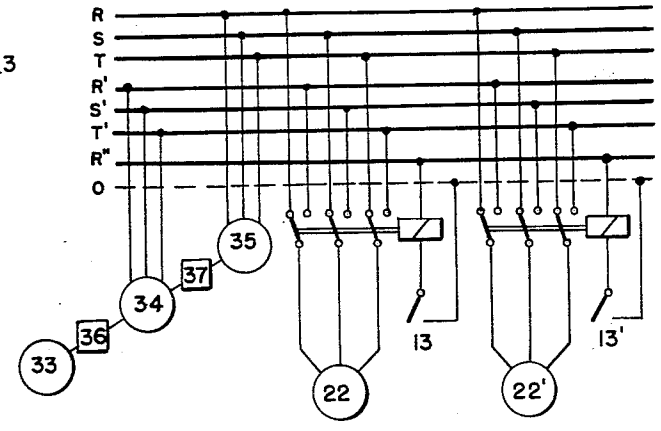

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FIG. 4

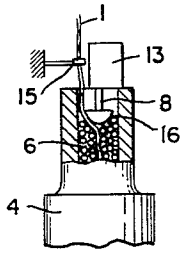


FIG. 5

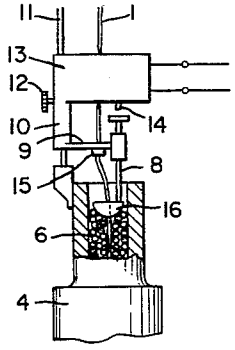


FIG. 8

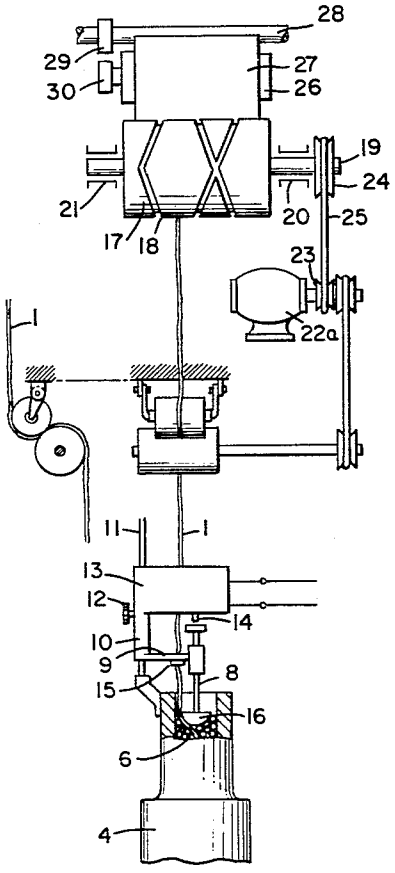


FIG. 6

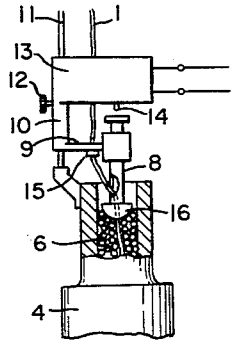
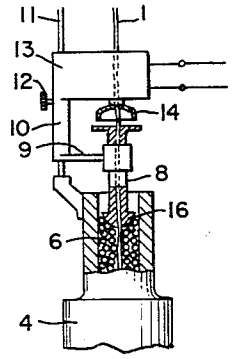


FIG. 7



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DEVICE FOR CRIMPING SYNTHETIC THREADS

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5 Claims. (Cl. 28—1)

The present invention is directed to means for crimping filaments such as nylon, rayon, acetate, vinyl resins, polyesters, acrylic, and vinylidene chlorine filaments. More particularly, the invention relates to a crimping device which includes a crimping chamber and to means for controlling the amount of thread material in said chamber by regulating either the rate at which the filaments are fed to the chamber or the rate at which the crimped threads are removed from the chamber.

In crimping devices of the type with which this invention is concerned, filaments are passed from a supply point to a stuffing chamber by means of paired conveyor rollers. In the chamber pressure is applied to the threads which compresses them tightly into layers. The layers of thread are passed through a heating zone and then a cooling zone within the chamber in order to fix the crimp. Thereafter, the crimped material is drawn off from the exit end of the chamber and is conducted to a winding device.

One of the important requirements of a crimping process is that the material must be fed into the stuffing chamber at one end and drawn off from the other end of the chamber in such a manner that the residence time of the thread in the heating zone remains as constant as possible and does not exceed a particular limit. It is also important in continuous operations to make certain that the chamber never becomes entirely empty.

Several methods have been proposed for regulating the passage of the thread through the stuffing chamber. In one method the operating speed of either the feed rollers or the drawing off rollers is adjusted according to how full the stuffing chamber is at any particular time. As the counter-pressure agent or stuffer which compresses the fibers moves up or down in the chamber from a desired position, a variable speed motor is actuated which controls either the feed rollers or the drawing off rollers. With this arrangement, however, it has been found that considerable and uncontrollable differences occur with regard to the staying time of any particular section of the running thread in the heating zone. It has also been found that undesirable fluctuations take place in the tension on the thread or on the crimping intensity produced by the compressing means.

In another known device, either the rate at which the feed rollers supply the thread to the stuffing chamber or the speed of the drawing-off rollers are controlled by means of an on and off switch which is intermittently operated by means of the counter-pressure agent. This type of apparatus also has not met with any substantial success. One reason is that the slip motors which are usually used in such a device behave differently in response to slight changes in operating conditions such as bearing friction. For this reason it is very difficult to preset a motor so that it can be speeded up or slowed down properly in response to changes in position of the counter-pressure agent.

There are still other devices in which the feed of the threads or the drawing off of the threads is controlled according to the amount of material in the chamber. Many of these systems, however, require complicated and expensive equipment which is subject to malfunctioning.

It is an object of the present invention to provide improved apparatus for crimping artificial fibers.

Another object of the invention is to provide an improved means for regulating the feed and/or withdrawal of material from the stuffing chamber of a crimping device.

Other objects will become apparent to those skilled in the art from the following detailed description of the invention, taken in conjunction with the accompanying drawing in which a specific embodiment has been set forth for purposes of illustration.

In the drawings:

FIGURE 1 is a diagrammatic view, partly in section, of a crimping apparatus embodying the present invention;

FIGURE 2 is a cross-sectional view taken along line 2—2 of FIG. 1;

FIGURE 3 is a diagrammatic view showing the wiring arrangement of a particular series installation;

FIG. 4 is a diagrammatic view, partly in section, showing one embodiment of the present invention;

FIG. 5 is a diagrammatic view, partly in section, showing one embodiment of the present invention;

FIG. 6 is a diagrammatic view, partly in section, showing one embodiment of the present invention;

FIG. 7 is a diagrammatic view, partly in section, showing one embodiment of the present invention; and

FIG. 8 is a diagrammatic view, partly in section, showing one embodiment of the present invention.

In FIG. 1, thread **1** is shown as being passed from a supply point (not pictured) through paired conveyor rollers **2** and **3** into stuffing chamber **5** of cylindrical tube **4**. In the chamber the thread is compressed against counter-pressure agent (which in this instance is ball packing **6**) into layers which lie tightly one upon the other. The layers of thread form plug **7**. The thread emerges from the plug in a crimped condition and is drawn off through the ball packing. Normally, the lower part of the chamber is equipped with a heating means which is not shown in the drawing. Similarly, the upper part of the chamber usually includes a corresponding cooling device. The heating and cooling sections of the chamber serve to fix the crimp As the stuffing chamber fills, plug **7** presses the ball packing toward the end of the chamber where an adjustable member **8**, which is pictured as a feeler prong, is slidably mounted on carrier arm **9**. The position of member **8** changes as the chamber filling either increases or decreases. Carrier arm **9** is mounted on sleeve **10** which in turn is slidably mounted on rod **11** which is attached to cylindrical tube **4**. By means of set screw **12**, sleeve **10** can be fixed at any desired height. Also mounted on sleeve **10**, and at a sufficient distance from carrier arm **9**, is a conventional throw-over switch **13**. This switch conveniently can be a micro switch having a push-button **14**, which is operated by the feeler and setting member **8** in accordance with the filling of the chamber. In another embodiment, push-button **14** can be considered a feeler prong and the switch **13** can be placed directly on the rim of cylindrical tube **4** (see FIG. 4).

The crimped thread is drawn off from chamber **5**, past the feeler prong and through eye **15** which can conveniently be arranged on carrier arm **9** (see FIG. 2). If it is desired, feeler plate **16** of feeler and setting member **8** may be pierced for passage of the crimped thread (see FIG. 5). Another possibility is to make the entire feeler prong hollow (see FIGS. 6 and 7).

The drawing off of the thread may be carried out by a special device placed between the crimping chamber and the winding means (see FIG. 8). In the drawing, however, the crimped thread is drawn off directly by the wind-

ing means. The winding device is arranged in a known manner. Drive roller **17** having grooves **18** for the back-and-forth distribution of the thread, along with drive shaft **19** of drive roller **17** is carried on the machine frame (not pictured) at points **20** and **21**. Shaft **19** is driven by motor **22***a* operating through pulleys **23** and **24** and belt **25**. Winding **27** is formed on spool holder **26**. Winding **27** is frictionally driven and swings on rod **28** at **29** along the spoolholder carrier **30** as the winding diameter increases.

The crimped thread is drawn off from the crimping chamber at a speed which corresponds to the winding speed. According to the subject invention, the speed at which the thread is drawn off is maintained at one of two rates depending upon the chamber filling. These two velocity stages are proportioned in such a manner that the thread plug either slowly grows or gradually is diminished.

In a preferred embodiment of the invention the drawing off speeds are controlled as accurately as possible by connecting drive motor **22** to one of two power sources of differing frequency. In this manner it is possible to obtain constant rates of revolution in each stage. This is particularly important where the winding program includes a series of stuffing chambers and winding devices. In this embodiment motor **22** is connected by means of magnetic throw-over switch **31**, which can be a relay, magnetic relay, or the like, to one power source RST having a frequency, for example, of 28 cycles per second and to a second power source R'S'T' having a higher frequency of, for example, 31 cycles per second. The throw-over switch **31** is operated by relay coil **32** which lies in one control-current circuit having an auxiliary potential source R''O. This control-current circuit is closed or interrupted, depending upon the chamber filling, by the micro switch **13**.

In the arrangement represented in FIG. 1, motor **22** is connected to the power source RST. The winding speed or drawing off speed is such that the chamber is being slowly filled. As thread plug **7** increases in size and ball packing **6** rises, feeler prong **8** is raised and eventually contacts push-button **14** on mirco switch **13**. This initiates a response in relay coil **32** and causes magnetic throw-over switch **31** to be shifted. Motor **22** is thereby connected to supply source R'S'T' which causes the motor rate to increase along with the drawing off speed. For this reason, thread plug **7** begins to diminish slowly in size. As the chamber is emptied and the ball packing sinks, feeler prong **8** also falls and in so doing again operates micro switch **13** so that the relay coil **32** activates magnetic throw-over switch **31**. In this manner, the motor once more is connected to upper supply main RST and the motor again slows down.

The frequencies required at any given time for carrying out a particular winding program as well as the difference between the two frequencies can be set by corresponding gears in the transformer unit. In FIG. 3, a transformer or converter unit is represented for a series installation of compression-crimping devices according to the subject invention. Drive motor **33** which can be a three-phase motor runs with a constant rate of revolution and drives generators **34** and **35**. A gear **36** is wired between motor **33** and generator **34**. If the winding program is altered, for example, by substituting threads of a different denier or if another crimping intensity is desired, the entire level of the winding velocity can be raised by means of gear **36**.

Generator **34** determines the lower frequency and generator **35** the higher frequency. A second gear **37** is interposed between generators **34** and **35** which is used to provide a predetermined frequency difference. Obviously, it is also possible to have generator **35** situated ahead of generator **34**. Likewise, the generators may be arranged in such a manner that the motor is located between them and drives a generator with each shaft end.

As is evident from the above discussion, it is proposed according to the subject invention that the drawing off rate or feed rate of the threads be controlled by alternately switching the driving mechanism between two predetermined speeds. Between the two speeds, which lie close together, is the required mean winding speed.

In prior art crimping devices of this type, the drive of the feed or drawing off means is intermittently interrupted and the rollers in question are brought to a stop. After the power is again switched on, the paired rollers are once more driven at full speed. In this arrangement the thread can easily be either overstretched or broken due to the sudden tension placed on the thread by starting and stopping the rollers. It has also been found that the prior art devices do not maintain the thread in the heating zone of the chamber for a uniform period of time. This causes the crimping intensity to deviate visibly between various sections of the thread. In contrast, the subject invention provides a gentle and uniform handling of the thread. This is accomplished by having the controlled drawing off or feed operation continue without interruption and by maintaining as small as possible the difference in speed between the two preadjusted stages.

As was pointed out in connection with the drawing, the stuffing chamber is operatively associated with a switch-over device, through the counter-pressure agent. The chamber filling is either gradually increasing or diminishing and as it reaches a desired level the counter-pressure agent acts indirectly or directly on a device which adjusts the drive for either the feed or drawing off means to one of the two speeds. This adjusting device may consist of a mechanical, electrical, electromagnetic, hydraulic, or other means which in themselves are known. The adjusting device may include a friction disk or an eddy current coupling which regulates the switching or wiring and connects the motor to one of two potentials. Other equivalent means can, of course, be used to accomplish the desired result.

It has been found that if a uniform crimping intensity is to be achieved, especially with a series installation, it is essential that the two speeds established for the feed or drawing off means, as well as the difference between these two speeds, be maintained as precisely as possible. This is very difficult to accomplish by means which are known in the art. In motors that are designed to operate tools at one of two speeds, for example, the usual three-phase or alternating current short circuit rotor motors are used. These motors most often are driven with alternating terminal potential and tend to slip considerably on reduction of the terminal potential. Accordingly, the rate of revolution delivered by such motors, especially with series installations, is not uniform.

In order to overcome the above problem, it has been proposed in a special embodiment of the invention that such three-phase or alternating current short circuit rotor motors be driven by electrical energy of differing frequency. In this manner, it is possible to maintain the torque of the motors constant even with a reduction of the frequency and a lowering of the rate of revolution and to obtain thereby a high degree of precision and agreement of the rates of revolution of adjacent working points. The transformer unit necessary for this purpose can without difficulty supply a large number of working points which are arranged in one or more series installations with two main potentials of differing frequency.

It is left to particular operators to determine whether their conditions make it more advisable to use the above described two-stage speed regulation in connection with the feed rollers with a constant drawing off rate or whether they maintain a constant feed rate into the crimping chamber and regulate the drawing off rate. If the drawing off rate is controlled either a special device for removing the crimped material from the chamber can be used or this can be omitted and the winding device or its drive roller can be regulated. The drive roller may also be arranged as a slit or groove drum. Regardless of whether the feed rate

or the drawing off rate (either by a special drawing off and conveying apparatus or directly by the winding device) of the crimped material is regulated, the speed is controlled in accordance with the crimping chamber filling.

It is also possible to switch conveniently the drawing off and the winding of the crimp material synchronously in such a manner that the drawing off and the winding device run in a constantly equal speed ratio (see FIG. 8).

Obviously, many modifications and variations can be made in the above described invention without departing from the spirit and scope thereof. For this reason only such limitations should be placed on the invention as are indicated in the following claims.

We claim:

1. Apparatus for crimping synthetic threads which comprises: a crimping chamber, drive means for conveying synthetic threads through said chamber, compressing means associated with said chamber for forming said threads into layers within said chamber, control means for regulating said drive means, said control means operating in response to changes in the level to which said chamber is filled with said thread material, said control means being characterized by the fact that the regulated rate alternately shifts from one to the other of two preselected speeds, the mean speed desired for said crimping apparatus lying between said two speeds, whereby the thread plug formed in said chamber alternates between a gradual growth and a gradual diminution.

2. Apparatus for crimping synthetic threads which comprises: a crimping chamber, drive means associated with said chamber for conveying synthetic threads through said chamber, compressing means within said chamber for crimping said threads, said compressing means being arranged to rise and fall within said chamber in response to changes in the level to which said chamber is filled with said thread, feeler means associated with said compressing means and designed to change its position in accordance with the changes in the position of said compressing means, said feeler means being arranged to operate control means for regulating said drive means, said control means being characterized by the fact that the regulated rate alternately shifts from one to the other of two preselected speeds, the mean speed desired for said crimping apparatus lying between said two speeds, whereby the thread plug formed in said chamber alternates between a gradual growth and a gradual diminution.

3. Apparatus for crimping synthetic threads which comprises: a crimping chamber, drive means associated with said chamber for passing synthetic threads into said chamber, drive means associated with said chamber for removing synthetic threads from said chamber, compressing means within said chamber for crimping said threads, said compressing means being arranged to rise and fall within said chamber in response to changes in the level to which said chamber is filled with said thread, feeler means associated with said compressing means and designed to change its position in accordance with the changes in the position of said compressing means, said feeler means being arranged to operate control means for regulating the drive means for passing thread into said chamber, said control means being characterized by the fact that the regulated rate alternately shifts from one to the other of two preselected speeds, the mean speed desired for said crimping apparatus lying between said two speeds.

4. Apparatus for crimping synthetic threads which comprises: a crimping chamber, drive means associated with said chamber for passing synthetic threads into said chamber, drive means associated with said chamber for removing synthetic threads from said chamber, compressing means within said chamber for crimping said threads, said compressing means being arranged to rise and fall within said chamber in response to changes in the level to which said chamber is filled with said thread, feeler means associated with said compressing means and designed to change its position in accordance with the changes in the position of said compressing means, said feeler means being arranged to operate control means for regulating the drive means for removing said thread from said chamber, said control means being characterized by the fact that the regulated rate alternately shifts from one to the other of two preselected speeds, the mean speed desired for said crimping apparatus lying between said two speeds.

5. An apparatus for crimping synthetic threads as in claim 2 wherein said drive means is an electric motor which is driven by a transformer which supplies two main potentials of differing frequency.

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