

The invention relates to apparatus for winding a thread supplied at constant speed on to a cheese comprising a spool roller bearing the cheese and driving it via its periphery, two regulating systems of which the first compensates periodic fluctuations in thread tension and the second has two cone wheels and compensates movements of range of thread tension by varying the drive speed of the spool roller, and a transmission element connected to the first regulating system and determining the transmission ratio of the second regulating system and disposed in axially adjustable manner between the cone wheels of the second regulating system and returnable to a normal position by a return device.

Cheeses of the kind in question are driven by way of their periphery, thus ensuring a constant peripheral speed in the driving range. If the thread supply is constant, as with open-end spinning machines and also with many winding machines, it is necessary only to compensate for differences in the travel of the thread across the width of the spool, and as a rule this can be done with relatively simple means, e.g. a curved thread guide rail. When the spools are driven over a part of their length, different diameters result in the operating area and outside the latter, and they lead to different peripheral speeds. The problem is more acute in the case of conical spools, in which, in addition to this different travel of the thread across the width of the spool, there are considerable differences in the

diameter on account of the conicity of the spool, so that there are considerable fluctuations in the length of thread wound per rotation of the spool. The resulting spool is therefore non-uniformly wound, which
5 may result in layers of thread falling off and difficulties during subsequent process, including thread breakages.

To compensate for these differences in thread lengths, it has already been proposed to drive the spool
10 at varying speed (GB-A1 249 247). The aim is to stabilise the tension of the thread, when fluctuations therein occur, by using a weight or one or more springs. It has been found, however, that when
fluctuations in thread tension occur, the fork
15 controlling the take-up speed oscillates around its central position, and the oscillation even results in a build-up of fluctuations in thread tension.

The object of the invention is thus to avoid the aforementioned disadvantages and to provide an apparatus
20 for producing uniformly wound, and in particular conical cheeses which ensure winding at uniform thread tension at each winding head, the apparatus also being simple and compact in design.

To this end, according to the invention, the
25 transmission element is associated with an abutment for determining a normal position of the transmission

element determining the maximum transmission ratio of the transmission gear. This ensures a stable basic adjustment of the transmission gear, so that unstable conditions are rapidly eliminated.

5 Advantageously the adjustable abutment is associated with a setting fork for the transmission element and actuated by the return device, and in this connection it has been found advantageous if the adjustable abutment is disposed on the setting lever.

10 In a simple embodiment of the apparatus according to the invention, the return apparatus can be constructed as a return spring, but the return apparatus is preferably constructed in the form of converging surfaces of the cone wheels. The converging surfaces of
15 the drive wheel and the driven wheel exert a force upon the transmission element which returns the latter to its normal position. To this end it can be provided that the cone wheel forming the driven part is mounted on a shaft which is inclined relative to the drive shaft
20 which carries the cone wheel forming the drive part. The inclination of this shaft can be adjustable. To this end, the adjustable shaft is advantageously mounted on a lever with which a setting cam is associated.

 In an alternative, preferred embodiment it is
25 provided that the cone wheels have various degrees of

conicity. Advantageously also, the surfaces of the transmission element have various degrees of conicity adapted to the conicity of the cone wheels. The return apparatus has the additional advantage that on account of the displacement of the transmission element which has taken place the transmission between the cone wheels also takes place at different places, so that excessive wear at a single peripheral line on the cone wheels is prevented.

In order to anticipate the risk that - during the formation of conical cheeses - the beginning of the reserve of thread formed at the larger-diameter end of the conical cheese will penetrate into the transmission gear, the transmission gear is advantageously disposed at the smaller-diameter end of the conical cheese inserted in the winding apparatus.

The term "spool roller" in the sense of the present invention means each component by means of which the cheese is driven by way of its periphery, irrespective of whether the said component extends along the entire length of the cheese or only along a more or less substantial part thereof.

The subject matter of the invention is simple in design, is reliable in operation, space-saving and easily adaptable to fluctuating thread tensions and winding conditions. In spite of a high winding speed the apparatus can be accurately controlled, so that both exact cylindrical and exact conical cheeses can be manufactured.

Various embodiments will be explained in greater detail with reference to the drawings, in which:

5 Fig. 1 is a front view, partly in section, of a first embodiment of a winding head designed according to the invention and comprising a transmission gear constructed in the form of a cone drive;

Fig. 2 is a section of a modification of the subject matter of the invention;

10 Fig. 3 is a front view, partly in section, of another modification of the apparatus according to the invention, comprising a transmission element constructed as part of a torque clutch, and a multi-part spool roller;

15 Fig. 4 is a front view of an embodiment of the subject matter of the invention comprising a drive shaft disposed outside the spool roller;

Fig. 5 is a perspective view of a mechanical control apparatus for the apparatus according to the invention.

20 Fig. 6 is a diagrammatic plan view of an embodiment of the apparatus according to the invention with a return apparatus for a setting fork which

controls the transmission element;

Fig. 7 is a lateral view of a thread-tension sensor
which can be applied in various regions;

Fig. 8 is a front view of another design of a return
5 apparatus for the transmission element; and

Fig. 9 is a lateral view of a further embodiment of a
return apparatus for the transmission element;

The winding apparatus 1 initially described and
shown in Fig. 1 is part of an open-end spinning machine
10 for producing conical cheeses 11, but the invention can
also be applied to other textile machines which comprise
winding heads or winding apparatus 1 for forming
cylindrical or conical cheeses 11.

As shown in Fig. 1, each winding apparatus 1
15 essentially comprises a spool holder 2, an individual,
axially immovable spool roller 3 and a likewise axially
immovable drive shaft 4 which drives the spool roller 3
by way of a controllable transmission gear 5.

In the illustrated embodiment, the spool holder 2
20 has two spool arms 20 and 21 for receiving a conical
sleeve 22 on which the conical cheese 11 is formed by
winding the thread 10 and is driven by friction by the

spool roller 3.

The spool roller 3 is mounted on two rolling bearings 30 and 31 so that it can rotate freely on the drive shaft 4. One end of the spool roller 3 is
5 non-rotatably connected to a toothed wheel 71 forming part of a spur gear 7 disposed between the transmission gear 5 and the spool roller 3.

The drive shaft 4 is jointly associated with a plurality of adjacent winding apparatus 1 and extends
10 across the said plurality of winding apparatus accordingly. In order, however, to be able to drive each cheese 11 separately, the spool roller 3 is driven not directly by the drive shaft 4 but with the interposition of the controllable transmission gear 5.

15 The transmission gear 5 shown in Fig. 1 comprises a controllable cone drive 6 and a spur gear 7 which is not controllable. The transmission gear 5 has a drive wheel which is formed as a cone wheel 60, is rigidly connected to the drive shaft 4 and which co-operates, with the
20 interposition of a transmission element 61, with a driven wheel which is formed as a cone wheel 62. The transmission element 61, which in the illustrated embodiment is constructed as a setting ring, can be moved parallel to the generatrices of the two cone
25 wheels 60 and 62, as will be described hereinafter.

The cone wheel 62 is mounted by way of rolling bearings 63, 64 on a shaft 65 which in turn is borne by a bearing 66. The cone wheel 62 is non-rotatably connected to a spur gear 70 which engages with a spur gear 71 connected to the spool roller 3.

The transmission element 61 is guided by a setting fork 80 which is associated with a suitable drive 8. This drive 8 can, for example, be a stepping motor which can be rotated forwards or in reverse and which, by way of a pinion, engages a rack connected to the setting fork 80. A stepping motor of this kind is inexpensive and does not need any regulating apparatus for its control, thus reducing the cost of control. In addition, a drive of this kind can be very finely graduated, so as to be practically equivalent to continuous adjustment of the transmission element 61. The drive 8 is connected to a control apparatus 9 which in turn is connected for control purposes to a thread-tension sensor 90.

As is evident from the following description, the thread-tension sensor 90 forms a first regulating system 96, whereas the transmission gear 5 forms a second regulating system 51.

In the case of the illustrated open-end spinning machine, the thread 10 to be wound is continuously

produced in a spinning apparatus 12 and drawn off with the aid of draw-off rollers 13 and 14. The thread 10 then passes a stationary thread guide 15 and a curved member 16 for compensating the thread tension. The
5 thread 10 is supplied in an oscillating manner to the sleeve 22 for forming a cheese 11, with the aid of a cross-winding thread guide 17 (indicated by broken lines).

When the cylindrical cheese (not shown) is formed,
10 the fluctuations in the thread tension caused by the cross-winding feed thread can as a rule be compensated with the aid of such a thread-tension compensating curved member 16. In a conical cheese 11, however, these fluctuations are too large and vary considerably,
15 particularly when the cheese is being formed. In a typical conical cheese, for example, the peripheral ratio between the small diameter and large diameter of the spool varies continuously from 10:16 to 10:11. This shows that it is impossible, using a rigid compensation
20 element such as a thread-tension compensating curved member 16, to compensate the fluctuations in the thread tension with uniform efficiency during the manufacture of conical cheese 11. This can sometimes be difficult, however, even in the case of cylindrical cheeses 11.

25 In the device described above, the thread 10 supplied to the winding apparatus 1 is sensed by a

thread-tension sensor 90. Any change in the thread tension is reported to the control apparatus 9, which actuates the drive 8 in accordance with the change in the thread tension and moves the transmission element 61 of the cone drive 6 parallel to the cone wheels 60 and 62, thus altering the transmission ratio of the transmission gear 5. The speed of the spool roller 3, driven by the shaft 4 by way of the transmission gear 5, for the conical cheese 11 alters as a function of the change in the thread tension, so that the resulting thread-winding speed, allowing for the change in thread motion, always corresponds to the constant thread delivery speed with which the thread 10 is drawn off the spinning apparatus 12 by the draw-off rollers 13 and 14. The first regulating system 96 formed by the thread-tension sensor 90, together with the second regulating system 51 formed by the transmission gear 5, thus causes the thread 10 to be wound under constant tension.

Fig. 5 is a perspective view of the cone wheel 62 of the cone drive 6, its transmission element 61 and the setting fork 80. As is clearly shown in this Figure, the transmission element 61 is constructed in the form of a setting ring movable axially parallel to the generatrix of the two cone wheels 60 and 62. The setting ring is dimensioned so that the cone 62 it surrounds is always surrounded by it with clearance.

irrespective of its momentary position. This is the case if the inner diameter of the setting ring is greater than the maximum outer diameter of the cone wheel 62 which it surrounds. The transmission element
5 61 constructed as the setting ring is guided between two pairs of drive pins 800 and 801, only one drive pin of which is shown in the Figure in each case.

A design of the transmission element 61 as a setting ring is particularly wear-resistant and
10 therefore long-lived as compared with other designs in which the transmission element used is, for example, in the form of a cord, a strap or the like. Also, the setting ring responds particularly quickly to adjustments made to it, and thus ensures very rapid
15 adaptation to changing conditions.

The previously-described embodiment, in addition to the controllable transmission gear 5, also contains an additional gear 7 having a non-controllable transmission ratio. This is particularly advantageous if, as shown
20 in Fig. 1, the drive shaft 4 is disposed inside the spool roller 3, since the drive shaft 4 can then be disposed concentrically to the spool roller 3. Also, in the embodiment shown in Fig. 1, the controllable transmission gear 5 is disposed between the drive shaft
25 4 and the non-controllable spur gear 7. The reason for this is that in order to secure the drive wheel (cone

wheel 60) borne by the drive shaft 4, a certain space is needed near the spool roller 3, whereas the spur gear 71 is secured to the spool roller 3 inside it. Since a cone wheel of a cone drive 6, owing to the desired
5 adjustment facility, is in any case wider than the spur gear of a spur-gear drive 7, it is this cone drive 6 with the controllable transmission ratio which is disposed between the drive shaft 4 and the additional gears 7 with the non-controllable transmission ratio.

10 The previously-described embodiment has a two-stage transmission ratio, but of course use could also be made of a single transmission stage or even more than two transmission stages.

A single-stage transmission is shown by way of
15 example in Fig. 2. In this connexion, the drive shaft 4 is mounted on each winding apparatus 1 by means of a rolling bearing 41 in a stationary bearing 40, on the other side of which one end of the spool roller 3 is also supported by way of a rolling bearing 30. At its
20 other end, the spool roller 3 has a conical inner contour 32. This inner contour 32, which is constructed in the form of a hollow cone, forms the driven part, rigidly connected to the spool roller 3, of the transmission gear 5, which is constructed as a cone
25 drive 6. This inner contour 32 cooperates by way of the transmission element 61 with the drive part formed as a

cone wheel 60 and disposed axially immovably on the drive shaft 4. The transmission element 61, as described with reference to Fig. 1, is actuated by means of the setting fork 80 for varying the transmission
5 ratio.

In order to dispose the transmission gear 5 between the drive shaft 4 and the spool roller 3, the spool roller 3 is disposed eccentrically of the drive shaft 4, to enable the transmission element 61 to be adjusted.

10 Owing to its conicity, the conical cheese 11 is driven along its various longitudinal regions at the same angular speed but at different peripheral speeds, and consequently the thread 10 on the cheese 11 is subjected to greater friction in the longitudinal
15 regions where the peripheral speed of the cheese 11 differs from the speed of the roller 3. This adversely affects the thread 10. To remedy this, therefore, the spool roller 3 shown in Fig. 2 comprises, along its central longitudinal region, a surface constructed as a
20 drive surface 33, whereas the remaining longitudinal regions of the spool roller 3 have a low friction coefficient with regard to the thread 10 and serve only as backing elements. In this connexion the drive surface 33 can be made of suitable material or can be
25 suitably profiled, or both features can be combined, to ensure efficient driving with regard to the cheese 11.

Since the drive surface 33 and the remaining longitudinal regions of the spool roller 3, used as backing elements, do not have to be chosen in dependence on a desired change in speed, they can be dimensioned so as always to ensure efficient transmission of rotation to the conical cheese 11.

Another development of a spool roller 3 of the aforementioned kind will now be described with reference to Fig. 3. According to this embodiment the spool roller 3 mounted on the drive shaft with the aid of rolling bearings 30 and 31 has a drive pulley 34 from which a sleeve-like connecting member 340 extends to a cord pulley 721 and is non-rotatably connected thereto. An idle pulley 35 is mounted on the said sleeve-like connecting member 340 with the aid of rolling bearings 350 and 351. The drive pulley 34, on its side remote from the cord pulley 721, likewise has a sleeve-like prolongation 341 extending to the end of the spool roller 3 and bears an additional idle pulley 36 by means of roller bearings 360 and 361. As before, the drive pulley 34 has a surface constructed as a drive surface 33. When the thread 10 is wound on to the cheese 11, the two idle pulleys 35 and 36 are not driven by the drive shaft 4 but by the cheese 11, thus greatly reducing the friction resulting from slippage between the cheese 11 and the idle pulleys 35 and 36 of the divided spool roller 3.

As Fig. 4 shows, more than merely two idle pulleys 35 and 36 can be provided. In that case, the drive pulley 34 of the roller 3 need not be disposed at the centre between the idle pulleys. Owing to the greater friction caused by greater weight at the greater diameter of the cheese 11, it is advantageous if, as shown in Fig. 4, the drive pulley 34 is eccentrically offset in the spool roller 3 towards the larger diameter of the cheese 11. In Fig. 4 this is achieved by varying the size of the idle pulleys on the two sides of the drive roller 34 and also in that three idle pulleys 35, 37 and 38 are disposed on the smaller-diameter side of the cheese 11 whereas only one idle pulley 36, which may if required be somewhat wider than the pulleys 35, 37 and 38, is disposed on the larger-diameter side of the cheese 11.

As Fig. 3 shows, the transmission gear 5 can be disposed and constructed in a different manner from the embodiment shown in Fig. 1. In the case of conical cheeses 11 a reserve of thread, which may be desired, always forms at the end of sleeve 22 (Fig. 1) where the cheese 11 has its larger diameter. It may happen therefore that the thread end reaches the transmission gear 5 and thus pulls the reserve thread off the sleeve 22 and also interferes with the transmission gear 5.

To counteract this, in accordance with Fig. 3, the gear 5 is disposed at the smaller-diameter end of the cheese 11 inserted into the holder 2.

According to Fig. 3 the controllable transmission gear is in the form of a torque clutch 50 disposed between two cord drives 72 and 73 and also forming the transmission element. The first cord drive 73 has a cord pulley 730 which is non-rotatably disposed on the drive shaft 4 and which drives a cord pulley 731 by way of a cord 732. The said cord pulley 731, together with another cord pulley 720, rests on a common shaft 65 borne by the bearing 66. The two cord pulleys 731 and 720 are interconnected through the torque clutch 50, e.g. an eddy-current or magnetic-powder clutch, which is controlled by the control apparatus 9. The aforesaid cord pulley 721 is driven by the cord pulley 720 by way of a cord 722.

In this embodiment likewise, the drive speed of the cheese 11 can be exactly adjusted to the desired thread tension, since the torque clutch 50 ensures that the rotation of the cord pulley 731 is transmitted only to the desired extent to the drive pulley 720. As before, therefore, the drive pulley 34 and thus the cheese 11 are not directly driven by the shaft 4, but their speed depends on the control of the torque clutch 50.

Depending on the desired accuracy of control, the torque clutch 50 can be controlled by the control apparatus 9 in a plurality of steps or preferably continuously. Even if the control of the torque clutch 50 is stepped, it is much more accurate than in the known prior art, where different clutches are used alternately.

Since the spur gear drive 7 in Fig. 1 is not controllable, it can likewise be replaced by a cord drive 72.

As Fig. 4 shows, the spool roller 3 can also be driven by way of its outer periphery, and accordingly the spool roller 3 has a drive surface 33 used both for driving it by way of the transmission gear 5 and also for driving the cheese 11. In Fig. 1, for example, the spur gear 70 can be replaced by a friction wheel abutting the said drive surface 33 and driving the spool roller 3 or a drive pulley 34.

According to Fig. 4 the drive shaft 4 is disposed outside the spool roller 3 and drives it from the exterior by way of a transmission gear 5. In the embodiment illustrated, the said transmission gear 5 comprises a cone drive 6 as described with reference to Fig. 1. The cone wheel 62 is connected to a friction wheel 74 and cooperates therewith to drive the spool

roller 3 as a whole or only the drive pulley 34 which, like the friction wheel 74 and the cone wheel 62, is borne by the bearing 66. In this embodiment, the spool roller 3 is mounted on a shaft 39 borne by two bearings 5 390 and 391. The conical cheese 11 is, as before, controlled in the described manner. In this connexion the driven part, rigidly connected to the spool roller 3, of a friction-wheel drive connected behind the transmission gear 5 is formed by the drive surface 33, 10 whereas the drive part of the said friction-wheel drive is formed by a friction wheel 74 connected to the cone wheel 62.

In the embodiments described above, the transmission element 61 of the cone drive 6 and thus the 15 second regulating system 51 are controlled by a control apparatus 9 which in turn is electrically controlled by the thread-tension sensor 90, i.e. the first regulating system 96. In this connexion the design of the thread-tension sensor 90 is basically unimportant. For 20 example it can work without contact and can determine the thread tension as a function of the size of a measured loop or in another suitable manner.

Fig. 5 shows an embodiment in which the transmission element 61 is controlled mechanically by 25 the thread-tension sensor 90. In this connexion, the thread-tension sensor 90, which in order to obtain easy

running consists of plastics material, has a member 91 pivotably mounted with the aid of a retaining means 92 on a shaft 93. The shaft 93 is borne by a bearing 94. The member 91 is resiliently acted upon by a torsion spring 95 which always holds it in abutment against the thread 10 and thus pivots it as a function of the thread tension. For this purpose, one end of a torsion spring 95 is anchored in the bearing 94 and the other end of the torsion spring 95 in the retaining means 92.

The circular end face 920 of the retaining means 92 eccentrically bears a drive pin 921 which engages in a slot 820 of a drive block 82 forming part of a linkage 81 connecting the member 91 to the setting fork 80. The drive block 82 is disposed on a push rod 83, the other end of which bears an additional drive block 84. This additional drive block 84 is connected by way of an angle lever 85 mounted on the machine frame 18 to an additional drive rod 86 guided parallel to the drive shaft 4 with the aid of a guide 87. This drive rod 86 bears the setting fork 80, which with its pairs of drive pins 800 and 801 (only one pin visible in each case) surrounds the transmission element 61 of the cone drive 6 (see also Fig. 1).

In the embodiment illustrated in Fig. 5, the drive block 82 is formed with a slot 820 extending in the direction of motion of the push rod 83, so that small fluctuations in thread tension do not immediately result in a displacement of the transmission element 61. In this way the thread-tension sensor 90 is able to compensate minor fluctuations in the thread tension without causing the transmission element 61 to be displaced. As already mentioned, this thread-tension sensor 90 thus forms a first regulating system 96 for compensating periodic fluctuations in the thread tension, which occur on account of the thread 10 being cross wound by the cross-winding thread guide 17 (see Fig. 1). During the formation of the conical cheeses 11, or during the formation of the first layers on an empty sleeve 22, the said first regulating system 96 is fully sufficient, in order to absorb the fluctuations in the thread tension.

Shortly after the beginning of winding the thread begins to fill up the gaps between the spool roller 3 and the cheese 11 outside the drive surface 33 (see regions 110 and 111 in Fig. 6). The spool volume is thus greater in these regions 110 and 111 than in the driven region 112, so that more thread 10 is wound up in the regions 110 and 111 of greater volume than corresponds to the driving speed of the cheese 11 in its

driven region 112. This leads to an increase in tension in the thread 10, so that the thread-tension sensor 90 is pivoted out of the original range I-II (see Fig. 7) into the range II-III. In this connexion the drive pin 5 921 comes to bear against the drive block 82 and by way of the linkage 81 causes a displacement of the transmission element 61, so that the transmission ratio of the transmission gear 5 is altered. The winding speed of the thread 10 is thus reduced when specific 10 threshold values of the thread tension determined by the abutment of the thread-tension sensor 90 on the drive block 82 are exceeded, so that the fluctuations in the thread tension are brought back into the original range. The thread-tension sensor 90 now moves again 15 into the range I-II, where it compensates the periodical thread fluctuations by oscillation, while the displaced transmission element 61 ensures the higher winding speed.

The transmission gearing 5 thus forms the aforesaid second regulating system 51 for compensating movements 20 in the range of fluctuations in thread tension.

Since these movements in range depend upon the diameter of the cheese 11, the second regulating system 51, in contrast to the embodiment described, can also operate independently of the first regulating system 96. 25 as the second regulating system 51 is controlled as a function of an increase in the diameter of the spool.

It is, however, possible to control the thread tension and also the spool quality more precisely, if the second regulating system 51 can be brought into effect when the specified range of fluctuations in the thread tension is
5 displaced by the first regulating system 96.

The range of the fluctuations in the thread tension, which should have no effect upon the second regulating system 51, can be adjusted in accordance with Fig. 5. As this illustration shows, in order to adapt
10 the accuracy of response to the desired requirements at a particular time, a setting screw 821, which projects into the opening 820 formed as a slot, is provided in the drive block 82 parallel to the push rod 83. The said setting screw 821 can be adjusted to vary the size
15 of the opening 820 and consequently the sensitivity of the apparatus.

If every change in the thread tension has to result in a control movement, the setting screw 821 should be set accordingly or a cylindrical opening for receiving
20 the drive pin 921 should be provided instead of the slot 820.

In order to ensure that when the winding head is inoperative the thread-sensing member 91 can move out of its inoperative position in which it abuts a stop

pin 940 borne by the bearing 94, the two drive blocks 82 and 83 are non-rigidly connected to the push rod 83. As shown in Fig. 5, a resilient coupling element 830 and 833 constructed in the form of a compression spring is provided in front of each drive block 82, 84 respectively (as seen by the observer), the elements 830 and 833 bearing against the push rod 83 by way of a setting ring 831 and 834 respectively. A stop 832 or a drive ring 835 respectively is disposed on the side of each of the two drive blocks 82 and 84 remote from the resilient coupling element 830 or 833 respectively.

In the described design, every movement of the thread-sensing member 91 is transmitted by way of the resilient coupling element 830 or 833 to the drive rod 86.

As shown in Fig. 5, the thread-sensing member 91 abuts a stop pin 940. If the said thread-sensing member 91 is now pivoted away from the stop pin 940, the drive pin 921 moves in a circle, one component of motion of the stop pin 921 disposed in the slot 820 being always oriented towards the coupling element 830. If the drive rod 86 is blocked because the winding head is inoperative and consequently the transmission element 61 cannot be adjusted, the drive block 82 entrained by the drive pin 921 can drive the push rod 83 by way of

resilient coupling element 830 only until the drive ring 835 abuts the drive block 84. Any further movement of the drive block 82 is absorbed by the resilient coupling element 830.

5 When the thread-sensing member 91 moves in the opposite direction towards the stop pin 940, the drive block 82 comes against the drive ring 832. If the drive rod 86 is blocked, so that the drive block 84 cannot follow the motion of the push rod 83, any further motion
10 of the push rod 83 is absorbed by the resilient coupling element 833.

A modification of the apparatus described, by means of which periodic fluctuations in the thread tension are likewise compensated and any exceeding of pre-determined
15 threshold values of the thread tension is additionally prevented by changing the winding speed, is shown in Fig. 6. The first regulating system 96 comprises — like the embodiment illustrated in Fig. 5 — a thread-tension sensor 90 which is mounted so as to be
20 rotatable about an axis 93 and is pre-tensioned by a torsion spring 94 (see Fig. 5). The thread 10 is guided below the member 91 by the draw-off rollers 13, 14, while it is guided above the member 91 by a thread guide 150 held by the machine frame 18.

The thread-tension sensor 90 is constructed in the form of a guide for the push rod 83 which carries a stop 832. This stop 832 is adjustable and occupies a position on the push rod 83 such that the thread-tension sensor 90 can move freely within the range I-II (see Fig. 7) in order to compensate fluctuations periodically occurring in the thread tension, without running up on the stop 832. The adjustment of the stop 832 on the push rod 83 thus determines the boundary of the range I-II with respect to the range II-III and thus the threshold values of the thread tension.

The push rod 83 is guided in a guide 880 at the end of a bell crank lever 88 and is resiliently supported on the said guide 880 by means of a setting ring 834 and a resilient coupling member 833. The bell crank lever 88 is mounted on the machine frame 18 and with its free end embraces a drive pin 802 of the setting fork 80, which is guided by means of two slots 803 and 804 and two guide pins 180 and 181 supported by the machine frame 18 parallel to the drive shaft 4 of the spool roller 3.

The setting fork 80 carries a stop 805 which cooperates with a stationary stop 182 of the machine frame 18. In the embodiment illustrated, one of the stops, namely the stop 805 of the setting fork 80, is adjustable, since it is constructed in the form of a

setting screw. In addition, a return apparatus 89 is provided. In accordance with the embodiment illustrated in Fig. 6 this is constructed in the form of a return spring 890, one end of which is secured to the machine frame 18 and the other end of which is secured to the setting fork 80.

On account of the return apparatus 89, if no forces transmitted from the first regulating system 96 act upon the second regulating system 51, the setting fork 80 and thus also the transmission element 61 are in a normal position which is determined by the stops 182 and 805. The fixing of the normal position causes the transmission ratio of the transmission gear 5 to be fixed. In this way the tensioning pull of the winding head depends upon the arrangement or setting of the stops 182/805. The maximum transmission ratio which cannot be exceeded, i.e. the maximum peripheral speed of the cheese 11, is therefore fixed by the adjustable stop 805.

If the periodic thread tensions move into another tension range as the cheese 11 increases on account of the regions 110 and 111 which have increased to a disproportionate extent and the increased winding speed thus produced, the thread-tension sensor 90 reacts to this by swings as far as the range II-III.

The thread-tension sensor 90 thus strikes the stop 832 and raises the setting fork 80 from the stop 182 by way of the push rod 83 and the bell crank lever 88. In this connexion the setting fork 80 moves the transmission
5 element 61 — e.g. a setting ring — from its normal position, so that it reaches the region of greater diameter of the cone wheel 60 and the region of smaller diameter of the cone wheel 62. The spool roller 3 is therefore now driven at a lower rotational speed in
10 order to avoid movements in the range of the fluctuations in the thread tension, so that even the peripheral speed of the cheese 11 driven by the spool roller 3 is reduced. In this way the winding speed is reduced, the thread tension is relaxed and the
15 thread-tension sensor 90 returns to the the range I-II.

On account of the biasing of the setting fork 80 by the return spring 890, the setting fork 80 has the tendency to return the transmission element 61 into the initial position. The increase in the peripheral speed
20 of the cheese 11 obtained in this way leads again to an increase in the thread tension and thus to a movement of the fluctuations in the thread tension into the range II-III. This cycle is repeated until there is an equilibrium at the transition between the ranges I-II
25 and II-III. In addition, the percentage differences in diameter between the ranges 110, 111 and 112 of the

cheese 11 become increasingly small as the spool increases, so that even the swings of the thread-tension sensor 90 are increasingly reduced.

The return apparatus 89 can also be used in the case of the embodiments illustrated in Figs. 1 to 5. It prevents the thread-tension sensor 90 — when leaving the range I-II — from displacing the transmission element 61 so far that on account of the reduction in the thread tension caused by this the thread-tension sensor 90 must immediately make a counter regulation, e.g. with the aid of a coupling member 830 and a setting ring 831 (Fig. 5). This can give rise to a risk that the fluctuations in the thread tension can finally no longer be compensated, but are increasingly amplified. This is reliably avoided, however, by the return apparatus.

In accordance with Figs. 6 and 7 the thread-tension sensor 90 comprises a lug 900, which extends essentially parallel to the drive shaft 4 and to the spool roller 3. An arm (not shown) of a maintenance apparatus, which can be moved along the machine, can cooperate with this lug 900, in order to pivot the thread-tension sensor 90 from the thread path into the position IV for thread-joining purposes for example. Since the setting fork 80 resting against the stop 182 cannot follow this

movement, the coupling member 833 disposed between the push rod 83 and the transmission element 61. i.e. the setting fork 80, takes the additional path as the thread-tension sensor 90 pivots into the position IV.

5 Another embodiment of a return apparatus 89 is shown in Fig. 8. In this connexion the cone wheel 62 is mounted on a shaft 65 which is at an inclination relative to the drive shaft 4 with the cone wheel 60. Although both cone wheels 60 and 62 have the same degree
10 of conicity, the surfaces of the cone wheels 60 and 62 converge at this inclination, so that a force component P, which tends to return the transmission element 61 into the normal position, acts upon the transmission element 61.

15 In accordance with Fig. 8 this convergence (angle α) can be set by the cone wheel 62 being mounted on a bell crank lever 68 by way of an intermediate lever 67. This bell crank lever 68 is pivotable about a shaft 680, the free end comprising a slot 681 in which a setting
20 eccentric 682 engages. The intermediate lever 67 is acted upon by a compression spring 670 which is supported in an appropriate manner on a stationary part of the machine frame 18.

In accordance with Fig. 9 this convergence (angle α) can be attained by the two cone wheels 60 and 62 having a different degree of conicity (see angles β_1 and β_2), as a result of which a force component P acts upon the transmission element 61, which tends to return it to the normal position. In order to ensure a long service life of the transmission member 61, its inner and outer peripheral surfaces have the same degrees of conicity as the two cone wheels 60 and 62, so that the degrees of conicity of the transmission member 61 and of the cone wheels 60 and 62 match one another.

As the preceding description shows, the subject matter of the invention can be modified in numerous ways. Other modifications can be made by exchanging one feature for another or replacing them by equivalents or combinations thereof, without departing from the invention. Thus, for example, instead of the stops 805 and 182, which are associated with the setting fork 80, a stop can also be provided on which the transmission element 61 runs up, so that this stop defines the maximum setting path of the transmission element 61 in its setting direction.

Claims:

1. Apparatus for winding a thread supplied at constant speed on to a cheese (11) comprising a spool roller (3) bearing the cheese and driving it via its periphery, two
5 regulating systems (96, 5) of which the first (96) compensates periodic fluctuations in thread tension and the second (5) has two cone wheels (60, 62) and compensates movements of range of thread tension by varying the drive speed of the spool roller (3), a
10 transmission element (61) connected to the first regulating system (96) and determining the transmission ratio of the second regulating system (5) and disposed in axially adjustable manner between the cone wheels (60, 62) of the second regulating system (5) and
15 returnable to a normal position by a return device (89), characterised in that the transmission element (61) is associated with an abutment (805) for determining a normal position of the transmission element (61) determining the maximum transmission ratio of the
20 transmission gear (5).

2. A device according to claim 1, characterised in that the adjustable abutment (805, 802) is associated with a setting fork (80) for the transmission element (61) and actuated by the return device (89).



3. A device according to claim 2, characterised in that the adjustable abutment (805) is disposed on the setting fork (80).
4. A device according to one or more of claims 1 to 3, characterised in that the return apparatus (89) is constructed as a return spring (890).
5. A device according to one or more of claims 1 to 4, characterised in that the return apparatus (89) is constructed in the form of converging surfaces of the cone wheels (60, 62).
6. A device according to claim 5, characterised in that the cone wheel (62) forming the driven part is mounted on a shaft (65) which is inclined relative to the drive shaft (4) which carries the cone wheel (60) forming the drive part.
7. Apparatus according to claim 6, characterised in that the inclination of the shaft (65) of the cone wheel (62) constituting the driven part is adjustable.
8. Apparatus according to claim 7, characterised in that the adjustable shaft (65) is mounted on a lever (68) with which a setting cam (682) is associated.



9. Apparatus according to claim 5, characterised in that the cone wheels (60, 62) have various degrees of conicity.

5 10. Apparatus according to claim 9, characterised in that the surfaces of the transmission element (61) have various degrees of conicity adapted to the conicity of the cone wheels (60, 62).

10 11. A device according to one or more of claims 1 to 10 for manufacturing conical cheeses, characterised in that the transmission gear (5) is disposed on the smaller-diameter end of the conical cheese (11) inserted into the spool apparatus.