Sept. 13, 1960 C. G. NEWTON 2,952,393

YARN TENSION COMPENSATOR

Filed May 6, 1957

Fig. 1.

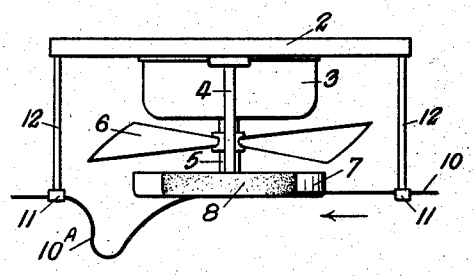


Fig. 2.

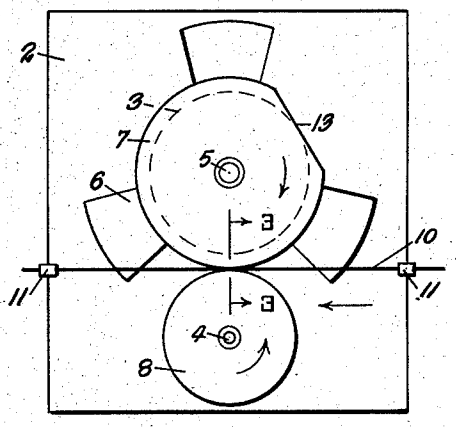


Fig. 4.

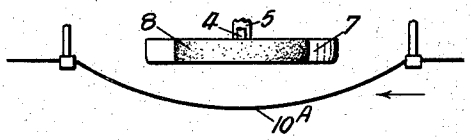


Fig. 3.

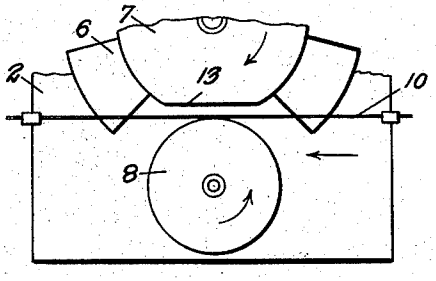


Fig. 5.

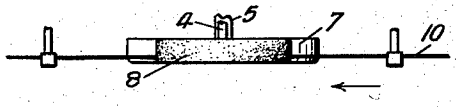


Fig. 7.

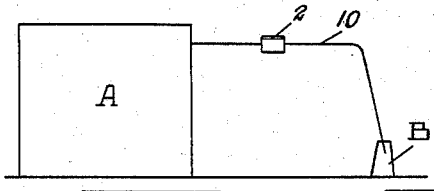


Fig. 6.

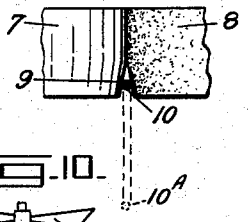


Fig. 8.

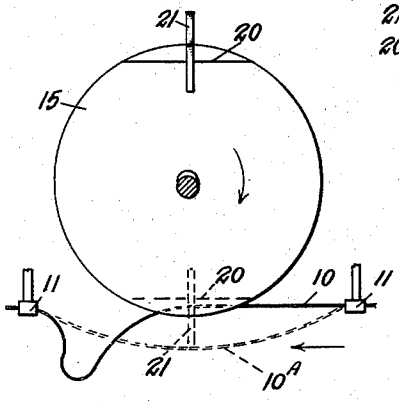


Fig. 9.

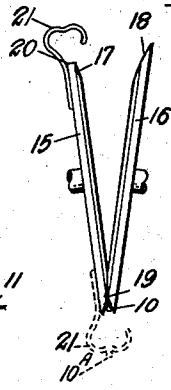
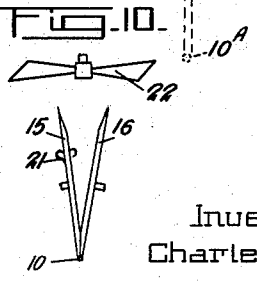


Fig. 10.



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United States Patent Office 2,952,393
Patented Sept. 13, 1960

2,952,393

YARN TENSION COMPENSATOR

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Filed May 6, 1957, Ser. No. 657,150

3 Claims. (Cl. 226—97)

This invention relates to a yarn tension compensating device, the purpose of the invention being to provide a device into which yarn is drawn from its cone and fed to a knitting machine, or any other yarn take-up element, at a predetermined constant substantially zero tension.

As is well known to those endeavouring to maintain quality control of goods knit of synthetic yarns, such as in the production of nylon hosiery, the variations in unwinding tensions of cones or tubes of yarn are amongst the major factors contributing to hose length and width variations and that the solution of this problem would be to constantly feed yarn to the predetermined tensioning member of the knitting machine at zero tension whereby the yarn at the point where it is taken up by the needles never varies in tension or stretch.

The object of this invention is to provide a simple device which will automatically compensate for variations in yarn cone or tube unwinding tensions and consistently deliver the yarn at substantially zero tension and at a self adjusting speed of feed proportionate to the knitting requirements; the device broadly comprising a pair of driven rollers running face-to-face and between which yarn is intermittently nipped to be drawn by the rollers and consequently intermittently stripped from its cone or tube, the arrangement being such that the peripheral speed of the rollers is somewhat greater than the maximum speed of yarn flow required by the knitting, the yarn being periodically released from the nip of the rollers whereby the device supplies a rapid succession of tension free loops of yarn to be taken up by the knitting, the length of and rapidity of formation of the loops being proportionate to the speed of yarn flow required by the knitting.

A further and particular object of the invention is to form the periphery of one roller with one or more flats whereby the yarn is released from the nip between the rollers each time a flat is in a position opposite to the other roller, the released yarn being ejected from the path of nip of the rollers either by an air draft directed transversely of such path or by an ejection arm mounted to rotate with the rollers, and whereby the yarn is moved to arch free of the rollers each time it is released from the nip by a flat.

Another and very important object of the invention is to provide a device wherein the tension produced in the yarn is solely directed to stripping the yarn from its cone or tube, the device at no time creating any tension in the yarn passing therefrom.

With the foregoing and other objects in view, as shall appear, the invention relates to a yarn tension compensating device all as hereinafter more particularly described and illustrated in the accompanying drawing in which:

Fig. 1 is a side elevational view of the device incorporating an air draft creating fan and showing the yarn nipped and being pulled by the rotating rollers.

Fig. 2 is an inverted plan view of the device in the same moment of movement as shown in Fig. 1.

Fig. 3 is a similar view to Fig. 2 and showing the rollers rotated to a position wherein a flat on one of the rollers is opposite to the face of the other roller, thereby forming a gap for release of the yarn from the nip.

Fig. 4 is a side view of the lower portion of the device wherein the rollers are in the position shown in Fig. 3, the yarn being released in the form of an arched loop thereunder.

Fig. 5 is a similar view to Fig. 4 showing the yarn at the moment of straightening and re-entering the nip of the rollers as the knitting is finally taking up the arched yarn loop as shown in Fig. 4.

Fig. 6 is an enlarged fragmentary view of the contacting portions of the pair of yarn nipping rollers, as taken through the line 3—3, Fig. 2.

Fig. 7 is a schematic view showing the relationship of a cone of yarn, the device and a knitting machine.

Fig. 8 is a side view of an alternative arrangement wherein the pair of nipping rollers are arranged at an inclination to one another, one roller carrying a yarn ejection arm in the vicinity of its flat.

Fig. 9 is an end view of the arrangement shown in Fig. 8, and

Fig. 10 is a schematic view similar to Fig. 9 and showing the inclusion of an air draft creating fan.

In the device, as illustrated in Figs. 1 to 6, the assembly is suspended from a suitably mounted plate **2** carrying upon its under face a motor **3** and an adjacent vertical spindle **4**. The vertical motor shaft **5** carries a fan **6** intermediately of its length and a roller **7** upon its lower end, the fan and roller rotating in unison with the motor shaft and the fan directing its air draft downwardly. A second roller **8** is rotatably mounted upon the lower end of the spindle **4**, being in frictional contact with the roller **7** and rotated thereby. The bottom corners of the rollers **7** and **8** are beveled to form at the rollers point of contact a jaw **9** within which the yarn is nipped, as shown in Fig. 6. In order to insure a slip free nipping action, one of the rollers as the roller **8**, preferably has a rubber-like face.

To guide the travelling yarn **10** in a path coincident with the nip jaw **9** at the point of contact of the rollers it is passed through a pair of eyes **11** in pendant brackets **12** on opposite sides of the device, the eyes and nip jaw being in alignment whereby the yarn in lifting from the position shown in Fig. 4 to the position shown in Fig. 5 enters the nip jaw **9** of the rollers, and as also shown in the transition from the dotted line position to the full line position, Fig. 6.

To periodically release the travelling pulled yarn from the nip of the jaw **9** as the rollers rotate, one of the rollers is formed with one or more peripheral flats dependant upon the relationship between the maximum speed of yarn flow required by the knitting and the size of the driving roller and its peripheral speed. In the illustrated device, the roller **7** has a single flat **13**, Fig. 3 showing the release of the yarn from the nip when the flat is opposite the face of the roller **8**.

Operation

In describing the operation of the invention, it is assumed that the knitting machine A is knitting hosiery from nylon yarn and that the speed requirements of the knitting machine is 8000 inches of yarn per minute. As the basis of the invention contemplates that the yarn be intermittently drawn off the cone B at a somewhat greater rate of flow than the speed of the knitting it is desirable that the driven roller **7** be of such diameter and have such a rotative speed that its peripheral velocity is somewhat greater than 8000 inches per minute.

As shown in Fig. 1, the yarn **10** travelling in the direction of the arrow is being drawn from the cone B by

the nip of the rollers, Fig. 2, at a greater speed than the knitting requirements and whereby a reserve tension free overfed loop of yarn **10A** is formed, the formation of the loop continuing until the flat **13** in the roller **7** rotates to a position opposite to the roller **8**, Fig. 3, and whereby the nip in the yarn is neutralized and the yarn loop blown downwardly by the breeze from the fan **6** into the position shown in Fig. 4.

While the knitting is taking up the tension free reserve yarn loop the rollers **7** and **8** are rotating to re-contact one another, as in Fig. 2, and whereby the yarn loop in being taken up by the knitting re-enters the nip **9** of the rollers, moving from the position shown in dotted lines to the position shown in full lines in Fig. 6. As the peripheral speed of the driven roller **7** is greater than that of the yarn speed requirements of the knitting no tension is put upon the yarn in its passage from the device to the knitting machine as the diminishing loop re-enters the nip of the rollers as shown in Fig. 5.

It will be appreciated that the sizes of successive reserve overfed loops **10A** will depend upon the speed of yarn take up by the knitting which governs the distance from the flat **13** of the point at which the yarn enters the nip, the maximum loop being that wherein the yarn enters the nip just as the flat has moved away from the roller **8** and the minimum loop wherein the yarn enters the nip just before the flat moves into position opposite the roller **8**. As in practice, a roller **7** having, for example, a circumference of four inches rotates approximately two thousand times per minute it will be appreciated that the formation and taking up of the reserve loops **10A** is very rapid. At such times as the knitting machine ceases to call for yarn it is not necessary to stop the device as the last loop formed by the yarn in coming to a standstill will hang stationary free of the rollers in the same manner as shown in Fig. 4.

In considering the invention being used in conjunction with a machine knitting fine gauge seamless nylon hosiery and of the 400 or 474 needle type, the yarn flow rate to the needles commonly varies within the range of 5000 inches per minute minimum to 8000 inches per minute maximum dependant upon the rate of rotation of the needle cylinder and the part of the stocking being knit, the maximum yarn flow rate being in the knitting of the welt which rate gradually diminishes to the minimum in the foot. It will thus be appreciated that under maximum demand yarn flow rate the overfeed loops **10A** will be smaller than at minimum demand yarn flow rate. In order to obviate the yarn re-entering the path of the nip of the rollers at the instant when the flat **13** is opposite to the roller **8** at which instant the yarn might conceivably be pulled by the knitting machine needles directly from the cone, the peripheral speed of the roller **7** and the size of its flat **13** in relation to the range of the demand yarn flow rates can be so calculated that the flat **13** is never opposite to the roller **8** when the yarn re-enters the path of the nip.

Figs. 8, 9 and 10 show an alternative arrangement wherein two rollers **15** and **16** are arranged in contact at an inclination to one another, the contacting face portions **17** and **18** of the rollers being beveled to form the yarn nip **19** at their point of contact. The driven roller **15** is formed with a nipped yarn releasing flat **20** and also carries a yarn ejection arm **21** in the vicinity of the flat and whereby such arm in its rotation engages the yarn **11** as the flat **20** moves into the nip neutralizing position and thus ejects the yarn into the roller free position shown in dotted lines in Fig. 8.

Fig. 10 schematically shows a driven fan **22** positioned above the rollers **15** and **16** and having the same action on the yarn as the fan **6**, it being possible to use either the fan or the arm for the ejection of the yarn or if desirable to use both the arm and the fan. While the device has been described as used in conjunction with a knitting machine it will be appreciated that it may be put to many other uses where the feeding of tension free yarn is required.

What I claim as my invention is:

1. A device of the character described for pulling yarn from a yarn supplying element and feeding it to a driven element taking up the yarn and comprising a pair of yarn pulling rollers having contacting peripheral faces forming a yarn nip and between which faces the yarn is drawn from the yarn supplying source, a portion of the peripheral face of one roller being spaced away from the peripheral face of the other roller to form a gap in the nip, power means for rotating the rollers at a speed whereby they pull the yarn from the yarn supplying source at an unvarying speed which is greater than the speed at which the driven element takes up the yarn, the rotation of the rollers forming a loop of overfed yarn between the rollers and the yarn taking-up element, and means for removing the looped yarn from out of the gap and the nip in the rollers and permitting the yarn to return into the nip of the rollers when the over fed yarn loop has been taken up by the yarn taking-up element.

2. A device as claimed in claim 1, wherein the means for removing the yarn from out of the gap and the nip of the rollers is a mechanically created current of air tending to blow the yarn away from the path of the nip of the rollers.

3. A device as claimed in claim 2, wherein the current of air is created by a driven rotating fan creating a current of air directed towards the nip of the rollers.

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