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Harris

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[54] **DRAWING APPARATUS**

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[63] Continuation of Ser. No. 129,026, March 29, 1972, abandoned.

[52] **U.S. Cl.** ..... **28/71.3**; 264/290 R

[51] **Int. Cl.**[2] **D02J 1/22**

[58] **Field of Search** 28/71.3; 264/290

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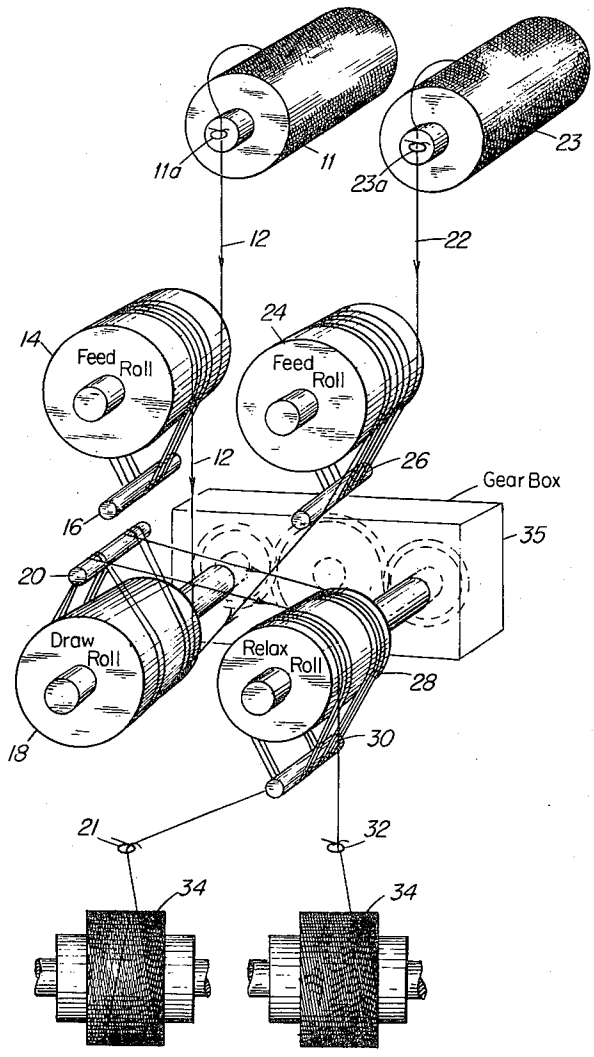
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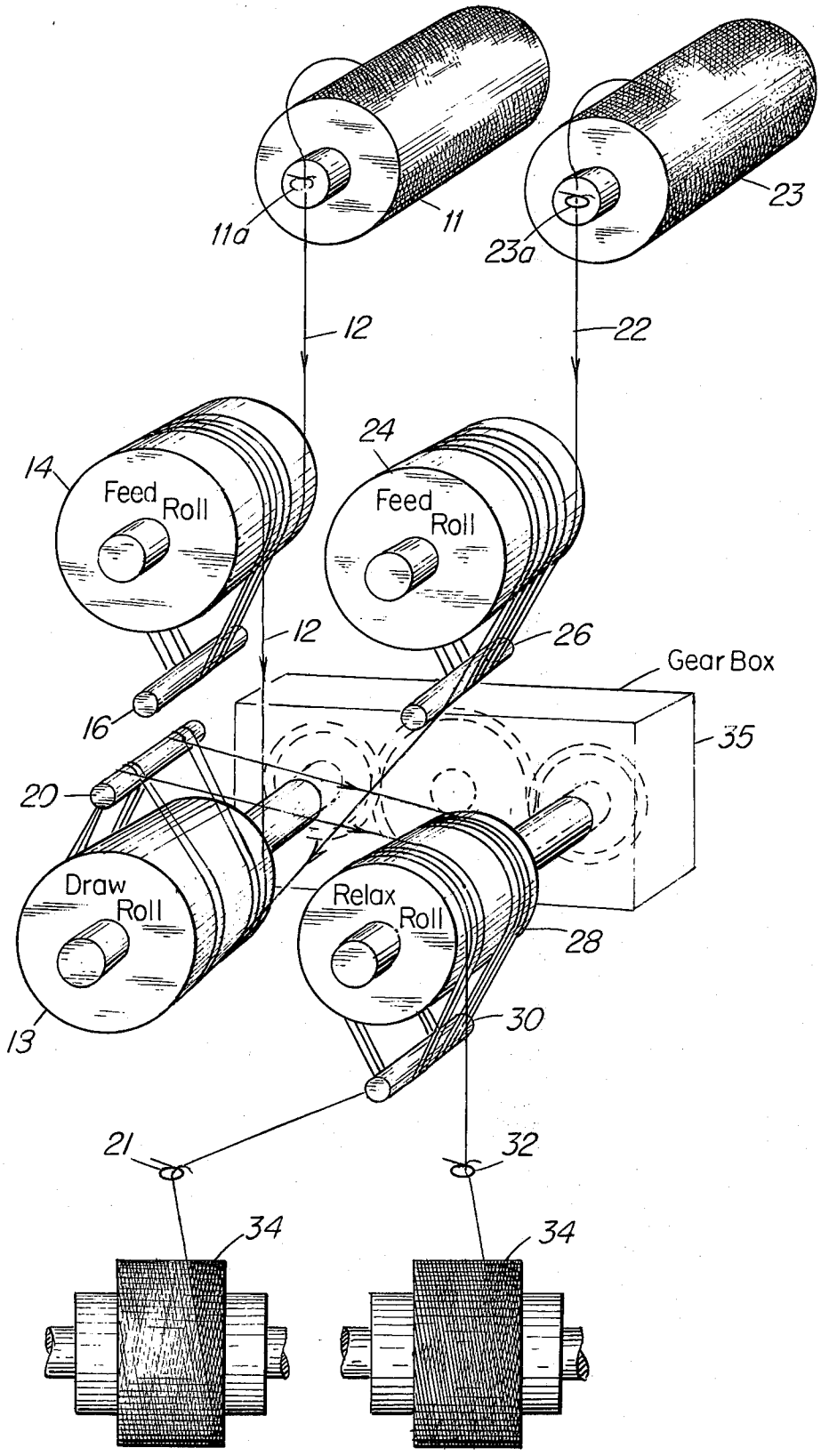
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[57] **ABSTRACT**

An apparatus and method is disclosed and claimed for increasing the capability of a standard draw frame comprised of at least two rolls, by utilizing at least one other adjacent draw frame in conjunction with the first draw frame to effect a greater number of stretch and/or relax stages than there are rolls in the individual draw frame. The product produced by this method and apparatus is a heat stable uniform filament yarn of uniform shrinkage for use as sewing thread and the like.

6 Claims, 1 Drawing Figure





Take-up Rolls

DRAWING APPARATUS

This is a continuation of application Ser. No. 129,026, filed Mar. 29, 1972, now abandoned.

This invention relates to the drawing of synthetic thermoplastic yarns and in particular to an improvement in the apparatus used for said drawing wherein the apparatus includes at least two adjacent draw frames wherein the draw frames are comprised of at least one feed roll and one draw roll.

Drawing, or elongation of synthetic thermoplastic yarns in the solid state, is required to orient the macromolecules comprising the individual filaments of the yarn thereby imparting strength to the yarn itself. Several types of drawing apparatus have been devised for carrying out the drawing step. One commonly used method is to feed an undrawn yarn around a first driven roll or roll set usually referred to as the feed roll or feed rolls, then to a second driven roll or roll set, usually referred to as the draw roll or draw rolls, rotating at a higher peripheral speed than the first driven roll. The first driven roll may be heated to facilitate elongation of the filaments and sufficient wraps of filamentary yarn are taken around the feed roll such that substantially all the drawing takes place substantially near the point at which the yarn leaves the feed roll. It is known to heat both the feed roll and the draw roll, however, adequate drawing may be achieved by maintaining either the feed roll or draw roll at ambient temperatures. The ratios of the peripheral speed of the draw roll to that of the feed roll is termed the draw ratio.

It has been found, however, with respect to the hereinbefore defined drawing process that the resultant yarns are found to vary in their degree of contraction upon takeup, standing or especially when heated dry or in hot or boiling water because of takeup tension variations. One technique for imparting uniformity to the product is to include in the draw frame a third roll, called a relax roll for imparting a controlled relaxation to the drawn yarn. In the past, however, for a manufacturer to add a controlled relaxation step to his drawing process meant either the purchase of machinery having at least a three roll draw frame or the purchase of additional rolls and the extensive modification of the customary two roll draw frame to provide for a three roll draw frame. Needless to say, the former method is economically unattractive due to a high initial outlay of capital and the possible resultant nonuse of the original machine containing the two roll draw frame while the latter also requires a high expenditure of capital to modify equipment.

In accordance with the present invention, a method is particularly described for converting a machine comprised of two roll draw frames to act as a machine comprised of three roll draw frames, thus allowing the inclusion of a contolled relaxation step without substantial modification to existing machinery or a large outlay of capital to either improve existing machinery or purchase new machinery. Of particular advantage is the ability to maintain the original two roll capacity in such conversion, notwithstanding the elimination of alternating draw rolls and the modification thereof so as to effect a third roll which would be expected to reduce the total machine capacity by at least 50 percent. To the contrary, applicant has cut the total production cost of his process by means of eliminating at least half of his heated draw rolls, while maintaining the total machine capacity.

THE INVENTION

This invention relates to modifying a drawing machine comprising a plurality of draw frames each of which has at least two rolls. The term draw frame employed herein refers to a group of rolls or roll sets, preferably two, to process a single source of synthetic thermoplastic yarn from a separate feeding source, e.g., a supply package or directly from an extrusion machine. Normally in this standard drawing machine at least two yarns in spaced parallel relationship are fed to a feed roll and subsequently passed to a draw roll and then collected by means of a ring and traveler takeup or other collecting means well known in the art. By the term yarn is meant monofilament or multifilament comprising up to 1,000 filaments or higher as is well known to those skilled in the art.

Stated another way, this invention is directed to an apparatus comprising at least two adjacent draw frames wherein each draw frame has n rolls, wherein n is an integer of from 2 to about 4 wherein the rolls are utilized in such a manner so as to effect a draw frame of $n + x$ rolls wherein x is an integer of from 1 to about 4.

More particularly, this invention preferably relates to modifying the draw frames in a standard drawing machine by providing a yarn or thread line path incorporating a pair of adjacent draw frames wherein the yarn during at least a portion of its treatment is passed between the adjacent draw frames and is treated (i.e., drawn and/or relaxed) in the adjacent draw frame. Thus, first and second stage drawing may be accomplished between vertically or horizontally aligned rolls and the yarn may then be passed in the same or in an adjacent draw frame to a further draw roll or relax roll. Preferably, this invention is implemented by removing alternate draw rolls and substituting therefor unheated relax rolls.

The unheated relax rolls may either be of slightly smaller diameter compared to the draw roll so as to impart a controlled relaxation or of equally or greater diameter if a suitable gearing arrangement is employed so as to effect a relax condition, i.e., the linear velocity of the relax roll must be lower than the linear velocity of the draw roll. Accordingly, with reference to two adjacent parallel lines, each line would employ the feed roll of their respective adjacent draw frames, however, both lines would employ the same draw roll located in the first draw frame and then would pass to the second draw frame and use its modified draw roll as a relax roll, thus effectively allowing a machine comprised of two roll draw frames to be employed as a machine comprised of three roll draw frames. It is of course understood that the manner of stringup of the yarn on the adjacent draw frames is optional to effect a plurality of stages, e.g., draw and/or relax, as hereinafter set forth.

With reference to the drawing, there is shown two adjacent draw frames of a standard multiple yarn drawing apparatus in which there is normally provided a plurality of draw frames. Two yarns 12 and 22 comes from spun yarn bobbins 11 and 23 via pretensioners (not shown) and pass several turns about their respective feed rolls 14 and 24 and their respective associated separator rolls 16 and 26. Both yarns 12 and 22 next move to draw roll 18 which is the draw roll normally associated with feed roll 14. The yarns pass several turns about draw roll 18 and associated separator roll 20 and then move in parallel to relax roll 28 which is posi-

tioned relative to its feed roll **24** substantially in the manner of draw roll **18** relative to its feed roll **14**; relax roll **28**; however, in this instance is not heated and its outer diameter is slightly smaller than that of draw roll **18**. Gear box **35** controls the amount of relaxation between the draw roll and relax roll. After the two yarns pass several wraps about relax roll **28** and its associated separator roll **30**, yarn **12** passes to pigtail guide **21** of the takeup **34** while yarn **22** passes independently to another pigtail guide **32** of the takeup **34** associated with its particular position on the machine. In this manner feeding, drawing and relaxing, normally requiring a three roll draw frame are carried out on a machine comprised of two-roll draw frames.

Although the above described modification is the preferred apparatus of this invention, it is possible to utilize the concept of this invention to achieve a greater degree of flexibility in drawing operations with the expenditure of relatively little time or capital by employing three adjacent yarn lines running in parallel fed to their respective feed rolls and thereafter all three lines employ a common draw roll. At this point the three parallel lines could then be fed to a relax roll of one of the lines and then collected which would mean that of the three draw rolls in the respective draw frames only one would be used as such, the second draw roll would be converted to a relax roll as hereinbefore described and the third draw roll would be left idle. The operator would also have the flexibility of utilizing two of the draw rolls as such and converting the third draw roll to a relax roll thus effecting a two stage draw and relax on a two roll draw frame. Therefore one could also utilize this invention to effect a four roll draw frame while only having a two roll draw frame. Substantially more alternatives are possible if the feed rolls are employed as draw rolls, thus having the adjacent yarn lines fed to a common feed roll. In this manner it is possible to employ a stringup to effect a four stage draw, or three stage draw/relax using two adjacent draw frames having two rolls each. Other stringup arrangements can be envisaged employing a plurality of adjacent draw frames which would be apparent to one skilled in the art upon having learned of this invention.

This concept could also effectively be employed in an entire bank of draw frames wherein a plurality of adjacent parallel lines of yarn are fed from their respective feed rolls to a common draw roll and thereafter it would be the operators option as to how many draw stages and/or relax stages would be utilized. It should be noted however that as more lines are included on the one draw roll, the draw roll will usually have to be modified by a lengthening process to accommodate the plurality of lines being fed thereto.

Accordingly this invention is directed to an apparatus comprising at least two adjacent draw frames wherein each draw frame has n rolls, wherein n is an integer of from **2** to about **4** wherein the rolls are utilized in such a manner so as to effect a draw frame of $n + x$ rolls wherein x is an integer of from **1** to about **4**. As hereinbefore discussed, n is most preferably **2** such as is found in a conventional **2** roll draw twister and x is preferably **1** or **2** and most preferably n is **1**.

This invention is particularly suited to employing a machine comprised of two roll draw frames to effect a machine comprised of three roll draw frames so as to include a controlled relaxation to the heat set drawn yarn. The product produced by this technique is a heat stable uniform filament yarn of uniform shrinkage. In this preferred embodiment it has been found preferable to maintain the feed rolls at a temperature of from **80°** to about **110°C.** and most preferable about **90°C** while the draw rolls are maintained at a temperature of from **150°** to **245°C.** and preferably from about **180°** to **245°C.** and most preferably about **235°C.** at a draw ratio of from about **1.1** to **1** to about **7.0** to **1** and most preferably about **5** to **1**. It is preferred to maintain the relax roll at ambient temperatures and impart a relax of from **0** to about **50** percent relaxation or higher, however, it is preferred to impart a relaxation of from **0** to about **12** percent and most preferably about **8** percent.

It is of course understood that other materials may be produced with slight modification such as a uniform dye uptake yarn for wearing goods apparel fabric and the like produced through a two stage draw with no controlled relaxation.

Any synthetic thermoplastic yarn produced from a filament-forming polymeric material which may be oriented and strengthened by drawing may be drawn using the improved drawing apparatus of this invention. Accordingly such filament-forming polymeric materials as polyesters, polyamides, polyolefins, polyacetals, cellulose esters, acrylics, modacrylics, spandex, polyvinylchlorides and the like. Particularly preferred are polyesters and most preferred is polyethylene terephthalate, although as hereinbefore mentioned, the apparatus of this invention may be employed by a fiber-forming polymeric material capable of being drawn.

The following example is offered to illustrate the practice of this invention employing the apparatus as depicted in the drawing. It is understood that many variations of this process may be made, as hereinbefore discussed, without departing from the spirit of this invention.

EXAMPLE

Polyethylene terephthalate yarn of **0.745** intrinsic viscosity as measured in orthochlorophenol at **25.00°** ± 0.02°C. comprising **24** filaments of **4.58** denier each was passed through a tension gate to a feed roll wherein about **0.5** percent draw was imparted. The feed rolls, maintained at about **90°C.** advanced the yarn to a common draw roll heated to **235°C.** whereby the draw ratio was **4.91**. Multiple passes about the respective feed and common draw rolls and their associated separator rolls ensured that the yarn was at substantially the temperature of the rolls. From the common draw roll, the yarn next was passed to a common relax roll maintained at ambient temperature so as to impart a controlled relaxation of about **8** percent. The yarn was then collected with ring and traveler takeups. The filaments had a tenacity of **7.8** grams per denier, elongation of **17.4** percent, an initial modulus of **76** grams per denier, a shrinkage in hot air at **350°F.** of **6.6** percent.

What is claimed:

1. In a multiple yarn drawing apparatus comprising a plurality of adjacent draw frames of at least two rolls, said two rolls being a feed roll and a draw roll, said apparatus having means for separately feeding individual yarns to said feed rolls of the separate rdraw frames, said draw frames having means for directing said separately fed individual yarns to said draw rolls of said separate draw frames and having means for collecting the drawn yarns, the improvement comprising utilizing said

rolls to effect a draw frame of n rolls + x rolls, wherein n is an integer of from two to about four and represents the actual number of rolls in each draw frame and x is an integer having a value of from one to about four, said improvement providing means for directing at least two yarns, being fed to separate adjacent draw frames, from separate feed rolls to a single draw roll, means for directing said separate yarns from said single draw roll to at least one other single draw roll located in a second draw frame.

2. The apparatus of claim **1** wherein said rolls are roll sets.

3. The apparatus of claim **1** wherein n has a value of two and x has a value of from one to two.

4. The apparatus of claim **3** wherein said other single draw roll is operated at a lower linear velocity than said single draw roll so as to effect a controlled relaxation.

5. The apparatus of claim **4** wherein said other single draw roll is of smaller diameter than the diameter of said single draw roll.

6. The apparatus of claim **4** wherein a gearing arrangement is employed on said other single draw rolls.

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