July 26, 1960 KIMIO KUROIWA ET AL 2,946,526

CONTINUOUS METHOD FOR WINDING UP YARNS

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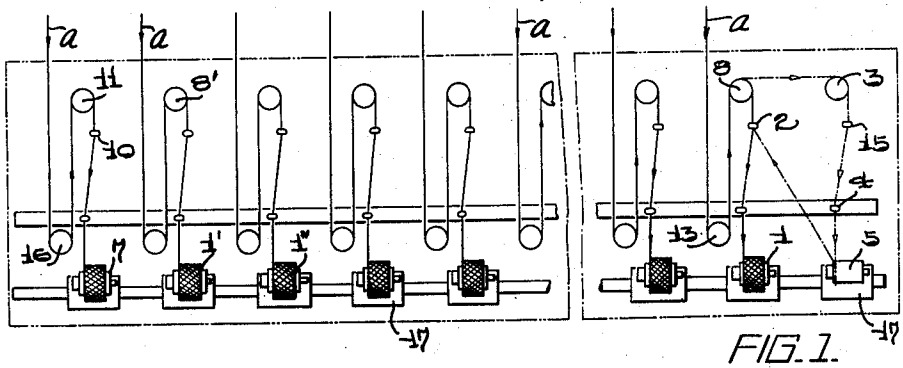


FIG. 1.

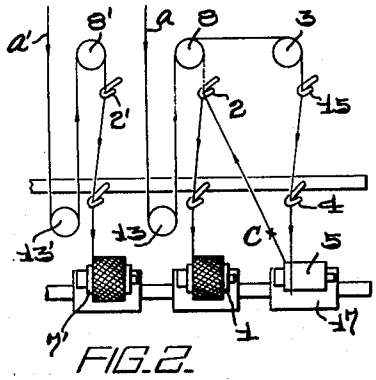


FIG. 2.

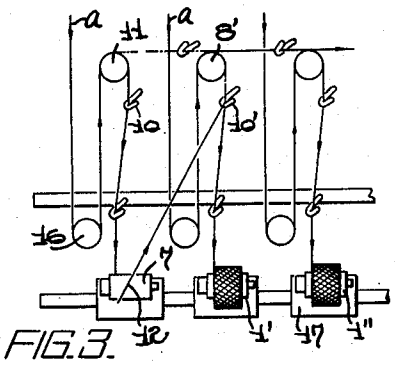


FIG. 3.

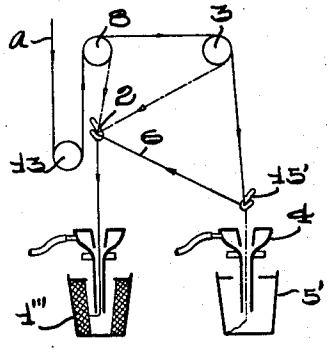


FIG. 5.

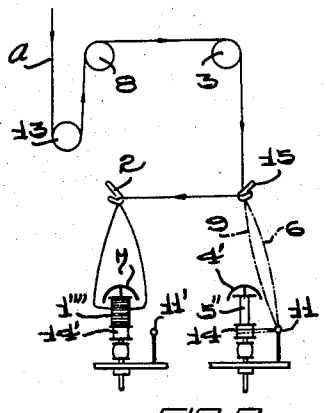


FIG. 6.

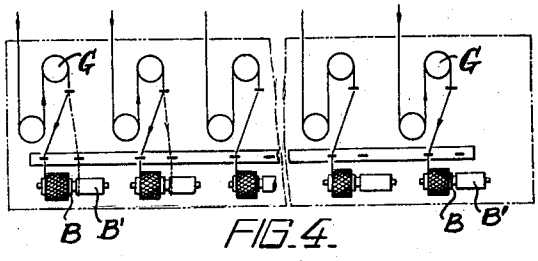


FIG. 4.

PRIOR ART

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CONTINUOUS METHOD FOR WINDING UP YARNS

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1 Claim. (Cl. 242—18)

This invention relates to methods for winding yarns.

In this specification and the appended claims, "yarn" is intended to mean, yarn, thread, rope and string and all other thread-like materials of polymerized compounds such as rayon, semi-synthetic fiber and synthetic fiber, synthetic resin, glass fiber and the like, and "package" is intended to mean a body of "yarn" wound by drum winding, pot winding, ring winding, spool winding, or other winding methods, including the use of bobbins and cakes, irrespective of the method of winding or the shape of the body of yarn.

This invention may be applied generally to:

(1) Drum winding: a type of winding in which a package is rotated by a driving drum contacting the circumference of the package;

(2) Pot winding: a type of winding in which a cake of yarn is formed by the centrifugal force of the yarn itself in a pot rotating at a high speed;

(3) Spool winding: a type of winding in which a spindle having wound yarn thereon is positively driven and the rotation of the spindle is controlled by the tension of the yarn;

(4) Ring winding: a type of winding in which yarn is wound on a bobbin mounted on a spindle while twist is given to the yarn by a ring and a traveller or a cap; this application is also applicable to other types of winding as well.

In known winding methods, in which the material is extruded by an extruding device and the speed of taking up is controlled by a godet rotating at a constant speed below the extruding device by utilizing the circumferential speed of said godet and the winding operation effected to form a desired package, there have been four types of operations as follows:

(1) A type in which yarn is wound up on the inside surface of a pot revolving at a high speed to form a cake by the centrifugal force of the yarn itself, the yarn being introduced into the pot through a funnel making a traverse motion up and down from the center of the pot;

(2) A type in which an apparatus is employed that comprises a device for rotatably supporting a package on the axial center of winding, a drum for giving rotation of the package by the circumferential contact and a guide making a traverse motion, and the axial center of winding is so arranged as to be moved away from the driving drum as the cake grows;

(3) A type in which a package is formed on a bobbin rotated by a spindle positively driven, the yarn being so arranged as to make a longitudinal traverse motion in relation to the package, and the winding up speed being maintained constant by maintaining the tension of the yarn constant thereby controlling the rotation of the spindle; and

(4) A type in which a package is formed on a bobbin mounted on a spindle revolving at a constant speed while twist is given to the yarn by a ring and a traveller or a cap.

In these types of winding, as described above, one godet or a set of two godets is provided for each extruding device, and one or two winding up units are used for winding the yarn. With one winding unit, when the package has become full, it is necessary to cut the yarn and to wind the cut end around the godet roller and to replace the center of the package with a new one, and then to cut the yarn again and wind the cut end around the new center. It is a difficult task to wind the cut end which is being delivered continuously at a high speed since there is only a short time available. To make such an operation less desirable, it involves a great loss of yarn which may amount to as high as 2% when yarn of coarse denier is wound up at a high speed, inasmuch as the portion of yarn wound on the godet in the operation becomes waste. This loss will be increased to maximum in the winding of undrawn yarn where a stretching process is absolutely necessary as in the case of synthetic fiber, for example, when undrawn yarn is spun and wound in the production of staple fiber of synthetic fiber, or when undrawn yarn is spun and taken up in the production of yarn of coarse denier for tyre cord.

When two "winding up" units are provided for one extruding device, yarn is to be wound alternatively on either of the two winding centers (B) (B') which are mounted in alignment in positions including a relatively large angle between them from one godet roller as shown in Fig. 4, and hence the swinging of the yarn to the right or left from the vertical line passing through the center of the godet roller (G) will become great and change the tension or increase the difference of the degree of stretching of the yarn thereby causing various disadvantages in the quality of the yarn such as irregularities in the shape of the wound up package, the denier and elongation of the yarn, the increase of braking of yarn and the like. Further, the cost of the plant will be increased inasmuch as two winding up devices in alignment provided for each extruding device will necessarily increase not only the cost of apparatus itself but also the floor space required by increasing the distance between the spindles.

According to the invention, the winding up apparatus comprises a plurality of extruding devices, a set of godet rollers of the same number as the extruding devices, continuous winding up units of the same number and associated with the godet roller respectively, an extra godet roller in addition to the group of godet rollers mentioned above and an extra winding up device in reserve; and the method of continuous winding up of this invention is characterized in that when the package has become full, the winding up operation is not suspended but is shifted to an adjoining winding up device to continue the operation. According to this invention, the loss of time in operation due to suspension as well as the loss due to waste will be eliminated completely and thus it is possible to attain 100% efficiency and yield. There will be neither the beginning end of yarn of extra coarse denier as produced in the conventional method in winding up of undrawn yarn of synthetic fiber requiring stretching process, nor the beginning end of fine denier of semi-drawn yarn as produced in the conventional method in some cases. When the invention is applied to pot winding, ring winding or cap winding, the yarn obtained will have a uniform twist from the beginning to the end of the yarn and no irregularity of the twist will be found at any portion of the yarn.

When this invention is applied, the package is formed vertically below the godet roller thereby minimizing the swinging motion of the yarn, and thus the undesirable effect on the quality of the yarn as caused when a twin taking up apparatus is employed will be completely

eliminated. As a result, the formation of excellent packages may be achieved and the ballooning tension in the subsequent drawing process will become very uniform. This brings about a great advantage in the drawing process of synthetic fiber required by the fact that it prevents yarn breakage and allows an increase of the drawing speed in the drawing process. This invention also makes it possible to economize not only in the cost of the construction of the apparatus but also in the plant since it requires less floor area. Advantages to be obtained by this invention are too numerous to enumerate but other advantages will become apparent as the explanation of the embodiments of this invention proceeds with reference to the accompanying drawings, in which:

Fig. 1 is a general diagrammatic front view of the apparatus according to this invention in which the bobbins are full and the bobbins are to be replaced with new empty bobbins from left to right one by one starting from the full bobbin at the right end;

Fig. 2 is a detailed view of a part at the right end of Fig. 1, in a larger scale, showing the operation for stopping the winding up operation from right to left before the replacement of the bobbin;

Fig. 3 is a detailed view of the part at the left end of Fig. 1 in a larger scale, and showing the apparatus in which the winding up operation with respect to each extruding device has been removed from right to left and the bobbins are full excepting the one at the left, the full bobbins being about to be replaced with new empty bobbins one by one starting from the full bobbin at the left end;

Fig. 4 is a view similar to Fig. 1, but showing a conventional apparatus which has two taking up devices for each extruding device;

Fig. 5 is a view similar to Fig. 2 but showing the yarn being wound by pot winding to form a cake; and

Fig. 6 is a view similar to Fig. 2, but showing the yarn being wound by cap winding to receive a twist during the winding up operation.

Fig. 1 illustrates a system which has one extra godet roller **3** and an extra bobbin **5** at the end of a continuous spinning machine. Yarn (*a*) passes over rollers **13**, **8** and through a guide **2** to a bobbin **1** to be wound thereon. When the bobbin **1** is fully wound, the yarn to be wound has to be shifted from the bobbin **1** to the bobbin **5** at the right end. For this shift, the portion of yarn between the roller **8** and the guide **2** is taken and passed over the roller **3** and through the guide **15** associated with the bobbin **5** while the winding operation on the bobbin **1** is continued. In this instance, the yarn (*a*) is passed over rollers **13**, **8**, **3** and guides **15**, **2** to the bobbin **1** to be wound thereon (Fig. 2). Next, the portion of the yarn between guides **15** and **2** is passed through a traverse guide **4** as shown in Fig. 2 and around the bobbin **5**. The yarn passes rollers **13**, **8**, **3**, guides **15**, **4**, the bobbin **5**, and the guide **2** to reach the bobbin **1** to be wound continuously on said bobbin. Since the bobbin **5** is rotated by a drum **17** at a circumferential speed equal to the winding up speed of the bobbin **1**, the yarn does not receive any tension between the two bobbins, and, under this condition, the winding up operation on the bobbin **1** is continued. Then, at an appropriate moment, the yarn is cut at a point (C) between the bobbin **5** and the guide **2**. The one end of the cut yarn may be wound on the bobbin **5** while the other end is wound on the bobbin **1**. The winding up operation of the yarn thereafter may be carried out through rollers **13**, **8**, **3**, guides **15** and **4** on the bobbin **5** and thus the operation is completely shifted from the bobbin **1** to the bobbin **5**. Since the shifting of the winding up operation is carried out in the above operation while the winding operation is being continued, there will be no suspension of the winding up operation at all. In this operation, the yarn is passed around the bobbin **5**, but when the yarn (*a*) is cut, the yarn may be wound on the driving drum. In order to prevent this winding on the driving drum and to secure the winding on the bobbin **5**, the yarn is passed around the bobbin **5** to form at least one loop on the bobbin **5** before cutting. Thus, the winding of the yarn on the drum may be prevented and the taking up on the bobbin **5** may be perfectly secured. After this operation, the full bobbin **1** is replaced by a new empty bobbin and the yarn (*a'*) being wound on the bobbin **7'** passing over rollers **13'**, **8'** and through a guide **2'** may be shifted to be wound on said new bobbin in the place of the full bobbin **7'**, the yarn (*a'*) being passed over rollers **13'**, **8'**, **8**, and the guide **2** to reach said new bobbin in a similar manner. This operation may be repeated until the winding up operation on the left end bobbin **7** is shifted to the bobbin **1'** next to the left end. The leftmost bobbin **7** is replaced with an empty bobbin and, when other bobbins on the right are full, the shifting of the winding up operation from right to left may be carried out. Fig. 3 illustrates such an operation from the bobbin **1'** to the bobbin **7**. Yarn (*a*) passes over rollers **16**, **11** and **8'** associated with the bobbin **1'** and is wound on the bobbin **1'**. For shifting the yarn (*a*) from the bobbin **1'** to the bobbin **7**, the yarn (*a*) is removed from the roller **8'** and is passed through the guide **10** and around the bobbin **7** before reaching the guide **10'** associated with the bobbin **1'** and the portion of the yarn at **12** is passed around the bobbin **7** to form at least one loop. Then the yarn (*a*) may be cut at a point between the bobbin **7** and the guide **10'** associated with the bobbin **1'**. By this operation, the winding up operation of the strand going to the bobbin **1'** may be shifted to the empty bobbin **7**. The full bobbin **1'** now may be replaced with a new empty bobbin. Then to this empty bobbin, the winding up operation may be shifted from the full bobbin **1''** on the right in a similar way. In this way, the shifting of the winding up operation may be repeated with no suspension of the operation and all the full bobbins may be replaced with new empty bobbins.

The shifting operation as mentioned above may be carried out theoretically between a spool at any position to an empty spool at any other position. However, when the two spools are not adjacent ones, the thread has to be stretched across the bank of machines for a long distance and such a stretching tends to affect the denier of the thread. Furthermore, if the thread is glass fiber, which must be drawn at a constant rate, such an operation is hardly possible. Further, the lacing of the thread from **5** to **7** upon cutting of the thread would leave a long loose end which would be apt to entangle with other running threads. Accordingly, it is to be understood that this invention is applied to shifting between adjoining spools.

In the example of Fig. 1, the winding on the spool (at the uttermost right) is to be started first and said spool is to be taken off last while the winding on the spool **1'** at the left is to be started last and said spool **1'** is to be taken off first and, therefore, the size of the package of the spool **1'** must be smaller than that of the spool **5**. However, the time required for the completion of winding on a spool is relatively long, for example, about one hour, while the time required for the shifting of the winding operation according to the present invention is relatively short. For example, when the number of the spools is 10, the time from starting the winding on the spool **5** to the taking off said spool from the winder is in the order of a few minutes. Accordingly, the difference in the size as mentioned above will not be very great. Even if the difference is fairly great, when the winding is not conducted for the preparation of the final product but for an intermediate product, for example, a material which is to be cut into staple fibers in the subsequent processing, or partly drawn material which is further to be drawn for the

preparation of final product, it is a matter of no importance whether the packages are of uniform size or not, and therefore the present invention can be conducted most advantageously in winding of an intermediate product.

In the above, the description is of the case where a single yarn is extruded from each extruding device. But it is to be understood that the invention is also applicable to the case where a plurality of yarns are extruded from one extruding device as long as an independent winding up device is provided for each of the yarns extended. However, in this case, it will be necessary to wind up the yarn on each individual bobbin separately, and when a loop or more loops are to be wound around the bobbin, the yarn has to be cut after all the yarns have been wound to have one or more loops around the bobbins and they have passed the traverse guides.

While the explanations have been made with regard to drum winding in the above, the method of this invention can be applied to spool winding and pot winding or any other type of winding. As to spool winding, there will be no necessity of mentioning anything further than that the difference from the case of drum winding exists simply in the winding up device to be used.

When the yarn is wound up by pot winding the method is also applied in a similar way, but the operation for shifting the winding up operation can be carried out more easily. Fig. 5 illustrates the application of the invention to pot winding. In Fig. 5, when it is desired to shift the operation from the pot 1''' to the pot 5', the yarn is first passed to take the passage by elements 13, 8, 3, 2 and 1. In this condition, the winding up operation is continued with respect to the pot 1'''. Then the yarn between the guides 3 and 2 is moved to take the position as shown by full line in the drawing by a fork or the line 15' in a hand of the operator; then air is passed to the funnel 4. The air over the funnel 4 is drawn into the funnel producing a rapid air stream into the funnel. When the yarn is cut at a point near the point 15', one end of the yarn will be drawn into the pot 5' by the air stream while the other end is wound up in the pot 1'''. Thus the shifting operation from left to right may be completed.

When the winding is carried out by cap winding the method of this invention can be also carried out in a similar way. The device for shifting the operation while the winding up operation is continued is a little different on this occasion but the principle is entirely same. Fig. 6 illustrates the application of this invention to cap winding. As shown in the drawing, a waste spool 14 fixed on a spindle is provided below a bobbin. The waste spool 14 is arranged to have same circumferential speed as the circumferential speed of the godet 3. In the beginning, the yarn is passing through a passage of rollers 13, 8 and the guide 2 to be wound on the spindle 1'''. To shift the winding operation from the spindle 1''' to the spindle 5'' on the right, the yarn is first passed to take the passage over rollers 13, 8, 3 and the guide 15 associated with the spindle 5'' before passing the guide 2 associated with the spindle 1'' to reach said spindle 1'''. Next the portion of the yarn between the guides 15 and 2 is passed through the guiding member 11 fixed on the machine frame and associated with the spindle 5'' and around the waste spool 14 and again through the guides 11' and 15'' and then to the guide 2 associated with the spindle 1''''. Then the yarn may be cut at a point as illustrated by 9 in Fig. 6. The cut end will now be wound on the waste spool 14, but when the yarn is removed from the guide 1', the yarn will receive thereafter the action of the cap 4' and will be wound on the spindle 5'' according to ordinary cap winding procedure, and thus the shift of winding operation from the spindle 1''' to the spindle 5'' is completed. Such a guiding member is, of course, to be provided for each waste spool. In Fig. 6, the waste spool and the guiding member in the adjacent position are indicated by 1'''', 14' and 11' respectively, but the machine frame is omitted. Other operations are entirely similar to those as described before relating to other types of winding. When the winding up operation is carried out by ring winding, the principle is same as the above, the only difference being that one of the two reciprocating portions of the yarn between 15 and 11 is passed inside of a traveller while the other is passed outside of the traveller in ring winding. With regard to the waste spool and others, there is no difference at all between the two. In the above two cases, the portion wound on the waste spool will become loss and 100% yield cannot be obtained, but still higher yield may be obtained in comparison with conventional methods.

As the result of the operation as described above according to this invention, the operation may be simplified. In contrast to the twin winding device which has two bobbins for each yarn causing various degradation effects on the quality of the yarn and an increase of the cost of the equipment and the required floor area, the method of this invention eliminates all these disadvantages and promotes efficiency in operation. The loss of waste yarn may be entirely eliminated or made minimum, the loss being limited to the beginning end of the yarn in spinning, if any. This method of winding up will thus bring about great advantage in continuous winding up operation of yarns of synthetic fibers and other fibers.

What is claimed is:

A method for continuously winding yarns on a succession of winding devices comprising winding the yarn on one of said devices by feeding the yarn thereto via a reserve device and cutting the yarn between said one and said reserve devices, with said one device having a determinable amount of yarn on it, whereupon the yarn is wound, without interruption, on said reserve device, said method further comprising providing a godet roller and a winding bobbin holder in reserve and, when it is desired to replace a full bobbin with an empty bobbin one by one from right to left successively, passing the yarn from the roller associated with the full bobbin to be replaced to the roller associated with the empty bobbin on the right to pass the yarn around the empty bobbin forming at least one loop before passing through the guide associated with said full bobbin, cutting the yarn between the empty bobbin and the guide associated with said full bobbin thereby shifting the winding operation from the full bobbin to the empty bobbin on the right, replacing the full bobbin with a new empty bobbin, and repeating the operation successively until the leftmost end full bobbin is replaced with an empty bobbin, and, when it is desired to replace a full bobbin with an empty bobbin one by one from left to right, removing the yarn from the roller associated with the full bobbin to be replaced and passing the yarn around an empty bobbin on the left forming at least one loop around said empty bobbin, cutting the yarn between the guide associated with the full bobbin and the empty bobbin thereby shifting the winding operation from the full bobbin on the right to the empty bobbin on the left, replacing the full bobbin with an empty bobbin, and repeating the operation successively until the utmost right full bobbin is replaced with a new empty bobbin, while continuing the winding operation.

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