A novel method of yarn traversing suitable even for longer traverse lengths

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Attempts have been made to develop a novel prototype yarn traversing mechanism for a filter winder to eliminate the use of grooved cam; especially to wind cylindrical packages of longer lengths such as PP/glass wound filter cartridges. The novel yarn traversing mechanism is found to wind 762 mm (30 inch) long filter cartridges. The traversing mechanism mainly includes three yarn guides mounted on an endless chain passing over six sprockets with an arrangement of relieving yarn from one guide to the other at traverse extremes. Filter cartridges with various traverse ratios are precision wound on this winder with 0.4 hank and 0.6 hank polypropylene yarn. The new traversing mechanism is simple, cost effective and can be adopted to develop a filter winder of any length.

Keywords: Cross winding, Filter winder, Quick reversal, Yarn traversing

Traversing mechanism on a winding machine traverses yarn to and fro across the length of the winding package. Method of traversing yarn using grooved cam and follower is well established and is used on many winding systems. During cross winding, it is necessary to reverse the direction of yarn guide at both extremes in least possible time. If yarn guide is not reversed quickly, the edges of the wound package tend to build higher diameter than rest portion of the package and become hard. Inertia of the yarn guide assembly causes difficulty in quick reversal of the yarn guide. This imposes limitation on the maximum possible traverse speed that can be attained with grooved cam traversing. To overcome this limitation for winding cylindrical packages, traversing mechanism with counter rotating blades is developed and used on many winding systems. In this method there are two sets of blades rotating in opposite direction. Here, a blade rotating in one direction traverses yarn from one extreme to the other. At the other extreme, this blade meets other blade rotating in the other direction where yarn is transferred from one blade to the other and the direction of yarn traverse is reversed. Thus, at each extreme yarn is relieved from one blade and is picked up by the other. In this method, only yarn reverses its direction of yarn traversing whereas blades continue to rotate in one direction only. Due to this the inertia problem associated with grooved cam traverse is eliminated. The longer the traverse the longer is the length of the blade. Therefore, this method is applicable only up to certain traverse length only. Patent literature also describes other methods of yarn traversing, eliminating the use of grooved cam but these methods are also mainly for shorter traverse lengths

Certain winding applications, e.g. a filter winder, use a long cylindrical package as long as 1829 mm (72 inch). Current commercial filter winding machines employ grooved cam traverse. The present study is undertaken to develop a novel method of yarn traversing developed for winding long cylindrical packages without the use of grooved cam. In this method also traversing elements are not required to instantaneously reverse their direction. This new mechanism is found to be simple and cost effective.

Description of Traversing Mechanism

Use of Chain for Yarn Traversing —For the purpose of traversing, an endless chain is used. Figure 1 shows an endless loop of chain passing over sprockets B. At regular intervals, links of chain carries projections D that project horizontally towards back. A bracket E, mounted horizontally, carries two slots in it. During movement of chain, the projections D pass through these slots. This arrangement prevents vibrations in horizontal portion of chain during its motion as well as minimizes sagging.

Three identical yarn guides C1, C2 and C3 projecting horizontally towards front are fitted on the chain at equal intervals along the length of the chain. The yarn is carried to and fro by these yarn guides. Upper horizontal portion of chain moves from right to left
while lower horizontal portion from left to right. From right extreme end of traverse, one of the yarn guides \( C_1 \) on upper portion of chain traverses yarn to left extreme end. At left extreme end of traverse, it meets yarn guide \( C_2 \) on lower horizontal portion of chain moving from left to right. Here yarn is transferred from yarn guide \( C_1 \) to yarn guide \( C_2 \). Yarn guide \( C_2 \) traverses yarn from left extreme towards right extreme. At right extreme, yarn guide \( C_2 \) meets yarn guide \( C_3 \) arrived on upper portion of chain. Here yarn is transferred from yarn guide \( C_2 \) to yarn guide \( C_3 \). Yarn guide \( C_3 \) on upper portion of chain traverses yarn from right to left. At left extreme, yarn from yarn guide \( C_3 \) is transferred to yarn guide \( C_1 \) which is now on bottom portion of chain moving from left to right. This cycle continues. Entire cycle repeats on three double traverses. Thus, yarn traversing is achieved by these three yarn guides.

**Length of Chain** — Commercial string wound filter cartridges are available in different lengths such as 254 mm (10 inch), 508 mm (20 inch), 762 mm (30 inch), 914 mm (36 inch) and 1829 mm (72 inch). This traverse motion was developed for an effective traverse length of 30 inch. Total length of the chain should be six times the length of traverse. 486 links of chain of pitch 9.525mm (3/8 inch) were employed. This amounts to traverse of 772 mm (30.375 inch). Traverse stroke in excess to 762 mm (30 inch) is taken as actual traverse on package, tend to be less than stroke of the yarn guide.

**Yarn Passage through Winding Machine** — As shown in Fig. 2, yarn \( H \) after passing though tensioner, passes around a guide rod \( F \) and then around a guide cum yarn release rod \( E \). Subsequently, yarn passes though any one of the three yarn guides and then it is wound on winding package. Winding package is mounted on an arm \( I \). Winding package remains pressed against a freely rotating press roll \( G \) during winding. As winding package diameter increases, arm \( I \) swings away from press roll.

**Construction of Yarn Guides** — Figure 3 shows two views of a yarn guide. The ‘A’ is view of yarn guide when it is on the bottom horizontal portion of chain moving from left to right and the ‘B’ is view of yarn guide when it is on upper horizontal portion of chain moving from right to left. Each guide has a fixed shorter arm ‘C’. Other longer arm ‘D’ can pivot about a fulcrum ‘H’. Slot formed between these two arms acts as a yarn guide.

Arm ‘D’ is fastened on a small stud. This stud can turn freely in body of yarn guide. As seen in view ‘B’,
the stud end on the opposite end of arm D carries a lever E on it. Lever E is connected with a spring G. A small pin F is fitted on lever G. Arm D is moved in direction as shown by arrow through pin F during transfer of yarn from one guide to the other at both extremities of traverse. I acts as stop pin.

**Yarn Transfer from One Guide to Other at Extreme** — At the end of the traverse, yarn transfer from one guide to the other at right extreme point of yarn traverse is shown in Fig. 4.

Figure 4 (a) shows a situation when yarn guide A is traversing yarn from left to right reaching towards right extreme point of traverse. At the same time yarn guide B is moving from right to left and is to receive yarn from yarn guide A. Yarn guide A moves below a yarn guide cum release rod C whereas yarn guide B would move above yarn guide cum release rod C. Yarn guide cum release rod C acts as a yarn guide and it also helps in releasing yarn from its yarn guide at the end of traverse. This rod is parallel to the axis of winding package except at extremes.

Shorter arm of yarn guide A carries yarn from left to right. Figure 4 (b) shows how yarn guide A releases yarn at right extreme. Shape of yarn guide cum release rod C at extreme pushes yarn out of yarn guide A.

Figure 4 (c) shows how yarn is received by guide B. As yarn guide B moves closer towards yarn receiving point, pin on lever E is pushed by a slanting fixed bar F which causes movement of longer arm of yarn guide B. When yarn guide A is about to leave the yarn, pin on lever E moves out of influence of bar F. Therefore, spring attached with lever E causes arm B to swing back to its original position. Hence, just before yarn is released by yarn guide A, it comes in space between longer and shorter arms of yarn guide B. Figure 4 (d) shows situation when the guide A is about to leave the yarn and the longer arm of guide in swung position to pick up the yarn.

Winding position when yarn is about to transfer from one guide to the other as well as view of the machine is shown in Fig. 5. Similar arrangement is provided for yarn transfer from yarn guide on upper portion of chain moving from right to left to yarn guide mounted on lower portion of chain moving from left to right. Thus, yarn keeps on traversing across the length of the winding package.

The machine is provided with four change gears to vary the traverse ratio. Traverse ratio is one of the important parameters in determining filtering

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**Figures**

Fig. 4—Yarn transfer from one guide to other at the extreme [A – Yarn guide at lower level reaching end of traverse, B – Yarn guide at upper level about to receive yarn, C – Yarn guide cum release rod, D – Yarn, E – Lever with pin, F – Fixed bar to swing movable arm of yarn guide B, and G – Winding package]

Fig. 5—Close up view of yarn transfer and view of machine
efficiency of a filter cartridge. Set of gears were designed to wind packages with different traverse ratios. Polypropylene yarns of 0.4 hank and 0.6 hank were used for winding. During winding packages with different traverse ratios, the variation in coil angle ranges between 20° and 32°.

This new method of yarn traversing without use of grooved cam is suitable for any traverse length. In this mechanism, before yarn is relieved from one yarn guide at the extreme of the traverse, it is brought in space between shorter and longer arms of the yarn guide that receives the yarn, i.e. receiving yarn guide takes complete control over the yarn before it is relieved from the yarn guide that is moving out of the traversing zone. Under absence of this feature, it is observed that when the yarn guide that is moving out of the traversing zone at the traverse extreme relieves the yarn, uncontrolled movement of yarn takes place towards centre of the package and inaccurate lay of yarn results towards package extreme. This also results into irregular reversal of yarn at the traverse extremes which leads to improper side faces of the wound package.

The elements of traversing mechanism include chain, sprockets, yarn traversing guides, yarn guide cum release rod, fixed bar to swing movable arm of receiving guide and fixed bracket to stabilize chain movement in traversing zone. In grooved cam traverse the traversing elements mainly include a grooved cam, a slide with cam follower and yarn traversing guide, and housing for cam with lubrication facility. The developed method of yarn traversing is simple in construction and is cost effective as it mainly involves just a loop of chain as main element of yarn traversing with three yarn traversing guides. The maximum possible attainable traversing speed is mainly determined by maximum possible linear speed of chain.

References
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