IMPROVED YARN TRAVERSING MECHANISM FOR A FILTER WINDER

Dr. Milind Koranne
Textile Engineering Department, Faculty of Technology and Engineering,
The Maharaja Sayajirao University of Baroda, Vadodara,
Gujarat State, 390 001, India

Abstract:
A novel prototype yarn traversing mechanism that 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 to wind 762 mm (30 inches) long filter cartridges has been already developed by the author[1]. However, this mechanism is prone to greater mechanical wear and tear because of kind of mechanical movement required in its working. To overcome this drawback, the author continued efforts of improving the design and developed improved yarn traversing mechanism which is described in this paper.

Key words: filter winder, springy deflectable arm, yarn transfer, yarn traversing guide

Introduction:
Method of traversing with grooved cam and follower is used on commercial filter winders as well as other winding applications. Quick reversal of yarn guide at traverse extremes is necessary during cross winding, to eliminate formation of hard edges. Patent literature describes various methods of yarn traversing based on mechanical principles, where use of grooved cam is eliminated [2-10]. These traversing mechanisms mainly use elements like counter rotating blades, belt segments or chain segments moving in mutually opposite direction. In these mechanisms only yarn reverses at traverse extremes whereas traversing elements have unidirectional motion in traversing zone. These mechanisms are suitable mainly for winding applications with shorter packages and therefore cannot be used for winding applications like filter cartridges cylindrical package winding where package length may be as long as 1829 mm (72 inches).

Earlier prototype yarn traversing mechanism based on mechanical principle to wind 762 mm (30 inch) filter cartridges leads to greater wear and tear of yarn traversing guides because of mechanical movement to be given to movable arm [1]. To overcome this draw back, subsequent efforts by the author resulted into a prototype yarn traversing mechanism with improved yarn traversing guides on the same filter winding machine which is described in this paper. These yarn traversing guides are less prone to mechanical wear and tear due to their simple construction and working.

Description of traversing mechanism:
Chain loop carrying yarn traversing guides:

Referring to Fig. 1(a), a loop of chain **A** passes around six sprockets **B**. Three yarn traversing guides **C** are mounted on chain links at equal interval of links. These yarns traversing guides together traverse yarn to and fro across the length of cheese. Chain loop has two segments **D** and **E** which are horizontal, closely spaced and parallel to each other as well as to the package being wound. Yarn traversing guides traverse the yarn when they lie in one of these segments. To give vibration free and steady movement to chain in the traversing zone, chain links are fitted with projections **F** at regular intervals. These projections pass through slots in a bracket **G** mounted on machine frame with brackets **H** and **I**. Figure 1(b) shows the side sectional view showing how projections **F** passing through slots in bracket **G** stabilize motion of chain **A**.

Passage of yarn through winding machine:
Referring to Fig. 2, chain **A** is driven by driving sprocket **J.** Cheese **K** is transmitted with drive to rotate it to wind the supply yarn **L** over it. Supply yarn **L** delivered from top, passes around a stationary guide rod **M** and then around yarn guide cum release rod **N** and passes through one of the three yarn traversing guides **C**. Thereafter it is wound on cheese **K**. Cheese **K** is pressed against a freely rotating press roll **O** to achieve compact winding of yarn on cheese. Cheese **K** is mounted on an arm **O** which has to gradually swing away from press roll **O** as the cheese diameter keep on increasing due to deposition of yarn on it.
Figure 3 shows side view showing machine elements coming across the passage of yarn shown in Fig. 2. Supply yarn **L** passes around guide rod **M** and then around yarn guide cum release rod **N**. Subsequently it passes through yarn traversing guide **C** and then wound on cheese **K** which is pressed against freely rotating press roll.

Yarn traversing by three yarn guides:

Referring to fig. 2, a yarn traversing guide traversing yarn in one direction say on segment **D** of chain moving from left to right meets any one of the remaining two yarn traversing guides moving in the opposite direction on chain segment **E** at the right extreme end of the traverse. Here yarn is relieved from the yarn traversing guide on chain segment **D** and is picked up by the other yarn traversing guide moving in opposite direction on chain segment **E** and therefore the direction of yarn traversing is reversed. Now the yarn that is traversed by yarn traversing guide on chain segment **E** meets other yarn traversing guide at left extreme where yarn transfer takes place and yarn traversing direction is again reversed. In this way yarn keeps on traversing through yarn being relieved from one guide and picked up by the other moving in opposite direction at extreme ends of traverse. Traverse given by each yarn traversing guide equals to one sixth the length of the chain. 486 links of chain of pitch 9.525 mm (3/8 inch) were used though which a traverse of 772 mm (30.375 inch) was obtained. Traverse stroke in excess to 762 mm (30 inch) was taken as actual traverse obtained on package tend to be less than stroke of yarn guide

Construction of yarn traversing guides:

Figure 4 shows construction of yarn traversing guides. **Q** is view of a yarn traversing guide when it is on lower horizontal chain segment **D** referred in Fig. 1. **R** is view of yarn traversing guide when it is on upper horizontal chain segment **E** referred in Fig. 1. Each guide has a fixed arm and a deflectable springy arm. $\mathbf{Q_1}$ and $\mathbf{R_1}$ are fixed arms of yarn traversing guides **Q** and **R** respectively. $\mathbf{Q_2}$ and $\mathbf{R_2}$ are deflectable springy arms of yarn traversing guides **Q** and **R** respectively. Yarn passes in the gap between parallel faces of fixed and deflectable springy arms of yarn traversing guides. Portion $\mathbf{Q_3}$ of arm $\mathbf{Q_2}$ is fixed whereas portion $\mathbf{Q_4}$ is springy that can cause deflection of arm $\mathbf{Q_2}$ upon little pressure. The protrusion of fixed and springy deflectable arms beyond guide body is almost the same. Similar arrangement is with arms of yarn traversing guide **R**.

Traversing of yarn by a yarn traversing guide:

Referring to Fig. 5, supply yarn **L** passes around guide rod **M**, yarn guide cum release rod **N** and then between parallel faces of fixed and springy deflectable arms of yarn traversing guide **Q**. Subsequently it is wound on cheese **K**. Yarn traversing guide **Q** moving from left to right is approaching towards right extreme of traverse where it would relieve the yarn; and yarn traversing guide **R** moving from right to left is also approaching towards right extreme of traverse where it would pick up the yarn from yarn traversing guide **Q**. Yarn guide cum release rod **N** is shaped straight parallel to cheese axis except at extreme ends where it is bent. Yarn guide cum release rod **N** helps in traversing the yarn and it relieves the yarn at the extreme ends of traverse through its bent portion. Moving from left to right, yarn traversing guides pass beneath yarn guide cum release rod and while moving from right to left pass above it.

Yarn transfer from one guide to the other at traverse extreme*:*

Figure 6 refers to situation when yarn traversing guide **Q** that is traversing from left to right and has reached right extreme of traverse is about to relieve yarn at the same time yarn traversing guide **R** is about to receive yarn. Due to bent portion of yarn guide cum release rod **N**, yarn **L** is pushed out of arm $\mathbf{Q_1}$ of yarn traversing guide **R**. If yarn is not received by yarn traversing guide **R** before it is relieved from yarn traversing guide **Q** then yarn tends to move towards centre of cheese because of yarn tension and an irregular and uncontrolled winding would results on package, especially at the end of the package. When yarn traversing guide **R** moving from right to left approaches towards right extreme of traverse, yarn **L** that is being pushed from left to right by arm $\mathbf{Q_1}$ gets around slanting portion of arm $\mathbf{R_2}$ of yarn traversing guide **R** that is moving from right to left. Deflection of yarn **L** around slanting portion of arm $\mathbf{R_2}$ exerts pressure on it due to which it deflects inwards towards chain due to its springiness. Just before yarn is relieved from arm $\mathbf{Q_1}$ of yarn traversing guide **Q**, it clears over slanting portion of arm $\mathbf{R_2}$ of yarn traversing guide **R**. The arm $\mathbf{R_2}$ now springs back to its original position and yarn gets in between space of parallel faces of fixed arm and springy deflectable arm of yarn traversing guide **R**, and therefore it is prevented from uncontrolled shifting towards centre of cheese giving improper winding of yarn over cheese. Similar action takes place at left extreme of yarn traverse. In this way yarn keeps on traversing through yarn transfer at traverse extremes from one guide to the other. Figure 7 shows top view of yarn transfer explained in Fig. 6 and Fig. 8 shows view of filter winding machine.

Arrangement to change traverse ratio:

Four change gears provided in machine enable selection of required traverse ratio which ultimately influences performance of a filter. Set of gears were determined to produce packages with difference traverse ratios to vary

crossing characteristics and gain. Packages with different traverse ratios were wound with 0.4 and 0.6 hank polypropylene yarns. The coil angle ranged between 20° and 32°.

Advantages of improved design of yarn traversing guides:

At traverse extreme, just before the yarn is relieved from one yarn traversing guide, it comes between fixed arm and springy deflectable arm of yarn traversing guide which receives it. This prevents uncontrolled movement of yarn. Therefore, irregular lay of yarn is avoided at package extremes. During yarn transfer from one yarn traversing to the other, only little movement of springy deflectable arm of receiving yarn traversing guide is necessary. Therefore, yarn transfer is gentle and free from impact which results into lesser wear and tear of yarn traversing guide. Reliability of yarn transfer is also increased. Moreover, simple construction and working of yarn traversing guides reduce cost of yarn traversing guide, facilitate easier setting and reliability of yarn transfer is increased.

References

1 Koranne M. V., Indian Journal of Fibre & Textile Research, of Fibre & Textile Research, Vol. 36(3), September 2011. pp. 285-288
2 Nydegger R.R., Winding apparatus, US Pat, 2238128 (to E. I. du Pont de Nemours & Co.), 15 April 1941, http://gb.espacenet.com.
3 Horwood J. M. , Yarn winding machine, US Pat 3294327 (to British Nylon Spinners Limited), 27 Dec 1966, http://gb.espacenet.com.
4 Ballard H. W., Strand traverse mechanism, US Pat 2662695 (to American Viscose Corporation), 15 December 1953, http://gb.espacenet.com.
5 Beckwith W. L., (Jr)., Winding machine, US Pat 3333782 (to Leesona Corporation), 1 August 1967, http://gb.espacenet.com.
6 Goodhue W. V., Winding machine, US Pat 3565359 (to Leesona Corporation), 1 August 1967, http://gb.espacenet.com.
7 Burdge S. W., Belt traverse device with jet means, US Pat 3586251, (to Monsanto Company), 22 June 1971, http://gb.espacenet.com.
8 Ueda S. & Fujimoto S, Traverse mechanism in use for fast yarn winding, US Pat 3620464, 16 November 1971 (to Teijin Seiki Co. Ltd.), http://gb.espacenet.com.
9 Niederer K. W., Apparatus and method for winding yarn to form a package, US Patent 4349160, (to Terrel Machine Company), 14 September 1982, http://gb.espacenet.com.
10 Kamp H., Yarn traverse winding apparatus, US Patent 4921181, (to W. Schlafhorst & Co.), 1 May 1990, http://gb.espacenet.com.

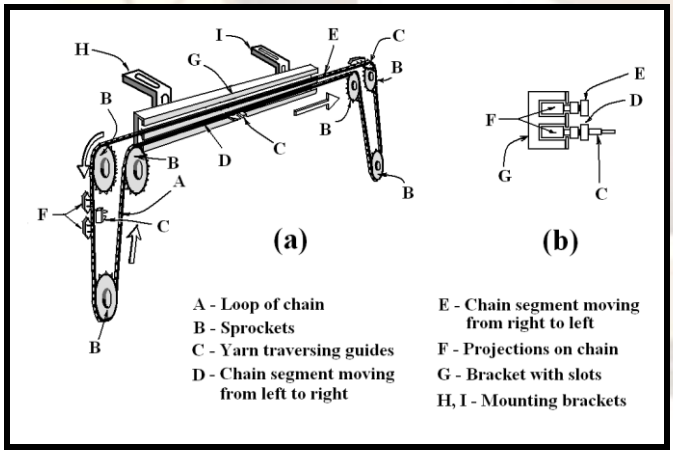

Fig. 1- Chain loop carrying yarn traversing guides [A – Loop of chain, B – Sprockets, C – Yarn traversing guides, D – Chain segments moving from left to right, E – Chain segment moving from right to left, F – Projections on chain, G – Bracket with slots, H, I – Mounting brackets]

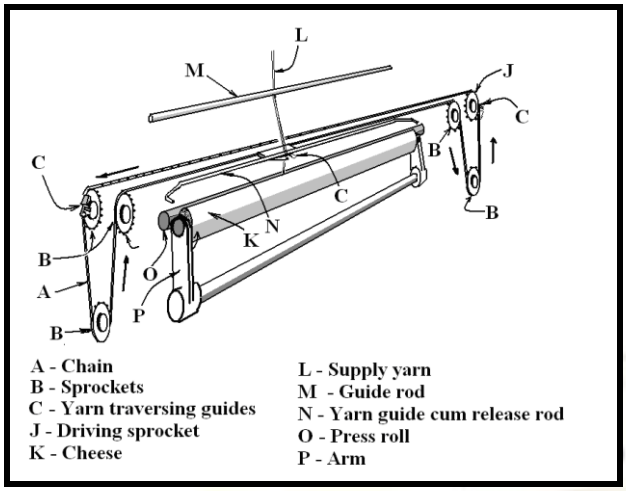

Fig. 2 - Passage of yarn through winding machine [A – Chain, B – Sprockets, C – Yarn traversing guides, J – Driving sprocket, K – Cheese, L – Supply yarn, M – Guide rod, N – Yarn guide cum release rod, O – Press roll, P – Arm]

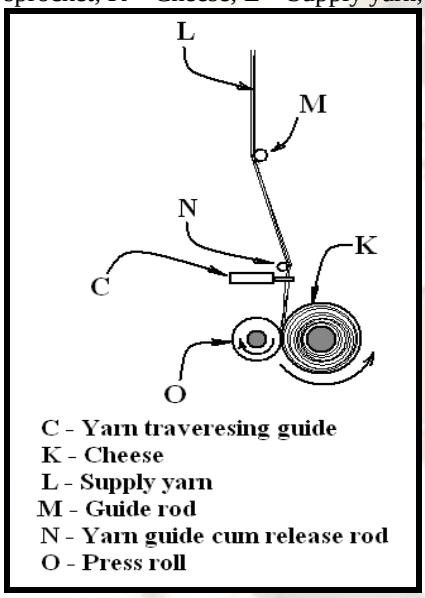

Fig. 3 - Machine side view [C – Yarn traversing guide, K – Cheese, L – Supply yarn, M – Guide rod, M - Yarn guide cum release rod, O – Press roll]

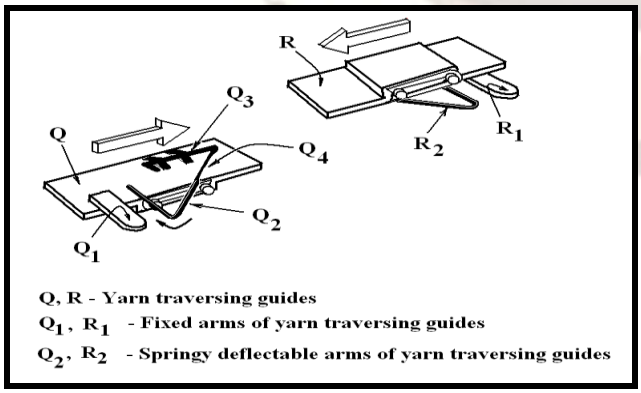

Fig. 4 - Construction of yarn traversing guides [Q, R – Yarn traversing guides, Q_1, R_1 – Fixed arm of yarn traversing guides, Q_2, R_2 – Springy deflectable arms of yarn traversing guides]

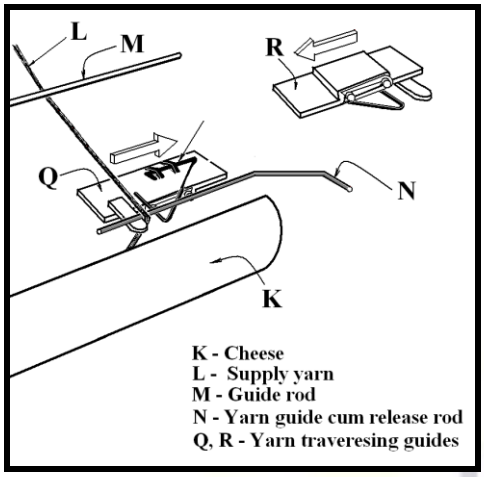

Fig. 5 - Traversing of yarn by a yarn traversing guide [K – Cheese, L – Supply yarn, M – Guide rod, N – Yarn guide cum release rod, Q, R – Yarn traversing guides]

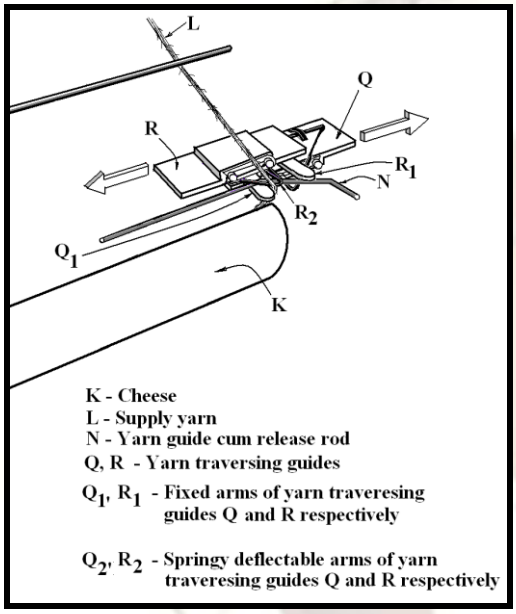

Fig. 6 - Yarn transfer from one guide to the other [K – Cheese, L – Supply yarn, N – Yarn guide cum release rod, Q, R – Yarn traversing guides, Q_1, R_1 – Fixed arm of yarn traversing guides, Q_2, R_2 – Springy deflectable arms of yarn traversing guides]

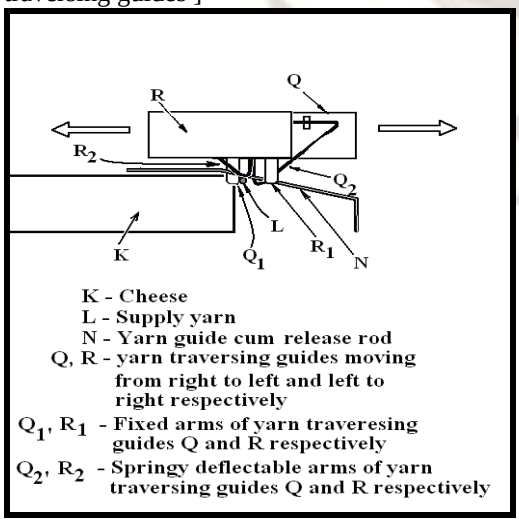

Fig. 7 - Top view of yarn traversing guides at transfer [K – Cheese, L – Supply yarn, N – Yarn guide cum release rod, Q, R – Yarn traversing guides, Q_1, R_1 – Fixed arm of yarn traversing guides, Q_2, R_2 – Springy deflectable arms of yarn traversing guides]

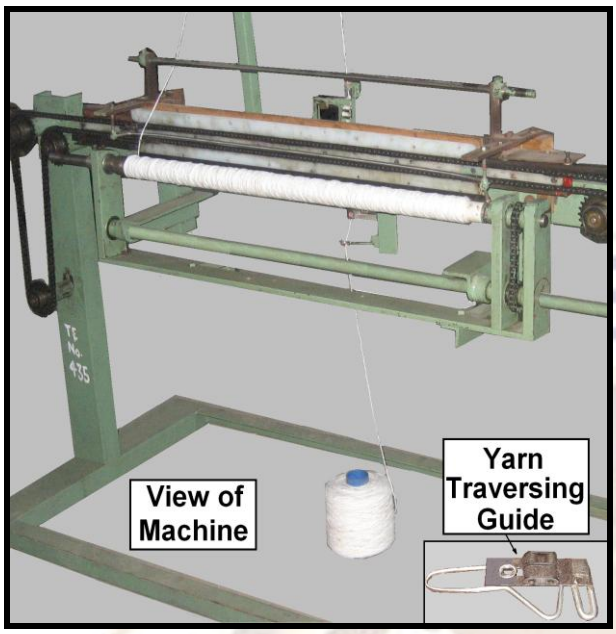

Fig. 8 – View of machine and yarn traversing guide