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Quality Parameters and Design Aspects of Warper's Beam

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ABSTRACT

There is a continuous increasing trend in speed of warp preparatory machines and looms. Also the demands for higher width fabrics is on a rise. The diameter of the beam has also increased due to increased demands of mass production. There has been rise in the use of manmade filaments also. With very high pressure of better and better quality output, the pressure on the quality and productivity of the warping process has increased tremendously. It is said that better warping is a great assurance for better sizing. Most of the work reported in the published literature have discussed about process control parameters. An attempt has been made here to identify some of the aspects of mechanical design of the warper's beam and its' effect on quality of the output at later on stage. The most important objective of a beam is to unwind well without causing any quality issues at later on stage.

Keywords: Beam, Beaming, Direct Warping, Drive, Head Stock, Sectional Warping

I. INTRODUCTION

Warping is an intermediate process of converting a single package to multi-end beam. Though the process is of simple conversion, it is considered to be very essential because any flaw in the process will result as a defect in later on stage. The process has not drawn much of the attention in the published literature. Most of the studies have talked about process control parameters. The most important objective of a beam [1] is to unwind well without causing any quality issues at later on stage. There is a continuous increasing trend in speed of warp preparatory machines and looms. Also the demands for higher width fabrics is on a rise. The diameter of the beam has also increased due to increased demands of mass production. There has been rise in the use of manmade filaments also. With very high pressure of better and better quality output, the pressure on the quality and productivity of the warping process has increased tremendously. It is said that better warping is a great assurance for better sizing.

II. ASPECTS OF WARP YARN QUALITY

Following is the list of requirements out of a warped beam which are likely to affect later on processes especially sizing and weaving.[2],[3],[4]

1. It is important that all threads are to be wound with equal tension. The tension should be maintained at a uniform level throughout the length and across the width of the warp sheet.
2. The surface of the warp on the beam should be cylindrical, uniform and smooth with no ridges or sunken part.

3. The threads near flanges are likely to sink inside the layers. The warp threads near flanges should not be caught in to the layers.
4. Many times it is observed that the selvedge threads are wound at a lesser tension and are loose. One has to make sure that these threads are wound at the same tension as that of the rest of the threads.
5. The hardness of the beam should be same throughout the width.
6. There should not be any marks of higher pressure value throughout the length of the yarn on beam.
7. The edges of the flanges are to be smoothly finished and should not cause any abrasion on the yarn during winding and unwinding. Also flanges should have clean surface and should not soil the yarn.

III. DESIGNING BEAM FOR DIRECT WARPING SYSTEM

Many warping machine manufacturers have stressed much on the quality of warp beam [5] and have highlighted importance of selecting best possible warp beams to achieve higher and better output from a warping machine. The main points to be checked about quality of beam are smoothness and finish of the flanges, about the type of adapters, beam driving means in terms of fixing it on either warping machine or afterwards on sizing and loom. The aspects are to be considered separately for beams to be used for direct and indirect warping. Also beams to be used for spun and filament will have different quality parameters.

The varying characteristics of the fibers being processed call for appropriate warper beam designs. The chosen material for the beam must be such that the limited elastic and plastic deformation can be adhered to at the given loads. This is particularly the case with warper beam tubes and flanges. In order to prevent uneven tensions being caused by the unevenness in warper beam heights, tube heights and flange axial thrust should be maintained up to tenths of a millimeter. Only warp beam flanges with smooth outer surfaces should be used. This also helps to produce warps which are free of fluff. Safety is also considerably enhanced.

The demand for automatic feeding is met by conically serrated drive couplings, where the drive pivot has to be aligned with the drive holes, which again holds good for the conventional warper beams with pivot bearing. This conical gearing can of course also be used for filament yarn beams. The conical gearing enables the warp beam to be centered, so that the tolerance from the center of the machine to that of the warper beam is equivalent to zero. The gearing, mechanically worked, is used for centering and for frictional connection.

Unwinding of the warper beams in the supply creel of the sizing machine is also best effected, for instance, with conically serrated drive couplings to ensure optimum tension adjustments with a very accurate, smooth beam motion. Again it is very important that this is achieved without any lever arm effect. The lever arm effect is present both on warper beams with gudgeons as well as from the beam to the warping machine itself as well as in the sizing machine supply creel.

To ensure careful handling of the pressure roller and to increase productivity, it is advisable to equip the warper beam tube with a cloth covering, or to treat the surface in such a way so as to ensure that the warp ends have better adherence. When processing cotton and rayon spun fiber yarns, the fabric should be fixed to the tube with a moisture-proof adhesive tape material.

When warping up, the end threads are tied into plaits, which run into the warp beam over the pressure roller and are then secured. These plaits have to be cut off, to prevent uneven running and thus vibrations on the machine. Using the method described above, the thread layers do not become uniform until after a number of revolutions, when the warp beam tube is covered with yarn sheet, it is no longer necessary to work with plaits.

When designing warper beams, advantage should be taken of the more favorable moment of inertia offered by lighter beams with accurately reproduced dimensions, resulting in more rapid starting and braking. A good warp quality is only possible if the tube diameter is not less than 250 mm. The internal and external transport of warper beams and of yarn carriers in general should be organized in such a way that they cannot get damaged.

If all these factors are taken into consideration, it should be possible to obtain uniform yarn tension in the warper beam supply creel. The warp tension should be monitored from its entry into the sizing machine in order to improve the running properties of the warp.

IV. DESIGNING BEAM FOR SECTIONAL WARPING SYSTEM

A few papers have discussed [6], [7] about the effect of increase in loads on beam by increasing the flange diameter. It is mentioned that processing of filament yarn also increases the load on beam. Based on most common process control parameters it will be possible to arrive at an optimum value of beam flange diameter for a given type of yarn without overloading the entire system.

Lange and Weinsdorfer have analyzed [8] stresses on yarn during warping and beaming. They have mentioned about impact of increased speed of looms and its effect on requirements out of preparatory processes specifically warping process. In the paper an extensive research project has been cited covering the yarn unwinding characteristics from the cross wound package in the creel, the action of different thread tensioners in current use in creels and thread tension variations between different package positions in a warping creel and a beaming creel. The testing was done using thread tension meter operating at high frequency which permits very short thread tension peaks to be recorded. The results may lead to an optimization of various parameters which in turn will reflect in reduced defect level at fabric stage particularly warp stripes problem. One of the main reasons for warp stripes problem is irregular thread tension which mainly arise at the warping stage.

V. FAULTS CAUSED DUE TO POOR QUALITY OF THE WARP

Caught ends are one of the main problem that occurs in the warped beams. They caused by poor edge areas, where the winding edge is periodically high and low. The cause of the fault is faulty clamping of the warp beam in the beaming machine, resulting in an eccentric beam motion. Another possible cause is uneven running of the warp beam flange. It can be the result of excessive play of the flange on the tube, clamping only effective at one end, in the case of steel flanges for half warp beams, if the tolerance of the end surface of the tube is not within admissible limits, deformation of the flange as a result of faulty transport (e .g. dropping the warp or warper beam onto the floor etc.) or a distorted tube, due to a week tube being used for a heavy tube or winding weight or if the tube is damaged during transport

Caught or pulled ends can still occur in spite of correctly wound edge yarn. In this case the beam flanges are not flexible enough. As the warp recovers, especially in the case of continuous filament yarn, the beam sags and causes a gap. By warp recovering it is meant a relaxation of the wound warp, so that the pressure on the tube is increased. Warp recovery can also occur on warps of spun fiber yarns. It the yarn was wound with excessive residual humidity or the warp was dried too quickly.

The increased winding pressure results in the tube elongating, and since the beam flanges follow the increase in length of the tube, the tube sags resulting in a gap of varying width between flange and wound yarn, if the flanges are insufficiently flexible and cannot press against the warp.

The fault mentioned above can also occur when the flange, despite maximum winding, has slightly rotated on the tube. The angle of inclination of the thread is responsible for this.

The following points should be noted to improve the quality of warping beams:

- ❖ Condition of beam flanges: If the beam flanges are damaged, the unwinding of yarn near the flanges will not be satisfactory. This will cause difficulties in sizing and weaving.
- ❖ Stop Motions and Breaks: Proper stopping of the warping machine after an end break ensures that the broken end on the beam can be traced easily.
- ❖ Condition of the driving drum: On most warping machines the beam is driven by frictional contact with the driving drum. In order to get a package of the correct density, the pressure between the drum and the warper's beam has to be kept at fairly high level.
- ❖ Barrel Diameter of the Beam: Beams of small barrel diameter give rise to high unwinding tension at sizing, particularly when the beam is about to become empty.
- ❖ Cuts in Accessories in the path of yarn: Drop pins of stop motion, guide rollers, reed denting etc. should not have any grooves.
- ❖ Creel Fans: Fluff accumulated on the machine, particularly at thread guides, causes tension variations in the yarn. This fluff can pass on to the beam.
- ❖ Length Measuring Motion: The length measuring motion should be accurate, otherwise estimation of beam count would be wrong and subsequently will give incorrect values of size percent which is commonly determined from the weights of yarns on the warper's and the size beams.
- ❖ Density of the Beam: The beam should be firm, inadequate pressure between the beam and the drum causes soft beam. Adequate pressure should be maintained by making suitable mechanical adjustments.

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