Unified Design of a Warper's Beam: A New Concept

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Abstract

Warping is an essential process for manufacturing woven fabrics. There are two systems mainly used for the same viz. Direct and Indirect. Both systems have their own set of applications. Users normally select either or both systems depending upon the requirements. While looking at the published literature, not many attempts are found which provide a single solution for warping all kinds of yarns. There are few attempts seen when patents are considered. Still it is not possible to provide the solution to the fullest. In this paper an attempt has been made to review some design modifications patented already. Also a totally new design concept has been attempted and the idea of the design for the same has been discussed. The new design offers an advantage of running both; mono colored as well as patterned warp to be used with the newly designed beam (Patent applied).

Keywords: Warping, Direct, Indirect, Creel, Beaming, Bobbin, Head Stock, Separator Plates, Drive

I. Introduction

There are mainly two systems of warping for preparing warp to manufacture woven fabrics [1]. These systems are direct and indirect (or sectional). The former consists of preparing a full width warper's beam in one step but containing lesser number of threads, while the latter consists of preparing only one section at a time, many such sections making a full width weaver's beam [2]. Users have their own set of application for either or both types of warping systems. The process of direct warping is simple but has limitation that only single colored warp can be used. Also the length of yarn to be wound per beam should be sufficiently large as the machine is running at speeds of more than 600 mpm. So direct warping is not a preferred choice for small length production. Warper's beams have the full width required finally but the number of threads are only few hundreds. As the number of threads are less, length of yarn wound on warper's beam can be very large. As many beams are to be combined at a later stage it is very difficult to process warp yarns having patterns [3]. Matching of the patterns will become highly complicated issue and in complex patterns will be impossible. On the other hand the production of the system is very high so suitable and preferred for producing simple varieties at mass scale.

In sectional warping, all the ends required finally will be wound on the beam so there is no need to agglomerate separate beams like direct warping. As all ends are to be accommodated on the drum, it is possible to use the system for warp having multi colored patterns [4]. Again as all ends have been transferred on the drum and later on the beam, there is possibility of using the beam directly on the loom if sizing is not required to be done. Also the process will be highly preferred if small length of warp is to be processed even if mono colored yarns are to be used.

On the other hand, the system has few problems like only small length of yarn can be accommodated on the drum. So the final beam may not have very large length or many weaver's beams cannot be produced like direct warping. This system may not be suitable for mass production of simple varieties. Cost of the machine is also comparatively higher and is justified only if there is sufficient requirement of suitable varieties. Lastly the machine is more complex in nature and fine-tuned calculations are required to be done to get the required quality characteristics of weaver's beam.

So, one can say that there is no single system which can provide solution to all types of yarns i.e. mono-colored and patterned warp. The articles published and the books written do not provide much insight in to the problem. But there are few attempts which have been made to provide solution to some extent in patent literature and the same have been discussed below.

II. Literature Review

Most of the books about weaving preparatory contain an account of process aspects and few talk about control of process parameters [5, 6]. As far as the developments in the machinery is concerned one is required to go through the patent literature. There have been many attempts towards unifying both systems in to one but the machinery manufacturer and the textile goods producers still rely mainly on two main systems of warping. Following are the main areas where unified system may be focusing:

1. Possibility of running patterned warp on direct warping
2. Increasing the size of the creel for direct warping
3. Increasing the yarn content on drum of the sectional warping.

One interesting patent is based on conventional sectional warping but with a modification in the beaming process. Normally one beam is produced after the sectional warping process. As per the patent by Schmitz [7] at least two beams can be produced. The design is as shown in figure 1 below. While starting beaming process first beam is wound. After required length is wound on first, second beam is started. With this modification it is possible to produce multiple beams from one warping process. Rest of the features are usual with any standard sectional warping machine.

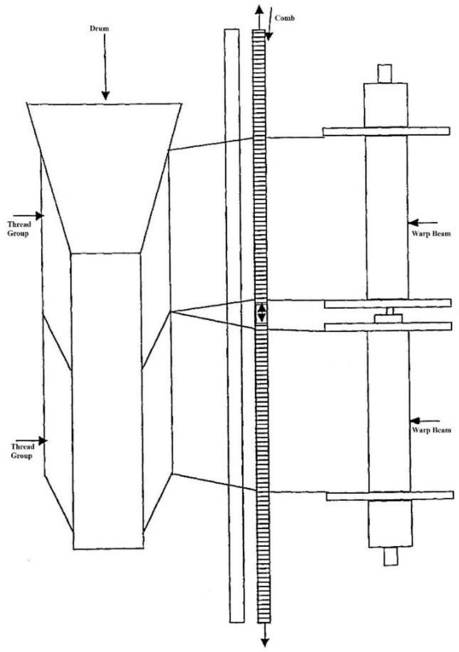

Fig. 1 Two beams from a sectional warping process [7]

Patent filed by Gaiser [8] is about the winding beams for Raschel knitting machine. Of course there is quite a great difference between a warping machines for warp knitting and for weaving but the idea of multiple beams can be adopted for weaving preparatory also. In his patent literature Gaiser has mentioned about following problems faced by warp knitting system at that point of time:

(i) One beam or two beams only can be prepared with identical traverse. More than one beam with different traverse on the same beaming is not available.

(ii) Tension variation between yarn creel and beam for different ends cannot be controlled positively.

(iii) Occasional failure of stop motion, particularly when texturized yarns are used, occurs mainly because the yarn contains small amount of oil and oil deposit restricts operation of stop motion.

In the invention, multiple beam winding with individual adjustable traverse for each beam is disclosed. Tension adjustment is also possible. 15 to 140 ends can be wound on to three beams with width of the wound portion of the beam ranging from 190 cm to 330 cm or more. An arrangement of such a device is as shown in figure 2 below.

The idea has some limitation for use in weaving preparatory like there is only one end at a time or a group of ends which are wound and are traversed throughout the narrow beam. Such three beams are prepared. For weaving one needs many parallel ends to be wound adjacent to each other for a long length. But the idea can be explored further to adapt to weaving preparatory processes. There have not been many evidences weather this idea has been commercially applied by any warp knitting beam warping machine makers or it is further explored by other researchers.

One more patent was filed by Hiroshi and Shozo [9] regarding automatic switching of patterned warp on a sectional warping machine. They have tried to provide solution to the problem of reducing creeling time which is lapsed when running patterned warp. Also changing the creel at the end of the beam is a highly time consuming operation. Again first and the last sections of the beam require a different number of threads as selvedge threads will be included. Each position in the creel has a knotter attached to it. So as and when required, the knotter, operated by a motor and controller, can switch the yarn by carrying out the knotting operation.

Similarly there are many patents which have tried to identify some area of increasing the flexibility of either of the warping systems. All have ended up with totally a different problem or limitation due to which the technological adaptability was not realized.

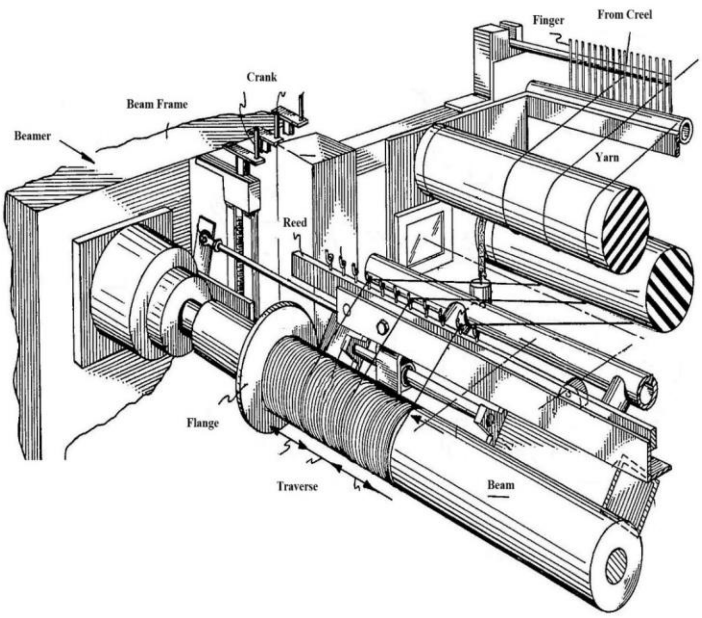

Fig. 2 Multiple beamer for Raschel Knitting [8]

III. Experimental Setup

As seen in earlier part there were few attempts which addressed the problem directly but not solving problem in total. The question of adjustment of section width is still not addressed anywhere. An attempt has been made by the authors of the paper to offer the solution to the problem by a novel design (Patent Applied) of a beam which is to be used on a direct warper and at the same time one will be able to wind the sections of the threads in a limited width like sectional warping. The manual model was prepared and was developed as three dimensional CAD model with the help of a dedicated mechanical design software. If one wants to prepare the beam containing mono-colored warp, then normal beam as used regularly on a direct warper is to be used. The novel designed beam (patent applied) is to be used when it is required to warp multicolor warp with complicated design.

IV. Unified Design of a Beam

Figure 3 below shows one such attempt aimed at providing the unified design of the beam. The assembly shows a normal warper beam with many modifications made. Both the flanges are same but the difference is that both (1 & 2) are movable on barrel. There are several separator plates (3) from left hand flange to the right side flange of the beam. The number of separator plates will depend upon the section width to be kept in the beam.

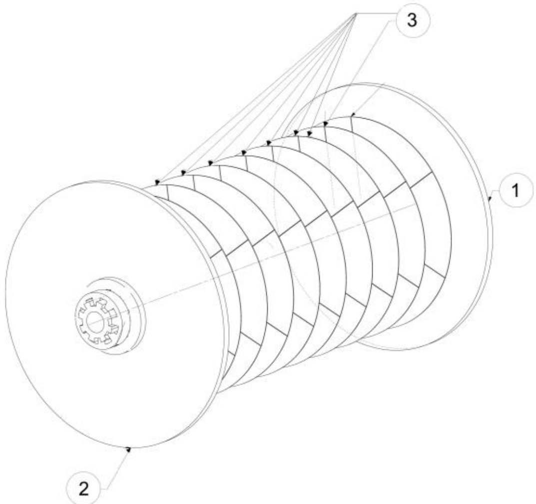

Fig. 3 Novel design of the Beam (patent applied)

V. Conclusion

So with the help of above mentioned design of the beam, it is possible to warp both types of warps i.e. mono colored or patterned. There are many adjustments required to be done but these are purely mechanical type and are easy to carry out. The investments in to both types of warping system can be done away with.

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