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Analysis of Developments in Mechanical Design of Textile Warping Machines

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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. In the paper an attempt has been made to review some design modifications patented already. Also, it contains limitations of the designs attempted so far. Out of two systems of warping, users have their own application area for selecting a particular system. Merits and demerits of both systems are discussed in the paper. Finally, a new design concept for unifying both systems is included in the paper.

KEYWORDS

Warping, Direct, Indirect, Creel, Beaming, Bobbin, Head Stock, Drive

INTRODUCTION

As mentioned by Thakkar et.al. (1), there are mainly two systems of warping for preparing warp to manufacture woven fabrics. These systems are direct and indirect (or Sectional). The former consists of preparing a full width warper's beam in one step, 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. There is no single system which can provide solution to all types of yarns i.e. mono-colored and patterned warp. Many attempts have been made to provide solution to some extent and the same have been discussed below.

LITERATURE REVIEW

Most of the books about weaving preparatory contain an account of process aspects and few talk about control of process parameters. (2, 3, 4). 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. As mentioned by Thakkar et.al. (1) following patents were discussed about the above-mentioned work.

i.	Direct Warping	Loncteaux H.J. & others	1937
ii.	Warp beam & method of Assembling	Harris S.A.	1961
iii.	Warp Beam	Erwin P.	1978
iv.	Warp Beam	Scholze	1974
v.	Beam Winding Apparatus	Colson W. B. & others	2003
vi.	Warping High twist yarn	Agnihotri K.	2008

Few more attempts which were made at solving the problem are presented here. As mentioned in their patent by Shi, et.al. (5), the barrel of the beam for winding the yarn has two flanges. In between two flanges two more separator plates have been arranged (Fig. 1). There is no mention about the distance between separator plates or between flange and separator plates.

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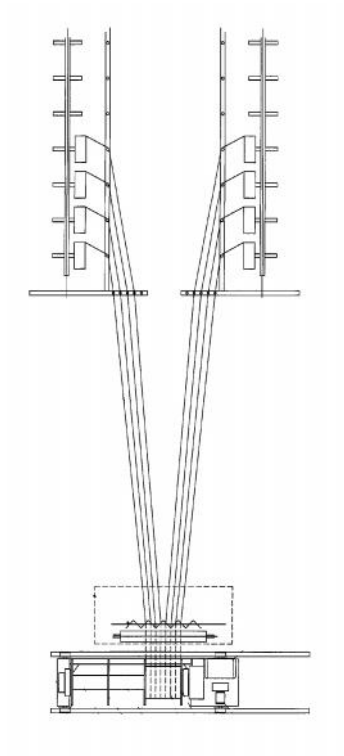

Fig. 1 Beaming Device & Warping Shaft (Shi, 2009)

However, there is mention about moving the beam in either direction when one of the sections is full. Other usual provisions like creel, expandable reed etc. have been developed and shown in the figure 1.

Another slightly different patent was filed by Martin Fuhr (6) regarding a modified design of a beam. The invention is about one of the flanges having slight conical shape for warping sample length or short length directly on to beam. The patent was also registered in other countries. (7, 8). As per the claim made Fuhr states that by providing a beam with a conical flange, one would be able to wind sections of the threads directly on to beam and later the same beam can be used on sizing or on a loom. He claims that as later processes are done at a slower rate, the shifting of the beam laterally can be done easily however the same is not revealed in the patent. The figure below show the concept as provided by Fuhr.

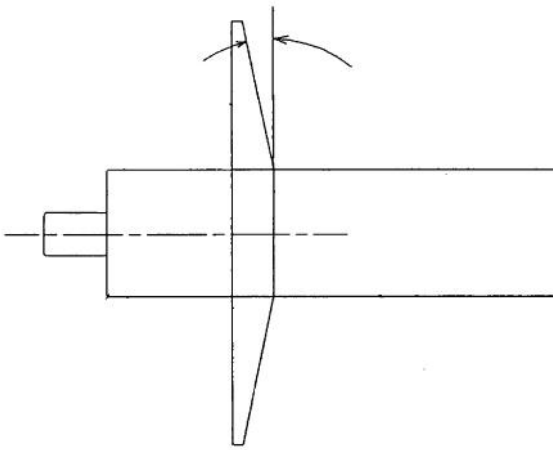

Fig 2 Warp Beam (Fuhr, 2010)

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A slightly different patent is filed by Tan et.al. (9). The invention is about a beam which can be used on warping and / or sizing. The beam can have one more plate between two flanges. All three can be adjusted manually and further can be locked with a locking arrangement. The number of plates between two flanges can be more also but there is no mention about the same in patent literature. Also how to wind yarn simultaneously in all segments is also not clear. It is presumed that the warping of yarn on different parts of the beam will happen one after the other. The figure 3 below shows the arrangement as published along with the patent literature. A bracket is provided to fix a particular plate in position while warping the yarn on the other side. The same is to be removed during the warping of the yarn on that side.

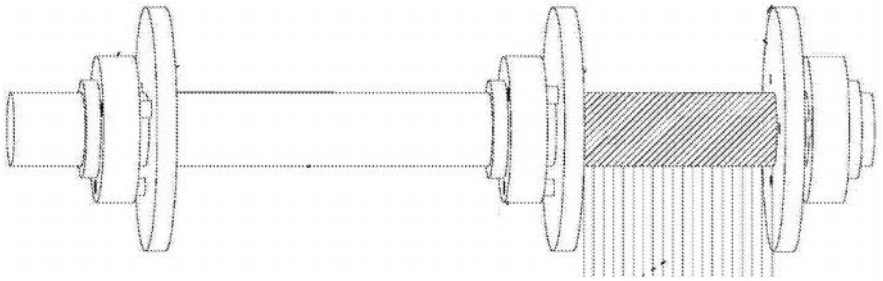

Fig 3 Warp Beam (Tan, 2016)

Another interesting patent is filed recently by Zhang et.al. (10). As shown in fig.4 below, the invention is about semicircular plates with two bolts on two ends.

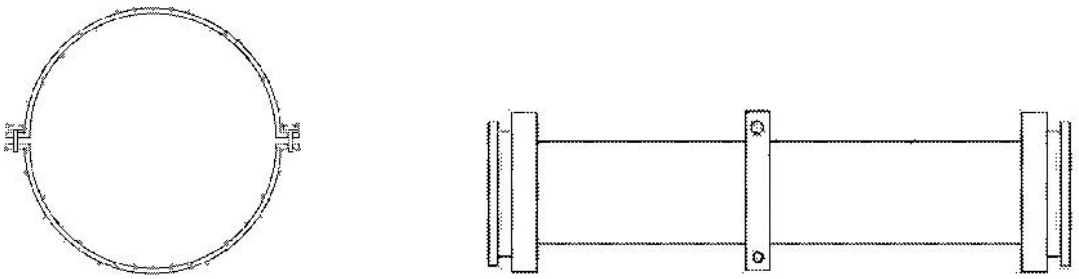

Fig. 4 Semicircular plates for a warp beam (Zhang, 2017)

This plate can be fixed anywhere on the beam so the width of the whole beam can be divided in to two parts. Again, it is not very clear from the patent literature that there can be many more plates like the same and no mention about the way in which the width of the entire warp sheet will be managed with given thickness of the semicircular plates.

Similarly, there are few more patents which have tried to solve the problem of unifying both systems in to one. One notable attempt is by Ki et.al. (11). A beam is provided with separator plates. Six separator plates for seven sections have been shown in the literature. The gap between plates is constant and there is no mention about the way in which they will be adjusted. However, in another patent filed by the same group (12) a system of joining and separating a beam shaft from pole shaped beam shaft is shown. A system of separating plates is arranged and can be mounted on to beam shaft. Provision for height adjustment is there to align both. In both the above patents the inventor mainly has written separator plates as a flat reed through which the yarn is passed. The reed can be adjusted in many ways so as to accommodate various densities of the warp yarn. The figure below shows the arrangement of both the patents.

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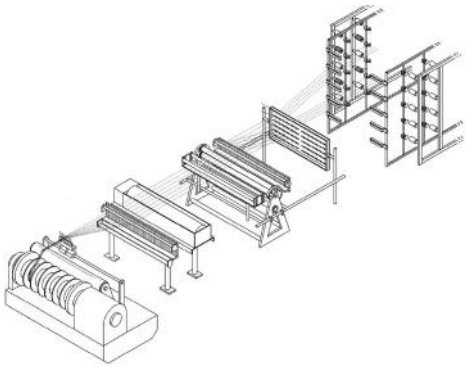

Fig. 5 Warping system with plates

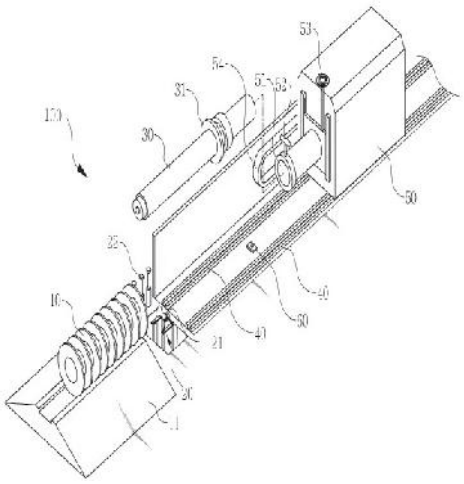

Fig. 6 Beam shaft

UNIFIED DESIGN OF A BEAM

As seen in earlier part there have been many attempts to provide solution to the problem of requirement of two systems of warping. 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 author of the paper to offer the solution to the problem by a novel design 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. 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 is to be used when it is required to warp multicolor warp with complicated design.

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