Design and Development of Warp Beam Storage Machine

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***Abstract*— the demands today made on modern weaving and warp-knitting mills are complex. More yarns on the beams and larger quantity that have to be dealt with require very specific design of storage system. This paper summarizes and gives a documentation of design of warp beam storage and retrieval system i.e. Beam-Stocker that minimize traversing distance, reduce material handling cost, convert storage area into production areas, minimize floor space requirement, accommodate computer control and automation, reduce labor cost, integration in a standardized logistic system and ease of operation.**

I. INTRODUCTION

The demands today made on modern weaving and warp knitting mills are complex. On the on hand there are the small, very fashionable batches that are produced. This required many warp beams in weaving preparation and just as many in the raw material ware-house which again requires a considerable storage and transport capacity. But in order to manufacture economically, the batches need to be large, which means more yarn on the beams and larger quantities that have to be dealt with. So both cases have very specific requirements with regard to transport and storage systems.

Engineering people in today's fast moving textile industry are continuously faced with the problem of where and how to store warp beams. Some of the essential requirements for storage system of warp beams can be listed as follow.

- It must be compatible with material to be stored.
- It must be economic in terms of cost per square meter or whatever other cost criterion is adopted.
- It must be capable of one man operation for depositing and with-drawl

Todo Seisakuso Catalog has describe about transport and storage equipment [1]. Also author has referred Computer controlled warp patterning on sectional warping machine [2], Manual Handling in the Textiles Industry[3], **:** Manual Handling Solution in the Textiles Industry [4], Weaving and Weaving Preparation at ITMA [5] and Material handling in Synthetic Textile Units [6]

II. DEVELOPMENT OF BEAM STOCKER MACHINE

The size, shape, and weight of the warp beam are generally too heavy to be handled without mechanical help.

Basic information of warp beam

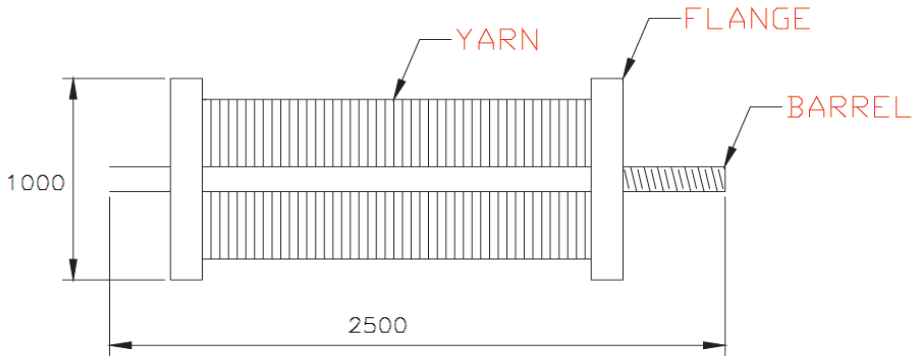

Figure 1 Warp Beam

Over all Beam dimensions

- Barrel Length = 2500 mm
- Flange Diameter = 1000 mm
- Maximum weight of the Beam (with yarn) = 30,000 N
- Hanger Pitch (P_h) = 1200 mm
- Chain Speed = 8 m/min

Selected layout of machine

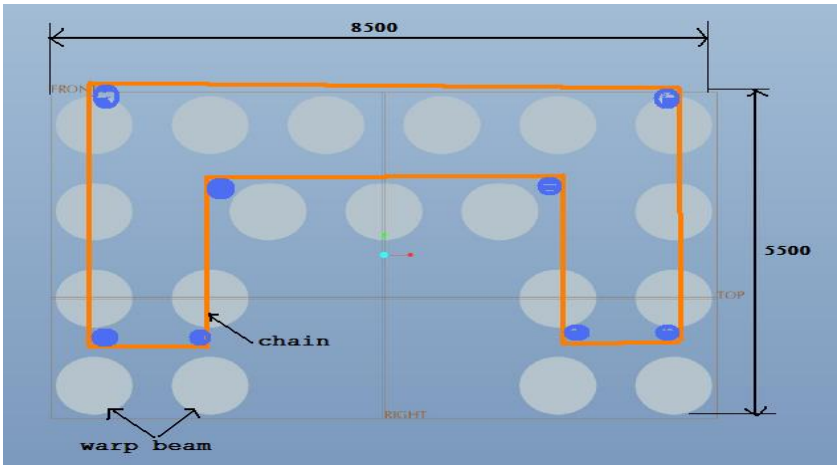

Figure 2 Selected layout

The above layout (figure 2) is perfect for max number of beam storage capacity within limited space. Also design is selected such a way that two warp beam is loaded on a single raw so the capacity of the machine become double. As per above layout 19 raw of beam is there. Each raw handle two warp beam so machine can store 38 warp beams.

Overall specification of beam stocker machine

Length = 8500 mm
Width = 6200 mm
Height = 8500 mm
Beam Stocker – Double Beam Horizontal Type
No of Beams to be store = 2× 19
Flange Diameter = 1000 mm
Hanger Pitch = 1500 mm
Overall length of the beam = 2500 mm
Maximum weight of the beam with yarn = 15000 N

Development of Machine

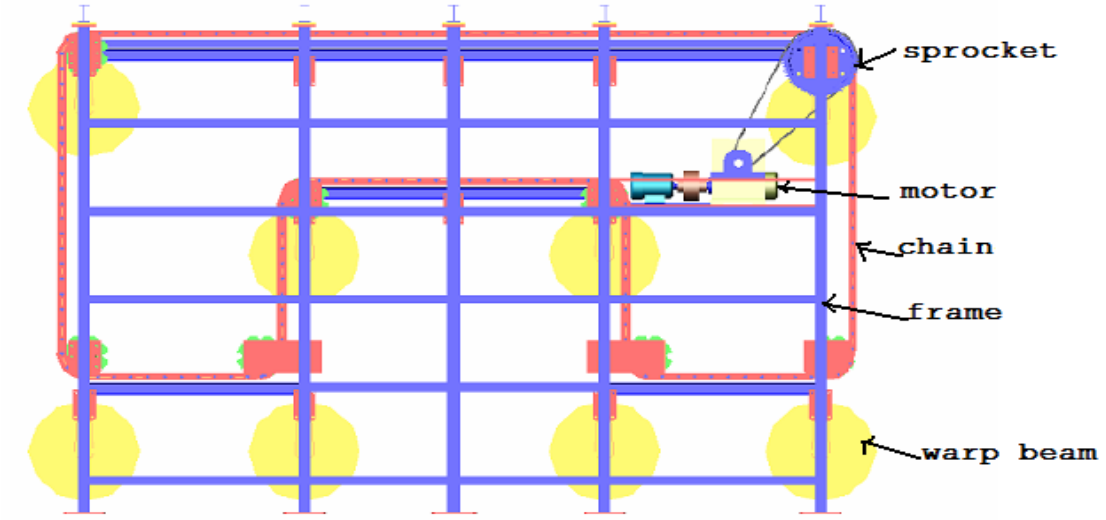

Figure 3 Development of Machine

As shown in the figure, machine is getting power from electrical motor. This motor is connected with gear box for speed reduction, because warp beam is moving at very slow speed but its need very high torque for rotation. The high torque from gear box is transmitted to sprocket. This sprocket is rotating chain. Warp beam is loaded on beam which is mounting on chain through a pin. So this machine is continuous working and it can store 39 warp beams at a time.

Aalysis of pin

pin shaft which is used to support beam at both side.Now apply boundary condition and force on the component as shown in figure 4 Here cylindrical joint applied because pin of shaft is inserted in the roller chain hole. Weigh of warp beam15000 N is applied on single pin.

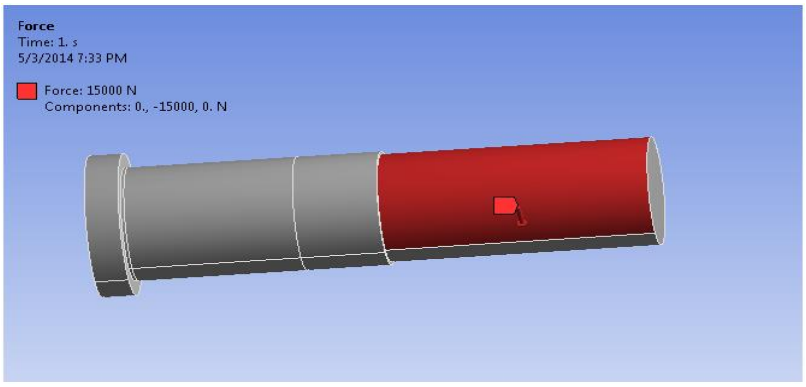

Figure 4 Boundary Condition of Pin

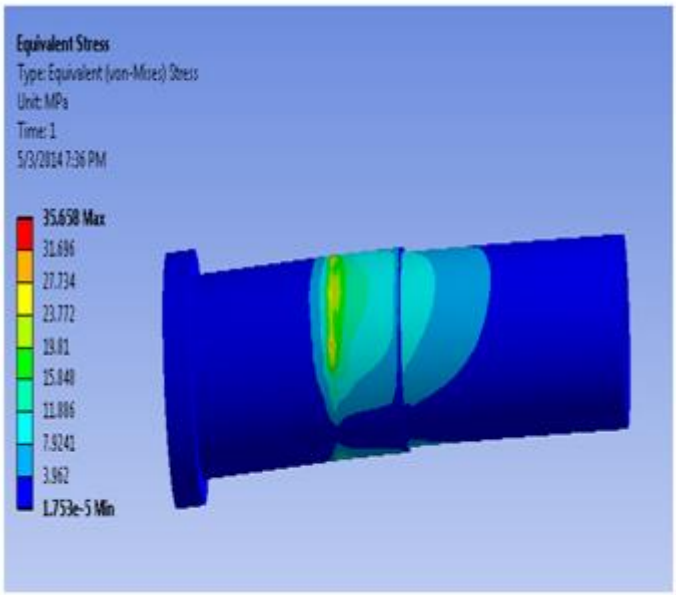

Figure 5 Von-Mises Stress of Pin

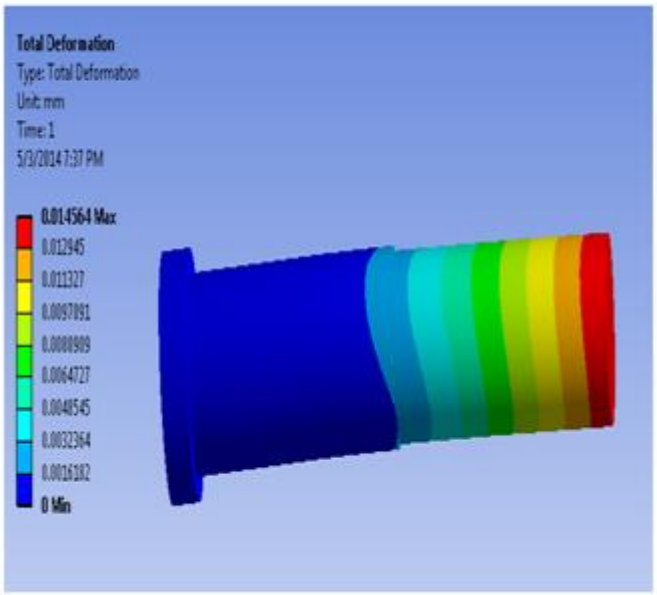

Figure 6 Total Deflection of Pin

Static analysis is done as shown in Figure 5 shows von-mieses stress induced in shaft is around 36 Mpa which is safer. And Figure 6 shows total deflection of shaft is around 0.014 mm which is safer than calculated safe deflection.

Aalysis of beam

Beam which is used to support warp beam at both side. Now apply boundary condition and force on the component as shown in figure 7. Here cylindrical joint applied because pin of shaft is inserted in the hole of beam. Weigh of single warp beam15000 N is applied on beam. Here two warp beam is hanged on single beam.

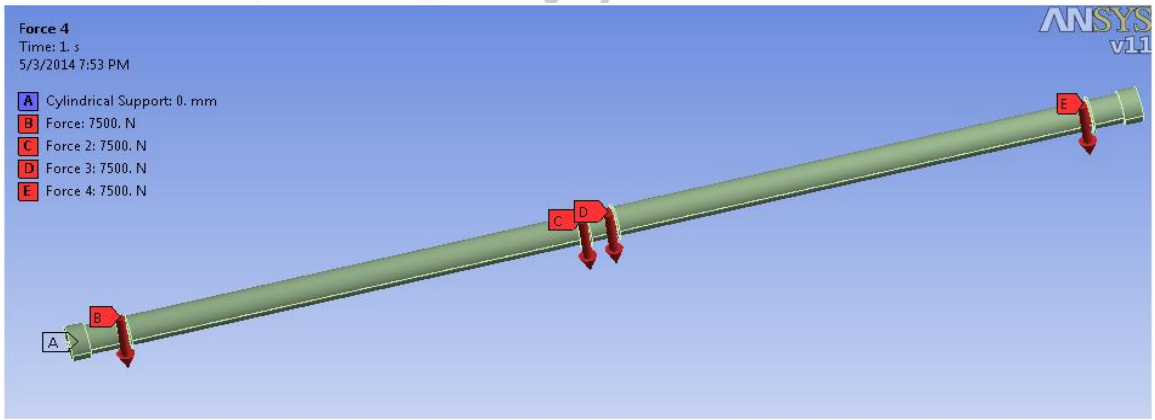

Figure 7 Boundary Condition of Beam

Figure 8 shows von-mieses stress induced in shaft is around 90 Mpa which is safer.

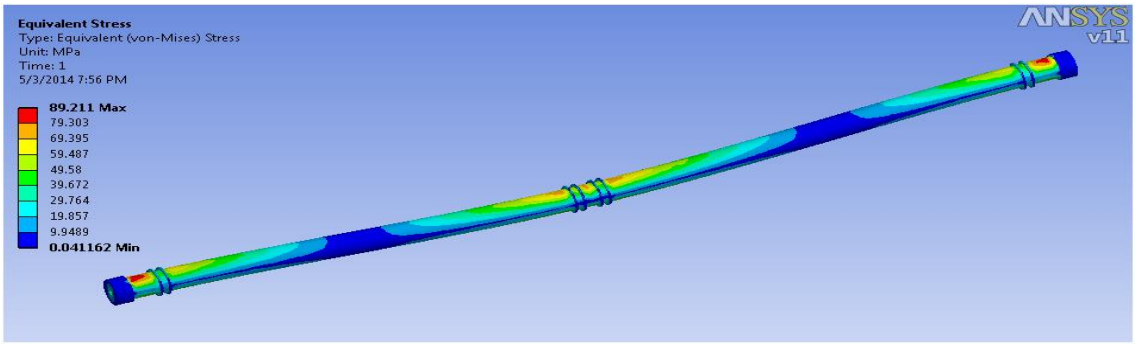

Figure 8 Von- Mises Stress of Beam

Figure 9 shows total deflection of shaft is around 6.6 mm which is safer than calculated safe deflection.

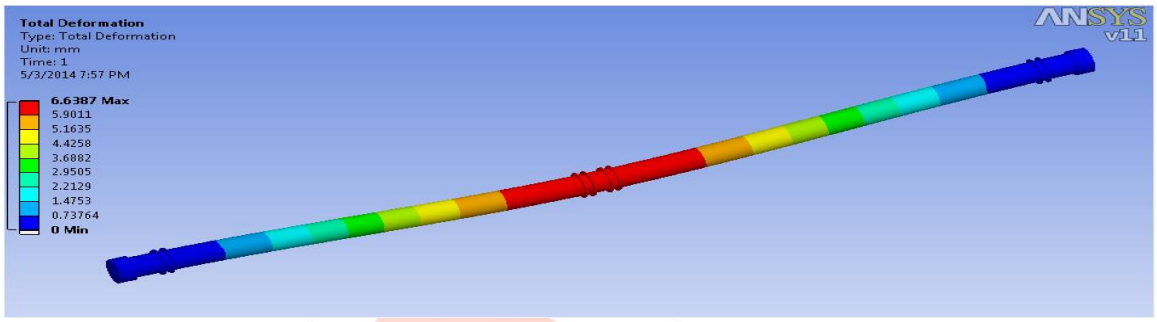

Figure 8 Total Deflection of Beam

Analysis of frame

As shown in figure 10, frame which is used to support all components placed on machine.

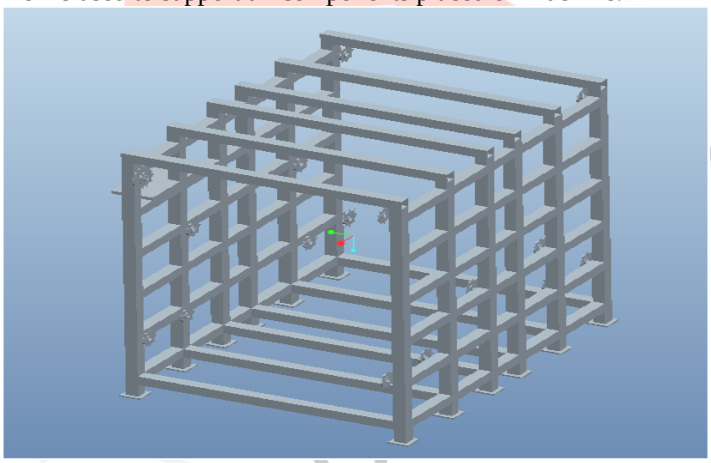

Figure 10 3-D View of Frame

Here single channel is used to fabricate frame as shown in figure 11. Square channel having dimension of 300×300×16 [7]

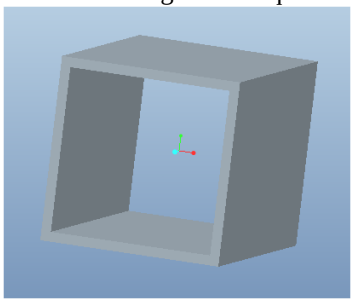

Figure 11 Shape of Square Channel

Now apply boundary condition and force on the component as shown in figure 12. Here fixed joint applied at A the bottom part of channel. Force is applied at all supporting assembly as shown in figure. Total weight to be carried out by chain by considering factor of safety is *917280* N is applied at C portion and 1500 N is the weight of motor and geared box is applied at B as shown in figure.

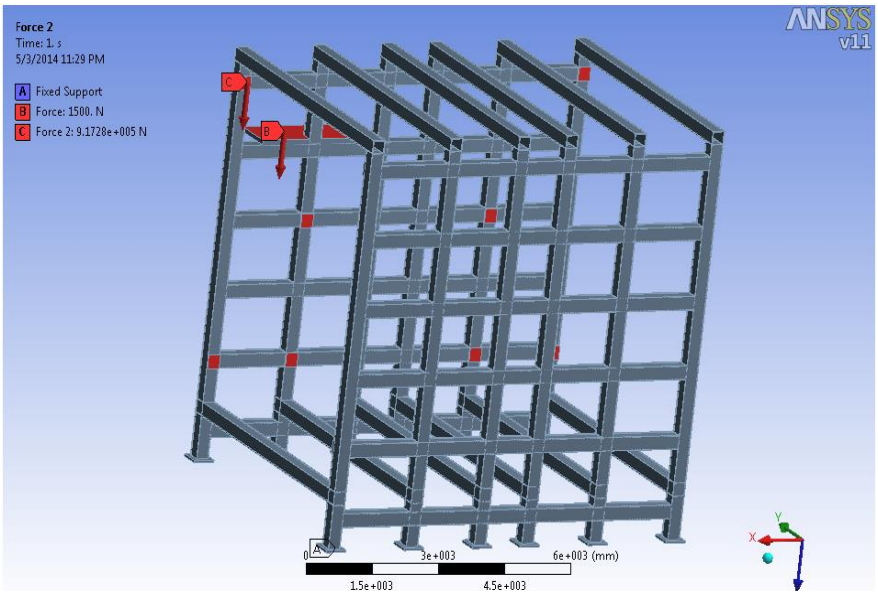

Figure 12 Boundary Condition of Frame

Figure 13 shows von-Mieses stress induced in frame is around 9 Mpa which is safer.

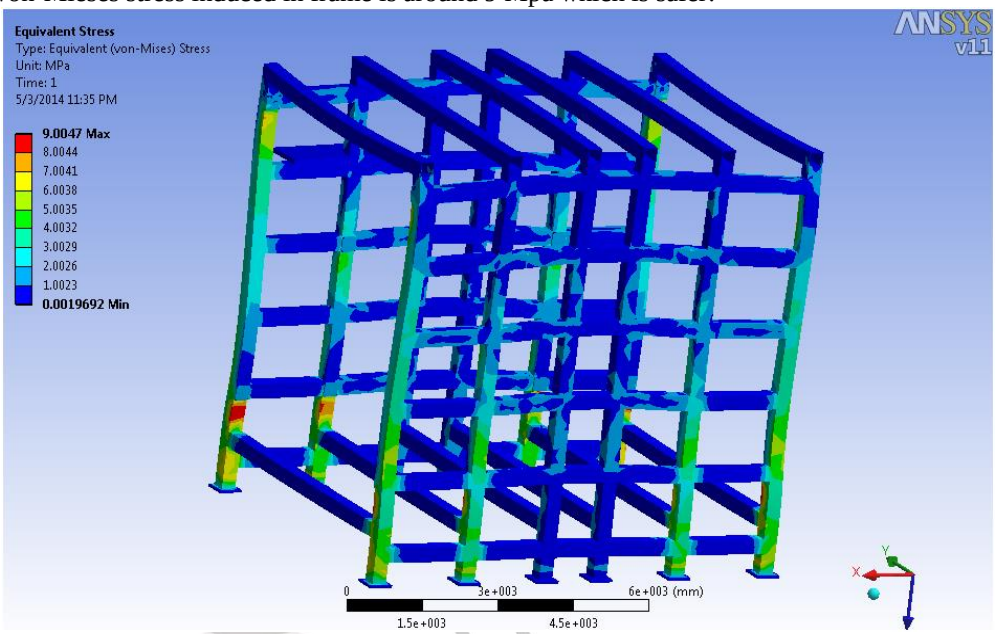

Figure 13 Von- Mises Stress of Frame

Figure 14 shows total deflection is around 0.23 mm which is safer than safe deflection.

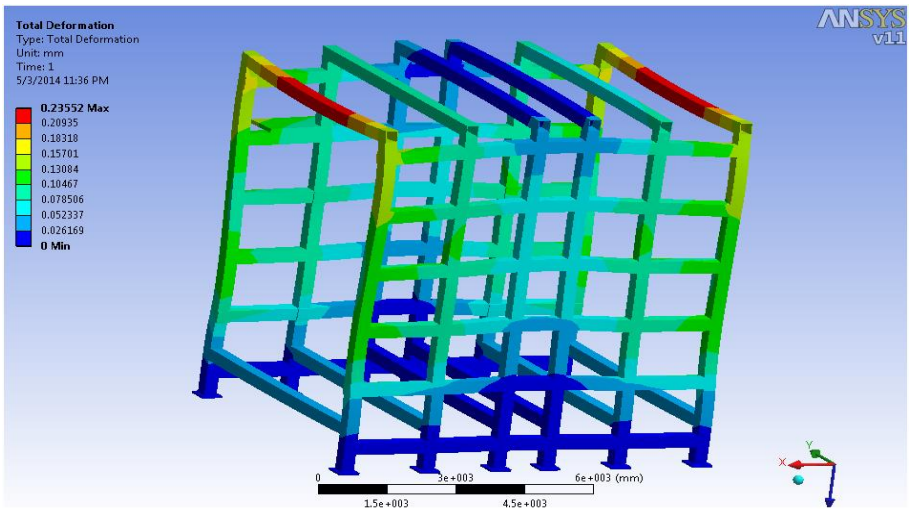

Figure 14 Total Deflection of Frame

III. CONCLUSION

The main objective of the project work is to develop a storage system with which handling of the heavy textile warp beam can be possible with one man operation and here with execution of the project it is fulfilled. Development and Analysis of machine is completed.

REFERENCES

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