Design and Analysis of Stenter Chain – A Review

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Abstract

The stenter chain is used in stenter machine in textile industry. The stenter pin chain and combined pin & clip stenter chain have been re-designed. The main object of present work to make simplest design and carried out its analysis for reducing the friction from the guide surface as much as possible and consequently decreasing the power required to drive the stentering machine and enabling the stentering chain to be higher linear speed. Also the objective of this project is to make light and strong chain. Some models of the stenter chain will be proposed and finite element analysis needs to carry out and these results will be comparing with existing design. The existing design of the stenter pin chain is made of mild steel and combined model is made of LM24 grade aluminium casted alloy. The material suggested for the proposed design is made up of the same material used in stenter pin chain and also suggest to use sheet metal instead of LM24 grade aluminium casted alloy for combined stenter pin and clip chain.
Keywords: Stenter pin chain, combined stenter pin & clip chain, stenter clip chain

I. INTRODUCTION

A. Stenter Machine:

Stenter is a machine for thermally treating a textile fabric. The fabric in open width condition is passed through the stenter. During the passage of the fabric through the stenter, hot air steam is directed onto the fabric from above and below by an assembly of blowers, radiators, nozzles etc. arranged above and below the fabric. The assemblies are known as chamber and are suitably insulated to ensure minimum loss of heat.

Fig. 1: Stenter Machine

B. Stenter Chain:

The stenter chain glides through the cast iron rails which provide long service life, low coefficient of friction between sintered bronze chain bottoms and special grade cast machined and ground rails reduces lode on the main drive motor and gears. The choice of chain type depends on the process and fabric. The chain is available in alternatively type of pin only, clip only and pin clip combined.

The clips are made of several individual, pressures die-cast, easily replacement components. These components are made from special corrosion resistant aluminium alloy and are distortion proof even at high heat setting temperature. These components are very well designed to ensure long trouble free performance all kinds of fabric. The steel shoe holding the clips are tatted with sintered metal liners and connected with steel links. The roller chain glides smoothly on special cast iron rails. The superb sliding property of sintered metal is to considerably reduce lubrication requirements even at high heat setting temperatures, thus ensuring safe operation and long life.

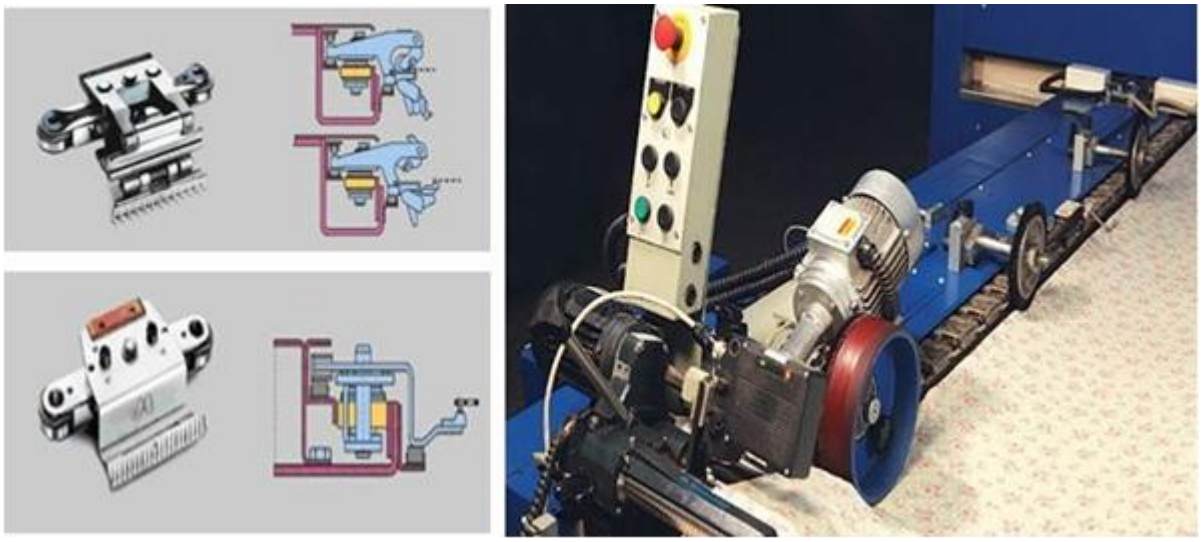

Fig. 2: Stenter Chain

II. LITERATURE REVIEW ON WORM AND WORM GEARBOX EFFICIENCY AND LIFE

A. Stenter Clip, Apte, Vasant Vyanktesh, EPO219941AI, 1987:

A stenter pin having pin body which is made of pressed sheet metal. One end of the pin body is attached to a chain that moves the pin between the hot air nozzles of a textile while it is transported through the stenter. The other end of the clip gate is to hold the edge of the textile while it is transported through the stenter. Alternatively the edge of the textile may be retained by the pin bar which is also mounted at the front of the clip body. The center region of the clip body has V-shaped region and a pair of rolling bearing are mounted on rolling bearing move in guide channel rails xed inside the stenter to prevent the tilting of the stenter clip. The clip is made of pressed metal and so is cheaper than known clips by arranging the bearing at 45 degree to the horizontal. The height of the clip can be very small allowing the nozzle of the stenter to be positioned closer to the textile and hence allowing more efficient treatment of the textile.

B. Stenter Chain, C.G.Renold, US1478454, 1923:

The aim of the present work to make lighter chain, decreasing the power required, increasing the linear speed and make a strong chain. This design relatively light chains are made on general lines usual in driving chains, the inner links are joined in pairs by bushes are passed to connect the outer links in pairs. The links are formed with laterally projecting lugs bent out from the metal of the links and these lugs support rollers which either take up the lateral tension or take up the weight of the chain according to the plane in which the pivotal axes of the chain links are arranged to move. The laterally projecting lugs may also serve for securing the stenter clips or pinned plates. The chain itself is then provided with rollers either on the projecting ends of studs passing through the inner bushes or on projecting ends of solid studs connecting the outer links. These rollers are arranged to operate in guide tracks and when the chain is arranged for the pivotal axes of the links to move in a horizontal plane, these rollers take the weight of the chain and any canting stress may act in either direction owing to the pull of the fabric on the one hand and to the thrust on the other hand necessary to open the spring clip jaws when such are employed. When the chain is arranged with the pivotal axes vertical these latter rollers serve to bear the lateral stresses.

C. Tenter Chain, H.A. Madenight, US2285820, 1942:

This design relates to improvement in stenter chain. The particular improvement disclosed resides in provision of means whereby the clips are maintained in desired alignment. The principle of these design to provide a form of connection for the roller links which will enable stenter clips to be associated there-with and still be maintained in substantial alignment so long as the clip are engaged with cloth being processed.

D. Combind Clip & Pin Chain Link for Fabric Stretching Machines, P.Deck, US2446131, 1948:

This design relates to improvement in combined clip and pin Chain links for fabric stretching machine. Clip links as parts of a stenter chain are known which are adapted to grip the edges of textile materials. The movable part of the clip link is customarily provided with a knife edge for securely engaging the fabric. Pin strips are known as parts a stenter chain in which the edge of the fabric is engaged by the pins for stretching the fabric. When the clips are used for stretching, the pin strips are left unguarded and the fabric can easily come into unwanted contact with the pins of the pin strips when the fabric is introduced into the clips and even after the fabric has been inserted into the clip due to small initial tension. The fabric is damaged thereby or a bending of the pins occurs. When alternately the pin strip are used for stretching, the movable parts on the clip link, which for the purpose of its clamping operation is customarily provided with a considerable weight for loading, lies with its sharp knife edge on the clip plat

by the movement of the chain links due to unavoidable vibrations and again falls back on to the same time. Because of this movement of the movable part of the clip links relative to the clip plate, the sharp knife edge of the movable part is worm.
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E. Pin Plate Attachment for clip tenter chain, E.C.Rust, US2822601, 1958:

In this research paper, Researcher studied different methods are discussed for power loss reduction. No load losses can be reduced, especially at low temperatures and part load conditions when using low viscosity oils with a high viscosity index and low oil immersion depth of the components. This in turn influences the cooling properties in the gear and bearing meshes. All in all a reduction of the gearbox losses in average of 50 % is technically feasible. There is a comparison of the no load losses of different bearing Types for same load capacity C = 20 kN. Lowest no load losses of radial bearings are expected for cylindrical roller bearings. They also low values of taper roller bearings are valid for unloaded bearing arrangements. Dependent on the application and the operating regimes a power loss reduction potential in a gearbox of some 50% was proven to be possible. In some applications only the simple change to a highly efficient lubricant can save some 20% power loss.

F. Tentering Clip Chain, H.H.Richter, US4134189, 1979:

This design relates to the base of stentering clips pivotally connected to form an endless tentering chain and especially to a structure wherein three rollers are placed in tandem on opposite sides of the base and wherein the roller shaft is also the pivotal connection between adjacent clips.

G. Chain Track Assembly for Tenter Clips, F.Gageur, US3457608, 1969:

This design relates to a chain track assembly for tenter clips comprising a substantially vertical flexible and joint less guide rails, a plurality of tenter clips guided by the rail and having roller means positioned adjacent the rail on both sides of the latter and angular clamping members for supporting the guide rail, a horizontal portion of one of the clamping member constituting supporting surface for a roller on each of the tenter clips.

H. Tenter Clip Chain, T.R.Coburn, US3418702, 1968:

A stenter clip chain comprising universal joints interconnecting base members of adjacent stenter clips, each clip being adapted to be drivable from to di erent direction by sprocket lying in two different planes.

III. CONCLUSION

I have referred various literature papers and market survey relevent to stenter chain. From my research I found problems like frictional loss, complicated design, less load carrying capacity, low speed, high manufacturing cost, high maintenance cost, high weight. So I will give new proposed design to overcome these problems. I will optimize design in CREO and will carry out its analysis in ANSYS and I will compare these results of existing and proposed model.

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