STUDIES ON THE PERFORMANCE OF SEWING THREADS DURING HIGH SPEED SEWING IN AN INDUSTRIAL LOCKSTITCH MACHINE

by

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Thesis submitted
in fulfilment of the requirements
for the award of the degree of
DOCTOR OF PHILOSOPHY

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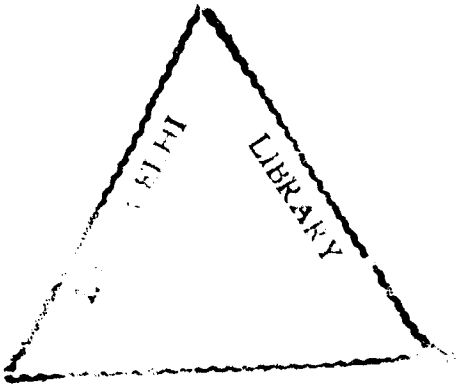
OCTOBER, 1996



to

my father, mother and

all who have been my source of inspiration and s

CERTIFICATE

This is to certify that the thesis entitled "***STUDIES ON THE PERFORMANCE OF SEWING THREADS DURING HIGH SPEED SEWING IN AN INDUSTRIAL LOCKSTITCH MACHINE***" being submitted by Mr. *G. Sundaresan*, to the Indian Institute of Technology, Delhi, for the award of the degree of **Doctor of Philosophy** in the Department of Textile Technology, is a record of *bona-fide* research work carried out by him. Mr. G. Sundaresan has worked under our guidance and supervision and fulfilled the requirements for the submission of the thesis.

The results contained in this thesis have not been submitted, in part or in full, to any other University or Institute for the award of any degree or diploma.

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ABSTRACT

Sewing threads which are ply, cord or cable yarns form an important stress member ir the seam of garments and other fabric assemblies. The steady rise in production rates the expanding applications of textile materials and the arrival of modern high spee machines with specific functions have resulted in making increasing demands on th performance of sewing threads. This has not only necessitated the production of bette quality threads but also has brought into focus the importance of the technologica properties of the thread that influence its performance.

The needle thread in a lockstitch machine amongst various sewing machines, is subjecte to higher stress which is the major constraint to any increase in machine speeds. Th seam produced on this machine is also more prone to pucker due to higher sewin tensions. Considering these aspects, the lockstitch machine was selected for the prese study.

The needle thread dynamic sewing tension and the reduction in thread strength are t two factors that can provide useful information on the important aspects of high spe performance of sewing threads. Though there have been many studies on these tv aspects, little has been suggested on the engineering of threads for better sewing a seam performance. The mechanism by which the tensile and frictional properties of t thread and machine parameters like the compensating disc tensioner settings influence

sewability is not fully known. These can be attributed to the fact that there have been very *little research* on the *dynamics of the machine* with reference to the way in which the *thread* and the fabric *mechanical properties* affect it. The present research work is, therefore, aimed at investigating such unexplored aspects of the performance of sewing threads. The *objective* of the work is to study the mechanism of *generation of dynamic sewing tension* and that of the *thread strength reduction* in order to have a fairly *comprehensive knowledge* on the *performance of sewing threads.*

The *generation of dynamic sewing tension* and the *withdrawal of thread* from the compensating disc tensioner during the stitch forming process have been analysed by employing the theories on *strain wave propagation* which explain the influence of *load-elongation* relation of materials on their *behaviour at high rates of loading*. Accordingly, the difference in the behaviour of polyester and cotton threads at high sewing speeds can be attributed to the difference in their load-elongation relation.

The dynamic needle thread tension for polyester and cotton threads has been measured using a *semiconductor strain gage* based tensiometer fabricated for this purpose and *interfaced to a 386 Personal computer to enable continuous recording* of the tension data. The needle thread tension along with static tension at the disc tensioner and the stitch tightening ratio clearly indicate the influence of modulus, the shape of the load-elongation curve and the thread-metal frictional property of the thread on the peak tensions and the let-off behaviour of the thread. The variations in the peak tension along with their traces over a stretch of 75 stitches highlights the limitations of the present thread let-off system.

Studies on the *thread strength* of sewn threads show that there is significant reduction i its tenacity, initial modulus and toughness. *Longitudinal* and *cross-sectional* investigatio of the sewn threads show that the reduction is mainly due to the structural damage thread. This is supported by the *strength reduction* and *SEM* studies of the constitue fibres.

The *thread structural properties* like its *size, twist, number of plies* and *fibre denier a strength* and *fabric tightness* have been found to have significant effect on thread streng reduction.

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