PRODUCTION OF COTTON NONWOVEN FABRICS USING H1 TECHNOLOGY NEEDLELOOM

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Abstract

H1 technology needleloom of Fehrer, AG is the latest development in needlepunching machinery. A brief overview about this technology is given in the article. In addition, the potential of this technology for the development of natural fibers based nonwoven webs is briefly discussed.

Introduction

Needle punching is the oldest and well-established method of forming nonwoven textile materials. Recently, Foster has given a useful overview of the history and developments at the 2000 INDA Needlepunch conference (1). Among the few needlepunch machinery manufacturers, Fehrer and Dilo are prominent and leaders in the trade. In order to remain competitive and innovative, needleloom manufacturers are constantly endeavoring to come up with new machinery designs and features. These activities have resulted in the increase in needle strokes per minute, improved needle zone configurations, improved needle shapes and designs, etc. The increase in needling speeds and needleloom designs have forced the needleloom feed unit manufacturers to constantly improve design features and keep in pace with the developments in needleloom technology.

Traditionally, manmade fibers such as polypropylene find immense applications in nonwoven textiles. There has been a major upsurge in research on the use of natural fibers such as cotton and wool in nonwoven fabrics. This has been mainly due to the types and the usefulness of specialty nonwoven products that can be developed from them and also due to several research programs in this area by research organizations such as Cotton Incorporated (USA) and Wool Research Organization of New Zealand.

The aim of this paper is to briefly review the latest developments in needleloom technology and its application in the development of nonwoven textile products from natural fibers.

H1 Technology Needleloom

The latest "state-of-the-art" needleloom technology is a patented invention of Dr. Ernst Fehrer of Fehrer, AG, Austria. The new H1 needleloom technology was aimed at enhancing the quality of nonwoven webs produced from them. Limited literature available on the new technology reveals that the contoured needle zone helps in the enhancement of the characteristics of the nonwoven web (2). According to Fehrer machinery (3), the contoured profile offers enormous advantages:

1) The longer needle path results in good fiber orientation and fiber entanglement than the conventional needle machine
2) Superior web properties can be obtained with fewer needle penetrations
3) The "state-of-the art" H1 technology needle loom has been found to be highly successful in developing composite and hybrid products

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In addition, the H1 technology machines have been found to be cost effective due to its increased productivity.

Figure 1 delineates the needling zone of the H1 technology machine. The oblique angled needle zone is clearly visible in the figure. It is because of the contoured profile, it is possible to obtain a well-integrated needle web. In addition, the strength realization is higher for H1 technology needle webs than the conventional webs.

Figures 2a and 2b show the macroscopic structural images of both the conventional and H1 technology needle webs. As is evident from Figures 2a and 2b, the structure of the H1 technology web is highly integrated and coherent than the conventional technology needle-punched mats.

Processing of Cotton and Natural Fibers using H1 Technology Needlepunching Machines

The major issue concerning the use of cotton in the manufacture of nonwoven products is the cost associated with its processing to develop superior nonwoven products that have specialty applications. Majority of the nonwoven cotton products find applications in the medical field. Some of their applications include medical wipes, bandages, cushion pads for lymphedema, wound wrappers, diapers, etc. These products require special care during processing and this exacerbates the production costs associated with the processing of these products. With the new H1 technology needlelooms, due to high throughputs, it is possible to increase the production. In addition, it is claimed by the manufacturers that the amount of needling required to produce a web of superior quality and performance is less compared to conventional needle loom — this again reduces the cost of production. In a similar vein, the increase in productivity will also enhance the use of animal fibers such as wool and mohair for developing carpets, floor and wall coverings, etc. In addition to the productivity aspect, the arrangement of fibers in the web and its structural integrity is also important for applications in carpets and medical textiles.

Cleaning and Feeding Requirements for the H1 Technology Machine

The feeding and other preparatory requirements for the H1 technology machine are similar to those of conventional needle looms. A paper by Sawhney and Parikh (4), in this conference have delineated the importance of proper cleaning and carding of cotton for developing cotton nonwoven products. There have been some improvements in the feeding devices in the recent past. These have been mainly to enhance the precision and the uniformity of the feed and control of the feed material to the needle loom. One such example is the micro control feed monitoring systems installed in feed units.

William Tatham, Ltd., England has most recently come up with a feed monitoring system known as Microfeed 2000 for monitoring and controlling the delivery of fibers to the card (5). This system is more or less similar to the autolevelers in drawframes that are used for maintaining the uniformity in feed and delivery. It is claimed by William Tatham, Ltd. that micro weigh/feed system improves the quality of webs produced on the needle looms. The manufacturers state that such systems are very useful in the manufacture of hybrid and composite products. Figure 3 shows the micro feed unit in conjunction with the feed unit to the card.

Conclusions

A short overview on the latest advancements in the needleloom technology has been given in this article. The overall aim of the article is to brief the advantages of the new H1 technology needleloom and understand its suitability for the production of nonwoven products from natural fibers like cotton. From the foregoing brief discussion it is clear that the changes in

needle zone contours and profiles will certainly improve the structural features of nonwoven webs. Furthermore, the amount of needling necessary in H1 technology needle looms is less compared to those of conventional needle looms. These aforementioned features are expected to increase the use of natural fibers in the development of nonwoven products. Most recently, a US Department of Defense (US Army SBCCOM) research contract to the principal author (S. S. Ramkumar) has made possible to obtain the "state-of-the art" H1 technology needleloom at the International Textile Center (ITC) of Texas Tech University. The main purpose of the grant is the development of nonwoven fabric substrates for protection against chemical and biological hazards. In addition, the new technology nonwoven machinery will be utilized to develop natural fiber nonwoven products. The nonwoven machinery will be installed at the ITC by March 2000. Experiments will be conducted immediately after the installation involving different types of fibers. Results on the development of natural fibers based nonwoven products will be reported at the 2002 Beltwide Conference.

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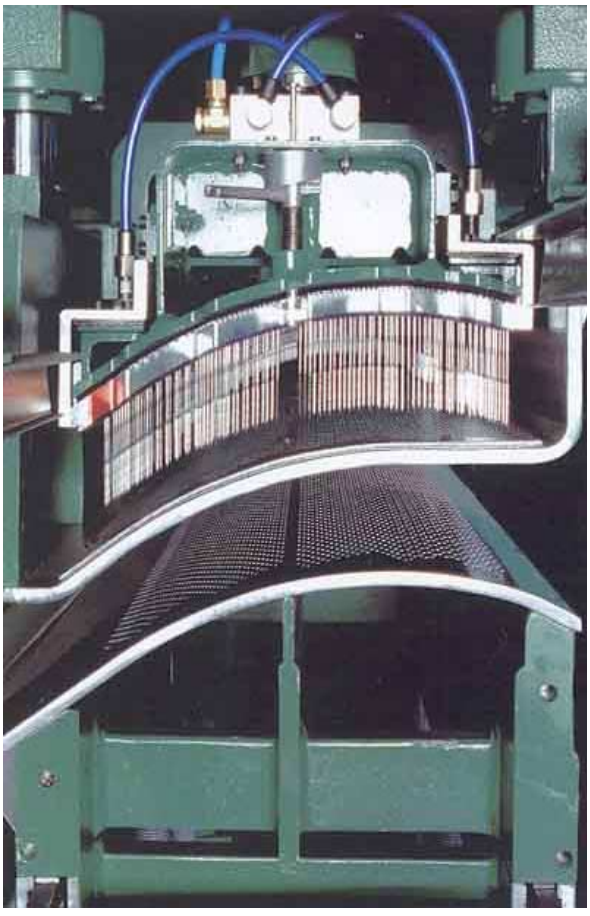
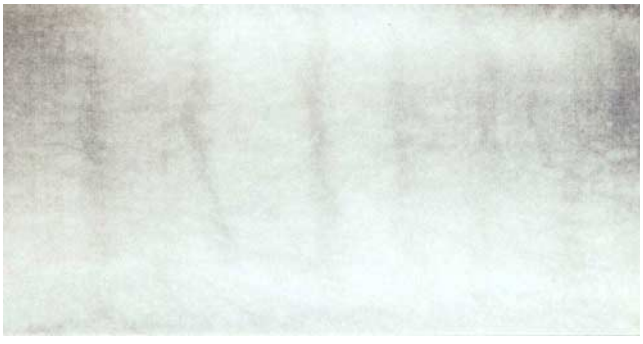


(Source: Fehrer, AG, Austria)

Figure 1. H1 Technology Needleloom.



(Source: Fehrer, AG, Austria)

Figure 2a. Conventional Technology Needle Web.

(Source: Fehrer, AG, Austria)

Figure 2b. H1 Technology Needle Web.

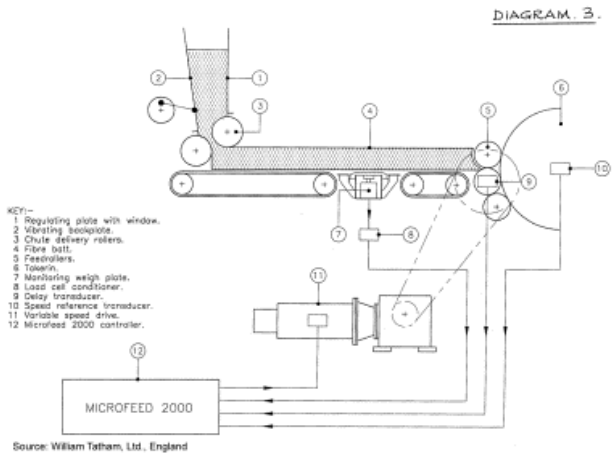


Figure 3. Micro Feed Unit to the Card.