Advanced tufted carpet patterning technology

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Abstract: After a review of the tufting industry’s development, and a brief introduction to available systems for producing patterned tufted carpets, the principle of ICN (Individually Controlled Needle) and the related advanced tufting technology Colortec are presented. Finally, Colortec machine, Axminster weaving machine, and Wilton loom are compared. It is believed that the Cobble Colortec machine is a significant jump forward in the tufted carpets industry as it now allows access to all major carpet markets in a competitive fashion.

Key words: Tufting, Patterning, Sliding needlebar, Colortec, Creel, Scroll

INTRODUCTION

China’s tufting machine industry has recently been developing rapidly against fierce competition from UK and USA manufactures, and its formerly narrow width tufting machines are now available in five meter width. The width increase was accompanied by the speed increase of up to 2000 r/min and integration with sliding needlebars and yarn feed roller control with scrolls and finally with computerized servo motors (Cooper, 2003).

Until recently, facilities for producing patterned carpets by tufting have been more limited than facilities for producing carpets by weaving. Despite the availability of many variants on the basic patterning mechanisms, more ingenuity has been demanded of designers to make tufted carpets aesthetically attractive. The patterning in tufted carpets can be created in many ways, including the control of the backing cloth, yarn feed and sliding needle bars. These different mechanisms can be controlled by electronic and (or) mechanical means.

The two major categories of techniques available in the industry are sliding needlebar techniques and yarn tensioning techniques. The sliding needlebar technique changes the sequence of pre-colored yarns laterally to give “crossover” style of carpet, all the colors being visible in all weft rows of the carpet. Yarn tensioning technique is commonly used to produce carpet with high and low loop, or carpets with areas of cut pile and loop pile. These two basic techniques have been elaborated by means of more sophisticated mechanisms: by combining the techniques or by designer’s techniques such as “planting” additional colors in the creel when using a yarn tensioning technique; or using space-dyed yarns to provide additional color in what is essentially a two-color design. Patterns may be controlled by mechanical, photoelectric or microprocessor systems.

In the last decades of years the patterning technique has evidently progressed. Varies of new techniques are created, such as computer controlled scroll patterning mechanism, buried end technology, MRA (multi roll attachment), enhanced sliding needlebar mechanism, full repeat scroll system, and so on. In the mid-1990s two quite new patterning mechanisms Colortec and Tapistron with the core principle of ICN became commercially available. They can generate six-color patterns similar to those produced on gripper Axminster looms. The status of these machines in the world carpet industry will undoubtedly develop in relation to industrial attitudes and consumer prefer-
INDIVIDUALLY CONTROLLED NEEDLE (ICN)

ICN method was invented by Cobble, one of the most important tufter manufacturers in the world. The ICN concept allows an individual needle to be selected to tuft or not to tuft. If the yarn is not required in any part of the design, it does not appear in the carpet at all, so there is no unnecessary buried yarn as in two-color scroll patterning or multi-frame Wilton weaving.

Fig. 1 shows the design of the individually controlled needle. The needlebar carriers (at a standard gauge of 3/16") are supported independently of the needle drive mechanism and a needle does not penetrate the backing fabric unless selected by the pattern control system. The solid state patterning system can instruct the pneumatic latching cylinder to engage or disengage the lath pin from the needle holder. When the latch pin is engaged, the needle interacts with a cut-pile looper in the conventional way. When the latch pin is disengaged, the needle holder is returned to its rest position by a lift spring. Yarn feed is started by the tufting action only, so yarn feed rollers are not installed. Until required, a spring tensioner located in the needle unit in the yarn feed mechanism holds each cut end of yarn securely (Xue, 2003).

Patterns are prepared by a separate CAD unit to allow the designer to prepare designs stitch by stitch for the exact placement of tufts into the base cloth. Patterns can be up to full-width repeat.

The Colortec machine is a further development that uses the ICN mechanism in combination with a sliding needlebar. The Colortec machine has broadened the market to allow tufting machines to enter the previously exclusive Wire Wilton and Axminster loom market. This is because intermittent cloth feed in conjunction with sliding needlebar and ICN needle selection, allows sideways filling of each row. Three sliding movements are used with three colors threading and six sideways movements with six threading colors. In this manner each tuft can be sewn selectively with any of the colors in use, producing individual tuft definition in complex patterns directly comparable with Axminster or Wilton pattern carpet.

COLORTEC

Cobble first created the Colortec machine that uses ICN tufting needles mounted on a single sliding needlebar. It can tuft full-width repeats of cut-pile carpet in up to six colors. Ohno, which used to be the cooperator of Cobble when it innovated the Colortec, used the machine for producing rugs, but initial interest in Europe and the USA was in the broadloom style.

The size of the creel for the Colortec machine is the same as that of a normal tufting machine. At most six colors are threaded in the same repeating sequence, e.g. 1–6, across the machine. The same color of yarn may be tufted by a particular needle up to six times within a cycle of the machine. Only one sixth of the creel positions are, therefore, occupied by a particular color.

In a six-color design, the sliding needlebar moves six times, one gauge point at a time. Therefore, each needle in a group of six has the opportunity to interact with any of the six loopers in the sequence. Selection of the interacting needle (color) is determined by the patterning system, which actuates the ICN mechanism. At the extreme, the same color may be selected for six strokes of the needlebar in all groups of six needles, giving a row of tufts in a single color. The needle movement within a cycle of six