I, Robert W. Cooper, declare as follows:

1. I am over 21 years of age and otherwise competent to make this Declaration. I make this Declaration based on facts and matters within my own personal knowledge.

2. I am Technical Editor at the Journal of Textile and Apparel, Technology and Management (JTATM), located in Raleigh, North Carolina and housed at North Carolina State University.

3. The JTATM is an online journal published by North Carolina State University that serves the professional needs of textile educators, researchers, and industry worldwide.

4. The article, "Three-Dimensionally Knit Spacer Fabrics: A Review of Production Techniques and Applications," authored by Bruer et al. and attached hereto as Exhibit A, was originally published in Volume 4, Issue 4 of the JTATM in Summer 2005. Specifically, the article was publicly available on the internet from JTATM's website at http://ojs.cnr.ncsu.edu/index.php/JTATM starting on or about September 2005.

5. Subsequent to the original publication of the attached article, comments were received from another researcher in February 2006 and certain corrections were made to the original version, as noted in the Managing Editor's note and coauthor's notes at the end of the attached article.

6. The revised version, which is the version appearing in the attached article, Exhibit A, was uploaded to JTATM's website on or about March 21, 2006.

7. Following JTATM's standard procedures, the Summer 2005 issue (Volume 4, Issue 4) of JTATM, including the attached article, was archived on or about June, 2008. When an issue of JTATM is archived, it is no longer posted on the web. However, anyone, including interested researchers, can contact JTATM to obtain a copy of archived issues.

8. To my knowledge, the article attached hereto as Exhibit A is a true and accurate copy of the article as it appeared on JTATM's website from about March, 2006 until June, 2008 when the Summer 2005 issue was archived.

9. I declare that all statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Executed on the _29_ day of August, 2016

Robert W. Cooper

Robert W. Cooper

EXHIBIT A

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JTATM

JOURNAL OF TEXTILE AND APPAREL, TECHNOLOGY AND MANAGEMENT

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Three-Dimensionally Knit Spacer Fabrics: A Review of Production Techniques and Applications

Shanna M. Bruer, Ph.D. Student
Professor Nancy Powell
Dr. Gary Smith, Associate Professor
NCSU College of Textiles

ABSTRACT

As the textile complex is faced with increasing competition, innovation and specialization have been employed by many machinery and product manufacturers to create a niche in the marketplace. In an effort to compete and appeal to the end-use market, products that go beyond the current range of performance and style have been developed. This paper will focus on the development of such specialized production through the use of knitted spacer fabrics. Basic knitting concepts will first be introduced followed by a review of literature on the history, technologies, advantages, disadvantages and potential end uses of knitted spacer fabrics.

Keywords: Spacer fabrics, knitting, automotive textiles, technical textiles

1.0 INTRODUCTION

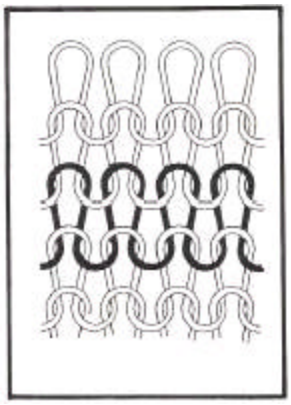
As control of the textile complex has shifted further downstream to the consumer, manufacturers have been faced with greater and more specialized demands. In order to compete and appeal to the end-use market, it is therefore important to offer products that go above and beyond the current range of performance and style offerings. One industry striving to meet such demands is the manufacturers of knitting machinery and knitted fabrics.

This paper will first introduce some necessary knitting concepts and then discuss the topic of spacer fabrics. Literature on the history, technologies, advantages, disadvantages and potential end uses of knitted spacer fabrics will then be presented to create a complete understanding of spacer fabric's purpose and means of production.

2.0 KNITTING FUNDAMENTALS

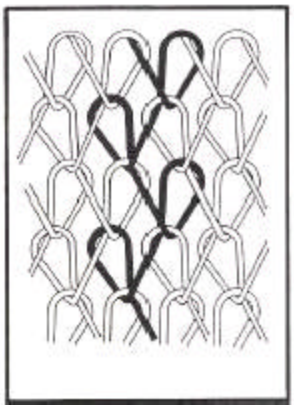
Simply stated, knitting is the interlooping of yarns to form a textile structure. There are two classifications of knits – weft and warp. Weft formations have yarns which are knit across the width of the fabric while warp formations have yarns being knitted along the length of the fabric (Spencer, 2001) (see Figures 2.0a and 2.0b).

Figure 2.0a: Weft Knit Structure



Source: Raz, 1987. Page 17

Figure 2.0b: Warp Knit Structure



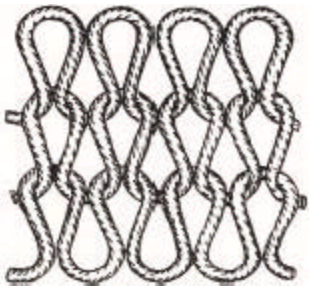
Source: Raz, 1987. Page 17

There are three primary loops, each having their own characteristics used to produce knit fabrics – the knit loop, the float loop and the tuck loop (Brown, 1973). In addition to having three primary loops there are three needles used in the production of knitted fabrics – the spring-bearded needle, the latch needle and the compound needle. The latch and compound needles, however, are more prevalent because of their efficiency and ability to increase productivity (Spencer, 1983).

2.1 Variations of Weft Knit Fabric Structures

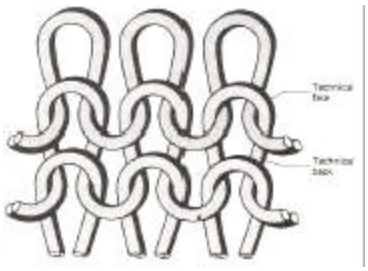
The three primary classifications of weft knit structures are the jersey (plain) structure and derivatives, rib fabric and derivatives and purl fabric and derivatives (Shinn, 1957; Smith, 1984; Smith, 2004). Jersey fabrics and their derivatives are single-sided structures and include fabrics such as plain jersey, feed stripe, pique, flat jacquard, fleece and plated jersey (Spencer, 2001; Smith, 2004). The two structures important for reference in this paper are the plain jersey fabric which is a single layer fabric in which the same yarn is being knit on the front and back of the fabric and a variation of the plain jersey called plated jersey (see Figures 2.1a and 2.1b).

Figure 2.1a: Technical Face of Plain Jersey Fabric



Source: Shinn, 1957. p. 10

Figure 2.1b: Plated Jersey Fabric



Source: Spencer, 2001. Pg. 57

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