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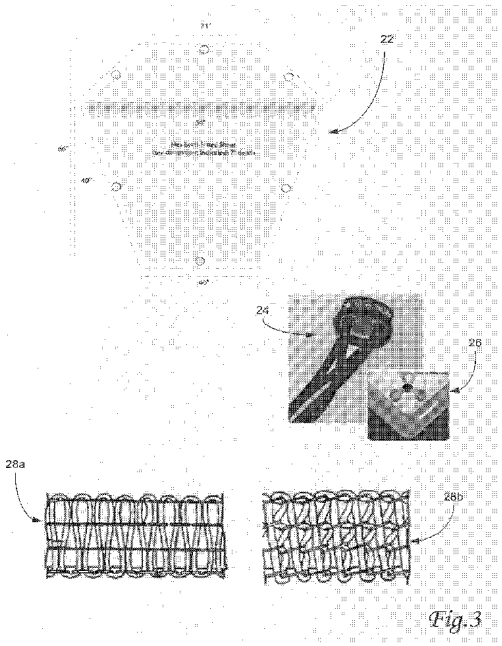

Fig.3

(57) **Abstract**: Bedding material including a first fabric section manufactured from performance fabric and having a first and second side; and, a second fabric section attached to the first side of the first fabric section. Additionally, a third fabric section can be attached to the second side of the first fabric section. The first fabric section can be attached to the second fabric section through a flatlock stitch. The first fabric section can include a first zone and a second zone wherein the first zone contains different performance properties from the second zone and the first zone can have thermal or moisture wicking properties.

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FABRIC SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to fabric systems, and more specifically to bed coverings constructed of high gauge circular knitted fabrics that accommodate and maintain optimum thermal conditions for sleep, which in turn can lead to faster sleep initiation and deeper, more restorative sleep.

2. Description of Related Art

Sleep problems in the United States are remarkably widespread, affecting roughly three out of four American adults, according to research by the National Sleep Foundation (NSF). Consequently, a great deal of attention has been paid to the circumstances surrounding poor sleep, along with strategies for how to improve it.

The implications are not merely academic. Sleep – not only the right amount of it but also the right quality – impacts not just day-to-day performance, but also "the overall quality of our lives," according to the NSF. Addressing the causes of poor quality sleep, therefore, has ramifications for millions.

Though many factors contribute to sleep quality, the sleep environment itself plays a critical role, and sleep researchers routinely highlight temperature as one of the most important components in creating an environment for optimal sleep. As advised by the University of Maryland Medical Center, "a cool (not cold) bedroom is often the most conducive to sleep." The National Sleep Foundation further notes that "temperatures above 75 degrees Fahrenheit and below 54 degrees will disrupt sleep," with 65 degrees being the ideal sleep temperature for most individuals, according to the NSF.

A lower environmental temperature is not the only thermal factor associated with improved sleep. Researchers have noted a nightly drop in body temperature among healthy, normal adults during sleep. This natural cycle, when inhibited or not functioning properly, can disrupt sleep and delay sleep onset, according to medical researchers at Cornell University. Conversely, the researchers noted, a rapid decline in body temperature not only accelerates sleep onset but also "may facilitate an entry into the deeper stages of sleep."

Therefore, maintaining an appropriately cool sleep environment and accommodating the body's natural tendency to cool itself at night should be a top priority for individuals interested in optimizing their sleep quality. Performance fabrics crafted into bedding applications would be uniquely capable of promoting cool, comfortable – and therefore better – sleep, as these advanced fabrics maximize breathability and heat transfer. Performance fabrics are made for a variety of end-use applications, and can provide multiple functional qualities, such as moisture management, UV protection, anti-microbial, thermo-regulation, and wind/water resistance.

There has been a long felt need in several industries to provide improved bedding to help individuals get better sleep. Such improved bedding would include beneficial wicking among other properties. For example, in marine, boating and recreational vehicle applications, bedding should resist moisture, fit odd-shaped mattresses and beds, and reduce mildew. Particularly with watercraft, there is a need to protect bedding, and specifically sheets, from moisture and mildew accumulation.

An additional problem with bedding, not just with marine and recreational vehicles, is the sticky, wet feeling that can occur when the bedding sheets are wet due to body sweat, environmental moisture, or other bodily fluids. In particular, when bedding is used during hot weather, or is continuously used for a long time by a person suffering from an illness, problems can arise in that the conventional bed sheet of cotton fiber or the like cannot sufficiently absorb the moisture. All of these issues lead to poor sleep.

To date, performance fabric bedding products are not known. There are width limitations in the manufacturing of high gauge circular knit fabrics, because the finished width of bedding fabrics are dictated by the machine used in its construction. At present, performance fabrics are manufactured with a maximum width of under 90 inches wide, given present manufacturing and technical limitations, along with the inability of alternate manufacturing processes to produce a fabric with identical performance attributes. Yet, normal bed sheet panels can be 102 by 91 inches or larger. Thus, performance fabrics cannot yet be used for bed sheets.

Some conventional solutions for the above issues that hinder a good night's sleep include United States Patent 4,648,186, which discloses an absorbent wood pulp cellulose fiber that is provided in a variety of sizes and is placed under a mattress. The wood pulp is water absorbent and acts to capture moisture to prevent such moisture from being retained by the bedding or the

bedding sheets. However, this proposed solution does not interact with the bedding or the bedding sheets, but merely acts as a sponge for moisture that is in proximity to the target bedding.

United States Patent 5,092,088 discloses a sheet-like mat comprised of a mat cover, the inside of which is divided into a plurality of bag-like spaces, and a drying agent packed into a bag and contained in the bag-like spaces in such a manner that the drying agent cannot fall out of the bag-like spaces. A magnesium sulfate, a high polymer absorbent, a silica gel or the like can be used as the drying agent. As can be seen, this proposed solution to moisture in bedding is cumbersome and chemically-based.

In the athletic apparel industry, moisture wicking fabric has been used to construct athletic apparel. For example, United States Patent 5,636,380 discloses a base fabric of CoolmaxQ high moisture evaporation fabric having one or more insulating panels of ThermaxB or ThermastatQ hollow core fiber fabric having moisture wicking capability and applied to the inner side of the garment for skin contact at selected areas of the body where muscle protection is desired. However, this application cannot be applied to bedding sheets due to the limitations of the size of the performance fabrics manufactured. Further, performance fabric such as this type cannot be easily stitched together as the denier is so fine that stitching this fabric results in the stitching simply falling apart.

Circular knitting is typically used for athletic apparel. The process includes circularly knitting yarns into fabrics. Circular knitting is a form of weft knitting where the knitting needles are organized into a circular knitting bed. A cylinder rotates and interacts with a cam to move the needles reciprocally for knitting action. The yarns to be knitted are fed from packages to a carrier plate that directs the yarn strands to the needles. The circular fabric emerges from the knitting needles in a tubular form through the center of the cylinder. This process is described in United States Patent 7,117,695. However, the machinery presently available for this method of manufacture can only produce a fabric with a maximum width of approximately 90 inches. Therefore, this process has not been known to manufacture sheets, since sheets can have dimensions of 91 inches by 102 inches or greater.

Further, the machinery that is used for bedding is very different than for athletic wear. For example, bedding manufacturing equipment is not equipped to sew flatlock stitching or to provide circular knitting. Bed sheets typically are knit using a process known as warp knitting, a

process capable of producing finished fabrics in the widths required for bedding. This method, however, cannot be employed to produce high-quality performance fabrics. Warp knitting is not capable of reproducing these fabrics' fine tactile qualities nor their omni-direction stretch properties, for example.

Circular knitting must be employed to produce a performance fabric that retains these fabric's full range of benefits and advantages. However, in order to produce a fabric of the proper width for bedding applications, a circular knit machine of at least 48 inches in diameter would be necessary. Manufacturing limitations therefore preclude the construction of performance fabrics at proper widths for bedding. The industry is unsure if it could actually knit and then finish performance fabrics at these large sizes, even if the machinery were readily available.

Further, athletic sewing factories are typically not equipped to sew and handle large pieces of fabrics so that equipment limitations do not allow for the manufacture of bedding sheets.

What is needed, therefore, is a bedding system that utilizes performance fabrics and their beneficial properties, the design of which acknowledges and addresses limitations in the manufacture of these fabrics. It is to such a system that the present invention is primarily directed.

BRIEF SUMMARY OF THE INVENTION

Briefly described, in preferred form, the present invention is a high gauge circular knit fabric for use in bedding, and a method for manufacturing such bedding. The bedding fabric has superior performance properties, while allowing for manufacture by machinery presently available and in use. In order to achieve a finished width of the size needed to create sheet-sized performance fabric, a high gauge circular knit machine of at least 48 inches in diameter is necessary. And while warp knitting machines are available that can produce wider fabrics, this method will not provide a fabric with the tactile qualities required, nor provide a fabric with omni-directional stretch.

In an exemplary embodiment, the present invention is a method of making a finished fabric comprising at least two discrete performance fabric portions, and joining at least two

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