

Dec. 13, 1966

N. L. SELTZER

3,290,702

FITTED SHEET

Filed July 30, 1964

2 Sheets-Sheet 1

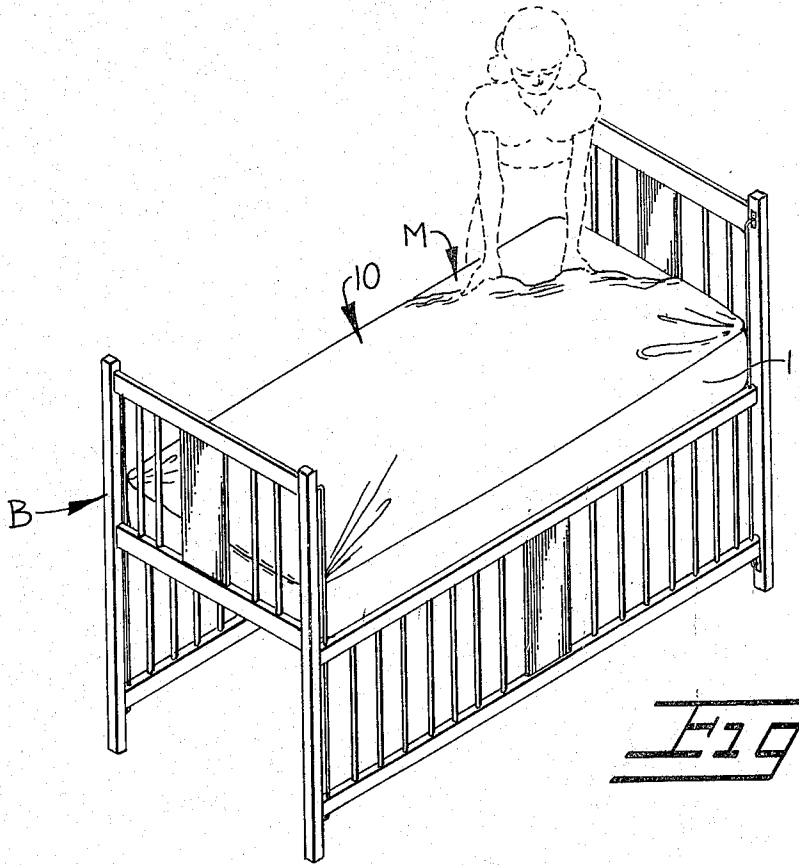


Fig-1

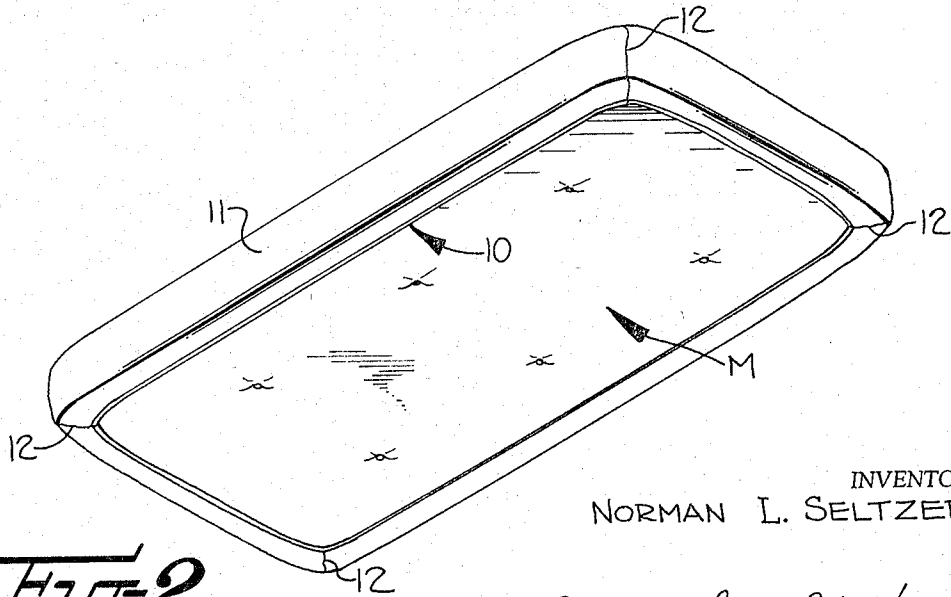


Fig-2

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2 Sheets-Sheet 2

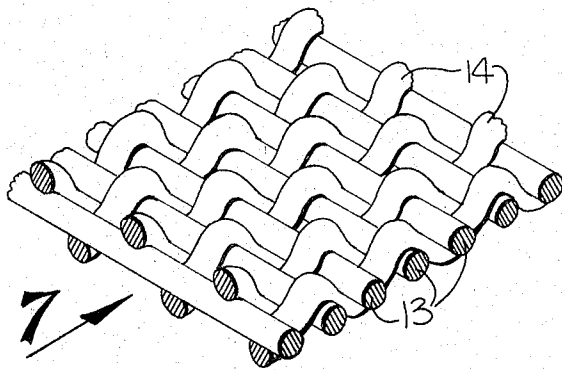


Fig-3

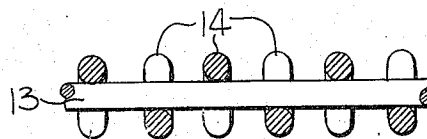


Fig-7

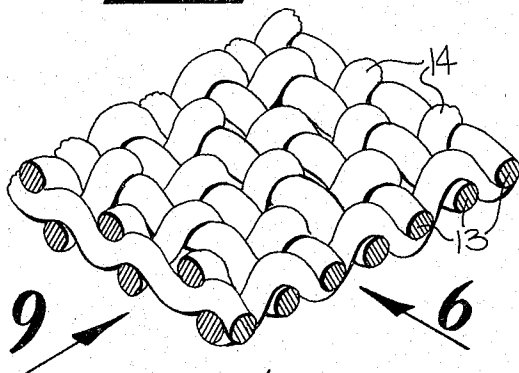


Fig-4

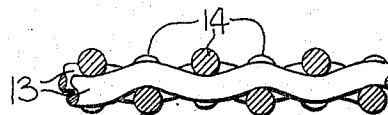


Fig-8

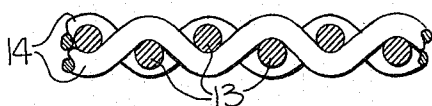


Fig-5

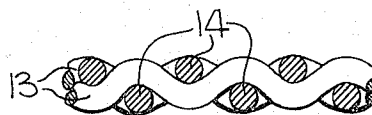


Fig-9

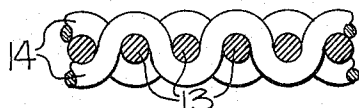


Fig-6

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FITTED SHEET

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10 Claims. (Cl. 5—334)

The present invention is a continuation-in-part of application Serial No. 128,810 (now Patent No. 3,145,132), filed August 2, 1961 and relates to fitted sheets and more particularly to fitted sheets having substantial stretchability and recoverability for easy placement and a conforming fit on mattresses.

As is well known, it is highly desirable to have a sheet which covers a mattress, commonly referred to as a bottom sheet, present a smooth, unwrinkled appearance and conformingly and snugly fit the mattress to resist removal therefrom. These features are particularly and acutely desirable in sheets for crib mattresses due to the sensitive nature of a baby's skin, which is subject to irritation by wrinkles, folds, etc., and due to the considerable and continuing movement of the baby and the likelihood of injury, including possible smothering or strangulation, if the sheet becomes dislodged from the mattress and the baby becomes entangled therein.

Various and sundry sheets, commonly referred to as "fitted sheets," have been proposed in attempts to provide the above desirable features, but all such sheets have one or more serious deficiencies or draw-backs. Probably the most commonly used conventional fitted sheet comprises a rectangular piece of conventional woven fabric with the corners thereof formed into pockets adapted to receive corners of the mattress therein. Such a conventional sheet is usually formed with dimensions corresponding to the purportedly standard dimensions of the various standard size mattresses. However, as is well known, mattresses, supposedly of a particular standard size, vary in their dimensions through a considerable range. Such conventional sheets may therefore be too large for a particular mattress, supposedly of the standard size for which the sheets were constructed to fit, and be subject to undesirable wrinkling with its attendant unsightly appearance and irritation to the skin of the user. Also, such conventional sheets may be too small for another mattress and, hence, be very difficult to place on the mattress.

In placing such a conventional fitted sheet on a mattress, three of the corners thereof may be placed over corresponding corners of the mattress with very little difficulty. However, since such a sheet is formed of conventional woven fabric, the placement of the fourth corner thereof over the corresponding corner of the mattress is very difficult if the dimensions of the sheet are such as to provide a proper, conforming, taut fit on the mattress. Actually, the only manner in which the fourth corner of this conventional sheet can be placed over the corresponding corner of the mattress is for the user to exert a large pulling force on the corner of the sheet while compressing or upwardly flexing the corner of the mattress.

Such a pulling force exerted on the corner of the sheet frequently results in tearing of the fabric thereof and particularly of the fabric and/or stitching forming the pocket at this corner of the sheet. Also, the compression or upward flexing of the corner of a mattress is difficult even when using both hands and is even more difficult when one hand is being used to pull the corner of the sheet thereover. Further, this compression or upward flexing of the mattress corner is deleterious thereto and this is particularly true when the mattress is of the innerspring type.

2

Many attempts have been made to solve the problems encountered with such conventional fitted sheets, examples of which are draw strings placed in hems around the periphery of the sheets which are intended to draw the sheet tightly over the mattress and secure the same in place; elastic members arranged in hems around or partially around the periphery of the sheets, similar to the draw strings and for a similar purpose; elastic straps or inserts extending diagonally of the corners of the sheets; elastic inserts inserted in cut-outs in the fabric of the sheets at the corners; forming the sheets of fabric having elastomeric yarns therein to render the fabric stretchable; and forming the sheet of or partially of knitted material to render the same stretchable. All of these attempts have been unsuccessful solutions to the problem since each has serious deficiencies therein. For example, all of these conventional sheets are quite expensive to manufacture due to increased cost of materials and/or increased steps in the fabrication thereof. In addition, the draw strings and elastic member in the hem of a sheet have proven ineffective to hold the sheet on the mattress in a manner to prevent wrinkling. Also, the draw string frequently becomes broken and pulled out of the hem which necessitates replacement thereof and the elastic member in the hem usually becomes brittle from launderings to lose its effectiveness long before the sheet itself has outlived its usefulness. Those conventional fitted sheets having elastomeric yarns, elastic straps and elastic inserts suffer from the same deficiencies. The conventional fitted sheets constructed partially or wholly of knitted material suffer from similar deficiencies since suitable knitted material is per yard usually more expensive than woven material. Also, such knitted material is notoriously unstable, having a tendency to stretch almost without restriction, and therefore is difficult to fabricate into fitted sheets.

With the foregoing in mind, it is an object of the present invention to provide a novel fitted woven sheet which obviates the aforementioned deficiencies encountered with conventional fitted sheets.

A more specific object of the present invention is to provide a fitted woven sheet of the character described which is characterized by substantial stretchability and recoverability in at least one direction for easy placement and a conforming fit thereof on a mattress, and which sheet does not lose any of its effectiveness upon laundering, but, in fact, is revitalized by each such washing and tumble drying.

Another object of the present invention is to provide a novel fitted woven sheet wherein the sheet is characterized by substantial stretchability and recoverability in one direction and is stabilized in the other direction against appreciable shrinkage from laundering.

A further more specific object of the present invention is to provide a novel fitted woven sheet wherein the sheet also has appreciable stretchability and recoverability in the direction in which the same is stabilized against shrinkage from laundering.

The term "non-stretchable" yarns as used herein is directed to those yarns such as cotton and rayon which are normally non-heat shrinkable and which inherently have little stretchability and to distinguish these yarns from those of a true stretchable nature such as texturized nylon, rubber or the like.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds, when taken in connection with the accompanying drawings, in which—

FIGURE 1 is an isometric view of a baby bed or crib illustrating the placement of a fitted sheet upon a mattress thereon;

3

FIGURE 2 is an isometric view of the bottom of a mattress having a sheet embodying the features of the present invention mounted thereon;

FIGURE 3 is a fragmentary isometric view of a portion of fabric for the instant sheet at an intermediate step in the processing thereof;

FIGURE 4 is a view similar to FIGURE 3 of a portion of the finished fabric of the present invention;

FIGURE 5 is a fragmentary sectional view taken transversely of the warp yarns of a portion of the instant fabric as woven;

FIGURE 6 is a view similar to FIGURE 5 looking in the direction of the arrow 6 in FIGURE 4;

FIGURE 7 is a fragmentary sectional view looking in the direction of the arrow 7 in FIGURE 3;

FIGURE 8 is a view similar to FIGURE 7 taken transversely of the filling yarns of the instant fabric after an intermediate step in the processing thereof; and

FIGURE 9 is a view similar to FIGURES 7 and 8 looking in the direction of the arrow 9 in FIGURE 4.

Referring now to the drawings and more specifically to FIGURES 1 and 2, there is shown a baby bed B which is shown only for purposes of illustrating the manner of placing fitted sheets on a mattress M and should not be considered as limiting the use of sheets or the like embodying the present invention to any specific type of bed.

A fitted sheet embodying the features of the present invention is generally indicated at 10 (FIGURE 1) and is shown being placed upon the mattress M. Sheet 10 is formed of woven fabric 11, a substantially rectangular blank of which is fabricated into fitted sheet 10 by having the corners thereof formed into pockets 12 for receipt of corresponding corners of the mattress M therein. Corner pockets 12 may be formed in any of various conventional ways which will not be described herein since the specific manner of forming the same does not form a part of the present invention.

Fabric 11 is formed of interwoven sets of warp and filling yarns 13 and 14, respectively (FIGURES 3-9). Fabric 11 is characterized by substantial stretchability and recoverability in the direction of at least one of the sets of warp and filling yarns, the fabric being sufficiently stretchable under manual force applied thereto by a user for easy placement on a mattress, regardless of any variance in the dimensions of the mattress from the supposedly standard dimensions, and the recoverability of the fabric from a stretched condition being sufficient to provide conforming securement of sheet 10 on the mattress to thereby prevent undesirable wrinkling or dislodgement of the sheet. This stretchability and recoverability is provided in the fabric by yarns which are non-stretchable and the character of the yarns, i.e., the sinuosity thereof, the material from which the yarns are formed, the size of the yarns, the twist therein and the manner of weaving the same into the fabric, all combining to provide this stretchability and recoverability in fabric 11. In this respect, at least the set of yarns in the stretchable direction of the fabric consists essentially, and preferably both essentially and mainly, of cellulosic fibers. Further, it is preferred for economic considerations, as well as appearance, wearability and other reasons, that both sets of yarns consist essentially, and more preferably both essentially and mainly, of cellulosic fibers. In the preferred embodiment of the present invention, these sets of yarns are formed of cellulosic fibers such as cotton, or high wet modulus rayon fibers, and preferably completely thereof.

For ease in processing fabric 11 to provide the aforeaid sinuosity in the at least one set of yarns to provide the stretchability and recoverability in the fabric, this one set of yarns is preferably the set of filling yarns 14, and filling yarns 14 preferably extend in sheet 10 in a direction corresponding to the widthwise direction of a mattress. This permits fabric 11 to be woven on narrower or more conventional width looms than if filling yarns 14 extended longitudinally of sheet 10.

4

As woven in fabric 11, warp yarns 13 may be of any yarn size conventionally employed in the manufacture of sheeting fabric, and preferably have a twist multiple within the standard twist multiple range of 3.5 to 4.25. Also, the number of warp yarns per inch in fabric 11 is preferably within the range normally used in conventional sheeting fabric.

As woven in fabric 11, filling yarns 14 are also of a yarn size and number per inch within the range normally employed in conventional sheeting fabric. While it is contemplated by the present invention that filling yarns 14 may have a twist multiple within the standard twist multiple range, it is preferred that these filling yarns have a twist multiple above the standard twist multiple range to enhance the sinuosity imparted thereto during finishing of fabric 11 to be presently described, and it has been determined that best results are achieved with a twist multiple within the range of about 4.5 to 8.5.

Two examples of fabric 11 which when finished and formed into sheet 10 will embody the features of the present invention are: (1) Warp yarns 13 formed of 100 percent cotton fibers, of 30/1 count, and with a twist multiple of 3.8; and filling yarns 14 also formed of 100 percent cotton fibers, of 30/1 count, and with a twist multiple of 6.5. These warp and filling yarns are interwoven in a plain weave pattern to form a fabric 73 inches wide and having 72 warp ends per inch and 80 filling picks per inch. (2) Warp yarns 13 are formed of 100 percent cotton fibers of 31.5/1 count and with a twist multiple of 3.8; and filling yarns 14 are formed of 100 percent cotton fibers, of 30/1 count, and with a twist multiple of 6.5. These warp and filling yarns are interwoven in a plain weave pattern to form a fabric 50 inches wide and with 60 warp ends per inch and 72 filling picks per inch. These fabric constructions are given by way of example only and it is contemplated that fabric 11 may be woven in any desired width and with any desired type of weave.

After fabric 11 is woven, filling yarns 14 are disposed in a sinuous path of travel (illustrated in FIGURE 5), but this initial sinuosity is not sufficient to provide appreciable stretchability in the fabric which would aid in placing a sheet formed therefrom on a mattress. To increase the sinuosity of the filling yarns to a predetermined value to provide, together with the number of yarns per inch, the size, twist, and weaving of such yarns, the desired stretchability and recoverability in fabric 11, the fabric is passed warpwise through a causticizing zone while a caustic treatment is applied thereto to cause filling yarns 14 to shrink to a shortened condition. This shrinking of filling yarns 14 is enhanced by the high twist multiple thereof and by the application of a predetermined warpwise tension to the fabric which causes warp yarns 13 to assume a substantially straight rod-like condition (FIGURES 3 and 7) and thereby causes filling yarns 14 to travel through a longer path in bending over and under these warp yarns. For example, during this causticizing treatment, the fabric construction of Example 1 above was woven 73 inches wide and shrunk to a width of 60 inches, and the fabric of Example 2 above was woven 50 inches wide and shrunk to a width of 39 inches.

The resultant sinuosity imparted to filling yarns 14 (illustrated in FIGURE 6), together with the number of yarns per inch, the size of the yarns, the twist thereof, and the weaving, of such yarns, provide substantial stretchability and recoverability in fabric 11 sufficient for easy placement on or removal from and a conforming fit of sheet 10 on a mattress. More particularly, fabric 11 is preferably stretchable within a range of about 25 to 50 percent at break and a substantial portion of this maximum stretchability may be termed "easy" or "working" stretchability due to the same being readily obtained by manual force applied by a user. This manual force for "easy" stretch corresponds approximately to 5 pounds per inch and it has been determined that about one-half

or more of the maximum stretchability of fabric 11 is achievable upon the application of such a 5 pounds per inch force thereto.

In the preferred embodiment of the present invention, sheet 10 has an easy or working stretchability of at least about 15 percent which is sufficient in substantially all cases for easy placement of the sheet over the corners of the mattress. For example, when finished, fabric 11 of Example 1 above has a maximum stretch of 31% at break and an easy or working stretch of 16.3%, and fabric 11 of Example 2 above has a maximum stretch of 45% at break and an easy or working stretch of 26%.

The recoverability provided in fabric 11 is sufficient to provide conforming securement of sheet 10 on a mattress, and more particularly, fabric 11 recovers by about one-half within two minutes from an easy or working stretched condition. In the preferred embodiment of the present invention, fabric 11 has at least about 70 percent recoverability within two minutes from a 15 percent stretched condition. Actually, fabric 11 of Example 2 has a recoverability of about 90 percent within two minutes from a 15 percent stretched condition and a recoverability of about 70 percent from a 25 percent stretched condition, which is about the maximum easy or working stretch in this fabric.

After fabric 11 is causticized, the same is preferably treated to stabilize warp yarns 13 against excessive shrinkage from laundering. Preferably, this stabilization is accomplished by subjecting fabric 11 to massive compaction or massive compressive shrinkage in the direction of the warp yarns which imparts considerable crimp or sinuosity to the warp yarns. This compaction is preferably achieved commercially by passing the fabric through two sanforizing or similar compressive shrinkage processes to impart a massive amount of compaction thereto. As is well known, conventional fabrics are normally compacted to stabilize the same against shrinkage by a single passage through a sanforizing process. Thus, the double compacted fabrics of the instant invention have a much greater amount of compaction than these conventional fabrics.

In this respect, the straight, rod-like condition of warp yarns 13 following the tensioning of fabric 11 during the causticizing thereof is illustrated in FIGURE 7; the slightly sinuous or crimped condition of warp yarns 13 following a single sanforizing treatment thereof is illustrated in FIGURE 8; and the crimped condition of warp yarns 13 following double sanforizing is illustrated in FIGURE 9.

Following single sanforization, fabric 11 will pass the usual sanforizing shrinkage test of washing and mangle drying with less than 1% shrinkage, but it has been determined that such fabric 11 will shrink as much as 7% upon being washed and tumble dried only five times. This amount of shrinkage is excessive and results in an unacceptable fitted sheet. Following double sanforization, fabric 11 exhibits surprising stability against any appreciable shrinkage upon being repeatedly washed and tumble dried.

While such massive compaction of warp yarns 13 is preferred for stabilization of fabric 11, it is recognized that warp yarns 13 could be stabilized by a resin treatment being applied to fabric 11. However, such resin treatment imparts undesirable stiffness and harshness to the fabric, and additionally lowers the tear strength, abrasive resistance, toughness and durability of the fabric. Thus, sheets formed therefrom would not have as long an effective life as sheets formed from fabric that has been massively compacted, as heretofore described. In addition, the sinuosity or crimp imparted to warp yarns 13 by the massive compaction process, together with the number of yarns per inch, the size, twist and weaving of these yarns, provide stretchability and recoverability in fabric 11 in the warpwise direction which would not be present from a resin treatment.

In this respect, massively compacted fabric 11 is stretchable in the warpwise direction within a range of about 15 to 25 percent at break and a substantial portion of this stretchability may be characterized as easy or working stretchability. This easy or working warpwise stretchability is about one-half of the maximum stretchability and contributes materially to the easy placement of sheet 10 on or removal thereof from a mattress. The warpwise recoverability of the fabric of the present invention is likewise substantial and contributes materially to the conforming fit and securement of sheet 10 on a mattress. Preferably, this warpwise recoverability is about 50% within two minutes from an easy or working stretched condition.

As stated above, fabric 11, from which sheet 10 is formed, has substantial recoverability from an easy or working stretched condition in both the fillingwise and warpwise direction. Another aspect of the present invention is that upon being laundered, i.e. washed and tumble dried, both the warp and filling yarns will normally recover completely from any stretched condition short of break if the same have not previously recovered therefrom. Therefore, upon each washing and tumble drying, sheet 10 has the stretchability and recoverability thereof revitalized or restored.

With the foregoing in mind, it is apparent that the present invention provides a novel fitted sheet having substantial stretchability for easy placement on and removal from a mattress and having substantial recoverability for conforming fit and securement on a mattress, and which sheet has a longer effective life than conventional fitted sheets.

In the drawings and specification there have been set forth preferred embodiments of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being defined in the claims.

I claim:

1. A fitted woven sheet of single layer plain weave construction characterized by substantial stretchability and recoverability for easy placement and a conforming fit on mattresses, supposedly of a particular standard size but having varying dimensions, to present a smooth, taut, unwrinkled appearance, said sheet being rectangular and having pockets formed at the corners thereof to receive corners of a mattress therein, said sheet being formed of fabric comprising interwoven sets of warp and filling yarns, at least one of said sets of yarns consisting essentially of cellulosic fibers and being disposed in a sinuous path with the sinuosity thereof, together with the number of yarns per inch, the size, twist and weaving of such yarns, providing substantial stretchability and recoverability in the fabric in the longitudinal direction of said one set of yarns, said fabric being readily and sufficiently stretchable upon the application of manual force thereto by a user for easy placement thereof over the corners of a mattress, the recoverability of said fabric providing conforming securement of the sheet on the mattress, and any loss in stretchability and recoverability of said fabric resulting from use being substantially restored upon laundering.

2. A sheet according to claim 1 wherein said stretchability provided in said fabric is within a range of about 25 to 50 percent, and a substantial portion of this stretchability is readily obtained by the application of manual force thereto by a user.

3. A fitted woven sheet of single layer plain weave construction characterized by substantial stretchability and recoverability for easy placement and a conforming fit on mattresses, supposedly of a particular standard size but having varying dimensions, to present a smooth, taut, unwrinkled appearance, said sheet being rectangular and having pockets formed at the corners thereof to receive corners of a mattress therein, said sheet being formed of a fabric comprising interwoven sets of warp and filling

yarns, at least one of said sets of yarns consisting essentially of cellulosic fibers and being disposed in a sinuous path with the sinuosity thereof, together with the number of yarns per inch, the size, twist and weaving of such yarns, providing stretchability and recoverability in the fabric, the fabric being stretchable within a range of about 25 to 50 percent in the longitudinal direction of said one set of yarns and being stretchable by at least about one-half of its maximum stretchability upon the application of a five pound per inch force thereto which substantially corresponds to the manual force normally applied thereto by a user in placing the sheet on a mattress, this stretchability of the fabric providing ready extension of the sheet and easy placement thereof over the corners of a mattress, the recoverability thereof providing conforming securement of the sheet on the mattress, and any loss in stretchability and recoverability of said fabric resulting from use being substantially restored upon laundering.

4. A fitted woven sheet of single layer plain weave construction characterized by substantial stretchability and recoverability for easy placement and a conforming fit on mattresses, supposedly of a particular standard size but having varying dimensions, to present a smooth, taut, unwrinkled appearance, said sheet being rectangular and having pockets formed at the corners thereof to receive corners of a mattress therein, said sheet being formed of fabric comprising interwoven sets of warp and filling yarns, said sets of yarns consisting essentially of cellulosic fibers and, as woven in the fabric, said warp yarns having a twist multiple within the standard twist multiple range and said filling yarns having a twist multiple above the standard twist multiple range, said filling yarns extending transversely of the sheet and being disposed in a sinuous path with the sinuosity thereof, together with the number of yarns per inch, the size, twist and weaving of such yarns, providing stretchability and recoverability in the fabric, the fabric being stretchable within a range of about 25 to 50 percent in the direction of said filling yarns and being stretchable to at least about 15 percent upon the application of a five pound per inch force thereto, which force substantially corresponds to the manual force normally applied thereto by a user in placing the sheet on a mattress, this stretchability of the fabric permitting ready extension of the sheet by a user for easy placement thereof over the corners of a mattress, said fabric having about 90 percent recoverability within two minutes from a 15 percent stretched condition for providing conforming securement of the sheet on the mattress, and any loss in stretchability and recoverability of said fabric resulting from use being substantially restored upon laundering.

5. A sheet according to claim 4 wherein said filling yarns have a twist multiple within the range of about 4.50 to 8.50.

6. A fitted woven sheet of single layer plain weave construction characterized by substantial stretchability and recoverability for easy placement and a conforming fit on mattresses, supposedly of a particular standard size but having varying dimensions, to present a smooth, taut, unwrinkled appearance, said sheet being rectangular and having pockets formed at the corners thereof to receive corners of a mattress therein, said sheet being formed of fabric comprising interwoven sets of warp and filling yarns, one of said sets of yarns consisting essentially of cellulosic fibers and being disposed in a sinuous path with the sinuosity thereof, together with the number of yarns per inch, the size, twist and weaving of such yarns, providing substantial stretchability and recoverability in the fabric in the longitudinal direction of said one set of yarns, said fabric being readily and sufficiently stretchable upon the application of manual force thereto by a user for easy placement thereof over the corners of a

mattress, the recoverability thereof providing conforming securement of the sheet on the mattress, any loss in stretchability and recoverability of said fabric resulting from use being substantially restored upon laundering, and the fabric, in the direction of the other of said sets of yarns, being stabilized against appreciable shrinkage from laundering.

7. A sheet according to claim 6 wherein both sets of yarns are formed of cellulosic fibers selected from the group consisting of cotton and high wet modulus rayon and wherein said fabric is massively compacted to provide said stabilization against shrinkage from laundering.

8. A sheet according to claim 6 wherein the other set of yarns in said stabilized direction of the fabric are crimped and provide stretchability in the fabric in the direction thereof within the range of about 15 to 25 percent.

9. A fitted woven sheet of single layer plain weave construction characterized by substantial stretchability and recoverability for easy placement and a conforming fit on mattresses, supposedly of a particular standard size but having varying dimensions, to present a smooth, taut, unwrinkled appearance, said sheet being rectangular and having pockets formed at the corners thereof to receive corners of a mattress therein, said sheet being formed of fabric comprising interwoven sets of warp and filling yarns, said sheet being elongate and said filling yarns extending transversely thereof, said sets of yarns being formed of cellulosic fibers and, as woven in the fabric, said warp yarns having a twist multiple within the standard twist multiple range and said filling yarns having a twist multiple above the standard twist multiple range, said fabric in the direction of the warp yarns, being massively compacted to stabilize the same against appreciable shrinkage upon laundering, said warp yarns being crimped and providing stretchability and recoverability in the fabric in the direction of the warp yarns, said fabric being stretchable warpwise within a range of about 15 to 25 percent, said filling yarns being disposed in a sinuous path with the sinuosity thereof, together with the number of yarns per inch, the size, twist and weaving of such yarns, providing stretchability and recoverability in the fabric in the direction thereof, said fabric being stretchable fillingwise within a range of about 25 to 50 percent, about one-half of the stretchability in both directions of the fabric being obtained upon the application of a five pound per inch force thereto and thereby permitting easy placement of the sheet over the corners of a mattress, the recoverability thereof providing conforming securement of the sheet on the mattress, and any loss in stretchability and recoverability of said fabric resulting from use being substantially restored upon laundering.

10. A sheet according to claim 9 wherein said recoverability in both directions of the fabric is about 50 percent within two minutes from a stretched condition under the five pound per inch force.

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