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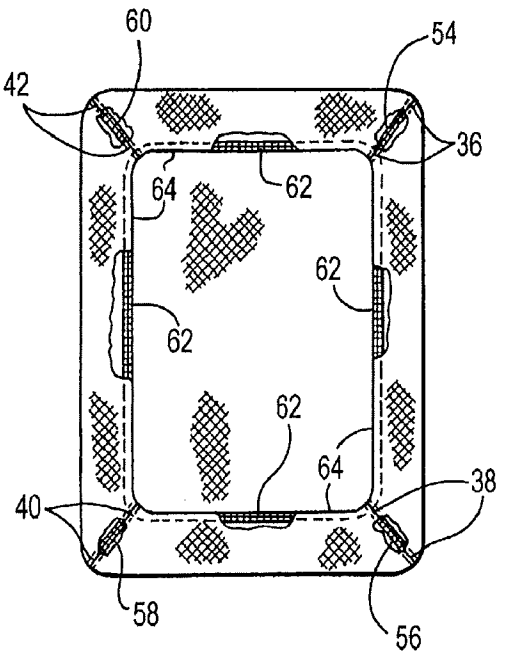

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A fitted sheet, for a mattress, comprising heat resistant elastic.

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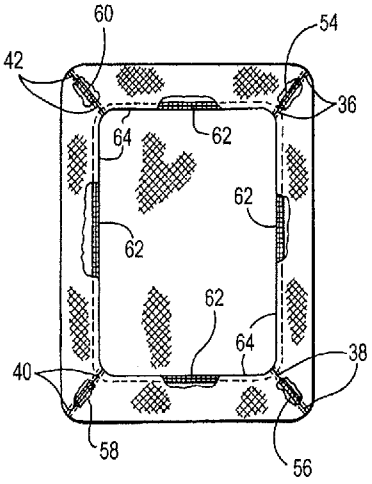

FIG. 10

(57) Abstract: A fitted sheet, for a mattress, comprising heat resistant elastic.

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A Fitted Sheet

Technical Field of the Invention

The present invention relates to articles used for bedding, and in particular, to bed sheets, blankets, quilts, duvets or duvet covers. More specifically, the invention relates to sheets and in particularly to fitted sheets that are configured to conform to the shape of mattresses of different thicknesses such that the fitted sheet forms a tight fit around said mattresses.

Background of the Invention

Fitted sheets, which are also referred to as "bottom" sheets, are conventionally formed of fabric and are used to cover and protect a mattress. A fitted sheet typically comprises a top panel, two side panels and two end panels, and in general, the top panel is disposed over the top surface of the mattress, while each of the four side and end panels extends from the top panel and covers a sidewall or endwall, and at least a portion of the bottom surface, of the mattress. Further, each side panel is usually joined to each adjacent end panel at their respective edges by seams, in a manner to form corners adapted to conform to the shape of the mattress.

A fitted sheet may also include some arrangement for securing the fitted sheet to the mattress and/or for keeping the fitted sheet in place on the mattress. Nevertheless, fitted sheets often become displaced during use, which causes a disheveled look, and which may also cause discomfort to the user. Moreover, although nowadays mattresses are available commercially in several popular sizes, having width and length dimensions that are standardized within the bedding industry (e.g., "king," "queen," "full," "twin," etc.), in fact the dimensions of mattresses do vary from manufacturer to manufacturer, and even among the various mattress lines or models of the same manufacturer, particularly with respect to the thickness of the mattress. In other words, there is no "standard" mattress thickness dimension; rather, the thickness of particular mattresses may vary, depending on a number of factors such as the type or manufacturer of the bed, and the preferences of individual users. Therefore, fitted sheets designed for use on a mattress of a particular size, such as a "queen" size mattress, may not fit snugly on all mattresses of that size. Moreover, over time, an individual mattress

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may tend to change its size and shape, due to a variety of factors such as age and/or excessive use and/or environmental factors.

Fitted sheets are often provided with a band of elastic that is sewn into the sheet, such that this band of elastic (that is normally located at the bottom (in use) of the side and end panels) helps to maintain the position of the fitted upon a mattress. The band of elastic used normally comprises cords of rubber that are sewn into a cord, tape or fabric. Unfortunately, despite the incorporation of said band of elastic into the fitted sheet, such sheets often become displaced during use.

While most mattresses have a standard width and length, they don't always have a standard thickness (depth). The thickness of mattresses may vary from bed to bed and therefore there is a need for a fitted sheet that is capable of fitting mattresses of varying thicknesses and that also resists displacement during its use.

An additional problem associated with fitted sheets, and one that often results in the need to purchase new fitted sheets, is that the elastic becomes damaged during use and may even lose its elasticity. This loss of elasticity results in the fitted sheets fitting onto mattresses less tightly.

Accordingly, there is a need for a fitted sheet capable of remaining in place during use, and which, at the same time, can accommodate and fit snugly on mattresses of varying thicknesses, and can also adapt to any changes in mattress size and shape, while continuing to appear smooth and neat, at least along the top surface and sidewalls of the mattress. Although efforts have been made in the prior art to provide fitted sheets that can overcome these problems, such as those described in U.S. Pat. Nos. 5,287,574, 7,398,570 and 8,171,581, those efforts have not been completely satisfactory.

Most of these prior art solutions involve blending stretchable and non-stretchable portions into the fabric that forms the side panels of the sheet, such that the stretchable fabric portions are located at or near the corners. However, this solution may lead to undesirable consequences, such as differential shrinkage of the sheet after laundering, as well as a "mottled" appearance due to slight differences in the coloration of portions of the sheet, either initially or after laundering. These undesirable consequences are a direct result of

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blending stretchable and non-stretchable yarns into portions of the fabric, as these portions are assembled of yarn fibers having different characteristics. Since such blending is common to all of these prior art solutions, it is a fundamental flaw of the abovementioned prior art.

The current applicant's previous patent application, see US pat. no. 8,813,280 B1, disclosed an improved fitted sheet, as compared to the abovementioned prior art, which substantially remains in place during use. This improved fitted sheet being able to fit the contours of mattresses of varying thicknesses, but wherein the improved sheet does not exhibit the undesirable effects caused by the incorporation, into the side panels of the sheet, of both stretchable and non-stretchable portions of fabric.

Following further investigations, modifications to the bed sheet disclosed in US pat. no. 8,813,280 B1 have been discovered that provide a fitted bed sheet that has improved performance over the applicant's previously disclosed bed sheet.

Summary of the Invention

According to a first aspect of the present invention there is provided a fitted sheet, for a mattress, comprising heat resistant elastic wherein the heat resistant elastic comprises a heat resistant rubber.

Preferably there is provided a fitted sheet, for a mattress, comprising a stretchable border member wherein the border member is manufactured from said heat resistant elastic comprising a heat resistant rubber. The border member is preferably provided in the form of a flexible and stretchable strip or tape comprised of a tightly woven elastic material (the material being more tightly woven than is possible using a knitted elastic). The border member is preferably 1.5 to 3.0 cm wide, and is more preferably 1.5 to 2.5 cm wide and most preferably is 1.8 to 2.3 cm wide, i.e. about 2.5 cm (1 inch wide).

Preferably there is provided a fitted sheet, for a mattress, wherein said heat resistant elastic has been heat set at a temperature in the range of 170 to 200 °C, i.e. the elastic is heated to a minimum temperature of 170 °C and a temperature not exceeding 200 °C, and held at this temperature for a period of approximately 1 minute. Thus the elastic manufactured in this way is heat resistant to a temperature of at least 170 °C.

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Preferably there is provided a fitted sheet, for a mattress, wherein said heat resistant elastic has been heat set at a temperature in the range of 170 to 200°C, for a period of time in the range of 50 to 70 seconds.

Preferably there is provided a fitted sheet, for a mattress, wherein the sheet comprises a web of textile material comprising:

a top panel;

two opposed side panels; and,

two opposed end panels;

the side and end panels extending from the periphery of said top panel,

wherein the top panel is dimensioned to substantially cover the top surface of a mattress, and the side panels and end panels are dimensioned to substantially cover the sides and ends of said mattress;

adjacent edges of the end panels and side panels being connected to each other to form four corner seams that, in use, are located adjacent the corners of said mattress, and each said corner seam having a longitudinal axis, a proximal end and a distal end;

the fitted sheet further comprising four stretchable corner members, each corner member having an un-stretched length that is shorter than the length of the adjacent corner seam, the corner members being attached to the sheet adjacent to the corner seams, and the corners members being shorter than the adjacent corner seams in their unstretched state, the corner members being attached to the corner seams in their stretched state in a position substantially overlying said associated corner seam;

the sheet further comprising four additional seams each said additional seam being substantially aligned axially with the longitudinal axis of an associated corner seam, and wherein each said additional seam extends substantially diagonally from the proximal end of said associated corner seam towards the centre of said top panel; and,

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a stretchable border member having an unstretched length which I shorter than the length of the perimeter of said sheet, said border member being secured in a stretched condition to the perimeter of said sheet; and,

wherein the stretchable border member is manufactured from heat resistant elastic comprising a heat resistant rubber.

The web of material being manufactured from a substantially inelastic material; the term substantially inelastic (non-elastic) is used to indicate the use of materials that are not intended to stretch elastically during use, for example materials such as non-stretchable textile fabric that is woven or knitted from cotton, silk, wool, rayon, polyester, viscose and/or other types of threads, yarns or fibers, and combinations thereof, as is conventional in the bedding industry. The heat resistant elastic, as mentioned above, comprises an elastic manufactured using heat resistant rubber, wherein after repeated cycles (50 times or more) of washings and drying (at temperature of up to 60 °C) the elastic and heat resistant rubber contained therein retain their elasticity and do not lose elasticity in the way that a standard elastic and the associated rubber would, i.e. a standard elastic being one that is manufactured using non-heat resistant rubber and/or that further does not comprise a construction of the type disclosed herein and/or does not comprise an elastic manufactured using processes disclosed herein. The heat resistant elastic that is disclosed for use herein has been found to be heat resistant to temperatures of up to 80 °C. The use of the heat resistant rubber in the manufacture of an elastic, for use in the manufacture of fitted sheets, gives an elastic that is heat resistant.

Reference to the top panel being dimensioned to "substantially" cover the top surface of a mattress relates to the use of a top panel that preferably covers at least 90% or more of the top surface of the mattress, in use. Preferably the top panel covers from 95% to 100% of the top surface of the mattress. Preferably the top panel covers from 98% to 100% of the top surface of the mattress, in use. Most preferably the top panel covers 100% of the top surface of the mattress, in use.

Reference to the side panels and end panels being dimensioned to "substantially" cover the sides and ends of said mattress is used to indicate that said panels cover from 90% to 100% of the sides and ends of the mattress to which they are adjacent, in use. More preferably, the side

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panels and end panels cover from 95% to 100% of the sides and ends of the mattress to which they are adjacent, in use. More preferably, the side panels and end panels cover from 98% to 100% of the sides and ends of the mattress to which they are adjacent, in use. Most preferably the side panels and end panels cover 100% of the top surface of the mattress, in use.

Reference to the corner members being attached to the corner seams in their stretched state in a position "substantially" overlying said associated corner seam is used to indicate that the stretched corner members cover from 90% to 100% of the corner seams to which they are attached. More preferably the stretched corner members cover from 95% to 100% of the corner seams to which they are attached. More preferably the stretched corner members cover from 98% to 100% of the corner seams to which they are attached. Most preferably the stretched corner members cover 100% of the top surface of the mattress.

Reference to the sheet comprising four additional seams, each said additional seam being "substantially aligned axially with the longitudinal axis of an associated corner seam" is a reference to each one of the additional seams extending diagonally, from the peripheral edge of top panel towards the center of top panel, along the same longitudinal axis as the adjacent corner seam i.e. the additional seam is in line with the adjacent corner seam to within 15 degrees or less of the line formed by said corner seam. More preferably, the additional seam is in line with the adjacent corner seam to within 10 degrees or less of the line formed by said corner seam. Most preferably the additional seam is in line with the adjacent corner seam to within 5 degrees or less of the line formed by said corner seam.

Reference to the sheet comprising four additional seams, and wherein each said additional seam extends "substantially" diagonally from the proximal end of said associated corner seam towards the centre of said top panel, is a reference to the additional seams extending in the direction of the centre of the top panel rather than parallel to the edges of the top panel.

Preferably there is provided a fitted sheet comprising a heat resistant elastic, wherein the heat resistant elastic comprises a heat resistant rubber with a modulus in the range of 26 to 34kg/cm^2.

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Preferably there is provided a fitted sheet wherein the heat resistant elastic has a stretch ratio in the range of 1:2 to 1:3. Elastics have different stretch ratios, the stretch ratio of an elastic is based on the elastics construction, i.e. the quality of rubber used, its gauge, the thickness (denier) of the polyester yarn, the ratio of the polyester yarn to the rubber used in the construction, etc. generally speaking the lower the stretch ratio is, the stronger the elastic is, woven elastics normally have a lower stretch ratio than knitted elastics due to the differing methods of manufacture. The stretch ratio of an elastic is the extent to which the elastic can be stretched before it reaches the point where it will not return to its original length when the stretching force is released.

Preferably there is provided a fitted sheet wherein the heat resistant elastic has a stretch ratio in the range of 1:2 to 1:2.5. The use of elastic with a stretch ratio of 1:2 to 1:2.5 is particularly advantageous with respect to the manufacture of the fitted sheet disclosed herein, as it reduces problems associated with stitching the border member and the layer of material covering the border member to the sheet.

Preferably there is provided a fitted sheet, wherein the heat resistant elastic comprises a woven elastic. The use of a woven elastic improves the resistance of the elastic to heat as compared to non-woven elastics.

More preferably there is provided a fitted sheet wherein the woven heat resistant elastic comprises a polyester yarn. The polyester yarn used in the invention is preferably heat set polyester yarn, i.e. the polyester yarn is heated to a temperature in the range of 100 to 110 °C before it is used in the manufacture of the woven elastic. The polyester yarn is most preferably heat set at a temperature of 170 to 200 °C. The polyester being heat set at a temperature of 170 to 200 °C and for a period of time of 50 to 70 seconds. In this way the shrinking of the polyester yarn, used in the manufacture of the heat resistant elastic, is minimised during the washing of a fitted sheet comprising said woven elastic; thus providing improved performance to a fitted sheet comprising such heat resistant elastic in the border member.

Preferably there is provided fitted sheet wherein the woven heat resistant elastic comprises rubber cords having a gauge in the range of 28 to 32. Using 28 to 32 gauge rubber cords

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provides a significant improvement, as regards the heat resistance of the rubber in the woven elastic, as compared to the use of thinner cords such as 38 gauge rubber cords.

The term gauge as used herein is British Standard Gauge wherein 32 gauge comprises a cord with a diameter of 0.3759 mm and 28 gauge comprises a cord with a diameter of 0.2743 mm. The fitted sheet disclosed herein normally comprises rubber cords that are 30 gauge.

Preferably there is provided a fitted sheet wherein the woven heat resistant elastic comprises an average in the range of 15 to 25 rubber cords per 2.54 cm across the width of the elastic used.

Preferably there is provided a fitted sheet wherein the woven heat resistant elastic comprises an average in the range of 21 to 23 rubber cords per 2.54 cm across the width of the elastic used.

It has been noted that a woven elastic comprising an average in the range of 21 to 23 rubber cords per 2.54 cm across the width of the elastic used, the rubber cords having a gauge in the range of 28 to 32, and a polyester yarn that has been heat set at a temperature of at a temperature in the range of 170 to 200 °C, provides an elastic that is particularly stable (a synergistic effect is observed), i.e. the elastic does not lose elasticity after repeated cycles (50 times or more) of washings and drying (at temperature of up to 60 °C) the elastic and heat resistant rubber contained therein retain their elasticity and do not lose elasticity in the way that a standard elastic and the associated rubber would.

Preferably there is provided a fitted sheet wherein the woven heat resistant elastic comprises a warp in the range of 250 to 350 denier Roto polyester yarn and a weft in the range of 100 to 200 denier Roto polyester yarn.

Preferably there is provided a fitted sheet wherein the woven heat resistant elastic comprises a warp in the range of 270 to 330 denier Roto polyester yarn and a weft in the range of 135 to 165 denier Roto polyester yarn.

Preferably there is provided a fitted sheet wherein the woven heat resistant elastic comprises a warp in the range of 290 to 310 denier Roto polyester yarn and a weft in the range of 140 to 160 denier Roto polyester yarn.

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Preferably there is provided a fitted sheet wherein the woven heat resistant elastic has a weight in the range of 20 to 25 grammes per metre, i.e. a weight of 20 to 25 grammes for a 1 metre length of elastic wherein the elastic has a width of 2.54 cm – the weight per linear metre of elastic.

More preferably the woven heat resistant elastic has a weight in the range of 21 to 22 grammes per metre.

Preferably there is provided a fitted sheet wherein the sheet comprises a truncated pyramidal shape. The use of a fitted sheet that comprises a truncated pyramidal shape provides a sheet that, in use, as the truncated pyramid structure narrows it progressively grips the adjacent sides and ends of said mattress more tightly.

Preferably there is provided a fitted sheet wherein the truncated pyramidal shape tapers towards the distal edges of the side and end panels. The tapering (narrowing) of the truncated pyramid toward the distal edges of the side and end panels gives a structure that as it narrows, it progressively grips the adjacent sides and ends of said mattress more tightly, as the sheet approaches the bottom of the mattress.

Preferably there is provided a fitted sheet wherein the truncated pyramidal shape is created by the use of side and end panels that are trapezoidal in shape. This provides a fitted sheet that, in use, grips the mattress more tightly along both the sides and ends of the mattress, as compared to a fitted sheet that only uses trapezoid shaped end panels.

Preferably there is provided a fitted sheet wherein the trapezoidal shaped side and end panels comprise side edges that are cut at an interior angle from 85 to 75 degrees relative to the adjacent peripheral edge of the top panel; e.g. the sections of the web that are removed from the initial web of material, to form the side and end panels, are cut with an interior angle that is from 85 to 75 degrees relative to the adjacent peripheral edge of the top panel (i.e. the peripheral edge of the top panel that is adjacent the side or end panel that is being formed by the cutting process). Such that the peripheral edges of the top panel are longer than the adjacent distal edges of the side and end panels thus providing side and end panels that are trapezoidal in shape

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In the applicant's previous application the side and end panels were formed using a standard angle of 90 degrees to cut the web (relative to the adjacent peripheral edge of the top panel) that is used to form side and end panels when manufacturing a sheet of the type disclosed in US pat. no. 8,813,280.

Preferably there is provided a fitted sheet wherein the border member is located between two or more layers of shielding material; the border member being manufactured from heat resistant elastic. The location of the border member between two layers of shielding material helps to protect the border member from damage, particularly damage that commonly occurs during the laundry process, e.g. the damage that may be caused by the use of washing machines or tumble dryers wherein the border member becomes snagged on the sides of the drums of such devices. Obviously, additional layers of shielding material may be used if desired and one of the layers of shielding material may be manufactured from the web of material from which the sheet is manufactured. Moreover, it has been noted that by covering the elastic in this way, the elastic is provided with improved stability and durability. It may not always be possible to enclose the elastic between shielding layers along its entire length, for instance in some circumstances it may not be possible to cover the elastic at the corners of the sheet due to constructional problems; nonetheless enclosing the elastic along the main length of the sheet still provides improved overall stability and performance to the sheet and the elastic used therein.

Preferably there is provided a fitted sheet wherein at least one of the two or more layers of shielding material comprise(s) the material forming the side panels and end panels.

Preferably there is provided a fitted sheet wherein at least two of the two or more layers of shielding material comprise the web of material from which the side panels and end panels are manufactured.

Preferably there is provided a fitted sheet wherein the border member is located in a pocket formed by two or more layers of shielding material. If the border member is enclosed in a pocket between two layers of shielding material formed by the web of material from which the sheet is manufactured, then the manufacturing process of the pocket is simplified, and the costs associated with creating the pocket may also be minimised.

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Preferably there is provided a fitted sheet wherein the sheet comprises means to identify a side(s) and/or end(s) of said sheet.

Preferably there is provided a fitted sheet wherein the means to identify the side(s) and/or end(s) of said sheet are provided in the form of one or more labels.

Preferably there is provided a fitted sheet wherein the corner members are manufactured from heat resistant elastic.

Preferably there is provided a fitted sheet wherein the heat resistant elastic used to manufacture the corner members comprises a warp of 250 to 350 denier Roto polyester yarn and a weft of 100 to 200 denier Roto polyester yarn.

Preferably there is provided a fitted sheet wherein the woven heat resistant elastic comprises a warp of 290 to 310 denier Roto polyester yarn and a weft of 140 to 160 denier Roto polyester yarn.

Preferably there is provided a fitted sheet comprising heat resistant elastic and wherein the extension of the elastic only increases by 0.7%, or less or more preferably by 0.6 % or less, or most preferably by 0.5 % - after the sheet has been washed, and dried (in a tumble dryer at 60 °C) multiple times (i.e. up to 50 times).

It will be appreciated that all details relating to the first aspect of the fitted sheet, as disclosed above and herein, also apply in respect of the second aspect of the invention disclosed below.

According to a second aspect of the invention there is provided a method of manufacturing a fitted sheet as disclosed above.

Preferably there is provided a method of manufacturing a fitted sheet as comprising the steps of:

i) providing a web of textile material comprising:

a top panel;

two opposed side panels; and,

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two opposed end panels;

the side and end panels extending from the periphery of said top panel,

wherein the top panel is dimensioned to substantially cover the top surface of a mattress, and the side panels and end panels are dimensioned to substantially cover the sides and ends of said mattress;

the panels being stitched together to form a fitted sheet;

ii) wherein a heat resistant elastic material, comprising heat resistant rubber, said heat resistant elastic having been heat set at a temperature in the range of 170 to 200 °C, is incorporated into said fitted sheet by stretching said elastic prior to affixing it to said sheet.

Preferably there is provided a method of manufacturing a fitted sheet wherein a bias cut is used to form the side and end panels of said sheet.

More preferably the bias cut used for the side and end panels of said sheet is cut with an interior angle in the range of 87 to 75 degrees relation to the adjacent peripheral edge of the top panel.

According to a third aspect of the invention there is provided a fitted sheet substantially as described herein with reference to and as illustrated by any appropriate combination of the drawings.

According to a fourth aspect of the invention there is provided a heat resistant elastic suitable for the manufacture of fitted sheets wherein the elastic comprises a heat resistant rubber.

Preferably the heat resistant elastic comprises a heat resistant rubber comprising a modulus value in the range of 26 to 34 kg/cm^2.

Preferably the heat resistant elastic has a stretch ratio in the range of 1:2 to 1:3.

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Preferably the heat resistant elastic has a stretch ratio in the range of 1:2 to 1:2.5.

Preferably the heat resistant elastic comprises a woven elastic.

Preferably the heat resistant elastic comprises a woven elastic comprises a polyester yarn.

More preferably the woven elastic comprising rubber cords having a gauge in the range of 28 to 32.

More preferably the woven heat resistant elastic comprises an average of 15 to 25 rubber cords per 2.54 cm across the width of the elastic used.

More preferably the woven heat resistant elastic comprises an average in the range of 21 to 23 rubber cords per 2.54 cm across the width of the elastic used.

Preferably the woven elastic comprises a warp of 250 to 350 denier Roto polyester yarn and a weft of 100 to 200 denier Roto polyester yarn.

Preferably the heat resistant elastic comprises a woven elastic comprising a warp of 290 to 310 denier Roto polyester yarn and a weft of 140 to 160 denier Roto polyester yarn.

Preferably there is provided a heat resistant elastic wherein the woven elastic has a weight in the range of 20 – 25 grammes per metre.

Preferably there is provided a heat resistant elastic wherein the woven elastic has a weight in the range of 21 to 22 grammes per metre.

Preferably the heat resistant elastic is used to manufacture the corner members of a fitted sheet.

Preferably the heat resistant elastic comprises a heat resistant elastic that is heat set at a temperature in the range of 170 to 200 °C. The heat setting of the elastic in this way provides an elastic with improved stability, wherein dimensional shrinkage of the elastic is minimised when a sheet comprising said heat resistant elastic is washed and dried, such that the overall performance of the elastic (and hence a sheet comprising the elastic) is improved as compared to fitted sheets comprising standard elastic.

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Preferably the heat resistant elastic comprises a heat resistant elastic that is heat set at a temperature in the range of 170 to 200 °C for a period of time in the range of 50 to 70 seconds.

Preferably the heat resistant elastic comprises a heat resistant rubber comprising a natural rubber.

Preferably the heat resistant elastic comprises an elastic comprising a heat resistant rubber comprising a latex rubber.

Preferably the heat resistant elastic comprises a heat resistant rubber comprising an elongation of less than 620%.

According to a fifth aspect of the invention there is provided a method of manufacturing a heat resistant elastic for the manufacture of fitted sheets as disclosed above.

According to another aspect of the invention there is provided an article of bedding adapted for disposition over a mattress having a top surface, side surfaces, end surfaces and corners, the article comprising:

(a) a substantially inelastic web of textile material comprising a top panel having an outer periphery dimensioned to at least substantially cover the top surface of said mattress, two opposed side panels and two opposed end panels, each said side and end panel extending from the periphery of said top panel and dimensioned to at least substantially cover a respective side and end surface of said mattress, each said side and end panel having a pair of side edges and a distal peripheral edge spaced apart from said top panel, said distal peripheral edges together defining the perimeter of said article, the adjacent side edges of the side and end panels being connected to define four corner seams, each said corner seam adapted to at least substantially cover a corner of said mattress and each said corner seam having a longitudinal axis, a proximal end and a distal end;

(b) four stretchable corner members, each said corner member being associated with one of said corner seams and having an unstretched length which is shorter than the length of said associated corner seam, and each said corner member being secured in stretched condition to said article in a position substantially overlying said associated corner seam;

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(c) four additional seams, each said additional seam being substantially aligned axially with the longitudinal axis of an associated corner seam, wherein each said additional seam extends substantially diagonally from the proximal end of said associated corner seam towards the center of said top panel; and,

(d) a stretchable border member having an unstretched length which is shorter than the length of the perimeter of said article, said border member being secured in stretched condition to the perimeter of said article.

Preferably there is provided an article of bedding wherein each said corner member is comprised of a strip of elastic material having a width ranging from about 8 mm to about 12 mm and having a length which is less than one-half of the length of said associated corner seam.

Preferably there is provided an article of bedding wherein each said corner member is secured with lock stitching.

Preferably there is provided an article of bedding wherein said each said additional seam is about 1.5 inches (3.8 cm) long and is formed using Daug stitching.

Preferably there is provided an article of bedding wherein said border member is comprised of a strip of elastic material about 1 inch (2.5 cm) wide and having a length which is about one-half of the length of the perimeter of said article, and wherein said elastic material has a stretch ratio in the range of from about 1:2 to 1:3, or more preferably a stretch ratio of 1:2 to 1:2.5.

More preferably there is provided an article of bedding wherein said border member is secured with twin needle lock stitching.

Preferably there is provided an article of bedding wherein the adjacent side edges of said side and end panels are connected with a five thread lock stitch to define said corner seams.

Preferably there is provided an article of bedding wherein said article is selected from the group consisting of bedsheets, bedspreads, blankets, quilts, duvets and duvet covers.

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Preferably there is provided an article of bedding wherein said textile material is woven or knitted from threads selected from the group consisting of cotton yarns, silk yarns, wool yarns, rayon fibers, polyester fibers, viscose fibers and mixtures thereof.

Preferably there is provided an article of bedding wherein said mattress and said top panel are substantially rectangular in shape.

In accordance with another aspect of the invention there is provided a mattress covering fabricated of substantially inelastic textile material and having top, side and end panels for substantially covering the top surface, side surfaces and end surfaces, respectively, of a mattress, the side and end panels each having side edges, the adjacent side edges of the side and end panels being connected to form four corner seams, each said corner seam having a longitudinal axis, a proximal end and a distal end, the side and end panels also each having a distal peripheral edge spaced apart from said top panel, said distal peripheral edges together defining the perimeter of said mattress covering, the improvement comprising:

(a) four stretchable corner members, each said corner member being associated with one of said corner seams and having an unstretched length which is shorter than the length of said associated corner seam, each said corner member being secured in stretched condition to said mattress covering in a position substantially overlying said associated corner seam;

(b) four additional seams, each said additional seam being substantially aligned axially with the longitudinal axis of an associated corner seam, wherein each said additional seam extends substantially diagonally from the proximal end of said associated corner seam towards the center of said top panel; and

(c) a stretchable border member having an unstretched length which is shorter than the length of the perimeter of said mattress covering, said border member being secured in stretched condition to the perimeter of said mattress covering.

According to another aspect of the invention there is provided a method of making an improved article of bedding, for disposition over a mattress, from a substantially inelastic substantially rectangular web of textile material having four sides and four corners, the method comprising the steps of:

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(a) cutting out and removing from the web a substantially square portion at each of the four corners, each said square portion being defined by two lines of cut of substantially equal length, each said line being substantially straight and generally perpendicular to a different side of the web, the length of each said line being dimensioned such that following said removing, the remaining portion of the web defines a top panel and side and end panels for substantially covering the top surface, side surfaces and end surfaces, respectively, of said mattress;

(b) connecting the adjacent edges of said side and end panels to form four corner seams, each said corner seam having a longitudinal axis, a proximal end and a distal end;

(c) providing four stretchable corner members, each said corner member being associated with one of said corner seams and having an unstretched length which is shorter than the length of said associated corner seam, and securing each said corner member in stretched condition to said article in a position substantially overlying said associated corner seam;

(d) forming four additional seams in said article, each said additional seam being substantially aligned axially with the longitudinal axis of an associated corner seam and each said additional seam extending substantially diagonally from the proximal end of said associated corner seam towards the center of said top panel; and,

(e) providing a stretchable border member having an unstretched length which is shorter than the length of the perimeter of said article, and securing said border member in stretched condition to the perimeter of said article.

According to another aspect of the invention there is provided a method of making an article of bedding comprising a mattress covering fabricated of substantially inelastic textile material and having a top panel for fitting in overlaying relationship to a top surface of a mattress and peripheral side and end panels for overlaying the sides and ends of the mattress, the side and end panels each having side edges and a distal peripheral edge spaced apart from said top panel, said distal peripheral edges together defining the perimeter of said article, the method comprising the steps of:

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(a) connecting the adjacent edges of said side and end panels to form four corner seams, each said corner seam having a longitudinal axis and a proximal end and a distal end;

(b) providing four stretchable corner members, each said corner member being associated with one of said corner seams and having an unstretched length which is shorter than the length of said associated corner seam, and securing each said corner member in stretched condition to said article in a position substantially overlying said associated corner seam;

(c) forming four additional seams in said article, each said additional seam being substantially aligned axially with the longitudinal axis of an associated corner seam and each said additional seam extending substantially diagonally from the proximal end of said associated corner seam towards the center of said top panel; and

(d) providing a stretchable border member having an unstretched length which is shorter than the length of the perimeter of said article, and securing said border member in stretched condition to the perimeter of said article.

Detailed Description of the Invention

In order that the invention may be more clearly understood embodiments thereof will now be described, by way of example only, with reference to the accompanying drawings wherein:

FIG. 1 is a top plan view of a substantially flat rectangular web of fabric from which the fitted sheet of the invention may be formed;

FIG. 2 is a view substantially similar to FIG. 1, illustrating in phantom lines the portions of the fabric web which are to be cut away and removed, so as to form side and end panels;

FIG. 3 is a view illustrating the web of fabric as shown in FIGS 1 and 2 wherein sections of the web have been removed to form side and end panels, and illustrating diagrammatically how the edge of each respective side panel is drawn towards the edge of an adjacent end panel, prior to stitching;

FIG. 4 is a bottom plan view of the fabric web of FIG. 3, after the side and end panels have been joined to form corner seams, thus forming a bed sheet;

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FIG. 5 is a top plan view of the bed sheet of FIG. 4;

FIG. 5A is an expanded view of the area enclosed by the circle X on FIG. 5;

FIG. 6 is a bottom plan view of the bed sheet of FIG. 5, after a flexible and stretchable strip has been added at each corner seam, and after an additional special seam has been formed adjacent each corner;

FIG. 6A is an expanded view of the area enclosed by the circle Y on FIG. 6;

FIGS. 7 and 7A are a bottom plan view, partially broken away, and a side perspective view, respectively, of the bed sheet of FIG. 6, after a flexible and stretchable strip has been stitched to the free peripheral edges of the side and end panels, thus forming a fitted bed sheet that is shown covering the top surface, the sidewalls and endwalls, and at least a portion of the bottom surface of a mattress;

FIG. 8 is a flow diagram depicting the process by which fitted bed sheets in accordance with the present invention (and the applicant's earlier invention as disclosed in US 8,813,280) may be is formed, from the rectangular web of fabric of FIG. 1;

FIG. 9 is top plan view showing a fitted bed sheet covering the top surface of a mattress;

FIG. 10 is a diagrammatic bottom plan view, partially broken away, and substantially similar to FIG. 7, illustrating a fitted bed sheet, covering a portion of the bottom surface of a mattress;

FIGS. 11-13 are diagrammatic bottom plan views depicting several fitted bed sheets of the prior art;

FIG. 14 illustrates a side perspective view of a fitted sheet in accordance with the present invention wherein a label has been affixed to an end panel of said fitted sheet;

FIG. 15 illustrates a side perspective view of a fitted sheet in accordance with the present invention, the sheet being located on a mattress and the bottom of the mattress being visible;

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FIG. 16 is a partial cross-sectional view taken along the line A-A on FIG. 15 of a fitted sheet in accordance with the present invention, illustrating how a fitted sheet and a layer of material may form a pocket for the flexible and stretchable strip that is stitched to the free peripheral edges of the side and end panels;

FIG. 17 is a partial cross-sectional view generally corresponding to FIG. 16, in accordance with the present invention, but wherein the pocket, in which the flexible and stretchable strip is to be located, is to be formed from the same web of fabric from which the fitted sheet is manufactured, the pocket not yet having been formed in FIG. 17.

FIG. 18 is a partial cross-sectional view generally corresponding to FIG. 16, in accordance with the present invention, wherein the pocket in which a flexible and stretchable strip is located has been formed from the same web of fabric from which the fitted sheet is manufactured.

FIG. 19 graphically illustrates a view substantially similar to FIGS. 1, 2 and 3, illustrating a web of fabric wherein sections of the web have been removed using a bias cut to form trapezoidal shaped side and end panels.

FIG. 20 graphically illustrates the web of fabric shown in Fig. 19 when formed into a bed sheet before a border member is attached.

Although the invention will be illustratively described hereinafter with reference to the formation of a fitted bed sheet, it is to be understood that the invention is not limited to the fitted sheets, but instead extends also to the formation of other bedding items, such as blankets, quilts, bedspreads, duvets and duvet covers.

In the applicant's previous application there is provided a fitted sheet that includes a top panel, and side and end panels that are continuous and made from the same fabric, using any standard fabric construction process such as weaving or knitting. A special seam being provided at the corners (corner seams) to insure that the sheet fits snugly over the mattress and does not pop up during usage. In addition, flexible and stretchable strips or tapes, which stretch when pulled, are used at those corner seams and also along the free peripheral edges of the side panels. Thus, the applicant's previous patent application provided improved

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articles for use as bedding materials, while another aspect of the earlier invention concerned methods for fabricating such articles. In order that the improvements disclosed in the present application may be more clearly understood and implemented, details are provided herein as to how the fitted sheet disclosed in US pat. no. 8,813,280 may be manufactured.

Referring first to FIGS. 1-3 and to the flow diagram of FIG. 8, the process of forming the fitted bed sheet of the previous invention begins with a flat web of material (fabric) 10, usually, although not necessarily, rectangular in shape, and preferably formed from a non-stretchable textile fabric that is woven or knitted from cotton, silk, wool, rayon, polyester, viscose and/or other types of threads, yarns or fibers, and combinations thereof, as is conventional in the bedding industry. To form the fitted bed sheet, initially the four corners of web 10 are cut, substantially along the lines 12, as shown in FIG. 2 (step 100 in FIG. 8), forming generally square corner portions 14, 16, 18, 20 that are removed. The resulting modified web 22 is still flat, and as shown in FIG. 3, it includes a top panel 24 having a peripheral edge 26, two opposed side panels 28, 30, as well as two opposed end panels 32, 34. Each of side panels 28, 30 and end panels 32, 34 has two respective side edges 35a, as well as a distal edge 35b.

Generally, the dimensions of the top panel 24 are selected so as to be sufficient to be disposed over, and to cover, the top surface of a mattress (not shown), and the dimensions of side panels 28, 30 and end panels 32, 34 are selected to be sufficient to cover the sidewalls and endwalls, respectively, of the mattress, but they also extend a sufficient distance from the peripheral edge 26 of top panel 24 so as to also cover at least a portion of the bottom surface of the mattress. In general, no matter what absolute dimensions are chosen for the side and end panels (such dimensions will depend upon the design, configuration, thickness and contours of the mattress on which the fitted bed sheet of the invention is to be used), opposed side panels 28, 30 will have a dimension L that will correspond substantially to the length dimension of the mattress, while opposed end panels 32, 34 will have a dimension W that will correspond substantially to the width dimension of the mattress; thus, opposed side panels 28, 30 will be substantially congruent, and similarly, opposed end panels 32, 34 will also be substantially congruent.

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Referring now to FIG. 4 in addition to the aforementioned FIGS. 1-3 and 8, the adjacent side edges 35a of side and end panels 28, 30, 32, 34 are then brought together as indicated by the arrows A in FIG. 3, and are joined, two by two (step 102 in FIG. 8), to form corner seams 36, 38, 40, 42 respectively, thus resulting in a bed sheet 44. Preferably, a five thread lock stitch is used to join these edges, as illustrated schematically in FIG. 4. This lock stitch uses multiple threads that are interlocked with each other to provide strength for the seams, and this stitch allows bed sheet 44 to accommodate the shape of a mattress at the corners, and maintains the sheet on the mattress. FIG. 4 comprises a reverse view of bed sheet 44 (as compared with FIG. 3), so as to illustrate the positions and orientations of the stitches forming the corners seams. Each of corner seams 36, 38, 40, 42 has a proximal end 43a and a distal end 43b. As will be apparent, the distal edges 35b of the side and end panels 28, 30, 32, 34 together form the peripheral free edge of bed sheet 44.

Referring next to FIGS. 5 and 6 in addition to the aforementioned FIGS. 1-4 and 8, an additional special seam is made (step 104 in FIG. 8) in the fabric of top panel 24 of bed sheet 44 in the general vicinity of each of the corners, along lines 45, each of which, as shown best in FIG. 5 (a top plan view (showing the side of the sheet that faces away from a mattress in use) of bed sheet 44), is formed along a line which is an extension of one of the corner seams. Each of these additional seams 46, 48, 50, 52 is preferably about 1.5 inches (2.5 cm) in length, and each one extends diagonally, from peripheral edge 26 of top panel 24 towards the center of top panel 24, along the same longitudinal axis as the adjacent one of corner seams 36, 38, 40, 42 (FIG. 7A shows the position of these additional seams when the fitted bed sheet of the invention is installed on a mattress). The purpose of these additional seams 46, 48, 50, 52 is to gather some of the fabric material of the bed sheet adjacent to the corners, and they help to insure that at each corner, the top panel 24 and each respective intersecting pair of side and end panels 28, 30, 32, 34, do not form a narrow pocket, but instead fit over the mattress corner snugly and assume the shape of the mattress. These additional seams 46, 48, 50, 52 can be formed using conventional sewing techniques, such as Daug stitching or using lock stitching placed at all four corners.

FIG. 5A is an expanded view of the are enclosed by the circle X on figure 5 to enable the line 45, the corner seam 40 and the stitching used to attach the corner elastic to the sheet, to be more clearly seen.

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As previously mentioned, even though mattresses have nominal standard (length×width) sizes, their actual dimensions may vary somewhat. This is particularly true of their thicknesses, which is also referred to herein as their heights. For example, some mattresses may have a height of 7 inches (approximately 17.8 cm), while others may be as high as 18 inches (45.7 cm). It would be inconvenient to manufacture a separate fitted sheet for mattresses of every possible height in each of the standard (length×width) mattress sizes. Therefore, in order to accommodate different heights, the fitted bed sheet of the present applicant's previous invention is provided with flexible and stretchable corner members (corner elastics) 54, 56, 58, 60 (step 106 in FIG. 8), one at each corner.

Corner members 54, 56, 58, 60 may be fabricated of any conventional tightly woven elastic material, having a stretch ratio ranging from about 1:2.75 to about 1:3, and may be provided on either surface of the sheet, but preferably they are provided on the surface which will become the inner surface of the sheet, that is, the surface which will be adjacent to the mattress when the sheet is in use. Each corner member is positioned overlying one of the corner seams 36, 38, 40, 42, respectively, as illustrated in FIG. 6, and is secured, preferably via conventional lock stitching; the corner members 54, 56, 58, 60, when the fitted bed sheet of the invention is installed on a horizontally-positioned mattress (FIG. 7A), are generally oriented vertically.

Each corner member 54, 56, 58, 60 is preferably provided in the form of a narrow strip or tape, about 8-12 mm wide, and its length is preferably smaller than the dimension chosen for the length of the side edge 35a of each of the side and end panels 28, 30, 32, 34; most preferably, the length of each corner member, before it is secured to bed sheet 44, is chosen to be less than one-half of the length of the side edge 35a of the side and end panels 28, 30, 32, 34. It is to be understood that, while the length of the corner members, as specified in the preceding sentence, is measured while each corner member is in a relaxed or "unstretched" condition, each corner member is secured to the sheet in "stretched" condition, that is, prior to securing each corner member to a respective corner seam, each corner member is stretched out, so that it essentially covers the respective corner seam from end to end. The elastic material from which corner members 54, 56, 58 and 60 may be formed is commercially available from a wide variety of sources, such as M/s. Shree Shyam Industries of Bhiwandi, Maharashtra, India and Mahendra Trading Company of Mumbai, Maharashtra, India.

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FIG. 6A is an expanded view of the area enclosed by the circle Y on figure 6 enabling the special seam 48, manufactured using Daug stitching, and the corner member 56 to be more clearly seen.

Referring now to FIG. 7 in addition to the aforementioned FIGS. 1-6 and 8, a border member 62 is secured, preferably via a single needle lock stitching, to the outer edge or perimeter 64 of fitted bed sheet 44 (that is, to the free peripheral edges of the side and end panels 28, 30, 32, 34), as illustrated in FIG. 7 (step 108 in FIG. 8). The border member 62 is preferably provided in the form of a flexible and stretchable strip or tape comprised of a tightly woven elastic material (the material being more tightly woven than is possible using a knitted elastic), that is preferably about 1 inch (2.5 cm) wide. The border member is normally attached to the side of the sheet that, in use, abuts a mattress so that the border member is not normally visible once the fitted sheet is placed on a mattress.

Preferably, the overall length of the border member 62 is shorter than the overall length of the perimeter 64 of sheet 44 (the length of perimeter 64 being the combined total of twice the value of dimension W and twice the value of dimension L, as illustrated in FIG. 2) most preferably, the length of border member 62 is chosen to be approximately one-half of the length of perimeter 64.

It is to be understood that, while the length of the border member 62, as specified in the preceding sentence, is measured while it is in the relaxed or "unstretched" condition, the border member is secured to the sheet in "stretched" condition, that is, prior to securing the border member 62 to the perimeter 64 of sheet 44, the border member 62 is stretched out, so that it essentially extends around the entire peripheral free edge of the sheet. Thus, due to the combined effect of flexible and stretchable corner members 54, 56, 58, 60 and flexible and stretchable border member 62, the final fitted bed sheet 44 is formed with a peripheral free edge having an irregular shape (see FIG. 7).

The resulting fitted bed sheet 44, as disclosed in the applicant's previous application, US pat. no. 8,813,280, and as described above, has several advantages over the prior art that pre-dates said applicant's earlier patent. Referring now to FIGS. 7A, 9 and 10 in addition to the aforementioned FIGS. 1-8, the additional seams near the corners insure that the sheet fits snugly and smoothly over the corners of the mattress, while the corner members 54, 56, 58,

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60 and the border member 62 cooperate to hold the top panel 24 and side and end panels 28, 30, 32, 34 evenly and smoothly on the various corresponding surfaces of the mattress. Moreover, the fitted bed sheet 44 not only adjusts automatically to variations in the dimensions of a mattress, but can also be used for mattresses with varying heights, depending on the dimension chosen for the edges of the side and end panels 28, 30, 32, 34 (that is, the dimension chosen for the length of the lines 12 shown in FIG. 2). For example, if 16 inches (40.6 cm) is chosen for that dimension, then the fitted sheet will accommodate mattresses with heights ranging from 7 inches (17.8 cm) to 18 inches (45.7 cm), whereas if 14 inches (35.6 cm) is chosen for that dimension, then the fitted sheet will accommodate mattresses with heights ranging from 5.5 inches (14 cm) to 16 inches (40.6 cm), while if 18 inches (45.7 cm) is chosen for that dimension, then the fitted sheet will accommodate mattresses with heights ranging from 9 inches (22.9 cm) to 20 inches (50.8 cm).

Referring to FIGS. 11-13 in addition to the aforementioned FIGS. 1-10, further advantages of the fitted bed sheet 44 of the applicant's previous invention over the fitted bed sheets of the prior art (that predate the applicant's US patent) become apparent. The known fitted bed sheet in FIG. 11 (described in U.S. Pat. No. 5,287,574) is provided with the entirety of each end panel 66, 68 being made of a special stretchable (e.g., Lycra®) fabric, as indicated by the arrows B. This fitted sheet is expensive to make, and after a while the knitted fabric loses its flexibility (especially after repeated washings, and detachment and reattachment of the sheet to a bed(s)) and fails to maintain its stretching characteristics. In addition, although the outer peripheral edge 70 of this fitted sheet is provided with a circumferential tubular elasticized "cord," this material is of insufficient size to insure that the sheet remains in place during use. FIG. 12 shows another known fitted sheet (described in U.S. Pat. No. 8,171,581) that is provided with segments 72 of special stretchable (e.g., Lycra®) fabric positioned adjacent the corners. Again, this construction is expensive to manufacture, requiring special assembly, particularly near the corner seams, in order to join the stretchable fabric segments with the non-stretchable fabric making up the rest of the fitted sheet. FIG. 13 shows yet another known fitted sheet (described in U.S. Pat. No. 7,398,570), similar to the one in FIG. 11, except that the end panels 74, 76 are "composites" of dual construction, in which a stretchable portion (as indicated by the arrows C) is attached to a non-stretchable portion. Again, this structure is expensive and time-consuming to assemble.

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The present application details below further improvements to the sheet that was disclosed in the applicant's earlier patent, US pat. no. 8,813,280. In accordance with a first embodiment of the present invention, the flexible and stretchable strip or tape 62, that is stitched to the free peripheral edges of the side and end panels, is preferably comprised of a heat resistant elastic. The heat resistant elastic used is most preferably a tightly woven elastic material that is manufactured using elastic having a stretch ratio of from 1:2 to 1:2.5. The use of heat resistant elastic provides a sheet that has an extended life as the elastic does not lose it elasticity as rapidly as standard elastic during the laundering process. The loss of elasticity is believed to be due to the degradation of normal elastic on exposure to heat when such fitted sheets are laundered, i.e. particularly when such sheets are tumble dried.

The heat resistant elastic, as used herein, is manufactured using a heat resistant rubber thread (cord) that is commercially available in the industry, and is simply sold as heat resistant rubber cord; such rubber cord may be purchased from Rubberflex Sdn. Bhd, 21st Floor, U.B.N Tower, Box No. 48, No. 10 Jalan P.Ramlee, 50250 Kuala Lumpur, Malaysia, Tel : +603 2072 0011, Fax :+603 2078 5103, Email : fikah@rubberflex.com.my, Website www.rubberflex.com.my. The heat resistant rubber threads (cords) used are manufactured using a natural rubber, i.e. a latex rubber.

The heat resistant elastic that has been developed specifically for use in the present invention, and is described herein, is presently manufactured by Royal Elastics, 19-B, Govt. Industrial Estate, Masat. Silvassa. -396230, (D.& N.H.) 02602640764, India.

Additional details for a preferred elastic to be used, in the manufacture of the border member, in accordance with the present invention are provided below:

1. No of rubber cords (strands) to be used:- 22 cords in a border member that is 2.54 cm (1 inch in width)
2. Rubber Gauge:- 30
3. Warp:- 300 Denier Roto polyester yarn.
4. No of Polyester yarns to be used warp:- 54 per inch (i.e. per 2.54cm) or 21 per cm.
5. Weft:- 150 Denier Roto polyester yarn.
6. No of Polyester yarn to be used in weft:- 58 per inch (i.e. per 2.54cm) or 21 per cm.
7. Weight:- 22 grammes/meter.

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One polyester yarn suitable for use in the present invention is sold under the trade name "Texturize – polyester yarn".

It has been noted that using 28 to 32 gauge rubber cords in the manufacture of heat resistant elastic provides a further significant improvement, as regards the heat resistance of the rubber in the woven elastic, as compared to the use of thinner cords such as 38 gauge rubber cords. The tables shown below provide comparative data in respect for the physical properties of a standard 38 gauge (non-heat resistant) rubber cord, as compared to a heat resistant 30 gauge rubber cord (as used in the present invention).

Tests Results (Using test method -IS 7703-Part-2)		30 Gauge rubber – Heat resistant rubber		38 gauge rubber (M)-Standard rubber (non-heat resistant rubber)
Breaking Strength in gms a) Original measurements		906		575
Breaking Strength in gms b) Measurements after Ageing at 100°C for 24 hours		908		578
% Elongation at maximum load a) Original		689		588
% Elongation at maximum load b) After Ageing at 100°C for 24 hours		590		593
Visual observation after heat ageing at 100°C for 24 hrs		No change – no change in the stiffness of the elastic and no cracking of the elastic was observed		

General comments regarding the results shown above in respect of the rubbers tested:

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i) The less the rubber shrinks, when subjected to heat, the better the rubber is, for use in the manufacture of heat resistant elastics of the type discussed herein.

ii) The higher tensile strength of rubber reflects the better quality of the rubber, from the point of view of rubber that is to be used in the manufacture of heat resistant elastic.

iii) In respect of rubber that is suitable for the manufacture of heat resistant elastic, the tensile strength of the rubber should vary by no more than +/- 20% or more preferably by +/- 15% (following the subjection of the rubber to a temperatures of 100 °C for a period of approximately 24 hours) to be suitable for use in the manufacture of heat resistant elastic of the type disclosed herein

iv) A higher elongation value is indicative of better quality elastic, particularly in respect of rubber that is to be used in the manufacture of heat resistant elastic.

The modulus (300 %) value of the 30 Gauge heat resistant rubber used herein has been found to be 26-34 (Kg/cm^2) as compared to a modulus (300 %) value of 36-42 (Kg/cm^2) for a 38 Gauge (non-heat resistant rubber) The modulus value of a rubber reflects a test wherein the rubber is stretched up to a length that is 300% greater than its original, and the strength of the rubber is then calculated on the basis of the results obtained.

The data provided above illustrates that the heat resistant 30 gauge rubber cords have much better modulus values than the 38 gauge rubber cords that are normally used in the manufacture of elastic.

The use of rubber cords with a lower modulus value, to manufacture elastic in accordance with the present invention, provides a fitted sheet that more tightly grips a mattress to which the sheet is fitted.

Generally speaking lower modulus values for rubber reflect the fact that the rubber has greater stretchability, whilst rubbers with "higher modulus values" have relatively less stretch. Hence elastic comprising rubber cords with higher modulus values provide a tighter fitting sheet which last longer and gives better grip to the sheets manufactured using such rubber cords as compared to sheets manufactured using elastic comprising lower modulus rubber based elastic.

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The use of heat resistant elastic to manufacture the border member 62 of a fitted sheet, as detailed above, provides a fitted sheet that may be washed repeatedly, but wherein the elastic does not suffer from a significant decrease in the elasticity of the elastic border member 62 during cycles of washing and drying. In order to provide comparative date two fitted sheets were subjected to testing, the sheets comprising: i) a fitted sheet wherein the border member 62 was manufactured using heat resistant elastic; and, ii) a corresponding sheet wherein the border member 62 of the fitted sheet was manufactured using standard elastic (non-heat resistant elastic). A table is shown below, that provides comparative technical data in respect of the border members of these two sheets before and after they have been "aged". The sheets were aged by being repeatedly washed (50 times), and dried (in a tumble dryer at 60 °C).

Fitted Sheet Standard Elastic			Fitted Sheet Using Heat Resistant Elastic		
Elongation Tests EN-14704-3		Results	Elongation Tests EN-14704-3		Results
Original	Length Growth %	6.0%	Original	Length Growth %	2.17%
	Time Decay	20.56%		Time Decay	15.93%
	Extension At 53 N	277.7%		Extension At 53 N	143.4%
After Ageing (Under Heating at 60°C)	Length Growth %	7.0%	After Ageing (Under Heating at 60°C)	Length Growth %	2.67%
	Time Decay	20.60%		Time Decay	16.10%
	Extension At 53 N	281.6%		Extension At 53 N	141.00%

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The standard fitted sheet comprised 2.5cm (1 inch) wide elastic, as disclosed in the present patentee's earlier application, that comprised 38 gauge (non-heat resistant) rubber as opposed to the improved fitted sheet that is disclosed herein and that comprises heat resistant elastic with a gauge of 30.

EN-14704-3 being a standardised elongation test for elastic/stretchable materials.

Extension at 53 N – A force of 53 N was applied to the stitched elastic and the relevant changes were observed, i.e. the extension of the elastic relative to its un-extended length

Stretch %=((Stretched length-Normal Length)/Normal Length))*100

The size of the sheets tested was 152 cm (width) x 203 cm (length) x 40 cm (depth).

The length of the elastic, in the sheets tested, was approximately 3.42 metres.

By comparing the length growth % figure for a sheet (manufactured in accordance with the present applicant's previous US patent) that incorporates standard elastic with the corresponding figures for a sheet (according to the present invention) that incorporates a heat resistant elastic it can be seen that after the elastics have been aged by repeated (50 times) washing and drying (ageing) in a tumble dryer at 60 °C the heat resistant elastic is subject to a change of 0.5 % in its Length Growth % (a change from 2.17 % to 2.67 %) whilst the standard elastic has degraded such that the Length Growth has changed by 1 % (a change in the length growth from 6.0 % to 7.0 %). Additionally, it can be seen that when the standard elastic is subjected to a force of 53 N the elastic initially extends to 277.7 % of its original length whereas after exposure to a temperature of 60 °C (by exposure to repeated tumble dryings) this standard elastic extends to a length of 281.6 % of its original length, a change of 3.9 %; the heat resistant elastic on the other hand undergoes a contraction in the extent to which it will contract at 53 N of 2.4% - thus illustrating that following repeated washing tumble drying of the sheets detailed above the fitted sheet that incorporated the heat resistant elastic showed lesser changes in its dimensions and elongation than a sheet that was manufactured using standard elastic, i.e. the heat resistant elastic retains its elasticity better than the non-heat resistant elastic.

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By comparing the time decay figures provided in the table above it can be seen that a sheet comprising the heat resistant elastic (as disclosed herein) returns to its original length, following its being stretched using a force of 53 N, more quickly than a similar sheet that is manufactured using a standard elastic, even after repeated washings and dryings.

The standard fitted sheet (manufactured in accordance with the applicant's earlier US patent no. 8,813,280 B1 – referred to by the applicant as a "True Grip" fitted sheet) and the improved heat resistant sheet disclosed here (referred to by the client as "True grip Plus" fitted sheet) that utilises heat resistant elastic both comprised woven elastic strips/tapes that were 2.5 cm in width. However, the heat resistant sheet tested above was manufactured using heat resistant rubber, as detailed above, and the standard fitted sheet comprised standard (non-heat resistant) rubber.

The rubber used to manufacture the heat resistant elastic for the heat resistant sheet was 30 gauge, whilst the rubber cords used to manufacture the standard (non-heat resistant) sheet were 38 gauge. The yarn used to produce the elastic of the heat resistant sheet had been pre-shrunk (as discussed above) whilst the elastic used in the manufacture of the standard sheet was not pre-shrunk).

The skilled addressee will appreciate that the flexible and stretchable corner members 54, 56, 58, 60, as described above, may similarly be manufactured from heat resistant elastic. The elastic for the corner members typically being approximately 1 cm in width.

The applicant's previous US application disclosed the use of a five thread lock stitch to join together the adjacent side edges 35a of side and end panels 28, 30, 32, 34. The applicant has found that a three thread lock stitch may also be used to join together the adjacent side edges 35a of side and end panels 28, 30, 32, 34.

The applicant has noted that in some cases, particularly in relation to larger sheets (e.g. super king size sheets, users may have difficulty in differentiating between the top and bottom of the sheet, and the sides of the sheet. This is because larger sheets have a similar length and width, for example a super king size fitted sheet has a width of 180 cm and a length of 200 cm. The applicant has therefore provided a means to address this problem wherein a label 250 (or more than one label) is/are affixed to the sheet to identify a side or end of the sheet.

Figure 14 illustrates a fitted sheet in accordance with the present invention wherein a label has been affixed to an end panel of said fitted sheet; it will be appreciated that the label 250 could be attached to the top panel 24 (adjacent any side of the top panel). Alternatively, the label 250 (or multiple labels) may be affixed directly to one (or more) of the side panels 28, 30 or to one (or more) of the end panels 32, 34, of a fitted sheet.

The label(s) 250 may be marked to indicate where on the sheet the label 250 has been attached, i.e. to a side panel (left or right – if they are different) or to an end panel (top or bottom – if they are different) of the sheet. Alternatively, the label 250 could be attached to the top panel 24 of the fitted sheet, adjacent to a peripheral edge 26 of the top panel 24, and the label may be marked accordingly to reflect which panel (end, side (left or right) or top) is adjacent said label.

The applicant has noted that in use, border members 62 of fitted sheets become damaged, such damage may be caused, for instance, when the sheets are being attached to or detached from a mattress, as the elastic may become caught in the edges of a mattress. However, damage to the border member more commonly occurs during the laundry process, e.g. the damage may be caused by the use of washing machines or tumble dryers wherein the border member becomes snagged on the sides of the drums of such devices. The applicant has developed an unexpected solution to this problem wherein the border member 62 is enclosed between the sheet 44 and a second layer of material 281 (i.e. between two layers of shielding material). In figure 15 there is shown a bottom/side perspective view of a fitted sheet 44, in accordance with the present invention, the sheet being located on a mattress 280. A partial cross-sectional view (see figure 16), taken along the line A-A on figure 15, illustrates how the fitted sheet 44 and a layer of material (fabric) 281 may form a pocket 282, the material 281 being affixed over the free surface of the border member 62, after said border member 62 has been secured to the sheet 44 as described above.

It will be appreciated by the skilled addressee, that the border member 62 may be located in a pocket 282 formed between a layer of material 281 and the fitted sheet 44, wherein the layer of material 281 is provided by one or more appropriately shaped strips of material that are affixed to the fitted sheet and/or to the border member 62 (step 111 in FIG. 8). The layer of material may be made from any suitable material as would be known to a skilled addressee.

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However, the layer of material is preferably manufactured from the same material that is used to manufacture the fitted sheet, in order to avoid shrinkage problems.

The enclosure of the border member 62 in a pocket 282 helps to protect the border member 62 from damage, of the type discussed above, thus prolonging the useful working life of sheets constructed in accordance with the present invention.

The border member 62 may be enclosed in a pocket 282 formed by a separate layer of material 281, as discussed above. Alternatively, the pocket 282 may be formed in its entirety from the web of fabric 10 from which the fitted sheet is manufactured. In such cases the side panels 28, 30 and end panels 32, 34 are selected such that they cover the sidewalls and endwalls of the mattress, they also extend a sufficient distance from the peripheral edge 26 of top panel 24 so as to also cover at least a portion of the bottom surface of the mattress (as discussed above), and additionally the panels extend beyond the point where the border member is to be attached to the sheet (as described above) (step 109 in FIG. 8). This provides a portion of material 44a that may be folded back over the border member 62 and affixed to the sheet to form a pocket 282 in which the border member 62 is located. The folded back portion 44a of the material may be affixed to the sheet 44 using stitching or any other suitable means, but preferably using a lock stitch (step 110 in FIG. 8).

The applicant has now found that the process described above for the manufacture of fitted sheets may be improved by switching the order of the steps 104 and 106, i.e. the flexible and stretchable corner members 54, 56, 58, 60 are attached to the fitted sheet such that they overlie the corner seams 36, 38, 40, 42 (step 106) prior to the additional seam being made in the fabric of the top panel 24 of the bed sheet 44 (step 104). Carrying out step 106 before step 104 provides an improved process wherein an automatic stitching machine, as would be known to a person skilled in the art, may be used to affix the stretchable corner members (54, 56, 58, 60) using a chain stitch. It is normally the case that when step 104 is carried out before step 106, a stitching machine (preferably a Juki stitching machine) is used to attach the stretchable corner members (54, 56, 58, 60) using a lock stitch. The use of the automatic stitching machine speeds up the process of affixing the stretchable corner members 54, 56, 58 and 60 to the bed sheet 44 such that they overlie the corner seams 36, 38, 40, 42.

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Referring now to figures 19 and 20, in a second embodiment of the invention, a bias cut is used to cut out sections from an initial rectangular shaped web of material 10, in order to form side panels 204i, 206i and end panels 203i, 205i that may then be used in the construction of a fitted sheet as described above. The use of said bias cut provides side panels 204i, 206i and end panels 203i, 205i wherein the distal edges of the side and end panels 35bi are shorter than the adjacent peripheral edges 26i of the top panel. Figure 19 illustrates the shape of a web fabric 10i wherein sections of the web have been removed to form side panels 204i, 206i and end panels 203i, 205i using a bias cut, the additional sections (as compared to the previous embodiment of the invention) of the web that are removed using a bias cut are enclosed by the broken lines 12a.

The side edges 35ai are preferably cut at an angle of between 80 and 75 degrees (see (a) on figure 19) relative to the peripheral edge 26i of the top panel 24i; such that the peripheral edges 26i of the top panel 24i are longer than the adjacent distal edges of the side and end panels 35bi, i.e. the side and end panels are trapezoidal in shape. The sheet is then constructed as previously described above. It will be appreciated by the skilled addressee that when the adjacent side edges 35ai of the side panels 204i, 206i and end panels 203i, 205i are brought together and joined, two by two (step 102 in FIG. 8), to form corner seams, the resulting bed sheet 44i that is initially formed (before the border member is attached) comprises a truncated pyramidal shape that tapers (narrows) towards the distal edges of the side and end panels 35bi, as graphically represented in figure 20. The use of a bias cut corner gives a sheet that is better fitting on mattresses and that is not as readily displaced from its original fitted position on a mattress during use; as the skilled addressee will appreciate mattresses have a tendency to shrink when they are compressed during use and the use of bias cut corners assists the fitted sheet, as disclosed herein, in generally maintaining its position on the mattress, even after repeated washing and drying of said sheet.

Once the border member 62 is attached to the sheet 44i, the sheet 44i still generally comprises a generally truncated pyramidal shape, wherein the pyramid tapers towards the outer edge or perimeter of the fitted bed sheet 44i, once the sheet 44i is stretched by its

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instalment on a mattress. However, the pyramidal shape is obviously not maintained in the section of the sheet 44i that is folded over the bottom surface of the mattress.

The construction of a sheet 44i using a bias cut, as described above, provides a fitted sheet wherein, in use when the sheet is fitted to a mattress, as the truncated pyramidal structure narrows it progressively grips the adjacent sides and ends of the mattress more tightly (thus avoiding unwanted movement of the sheet) until the point is reached wherein the remainder of the truncated pyramid structure overlaps the bottom of the mattress. Thus the use of a bias cut to form a fitted sheet provides a sheet that is better able, in use, to resist unwanted movement of said sheet relative to the mattress to which the sheet 44i has been fitted, due to the lower section of the truncated pyramid structure providing additional resistance to the movement of said sheet on the mattress.
The above embodiments are described by way of example only. Many variations are possible without departing from the scope of the invention, as defined in the appended claims.

Whilst the use of labels was previously described to assist users identifying the top and/or bottom of a fitted sheet, the skilled addressee will appreciate that alternative means may be provided to assist a user in orientating said fitted sheets on a mattress, for instance a different pattern may be used on one of the side or end panels.

Whilst the top panel, the two side panels and the two end panels are described above as being formed from a single piece of material that may comprise, but is not limited to cotton, polyester, viscose or any combination/blend thereof, as described above; The skilled addressee will appreciate that top panel, the two side panels and the two end panels may also be formed from separate pieces of material that are joined together by stitching or by the use of other suitable methods such as gluing, etc.

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Claims

1. A fitted sheet, for a mattress, comprising heat resistant elastic wherein the heat resistant elastic comprises a heat resistant rubber characterised in that the heat resistant elastic has been heat set at a temperate in the range of 170 to 200°C, wherein the heat resistant elastic comprises a woven elastic which comprises a polyester yarn, rubber cords having a gauge in the range of 28 to 32 and an average in the range of 15 to 25 rubber cords per 2.54 cm across the width of the elastic used.

2. A fitted sheet, for a mattress, as claimed in claim 1 comprising a stretchable border member wherein the border member is manufactured from said heat resistant elastic comprising a heat resistant rubber.

3. A fitted sheet as claimed in claim 1 or 2, wherein said heat resistant elastic has been heat set at a temperature in the range of 170 to 200 °C for a period of time in the range of 50 to 70 seconds.

4. A fitted sheet, for a mattress, according to any one of claims 1 to 3, wherein the sheet comprises a web of textile material comprising:

   a top panel;

   two opposed side panels; and,

   two opposed end panels;

   the side and end panels extending from the periphery of said top panel,

   wherein the top panel is dimensioned to substantially cover the top surface of a mattress, and the side panels and end panels are dimensioned to substantially cover the sides and ends of said mattress;

   adjacent edges of the end panels and side panels being connected to each other to form four corner seams that, in use, are located adjacent the corners of said mattress, and each said corner seam having a longitudinal axis, a proximal end and a distal end;

   the fitted sheet further comprising four stretchable corner members, each corner member having an un-stretched length that is shorter than the length of the adjacent corner seam, the corner members being attached to the sheet adjacent to the corner seams, and the corners members being shorter than the adjacent corner seams in their unstretched state, the corner members being attached to the corner seams in their stretched state in a position substantially overlying said associated corner seam;

   the sheet further comprising four additional seams each said additional seam being substantially aligned axially with the longitudinal axis of an associated corner seam, and wherein each said additional seam extends substantially diagonally from the proximal end of said associated corner seam towards the centre of said top panel;

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a stretchable border member having an unstretched length which I shorter than the length of the perimeter of said sheet, said border member being secured in a stretched condition to the perimeter of said sheet; and,

wherein the stretchable border member is manufactured from heat resistant elastic comprising a heat resistant rubber.

5. A fitted sheet comprising a heat resistant elastic, according to any one of claims 1 to 4, wherein the heat resistant elastic comprises a heat resistant rubber with a modulus in the range of 26 to 34 kg/ cm^2.

6. A fitted sheet, according to any one of claims 1 to 5, wherein the heat resistant elastic has a stretch ratio in the range of 1:2 to 1:3.

7. A fitted sheet, as claimed in any of claims 1 to 5, wherein the heat resistant elastic has a stretch ratio in the range of 1:2 to 1:2.5.

8. A fitted sheet, as claimed in any one of claims 1 to 7, wherein the woven heat resistant elastic comprises an average in the range of 21 to 23 rubber cords per 2.54 cm across the width of the elastic used.

9. A fitted sheet, as claimed in any one of claims 1 to 8, wherein the woven heat resistant elastic comprises a warp of 250 to 350 denier Roto polyester yarn and a weft of 100 to 200 denier Roto polyester yarn.

10. A fitted sheet, as claimed in any one of claims 1 to 8, wherein the woven heat resistant elastic comprises a warp of 290 to 310 denier Roto polyester yarn and a weft of 140 to 160 denier Roto polyester yarn.

11. A fitted sheet, as claimed in any one of claims 1 to 10, wherein the woven heat resistant elastic has a weight in the range of 20 to 25 grammes per metre.

12. A fitted sheet, as claimed in any one of claims 1 to 10, wherein the woven heat resistant elastic has a weight in the range of 21 to 22 grammes per metre.

13. A fitted sheet, according to any one of claims 1 to 12, wherein the sheet comprises a truncated pyramidal shape.

14. A fitted sheet, as claimed in claim 13, wherein the truncated pyramidal shape tapers towards the distal edges of the side and end panels.

15. A fitted sheet, as claimed in claim 13 or 14, wherein the truncated pyramidal shape is created by the use of side and end panels that that are trapezoidal in shape.

16. A fitted sheet, as claimed in any one of claims 13 to 15, wherein the trapezoidal shaped side and end panels comprise side edges that are cut at an angle in the range of 80 to 75 degrees relative to the adjacent peripheral edge of the top panel.

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17. A fitted sheet, as claimed in any one of claims 2 to 16, wherein the border member is located between two or more layers of shielding material.

18. A fitted sheet, as claimed in claim 17, wherein at least one of the two or more layers of shielding material comprises the material forming the side panels and end panels.

19. A fitted sheet, as claimed in claim 17 or 18, wherein at least two of the two or more layers of shielding material comprise the web of material from which the side panels and end panels are manufactured.

20. A fitted sheet, as claimed in any one of claims 17 to 19, wherein the border member is located in a pocket formed by two or more layers of shielding material.

21. A fitted sheet according to any one of claims 1 to 20, wherein the sheet comprises means to identify at least one of a side and end of said sheet.

22. A fitted sheet, as claimed in claim 21, wherein the means to identify the at least one of a side and end of said sheet are provided in the form of one or more labels.

23. A fitted sheet, as claimed in any one of claims 4 to 22 wherein the corner members are manufactured from heat resistant elastic.

24. A fitted sheet, as claimed in claim 23, wherein the heat resistant elastic used to manufacture the corner members comprises a warp of 250 to 350 denier Roto polyester yarn and a weft of 100 to 200 denier Roto polyester yarn.

25. A fitted sheet, as claimed in claim 23, wherein the woven heat resistant elastic comprises a warp of 290 to 310 denier Roto polyester yarn and a weft of 140 to 160 denier Roto polyester yarn.

26. A method of manufacturing a fitted sheet according to any one of claims 1 to 25 comprising the steps of:

    i) providing a web of textile material comprising:

    a top panel;

    two opposed side panels; and,

    two opposed end panels;

    the side and end panels extending from the periphery of said top panel,

    wherein the top panel is dimensioned to substantially cover the top surface of a mattress, and the side panels and end panels are dimensioned to substantially cover the sides and ends of said mattress;

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the panels being stitched together to form a fitted sheet;

ii) wherein a heat resistant elastic material, comprising heat resistant rubber, said heat resistant elastic having been heat set at a temperature in the range of 170 to 200 °C is incorporated into said fitted sheet by stretching said elastic prior to affixing it to said sheet.

27. A method of manufacturing a fitted sheet, as claimed in claim 26, wherein a bias cut is used to form the side and end panels of said sheet.

28. A method of manufacturing a fitted sheet, as claimed in claim 27, wherein the bias cut used to form the side and end panels of said sheet is cut with an interior angle in the range of 85 to 75 degrees relative to the adjacent peripheral edge of the top panel.

29. A heat resistant elastic suitable for the manufacture of fitted sheets wherein the elastic comprises a heat resistant rubber, characterised in that the heat resistant elastic is heat set at a temperature in the range of 170 to 200 °C, wherein the heat resistant elastic comprises a woven elastic comprising a polyester yarn, rubber cords having a gauge in the range of 28 to 32 and an average in the range of 15 to 25 rubber cords per 2.54 cm across the width of the elastic used.

30. A heat resistant elastic suitable for the manufacture of fitted sheets, as claimed in claim 29, wherein the elastic comprises a heat resistant rubber comprising a modulus value in the range of 26 to 34 kg/cm^2.

31. A heat resistant elastic suitable for the manufacture of fitted sheets, as claimed in claim 29 or 30, wherein the heat resistant elastic has a stretch ratio in the range of 1:2 to 1:3.

32. A heat resistant elastic suitable for the manufacture of fitted sheets, as claimed in claim 29 or 30, wherein the heat resistant elastic has a stretch ratio in the range of 1:2 to 1:2.5.

33. A heat resistant elastic suitable for the manufacture of fitted sheets, as claimed in claim 30 , wherein the woven heat resistant elastic comprises an average in the range of 21 to 23 rubber cords per 2.54 cm across the width of the elastic used.

34. A heat resistant elastic suitable for the manufacture of fitted sheets, as claimed in any one of claims 29 to 33 , wherein the woven heat resistant elastic comprises a warp of 250 to 350 denier Roto polyester yarn and a weft of 100 to 200 denier Roto polyester yarn.

35. A heat resistant elastic suitable for the manufacture of fitted sheets, as claimed in any one of claims 29 to 33, wherein the woven heat resistant elastic comprises a warp of 290 to 310 denier Roto polyester yarn and a weft of 140 to 160 denier Roto polyester yarn.

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36. A heat resistant elastic suitable for the manufacture of fitted sheets, as claimed in any one of claims 29 to 35, wherein the woven heat resistant elastic has a weight in the range of 20 to 25 grammes per metre.

37. A heat resistant elastic suitable for the manufacture of fitted sheets, as claimed in any one of claims 29 to 35, wherein the woven heat resistant elastic has a weight in the range of 21 to 22 grammes per metre.

38. A heat resistant elastic suitable for the manufacture of fitted sheets, as claimed in any one of claims 29 to 37, wherein the heat resistant elastic is used to manufacture the corner members of a fitted sheet.

39. A heat resistant elastic suitable for the manufacture of fitted sheets, as claimed in claim 29, wherein the elastic comprises a heat resistant rubber and the heat resistant elastic that is heat set at a temperature in the range of 170 to 200 °C for a period of time in the range of 50 to 70 seconds.

40. A heat resistant elastic suitable for the manufacture of fitted sheets, as claimed in any one of claims 29 to 39, wherein the elastic comprises a heat resistant rubber comprising a natural rubber.

41. A heat resistant elastic suitable for the manufacture of fitted sheets, as claimed in claim 40, wherein the elastic comprises a heat resistant rubber comprising a latex rubber.

42. A heat resistant elastic suitable for the manufacture of fitted sheets, as claimed in any one of claims 29 to 41, wherein the elastic comprises a heat resistant rubber comprising an elongation of less than 620%.

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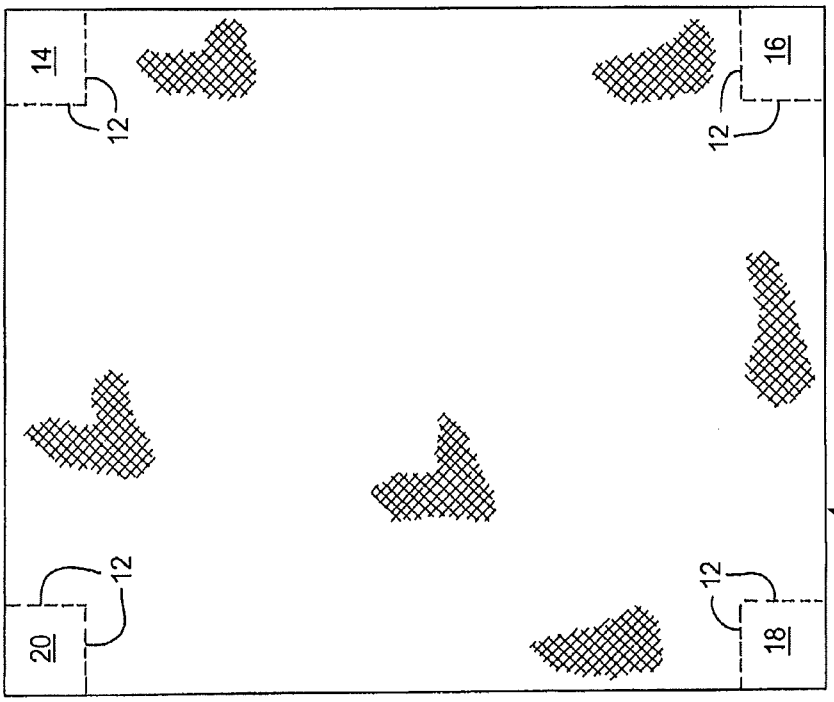


FIG. 2

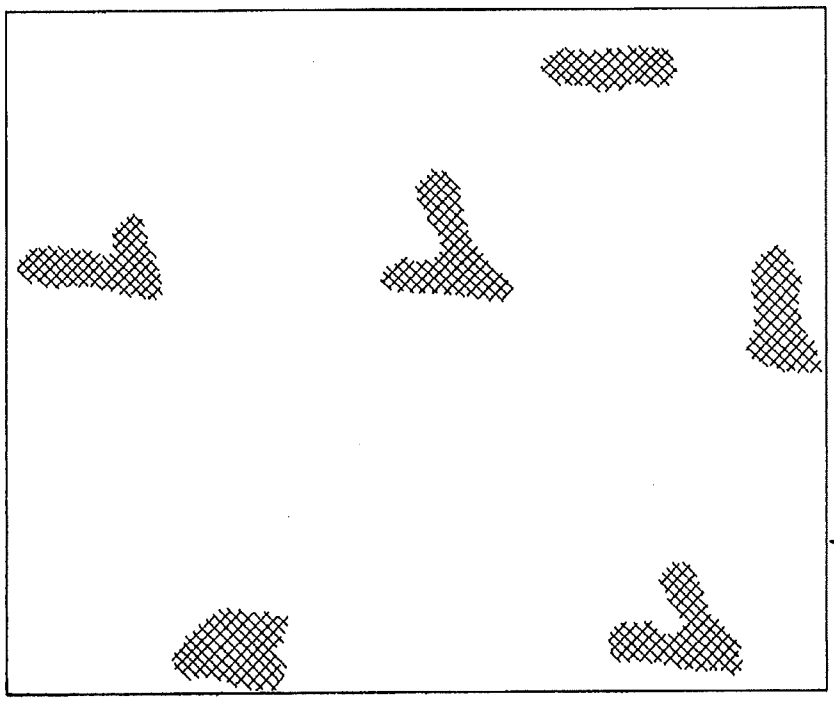


FIG. 1

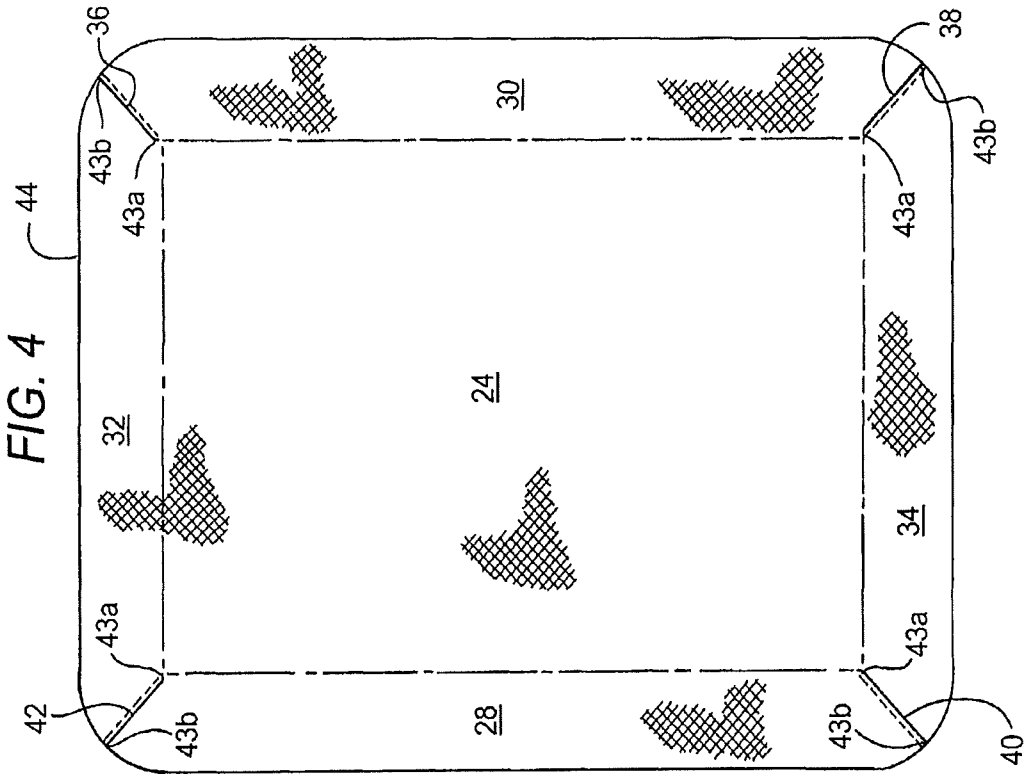


FIG. 4

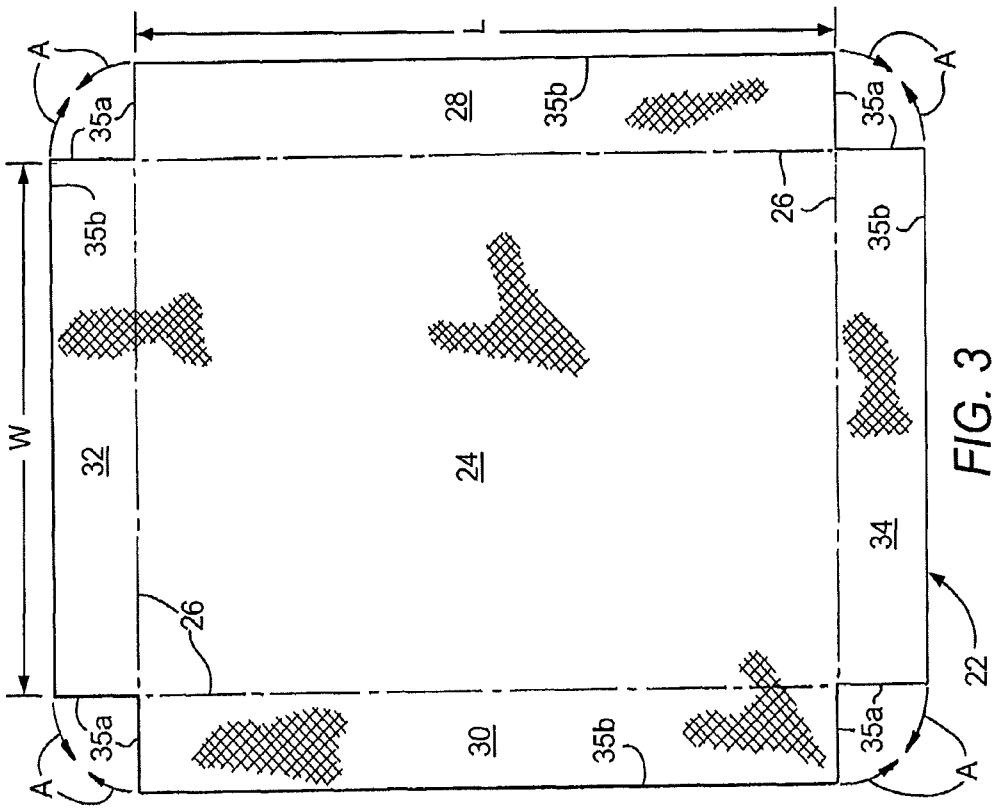


FIG. 3

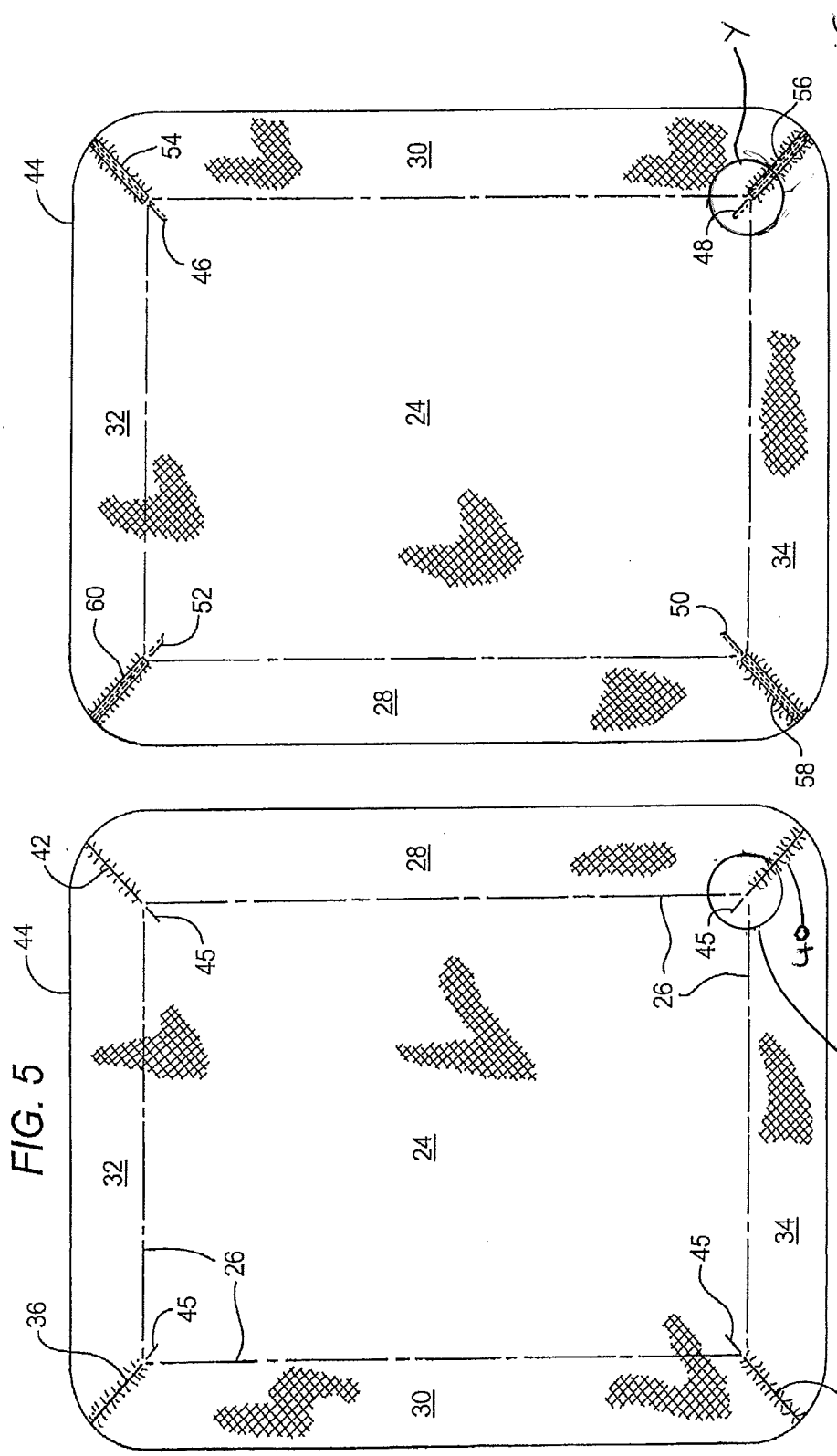


FIG. 5

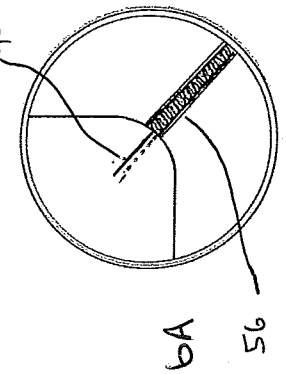


FIG. 6A

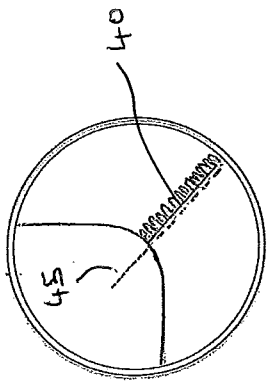


FIG. 5A

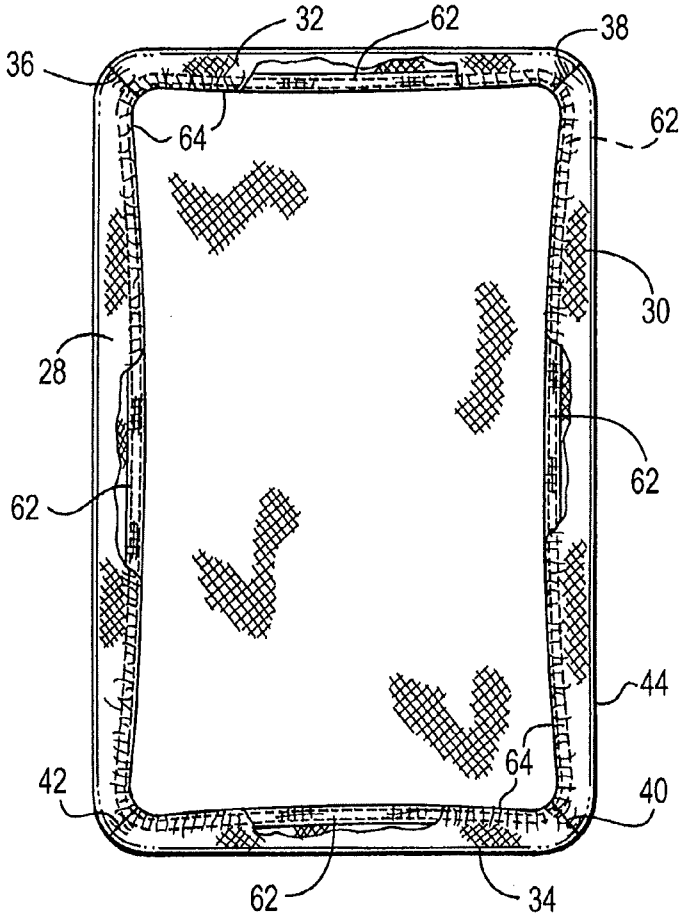

32
62
38
36
64
62
30
28
62
62
44
64
42
40
62
34

FIG. 7

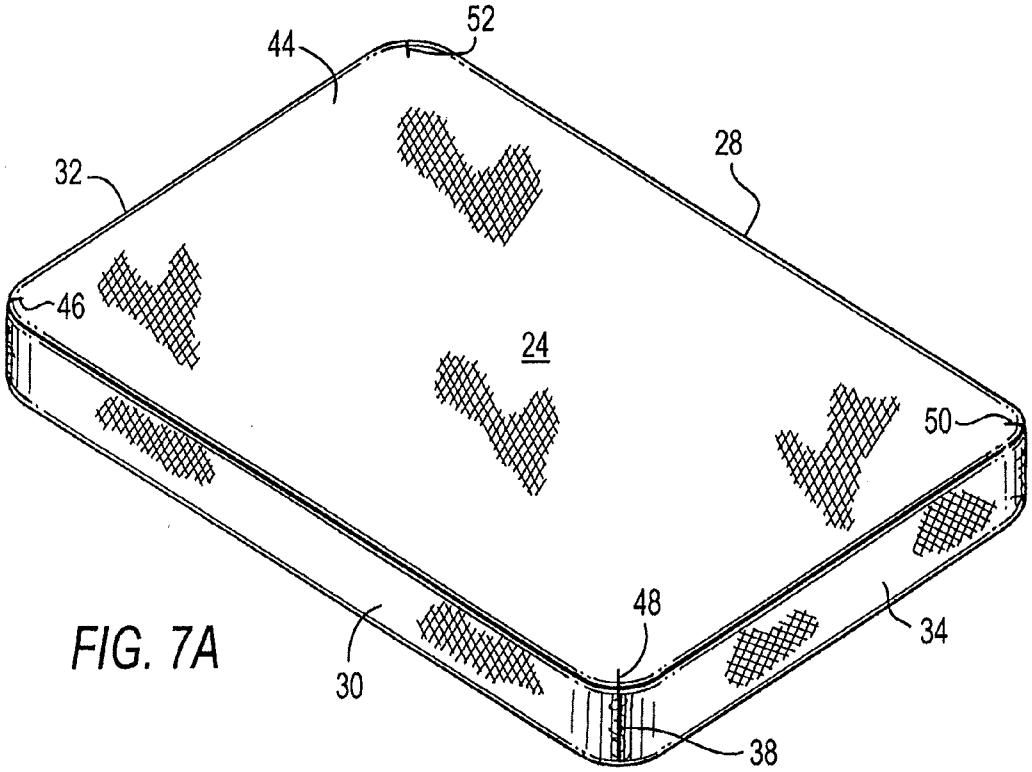
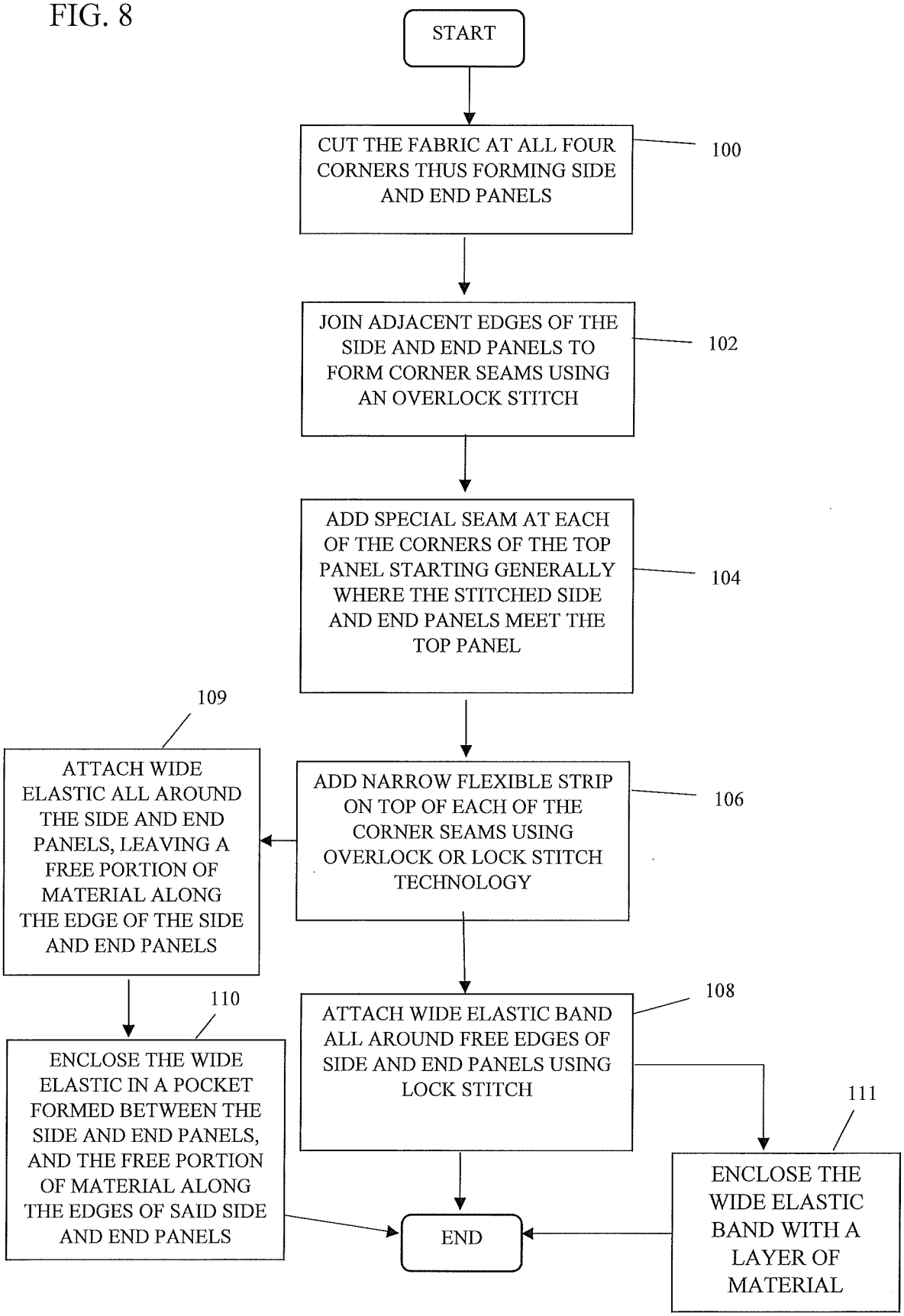

52
44
28
32
46
24
50
48
34
30
38

FIG. 7A

FIG. 8


START
CUT THE FABRIC AT ALL FOUR CORNERS THUS FORMING SIDE AND END PANELS
100
JOIN ADJACENT EDGES OF THE SIDE AND END PANELS TO FORM CORNER SEAMS USING AN OVERLOCK STITCH
102
ADD SPECIAL SEAM AT EACH OF THE CORNERS OF THE TOP PANEL STARTING GENERALLY WHERE THE STITCHED SIDE AND END PANELS MEET THE TOP PANEL
104
ADD NARROW FLEXIBLE STRIP ON TOP OF EACH OF THE CORNER SEAMS USING OVERLOCK OR LOCK STITCH TECHNOLOGY
106
109
ATTACH WIDE ELASTIC ALL AROUND THE SIDE AND END PANELS, LEAVING A FREE PORTION OF MATERIAL ALONG THE EDGE OF THE SIDE AND END PANELS
110
ENCLOSE THE WIDE ELASTIC IN A POCKET FORMED BETWEEN THE SIDE AND END PANELS, AND THE FREE PORTION OF MATERIAL ALONG THE EDGES OF SAID SIDE AND END PANELS
ATTACH WIDE ELASTIC BAND ALL AROUND FREE EDGES OF SIDE AND END PANELS USING LOCK STITCH
108
111
ENCLOSE THE WIDE ELASTIC BAND WITH A LAYER OF MATERIAL
END

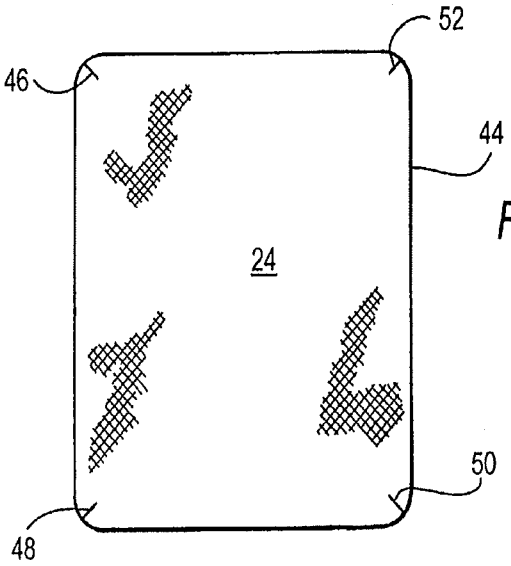


FIG. 9

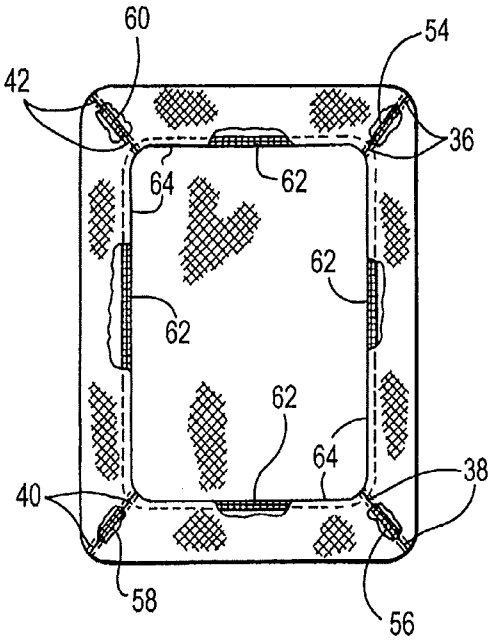


FIG. 10

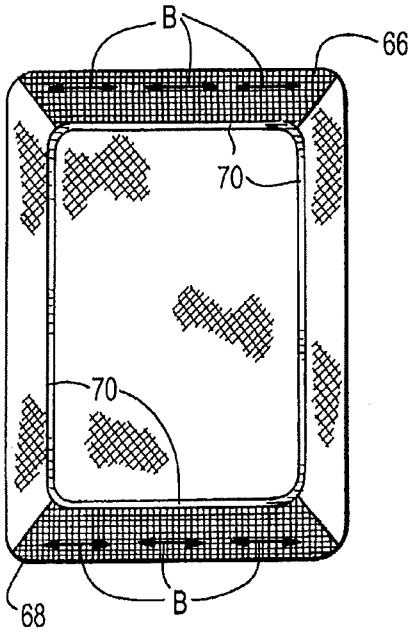


FIG. 11
PRIOR ART

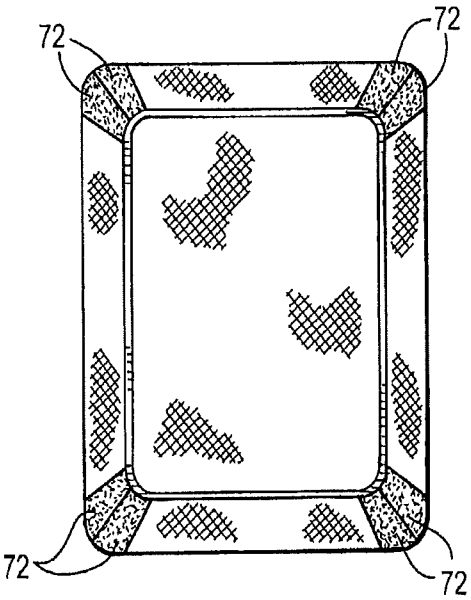


FIG. 12
PRIOR ART

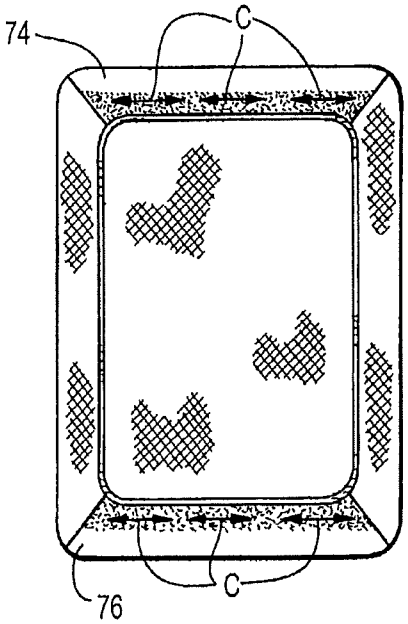


FIG. 13
PRIOR ART

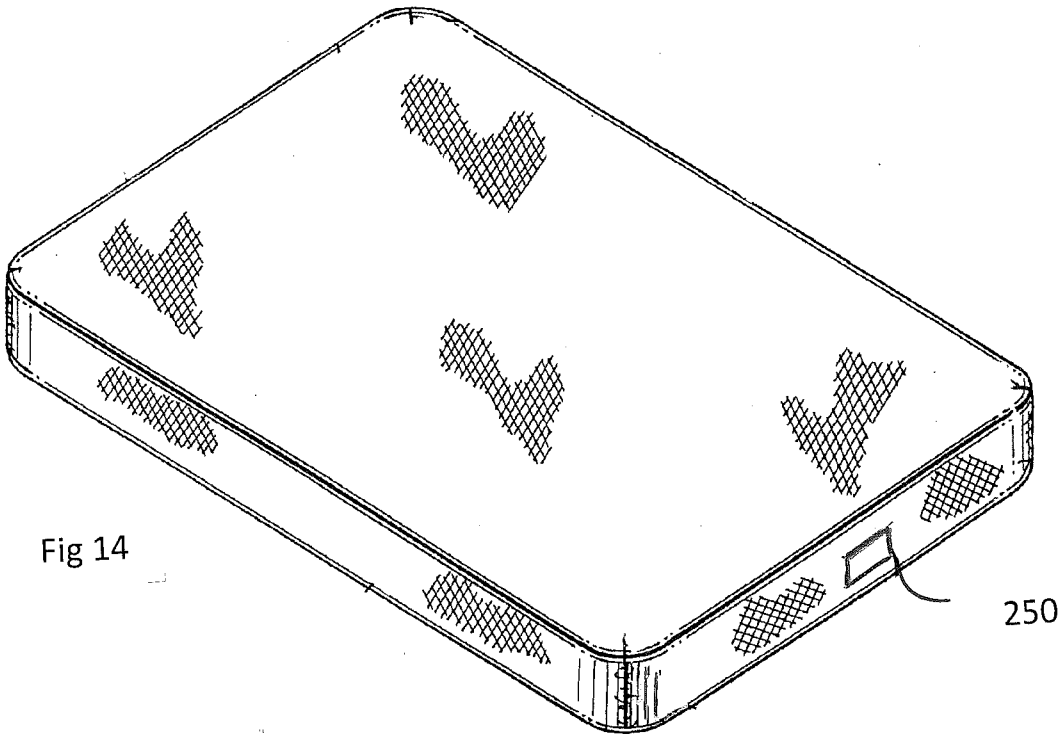


Fig 14

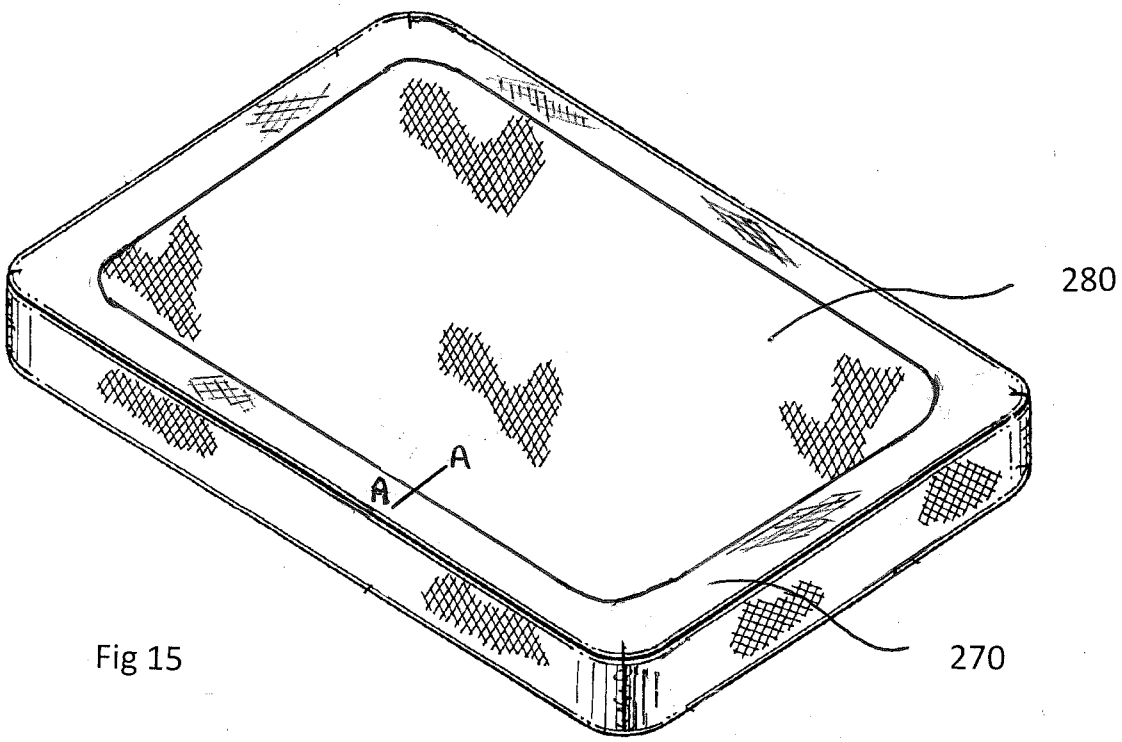


Fig 15

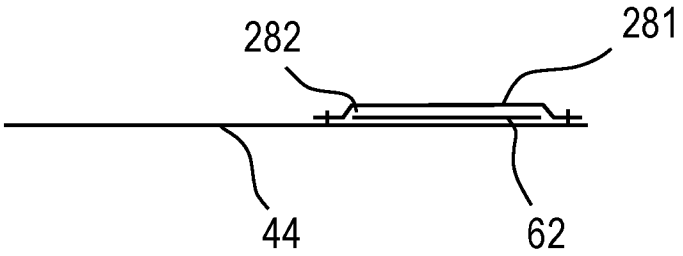


Fig. 16

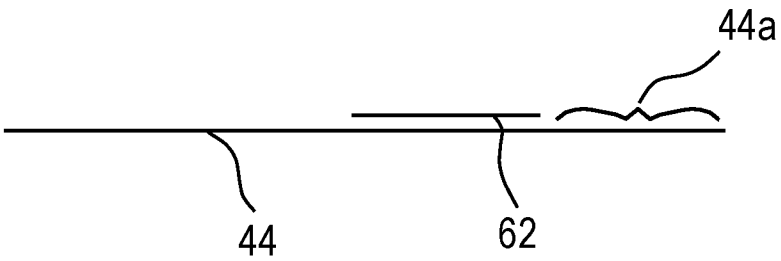


Fig. 17

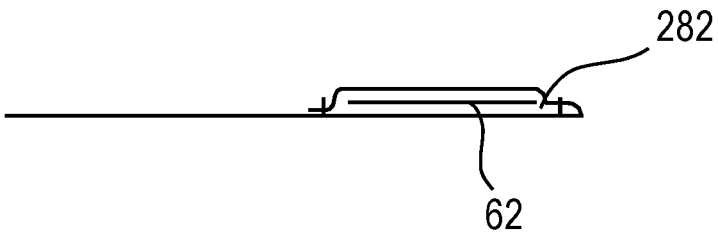


Fig. 18

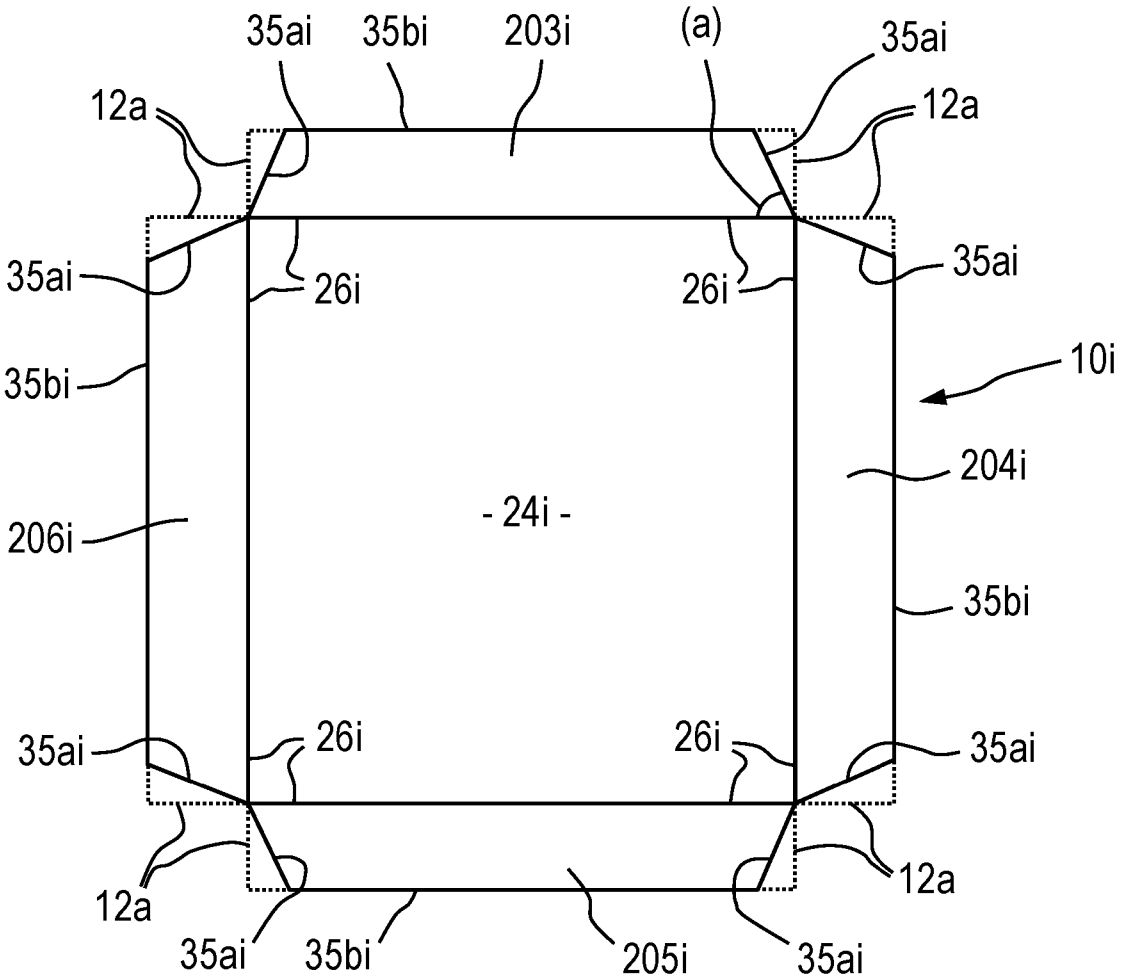

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Fig. 19

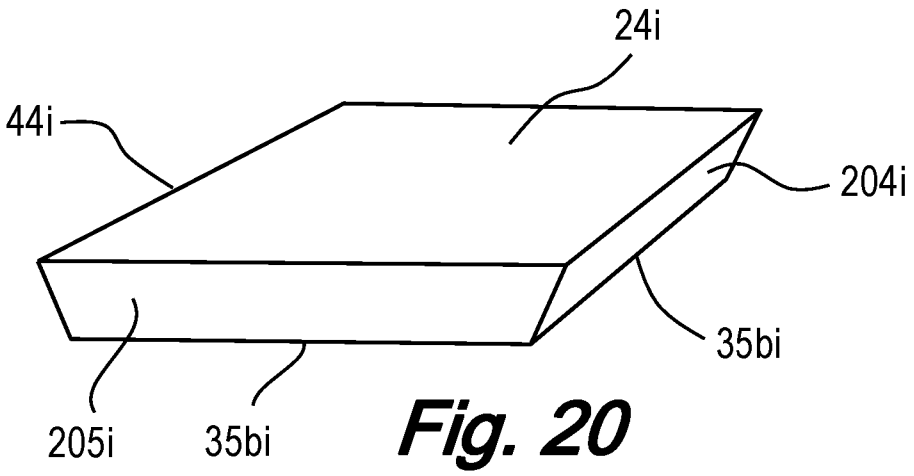
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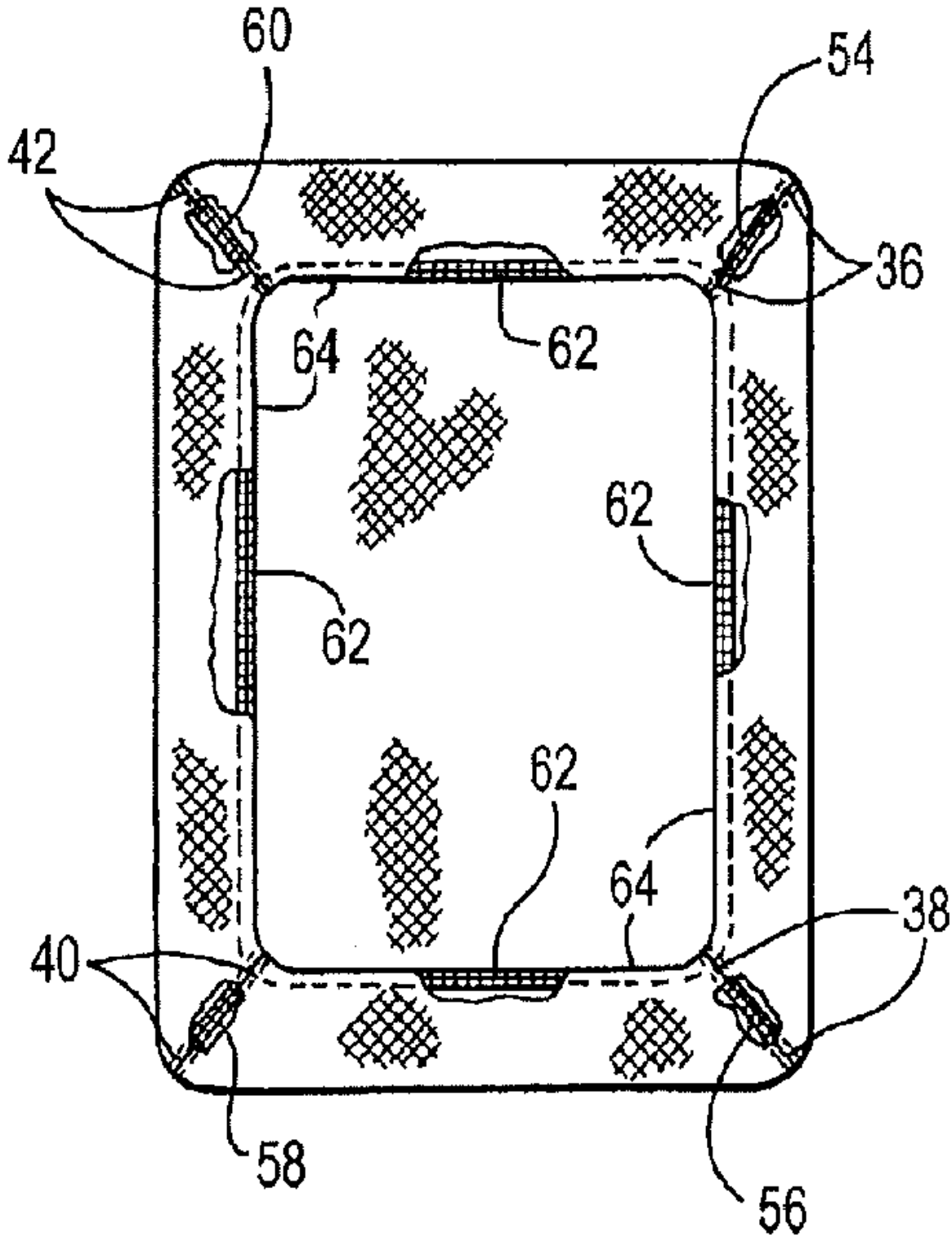
Fig. 20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