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(54) **THORACO-LUMBO-SACRAL ORTHOSIS**

(57)

**ABSTRACT**

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A thoraco-lumbo-sacral brace formed of flexible materials designed to fit patients of varying shapes and sizes. The brace comprises an anterior support and a posterior support, both made of a hook and loop material, and connected by two sets of connection straps. The connection straps comprise a series of flexible straps attached to a common strap, and a rigid strap. Each flexible strap passes through a loop attached to the posterior support. The common strap is made of a hook and loop material. The common strap may be fastened to the anterior support at any angle in order to tighten the brace and adjust it to fit a variety of body types. The rigid strap similarly passes through a loop and is attached to the anterior support atop the common strap, thereby minimizing unwanted lateral motion. The anterior support further may accept a plurality of splints sized to fit within a plurality of cavities located on the front side of the anterior support. These splints provide additional support for the patient. Lateral panels may be attached between the anterior support and posterior support to widen the brace. A thoracic lumbar support may be attached to the posterior support, providing increased support for a patient's upper back. A sternal extension may be attached to the anterior support, thus providing additional bracing for a patient's chest.

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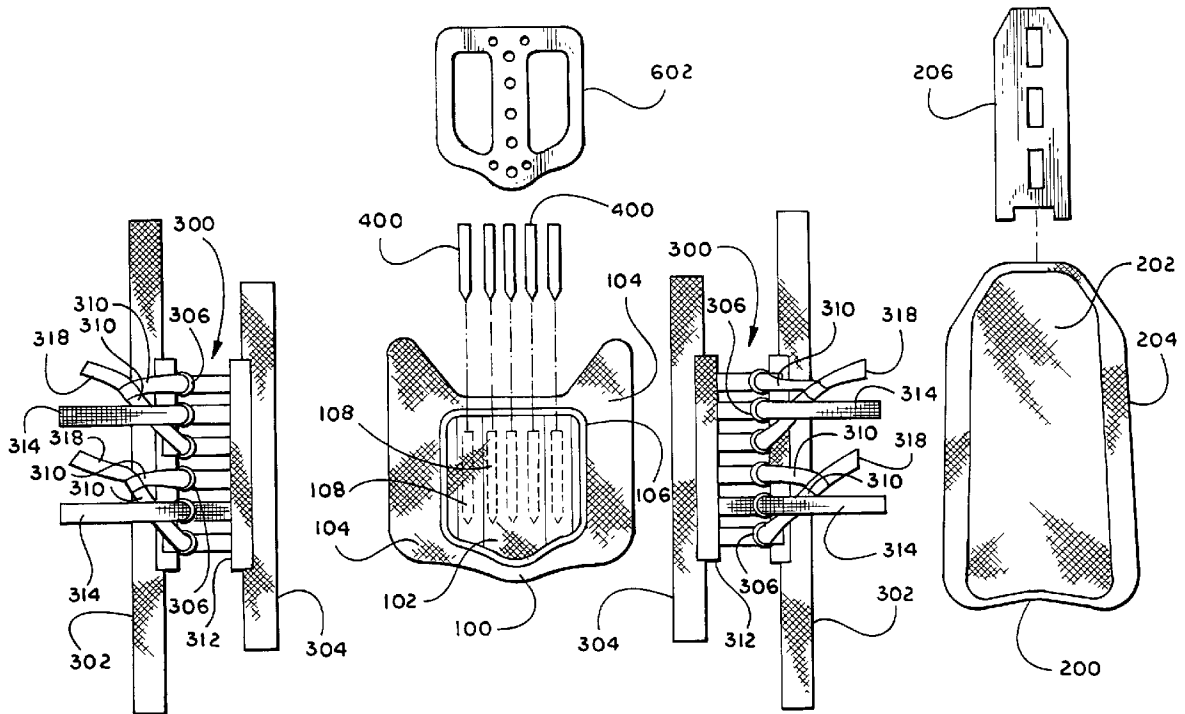
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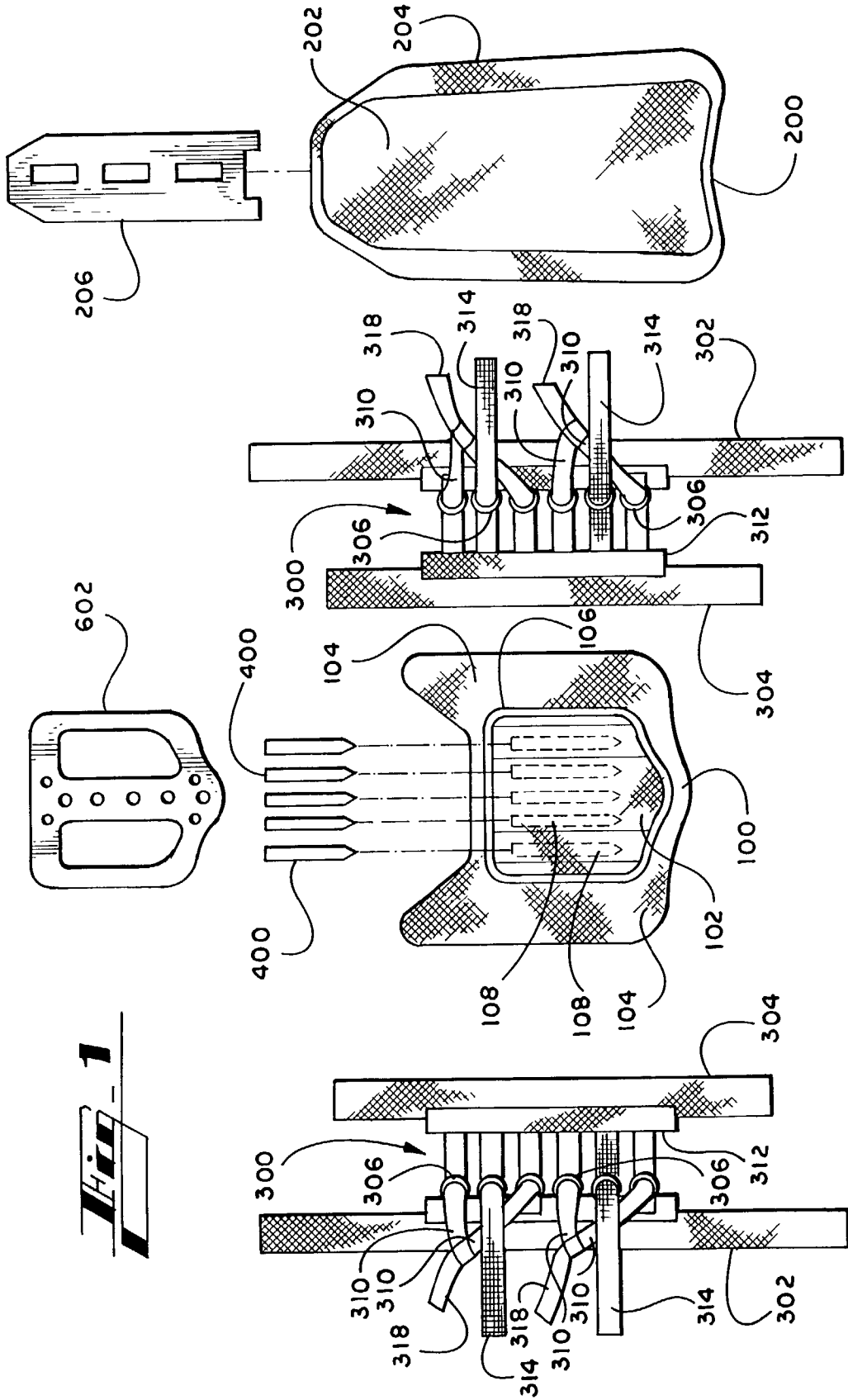
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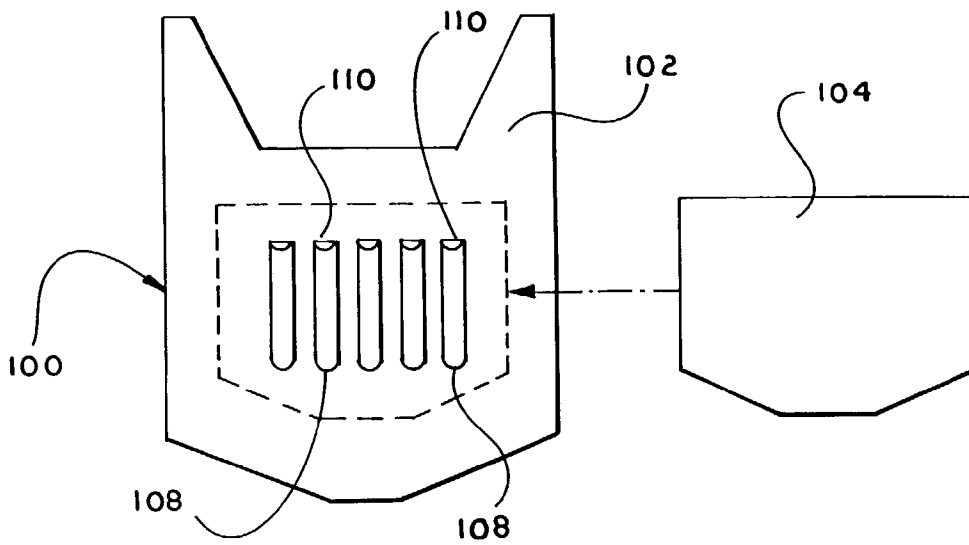
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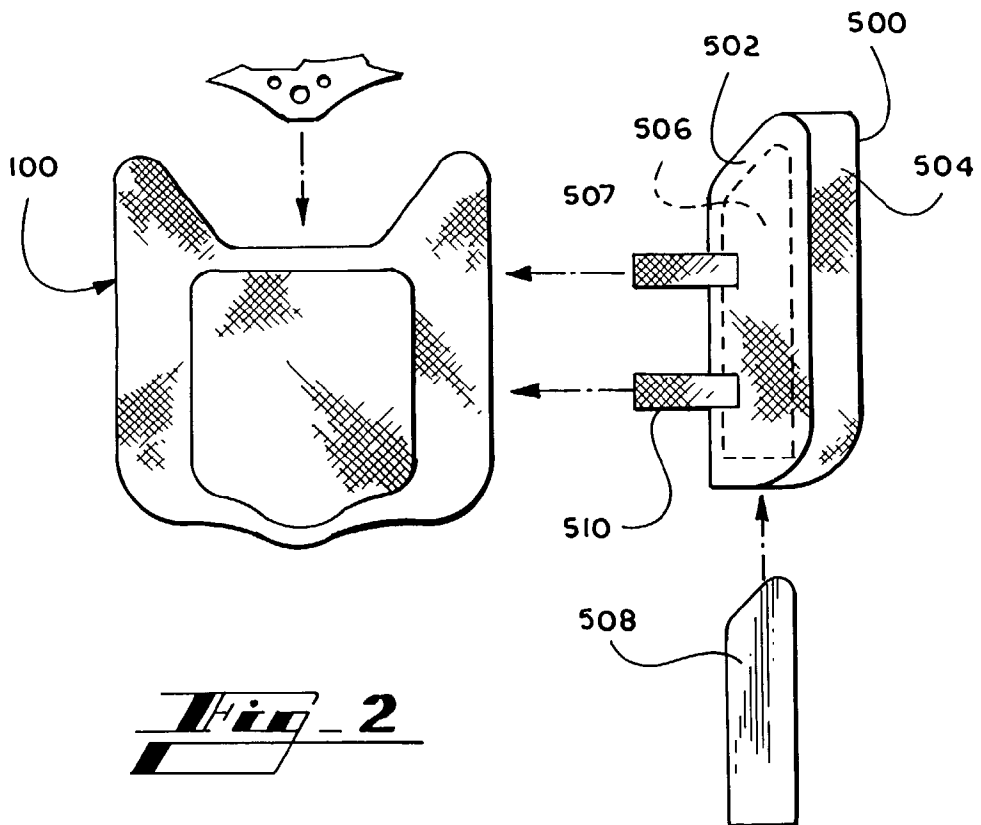
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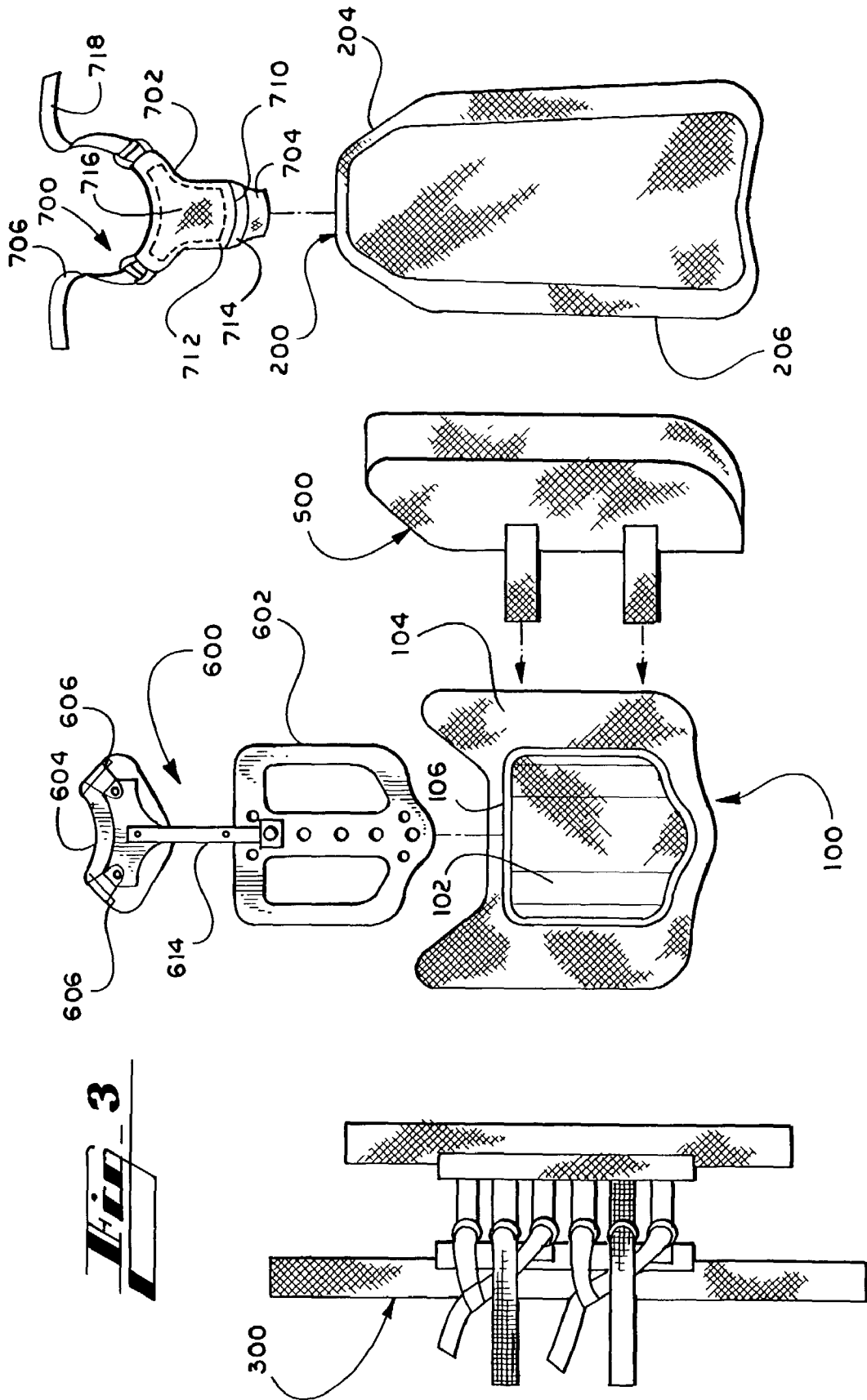




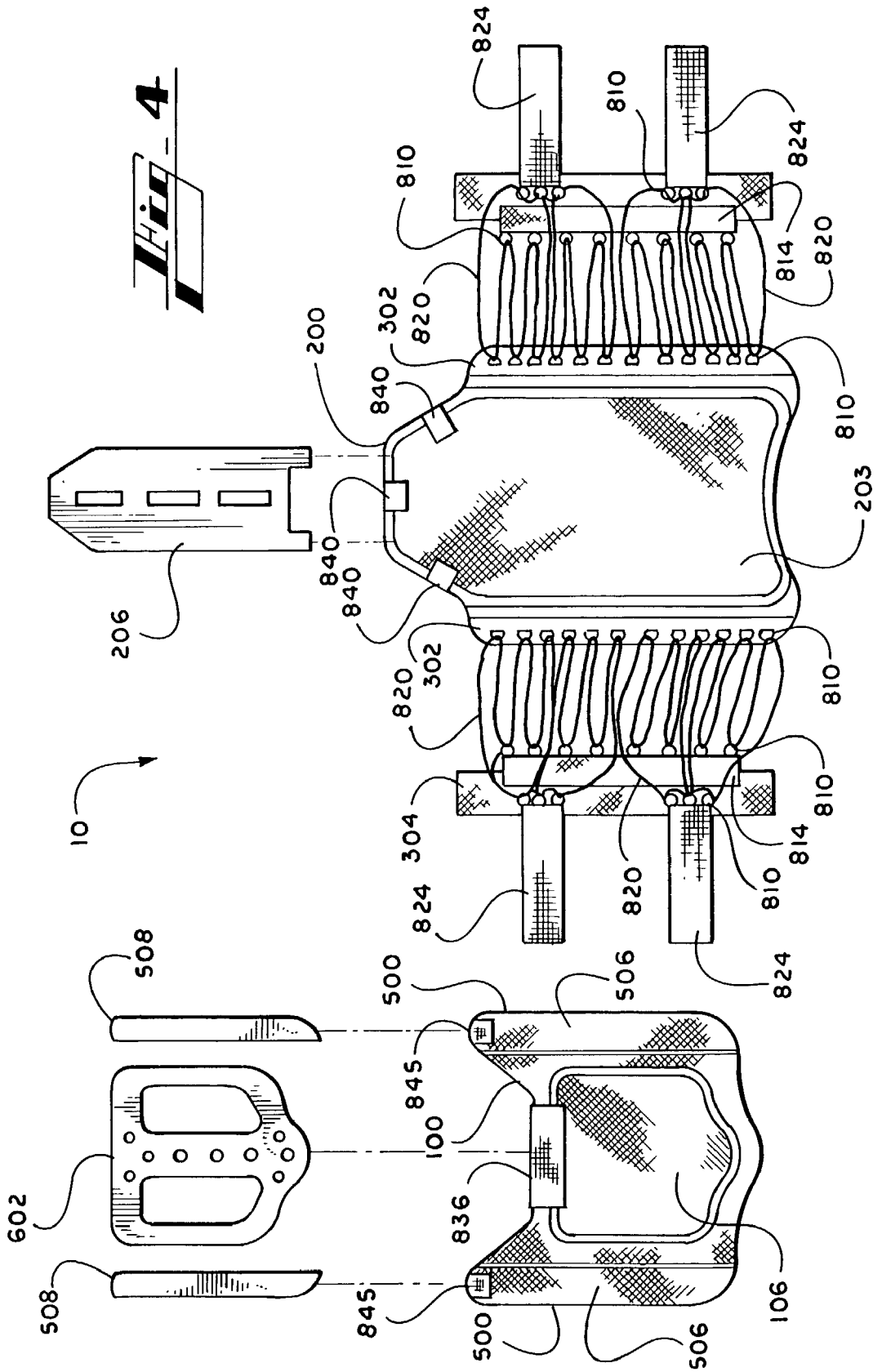
**Fig. 1A**



**Fig. 2**



**Fig. 3**



**Hi**-4

## THORACO-LUMBO-SACRAL ORTHOSIS

### TECHNICAL FIELD

[0001] The present invention relates to a thoraco-lumbo-sacral orthosis for supporting a patient's back and spine, and more particularly relates to a flexible adjustable brace that may be quickly and individually tailored to a patient's physique and condition.

### BACKGROUND

[0002] Various types of body braces have been used for many years to aid in the rehabilitation of the spine. These braces traditionally comprise rigid bodies having integrated splints. Due to the limitations of these types of braces, elderly, disabled, and severely injured persons often experience great difficulty in adjusting, fastening, and wearing these types of body braces.

[0003] One alternative to rigid body braces are soft, flexible body braces. The typical flexible body brace uses corset lacings and buckles or snaps to fasten together the various portions of the brace. The corset lacings, buckles, or snaps require constant adjustment to provide maximum comfort and support for the wearer. Further, buckles and snaps may only be adjusted in quantum increments, much like a belt. If the zone of maximum comfort for a patient falls between two adjustment levels, the patient is forced to choose a setting for the brace that is either too tight or too loose.

[0004] Flexible braces that do not employ a snap or buckle fitting often suffer from additional problems. First, many flexible braces are only manufactured in specific sizes and typically do not include sizes for larger people. Second, due to their very nature, many flexible braces fail to adequately control lateral motion. In particular, the brace fittings may comprise soft flexible straps that stretch or constrict excessively when the patient moves. The stretching or constriction of these straps may cause the fit of the brace to become improper, thereby prolonging the patient's recovery.

[0005] Additionally, most braces only provide one set level of support for a patient. The brace either incorporates a rigid splint member into the fittings for support, or may have a single removable splint. However, many patients find that their need for back support diminishes as they heal, and that a brace that continues to provide the initial level of support throughout the patient's recuperation quickly becomes uncomfortable. Further, the typical back brace only supports the lower back and chest, and fails to provide any support for the upper portions of the back.

[0006] Thus, there is a need for a soft, flexible thoraco-lumbo-sacral brace that may be easily adjusted to fit a variety of body shapes and sizes. There is a further need for a brace that provides varying levels of back support, according to the rehabilitative needs of the patient and the patient's rate of healing. There is also a need for a back brace that provides adequate support for the thoracic and lumbar regions of the back. Finally, there is a need for a brace that provides adequate lateral support in order to minimize unwanted lateral torso motion.

### SUMMARY

[0007] The present invention satisfies the needs identified above. The invention comprises a thoraco-lumbo-sacral

orthopedic brace which may be easily and quickly adjusted to fit varying body types though the use of flexible connection straps. A rigid strap placed over the flexible straps serves to minimize undesired lateral torso motion. Lateral panels may be added to the brace to further expand its size and allow for fitting of large patients. Varying levels of back support are provided through the use of a plurality of removable splints. The splints may be added or removed as necessary to match a patient's support requirements. A thoracic lumbar support dorso-lumbar extension and sternal pad extension unit add additional bracing for the upper back and chest.

[0008] Generally described, the present invention provides a thoraco-lumbo-sacral orthopedic brace apparatus formed of flexible materials to fit patients of varying heights and sizes. The brace comprises a flexible anterior support with a large cavity sized to receive a rigid splint. The rigid splint provides back support beyond that provided by the brace alone. Located within the large cavity are multiple smaller cavities sized to receive a series of smaller splints. Each small cavity may contain a single smaller splint. These smaller splints may be used singly or in combination to provide varying degrees of support for a patient, according to the patient's individual needs. The smaller splints may be used simultaneously with the single large splint in the case where a patient needs a significant amount of back support. The brace may also comprise a posterior support that is similar to the anterior support.

[0009] The brace's anterior and posterior flexible supports are formed of a hook and loop material, and are connected by a set of connecting straps. The connecting straps are also formed of a hook and loop material. A plurality of flexible connecting straps are attached to a second crossbar, which is in turn attached to the anterior support. The flexible straps pass through a plurality of loops connected to a first crossbar, which is in turn attached to the posterior support. The flexible straps are folded over on themselves and attached via the hook and loop material to the anterior support, thus tightening and connecting the various portions of the brace. Because each of the connecting straps is formed of the hook and loop material, any portion of any strap may be attached to the anterior support. A rigid strap is also attached to the first crossbar and passes through a loop attached to the second crossbar. The rigid strap passes over the flexible straps and is affixed to the anterior support. This rigid strap minimizes the flexibility and give of the flexible straps, thus minimizing unwanted torso motion while retaining the brace's ability to be adjusted to a wide variety of body shapes and sizes. Conventional corset lacing using parachute cord can also be used to help prevent unwanted torso motion.

[0010] Flexible lateral panels may be incorporated into the brace in order to further expand its size. The lateral panels are curved to follow the natural curve of a patient's side and are formed of hook and loop material. The panel is attached to the anterior support of the brace, and the connector straps connect to the anterior support. In this manner, the circumference of the brace is expanded by the width of the lateral stays. The flexible lateral panels further have a cavity sized to contain a removable rigid splint. The removable rigid splint affords a higher level of support to a patient than does a conventional flexible brace.

[0011] The lumbo-sacral brace may further comprise a thoracic lumbar support and sternal extension to provide support for the upper back and chest. The thoracic lumbar support consists of a soft, flexible y-shaped body, a pair of flexible straps, a bottom flap, and a cavity. The bottom flap is formed of a hook and loop material in order to allow a patient to attach the thoracic lumbar support to any portion of the posterior support at any height. The cavity may contain a rigid splint in order to provide enhanced bracing to the upper back. A pair of flexible straps connects the thoracic lumbar support to the sternal extension.

[0012] The sternal extension may be removably attached to the anterior portion to abut the collarbone of a patient. A pair of loops is attached to the u-shaped padded body which rests against the chest wall. The flexible straps of the thoracic lumbar support are threaded through these loops in order to connect the two supports. The padded body of the sternal extension is connected to a rigid insert by a connector bar. The connector bar may be adjusted to vary the distance between the body and the insert, thus accounting for patients of different heights. The rigid insert is placed within the large cavity of the anterior support, thus providing additional support to the patient and securing the sternal extension to the brace. The lumbo-sacral brace may further comprise a dorso-lumbar extension piece. This is comprised of the rigid material that is inserted into the pockets and is removable. It is attached using screws and barrel nuts. This produces a dynamic unit that serves to pull the patient into hyper-extension, a position that is desirable for most spine pathologies.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIG. 1 depicts a lumbo-sacral brace in accordance with the present invention.

[0014] FIG. 1A depicts a sectional view of an anterior support in accordance with the present invention.

[0015] FIG. 2 depicts a lateral panel for expansion of a lumbo-sacral brace in accordance with the present invention.

[0016] FIG. 3 depicts a thoracic lumbar support and sternal extension in accordance with the present invention.

[0017] FIG. 4 depicts another embodiment of a lumbo-sacral brace in accordance with the present invention.

#### DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

[0018] The present invention is directed to a lumbo-sacral orthosis or brace for limiting or controlling the motion in the thoracic and lumbo-sacral areas of the spine of a patient.

[0019] The brace provides enhanced support for a patient's back. The anterior and posterior supports comprising the brace are made of a soft, breathable material with a foam core for the comfort of the patient. The size of the brace may be adjusted to fit any size patient through the use of flexible connection straps and lateral expansion panels. The flexible straps permit the brace to expand to any size, rather than forcing the brace to expand in steps as with snaps or buckles. Lateral stays may also contain a rigid splint to provide side support in addition to expanding the brace size. A rigid strap may be fastened over the flexible straps in order to minimize unwanted side motion resulting from the use of

flexible straps instead of a stiff binding. A thoracic lumbar support may be added to the back of the brace in order to support a patient's upper back. A sternal extension similarly may provide additional support for a patient's chest. The level of support provided by the brace may be individually tailored to a patient's needs by adding or removing a set of rigid stays located within the anterior support.

[0020] Referring now the drawings, in which like numerals indicate like elements throughout the several figures, illustrative embodiments of the invention will be described below with reference to the appended drawings.

[0021] Turning now to FIG. 1, a lumbo-sacral orthopedic brace 10 comprises an anterior support 100, a posterior support 200, and a set of connection straps 300. The anterior support 100 and posterior support 200 are formed of a soft breathable material. The anterior support 100 and posterior support 200 are removably attached to each other through the use of the set of connection straps 300 that may be adjustably positioned in order to fit patients of varying forms and sizes.

[0022] The anterior support 100 has front 102 and rear sides 104 made of a hook and loop material, such as VELCRO, defining a large cavity 106. Within this cavity are located a plurality of pockets 110, formed by a series of soft flexible webs 108 connected on the sides and the bottom to the rear side 104 of the anterior flexible support 100. An expanded view of the anterior support 100 detailing the placement of the pockets 110 may be seen in FIG. 1A.

[0023] Returning to FIG. 1, a plurality of lightweight polymer stick-shaped splints 400 may be inserted into the plurality of pockets 110 in order to limit motion. As a patient's need for lumbo-sacral support decreases, the polymer stick-shaped splints 400 may be removed one by one in order to provide the proper amount of support. The polymer stick-shaped splints 400 may also be used in conjunction with a single large splint 602 inserted into large cavity 106 to provide an even greater level of support. This ensures that the amount of support provided by the brace 10 may be matched exactly to a patient's individual requirements.

[0024] The posterior support comprises a front side 202 and a back side 204 formed of a hook and loop material. The posterior support 200 incorporates a cavity within the posterior support 200 sized to accept a rigid splint 206. This would allow a patient to vary the bracing provided by the posterior support as needed.

[0025] The flexible anterior 100 and posterior 200 supports, as well as the lateral stays 500 and thoracic lumbar support 700, may be made of a soft breathable material, such as ORTHO-WICK, laminated to a foam with a loop material outer layer. This provides a breathable material which is cool and flexible to enhance a patient's comfort and which will fit a patient snugly. Further, such a material may be readily adjusted to form a soft body jacket that may apply the forces desired to immobilize specific types of motion in specific patients. Although in an illustrative embodiment the polymer splints 400 are made of a high-density polyethylene material, they may be made of any substantially rigid or semi-rigid material including various metals without departing from the spirit or scope of the invention.

[0026] The set of connection straps 300 secure anterior support 100 and posterior support 200 together to form the

completed brace **10**. Each side of the anterior support **100** and posterior support **200** is connected to the other by a set of these connection straps **300**. Each set of connection straps **300** has a first crosspiece **302** and a second crosspiece **304**, both formed of a hook and loop material such as VELCRO. The first crosspiece **302** is attached to the edge of posterior support **200** and the second crosspiece **304** is attached to the edge of the anterior support **100**.

[0027] In an illustrative embodiment, the first crosspiece **302** comprises a set of loops **306** through which a series of flexible straps **310** pass. Each strap **310** is attached to the second crosspiece **304** with a nylon strip **312**. Each flexible strap **310** passes through one of the set of loops **306** after which a group of flexible straps **310** is attached to a common strap **318** made of a hook and loop material. In the illustrative embodiment, two flexible straps **310** pass through two loops **306** and are coupled to one of a number of common straps **318**. Each common strap **318** is pulled back over flexible straps **310** and attached at any angle to either second crosspiece **304** or anterior support **100** in order to tighten the set of connection straps **300** and connect the anterior support **100** and posterior support **200** together and thereby secure the brace **10** to the patient.

[0028] The set of connection straps **300** further comprises a rigid strap **314** attached to anterior support **100** with nylon strip **312**, and passing through one of said plurality of loops **306**. Unlike the plurality of flexible straps **310**, rigid strap **314** is not attached to one of the common straps **318** after passing through the loop, but instead may be freely positioned or removed from the loop. Like common strap **318**, rigid strap **314** is folded back over flexible straps **310** and attached to the second crosspiece **304** or to anterior support **100**. Rigid strap **314** thus covers the flexible straps **310**, minimizing their flexibility and locking out unwanted motion. As with common strap **318** detailed above, the rigid strap may be attached at any angle to the anterior support (or to second crosspiece **304**), thereby ensuring that the fitting of brace **10** may be tailored to a patient of any size or shape. The illustrative embodiment is shown with two sets of flexible straps **310** and two rigid straps **314**. It will be appreciated by those skilled in the art that more or less sets of flexible straps and/or rigid straps may be used without departing from the spirit or letter of the invention.

[0029] Referring now to FIG. 2, a lateral expansion panel **500** is illustrated that, when coupled with brace **10** shown in FIG. 1, substantially increases the circumference of the brace. Lateral panel **500** comprises front side **502** and back side **504** made of a hook and loop material. A pair of straps **510** is fastened to an edge of the lateral panel. The straps **510** may be adjustably connected at any angle to any portion of the anterior support, while the rear side **504** of lateral panel **500** may be engaged at any angle by the connection straps **300**. This allows a patient to vary the angle at which lateral panel **500** rests when brace **10** is worn, thereby ensuring a closer fit. Further, because straps **510** may be attached to any portion of the anterior support **100**, the effective size of the brace **10** may be increased or decreased by varying the point at which the lateral panel **500** is connected to the anterior support in order to account for patients of different sizes.

[0030] Two lateral panels **500** may be combined on a single side of the brace by attaching the straps **510** of one lateral panel to the straps of the second lateral panel, then

attaching the second lateral panel to the anterior support of the brace **10**. When combined with connecting straps **300** described with respect to FIG. 1, the overall effect of lateral panel **500** is to allow a lumbo-sacral brace to fit any patient ranging from the extremely small to the especially large.

[0031] Additionally, lateral panel **500** comprises a cavity **506** defined by the front side **502** and back side **504** of lateral panel **500**. Cavity **506** may contain a rigid lateral splint **508**. Rigid lateral splint **508** affords additional protection to the side of an injured patient as well as serving as yet another means of eliminating unwanted torso motion.

[0032] Referring now to FIG. 3, a lumbo-sacral brace **10** incorporating a thoracic lumbar support member **700** and sternal extension **600** is shown. The thoracic lumbar support **700** provides additional bracing for the upper back. The sternal extension **600** allows the brace to limit the forward flexion motion of the torso, working in tandem with the thoracic lumbar support.

[0033] The lumbar support **700** comprises a y-shaped padded body **702**, a bottom flap **704**, and flexible straps **706**. The y-shaped padded body **702** of the thoracic lumbar support **700** is formed of a soft, flexible material and has a front side **712** and back side **714**. A cavity **710** is formed by the front and back sides, with the mouth of the cavity located at the bottom of the y-shaped padded body **702**. A lightweight polymer splint **716** may be inserted within the cavity **710** in order to minimize backward motion of the upper back providing additional thoracic support. In an illustrative embodiment, the splint **716** is fixed within cavity **710** and may not be removed. However, alternate embodiments may allow the splint **716** to be removed and inserted at will in order to provide for varying degrees of support and minimization of motion.

[0034] The bottom flap **704** is connected to padded body **702** and is made of a hook and loop material such as VELCRO. Bottom flap **704** is affixed to the back side **714** of the padded body **702**. The bottom flap **704** may be attached to the back side **204** of posterior support **200** at any height or angle. Thus, the thoracic lumbar support **700** may be adjusted to support each patient individually.

[0035] Flexible straps **706** are formed of a hook and loop material and connected to each branch of y-shaped padded body **702**, as shown in FIG. 3. Each of flexible straps **706** contain a hook strip **718** that may be adjustably positioned anywhere on the flexible strap. Hook strip **718** is typically positioned so that flexible straps **706** may be extended and doubled back in such a fashion that the end of the flexible strap is held to the hook strip. This allows flexible straps **706** to pass through or around a loop, ring, or other object and still attach to hook strip **718**.

[0036] Flexible straps **706** connect thoracic lumbar support **700** to sternal extension **600** shown in FIG. 3. The sternal extension **600** includes a rigid lightweight polymer splint **602**, a connector rod **614**, and a u-shaped padded body **604**. The splint **602** is shaped to fit into the large cavity **106** of anterior support **100**. The splint **602** provides additional support to eliminate forward flexion motion of a patient's spine and abdomen, and may be used with the stick-shaped splints **400** described above with respect to FIG. 1 in cases where enhanced longitudinal support is necessary. One end of the connector rod **614** is fastened to the polymer splint



**602**, while the other end of the connector rod **614** is attached to the u-shaped padded body **604**. The connector rod **614** is made of a rigid load-bearing material, preferably a light-weight metal. The u-shaped padded body **604** is sized such that the concave portion of the body fits snugly against the chest wall of a patient. A ring **606** is attached to the top of each branch of the u-shaped padded body **604**. In an illustrative embodiment, flexible straps **706** pass through a plurality of sternal extension rings **606**; each strap passes through a separate ring and then is folded back over itself to connect to hook strip **718**. Flexible straps **706** may be pulled in order to tighten the fit of sternal extension **600** and thoracic lumbar support **700**. The flexible straps adhere to hook strips **718** in order to maintain the fit chosen for each patient.

[0037] In another embodiment of the present invention, as shown in **FIG. 4**, twelve lacing loops **810** are provided along the edge of the first crosspiece **302** which is attached to the posterior support **200**. It should be understood that the number of lacing loops **810** may vary based on the design of the brace **10**.

[0038] Eight additional lacing loops **810** are located along the edge of the nylon strip **814** attached to the second crosspiece **304**. The second crosspiece **304** is formed of hook and loop material which attaches to the lateral edge of the anterior support **100**. It should be understood that the second crosspiece **304** may also attach to the edge of the lateral panel **500** if provided with the anterior panel **100**.

[0039] As shown in **FIG. 4**, each lateral panel **500** comprises the cavity **506**. Rigid splints **508** are positioned in the cavity **506** to provide additional protection to the sides of the patient.

[0040] The posterior panel is connected to the anterior panel by two continuous lacings **820**. It is preferable to use a nylon cord for the lacing **820** which provide resiliency and strength. Each lacing **820** passes through six adjacent lacing loops **810** attached to the posterior support **200** and four adjacent lacing loops **810** attached to the nylon strip **814**. Each lacing is joined to an attachment strap **824** through three lacing loops **810** connected to the attachment strap **824**. The ends of the lacings **820** are joined at the lacing loops of the attachment strap **824** forming a continuous loop. The lacings **820** can be joined by chemical or heat bonding means. One side of the attachment strap is covered with hook fastening material.

[0041] In order to properly fit the brace **10**, a user can remove the second crosspiece **304** from the anterior support **100**. This allows the user to easily slip the brace **10** around the waist rather than slipping it over the user's head. After properly positioning the brace **10** on the user's torso, the second crosspiece **304** is re-attached to the anterior support **100** using the hook and loop material attachment. The user then grips each attachment strap **824** and pulls until achieving a snug fit and proper support for the back. This action tightens the brace **10** by adjusting the lacings **820**. The hook material located on the attachment straps **824** are used to attach the attachment straps **824** to the anterior support **100**.

[0042] When the user desires to remove the brace **10**, the user simply releases the attachment straps **824** from the anterior support **100**. This action loosens the lacings **820** allowing the user to remove one of the second crosspieces

**304** from the anterior support **100** and remove the entire brace **10**. Those skilled in the art will understand that the use of lacings **820** with the attachment straps **824** provides easy adjustment of the tension of the brace **10**.

[0043] In the embodiment of **FIG. 4**, the splint **602** can be placed in the cavity **106** of the anterior support **100** and secured using closure tab **836**. One side of the closure tab **836** is covered with hook-type material which attaches to the loop material covering the anterior support **100**, sealing the cavity **106**. Similarly, the rigid splint **206** can be secured in the cavity **203** using closure tabs **840**. Lateral splints **508** can be secured inside the cavity **506** of the lateral panels **500** using closure tabs **845**. It should be understood that closure tabs **840**, **845** also have one side covered with hook material which is used to seal cavities **203**, **506**, similar to closure tab **836**.

[0044] The brace **10** is made to simulate the viscoelastic qualities of the human body while combining the best features of a soft corset with those of a rigid plastic body jacket and to form-fit the supports to the patient. This allows the supports to minimize undesired spinal motion and still provide a comfort level suitable for long-term wear. The brace **10** may be custom fitted to different types of patients without alterations or modifications beyond those readily performed by hand, and without physically altering or manipulating the dimensions of any portion of the brace. The brace **10** is lightweight and fits patients of all heights and weights. However, the illustrative embodiment described above and displayed in **FIGS. 1-4** should be considered to be an example of one of many possible forms for the invention, rather than displaying the sole embodiment of the invention. Accordingly, the figures and above description are intended by way of illustration rather than limitation, and alternate methods of practicing the invention will occur to those skilled in the art upon reading the specification without departing from the spirit or the letter of the claims.

I claim:

1. A thoraco-lumbo-sacral orthopedic brace comprising:
  - an anterior flexible member shaped to fit over the front of a patient's torso having front and rear sides defining a cavity;
  - a plurality of pockets located within said cavity;
  - a posterior flexible member shaped to fit over the rear of a patient's torso and connected to said anterior flexible member;
  - a plurality of substantially rigid splints positioned within said plurality of pockets of said anterior flexible member; and
  - a plurality of flexible straps to interconnect the anterior flexible member and the posterior flexible member.
2. The brace of claim 1, wherein said plurality of substantially rigid splints may be removed from said pockets.
3. The brace of claim 1, wherein said plurality of substantially rigid splints serve to minimize the forward flexibility of said brace.
4. A lateral stay for expanding the size of a back brace, comprising:

- a rectangular member having front and back sides defining a cavity, said front side formed of a hook and loop material;
- a substantially rigid splint located within the cavity; and
- a flexible strap formed of a hook and loop material.
- 5.** The apparatus of claim 4, further comprising top and bottom edges defining a slot located at the top of said cavity, said substantially rigid splint removable through said slot.
- 6.** A thoraco-lumbo-sacral orthopedic brace comprising:
- an anterior flexible member shaped to fit over the front of a patient's torso and being formed of a hook and loop material;
- a posterior flexible member shaped to fit over the rear of a patient's torso and being formed of a hook and loop material; and
- a flexible lateral stay formed of a hook and loop material comprising:
- front and back sides defining a cavity, said back side attached to said posterior flexible member; and
- a plurality of flexible straps to interconnect the anterior flexible member, the posterior flexible member, and the flexible lateral stay.
- 7.** The brace of claim 6, wherein said flexible lateral stay may be adjustably positioned to attach to any portion of said anterior flexible member.
- 8.** The brace of claim 6, further comprising a second flexible lateral panel formed of a hook and loop material, wherein the plurality of flexible straps of the second lateral panel is attached to the plurality of flexible straps of the first lateral stay, and the back side of the second lateral stay is attached to said anterior flexible member.
- 9.** The brace of claim 6, further comprising a substantially rigid splint located within the cavity.
- 10.** An apparatus for securing a brace, comprising:
- a first crosspiece;
- a second crosspiece;
- a first plurality of loops attached to the first crosspiece;
- a second plurality of loops attached to the first crosspiece;
- a first plurality of flexible straps attached to the second crosspiece and passing through said first plurality of loops;
- a second plurality of flexible straps attached to the second crosspiece and passing through said second plurality of loops;
- a first rigid strap attached to the second crosspiece and passing through said first plurality of loops; and
- a second rigid strap attached to the second crosspiece and passing through said second plurality of loops.
- 11.** The apparatus of claim 8, wherein said first and second rigid straps restricts the motion of said first and second plurality of flexible straps.
- 12.** A thoraco-lumbo-sacral orthopedic brace comprising:
- an anterior flexible member shaped to fit over the front of a patient's torso having front and rear sides defining a cavity, and having first and second edge portions, said front side having the surface thereof formed of hook and loop material;
- a sternal extension member comprising:
- a substantially rigid anterior insert sized to fit within said cavity of said anterior flexible member;
- a concave padded cushion;
- a first ring connected to said concave padded cushion;
- a second ring connected to said concave padded cushion; and
- a rigid bar connecting said concave padded cushion to said substantially rigid anterior insert;
- a posterior flexible member shaped to fit over the rear of a patient's torso and having first and second edge portions, and having front and rear sides, said front side being formed of hook and loop material;
- a rigid posterior insert;
- a thoracic lumbar support comprising:
- a y-shaped padded body with first and second sides defining an interior cavity, and having first and second extensions;
- a bottom flange formed of hook and loop material and connected to said anterior flexible member;
- a first flexible strap formed of a hook and loop material connected to said first extension, and adjustably connected to said first ring; and
- a second flexible strap formed of a hook and loop material connected to said second extension, and adjustably connected to said second ring;
- a first plurality of flexible straps attached to said posterior flexible member first edge portion;
- a second plurality of flexible straps attached to said posterior flexible member second edge portion;
- a first plurality of loops attached to said anterior flexible member first edge portion and having each one of said first plurality of flexible straps passing through each of said first plurality of loops; and
- a second plurality of loops attached to said anterior flexible member first edge portion and having each one of said second plurality of flexible straps passing through each of said second plurality of loops.
- 13.** The brace of claim 12, wherein the bottom member of the thoracic lumbar support may be connected to any point of the posterior flexible member.
- 14.** The brace of claim 12, further comprising a substantially rigid insert located within said cavity.
- 15.** An apparatus for providing thoracic lumbar support, comprising:
- a y-shaped padded body with first and second sides defining an interior cavity, and having first and second extensions;
- a bottom flange formed of hook and loop material, connected to said first side;

- a first flexible strap formed of a hook and loop material connected to said first extension;
- a second flexible strap formed of a hook and loop material connected to said second extension.
- 16.** The apparatus of claim 14, further comprising a substantially rigid insert located within said cavity.
- 17.** A thoraco-lumbo-sacral orthopedic brace comprising:
- an anterior flexible member shaped to fit over the front of a patient's torso having front and rear sides defining a cavity;
  - a posterior flexible member shaped to fit over the rear of a patient's torso and connected to said anterior flexible member;
  - a substantially rigid splint positioned within said of said anterior flexible member; and
  - a plurality of lacings to interconnect said anterior flexible member and said posterior flexible member, each of said lacings connected to an attachment strap for securing said brace.
- 18.** The brace of claim 17, wherein said rigid splint may be removed from said cavity.
- 19.** The brace of claim 17, further comprising a cavity defined in said posterior flexible member.
- 20.** The brace of claim 19, further comprising a substantially rigid splint positioned within said cavity of said posterior flexible member.
- 21.** An apparatus for securing a brace, comprising:
- a first crosspiece;
  - a second crosspiece;
  - a first plurality of loops attached to said first crosspiece;
  - a second plurality of loops attached to said second crosspiece;
  - a plurality of lacings connecting said first crosspiece to said second crosspiece through said first plurality of loops and said second plurality of loops; and
  - a plurality of attachment straps connected to said lacings.
- 22.** The apparatus of claim 21, wherein said attachment straps are operable to attach to said brace for securing said brace.
- 23.** A thoraco-lumbo-sacral orthopedic brace comprising:
- an anterior flexible support member shaped to fit over the front of a patient's torso, said anterior flexible support member having front and rear sides, defining a pocket;
  - a posterior flexible support member shaped to fit over the rear of a patient's torso, said posterior flexible support member connected to said anterior flexible support member;
  - a rigid splint positioned within said pocket of said anterior flexible support member;
- lacing means for connecting said posterior flexible support member to said anterior flexible support member; and
- attachment means connected to said lacing means for adjusting and securing said brace.
- 24.** The brace of claim 23, wherein said lacing means comprises a first plurality of loops attached to said posterior flexible member;
- a crosspiece for attaching to said anterior flexible support members;
  - a second plurality of loops attached to said crosspiece; and
- lacing between said first plurality of loops and said second plurality of loops.
- 25.** The brace of claim 24, further comprising a cavity defined in said posterior flexible support member; and
- a substantially rigid splint positioned within said cavity of said posterior flexible support member.

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