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Portable thoracic brace with spinal traction and method

Abstract

A wearable traction device includes: a traction rod including a superior segment, and an inferior segment; a lower anchoring assembly coupled to the inferior segment of the traction rod, the lower anchoring assembly configured for affixing to a lower torso of a user; an upper anchoring assembly movably coupled to the superior segment of the traction rod, the upper anchoring assembly configured for affixing to an upper torso of a user; a releasable lock supported on the upper anchoring assembly, the lock having: (i) an engaged position configured to permit movement of the upper anchoring assembly in a superior direction along the superior segment of the traction rod, and prevent movement of the upper anchoring assembly in an inferior direction along the superior segment, and (ii) a disengaged position configured to permit movement of the upper anchoring assembly in the superior and inferior directions.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS (1) This application claims priority to U.S. Provisional Patent Application No. 63/403,464, filed Sep. 2, 2022, the contents of which are incorporated herein by reference.

FIELD

(1) The present invention relates to a thoracic brace, and more particularly to a thoracic brace that applies spinal traction resulting in spinal decompression.

BACKGROUND

(2) Back problems are a significant issue for much of the human population; consider that eight out of 10 American will experience back pain in their lifetime. According to Global Burden of Disease Study 2017 (Institute for Health Metrics and Evaluation (IHME), *Findings from the Global Burden of Disease Study* 2017, Seattle, WA: IHME, 2018), back pain is a leading cause of disability worldwide and prevents people from working and doing everyday simple activities. Research by the Mayo Clinic also found that back problems are the third most common reason for a visit to the doctor's office.

(3) Conventional consumer back braces may provide limited support for the spine, e.g., limited to lumbar or lumbar and partial thoracic support. These braces and supports are typically designed from plastics and fabrics and are designed for all day use. Other long-term wear braces exist to treat

spinal curvature conditions (scoliosis or kyphosis) and are not suitable for relieving pain from chronic conditions such as sciatica, or herniated or bulging disc. Devices that apply traction to a user's spine may have bed-like form factors, and the use of such devices may therefore involve lying down and being restrained against the device, impeding or preventing other activities. Such devices may also be complex and costly.

SUMMARY

(4) An aspect of the specification provides a wearable traction device, comprising: a traction rod including a superior segment, and an inferior segment; a lower anchoring assembly coupled to the inferior segment of the traction rod, the lower anchoring assembly configured for affixing to a lower torso of a user; an upper anchoring assembly movably coupled to the superior segment of the traction rod, the upper anchoring assembly configured for affixing to an upper torso of a user; a releasable lock supported on the upper anchoring assembly, the lock having: (i) an engaged position configured to permit movement of the upper anchoring assembly in a superior direction along the superior segment of the traction rod, and prevent movement of the upper anchoring assembly in an inferior direction along the superior segment, and (ii) a disengaged position configured to permit movement of the upper anchoring assembly in the superior and inferior directions.

Description

BRIEF DESCRIPTIONS OF THE DRAWINGS

(1) Embodiments are described with reference to the following figures.

(2) FIG. **1** is a diagram of a wearable traction device worn by a user.

(3) FIG. **2** is an isometric view of the wearable traction device in isolation.

(4) FIG. **3**A is a flow chart of a method of applying and activating the device of FIG. **2**.

(5) FIG. **3**B is a flow chart of another method of applying and activating the device of FIG. **2**.

(6) FIG. **4** is a diagram of an example performance of the method of FIG. **3**A.

(7) FIG. **5** is a diagram of an example performance of the method of FIG. **3**B.

DETAILED DESCRIPTION

(8) FIG. **1** depicts a wearable traction device **100** (also referred to herein as the device **100**) in an operational configuration, e.g., worn by a user **104**. The device **100** includes an upper anchoring assembly **108**, a lower anchoring assembly **112**, and a traction rod **116** (which may also be referred to as the decompression rod **116**) extending between the anchoring assemblies **108** and **112**. The upper anchoring assembly **108**, in this example, includes a traction plate **120** and a belt **124**. The plate **120** is configured to rest against a back **128** of the user **104**, and the belt **124** is configured to encircle the torso of the user **104**, e.g., under the arms **126** of the user **104** to wrap around the chest, to substantially affix the plate **120** in the illustrated position (e.g., to mitigate or prevent movement of the plate **120** relative to the back **128**).

(9) The lower anchoring assembly **112** includes a traction plate **132** configured to rest against the back **128**, and a belt **136** configured to encircle the torso of the user **104**, e.g., at or near the waist of the user **104**, to substantially affix the plate **132** in the illustrated position. The belts **124** and **136** can include Velcro, buckles, or other adjustment mechanisms to accommodate various torso sizes. The belts **124** and **136** can further include pouches or the like to receive one or more reinforcing plates. For example, the belts **124** and **136** can include nylon or other textile belts, configured to receive reinforcing plates of plastic (e.g., ABS or the like). In other examples, such reinforcing plates can be omitted, e.g., if the belts **124** and/or **136** are sufficiently rigid. For example, a segmented metal belt, a leather belt, or the like, may have sufficient stiffness to avoid the need for reinforcement.

(10) The upper anchoring assembly **108**, in other words, is configured to affix to an upper torso of

the user **104**, e.g., placing the plate **120** adjacent to thoracic vertebrae (e.g., T**5** and/or T**6**, although the exact position of the plate **120** may vary). The lower anchoring assembly **112**, meanwhile, is configured to affix to a lower torso of the user **104**, e.g., placing the plate **132** adjacent to the lumbar vertebrae and/or sacrum of the user **104**. As described below in greater detail, the positions of either or both of the anchoring assemblies **108** and **112** along the traction rod **116** can be adjusted to increase a distance "D" between the plates **120** and **132**. Engagement between the anchoring assemblies **108** and **112** and the traction rod **116** serves to maintain a set distance D between the anchoring assemblies **108** and **112**, resisting or preventing a reduction in the distance D during use of the device **100**.

(11) Affixing of the anchoring assemblies **108** and **112** to the user **104**, coupled with maintenance of the distance D via the traction rod **116**, therefore enables the device **100** to apply traction to a portion of the spine of the user **104**. Application of traction by the device **100** can decompress the spinal column of the user **104**, which may relieve pain from various conditions (e.g., compressed nerve roots, joints, and related tissues), while the device **100** is worn and for a period of time (e.g., hours to days) after the device **100** is removed. Further, as discussed below, the device **100** can be operated by the user **104** with little or no assistance from third parties, and because the device **100** is wearable, the user **104** may remain mobile while wearing the device **100**, rather than being restricted to a fixed location, as is the case with certain other spinal traction devices.

(12) Turning to FIG. **2**, an example embodiment of the device **100** is shown in isolation, with the belts **124** and **136** omitted. As shown in FIG. **2**, the traction plate **120** of the upper anchoring assembly **108** includes a base **200** supporting a pad **204**. The base **200** can be fabricated from a suitable plastic, metal, composite, or the like, and couples the plate **120** to the traction rod **116**. In particular, the base **200** defines a channel **208** through which a superior segment **212** (e.g., upper, towards the head of the user **104** when the device **100** is in use) of the rod **116** is received.

(13) The base **200** also defines a raceway **216** or other form of channel therethrough, for receiving the belt **124**. The base **200** can support one or more locking screws **220** (two are shown in this example) to secure the belt **124** within the raceway **216** (e.g., by extending into the raceway **216** and pinning the belt **124** against the other side of the raceway **216**). In other examples, the belts **124** and/or **136** can include distinct pieces or sections coupled to either side of the plates **120** and **132** respectively, rather than one piece or section that traverses the corresponding plate **120** or **132** via a raceway such as the raceway **216**.

(14) The pad **204** can be formed from a suitable foam, rubber, or the like, e.g., with a lower stiffness than the material forming the base **200**. The pad **204** is configured to rest directly against the back **128** of the user **104** (not necessarily in contact with skin, e.g., over the user's clothing). In the illustrated example, the surface of the pad **204** configured to contact the user's back **128** is planar, but in other examples the pad **204** can have a curved surface for user comfort.

(15) The device **100** also includes a releasable lock **224**. The lock **224** is supported on the upper anchoring assembly **108** (e.g., by the member defining the channel **208**), and specifically on the base **200** in this example. The lock **224**, as shown in the detail view D**1** includes, one or more protrusions **226** that extend into the channel **208** to engage with a ratchet **228** (e.g., a linear gear) defined on the superior segment **212** of the rod **116**. The lock **224** has an engaged position (illustrated in FIG. **2**), in which the lock **224** is engaged with the ratchet **228**, and prevents movement of the base **200** in an inferior direction (e.g., towards the lower anchoring assembly **112**). The lock **224** permits, however, movement of the base **200** in a superior direction (e.g., away from the lower anchoring assembly **112**, towards a head of the user **104** in operation) in the engaged position. In a disengaged position, the protrusions of the lock **224** are at least partially withdrawn from the channel, such that they no longer engage with the ratchet **228**. The base **200** can then move in either direction along the rod **116**. The lock **224** is biased towards the engaged position, e.g., with a spring or the like.

(16) The base **200** can also, in some examples, include a slot **232** (in this example, the base **200**

includes two slots **232**) configured to receive a strap or sling (not shown). The strap or sling can assist application of the device **100** to the user **104**, e.g., by suspending the device **100** from one or both shoulders, or from the neck, of the user **104** before the belts **124** and **136** are fastened.
(17) Turning to the lower anchoring assembly **112**, as shown in FIG. **2** the plate **132** includes a base **236**, and a pad **240**. The pad **240** can be mounted to the base **236** at an adjustable angle **242**, e.g., by rotating about a pivot **244** defined by the base **236**. The plate **132** can include a bias element such as a coil spring between the base **236** and the pad **240**, e.g., to bias the pad **240** outwards from the base **236**. As with the plate **120**, the base **236** defines a raceway **248** to receive the belt **136**, and one or more locking screws **252** (two are shown in this example) to secure the belt **136** within the raceway **248**. The base **236** also includes a channel **256** to receive an inferior segment **260** (e.g., lower, towards the feet of the user **104** when the device **100** is in use) of the traction rod **116**.
(18) The segments **212** and **260** of the rod **116** can, in some examples, be formed as a single integrated rod. In this example, the segments **212** and **260** are separate to allow telescopic adjustment of the length of the rod **116**, e.g., to accommodate various user heights. The segments **212** and **260** can also be coupled at a joint **264** that allows some angular deflection between the segments **212** and **260** (e.g., up to about ten degrees), to better conform to the shape of the user's back **128**. The rod **116** can be fabricated from any material sufficiently stiff to substantially resist deformation when the device **100** is applying traction to the user **104** (e.g., to compress no more than about one percent of the total length of the rod **116**, and/or to flex no more than about five degrees).
(19) In some examples, the position of the lower anchoring assembly **112** along the rod **116** can be adjusted, via adjustment of the plate **132** along the rod **116**. For example, the device **100** can include one or more (two are shown in this example) locks **268** supported by the plate **132** and configured to engage apertures **272** in the inferior segment **260** of the rod **116**. The locks **268** prevent movement of the plate **132** along the segment **260** of rod **116** when engaged, and permit movement of the plate **132** along the segment **260** when disengaged. The locks **268** can therefore be employed to adjust the position of the lower anchoring assembly **112** to accommodate various user heights, in addition to or instead of the telescopic adjustment mentioned above. In other examples, the lower segment **260** can include a ratchet similar to the ratchet **228** for adjusting the position of the plate **132**. In such examples, the locks **268** can serve to permit only movement in an inferior direction when engaged, and to permit movement of the plate **132** in either direction when disengaged.
(20) Turning to FIG. **3**A and FIG. **3**B, various methods of operating the device **100**, e.g., by the user **104**, are discussed. FIG. **3**A illustrates a first method **300** of applying and activating the device **100** (e.g., to apply spinal traction to the user **104**). At block **305**, the lower anchoring assembly **112** is affixed to the user **104**, e.g., by fastening the belt **136** around the user's waist as shown in FIG. **1**. At block **310**, the upper anchoring assembly **108** is affixed to the user **104**, e.g., by fastening the belt **124** around the user's chest as shown in FIG. **1**. Blocks **305** and **310** can be performed in the opposite order than that shown in FIG. **3**A, in other examples. The slot(s) **232** can be employed to hang the device **100** from one or both shoulders of the user **104** via straps or slings, until at least one of the belts **124** and **136** is fastened.
(21) Once the belts **124** and **136** are fastened, at block **315** the user **104** can roll forward (e.g., apply spinal flexion) to increase the distance between the plates **120** and **132**. The lock **224**, in the engaged position, permits superior movement of the plate **120**, and resists inferior movement of the plate **120** along the rod **116**. Thus, when the user **104** returns to an upright position, the plate **120** remains at the increased distance, thus applying traction to a portion of the user's spine (e.g., resisting spinal compression resulting from the weight of the user's torso by transferring the weight to the belt **136** and the user's hips).
(22) While applying spinal flexion at block **315**, the user **104** can hold the lower anchoring assembly **112** in place by hand, e.g., to prevent the lower anchoring assembly **112** from sliding

upwards along the torso of the user **104**. In other examples, a strap can be mounted to a slot on the inferior side of the plate **132** (similar to the slots **232**), with a length sufficient to reach the user's feet. By stepping on the strap, the lower anchoring assembly can be maintained in position while traction is applied at block **315**.

(23) FIG. **4** illustrates an example activation of the device **100** via the method **300**. In particular, as shown in the left portion of FIG. **4**, in an initial position, the device **100** is affixed to the user **104**. When first affixed to the user **104**, the device **100** applies little or no traction. As shown in the right portion of FIG. **4**, when the user rolls forward (range of motion exaggerated for illustrative purposes), the distance between the plates **120** and **132** is increased, and the ratchet subsequently maintains the increased distance when the user **104** returns to an upright position. As shown in FIG. **4**, a strap **400** extending from a slot **404** or other fixture on the plate **132** can extend under the feet of the user **104** to prevent the plate **132** from sliding up the user's back.

(24) Returning to FIG. **3**B, a further method **350** of applying and activating the device **100** is illustrated. At block **355**, the lower anchoring assembly **112** is affixed to the user **104**, as noted above in connection with block **305**. The upper anchoring assembly **108** can be fastened loosely, but is not affixed at this point. At block **360**, the upper anchoring assembly **108** is pulled, e.g., overhead by the user **104**, to move the upper anchoring assembly **108** in a superior direction along the rod **116**. Once the position of the upper anchoring assembly **108** has been set, the upper anchoring assembly **108** can be affixed at block **365**, e.g., by tightening the belt **124**. FIG. **5** illustrates an example performance of block **360**, in which the user pulls overhead on the upper anchoring assembly, e.g., via a strap or sling **500** mounted to the plate **120** via one or more slots **232**.

(25) The scope of the claims should not be limited by the embodiments set forth in the above examples, but should be given the broadest interpretation consistent with the description as a whole.

Claims

1. A wearable traction device, comprising: a traction rod including a superior segment, and an inferior segment; a lower anchoring assembly coupled to the inferior segment of the traction rod, the lower anchoring assembly configured for affixing to a lower torso of a user; an upper anchoring assembly movably coupled to the superior segment of the traction rod, the upper anchoring assembly configured for affixing to an upper torso of the user; a releasable lock supported on the upper anchoring assembly, the releasable lock having: (i) an engaged position configured to permit movement of the upper anchoring assembly in a superior direction along the superior segment of the traction rod, and prevent movement of the upper anchoring assembly in an inferior direction along the superior segment, and (ii) a disengaged position configured to permit movement of the upper anchoring assembly in the superior and inferior directions.

2. The wearable traction device of claim 1, wherein the lower anchoring assembly and the upper anchoring assembly each include: a traction plate coupled to the traction rod, and configured to rest against a back of the user; and a belt coupled to the traction plate, and configured to extend around a torso of the user.

3. The wearable traction device of claim 2, wherein the traction plate of the lower anchoring assembly further includes: a base coupled to the traction rod; and a pad mounted to the base at an adjustable angle relative to the base.

4. The wearable traction device of claim 3, wherein the traction plate of the lower anchoring assembly further includes a bias member biasing the pad away from the base.

5. The wearable traction device of claim 2, wherein the belt of each anchoring assembly includes a pocket configured to receive a reinforcing member.

6. A method of activating the wearable traction device of claim 1, the method comprising: affixing

the lower anchoring assembly to the lower torso of the user; affixing the upper anchoring assembly to the upper torso of the user; subsequent to affixing the lower anchoring assembly and the upper anchoring assembly, applying traction to the upper anchoring assembly to move the upper anchoring assembly in the superior direction along the traction rod.

7. The method of claim 6, wherein applying traction includes performing a spinal flexion movement by the user.

8. The method of claim 6, wherein the method further comprises: after affixing the lower and upper anchoring assemblies, and prior to applying traction to the upper anchoring assembly, restricting movement of the lower anchoring assembly relative to the torso of the user.

9. The wearable traction device of claim 1, wherein the superior segment of the traction rod includes a ratchet, and wherein the releasable lock includes a protrusion configured to engage with the ratchet in the engaged position.

10. A method of activating the wearable traction device of claim 1, the method comprising: affixing the lower anchoring assembly to the lower torso of the user; subsequent to affixing the lower anchoring assembly, applying traction to the upper anchoring assembly to move the upper anchoring assembly in the superior direction along the traction rod; and subsequent to applying traction to the upper anchoring assembly, affixing the upper anchoring assembly to the upper torso of the user.