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(54) **FURNITURE SUPPORT STRUCTURE**

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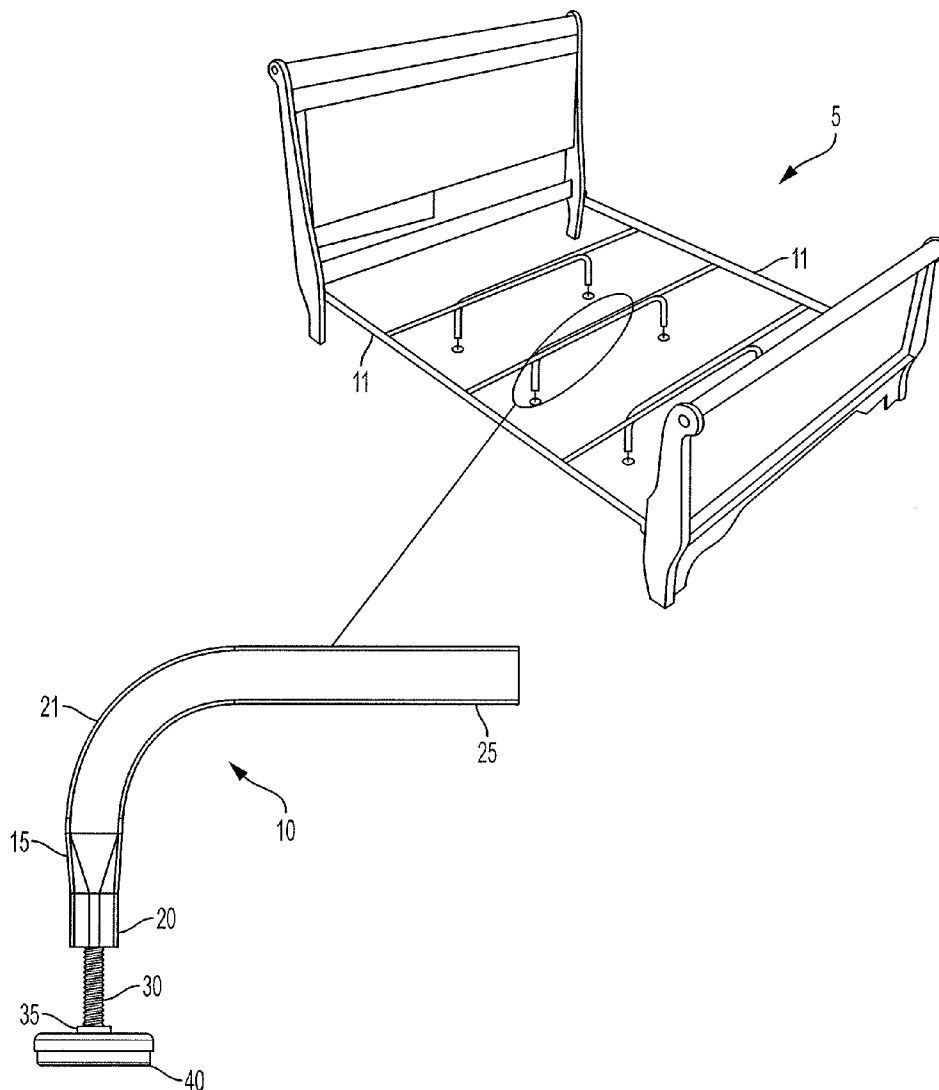
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(57) **ABSTRACT**

The present invention relates generally to a furniture support structure that can be used, for example, on beds, desks, tables, chairs, and other furniture. In some embodiments, a furniture support structure comprises a hollow elongated metal tube having a first end and a second end, wherein the first end is crimped and comprises a hollow circular cross-section and wherein at least a portion of the inner surface of the hollow circular cross-sectional portion of the first end is threaded. Some embodiments of the present invention also relate to devices for adjusting the height of a furniture item.

Related U.S. Application Data

(60) Provisional application No. 62/105,487, filed on Jan. 20, 2015.



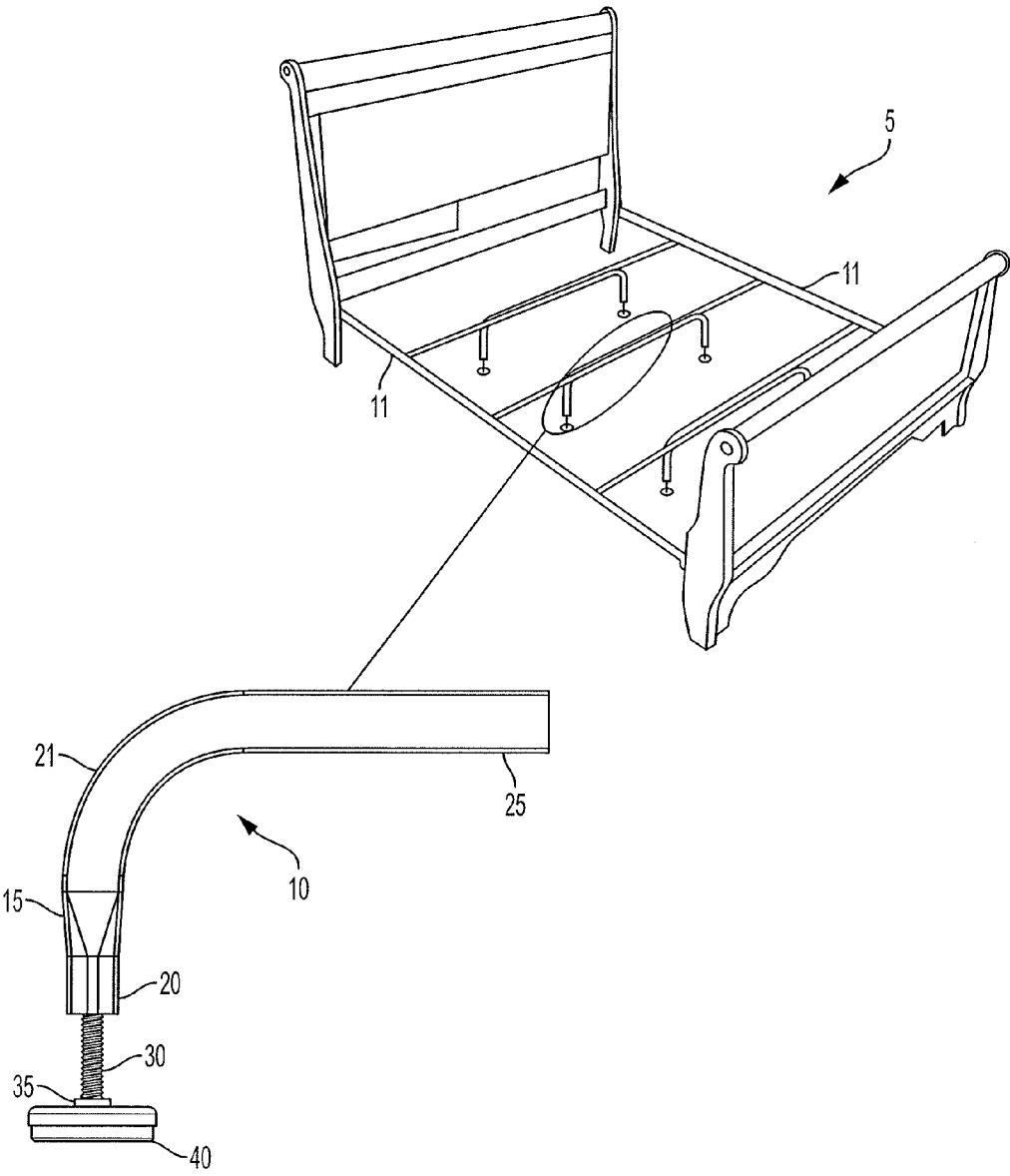


FIG. 1

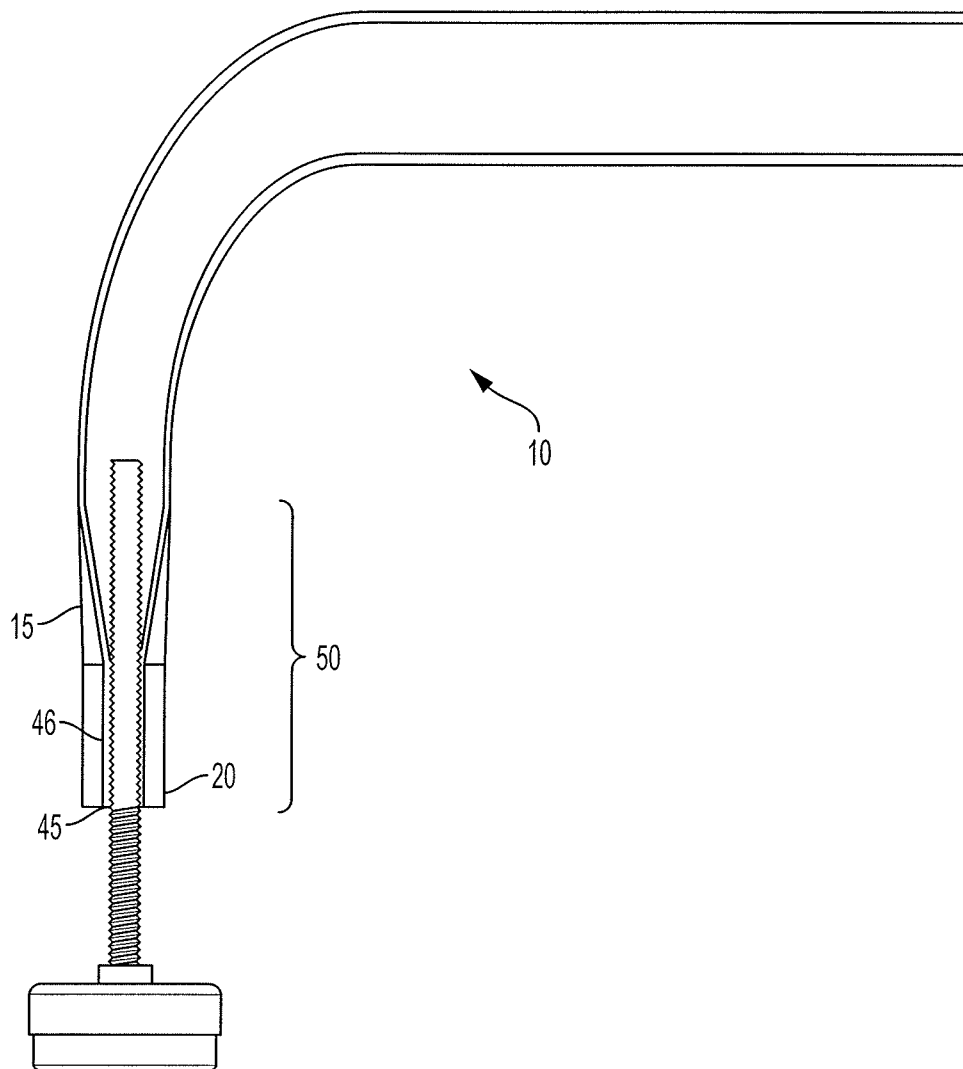


FIG. 2

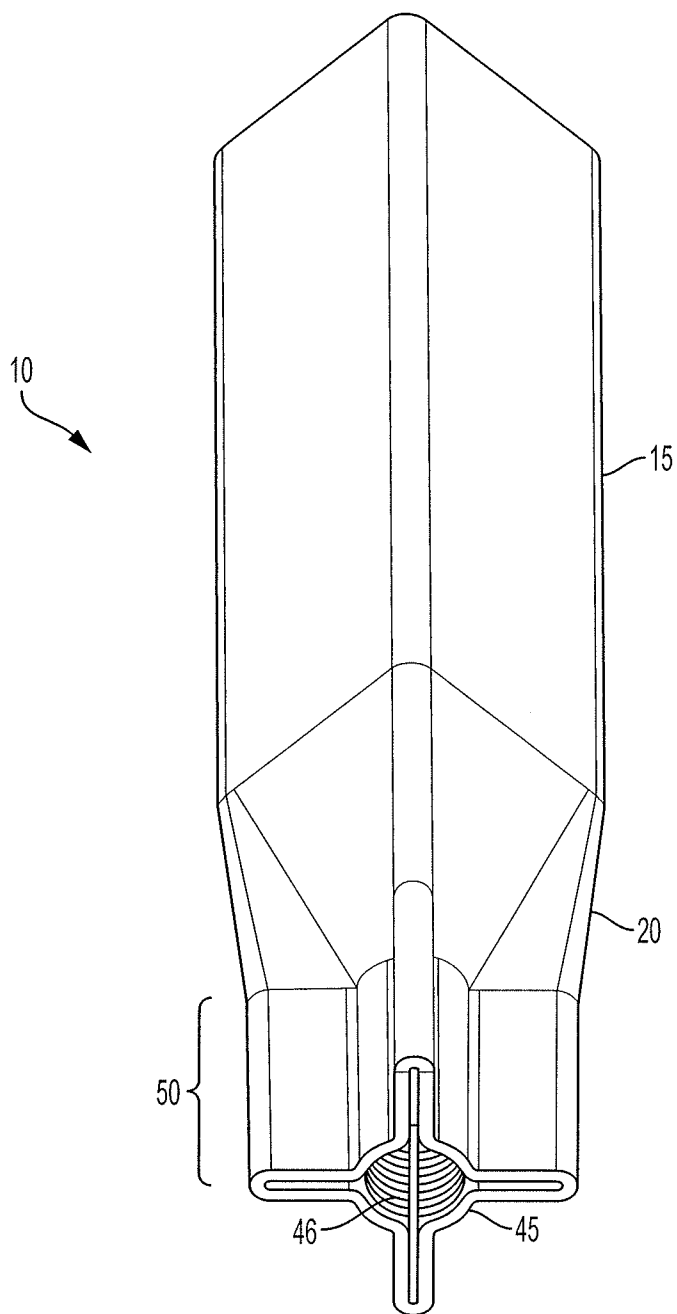


FIG. 2A

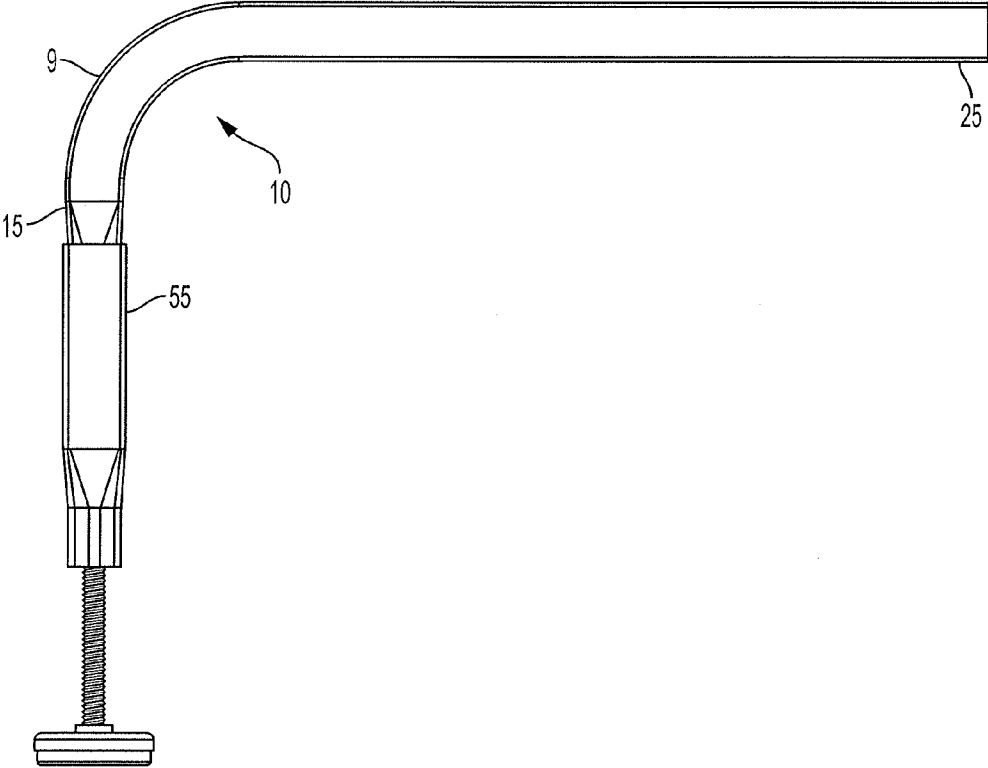


FIG. 3

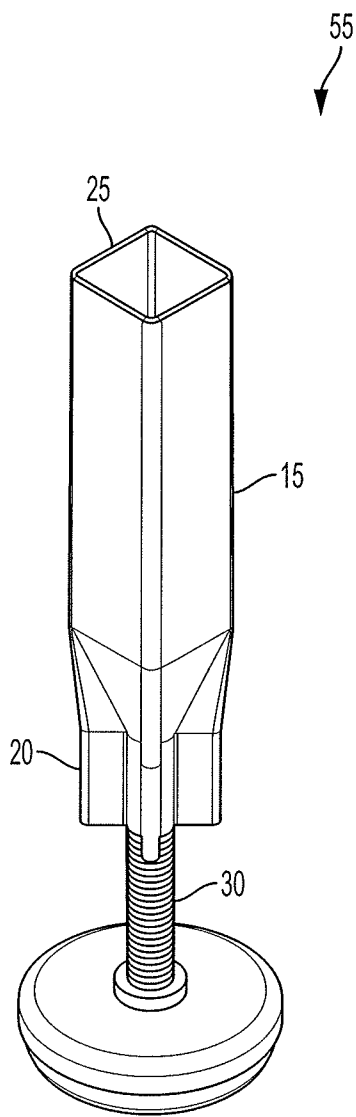


FIG. 4

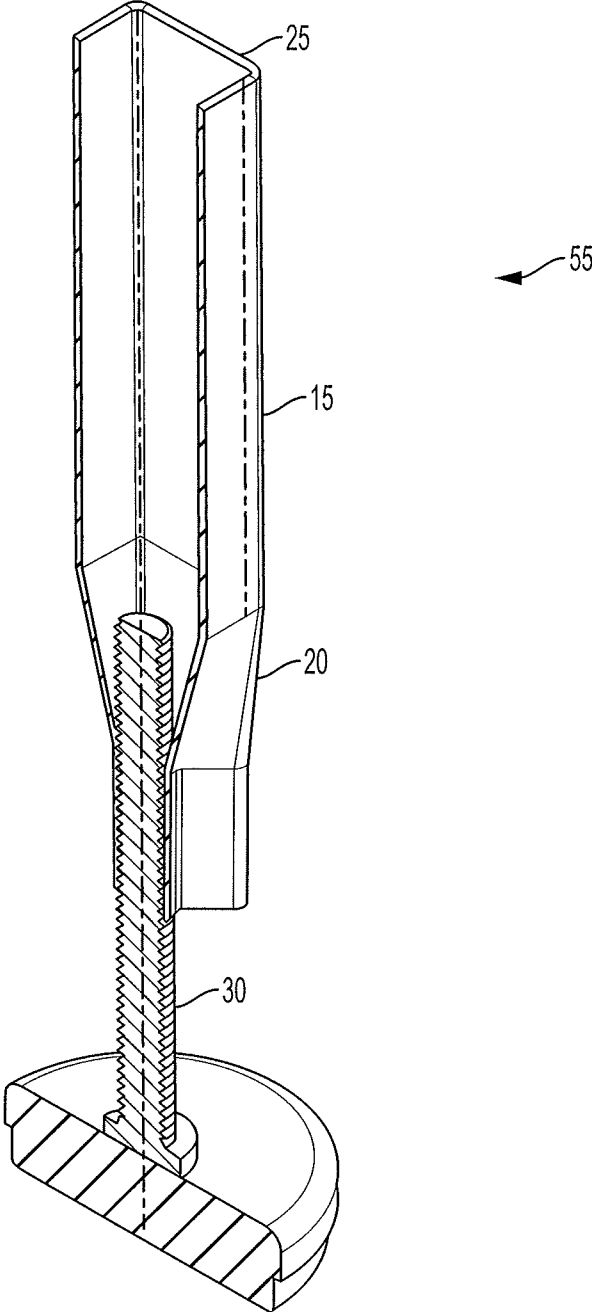


FIG. 4A

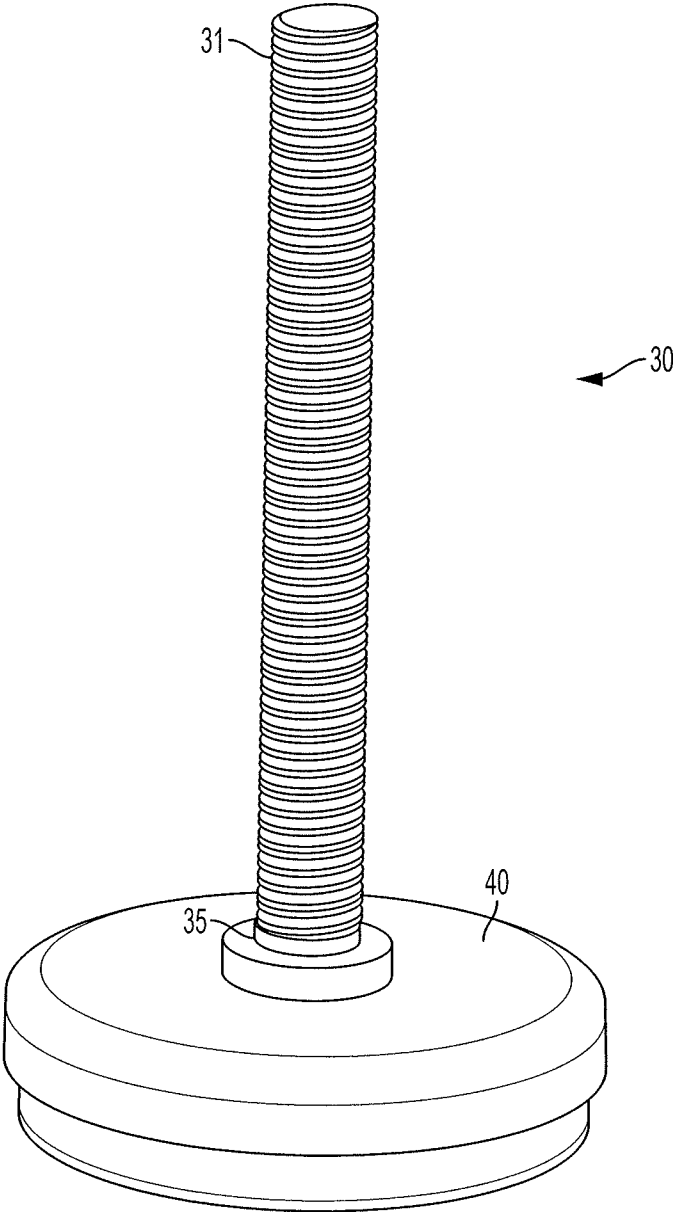


FIG. 5

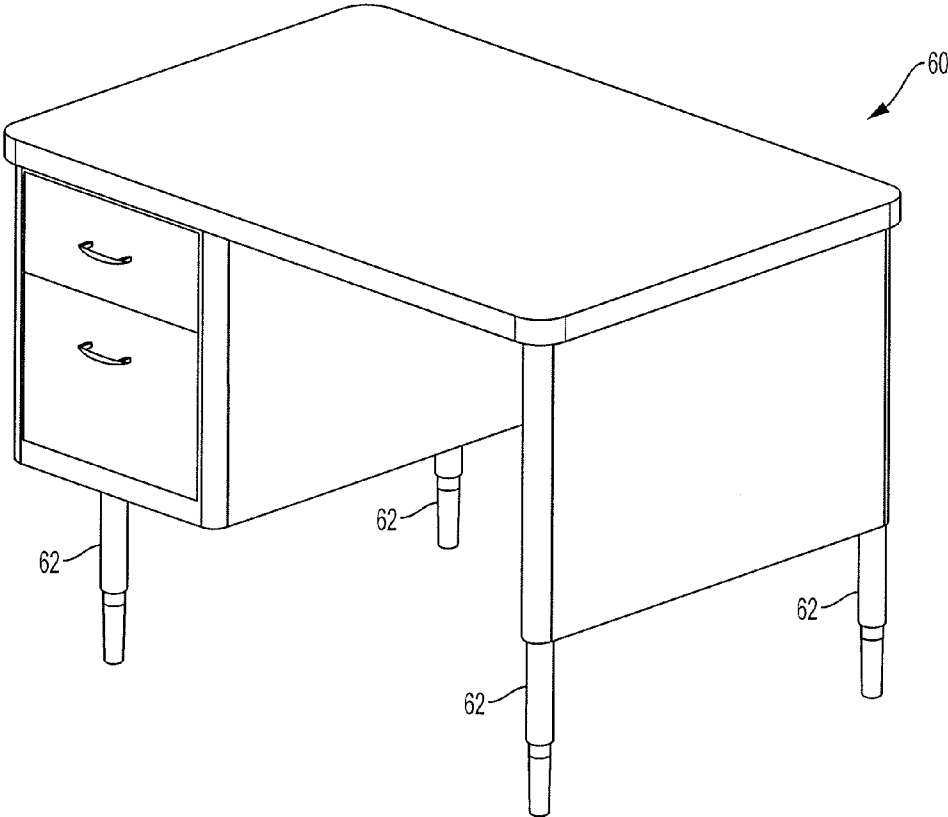


FIG. 6

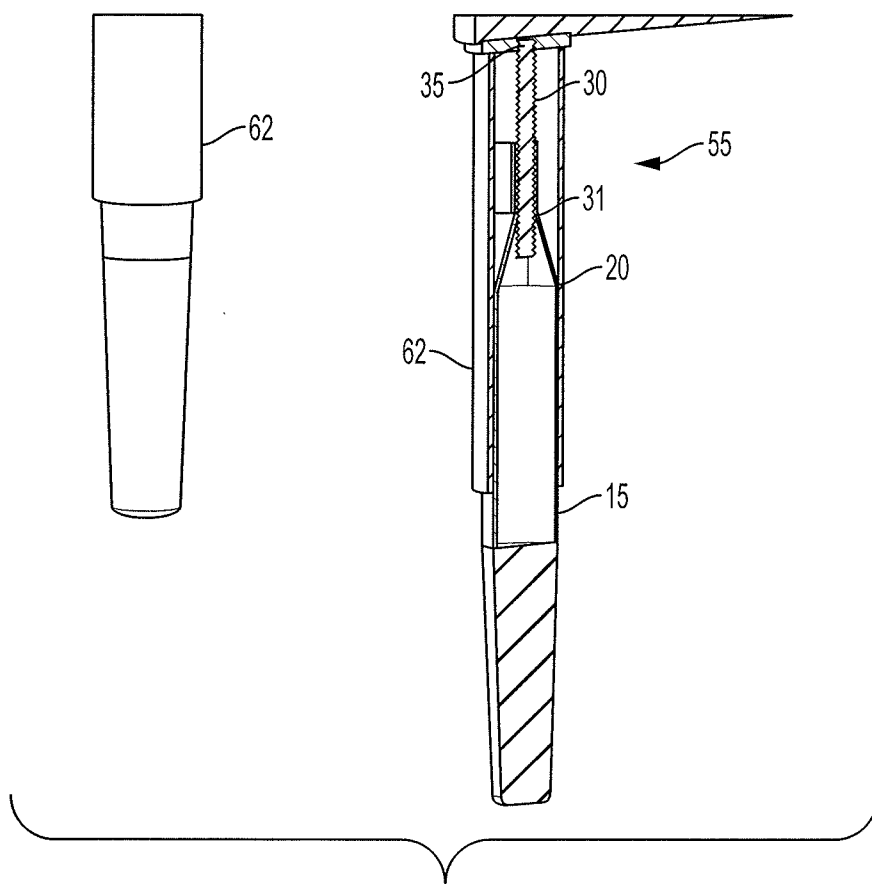


FIG. 6A

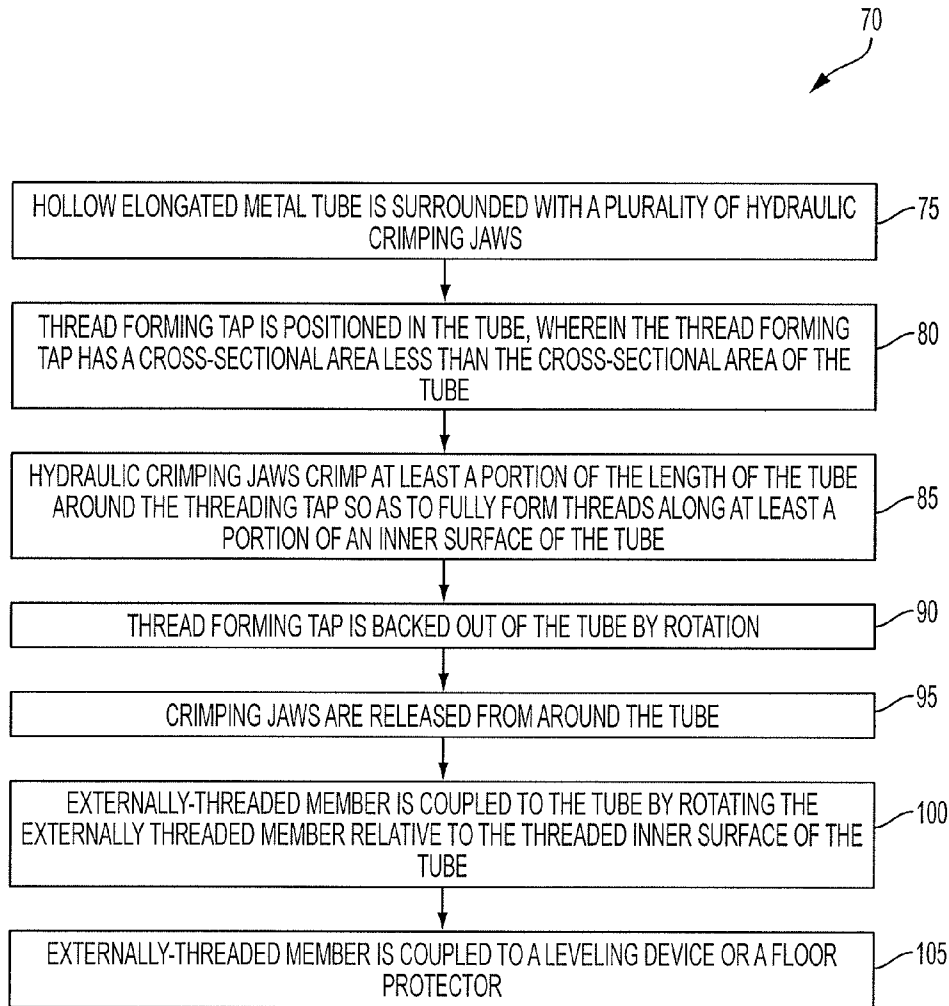


FIG. 7

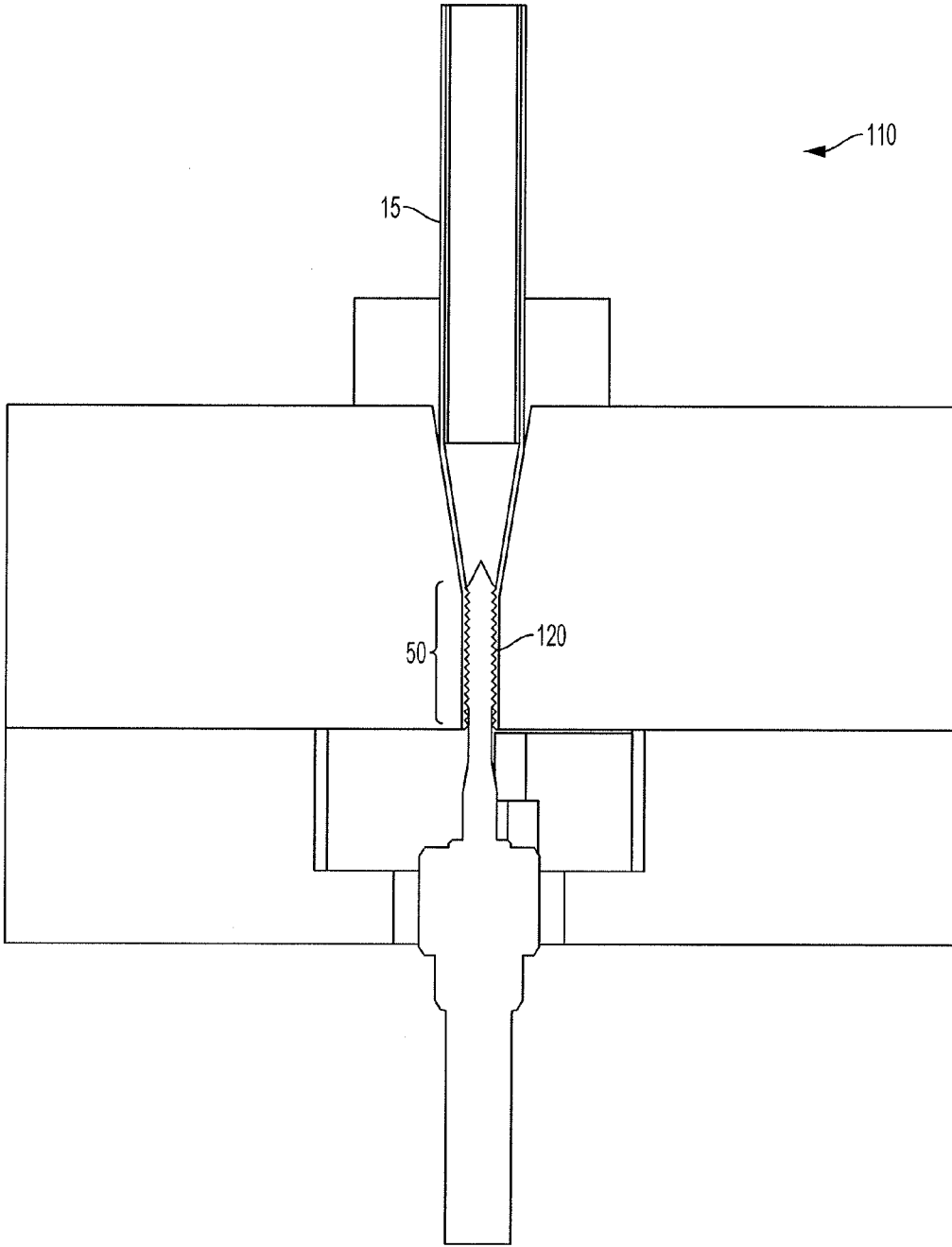
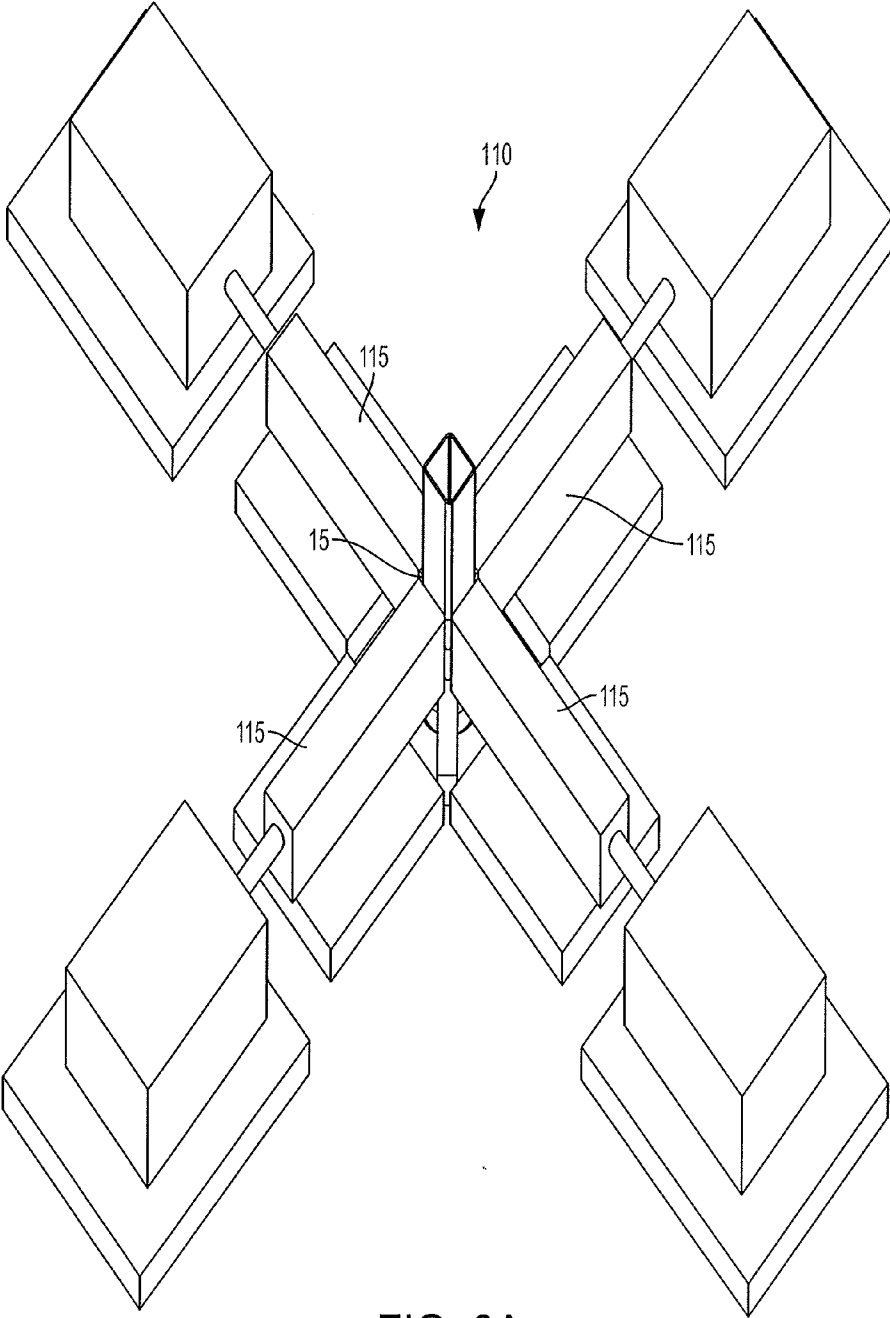


FIG. 8



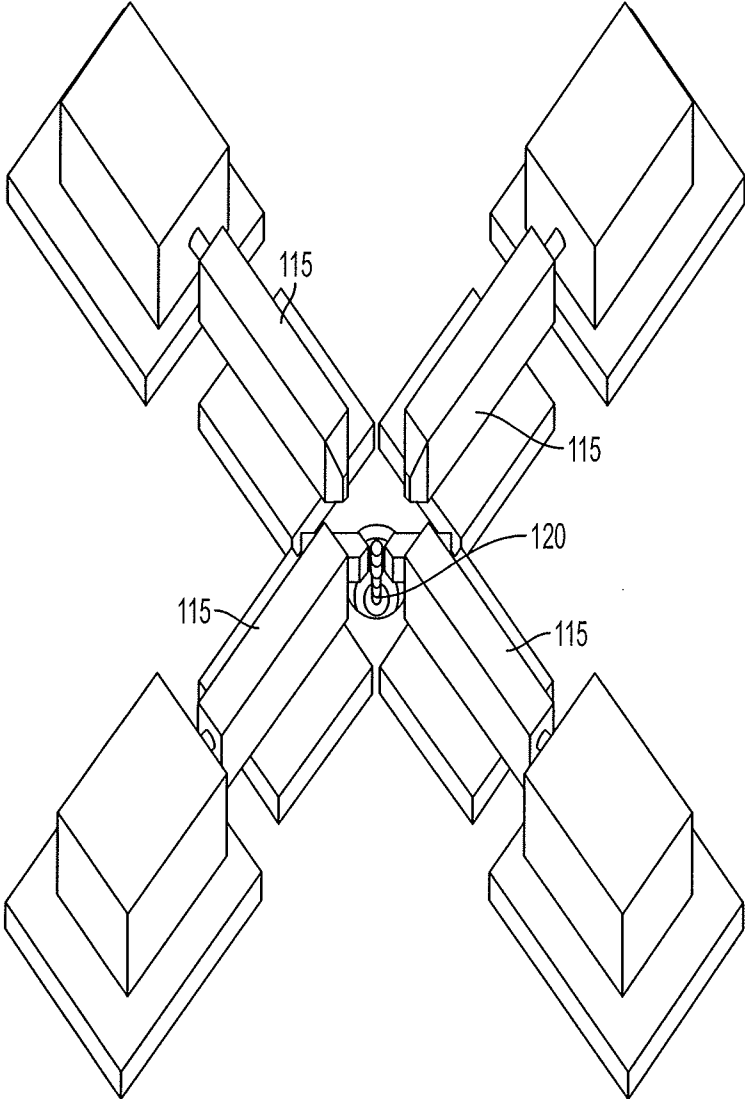


FIG. 8B

FURNITURE SUPPORT STRUCTURE

REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to U.S. Provisional Patent Application No. 62/105,487, entitled “Furniture Support Structure,” filed Jan. 20, 2015, the entirety of which is hereby incorporated by reference herein.

FIELD OF THE INVENTION

[0002] The present invention relates generally to furniture support structures that can be used, for example, with bed frames, desks, tables, chairs, and other furniture.

BACKGROUND

[0003] There is often a need to adjust the height of a furniture item or to stabilize a furniture item, for example, to improve accessibility, to satisfy aesthetic preferences, to level the furniture item, to prevent the furniture item from wobbling, etc. Examples of furniture items that are sometimes leveled include, without limitation, bed frames, desks, tables, chairs and other furniture items. Adjusting the height of a furniture item often involves adjusting the height of a furniture support structure such as a leg, foot, etc. While a number of techniques exist for adjusting the height of furniture items, it would be desirable to develop new methods and furniture support structures to facilitate adjustment of furniture items.

SUMMARY

[0004] Various embodiments of the present invention relate to furniture support structures and devices for adjusting the height of a furniture item, and related items. Such furniture items can include, in various embodiments, beds, desks, tables, chairs, and other furniture items. Various embodiments of furniture support structures and devices for adjusting the height of a furniture item of the present invention can provide a number of advantages that are discussed in more detail herein.

[0005] In some embodiments of the present invention, a furniture support structure comprises a hollow elongated metal tube having a first end and a second end, wherein the first end is crimped and comprises a hollow circular cross-section and wherein at least a portion of the inner surface of the hollow circular cross-sectional portion of the first end is threaded.

[0006] In some embodiments, a furniture support structure comprises a hollow elongated metal tube with a first and second end, wherein the first end is crimped and comprises a hollow circular cross-section and wherein at least a portion of the inner surface of the hollow circular cross-sectional portion of the first end is threaded, and an externally-threaded member configured to be coupled to the hollow cross-sectional portion of the metal tube.

[0007] Some embodiments of the invention may include one or more of the following features. The hollow elongated tube, in some embodiments, may have a rectangular, circular, oval, hexagonal, octagonal, pentagonal, polygonal, or other cross-section. In some embodiments, the hollow elongated tube may be constructed from steel or aluminum. The hollow elongated tube may have a metal thickness that is at least 120% of the depth of the threads on the inner surface of the hollow cross-sectional portion in some embodiments.

[0008] In some embodiments comprising an externally threaded member, the first end of the externally-threaded

member is threaded and a second end of the threaded member is coupled with a leveling device or floor protector.

[0009] Some embodiments of the present invention relate to a bed frame that comprises a furniture support structure comprising a hollow elongated metal tube having a first end and a second end, wherein the first end is crimped and comprises a hollow circular cross-section and wherein at least a portion of the inner surface of the hollow circular cross-sectional portion of the first end is threaded. In some embodiments, the bed frame further comprises an externally-threaded member coupled to the hollow cross-sectional portion of the metal tube.

[0010] Some embodiments of the present invention relate to a furniture item that comprises a furniture support structure comprising a hollow elongated metal tube having a first end and a second end, wherein the first end is crimped and comprises a hollow circular cross-section and wherein at least a portion of the inner surface of the hollow circular cross-sectional portion of the first end is threaded. In some embodiments, the furniture item further comprises an externally-threaded member coupled to the hollow cross-sectional portion of the metal tube.

[0011] Some embodiments of the present invention relate to a device for adjusting the height of a furniture item. In some embodiments, a device for adjusting the height of a furniture item comprises a hollow elongated metal tube having a first end and a second end, wherein the first end is crimped and comprises a hollow circular cross-section and wherein at least a portion of the inner surface of the hollow circular cross-sectional portion of the first end is threaded, and an externally-threaded member coupled to the threaded hollow circular cross-sectional portion of the metal tube; wherein the externally-threaded member can be rotated to adjust the distance from which the externally-threaded member extends from the first end of the metal tube.

[0012] Some embodiments of the present invention relate to methods for manufacturing a device for adjusting the height of a furniture item. In some embodiments, a method for manufacturing a device for adjusting the height of a furniture item comprises surrounding a hollow elongated metal tube with a plurality of hydraulic crimping jaws, positioning a thread forming tap in the tube, wherein the thread forming tap has a cross-sectional area less than the cross-sectional area of the tube, crimping at least a portion of the length of the tube around the thread forming tap with the crimping jaws so as to fully form threads along at least a portion of an inner surface of the tube, backing out the thread forming tap from within the tube by rotation, and releasing the crimping jaws from around the tube. In some embodiments, methods for manufacturing a device for adjusting the height of a furniture item further comprise coupling an externally threaded member to the tube by rotating the externally threaded member relative to the threaded inner surface of the tube.

[0013] These and other embodiments of the present invention are described in greater detail in the Detailed Description that follows.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] FIG. 1 is a perspective view of a furniture support structure installed on a bed frame that is attached to a bed according to one embodiment of the present invention.

[0015] FIG. 2 is a cross-sectional side view of a furniture support structure according to one embodiment of the present invention.

[0016] FIG. 2a is a front perspective view of a furniture support structure according to one embodiment of the present invention.

[0017] FIG. 3 is a furniture support structure used to connect or attach furniture items according to one embodiment of the present invention

[0018] FIG. 4 is a device for adjusting the height of a furniture item according to one embodiment of the present invention.

[0019] FIG. 4a is a cross-sectional side view of a device for adjusting the height of a furniture item according to one embodiment of the present invention.

[0020] FIG. 5 is a front perspective view of an externally-threaded member to be coupled to a furniture support structure according to one embodiment of the present invention

[0021] FIG. 6 is a desk comprising a device for adjusting the height of a furniture item according to one embodiment of the present invention.

[0022] FIG. 6a is a cross-sectional side view of a desk leg comprising a device for adjusting the height of a furniture item according to one embodiment of the present invention.

[0023] FIG. 7 is an example of a flow chart of a method for manufacturing a device for adjusting the height of a furniture item according to one embodiment of the present invention.

[0024] FIG. 8 is a cross-sectional side view of an apparatus for manufacturing a device for adjusting the height of a furniture item according to one embodiment of the present invention.

[0025] FIG. 8a is a top perspective view of an apparatus for manufacturing a device for adjusting the height of a furniture item according to one embodiment of the present invention.

[0026] FIG. 8b is a top perspective view of an apparatus for manufacturing a device for adjusting the height of a furniture item according to one embodiment of the present invention.

DETAILED DESCRIPTION

[0027] The following description recites various aspects and embodiments of the present invention. No particular embodiment is intended to define the scope of the invention. Rather, the embodiments merely provide non-limiting examples of various methods and systems that are at least included within the scope of the invention. The subject matter to be claimed may be embodied in other ways, may include different elements or steps, and may be used in conjunction with other existing or future technologies. This description should not be interpreted as implying any particular order or arrangement among or between steps or elements except when the order of individual steps or arrangement of elements is explicitly described. The description is to be read from the perspective of one of ordinary skill in the art; therefore, information well known to the skilled artisan is not necessarily included.

[0028] As used herein, the singular forms “a,” “an,” and “the” include plural referents, unless expressly and unequivocally disclaimed.

[0029] Some embodiments of the present invention relate generally to support structures for use with, or as part of, furniture items. For example, some embodiments of the present invention generally provide a support structure for stabilizing a furniture item and/or adjusting the height of a furniture item. Furniture items usually have at least two legs (often, three or more legs). While certain embodiments of the present invention may be described in connection with their usage with beds and desks, it should be understood that such

structures can likewise be used or adapted for use with tables, chairs, and other furniture items.

[0030] In some embodiments, furniture support structures of the present invention comprise a hollow elongated metal tube with a crimped first end and a hollow circular cross-section at the first end, wherein at least a portion of the inner surface of the hollow circular cross-sectional portion of the first end is threaded.

[0031] In some embodiments, a furniture support structure comprises a hollow elongated metal tube having a first end and a second end, wherein the first end is crimped and comprises a hollow circular cross-section and wherein at least a portion of the inner surface of the hollow circular cross-sectional portion of the first end is threaded.

[0032] In some embodiments, a furniture support structure comprises a hollow elongated metal tube having a first end and a second end, wherein the first end is crimped and comprises a hollow circular cross-section and wherein at least a portion of the inner surface of the hollow circular cross-sectional portion of the first end is threaded, and an externally-threaded member configured to be coupled to the hollow circular cross-sectional portion of the metal tube.

[0033] In some embodiments, a furniture support structure comprises a hollow elongated metal tube having a first end and a second end, wherein the first end is crimped and comprises a hollow circular cross-section and wherein at least a portion of the inner surface of the hollow circular cross-sectional portion of the first end is threaded, and an externally-threaded member configured to be coupled to the hollow circular cross-sectional portion of the metal tube, and a first end of the threaded member is threaded and a second end of the threaded member is coupled with a leveling device or floor protector.

[0034] In some embodiments, a furniture support structure comprises a hollow elongated metal tube having a first end and a second end, wherein the first end is crimped and comprises a hollow circular cross-section, wherein at least a portion of the inner surface of the hollow circular cross-sectional portion of the first end is threaded, and wherein the hollow elongated metal tube has a metal thickness that is at least 120% of the depth of the threads on the inner surface of the hollow circular cross-sectional portion.

[0035] As indicated above, various embodiments of the furniture support structures can be used with a number of furniture items including, for example and without limitation, beds, desks, tables, chairs, and other furniture. In some embodiments, the furniture support structure can be adapted for use on a particular furniture item depending on the particular item, the amount of height adjustment desired, the desired strength of the furniture support structure, the number of furniture support structures to be incorporated into the furniture item, and other factors. In one example, a bed frame comprises a furniture support structure comprising a hollow elongated metal tube having a first end and a second end, wherein the first end is crimped and comprises a hollow circular cross-section and wherein at least a portion of the inner surface of the hollow circular cross-sectional portion of the first end is threaded. In some embodiments, a bed support can comprise a plurality of such furniture support structures.

[0036] In another example, a furniture item, such as a desk, comprises a furniture support structure comprising a hollow elongated metal tube having a first end and a second end, wherein the first end is crimped and comprises a hollow circular cross-section and wherein at least a portion of the

inner surface of the hollow circular cross-sectional portion of the first end is threaded. In some embodiments, a desk or other furniture item can comprise a plurality of such furniture support structures.

[0037] Some embodiments of the present invention relate to devices for adjusting the height of a furniture item. In some embodiments, a device for adjusting the height of a furniture item comprises a hollow elongated metal tube having a first end and a second end, wherein the first end is crimped and comprises a hollow circular cross-section and wherein at least a portion of the inner surface of the hollow circular cross-sectional portion of the first end is threaded, and an externally-threaded member coupled to the threaded hollow circular cross-sectional portion of the metal tube, wherein the externally-threaded member can be rotated to adjust the distance from which the externally-threaded member extends from the first end of the metal tube.

[0038] Some embodiments of the present invention relate to methods for manufacturing a device for adjusting the height of a furniture item. In some embodiments, a method for manufacturing a device for adjusting the height of a furniture item comprises surrounding a hollow elongated metal tube with a plurality of hydraulic crimping jaws, positioning a thread forming tap in the tube, wherein the thread forming tap has a cross-sectional area less than the cross-sectional area of the tube, crimping at least a portion of the length of the tube around the thread forming tap with the crimping jaws so as to fully form threads along at least a portion of an inner surface of the tube, backing out the thread forming tap from within the tube, by rotation, and releasing the crimping jaws from around the tube. In some embodiments, methods for manufacturing a device for adjusting the height of a furniture item can further comprise coupling an externally threaded member to the tube by rotating the externally threaded member relative to the threaded inner surface of the tube. In some embodiments, methods for manufacturing a device for adjusting the height of a furniture item can further comprise coupling the externally-threaded member to a leveling device or floor protector.

[0039] As noted herein, in some embodiments, a furniture support structure comprises a hollow elongated metal tube having a first end and a second end, wherein the first end is crimped and comprises a hollow circular cross-section. While an element of the furniture support structure may be referred to herein as a “hollow elongated tube,” “hollow tube,” or “tube,” it should be understood that the term “tube” is not intended to limit the furniture support structure to structures having only round cross-sections and that the term “tube” should be understood to include furniture support structures with square, rectangular, oval, circular, hexagonal, octagonal, pentagonal, or other cross-sections.

[0040] The following illustrative examples are given to introduce the reader to the general subject matter discussed here and are not intended to limit the scope of the disclosed concepts. The following sections describe various additional features and examples with reference to the drawings in which like numerals indicate like elements, and directional descriptions are used to describe the illustrative aspects but, like the illustrative aspects, should not be used to limit the present disclosure.

[0041] Referring now to the Figures, FIG. 1 illustrates components of one embodiment of a bed frame comprising at least one furniture support structure of the present invention. FIG. 1 shows a bed frame 5 comprising a furniture support struc-

ture 10. The furniture support structure 10 comprises at least one hollow elongated metal tube 15 having a first end 20 and a second end 25, wherein the first end 20 is crimped and comprises a hollow circular cross-section and wherein at least a portion of the inner surface of the hollow circular cross-sectional portion of the first end 20 is threaded. In the embodiment shown, the hollow elongated metal tube 15 has a curved portion 21 between the first end 20 and the second end 25 so as to allow the furniture support structure 10 to be coupled to bed slats 11 to provide support for the bed frame 5. In other embodiments, the hollow elongated metal tube 15 can be straight or substantially straight. In this embodiment of the furniture support structure 10, the hollow cross-sectional portion of the metal tube 15 is coupled to an externally-threaded member 30. The externally-threaded member 30 is further coupled with a leveling device or floor protector 40 at a second end 35 of the externally-threaded member 30. In addition to the furniture support structure 10 highlighted in detail, the bed frame 5 can comprise at least five other furniture support structures 10. The number of furniture support structures used in connection with a bed frame or other items of furniture can depend on a number of factors including for example, the size of the furniture item, the weight of the furniture item, the weight distribution of the furniture item, and other factors. For example, in others embodiments, a bed frame can comprise at least nine furniture support structures.

[0042] FIG. 2 is a cross-sectional side view of one embodiment of a furniture support structure according to the present invention. FIG. 2a is a front perspective view of the embodiment in FIG. 2. FIG. 2 shows an example of a furniture support structure 10 comprising a hollow elongated metal tube 15 wherein the first end 20 is crimped and comprises a hollow circular cross-section 45 and wherein at least a portion 50 of the inner surface of the hollow circular cross-sectional portion of the first end is threaded. In the embodiment shown, the crimped portion of the metal tube 15 is formed when the walls of the metal tube are pinched together or compressed inwardly by crimping jaws, to reduce the diameter of the metal tube. As the diameter of the metal tube is reduced, for example, to form a hollow circular cross-section, regions of the metal tube's walls will compress to form crimps, folds or ridges in the spaces between the crimping jaws. In this embodiment, the crimped portion of the metal tube has a diameter less than the initial diameter of the metal tube. In this embodiment, crimping the end of the furniture support structure advantageously leaves a circular cross-section and crimps that allow the furniture support structure to be used for a variety of purposes. For example, the crimped circular cross-section can receive another structure (e.g., a threaded member, an extension, a floor protector, etc.) or pieces in an assembly. In another example, the crimped circular cross-section can facilitate insertion of the furniture support structure into another structure (e.g., the crimped end can be inserted into the end of another furniture support structure or other furniture component). Further, in the embodiment shown in FIG. 2, at least a portion 50 of the hollow circular cross-sectional portion 45 of the first end of the metal tube is threaded 46. In being threaded, as is understood by those of skill in the art, at least a portion of the circular cross-sectional portion comprises a plurality of helical or spiral ridges or grooves configured to engage with another structure or object having corresponding threads. The threaded end of the furniture support structure advantageously allows the furniture support structure to be coupled to another threaded member.

Further, the threaded end of the furniture support structure eliminates the need to insert a threaded device, for example, a nut or fastener, into the metal tube so that the metal tube can receive another threaded member. In some embodiments, the hollow elongated metal tube has a thickness that is at least 120% of the depth of the threads on the inner surface of the hollow circular cross-sectional portion. In such embodiments, the thickness of the hollow elongated metal tube can prevent the threads from wearing through the metal tube when being formed by a thread forming tap.

[0043] In the embodiments shown in the various Figures, the hollow elongated metal tubes have rectangular cross-sections. As noted above, in other embodiments, the hollow elongated metal tubes can be hollow tubes having other cross-sections such as square, triangular, oval, circular, hexagonal, octagonal, pentagonal, or other cross-sections. The hollow elongated metal tube can be constructed from a number of materials including, without limitation, steel, aluminum, brass, copper, bronze, or other metals or metal alloys. In selecting a material to use for the construction of the hollow elongated metal tube, one should consider whether the material will provide enough strength and rigidity to withstand the compressive force/stress from the furniture item. In other words, the material used for the hollow elongated metal tube, in some embodiments, should be rigid enough, and have enough compressive and tensile strength, to maintain the set height and stability of the furniture item. As to the height or length of the hollow elongated metal tube, persons of ordinary skill in the art can select an appropriate height depending on any number of factors including, without limitation, the size of the furniture, the height of the furniture item, the size of the legs of the furniture item, the type of furniture to which the support structure is to be attached, and other factors. Similarly, the diameter of the hollow elongated metal tube (or cross-sectional area depending on the cross-sectional shape) can be a variety of sizes depending, for example, on the size of the legs of the furniture item, the desired thickness of the tube, the weight of the furniture item, the weight to be supported by the furniture item, and others.

[0044] As shown in the various Figures, the furniture support structure can be used on a variety of furniture items including, without limitation, desks, tables, chairs, and other furniture items. For example, FIGS. 6 and 6a show a desk 60 comprising a plurality of furniture support structures 62. The furniture support structures can be used to adjust the height of the desk (or other furniture items) according to one embodiment of the present invention.

[0045] In some embodiments, a furniture support structure can be used as a connector, for example for connecting other furniture support structures, or to connect pieces in an assembly, and for other similar uses. As shown in FIG. 3, a furniture support structure 10 can comprise a hollow elongated metal tube 15 wherein the first end is crimped and comprises a hollow circular cross-section. As set forth below, a crimped portion of the metal tube 15 can be formed, for example, by using crimping jaws to pinch together or compress inwardly the walls of the metal and reduce the diameter of the metal tube. As the diameter of the metal tube is reduced, for example, to form a hollow circular cross-section, regions of the metal tube's walls will compress to form crimps, folds or ridges in the spaces between the crimping jaws. In such embodiments, the crimped portion of the metal tube has a diameter less than the initial diameter of the metal tube. In such embodiments, crimping the end of the furniture support

structure advantageously allows the furniture support structure to be used for a variety of purposes. For example, the crimped end of the furniture support structure 10 can receive another structure including, without limitation, another furniture support structure, a device for adjusting the height of a furniture item, or pieces in an assembly. In another example, the crimped end of the furniture support structure can facilitate insertion of the furniture support structure into another structure. In another example, the furniture support structure can be used to connect or attach furniture items. In the embodiment shown in FIG. 3, the crimped end of the furniture support structure 10 allows the furniture support structure 10 to receive a device for adjusting the height of a furniture item 55.

[0046] FIG. 4 illustrates the components of one embodiment of a device 55 for adjusting the height of a furniture item according to the present invention (which may also be a furniture support structure). FIG. 4a is a cross-sectional side view of the embodiment in FIG. 4. The device 55 comprises a hollow elongated metal tube 15 having a first end 20 and a second end 25, wherein the first end 20 is crimped and comprises a hollow circular cross-section and wherein at least a portion of the inner surface of the hollow circular cross-sectional portion of the first end 20 is threaded. As noted above, in some embodiments, the crimped portion of the metal tube 15 is formed when the walls of the metal tube are pinched together or compressed inward by crimping jaws, to reduce the width or diameter of the metal tube. As the width or diameter of the metal tube is reduced, for example, to form a hollow circular cross-section, regions of the metal tube's walls will compress to form crimps, folds or ridges in the spaces between the crimping jaws. In the embodiment shown, the walls of the metal tube have been pinched together to form four crimps. In other embodiments, the walls of the metal tube can be pinched together to form more or fewer crimps, depending on any number of factors including, without limitation, the number of crimping jaws used to pinch the walls of the metal tube, the shape of the cross-section of the hollow elongated metal tube, and other factors. In the embodiment shown, an externally-threaded member 30 is coupled to the threaded hollow circular cross-sectional portion of the metal tube 15. In the embodiment shown, the externally-threaded member 30 is configured such that it can be rotated to adjust the distance from which the externally-threaded member extends from the first end 20 of the metal tube 15. In the embodiment shown, the externally-threaded member 30 has a diameter less than that of the circular cross-sectional portion of the metal tube 15. The externally-threaded member having a diameter less than that of the circular cross-sectional portion of the metal tube advantageously allows the externally-threaded member to be coupled to the circular cross-sectional portion of the metal tube. In some embodiments, the externally-threaded member can include, without limitation, a bolt, screw, or other similar structure configured to engage with another structure or object having corresponding threads.

[0047] As shown in FIG. 5, in some embodiments, the externally-threaded member can be threaded on a first end 31 to allow the externally-threaded member 30 to be coupled to the threaded hollow circular cross-sectional portion of the metal tube and threaded at a second end 35 to allow the externally-threaded member to be coupled to a leveling device or a floor protector 40, or to another structure or object having corresponding threads. In another embodiment, the

externally-threaded member can be threaded on a first end to allow the externally-threaded member to be coupled to the threaded hollow circular cross-sectional portion of the metal tube, but not threaded on a second end to allow the externally-threaded member to be coupled to a non-threaded leveling device or floor protector, or to another non-threaded structure or object. In another embodiment, the externally-threaded member can be an assembly comprising an externally-threaded member coupled to a leveling device, a floor protector, or another structure or object configured to engage with the externally-threaded member. In some embodiments, the externally-threaded member can be formed with a leveling device, a floor protector or other structure at one end as a single structure.

[0048] As noted above, the device for adjusting the height of a furniture item can be used on a variety of furniture items including, without limitation, desks, tables, chairs, and other furniture items. For example, in some embodiments, the device 55 for adjusting the height of a furniture item depicted in FIGS. 4 and 6a can be used to adjust the height of a variety of furniture items. FIGS. 6 and 6a illustrate an embodiment where a plurality of devices 55 for adjusting the height of a furniture item (or furniture support structures) is utilized with a desk 60. In some embodiments for use with desks and chairs, the device(s) 55 for adjusting the height of a furniture item can be positioned under the chair or desk 60 (e.g., as part of the legs). In the embodiment shown, the device 55 for adjusting the height of a furniture item is enclosed within a surrounding tube 62 as an example of an aesthetically pleasing way in which to use a device for adjusting the height of a furniture item.

[0049] In the embodiment shown in FIGS. 6 and 6a, the device 55 for adjusting the height of a furniture item structure comprises a hollow elongated metal tube 15 with a circular cross-section. In this embodiment, the first end 20 of the metal tube 15 is crimped and comprises a hollow circular cross-section.

[0050] In the embodiment shown, an externally-threaded member 30 is threaded on a first end 31 to allow the externally-threaded member 30 to be coupled to the threaded hollow circular cross-sectional portion of the metal tube 15. In the embodiment shown, the externally-threaded member 30 has a diameter less than that of the circular cross-sectional portion of the metal tube 15. The externally-threaded member having a diameter less than that of the circular cross-sectional portion of the metal tube advantageously allows the externally-threaded member to be coupled to the circular cross-sectional portion of the metal tube. In the embodiment shown, the metal tube 15 can be configured such that it can be rotated to adjust the distance from which the metal tube 15 extends from the first end 31 of the externally-threaded member 30. As the metal tube 15 can be the bottom of the leg of the desk 60, such a feature permits adjustment of the length of this leg and thereby the height of the desk 60.

[0051] The externally-threaded member can also be threaded at a second end to allow the externally-threaded member to be coupled to a desk having corresponding threads. In the embodiment shown, the externally-threaded member 30 is coupled to the desk 60 and extends downward from the base of the desk 60. In another embodiment, the externally-threaded member 30 can be threaded on a first end 31 to allow the externally-threaded member 30 to be coupled to the threaded hollow circular cross-sectional portion of the

metal tube 15, but not threaded on a second end 35 to allow the externally-threaded member 30 to be coupled to a non-threaded desk.

[0052] As another example, a device for adjusting the height of a furniture item (or furniture support structure) can be used on a bed frame. In some embodiments for use with beds, like the bed frame shown in FIG. 1, the device(s) 55 for adjusting the height of a furniture item (or furniture support structures) can be positioned near the center of bed slats 11. In other embodiments, the device(s) can be placed at any location where the bed frame contacts the floor, such as the corners of the bed, along side rails, beneath slats, underneath a headboard, underneath a footboard, or combinations of such locations.

[0053] Furniture support structures and devices for adjusting the height of a furniture item can be manufactured using a variety of techniques. FIG. 7 is an example of a flow chart 70 summarizing a method for manufacturing a device for adjusting the height of a furniture item according to one embodiment of the present invention.

[0054] In step 75, a hollow elongated metal tube is surrounded with a plurality of hydraulic crimping jaws. The tube is positioned so that the hydraulic crimping jaws can be pressed against the tube to crimp the tube. As noted above, in some embodiments, the hollow elongated metal tube can be a hollow tube having any cross-section such as a square, triangular, oval, circular, hexagonal, octagonal, pentagonal, or other cross-section. The hollow elongated metal tube can be constructed from a number of materials including, without limitation, steel, aluminum, brass, copper, bronze, or other metals or metal alloys. As to the number of crimping jaws to be used to surround a tube with a particular cross-section, persons of ordinary skill in the art can select an appropriate number of crimping jaws depending on any number of factors including, without limitation, the size of the crimping jaws, the shape of the cross-section of the hollow elongated metal tube, the diameter or dimensions of the tube, the thickness of the tube, and other factors. For example, in some embodiments, for a hollow elongated metal tube with a circular cross-section, the number of crimping jaws to be used to surround the tube can be two or three. In another embodiment, for a hollow elongated metal tube with a square or rectangular cross-section, the number of crimping jaws to be used to surround the tube can be four.

[0055] In step 80 a thread forming tap is positioned in the tube. The thread forming tap has a cross-sectional area that is less than the cross-sectional area of the tube. In some embodiments, the thread forming tap has a diameter less than the diameter of the hollow elongated metal tube (or having a cross-sectional area less than the cross-sectional area of the hollow elongated metal tube). The thread forming tap having a diameter less than the diameter of the hollow elongated metal tube advantageously allows the thread forming tap to be positioned inside the tube. Further, the tap being threaded and having a diameter less than the diameter of the hollow elongated metal tube allows the tap to fully form threads along a portion of the inner surface of the tube as the tube is crimped around the thread forming tap. In some embodiments, the diameter of the thread forming tap can correspond to the diameter of an externally-threaded member to be coupled to the metal tube.

[0056] In step 85, the hydraulic crimping jaws crimp at least a portion of the length of the tube around the thread forming tap so as to fully form threads along at least a portion

of an inner surface of the tube. The crimped portion of the metal tube forms as the walls of the metal tube are pinched together or compressed inward by the crimping jaws to reduce the diameter or width of the metal tube. As the diameter or width of the metal tube is reduced, for example, to form a generally round cross-section, regions of the metal tube's walls will compress to form crimps, folds or ridges in spaces between the crimping jaws. As the metal tube is crimped around the thread forming tap, the thread forming tap fully forms threads along a portion of the inner surface of the tube.

[0057] In step 90 the thread forming tap is fully removed from the tube by backing the tap out of the tube by rotation (e.g., reversing the thread forming tap out of the crimped portion of the tube) while the crimping jaws are compressing the tube against the thread forming tap. Removing the thread forming tap from the tube while the crimping jaws are compressing the tube against the thread forming tap can allow deeper threads to be formed in the tube. In step 95 the crimping jaws are released from around the tube. In some embodiments, the method further comprises steps 100 and 105. In step 100, an externally-threaded member is coupled to the tube by rotating the externally threaded member relative to the threaded inner surface of the tube. In another embodiment, the method further comprises step 105. In step 105, the externally threaded member is coupled to a leveling device or a floor protector.

[0058] FIG. 8 is a cross-sectional side view of an apparatus for manufacturing a furniture support structure according to one embodiment of the present invention. The apparatus 110 can include hydraulic crimping jaws (as shown in FIGS. 8a and 8b) to crimp an end of a hollow metal tube. In some embodiments, the apparatus can be used to manufacture a furniture support structure according to some embodiments of the present invention.

[0059] In the embodiment shown, the apparatus 110 includes a thread forming tap 120 wherein the thread forming tap 120 has a cross-sectional area less than the cross-sectional area of the metal tube 15 to be crimped. The hydraulic crimping jaws crimp at least a portion of the length of the metal tube 15 around the thread forming tap 120 so as to fully form threads along at least a portion 50 of an inner surface of the metal tube 15. When threads are fully formed, the thread forming tap 120 can be removed from within the metal tube 15 by backing the thread forming tap 120 out of the metal tube 15 by rotation, and the hydraulic crimping jaws can then be released.

[0060] FIG. 8a is a top perspective view of the embodiment of an apparatus 110 shown in FIG. 8. The hollow elongated metal tube 15 is surrounded by four hydraulic crimping jaws 115 to crimp at least a portion of the metal tube 15. In this view, the hydraulic crimping jaws 115 have been extended in order to crimp a lower portion of the metal tube 15 around the thread forming tap 120. In the embodiment shown in FIG. 8a, the metal tube 15 has a rectangular cross-section. As noted above, in other embodiments, the metal tube 15 can be a hollow tube having any cross-section such as square, triangular, oval, circular hexagonal, octagonal, pentagonal, or other cross-section.

[0061] FIG. 8b is a top perspective view of the embodiment of the apparatus 110 shown in FIGS. 8 and 8a, except that the hydraulic crimping jaws 115 have been released and the metal tube 15 has been removed from the thread forming tap 120. In this example, there are four hydraulic crimping jaws 115 to be used to crimp at least a portion of the length of the

tube around the thread forming tap 120. As noted above, in other embodiments, an apparatus can include a different number of hydraulic crimping jaws. As to the shape of the hydraulic crimping jaws to be used with a tube of a particular cross-section, persons of ordinary skill in the art can select an appropriate shape depending on any number of factors including, without limitation, the shape of the cross-section of the hollow elongated tube, the number of crimping jaws, and other factors. As noted above, in other embodiments, the thread forming tap has a cross-sectional area less than the cross-sectional area of the tube. In some embodiments, the thread forming tap has a diameter less than the diameter of the hollow elongated metal tube (or width depending on the cross-sectional shape).

[0062] As is evident from the various Figures, furniture support structures and devices for adjusting the height of a furniture item of the present invention can be utilized in multiple ways. FIG. 3 illustrates the usage of one embodiment of a furniture support structure according to the present invention. In some embodiments, as shown in FIG. 3, the furniture support structure can be used as a connector, for example for connecting other furniture support structures, or to connect pieces in an assembly, and for other similar uses. As shown in FIG. 3, the furniture support structure 10 can be used to connect to or receive a device for adjusting the height of a furniture item 55. In other examples, the furniture support structure 10 can also be used to connect or attach furniture items.

[0063] In another example, FIG. 6 illustrates another usage of one embodiment of a device for adjusting the height of a furniture item according to the present invention. In the embodiment shown in FIG. 6, the device 55 for adjusting the height of a furniture item can be used to adjust the height of a desk 60. In some embodiments for use with desks and chairs, the device(s) 55 for adjusting the height of a furniture item can be positioned under the chair or desk 60. The device 55 for adjusting the height of a furniture item can be enclosed within a surrounding tube or leg of the chair or desk 60. In other examples, the device for adjusting the height of a furniture item 55 can be used as the leg of the chair or desk.

[0064] While not shown in the other Figures, it should be understood that furniture support structures and/or devices for adjusting the height of a furniture item according to various embodiments of the present invention can likewise be used or adapted for use with other furniture items.

[0065] Desirable characteristics, which can be exhibited by various embodiments of the present invention, can include, but are not limited to, the provision of furniture support structures that provide a way to adjust the height of a furniture item to improve accessibility; the provision of furniture support structures that allow one to stabilize an item of furniture with relative ease; the provision of furniture support structures that eliminate the need for additional crimped parts for the connection of hollow metal tubes; the provision of furniture support structures that can be cost-effective to manufacture by eliminating costs related to purchasing additional crimped parts and assembly labor; the provision of furniture support structures that can remove the opportunity for noise from the relative motion of numerous components by eliminating the need for separate additional parts; the provision of furniture support structures that can provide greater strength than tube connecting nuts, fasteners, and plastic alternatives; and/or others.

[0066] It is to be understood that the present description illustrates aspects of the invention relevant to a clear understanding of the invention. Certain aspects of the invention that would be apparent to those of ordinary skill in the art and that, therefore, would not facilitate a better understanding of the invention have not been presented in order to simplify the present description. Although the present invention has been described in connection with certain embodiments, the present invention is not limited to the particular embodiments disclosed, but is intended to cover modifications that are within the spirit and scope of the invention.

What is claimed:

- 1. A furniture support structure comprising: a hollow elongated metal tube having a first end and a second end, wherein the first end is crimped and comprises a hollow circular cross-section and wherein at least a portion of an inner surface of the hollow circular cross-sectional portion of the first end is threaded.
- 2. The furniture support structure of claim 1, further comprising an externally-threaded member configured to be coupled to the hollow circular cross-sectional portion of the metal tube.
- 3. The furniture support structure of claim 2, wherein a first end of the threaded member is threaded and a second end of the threaded member is coupled with a leveling device or floor protector.
- 4. The furniture support structure of claim 2, wherein a first end of the threaded member is threaded and comprises a leveling device or floor protector at a second end.
- 5. The furniture support structure of claim 1, wherein the hollow elongated metal tube has a rectangular, a circular, or a polygonal cross-section.
- 6. The furniture support structure of claim 1, wherein the hollow elongated metal tube is constructed from steel or aluminum.
- 7. The furniture support structure of claim 1, wherein the hollow elongated metal tube has a metal thickness that is at least 120% of a depth of the threads on the inner surface of the hollow circular cross-sectional portion.
- 8. A bed support comprising the furniture support structure of claim 1.
- 9. A furniture item comprising the furniture support structure of claim 1.
- 10. A device for adjusting the height of a furniture item, comprising: a hollow elongated metal tube having a first end and a second end, wherein the first end is crimped and comprises a hollow circular cross-section and wherein at least a portion of an inner surface of the hollow circular cross-sectional portion of the first end is threaded;

a threaded member coupled to the threaded hollow circular cross-sectional portion of the metal tube; wherein the threaded member can be rotated to adjust a distance from which the threaded member extends from the first end of the metal tube.

11. The device of claim 10, wherein the hollow elongated metal tube has a rectangular, a circular, or a polygonal cross-section.

12. The device of claim 10, wherein the hollow elongated metal tube is constructed from steel or aluminum.

13. The device of claim 10, wherein the hollow elongated metal tube has a metal thickness that is at least 120% of a depth of the threads on the inner surface of the hollow circular cross-sectional portion.

14. The device of claim 10, wherein a first end of the threaded member is externally threaded and a second end of the threaded member is coupled with a leveling device or a floor protector.

15. The device of claim 10, wherein a first end of the threaded member is externally threaded and comprises a leveling device or floor protector at a second end.

16. A bed support comprising the device of claim 10.

17. A furniture item comprising the device of claim 10.

18. A method for manufacturing a device for adjusting the height of a furniture item, comprising:

surrounding a hollow elongated metal tube with a plurality of hydraulic crimping jaws;

positioning a thread forming tap in the tube, wherein the thread forming tap has a cross-sectional area less than the cross-sectional area of the tube;

crimping at least a portion of a length of the tube around the thread forming tap with the hydraulic crimping jaws so as to fully form threads along at least a portion of an inner surface of the tube;

removing the thread forming tap; and releasing the hydraulic crimping jaws.

19. The method of claim 18, wherein the hollow elongated metal tube is constructed from steel or aluminum.

20. The method of claim 18, wherein the hollow elongated metal tube has a rectangular, a circular, or a polygonal cross section.

21. The method of claim 18, further comprising coupling an externally threaded member to the tube by rotating the externally threaded member relative to the threaded inner surface of the tube.

22. The method of claim 21, further comprising coupling the externally threaded member to a leveling device or a floor protector.

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