TORSION SPRING TRAMPOLINE

Applicant: Samuel Chen, Shanghai (CN)
Inventor: Samuel Chen, Shanghai (CN)

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ABSTRACT

A torsion spring trampoline has a frame having a horizontal frame member and vertical members. The trampoline also has a trampoline bed that users can jump on. A plurality of torsion springs connect the trampoline bed to the frame. The torsion springs have a coil allowing bending of the torsion springs inward toward a middle of the trampoline bed. The trampoline bed is in a loaded state. Torsion springs preferably have at least a first coil turn. Torsion springs may also have a second coil turn in addition to the first coil turn. Torsion springs may also have a third coil turn in addition to the second coil turn and in addition to the first coil turn. Torsion springs may also have a fourth coil turn in addition to the third coil turn, the second coil turn, and the first coil turn.
TORSION SPRING TRAMPOLINE

FIELD OF THE INVENTION

[0001] The present invention is in the field of trampolines.

DISCUSSION OF RELATED ART

[0002] Recreational trampolines have a variety of different configurations for the enclosure structure and the trampoline bed. Smaller trampolines have used elastic fabric for providing rebounding energy or helical springs. A plate spring trampoline has also been designed, as described in U.S. Pat. No. 6,837,828 entitled elasticity controllable trampoline using plate spring, issued Jun. 4, 2005. Traditionally, recreational backyard trampolines have used helical springs also called coil springs to store rebounding energy by connecting the helical springs between the frame and the trampoline bed. Other spring configurations have been devised such as U.S. Pat. No. 6,319,174 entitled Soft-Edged Recreational Trampoline by inventor Keith Vivian Alexander, issued Nov. 20, 2001, the disclosure of which is incorporated herein by reference, which discloses, "A trampoline which incorporates a flexible mat supported above a support frame by a number of spaced flexible rods; each rod is secured at one end to the mat and at the other end to the support frame." A variety of different trampoline configurations have various benefits and drawbacks.

SUMMARY OF THE INVENTION

[0003] A torsion spring trampoline has a frame having a horizontal frame member and supporting members that can be vertical members supporting the horizontal frame member. The trampoline also has a trampoline bed that users can jump on. A plurality of torsion springs connect the trampoline bed to the frame. The torsion springs have a coil allowing bending of the torsion springs inward toward a middle of the trampoline bed. The trampoline bed is in a loaded state. Torsion springs preferably have at least a first coil turn. Torsion springs may also have a second coil turn in addition to the first coil turn. Torsion springs may also have a third coil turn in addition to the second coil turn and in addition to the first coil turn. Torsion springs may also have a fourth coil turn in addition to the third coil turn, the second coil turn, and the first coil turn.

[0004] The spring lower portion is inserted into a frame opening formed on the horizontal frame member. Connectors connect the plurality of torsion springs to a periphery of the trampoline bed. The connectors can be elastomeric or plastic injection molded connectors. The connectors have a spring connector retaining edge or surface that retains to the periphery of the trampoline bed.

[0005] The torsion spring trampoline has a trampoline pad attached over at least a portion of the torsion springs. The torsion spring trampoline also has an enclosure having an enclosure net secured to enclosure poles. The enclosure has a strap connected to the enclosure net that secures the net to a strap connection on an enclosure pole. The enclosure net is secured to the enclosure pole between a net top edge and a net bottom edge. The enclosure has an enclosure net secured to enclosure poles such as by a zipper. A strap or more than one strap is connected to the enclosure net that secures the net to a strap connection on an enclosure pole. The net is secured to the enclosure pole between a net top edge and a net bottom edge. A fabric sheet flag panel can be connected to the enclosure net that secures the net to a sleeve connection on an enclosure pole. The net is secured to the enclosure pole between a net top edge and a net bottom edge.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIG. 1 is a cross section diagram of a torsion spring configuration with a grommet connection.

[0007] FIG. 2 is a cross section diagram of a torsion spring configuration with a lower connection.

[0008] FIG. 3 is a cross section diagram of a torsion spring configuration with a plug connection.

[0009] FIG. 4 is a cross section diagram of a torsion spring configuration with a double plug connection.

[0010] FIG. 5 is a cross section diagram of a flexible rod configuration during a non-loaded mode.

[0011] FIG. 6 is a cross section diagram of a flexible rod configuration during a loaded mode.

[0012] FIG. 7 is a top view of the torsion spring attachment also showing the cross section taken for FIG. 1 which is the same cross section taken as the other cross-sections FIGS. 2-6, 8.

[0013] FIG. 8 is a cross section diagram of a torsion spring configuration without loading.

[0014] FIG. 9 is a side view diagram of a torsion spring trampoline.

[0015] FIG. 10 is an exploded view diagram of a trampoline frame with an optional attached swingset, and also showing a perspective close-up view of a torsion spring.

[0016] FIG. 11 is a perspective view diagram of a torsion spring having two legs and a single coil.

[0017] FIG. 12 is a perspective view diagram of a torsion spring having four legs and a pair of coils.

[0018] FIG. 13 is a perspective view diagram of a torsion spring having four legs and a pair of coils.

[0019] FIG. 14 is a perspective view diagram of a torsion spring having four legs and a pair of coils.

[0020] The following call out list of elements can be a useful guide in referencing the elements of the drawings.

[0021] 10 Trampoline Frame

[0022] 16 Horizontal Frame Member

[0023] 18 Hollow

[0024] 20 Torsion Springs

[0025] 21 Top Bend

[0026] 22 Primary Spring Connector

[0027] 23 Spring Connector Retaining Edge

[0028] 24 Spring Upper Portion

[0029] 25 Spring Coil

[0030] 26 Threaded Connection

[0031] 27 Spring Lower Portion

[0032] 28 Nut

[0033] 29 Hook End

[0034] 30 Connector

[0035] 31 Grommet

[0036] 32 Bed Opening

[0037] 33 Bed Edge

[0038] 35 Hem Stitch

[0039] 36 Wire

[0040] 40 Trampoline Bed

[0041] 41 Trampoline Bed Periphery

[0042] 43 Bed Net Retainer

[0043] 44 Lower Connection

[0044] 50 Enclosure Pole

[0045] 51 Lower Middle Strap Connection

[0046] 52 Middle Middle Strap Connection
The present invention has a trampoline frame 10 having vertical frame members and also having horizontal frame members 16 made of tubular metal members welded together. The tubular metal members have a hollow 18 because they are made of steel tubes. The general frame structure can be made similar to other trampolines, such as seen in exploded view FIG. 10. The general frame structure can also be connected to auxiliary structures such as an attached swingset 130. A variety of different welding techniques can be used to join horizontal frame members to vertical frame members, such as the configuration described in U.S. Pat. No. 6,923,744 by inventor Samuel Chen entitled Trampoline System patented Aug. 2, 2005, the disclosure of which is incorporated herein by reference. Horizontal frame members 16 have apertures on a top surface of the horizontal frame members. The apertures can receive ends of springs.

A plurality of torsion springs 20 are used to connect the trampoline bed 40 to the horizontal frame members 16. The torsion springs generally have a spring coil 25 that faces inward. When a jumper is jumping on the trampoline bed 40, the torsion springs 20 bend at the spring coil 25. The jumping area is in the middle portion of the trampoline bed which is the inside direction. The periphery of the trampoline bed is the outside direction. The spring coil 25 can be a single turn, a double turn, a triple turn, a quadruple turn, or more than four turns. During use, the spring coil expands and contracts. The spring coil contracts in constriction to a smaller radius in a compressed position and expands in expansion to a larger radius at a neutral position. The spring coil 25 is preferably oriented to face toward the inside of the trampoline as seen in FIGS. 1, 3, 4, but can also be oriented to face outward as seen in FIG. 2. The spring coil 25 is generally cylindrical in shape with an axis that is generally parallel to horizontal frame members. The spring coil 25 is oriented to bias the trampoline bed upward.

The horizontal frame members 16 can form a circle or square as seen from a top view. The horizontal frame members are supported by the vertical frame members. The torsion springs 20 extend up from the horizontal frame members 16 to suspend a lower surface of the trampoline bed 40 above a level of the horizontal frame members. The trampoline bed 40 has a flat planar surface that is parallel and suspended above a plane that passes through the horizontal frame members. The torsion spring may generally have a top bend 21 at an obtuse angle.

The connector 30 includes a primary spring connector 22 and also possibly a secondary spring connector 71 as seen in FIG. 4. The primary spring connector 22 can be formed of a plastic plug molded around a spring upper portion 24. Alternatively, the spring upper portion 24 can be inserted into a molded primary spring connector 22 with the hook end 29 snapping into the primary spring connector 22 using manual snap fit insertion. The primary spring connector 22 can be inserted into a bed opening 32 which is an aperture formed in the trampoline bed 40. The trampoline bed is preferably a heavy fabric that provides rebounding force to a user. The primary spring connector 22 also may include a spring connector retaining edge 23 that is formed as a notch or an indentation to secure to a grommet 31 or a wire 36 that is mounted to the trampoline bed.

FIG. 1 shows the primary spring connector 22 fitting on a grommet that is mounted to the trampoline bed periphery 41. FIG. 4 shows the primary spring connector 22 reinforced by a secondary spring connector that connects to the primary spring connector. The primary and secondary spring connectors can be snapped together or screwed together.

FIG. 2 shows that the primary spring connector 22 can also be secured to an underside of a bed net retainer 43 at a lower connection 44. The primary spring connector can have a top flat surface that can be stitched or thermally laminated to the bed net retainer 43. The bed net retainer 43 can be a less flexible area of the trampoline bed periphery 41. FIG. 1 shows that the wire is a reinforcing wire that can be formed to the bed net retainer 43 such as by wrapping a bed edge around and over the wire 36 and then stitching the edge at a hem stitch 35.

The spring upper portion 24 preferably terminates at a hook end 29. The hook end 29 can be inserted into the primary spring connector 22 as a snap in construction method, or the hook end 29 can be integrally molded to the primary spring connector 22. The trampoline bed periphery 41 terminates at a bed edge 33. A wire 36 preferably passes around the circumference of the trampoline bed near the bed edge for additional support if necessary. As seen in FIGS. 4, 5, and 6, the hook end 29 can be formed as a through grommet hook 81 where the through grommet hook hooks onto the grommet instead of being encapsulated within the primary spring connector 22. The through grommet hook passes through the grommet.

The torsion spring 20 also includes a spring lower portion 27 extending downwardly from the spring coil 25 toward the horizontal frame member 16. The spring lower portion 27 passes through a frame opening 82 that can be drilled or otherwise formed through a top surface of the horizontal frame member 16. The frame opening 82 is preferably of the same size as the spring lower portion 27 and having the same cross section. The spring lower portion 27 passes through the horizontal frame member 16 and can be secured by a threaded connection 26 formed on the spring lower portion 27. A nut 28 or other type of hardware securing means can be used for securing to the threaded connection 26 against an outside surface of the horizontal frame member.
Other hardware securing means can be used for securing the spring lower portion 27 to the horizontal frame member 16. For example, the spring lower portion 27 can be set in a depression formed on an inside surface of the horizontal frame member 16. As seen in FIG. 2, a nut can be welded to the spring lower portion 27 so that the nut supports the spring lower portion 27, while another nut secures a lower tip of the spring lower portion 27.

As seen in FIG. 4, the torsion springs 20 may have a pad 70 that provides cushioning. A spring pad 72 can cover the spring portion of the trampoline bed edge and a bed pad 73 can cover a peripheral portion of the bed including the connector 30. The spring pad 72 and the bed pad 73 can be connected at a pad connection 74.

As seen in FIGS. 5, 6, it may be possible to use a rod spring 80 that bends inward, as seen in FIG. 6, instead of a torsion spring that also bends inward. A torsion spring is preferred over the rod spring because the spring coil 25 of the torsion spring provides smoother motion and the spring coil 25 would be absent on a rod spring. The rod spring 80 could also be installed through the frame opening 82 of the horizontal frame member 16. The rod spring 80 may also have a through grommet hook 81 for connecting to a trampoline bed.

As seen in FIG. 7, a top view of the trampoline frame to trampoline bed connection shows that the spring coil 25 can be a single turn coil, a double turn coil, a triple turn coil, or a quadruple turn coil. The single turn coil is a first coil turn and the double turn coil provides a second coil turn in addition to the first coil. The triple turn coil provides a third coil turn in addition to the first and second coil turn. The quadruple turn coil provides a fourth coil turn in addition to the first, second and third coil turn. Each coil turn is at least a 360° turn of the spring coil 25.

The coil orientation of the torsion springs is toward the center of the trampoline bed. As a user jumps on the trampoline bed, the coils of the torsion spring retain and release potential energy.

The torsion spring connections shown in FIGS. 1, 2, 3, 4, and 8 are different configurations for the connector 30. These different configurations could be used in a mixed fashion on the same trampoline with different spring constants, however this is not preferred. Also, the torsion spring can be mixed with the rod spring on the same trampoline, however this is also not preferred.

As seen in FIG. 8, the neutral position of the torsion spring can be generally vertical, but bending inward due to the tension provided by the trampoline bed. The connector 30 can be a flexible connection with slack to allow some shock attenuation with free range of motion.

As seen in FIG. 9, enclosure poles 50 can be placed on a periphery so as to provide a structure for the enclosure net 60. The enclosure net 60 is secured to the enclosure poles 50. The enclosure poles 50 are preferably rigid to prevent a user from hitting the ground, but can also be made flexible. It is preferred that the enclosure poles are substantially inflexible at their top ends, but in certain circumstances, the enclosure poles can be made flexible as well. When made inflexible, the poles should be made of tube steel and if made to be flexible the poles should be made of fiberglass rods. The enclosure poles are connected to each other at a top net retainer 54 that can be formed as a metal flexible ring made of steel such that it is flexible steel. Steel flexibility of the top ring top net retainer allows suspension of the enclosure net 60 from the top net retainer 54 that is shaped as a steel and flexible ring. The enclosure poles 50 are connected to the trampoline frame at an enclosure pole base 57.

The net can be secured to the enclosure pole 50 at various locations besides the top net retainer 54. The net can be secured to the enclosure pole at a net bottom edge 66 that is connected to the bed net connection 56. The bed net connection 56 can be made by machine stitching, or hand sewing the net to the connectors 30. Cord can be used for tying the net to the trampoline bed periphery. The net bottom edge 66 can have a zipper that zips to the periphery of the trampoline bed.

Additionally, for side connection of the net, a lower middle strap 61 of the net can connect to a lower middle strap connection 51 on the enclosure pole 50. Preferably, a middle middle strap 62 connected to the net can be secured to the middle middle strap connection on the enclosure pole 50. Preferably, an upper middle strap connection 53 on the enclosure pole retains an upper middle strap 63. Thus, the net can be secured at a top ring, at three middle straps, and at a net bottom edge 66 for a total of five securing points. The net can be secured to the enclosure pole at a flat flag panel 65. The flag panel 65 can be formed of fabric and is preferably a sheet of fabric. The flag panel provides a continuous linear vertical connection on a segment of the net between the net and the enclosure pole. The flag panel 65 connects to a sleeve retainer 55 that fits over the enclosure pole like a sleeve. The sleeve can be zipped to the enclosure pole with a heavy-duty zipper. The flag panel 65 optionally also includes a flag panel opening 67 that can be used for placement of decorative logos or installation of other structures such as warning labels. The flag panel preferably retains the flexible net toward the rigid enclosure pole.

The entrance 68 is preferably formed on a side of the net to allow entrance of users. The entrance can be parabolic shaped door, rectangular shaped door or a vertical zipper door configuration. The bottom of the entrance is preferably connected to the periphery of the trampoline bed as well.

A torsion spring by definition requires a coil and at least an upper leg and a lower leg. The lower leg is anchored to the horizontal frame member and the upper leg is mounted to the trampoline bed. As seen in FIG. 11, a torsion spring can have two legs and a single coil that has ends not yet bent to connect to a connector. The first leg is an upper portion and the second leg is a lower portion. The lower portion can be inserted into an aperture of the horizontal frame member. The coil shown in FIG. 11 has about four turns, however the coil can have one turn, two turns, three turns, or more than four turns. The height of the coil should be at least several inches so that the suspension of the trampoline bed would be several inches above the horizontal frame member.

As seen in FIG. 12, the torsion spring used on the present invention trampoline can have more than one coil and legs can be connected together as a loop for additional stability or for decreasing number of parts required. The torsion spring of FIG. 12 shows a left coil having a left top leg and a left bottom leg. The right coil has a right top leg and a right bottom leg. The right top leg is connected to the left top leg and the right bottom leg is connected to the left bottom leg. The left top leg extends from the left side of the left coil and the right top leg extends from the left side of the right coil, however it is also possible to have the left top leg extension of the right side of the left coil or to have the right top leg extension of the right side of the right coil. Similarly, the right bottom leg extends from the right side of the right coil, and the
left bottom leg extends from the right side of the left coil, however the right bottom leg could also extend from the left side of the left coil, and the left bottom leg could also extend from the left side of the left coil. During fabrication, the spring coil leg ends may be bent to secure to a connector.

As seen in FIG. 13, a torsion spring can have more than one coil with bottom legs connected together as a loop for additional stability, but with top legs free for inserting into circular or slot apertures of a top surface of a horizontal frame member. As seen in FIG. 14, a torsion spring can have more than one coil with top legs connected together as a loop for additional stability, but with bottom legs free for inserting into circular or slot apertures of a top surface of a horizontal frame member. If the bottom lines of the torsion spring were connected, a slot aperture on the horizontal frame member may be required. Rod springs do not have a coil and only have a single shaft that is anchored to the horizontal frame member at a lower end and connected to the trampoline bed at an upper end. Although it is possible to make the present invention with rod springs, it is not preferred because the coil likely improves dynamic performance.

Although the invention has been disclosed in detail with reference only to the preferred embodiments, those skilled in the art will appreciate that various other embodiments can be provided without departing from the scope of the invention. For example, the enclosure poles can be formed into arches as seen in FIG. 10. Accordingly, the invention is defined only by the claims set forth below.

1. A torsion spring trampoline comprising:
   a. a frame having a horizontal frame member;
   b. a trampoline bed;
   c. a plurality of torsion springs connecting the trampoline bed to the frame, wherein the torsion springs have a coil allowing bending of the torsion springs inward toward a middle of the trampoline bed, when the trampoline bed is in a loaded state.
   2. The torsion spring trampoline of claim 1, wherein plurality of torsion springs have a first coil turn.
   3. The torsion spring trampoline of claim 2, wherein plurality of torsion springs have a second coil turn in addition to the first coil turn.
   4. The torsion spring trampoline of claim 3, wherein plurality of torsion springs have a third coil turn in addition to the second coil turn and in addition to the first coil turn.
   5. The torsion spring trampoline of claim 4, wherein plurality of torsion springs have a fourth coil turn in addition to the third coil turn, the second coil turn, and the first coil turn.
   6. The torsion spring trampoline of claim 1, wherein the spring lower portion is inserted into a frame opening formed on the horizontal frame member.

7. The torsion spring trampoline of claim 6, further comprising connectors connecting the plurality of torsion springs to a periphery of the trampoline bed.
8. The torsion spring trampoline of claim 7, wherein the connectors have a spring connector retaining edge that retains to the periphery of the trampoline bed.
9. The torsion spring trampoline of claim 6, further comprising a trampoline pad attached over at least a portion of the torsion springs.
10. The torsion spring trampoline of claim 6, further comprising an enclosure having an enclosure net secured to enclosure poles, wherein a strap is connected to the enclosure net that secures the net to a strap connection on an enclosure pole, wherein the net is secured to the enclosure pole between a net top edge and a net bottom edge.
11. The torsion spring trampoline of claim 6, further comprising an enclosure having an enclosure net secured to enclosure poles, wherein a strap is connected to the enclosure net that secures the net to a strap connection on an enclosure pole, wherein the net is secured to the enclosure pole between a net top edge and a net bottom edge.
12. The torsion spring trampoline of claim 6, further comprising an enclosure having an enclosure net secured to enclosure poles, wherein a flag panel is connected to the enclosure net that secures the net to a sleeve connection on an enclosure pole, wherein the net is secured to the enclosure pole between a net top edge and a net bottom edge.
13. A rod spring trampoline comprising:
   a. a frame;
   b. a trampoline bed;
   c. a plurality of flexible rods connecting the trampoline bed to the frame.
14. The torsion spring trampoline of claim 13, wherein the spring lower portion is inserted into a frame opening formed on the horizontal frame member.
15. The torsion spring trampoline of claim 14, further comprising connectors connecting the plurality of torsion springs to a periphery of the trampoline bed.
16. The torsion spring trampoline of claim 14, wherein the connectors have a spring connector retaining edge that retains to the periphery of the trampoline bed.
17. The torsion spring trampoline of claim 16, further comprising a trampoline pad attached over at least a portion of the torsion springs.
18. The torsion spring trampoline of claim 16, further comprising an enclosure having an enclosure net secured to enclosure poles, wherein a strap is connected to the enclosure net that secures the net to a strap connection on an enclosure pole, wherein the net is secured to the enclosure pole between a net top edge and a net bottom edge.

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