STABILIZATION MECHANISM FOR POOL WITH MOVABLE COVER

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ABSTRACT
A locking system for securing a cover that moves within a hole between a lowered position and a raised position is disclosed. The locking system includes one or more locking mechanisms. Each locking mechanism includes an upper leg and a lower leg, each upper leg and the lower leg having a proximal end and a distal end. Each locking mechanism further includes a first joint that joins the upper leg near the respective distal ends of the upper leg and the lower leg, the first joint allowing planar rotational motion of the upper leg relative to the lower leg between a minimum folded angle in the lowered position and a maximum unfolded angle in the raised position. Each locking mechanism further includes a second joint to flexibly attach the distal end of the upper leg on the bottom side of the cover to allow planar rotational motion of the upper leg relative to the cover, and a third joint to flexibly attach the distal end of the lower leg to an attachment disposed on the bottom of the hole.
STABILIZATION MECHANISM FOR POOL
WITH MOVABLE COVER

CROSS REFERENCE TO RELATED APPLICATION


BACKGROUND

[0002] Humans have enjoyed swimming pools for hundreds, if not thousands, of years. Most pools are formed of a container having at least a sloping bottom, or a flattened bottom and side walls. Some modern pools that have a movable bottom that can be moved up or down to adjust the depth of the pool. These pools rely on track mechanisms, usually positioned at peripheral edges of the bottom coincident to the side walls.

[0003] Now, a new breed of swimming pool has recently been introduced that includes a hydraulically-operated, vertically-moving retractable cover. In the fully raised position, the pool cover completely covers the water and forms a deck on which people can sit, walk or play. In a lowered position, i.e. at a position anywhere between the fully raised position and a fully lowered, the cover acts as a bottom of the pool at a desired depth. The covers of these types of pools are raised and lowered primarily by means of a single hydraulic cylinder or other single hydraulic element, which is usually coupled to the center of the underside of the cover.

[0004] These pools with movable, retractable covers have safety and stability requirements not present with conventional pools. For example, there is a general OSHA requirement to lock-out/tag-out heavy equipment during service (i.e. disabling the machine from running), and in cases where a person can get into the mechanism, the mechanism needs to be mechanically prevented from moving. Also, in the event of a hydraulic failure, the retractable cover, and any weight or potential live loads exerted on it, needs mechanical support.

SUMMARY

[0005] This document describes a stabilization mechanism, including one or more locking legs, for adding stability and safety to a movable cover for a pool.

[0006] The details of one or more embodiments are set forth in the accompanying drawings and the description below. Other features and advantages will be apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] These and other aspects will now be described in detail with reference to the following drawings.

[0008] FIG. 1 is an isometric diagram showing a collapsible support.

[0009] FIG. 2 shows a collapsible support being collapsed or retracted.

[0010] FIG. 3 is a schematic diagram of a portion of the collapsible support shown in FIG. 1.

[0011] FIG. 4 shows a variation of the collapsible support in which the upper leg has a feature that allows an extendable member to slidably attach to a slot or groove.

[0012] FIG. 5 shows the collapsible support of FIG. 4 being lowered.

[0013] FIG. 6 shows yet another variation of a collapsible support.

[0014] FIG. 7 shows two positions of another variation of a collapsible support without extendable member.

[0015] FIG. 8 illustrates a system that uses air to raise and lower a cover.

[0016] FIG. 9 shows the use of compressed air to move the extendable member.

[0017] FIG. 10 shows an alternative implementation of a collapsible support in which the leg hyper-extends about an articulation point.

[0018] FIG. 11 is a more detailed view of the support in the locked position.

[0019] FIG. 12 illustrates a pool with movable cover for which a collapsible support can desirably be used.

[0020] Like reference symbols in the various drawings indicate like elements.

DETAILED DESCRIPTION

[0021] The subject matter disclosed herein relates to retractable, lockable covers for pools or other openings. The currently disclosed subject matter can provide, among other potential benefits, apparatus, systems, methods, techniques and/or articles of manufacture that can be used in conjunction with a cover for a pool or other opening. The cover can be raised and lowered in the opening such that when the cover is in its fully raised position, it can support substantial weight.

[0022] As shown in FIG. 12, a cover 6 can have a top side and a bottom side and can be moveable between a lowered position and a raised position in a hole 1 that comprises an upper rim, a bottom 5, and one or more sidewalls connecting the bottom and the upper rim. The cover 6 can be connected to a cylinder 3 or other type of moving mechanism to move the cover 6. The cylinder 3 can be hydraulically or pneumatically moved to retract into or extend from a receiving cavity 2, and held in place by collar or gasket 4. The hole 1 can in some variations be a pool such as a swimming pool, but the current subject matter can be adapted to provide a retractable, lockable cover for any number of holes or openings, either in the ground, or as part of an above-ground structure. In the example where the hole 1 is a pool such as a swimming pool, the cover can be a pool cover.

[0023] One or more supports, in the form of collapsible structures, can be included as part of the apparatus supporting the cover 6. These supports enable the cylinder 3 to be reduced in size, since load can be redistributed to the supports. The supports also act as a mechanical stop for the maximum height of the cover in the raised position, and prevent rotation of the cover within the hole. The supports can be adapted to lock the cover height at any level, and the positioning of the support minimizes damage to the rest of the structure in the event of a support malfunction. The supports eliminate teeter-totter about the main cylinder and eliminate cantilever effects on other supports.

[0024] Each such support can include an upper leg and a lower leg, each having a proximal end and a distal end. A first joint that joins the upper leg and the lower leg can be provided near the respective distal ends of the upper leg and the lower leg. The first joint can allow planar rotational motion of the
upper leg relative to the lower leg between a minimum folded angle and a maximum unfolded angle of less than approximately 180 degrees. Alternatively first joint can allow planar rotational motion of the upper leg relative to the lower leg between a minimum folded angle and a maximum unfolded angle of greater than approximately 180 degrees, to "lock in" the support in a hyper-extended position. A second joint can flexibly attach the distal end of the upper leg on the bottom side of the pool cover, or to any member extending from the bottom side of the cover, and thereby allow planar rotational motion of the upper leg relative to the cover. A third joint can flexibly attach the distal end of the lower leg to an attachment disposed on one of the one or more side walls or on the bottom of the hole. An extendable mechanism can be included that provides a force on the upper leg that extends the first joint until the maximum unfolded angle is reached and the pool cover is elevated to the raised position. The collapsible structure can bear the weight of the cover when the first joint is at its maximum unfolded angle. As the cover moves toward the raised position, the supports straighten out and increase in strength and stability.

Each leg of the support can be formed of a rigid material such as stainless steel, aluminum, carbon fiber composite material, or any other rigid material. Preferably, the material is accommodative to a water environment.

In optional variations of the subject matter described herein, the pool cover can be disposed approximately level with the upper rim of the hole when the cover is in the raised position. Additionally, the cover need not comprise a locking mechanism to lock the cover to the sidewalk when the cover is in the raised position. The extendable mechanism can optionally include a piston with a cross-sectional shape and a piston case comprising a cavity having the same cross-sectional shape as the piston and a fluid inlet to the cavity that permits fluid to be forced into the cavity or released therefrom. Forcing fluid into the cavity via the fluid inlet can cause the piston to extend out of the cavity and allowing fluid to escape from the cavity via the fluid inlet can cause the piston to retract into the cavity, thereby facilitating raising and lowering, respectively, of the cover.

The subject matter can also be implemented as an apparatus that includes an upper leg and a lower leg, each with a proximal end and a distal end. A first joint joining the upper leg and the lower leg near their respective distal ends and allowing planar rotational motion of the upper leg relative to the lower leg between a minimum folded angle and a maximum unfolded angle of less than approximately 180 degrees can be included, as can a second joint flexibly attaching the distal end of the upper leg on the bottom side of a cover and allowing planar rotational motion of the upper leg relative to the cover and a third joint flexibly attaching the distal end of the lower leg to an attachment disposed on a sidewalk or a bottom of a hole. An extendable mechanism that provides a force on the upper leg to extend the first joint until the maximum unfolded angle is reached and the cover is elevated to a raised position can be included such that the collapsible structure is capable of bearing the weight of the cover when the first joint is at its maximum unfolded angle.

In another implementation, a method of raising a lowering a cover disposed in a hole can include providing a force on an upper leg of a collapsible structure that extends a first joint. The first joint can join the upper leg and a lower leg near respective distal ends of the upper and lower legs and also allow planar rotational motion of the upper leg relative to the lower leg between a minimum folded angle and a maximum unfolded angle of less than approximately 180 degrees. A distal end of the upper leg can be flexibly attached by a second joint to a bottom side of the cover and a distal end of the lower leg can be flexibly attached to an attachment disposed on a sidewalk or on a bottom of the hole. The cover can be elevated to a raised position such that the collapsible structure bears the weight of the cover when the first joint is at its maximum unfolded angle. By reducing the force on the upper leg, the angle defined by the first joint and the second joint can be decreased from the maximum unfolded angle, thereby lowering the cover from the raised position.

FIG. 1 is an isometric diagram showing a collapsible support 100 that can be used in conjunction with a retractable, locking cover of a pool or other type of hole. As shown, in some examples, the support 100 can include an upper leg 102 and a lower leg 104, each having a proximal end and a distal end. The support 100 can further include a first joint 106 that is a hinge and also an extendable member 108 that causes the first joint 106 to expand to its maximum angle as the extendable member 108 extends. As the extendable member 108 retracts, the collapsible support 100 folds about the first joint 106, thereby causing a cover 110 mounted on top of the collapsible structure to be lowered toward a bottom 112 as shown in FIG. 2.

FIG. 3 is a schematic diagram of a portion of the collapsible support 100 along with a cover 120, and also showing the fully raised and fully lowered positions of the collapsible support 100. FIG. 4 shows a variation of the collapsible support in which the upper leg has a feature that allows an extendable member to slidably attach to a slot or groove 132 in the upper leg such that extension of the extendable member causes the attachment point of the extendable member to the upper leg to move as the collapsible support is raised. This variation is also shown in FIG. 5 as the collapsible support is being lowered. FIG. 6 shows yet another variation of the collapsible support, in which a slot or groove 140 is connected to a stability leg 142.

FIG. 7 shows two positions of another variation of a collapsible support 150, in which no extendable member is included, and which can lock into place in a fully raised position. As in the device of FIG. 1 and FIG. 2, the collapsible support of FIG. 7 can fully support the cover when it is in the fully raised position. The distal end of the upper leg can be attached to some form of raising or lowering mechanism that can provide a force necessary to lift and drop the cover in the hole. Alternatively, the force needed to raise the cover can be provided by one or more flotation tanks 160 that can be filled with air supplied by an outside source 162 such as a tank or a pump, as shown schematically in FIG. 8. The extendable members shown in FIG. 1, FIG. 2 and discussed elsewhere herein can optionally be operated via a source of compressed air 164 as shown schematically in FIG. 9. Other means of extending and/or retracting the extendable supports are possible. The extendable supports need not be pneumatic in nature, as screw-operated devices or other mechanisms for extending a supporting brace can be incorporated based on the teachings provided herein.

FIG. 10 shows an alternative implementation of a collapsible support 200, which functions as a locking leg in which the leg hyper-extends about an articulation point for added stability. FIG. 11 is a more detailed view of just the leg in the locked position.
In this alternative implementation, each support 200 can include an upper leg 202 and a lower leg 204, each having a proximal end and a distal end. A first joint 206, or articulation point, that joins the upper leg 202 and the lower leg 204 can be provided near the respective distal ends of the upper leg 202 and the lower leg 204. The first joint 206 can allow planar rotational motion of the upper leg 202 relative to the lower leg 204 between a minimum folded angle and a maximum unfolded angle of greater than approximately 180 degrees, to “lock in” the support 200 in a hyper-extended position. A second joint 208 can flexibly attach the distal end of the upper leg 202 on the bottom side of a pool cover 201, or any member extending therefrom, and thereby allow planar rotational motion of the upper leg 202 relative to the cover 201. A third joint 210 can flexibly attach the distal end of the lower leg 204 to an attachment disposed on one of the one or more sidewalls or on the bottom 203 of the hole. An extendable mechanism 212 can be included that provides a force on the lower leg 204 that locks the first joint 206 into the hyper-extended position until the maximum unfolded angle is reached and the pool cover 201 is elevated to the raised position. The collapsible support 200 can bear the weight of the cover 201 when the first joint 206 is slightly hyper-extended and at its maximum unfolded angle. In alternative implementations, the extendable mechanism 212 can be attached between the cover 201 and the upper leg 202.

The support can have a simple locking mechanism. The support 200, which may collapse such that the upper leg 202 and lower leg 204 form an acute angle, i.e. may be ‘straightened’ slightly past 180 degrees, at which point there is a rigid stop that prevents the first joint 206 or hinge from rotating further. The support 200, in this full ‘straight’ position can be put under compression without the legs 202, 204 buckling at the first joint 206. In some implementations, the extendable mechanism 212 pulls the leg into this ‘straight’ position, and then the weight of the cover is set on the support 200. The weight of the cover locks the legs into place, as the legs will try to buckle, but a hinge used for the first joint 206 will resist such buckling.

The extendible mechanism 212 may be an actuator, for example, a hydraulic actuator, and can be connected to either the upper leg 202 or lower leg 204 to provide force to collapse or straighten the support 200. The other end of the actuator (assuming the actuator operates in a linear fashion) can be connected to the underside of the cover 201, or the bottom 203, or even to the side of the hole. In one preferred implementation, the actuator is connected to the lower leg 204, with the other end of the actuator connected to the pool bottom 203, near the main hydraulic cylinder, via a hinge. Rotary actuators, or other actuators, may be used to apply force to the leg assembly.

Using one or more supports 200 with a movable cover in a pool or hole helps to prevent rotation (yaw) of the cover 201 with respect to the pool shell throughout the motion range, and it eliminates any requirement for an unusual shaped (non-round) cylinder ram. Any number of supports can be used. In some implementations, the bottom connection point of the support 200 is further from the center than the top connection point, forming a tripod when the support 200 is extended and locked.

The legs 202 and 204 are rigid and resist twisting, even in a bent or collapsed position, further assisting rotational stiffness of the cover 201. In the locked position, the legs 202, 204 make the cover more rigid to vertical deflection.

In a specific alternative, the connection point between each support 200 and the cover 201 is approximately 2-3 feet from the center of the cover. When a multiplicity of supports 200 is used, the wide spacing between the supports 200 helps stability.

Although a few variations have been described in detail above, other modifications are possible. Other embodiments may be within the scope of the following claim.

What is claimed:
1. A locking system for a cover that is moveable between a lowered position and a raised position in a hole that comprises an upper rim, a bottom, and one or more sidewalls connecting the bottom and the upper rim, the locking system comprising: one or more locking mechanisms, each locking mechanism including:
   - an upper leg and a lower leg, each upper leg and the lower leg having a proximal end and a distal end;
   - a first joint that joins the upper leg near the respective distal ends of the upper leg and the lower leg, the first joint allowing planar rotational motion of the upper leg relative to the lower leg between a minimum folded angle in the lowered position and a maximum unfolded angle in the raised position;
   - a second joint to flexibly attach the distal end of the upper leg on the bottom side of the cover to allow planar rotational motion of the upper leg relative to the cover;
   - and a third joint to flexibly attach the distal end of the lower leg to an attachment disposed on the bottom of the hole.
2. The locking system in accordance with claim 1, further comprising an extendable mechanism that provides a force on the lower leg that extends the first joint until the maximum unfolded angle is reached and the cover is elevated to the raised position.
3. The locking system in accordance with claim 1, further comprising an extendable mechanism that provides a force on the upper leg that extends the first joint until the maximum unfolded angle is reached and the cover is elevated to the raised position.
4. The locking system in accordance with claim 2, wherein the maximum unfolded angle is greater than 180 degrees.
5. The locking system in accordance with claim 2, wherein the extendable mechanism includes an actuator.
6. The locking system in accordance with claim 5, wherein the hole is a pool filled with water, and wherein the actuator is a hydraulic actuator that utilizes water from the pool.
7. A pool, comprising:
   - a hole having an upper rim, a bottom, and one or more sidewalls connecting the bottom and the upper rim;
   - a cover sized to fit within the upper rim and that is moveable between a lowered position and a raised position in the hole;
   - a locking system for securing the cover in the raised position, the locking system comprising one or more locking mechanisms, each locking mechanism including:
     - an upper leg and a lower leg, each upper leg and the lower leg having a proximal end and a distal end;
     - a first joint that joins the upper leg near the respective distal ends of the upper leg and the lower leg, the first joint allowing planar rotational motion of the upper leg relative to the lower leg between a minimum folded angle in the lowered position and a maximum unfolded angle in the raised position;
a second joint to flexibly attach the distal end of the upper leg on the bottom side of the cover to allow planar rotational motion of the upper leg relative to the cover; and; and
a third joint to flexibly attach the distal end of the lower leg to an attachment disposed on the bottom of the hole.

8. The pool in accordance with claim 7, further comprising an extendable mechanism that provides a force on the lower leg that extends the first joint until the maximum unfolded angle is reached and the cover is elevated to the raised position.

9. The pool in accordance with claim 7, further comprising an extendable mechanism that provided a force on the upper leg that extends the first joint until the maximum unfolded angle is reached and the cover is elevated to the raised position.

10. The pool in accordance with claim 8, wherein the maximum unfolded angle is greater than 180 degrees.

11. The pool in accordance with claim 8, wherein the extendable mechanism includes an actuator.

12. The pool in accordance with claim 11, wherein the hole is a pool filled with water, and wherein the actuator is a hydraulic actuator that utilizes water from the pool.

13. The pool in accordance with claim 7, wherein the locking system includes three locking mechanisms equally spaced in the hole about the cover.

14. A locking system for securing a cover in a raised position, where the cover moves from a lowered position to a raised position within a hole having an upper rim, a bottom, and one or more sidewalls connecting the bottom and the upper rim, the locking system comprising:

three locking mechanisms equally spaced about a bottom side of the cover, each locking mechanism comprising an upper leg and a lower leg, each upper leg and the lower leg having a proximal end and a distal end;
a first joint that joins the upper leg near the respective distal ends of the upper leg and the lower leg, the first joint allowing planar rotational motion of the upper leg relative to the lower leg between a minimum folded angle in the lowered position and a maximum unfolded angle of greater than 180 degrees in the raised position;
a second joint to flexibly attach the distal end of the upper leg on the bottom side of the cover to allow planar rotational motion of the upper leg relative to the cover; and;
a third joint to flexibly attach the distal end of the lower leg to an attachment disposed on the bottom of the hole; and
an extendable mechanism connected between the bottom and the lower leg that provides a force on the lower leg that extends the first joint until the maximum unfolded angle is reached and the cover is elevated to the raised position.

15. The locking system in accordance with claim 14, wherein the extendable mechanism includes an actuator.

16. The locking system in accordance with claim 14, wherein the hole is a pool filled with water, and wherein the actuator is a hydraulic actuator that utilizes water from the pool.