The present invention provides a novel system and method of covering a pool and making the pool invisible. The present system comprises a flat board and at least one lifting device. The board has sufficient size for covering the pool and is made of rigid materials so as to be able to bear heavy weight. The lifting device includes two parts: a movable part and a fixed part. The one part of the lifting device is fixed on the ground or somewhere in a building near the pool, and another part is joined to the covering board. The lifting device can vertically move the horizontal covering board upward or downward and keep the covering board always horizontal. When want to swim, the users only lift up the covering board, and when want to BBQ, they only lower the covering board to cover the pool. Once the covering board reaches the top of the pool wall, the pool becomes hidden and invisible. The users can do some activities and put something on it even on the lifted covering board as on the floor or on the ground. This expands actually their living space.
SYSTEM AND METHOD OF MAKING A POOL INVISIBLE.

[0001] This invention uses the transmission of my provisional patent application, No. 62/371,732, Filed on Aug. 6, 2016.

TECHNICAL FIELD

[0002] The present invention is related to a home pool, especially to the cover of the pool.

BACKGROUND OF THE INVENTION

[0003] There are some covers of the pool for sale in the market now. Most of these covers are made of flexible materials such as plastic fabric and canvas. The main function of the cover is to prevent water from evaporating and children and pets from falling into the water. The flexible materials can’t be rigid and are not strong enough for the human activities on their surface although some materials are firmer. Some of the pool covers have a driving device such as a winder and a folder that can drive the cover. The driving device can roll up or fold up the flexible cover and enable the cover to move horizontally for opening or closing the pool.

[0004] Let us see the use of another kind of equipment being seemingly irrelevant to the above cover. That is a lifting device. The commonest lifting device is just a lifter. The lifter can lift people and objects from the ground to the higher floor. Let us see more: In a warehouse workers use a forklift to lift goods from the ground to a higher shelf. In a building site workers use a crane to lift building materials such as floorboards to an appointed position. In a hall a worker stands a platform supported by the lifting devices for installing a ceiling lamp. In a harbor a gantry crane lifts containers. At a theatre artists use the lifting platform to move scenery and actors to a designated position.

[0005] The lifting device mentioned above can have various structures and is made of different materials, but they have a common function, i.e., lifting people and objects to a predetermined position. Most of the lifting devices have a load-bearing base, such as the floor of the cage of the lifter, the fork of the forklift, the platform of the lifting device stated above. The load-bearing base is used to load the people and objects so as to lift or lower them to expected position. In sum, the lifting devices of prior arts all are used in the lifting field for many years.

[0006] Now, if we change our way of thinking to expend the use of the lifting device, such as, making the load-bearing base of the lifting device be not only a loading platform but also a rigid cover of covering something, and enabling the lifting device not only to lift the people and objects but also to perform the control task of covering something. What new and unexpected result will happen? The present system and method is that using lifting technique improves the existing pool cover. The present invention will create a new industry and a new product to meet the people’s long-felt need.

Objects and Advantages

[0007] 1. The present invention provides a novel system and method of covering a pool and making the pool invisible. The present system comprises a large flat board and at least one lifting device. The board is made of rigid materials so as to be able to accommodate use by a human being for standing, walking, working, and putting something on it and has sufficient size for covering the pool. The lifting device includes two parts: a movable part and a fixed part. The one part of them is fixed on the ground or somewhere in a building near the pool, and another part is joined to the covering board. The present invention combines the covering board with the lifting device(s) to form a whole system. The lifting device can vertically move the horizontal covering board upward or downward and keep the covering board always horizontal. The present invention changes the material used in the pool cover from the conventional flexible materials to the rigid material. The rigid material, such as the steel, replaces the conventional winding and folding machines with the lifting device to change the way of opening and closing the pool from the existing horizontal moving way to the vertically lifting way. So, the covering board has double uses, that is, it not only can cover the pool but also can lift the people and objects.

[0008] 2. Because the existing cover is flexible, it can’t bear heavy weight and isn’t suitable for walking or working on it. While the present invention uses the covering board of rigid materials, and the covering board can bear heavy weight like a floor. So, the human being can stand, walk, work, putting something, and BBQ on it as on the floor or on the ground. Everybody wants a pool at their homes, but it is difficult to accomplish the dream for many families because their yards are too small. To dig the pool out must occupy quite a lot of ground so that there isn’t more space for usual activities in their yard. But right now, using the present system and method, even if their backyard is very small, they can build a pool approximating the backyard in size. When want to swim they only lift up the board to open the pool, and when want to BBQ, only lower the covering board to cover the pool, and the pool becomes hidden and invisible. This expands actually the size of their backyard, that is, buying such a covering system is equal to buying a piece of land. The present system solved people’s long-felt need.

[0009] 3. Because the existing flexible cover moves horizontally on the surface of the pool and be finally rolled up or folded up when opening the pool, nothing may be on it. If any, it has to be removed from the flexible cover before opening the pool. While the present system and method can always keep the rigid covering board horizontal and enable the covering board to move vertically upward or downward, one can put something such as a table, a chair, a TV set, a sofa or a BBQ oven on the rigid covering board and needn’t remove them when opening the pool. This is obviously superior to the flexible cover of the prior arts. The present invention not only aids the users out of trouble of removing those things, but also saves the space of putting the removed things on the ground.

[0010] 4. Because of the above structural features of the present system the users can even build the pool inside their house if they have no backyard. They may build their indoor pool in their family room or garage. On the first floor of an apartment they can do so. If have a duplex, even if it is on the high floor, they can build their indoor pool in a room with a high ceiling as long as their duplex can bear lots of water. Owing to the
present system and method, this kind of pool doesn’t occupy the indoor space. A TV set, a table, a sofa, and a carpet are still set as usual. When want to swim they only lift the covering board up with the TV set, the table, the sofa, and the carpet, and when want to watch TV, or throw a family party, they only lower the covering board to cover the swimming pool. Generally, the service time of an outdoor pool isn’t more than half a year, even only in summer. This wastes actually the resource of the pool. If the users want to swim in winter, they have to invest extra money in a big tent and heating. So, even if the users have a backyard, they may still build the indoor pool for enjoying swimming in cold winter by using the present system and method. The indoor pool belongs to only the rich before because this needs a very large house, but now average people can have it if they use the present system and method. The present invention solved a space-lacking problem and save money.

[0011] 5. Because the covering board stays horizontally in midair when the pool is open, like a gigantic sunshade, this covering board can well prevent ultraviolet light from harming swimmers. Besides the above advantages the present invention retains the function of the flexible cover, that is, the present invention can also prevent water from evaporating, and children and pets from falling into the water.

BRIEF DESCRIPTION OF DRAWINGS

[0012] FIG. 1 is a diagram of the present system with 4 lifting devices of a hydraulic type.
[0013] FIG. 2 is a diagram of the present system with 4 lifting devices of a chain type.
[0014] FIG. 2’ is a vector graph used to analyze the force and motion.
[0015] FIG. 3 is a diagram of the present system with 1 lifting device of a screw type.
[0016] FIG. 4 is a diagram of the present system with 1 lifting device of a hydraulic type.
[0017] FIG. 5 is a diagram of a lifting device of a gear type.
[0018] FIG. 6 is a diagram of the system with lifting devices of a sliding-guide type.
[0019] FIG. 7 is a diagram of a lifting device of a scissors type.
[0020] FIG. 8 is a diagram of a double-tier covering board for a two-tier pool.
[0021] FIG. 9 is a diagram of the present system with a pulley group.

REFERENCE NUMERALS IN DRAWINGS

[0022] 1 covering board
[0023] 2 lifting device (including fixed part and movable part)
[0024] 3 fixing location
[0025] 4 joining location
[0026] 5 pool wall
[0027] 6 furniture
[0028] 7 crossbeam
[0029] 8 prop
[0030] 9 hydraulic pump
[0031] 10 chain
[0032] 11 roller
[0033] 12 screw
[0034] 13 nut
[0035] 14 gear
[0036] 15 rack bar
[0037] 16 support
[0038] 17 pneumatic cylinder
[0039] 18 rope
[0040] 19 pulley
[0041] 20 guiding angle track
[0042] 21 guiding post
[0043] 22 guiding hole
[0044] 23 counterweight
[0045] 24 the parts that can move horizontally

SUMMARY OF THE INVENTION

[0046] The present system and method comprises a flat board and at least one lifting device. The flat board has sufficient size for covering a pool and is made of rigid materials so as to be able to bear heavy weight. The lifting device includes two parts: a movable part and a fixed part. The one part of them is fixed on the ground or somewhere in a building near the pool, and another part is joined to the covering board. The lifting device can vertically move the horizontal covering board upward or downward and keep the covering board always horizontal. When want to swim, the users only lift up the covering board, and when want to BBQ, they only lower the covering board to cover the pool. Once the board reaches the top of the pool wall, the pool becomes hidden and invisible. The users can do some activities and put something on it even on the lifted covering board as on the floor or on the ground. This expands actually their living space.

DETAILED DESCRIPTION

[0047] The following description is presented to enable anyone skilled in the art to make and use the present invention. For purposes of explanation, the specific nomenclature is set forth to provide a thorough understanding of the present invention. The descriptions of the specific applications are provided only as examples.

[0048] The structural features of the present system should first be discussed. Referring to FIG. 1, 2, 3, 4, the present system comprises a flat rigid covering board 1 and at least one lifting device 2 (shown as 2a, 2e and 2f in FIG. 2). Unlike those existing pool covers, covering board 1 is made of rigid materials. The rigid materials may be various, such as a plank, or tempered glass, or rigid plastic, or lightier and stronger carbon fiber. The method of making the covering board is various too. Please refer to the following Operation Section. Regardless of what material is used, it is necessary that covering board 1 should be firm enough so that a human
being can stand, walk, work, BBQ, play tennis, and put something such as furniture  etc. on it as on the floor or on the ground. The covering board must be flat and has sufficient size to cover a whole or a portion of the pool. Generally the covering board matches with the shape of the pool, but it is not necessary. For example, in FIG. 4 covering board 1' shown with dashed lines is oval and larger than the round pool, and the line-dashed lifting device 2' stands at the edge of the pool. This may avoid setting up the lifting device in the center of the pool.

[0049] The lifting device is used to lift the covering board. There are various types of lifting device, but they all should include two parts: a movable part and a fixed part.

[0050] The movable part of the lifting device is able to move or to rotate so as to lift the covering board, such as a prop 8 in FIG. 1, a chain 10a, 10b, 10c and 10d in FIG. 2, a screw 12 in FIG. 3, a gear 14 in FIG. 5, a support 16 in FIG. 6. The term will below be abbreviated to the movable part.

[0051] The fixed part of the lifting device means the part that is fixed somewhere and can’t move, but some members within the fixed part can rotate in its fixed position, such as a hydraulic pump 9 in FIG. 1, a roller 11a receiving chain 10a, and a roller 11d of FIG. 2, a nut 13 in FIG. 3, a neck bar 15a, 15b in FIG. 5, and a pneumatic cylinder 17 in FIG. 6. The term will be abbreviated to the fixed part below.

[0052] The fixed part is usually fixed on the ground or somewhere in a building near the pool. The movable part is usually joined to covering board 1. This isn’t absolute. Sometimes, the fixed part may also be joined to covering board 1, and an end of the movable part is fixed somewhere but covering board 1. Lifting device 2 is driven by a motor and a transmission (they aren’t shown in the figures because they are unrelated to the structure the present system but as an universal power). The movable part is driven by the power, and thus lifting device 2 can lift covering board 1 from the top of a pool wall 5 to a predetermined height or lower it from the predetermined height to the top of pool wall 5. There are many types of lifting device with different structures being able to perform the lifting function. Take some examples: FIG. 1 shows a kind of hydraulic structure of lifting device. In FIG. 1 a fixed hydraulic pump 9 (shown in dashed lines) of lifting device 2 is buried in concrete of the foundation at a fixing location 3, and its movable prop 8 is joined to covering board 1 at a joining location 4. FIG. 2 shows a kind of lifting device with a chain as the movable part being able to hoist covering board 1 to the predetermined height. In FIG. 2 a fixed roller 11 of lifting device 2 is fixed on a crossbeam 7 of the building in a certain way at fixing location 3, and chain 10 is joined to covering board 1 at joining location 4. As mentioned above, it isn’t absolute. Fixed roller 11 may also be joined on covering board 1, and the end of movable chain 10 is fixed to crossbeam 7. It works well likewise. Obviously, the chain may be replaced by a strong rope. In FIG. 3 lifting device 2 uses a kind of structure comprising a screw 12 and a nut 13. Nut 13 belongs to the fixed part being fixed on crossbeam 7, and screw 12 is its movable part. In FIG. 5 the lifting device has a kind of structure comprising rack bar 15 and gear 14. Rack bar 15 is the fixed part fixed on the wall or on pillars, and gear 14 is the movable part joined to covering board 1. In FIG. 6 lifting device 2 comprises support 16 and pneumatic cylinder 17, and both connect with each other at a certain angle. And support 16 and pneumatic cylinder 17 are separately fixed on the axles at point C and point D. The axles cannot move, but support 16 and pneumatic cylinder 17 can separately rotate around their axles. FIG. 7 shows another type of lifting device of a scissor structure. The above examples indicate that the lifting device is various in structure and material.

[0053] There are many different means to fix the fixed part (sometimes, the movable part) of the lifting device under different conditions, such as, screwing, welding, riveting the fixed part on the foundation (refer to fixing location 3 of FIG. 1 and FIG. 4) or on crossbeams 7 (refer to fixing location 3 of FIG. 2 and FIG. 3), even burying it into concrete of the foundation (refer to the fixing location 3 of FIG. 1 and FIG. 4).

[0054] Similarly, there are many different means to join the movable part (sometimes, the fixed part) of the lifting device to covering board 1, such as, screwing, welding, magnetizing, hooking, knotting, and latching at location 4 of FIG. 1, FIG. 2, FIG. 3, and FIG. 4. Specially explaining, in FIG. 6 and A of support 16 of lifting device 2 is embedded in a sliding guide of covering board 1 and can slide along the sliding guide. This is a kind of dynamic joint. FIG. 7 is similar to FIG. 6. A kind of axletree structure can also be used, for instance, in FIG. 4 covering board 1 is round and only one lifting device 2 is joined to it in its center. If join the movable part to the covering board by setting an axletree or a bearing between both, this covering board can not only go vertically up and down, but also rotate horizontally around the lifting device over the top of the pool wall 5. So, the users have not only a pool but also a carousel in their home as in an amusement park.

[0055] At least one lifting device is required to lift up the covering board. The actually required number depends on the size of the covering board, the performance of the lifting device, and a user’s preference. For example, in FIG. 3 and FIG. 4 there is only one lifting device separately, and there are separately four lifting devices in FIG. 1 and FIG. 2. Of course, there may be more or less.

[0056] Regardless of the structure, the material, for the system of the present invention

[0057] the covering board should be flat and be firm enough to bear considerable weight and have sufficient size to cover the pool;

[0058] there must be at least one lifting device including a fixed part and a movable part;

[0059] one of the two parts of the lifting device must properly be joined to the covering board and another part must properly be fixed somewhere but the covering board.

Operation

[0060] To easily understand, let us first define and explain several terms before discussing how the present system and method work.

[0061] The rated range of the lifting device (or rated range for short) means the maximum distance the movable part of a lifting device can travel in its physical moving path without external limitation. The rated range is determined by the performance of the lifting device as being made. Generally, it is related to the length of the movable part, strength of its material, and its capacity for doing work, but isn’t related to installing conditions. In FIG. 1 the maximum length for
which movable prop 8 stretches from the end of hydraulic pump 9 is the rated range of lifting device 2. In FIG. 2 the maximum length for which movable chain 10 stretches from roller 11 is the rated range of lifting device 2. The lifting device can work only within the rated range.

[0062] The actual travel of the lifting device (or actual travel for short) means the actual distance the movable part of the lifting device moves from the top of the pool wall to some position along its physical moving path in the process of lifting. The movable part of the lifting device moves always along its physical moving path. Give some examples. In FIG. 2 movable chain 10a is vertical to covering board 1. When chain 10a hoists covering board 1 vertically, its moving path is physically vertical to covering board 1. While movable chain 10d and covering board 1 form an acute included angle 6d. Chain 10d isn’t vertical to covering board 1. Chain 10d moves physically along the leaning moving path when lifting device 2d hoists covering board 1. In FIG. 6 movable support 16 of lifting device 2 makes arc motion from A to A" when it lifts covering board 1. The arc is just the physical moving path of support 16. In the process of lifting the covering board, though the position of the movable part changes possibly in space, the movable part moves always along its moving path. The actual travel just is the actual distance the movable part moves in its physical moving path. The actual travel wouldn’t exceed the rated range, but wouldn’t reach the rated range usually due to the limitation of external conditions.

[0063] The effective lifting height of the lifting device (or effective lifting height for short) means the relative travel of the movable part in the vertical direction when the movable part of the lifting device moves along its physical moving path. The purpose of the lifting device is to lift the covering board upward or downward, but the physical moving path of the movable part isn’t vertical to the covering board sometimes. When the movable part moves in a slant path, its relative travel in the vertical direction is just effective in lifting covering board. In other words, the height to which an object is lifted up by a lifting device is just the effective travel of the lifting device. The relative travel in the vertical direction is termed the effective lifting height of the lifting device. FIG. 2 is a vector graph being used to analyze force and motion. In FIG. 2 a point O denotes a point of application of a pull force on the covering board. In the embodiment of FIG. 2 it is a joint of the movable chain of the lifting device to the covering board. A line segment OM from point O to point M represents the direction and magnitude of the pull force, and it is just the physical moving path of the movable part. A line segment OV from point O to point V represents the direction and magnitude of the vertical component of the pull force, and does also the moving direction and the lifted height of the covering board. This lifted height in the vertical direction is the effective lifting height of the lifting device. And a line segment OH from point O to point H represents the direction and the magnitude of the horizontal component of the pull force. There is an included angle θ between segment OM and segment OH. The included angle represents the included angle between the moving path of the movable part and the surface of the covering board in the embodiment of FIG. 2. FIG. 2 shows that the larger the included angle θ is, the longer segment OV is, i.e. the greater the effective lifting height of the lifting device is. When included angle θ is equal to 90° segment OV must be equal to segment OM, that is, the effective lifting height of the lifting device is equal to the actual travel of the lifting device. The effective lifting height of a lifting device is related to not only the included angle but also its actual travel. If the included angle keeps unchanged, the effective lifting height of the lifting device is proportional to its actual travel. If the actual travel reaches its rated range, its effective lifting height gets to the maximum value. See FIG. 2, crossbeam 7c and crossbeam 7d are at the same level, and the length of chain 10a of lifting device 2a is less than the length of chain 10c of lifting device 2c. Since both are all vertical to covering board 1, when covering board 1 is lifted to a certain height and keeps horizontal, their actual travel is the same, their effective lifting height is the same too. Sometimes the lifting device isn’t vertical to the covering board owing to limitation of installing conditions, e.g., the higher crossbeam is divided to two segments: crossbeams 7c and 7d due to a possible light bridge between them. Because no crossbeam is right above location 4d, and crossbeam 7d is outside the vertically upward projection area of covering board 1, roller 11d of lifting device 2d have to be fixed on crossbeam 7d so as to make a leaning chain 10d. Comparing the two included angles between the chain and covering board 1, chain 10a of lifting device 2a is vertical to covering board 1, but there is an acute included angle 6d between chain 10d and covering board 1. Since they are driven by the common motor, their actual travel in their respective moving path is the same, but the effective lifting height of lifting device 2a is greater than that of lifting device 2d based on the principle set forth above. In FIG. 6 in the process of lifting the covering board support 16 of lifting device 2 makes arc motion from A to A", and its effective lifting height should be the vertical distance from the top of the pool wall to the covering board, but not the arc length.

[0064] The collective lifting range of the system (or collective lifting range for short) means the vertical distance from the top of the pool wall to the highest position that the covering board lifted collectively by all the lifting devices of one system can reach. The collective lifting range is related to the performance of the lifting device and the installing condition. There may be more than one lifting devices in the same system. Generally, all the lifting devices within the same system are the same in structure, i.e., they should be the same type of lifting device in the same system, but the performance parameters of these lifting devices may be different, for example, the length of their movable parts may be different. Referring to FIG. 2, the rated range of the lifting device of chain 10a and chain 10c isn’t the same possibly. The collective lifting range of the system is limited by that lifting device having the narrower rated range. That is, the collective lifting range of the system mustn’t exceed the rated range of that lifting device having the narrowest rated range. Take the installing conditions such as the possible acute
included angle into account, the collective lifting range of the system depends on the effective lifting height of the lifting device as well. Precisely, the collective lifting range of the system is limited by the lowest effective lifting height. For example, in FIG. 2 those crossbeams aren’t at the same level. This is possible if have an inclined roof. Crossbeams 7a and 7d are higher than crossbeam 7a. Lifting devices 2a and 2b are fixed on the same crossbeam 7a, and both are vertical to covering board 1, so chains 10a and 10b are equal in length, and their effective lifting heights are the same if they move the same distance synchronously. Chain 10c is vertical to covering board 1 too, but it is longer than chains 10a and 10b, so the rated range of lifting device 2c is possibly wider than that of lifting devices 2a and 2b. But even so, their effective lifting height is the same as long as they move synchronously the same distance. Chain 10d isn’t vertical to covering board 1, and there is an acute included angle between it and covering board 1. Although lifting device 2d has possibly the wider rated range, its effective lifting height is possibly less than the others when their actual travel is the same. The collective lifting range of this system is limited by that lifting device having the lowest effective lifting height. The lifting device having the lowest effective lifting height is either lifting devices 2a or lifting device 2d in FIG. 2. It shows that the system having the same lifting devices has the different collective lifting range under different installing conditions. The above instances are only to explain these terms, and in practice the included angles between the covering board and each lifting device within the same system must be the same usually. For details, please refer to the following description.

0065 The actual lifted height of the covering board (or actual lifted height for short) is the height at which a covering board stays really in-use. The actual lifted height is determined by a user, and it may be adjusted within the collective lifting range of the system by the user based on the user’s height and the space conditions. Supposing the user put a sofa on the covering board, the user should find a suitable stop position where the sofa doesn’t touch the ceiling and the user have a suitable space for pluming into water conveniently. In FIG. 6, if a user turns off the power when the end A of support 16 moves to point A′, covering board 1 stops in a middle position like the position of linedashed covering board 1′. The height from the top of the pool wall to this position is just the actual lifted height of the covering board. The actual lifted height is equal to or lower than the collective lifting range of the system. When end A of support 16 moves to point A′, the actual lifted height of the covering board 1 reaches its maximum, i.e. the collective lifting range of the system.

0066 Next we will discuss the operation of the present system and method where the above several terms will be used. The discussion will cover the following seven aspects:

0067 1. Make a flat rigid covering board based on the shape and size of the pool;

0068 2. Select at least one lifting device based on site conditions;

0069 3. Fix one of the two parts of the lifting device somewhere but covering board;

0070 4. Join another one of the two parts to the covering board;

0071 5. Drive the lifting device;

0072 6. Transform the motion of the movable part into that of the covering board;

0073 7. Control the actual lifted height of the covering board.

(1) Make a Flat Rigid Covering Board Based on the Shape and Size of the Pool

0074 To make a covering board is the first thing. Generally the covering board should match with the shape and size of the pool. For instance, FIG. 8 shows a two-tier pool with a double-tier covering board 1. The double-tier covering board 1 matches with the two-tier pool completely. But it is not necessary. One can only want to cover the portion of the pool so as to be able still see some water, then the one may make a smaller covering board than the pool. Someone can also design a covering board being different from the pool in shape. For example, covering board 1′ shown in dashed lines in FIG. 4 is oval and larger than the round pool. Besides, under some site conditions, because the lifting device can’t be installed at a proper location, the shape and size of the covering board has to be changed to fit the lifting device. To make the covering board must consider the site conditions, and a user’s preference as well.

0075 The covering board should be made of rigid materials. The rigid materials may be various, such as a plank, rigid plastic, tempered glass, or lighter and stronger carbon fiber. The method of making the covering board is different. The usual method includes putting some planks on wood beams to form a large and flat board like a floor, using the rigid plastic to assemble the covering board, setting tempered glass on the aluminum framework to form the large glass floor, casting the covering board in concrete. If it’s, one may decorate the surface of the covering board with a tile, marble, turf, or a carpet etc. If using the transparent tempered glass or rigid and transparent polymer, the one can see clear water under the covering board when walking on the board or sitting on the sofa.

0076 Making a rigid covering board is to replace the existing flexible cover. The covering board must have sufficient size for covering the pool and be able to bear heavy weight to accommodate use by a human being for standing, walking, working, and putting something on it.

(2) Select at Least One Lifting Device Based on Site Conditions

0077 Selecting the lifting device should be based on site conditions. A different type of lifting device fits the different site conditions. For example, a lifting device with a chain structure (FIG. 2) generally fits only an indoor pool, but doesn’t fit an outdoor pool because there no crossbeam or other analogues may be used to install the lifting device. Besides the structure and the type, the performance parameters of the system and the performance parameters of the lifting device must be considered. Supposing the collective lifting range of the system expected based on the site conditions is 80 inches, the maximum of the effective lifting height of the used lifting device can’t be lower than 80 inches. According to the included angle θ designed based on the site conditions and the maximum of the effective lifting height of the lifting device an engineer can get the rated
range that the lifting device should at least have by calculating, and the minimum of the rated range should be 80/sin 0 inches in theory. In practice, some other factors like the distance between the fixing location and the joining location should also be considered when selecting the lifting device.

[0078] All the lifting devices in one system should be the same type and have the same structure. It is very difficult to use two or more types of lifting device in the same system. However, the differences of some performance parameters of the same lifting device such as the rated range of the lifting device are allowed. In FIG. 2 the rated range of the lifting device 2a is possibly narrower than that of lifting device 2b.

[0079] The system needs at least one lifting device to lift the covering board. The actually needful number depends on the size of the covering board, the site conditions, and a user’s preference. Referring to the figures in FIG. 3 and FIG. 4 there is only one lifting device separately, but there are separately four lifting devices in FIG. 1 and FIG. 2. Of course, there may be more or less.

[0080] The system uses the lifting device to replace the existing winder and folder. The existing flexible cover moves horizontally on the surface of the pool and be finally rolled up or folded up when opening the pool, so nothing can be put on it. If any, the user has to remove them from the cover before opening. The present invention uses the lifting device to lift a rigid covering board, and its purpose is just to change the existing way of opening and closing the pool. This new lifting way enables the covering board to move vertically upward or downward and to keep always horizontal (referring to the description below). So the user can put something such as a TV set, a table, a chair or a BBQ oven on the covering board and needn’t remove them when open the pool. This is obviously superior to the flexible cover of the prior arts.

[0081] After making the qualified covering board and selecting the proper lifting device, the next task is to combine the lifting device with the covering board to form the whole system. Next we will discuss how to combine the lifting device with the covering board below.

(3) Fix One of the Two Parts of the Lifting Device Somewhere But the Covering Board

[0082] The lifting device includes two parts: the fixed part and the movable part. The fixed part is usually fixed on the ground or somewhere in the building near the pool but on the covering board. As mentioned above, sometimes, the end of the movable part may also be fixed in the above way, and the fixed part is joined to the covering board. Before fixing, it is necessary to determine a proper fixing location and the direction of the lifting device.

[0083] If more than one lifting devices are used, these lifting devices are usually fixed at as evenly spaced locations as possible so as to be able to evenly share weight of the covering board and the loads on it. This isn’t absolute. Maybe a user desires an unconventional view, for example, in FIG. 4, the user uses the oval covering board 1’, and only one lifting device 2’ stands at the edge of the pool. This design may be fulfilled as long as the lifting device is strong enough and there is an appropriate counterweight 23 at an appropriate location. The fixing location depends on the site conditions, the structure of the lifting device, and the user’s preference. All the fixing locations must be on the same side of the covering board.

[0084] Besides the location, the direction of the lifting device should also be considered when fixing. The direction of the lifting device means the direction of the motion of its movable part, and it should be toward the covering board. Determining the location and direction must ensure that the movable part can reach the covering board being in the state of covering the pool normally and move the covering board vertically to a predetermined position. This rule includes four points essentially: “reach the covering board”, “in the state of covering the pool normally”, “move the covering board vertically”, and “to a predetermined position”. The following is detail explanations.

[0085] Determining the fixing location and direction of the lifting device must enable the movable part of the lifting device to reach the covering board. In FIG. 1 fixed hydraulic pump 9 (represented in dashed lines) of lifting device 2 is buried completely in the foundation at location 3. If fixed hydraulic pump 9 outside the area that covering board 1 can normally cover the pool, or if pump 9 doesn’t point to the covering board, e.g., hydraulic pump 9 doesn’t stand on the foundation, but lays there, certainly, movable prop 8 can’t reach covering board 1, and lifting device 2 will lose the function of supporting covering board 1. In FIG. 2 if its roller 11 on a higher crossbeam but its chain 10 is too short to reach the covering board, lifting device 2 can’t hoist covering board 1. So it is necessary to locate an appropriate location to enable the movable part to reach and to point to the covering board.

[0086] When determining the location and the direction of the lifting device, the covering board as a benchmark must be in the state of normally covering the pool. The so-called “normally cover” means that the covering board can cover a whole or a portion of the pool based on the design and touch the top of the pool wall completely without any gap. This contains two meanings. (1) The covering board can’t have any displacement from the normal position of covering the pool. If the covering board has the horizontal displacement like line-dashed covering board 1’ of FIG. 1, it can’t cover the pool normally. If the location and the direction are set based on such a wrong benchmark, it will result in failure of the system. For example, in FIG. 1, if hydraulic pump 9 isn’t fixed on the edge of the pool, but away from the edge of the pool to fit covering board 1’ having displaced, though movable prop 8 can possibly reach covering board 1’ having displaced, the present system can’t cover the pool normally.

(2) The covering board must completely touch the top of the pool wall. Generally, the top of the pool wall is horizontal. If the covering board can completely touch it, the covering board is horizontal. The horizontal state means there isn’t any gap between the covering board and the top of the pool wall. If there is any gap somewhere, the covering board will tilt. In addition, if the complete covering board doesn’t touch the top of the pool wall but be at a higher level over the top of the pool wall when fixing the lifting device and joining the lifting device to the covering board, referring to FIG. 2, the covering board will overhang the top of the pool wall but not cover the pool when lower down. In FIG. 1, movable prop 8 is wrapped in hydraulic pump 9 when the covering board is on the top of the pool wall 5. If the end of movable prop 8 of one lifting device 2 projects over the top of pool wall 5 when pump 9 is buried, but the others are at the same level as the top of pool wall 5, the covering board will be blocked by that prop 8 at this location. This will leave a gap between the covering board and the top of the pool wall so that the
covering board can’t completely touch the top of pool wall 5 and thus becomes a slope board. In FIG. 6 the end A of support 16 of lifting device 2 is embedded in the sliding guide of covering board 1 and can slide along the sliding guide. If one of the supports and the top of the pool wall form an included angle being larger than 0 degree when set support 16, but all other included angles are zero degree, this support will make a gap between the covering board and the top of the pool wall, and thus result in a sloping board. This is not to be allowed. The travel of every lifting device starts from the top of the pool wall. This top position is called the start point of the travel. The covering board is in the horizontal state at starting point, and it is conducive to always keeping horizontal in the lifting process. FIG. 8 covers a drawing. In this case, theoyo can’t reach cover 1. As long as the double-tier covering board 1 can completely touch the top of pool wall, though the two tiers don’t be at the same level, they are horizontal.

[0087] Determining the fixing location and direction of the lifting device must enable the lifting device to move vertically the covering board upward or downward. In order to enable the lifting device to vertically lift the covering board up, the simplest method is to set the lifting devices over or under the covering board and to have them being vertical to the covering board. This method is the best for most cases and the most energy-efficient because the lifting force isn’t resolved when the included angle between the movable part of the lifting device and the covering board is a right angle. FIG. 1 shows such an embodiment where lifting device 2 is under covering board 1 and is vertical to covering board 1. In many cases, the simplest method becomes even a rule that must be followed. The following cases may prove it. In FIG. 3 movable screw 12 is vertical to covering board 1. If screw 12 becomes horizontal, or it and covering board 1 form an acute angle (referring to dashed covering board 1′, screw 12′ and nut 13′) due to the incorrect location and direction of the lifting device, covering board 1′ can’t move vertically. In FIG. 5 the rack bar is fixed on the wall. When fixing, the teeth and grooves of the rack bar should be parallel with the top of pool wall 5. So, the moving track of the gear 14 can be vertical to the top of pool wall 5. If rack bar 15a or rack bar 15b are tilted, covering board 1 cannot move vertically. The vertical relationship is an ideal state. But, sometimes, because of the limitation of the installing conditions or the structure of the lifting device, the lifting device can’t be vertical to the covering board. Take some examples as follows. In FIG. 2 fixed roller 11d have to be fixed on crossbeam 7d because there is no crossbeam in this corner of the vertically upward projection area of covering board 1. Crossbeam 7d is outside but near this projection area of covering board 1. In this case, chain 10d can’t reach covering board 1 vertically, but lifting device 2d can still lift covering board 1 vertically upward or downward if set the location and the direction of the lifting device correctly. In FIG. 6, support 16 and pneumatic cylinder 17 are separately fixed on the axles at point C and point D. At the starting point support 16 isn’t vertical to covering board 1, but it can turn around the axle, and thus 4 supports 16 can lift the covering board 1 up vertically. Because of the difference of the structures, the movable part has the different operating ways such as moving, rotation, turning and sliding, and some lifting devices aren’t physically vertical to the covering board. So, the simplest method can’t apply all the cases. The following is further discussion.

[0088] Next we discuss the fourth key point: the covering board must be able to be lifted to reach a predetermined position. To gain this object, two factors must be considered. One factor is the fixing location, and another one is the performance parameter of the lifting device. For example, in FIG. 2, if fixed roller 11 at inappropriate location such as at the very low level on the wall near the ground, this will form a very small included angle between the lifting device and the top of the pool wall (or the parallel covering board). The lifting device can’t lift the covering board even a bit because under this condition the effective lifting height of the lifting device is very low, instead, if several lifting devices in this system are at the same low level, the larger horizontal component forces on different devicer would possibly break the covering board. We analyzed the force and the motion in FIG. 2 when explaining the term of the effective lifting height of the lifting device in the foregoing section. By the analysis we learned that the larger the included angle 0 is (but it isn’t larger than 90 degree), the greater the effective lifting height is. In addition, the performance parameter of the lifting device is important. If the rated range of the lifting device can’t provide the sufficient effective lifting height, the covering board can’t reach the predetermined position too. So, the lifting device must have the sufficient rated range so that the collective lifting range of the system isn’t less than the distance from the top of the pool wall to the predetermined position.

[0089] The above examples indicate that the included angle between the lifting device and the covering board should be as close to 90 degree as possible to get the greatest effective lifting height when fixing the lifting device, but this definition isn’t flawless. For example, in FIG. 6 as the end of support 16 turns from point A to point A′, the included angle between support 16 and the top of pool wall 5 gradually increases from 0 degree to 90° at the same time. In this process the included angle has dynamically been changing. As stated above, the covering board must be in the state of covering the pool normally when fixing, so the included angle should be 0° at the start point, but not as close to 90 degree as possible. This shows that the above definition isn’t suitable for the case of FIG. 6. Through analyzing the motion of the movable part of the lifting device the following facts are presented: The track of the motion of chain 10 is linear, and the rotation of support 16 occurs in a plane. If the plane is parallel with the top of the pool wall, however support 16 rotates, the included angle between support 16 and the top of the pool wall 5 will always be 0 without any change. If so, support 16 loses its function. So, the plane in which support 16 rotates must intersect the top of the pool wall, but not be parallel with it, and the best is that the plane is vertical to the top of the pool wall, or at least the included angle between the plane and the top of the pool wall is as close to 90 degree as possible. Only in this way, can support 16 lift covering board 1 by its rotation. The case of FIG. 7 is similar to FIG. 6. The plane in which the motion of the scissors bars occurs should be vertical to the top of the pool wall.

[0090] Because the structure of the lifting device is various and every site conditions are different, the rules set forth above should be followed when fixing the lifting device. In order to ensure that the lifting device can vertically move the horizontal covering board upward and downward and reach the predetermined position, it is required that the included angle between the moving track of the lifting device (or the
plane in which the lifting device moves) and the top of the pool wall (or the parallel covering board) should be 90 degree or as close to 90 degree as possible when fixing the lifting device.

[0091] There are many different means to fix the fixed part (sometimes the end of the movable part) of the lifting device such as screwing, welding, locking, riveting. This depends basically on the structural feature of the lifting device and the site conditions.

[0092] The above description can be summarized as follows: one part of the lifting device should be fixed by a certain way in the correct direction at appropriate locations on the same side of the covering board on the ground or somewhere in the building near the pool but the covering board. And fixing must

[0093] use the covering board being in the state of covering the pool normally as benchmark, and

[0094] enable the lifting device to reach the covering board, and

[0095] enable the included angle between the moving track of the lifting device (or the plane in which the lifting device moves) and the top of the pool wall to be 90 degree or as close to 90 degree as possible so that the lifting device can move the horizontal covering board vertically upward or downward and reach the predetermined position.

(4) Join Another One of the Two Parts to the Covering Board

[0096] Besides fixing one part (usually the fixed part) of the lifting device, another part (usually the movable part) should be joined to the covering board. Joining the movable part to the covering board and fixing the fixed part aren’t unrelated. The location and the direction of fixing the lifting device should be conducive to correctly joining the movable part to the covering board, and on the other hand, joining the movable part to the covering board should correspond with the fixing location and the direction of the lifting device. Both are closely correlated.

[0097] Joining another part (replaced by the movable part below for clearer descriptions) of lifting device to the covering board should first find an appropriate location(s). The location(s) should be the mapping from the fixing location(s) and respectively corresponding to the fixing location(s) if have several lifting devices. Referring to FIG. 2, don’t join chain 10a of lifting device 2a to covering board 1 at location 4b, similarly, and don’t join chain 10b of lifting device 2b to covering board 1 at location 4a. If do so, both will cross. This would impact the vertical motion and stability of the covering board.

[0098] As fixing one part of the lifting device, when joining another part to the covering board, the covering board must be in the state of covering the pool normally and completely. The so-called “normally cover” has been defined in the foregoing section. Suppose the lifting device has been fixed based on the covering board normally covering the pool, but in fact the covering board has a horizontal displacement to deviated from the normal position when joining the movable part to the covering board, likely, the movable part can’t touch the covering board at all, naturally, joining is impossible. If the flexible chain type, maybe joining can constrainedly be done, but when the lifting device hoists the covering board, the covering board must return to the normal position of covering the pool by gravity and it will result in waggling and tilt of the covering board.

While if fixing the fixed part is incorrectly based on the covering board having a horizontal displacement, and joining the movable part to the covering board is just based on the wrong fixing location, the lifting device can possibly lift or lower the covering board, but it is at a wrong location, and the covering board must be unable to normally cover the pool, and thus the whole system will lose its function of covering the pool. So, whether fixing the fixed part, or joining the movable part, the covering board must be in the state of covering the pool normally.

[0099] The included angle between every lifting device and the covering board must be equal when where are several lifting devices in one system. If not, they can’t reach the same height when all the lifting devices travel synchronously the equal distance at the same velocity, it must result in a sloping and unsteady covering board. In fact, the case shown in FIG. 2 isn’t allowed. In FIG. 2, inclined angle 6d between chain 10d of lifting device 2d and covering board 1 is less than 90 degree, but the other three included angles are right angle. Because all the lifting devices are synchronously driven by the same motor and transmission, their actual travel is the same. While the effective lifting height of the lifting device 2d having an acute included angle is lower than the effective lifting height of the others having a right angle based on the principle stated in FIG. 2. And from the point of view of force, the component force in the vertical direction of lifting device 2d is smaller than that of the others. This will result in the adverse displacement and tilt of the covering board. Therefore, all the included angles must be the same so as to enable the vertical component force of every lifting device to be equal in order to keep the covering board horizontal.

[1000] To avoid the displacement and tilt of the covering board, besides the vertical component force of every lifting device being the same, their horizontal resultant force should be zero. In the present system, since the lifting force of every lifting device is the same, if the included angles are equal, their horizontal component force is equal in magnitude. To make the horizontal resultant force into zero, a simple way is to make the direction of every two horizontal component force opposite and be offset each other, or if the covering board is round, to make every lifting device be evenly distributed on the edge around the covering board, and every horizontal component force be outward from the center of the covering board. So, when all the included angles are the same, the vector sum of the horizontal component force of all the lifting devices becomes zero, that is, the horizontal resultant force of the system is zero. If the horizontal resultant force isn’t zero due to the unequal included angles, the covering board will deviate from its normal lifting path in the direction of the horizontal resultant force. Illustrating with FIG. 2, suppose chain 10a and chain 10b are replaced separately by line-dashed chain 10a’ and line-dashed chain 10b’ that are not vertical to covering board 1, chain 10a’ and covering board 1 will form included angle 6a and chain 10b’ and covering board 1 form also included angle 6b. If angle 6a is equal to angle 6b, the horizontal component force Fha of chain 10a is equal to the horizontal component force Fhb of chain 10b’ due to the equal force acting on these two chains. Since the directions of the two horizontal component forces are opposite and their magnitude is equal, the two will offset each other. If chain 10a and chain 10b are set in the same way, their horizontal resultant force becomes zero, and the covering board will keep steady.
But, as shown in FIG. 2, chain 10c is replaced by line-dashed chain 10b, and angle 6c is equal to angle 6d, and the directions of the two horizontal component forces are the same, so they can’t offset each other, and their resultant force isn’t zero. The covering board must be skewed. Balancing the horizontal component force can avoid the displacement and tilt of the covering board, but the outward horizontal component forces still break possibly the covering board. So, the right included angle is regard as a standard method of installing the system. Only when the right included angle can’t be done due to the limit of conditions, the acute included angle is considered.

[0101] Besides, the acute included angle causes some other trouble. In FIG. 3, the joint of line-dashed movable screw 12' to line-dashed covering board 1' is fixed. Both form an unchangeable acute included angle. Line-dashed nut 13' is fixed on the crossbeam. When nut 13' rotates, screw 12' with covering board 1' moves along its slanting path, but not a vertical path. The rising motion along the slant path results in a horizontal displacement of covering board 1'. The covering board would go out of the vertically upward projection area of covering board 1'. If there is a building or a tree there, covering board 1' would be blocked, and thus the covering board can’t possibly reach the predetermined position and the system would occupy more space. Taking another case of FIG. 2, on the basis of the analysis of FIG. 2, if the included angle between the lifting device and the covering board isn’t a right angle, it will gradually decrease as the covering board rises, and the position of the lifting device in space changes gradually too. Unlike the case of FIG. 3, in FIG. 2, since the movable part of the lifting device is flexible chain 10 and the joint of chain 10 to covering board 1 is movable and chain 10 can turn as the included angle decreases, the present system can still possibly implement. The precondition is that the system has at least two lifting devices to balance the horizontal component forces of the lifting devices. If only one, as lifting, the acute included angle will change to the right angle soon by gravity, and the covering board will deviate from the normal lifting path of the covering board. Even though the system can work, there is a risk of breaking the covering board. So the horizontal component forces should well be controlled.

[0102] As stated above, the follow basic rules of joining the lifting device to the covering board should be followed:

[0103] joining the lifting device to the covering board at the appropriate location(s) being respectively corresponding to the fixing location(s), and
[0104] joining the lifting device to the covering board being in the state of covering the pool normally, and
[0105] joining the movable part to the covering board at the 90 degree included angle (or being close to 90 degree) between the moving track of the lifting device (or the plane in which the lifting device moves) and the covering board, and
[0106] all the included angles should equal, and
[0107] making the vector sum of the horizontal nys (sides) of all the included angles zero .

[0108] There are various means to join the movable part of the lifting device to the covering board such as screwing, welding, riveting, hooking, knotting, pinning. This depends basically on the structural feature of the lifting device and the site conditions. Even there may be an axletree or a bearing installed between the lifting device and the covering board so that the covering board can rotate around the lifting device over the top of the pool wall as shown in FIG. 4.

[0109] FIG. 9 shows a kind of lifting device comprising rope 18 and pulley 19. One end of rope 18 is fixed, and another end is free. Rope 18 goes through 6 fixed pulleys and 4 movable pulleys. It is divided into several segments by the pulleys. The segments around the movable pulleys are vertical to covering board 1. This seems to meet the rules stated above, but in fact it can’t work normally. The cause is that each lifting device isn’t independent, and they form a linkage group. When pulling the free end of rope 18, the full force is first transmitted to the nearest pulley, and then to the second pulley, the third pulley . . . each pulley doesn’t start rotating at the same time, and the length of each rope segment at the same time isn’t the same. In this case covering board 1 is likely tilted. So, it is required as complement to the above rule that all the lifting devices must synchronously move at the same velocity and be able to reach the predetermined height. The weight of the covering board and the loads on it are also an important factor affecting the stability of the pulley structure. When the loads such as the furniture gather near one movable pulley, this portion of the covering board connecting to this pulley would decline. If one walks on the covering board, the covering board would inevitably sway and move up and down owing to the shift of the barycenter of the covering board and its loads. This shows that the case of FIG. 9 isn’t a good embodiment unless adding some auxiliary parts such as a guiding angle track 20 and a guiding post 21 to the present system. It would be a good idea to set at least one pair of guiding angle tracks 20 to covering board 1 at the two opposite corners to embrace covering board 1, or to set at least one pair of guiding posts 21 at the opposite locations to go through corresponding guiding holes 22 of covering board 1. So guiding angle track 20 and guiding post 21 can guide and limit the motion of covering board 1. Under the guidance of the guiding parts covering board 1 can vertically go upward or downward and keep horizontal without displacement, sway, ups and downs. If using the guiding part, the system may have only a single set of pulley to lift and lower the covering board. The guiding part is the auxiliary part of the present system. It is an eyesore possibly, and particularly for an indoor pool the extra part will occupy more space and damage the indoor harmony. In fact, rope 18 should be replaced by 4 independent ropes in the above case. Their ends are separately fixed, and another end rounds the corresponding movable pulley and fixed pulley, and then pull 4 ropes together.

[0110] Generally, the system with the flexible movable part such as rope 18 of FIG. 9 and chain 10 of FIG. 2 has the trouble stated above. Based on the above illustration, the installing rule needs a complement as follows:

[0111] enable all the lifting devices to move synchronously at the same velocity and to reach the same predetermined height.

[0112] add the extra guiding devices to the system being equipped with the flexible movable part to enable the covering board to move vertically and smoothly without displacement, sway, ups and downs.

(5) Drive the Lifting Device

[0113] All the lifting devices are driven by the same motor, and the power is transmitted to the lifting device(s) by a transmission. The motor and the transmission are universal
and unrelated to the featured structure of the present system. They only power the present system. So they aren’t specifically described here and aren’t shown in figures. Generally the system has only one motor and a set of transmissions to conduct synchronization of the lifting devices. The synchronization means that the movable parts of all the lifting devices must be started at the same time and run at the same speed. If one lifting device is driven earlier than the others, the portion of the covering board to which this lifting device joins would be lifted first. If running speed is different, that one running faster would faster be lifted. These all will cause the covering board a tilt.

[0114] Not only the start time and the running speed should be the same, but also the included angles between every lifting device and the covering board must always keep the same in the running process. Reviewing FIG. 2, line segment OM represents a longer chain, and segment OM' represents the shorter in FIG. 2. Their fixed parts are fixed at different level separately at point M and point M', but the location of their movable parts joining to the covering board are all at the common point O, and point M, M' and O are in the same straight line, so line OM and OM' have the same included angle θ at this time. If longer chain OM and shorter chain OM' separately go in their own moving path at the same speed at the same time, they will go the same distance OS. Suppose the distance OS is very very short, since they have the same included angle θ at the beginning time, the difference of their effective lifting height may be ignored. The covering board is lifted to level O'F from level OH in this process. The included angle θ must gradually decrease as the covering board rises. Since these two chains are different in length, and the shorter the movable chain is, the larger the decrease of the included angle is, this makes the two included angles will no longer be the same, and angle MOY is larger than angle MO'Y. Segments O'M' and O'M no longer overlap each other. We draw an arc with center θ and radius OM', then get point M' and line segment O'M' on line segment O'M. O'M' is equal to O'M. If the two chains continue to move at the same speed in the respective moving path, they will still move the same distance at the same time. Suppose the moving distance of the shorter chain is O'M', the moving distance of the longer chain is O'M. Since their included angles have been different at this time, their effective lifting height must be different. The effective lifting height OV of the longer chain O'M is larger than the effective lifting height OV' of shorter chain O'M'. This must cause the covering board to tilt. In FIG. 6, similarly, if the included angle between support 16 of one lifting device and the covering board becomes less than the others in the process of running, the covering board will tilt. Thus, the following rule is required:

[0115] The movable parts of all the lifting devices must move at the same speed synchronously in the respective moving path and always keep the included angle between every lifting device and the covering board the same in the process of lifting the covering board.

[0116] To meet the above rules, if the included angle is less than 90 degrees, the movable parts of all the lifting devices and the covering board being the same, the fixed parts of all the lifting devices must be fixed at the same level. If they are fixed at the different level, even if their movable chains are joined to the covering board at the same included angle, the covering board would tilt because these included angles will change from the same to the different in the process of lifting the covering board based on the above discussion about FIG. 2. But if the included angle is the right angle, the fixed parts may be fixed at the different level or at the same level because the included angles keep 90 degree and don’t change in the lifting process under this condition. To meet the rule of “always keep the included angles the same” one must select a proper way to fix the fixed part based on the site conditions. If the site condition doesn’t allow the lifting device to be vertical to the covering board, the fixed part must be fixed at the same level; if the condition allows the lifting device to be vertical to the covering board, the fixed part may be fixed either at the different level or at the same level.

[0117] Fixing the fixed part either at the different level or at the same level if the lifting device is vertical to the covering board; fixing the fixed part at the same level if the movable part isn’t vertical.

[0118] The above rules say that the movable parts of all the lifting devices must move the equal distance at the same speed synchronously. It should be emphasized that the said speed means the speed of the movable part but not the speed of the fixed part. Some members of some fixed parts can rotate, turn or move. Cite some examples. In FIG. 2 chain 10a is rolled on roller 11a of the fixed part. If the diameter of roller 11a is different from that of the other rollers, the moving distance of chain 10a will also be different from that of the other chains even if every roller rotates at the same speed (generally, the speed of the rollers is the same because they are driven by the same motor and transmission). If the diameter of one roller is really different from the others, its rotating speed has to be adjusted to ensure that the moving speed of its movable part is the same as the others. In FIG. 5, if the teeth spaces of each gear and rack bar are different, the moving distance of the movable parts aren’t the same even if gears 14 rotate synchronously at the same speed. Essentially, the speed of the movable part means the speed of the movable part moving the covering board vertically upward or downward.

[0119] Every lifting device in one system must be the same in size and type to ensure that the movable parts of all the lifting devices can travel the equal distance (height) at the same speed synchronously.

(6) Transform the Motion of the Movable Part into That of the Covering Board

[0120] The ultimate goal of the present system is that the lifting devices can move the covering board vertically upward or downward. This requires that the motion of the movable part must be transformed into the vertical motion of the covering board. If one system can’t perform such a moving transformation, the system will lose its significance. Take some cases to explain how the motion is transformed. In FIG. 1 the end of movable prop 8 of lifting device 2 is directly and tightly joined to covering board 1. While prop 8 is driven to move upward, it lifts covering board 1 up. So, the motion of movable prop 8 is directly transformed into the motion of covering board 1. In FIG. 3 lifting device 2 employs a kind of structure comprising a screw 12 and a nut 13. Screw 12 is the movable part of lifting device 2. Nut 13 belongs to the fixed part. The exterior wall of nut 13 has the gear teeth, and the interior wall of its borehole has an inner screw. While the motor and the transmission drive nut 13 to rotate around screw 12, the inner screw of nut 13 will drive screw 12 to move along the long axis of screw 12. Because screw 12 is directly joined to covering board 1, screw 12 can
lift covering board 1 upward or downward. In this process, the rotation of nut 13 is transformed into the linear motion of screw 12, and the linear motion of screw 12 is transformed into the upward or downward motion of covering board 1. In FIG. 5, lifting device 2 has a kind of structure of a gear 14 plus a rack bar 15. Rack bar 15 is the fixed part being fixed on the wall or on the pillars, and gear 14 as the movable part is joined to covering board 1. While the motor drives gear 14 to rotate, gear 14 leads covering board 1 along rack bar 15 upward or downward. The case of FIG. 6 is more special. In FIG. 6 lifting device 2 includes a support 16 and a pneumatic cylinder 17, and the two connect with each other at a certain angle. Support 16 and pneumatic cylinder 17 are separately set up on the axes at point C and point D. The axes can’t move, but support 16 and pneumatic cylinder 17 can turn individually around axe C and axe D. While the motor drives the rod of pneumatic cylinder 17 to move from point B to point B', the rod pushes support 16 to turn around axe C, and the end of support 16 moves from A to A'. Because the end is embedded in the sliding guide of covering board 1 and can slide along the sliding guide, while support 16 turns around axe C from A to A', the end slides to the side of covering board 1 from the middle, and the end gets higher and higher away from the top of the pool wall at the same time. So, support 16 can lift covering board 1 up.

In this process, the turning motion of support 16 is transformed to the upward and downward motion of covering board 1 by the sliding joint 18. If the included angles between supports 16 and the top of the pool wall are the same, and all the included angles between the plane in which support 16 turns and the top of the pool wall are the same too, and pneumatic cylinders 17 start synchronously, and supports 16 turn at the same speed, covering board 1 can move vertically upward or downward and always keep horizontal. Once the end of support 16 reaches position A', support 16 is vertical to the top of the pool wall. This is its final position. The case of FIG. 7 is similar to FIG. 6.

Owing to the difference of transformation way the joint between the lifting device and the covering board is various, such as, the fastening joint used in the case of FIG. 1, the hooking joint of FIG. 2, the gear joint of FIG. 5, the sliding joint of FIG. 6. The different joint suits the different transformation. However, the motion of the lifting device must effectively be transformed into the vertically upward or downward motion of the covering board. If one system can’t perform the effective transformation, this system must fail.

The motion of the movable part must be transformed into the vertical upward or downward motion of the covering board to enable the covering board to move from the top of the pool wall to the predetermined lifting height. (7) Control the Actual Lifted Height of the Covering Board

The collective lifting range of the system is equal to the maximum height that the covering board of the system can reach. In practice, a user doesn’t possibly need such a height. In the process of lifting the covering board, the user may stop it in any position within the collective lifting range of the system. That is, the user can control the actual lifted height of the covering board on the basis of the user’s own height and the space condition. For example, in FIG. 6 when the end of support 16 turns to point A' from A, the system reaches the maximum of its collective lifting range. If the user turns off the power when the ends of every support 16 turn to point A' from A at the same speed synchronously, the covering board will stop and lie horizontally in a position A' within the collective lifting range of the system, just like the position of line-dashed covering board 1' in FIG. 6. In addition, some site conditions affect usually the actual lifted height of the covering board. For instance, the user puts a sofa on the covering board, the user should find a suitable stop position where the sofa doesn’t touch the ceiling and the user has a suitable space for plunging into water conveniently.

CONCLUSION, RAMIFICATIONS, AND SCOPE OF THE INVENTION

Accordingly, the present invention provides a system and method of covering a pool and making the pool invisible. The system comprises a rigid covering board and at least one lifting device. The present invention changes the material used in the pool cover from the conventional flexible materials to the rigid one, and replaces the conventional winder and folder with the lifting device to change the way of opening and closing the pool from the existing horizontal moving way to the vertically upward and downward lifting way. The present invention combines the covering board with the lifting device(s) to form a whole system. The rigid covering board has sufficient size for covering the pool and is firm enough to bear heavy weight and to accommodate use by a human being for standing, walking, working, and putting something on it. The system and method has double uses. It can not only cover the pool but also lift the covering board and the loads on it.

In this specification we have discussed the many kinds of structure of the system and the various methods of building and using the system, and get some general rules of building and using the system. This specification described only the basic structure of the present system applying to general installing conditions. If we add some auxiliary parts to the present system, the present system and method can apply to more various structures and more complex conditions. For example, in the case of FIG. 9 the guiding angle tracks and the guiding posts are added to the present system. All the embodiments stated in the present specification use a common motor and transmission. If equip every lifting device separately with one transmission, and add a sensor and a controller to every lifting device, we will get a ramification of the basic version of our system with better performance. The sensors can individually detect the effective lifting height of the lifting device in real time. The system may use the effective lifting height of one of the lifting devices as a reference. If another one sensor detects the effective lifting height of its lifting device is smaller than the reference, its controller will instruct the related transmission to increase its speed. The faster the speed is, the greater the actual travel of the lifting device is, the greater the effective lifting height of the lifting device is. Similarly, if the sensor detects the effective lifting height of its lifting device is greater than the reference, the controller will instruct the related transmission to decrease its speed. By such controlling and adjusting, the effective lifting height of all the lifting devices of the same system can dynamically keep the same, and the covering board can keep horizontal dynamically. The application of the electronic control technology invalidates partly the foregoing rules. For example, if the lifting devices can’t be vertical to the covering board,
or/and their included angles can’t be the same because of the restriction of the conditions, the system can’t run according the above rules. However, by using the electronic control, the covering board may still move vertically upward or downward and keep horizontal. Even so, the general rules are necessary and useful. For example, the covering board must normally cover the pool, and the lifting device of the system can move the covering board vertically upward or downward and reach the predetermined height. Whether to add auxiliary parts or not, however, to install the system, these basic principles must be followed. The electronic control technology enables the present system to apply to more complex installing conditions, but it would greatly increase the cost of the system.

[0126] Any modification to the present embodiment is apparent to those skilled in the art. All the general principles defined herein, however, apply to the modified embodiments without departing from the spirit and the scope of the invention. Thus, the present invention is not intended to be limited to the present embodiment shown, but to be accorded the widest scope consistent with the principles and the features disclosed herein.

1. A method of covering a pool comprising:
   a) making a board of rigid material of sufficient size to accommodate use for covering said pool and by a human being for standing, walking, working, and putting something on it, and
   b) using at least one device including a movable member and a fixed member for lifting said board being parallel with the surface of said pool vertically upward or downward, and
   c) fixing one of the two members of each of said device(s) pointing to and being able to reach said board being in the state of covering normally said pool at appropriate fixing location(s) on the ground or somewhere in a building near said pool on the same side of said board but not on said board, said fixing location(s) allowing said board to move vertically and to get to a predetermined height, and
   d) joining another one of the two members of each of said device(s) to said board being in the state of covering normally said pool at the about 90 degree included angle between the moving track of said device (or the plane in which said device moves) and said board at the appropriate location(s) being in respective correspondence with said fixing location(s), every included angle being required to be always equal and their vector sum of horizontal rays being required to be always zero when joining and in the lifting process so as to keep said board always horizontal and having no horizontal displacement, and
e) coupling a power transmission with said movable member(s) of said device(s) so as to enable said movable member(s) to move at the same speed synchronously, and
f) transforming the various types of motion of said movable member into the vertical upward or downward linear motion of said board between the surface of said pool and the predetermined height.

2. A system for covering a pool comprising:
a) a board of rigid material of sufficient size to accommodate use for covering said pool and by a human being for standing, walking, working, and putting something on it, and
b) at least one device including a movable member and a fixed member for lifting said board being parallel with the surface of said pool vertically upward or downward, and
c) means for fixing one of the two members of each of said device(s) pointing to and being able to reach said board being in the state of covering normally said pool at appropriate fixing location(s) on the ground or somewhere in a building near said pool on the same side of said board but not on said board, said fixing location(s) allowing said board to move vertically and to get to a predetermined height, and
d) means for joining another one of the two members of each of said device(s) to said board being in the state of covering normally said pool at the about 90 degree included angle between the moving track of said device (or the plane in which said device moves) and said board at the appropriate location(s) being respectively corresponding to said fixing location(s), every included angle being required to be always equal and their vector sum of horizontal rays being required to be always zero when joining and in the lifting process so as to keep said board always horizontal and having no horizontal displacement, and
e) means for coupling a power transmission with said movable member(s) of said device(s) so as to enable said movable member(s) to move at the same speed synchronously, and
f) means for transforming the various types of motion of said movable member into the vertical upward or downward linear motion of said board between the surface of said pool and the predetermined height.