A solar heating system for heating a pool of water includes a water bag formed of materials such that when it is not in use, it is deflated and compressed so as to occupy little space. When the water bag is in use it is inflatable and expandable so as to contain a substantial amount of water which can be heated by the rays of the sun absorbed by the water bag. A water bag embodying the invention can be formed of inexpensive materials (e.g., plastic, rubber or canvas). The water bag is very portable and can be set up (to collect water and heat it) quickly and easily. When not in use it can be folded or rolled up taking up very little storage space. It does not interfere with the use of the pool of water it is intended to warm. It can be set up any place, close to the pool of water or by using longer hoses it can be located away from the pool, where the best sunlight and solar heat is available.
Fig. 8

12

14

36, 38
Intake / Discharge Tube

18
APPARATUS AND METHOD FOR SOLAR HEATING OF A POOL OF WATER

[0001] This application claims the benefit of U.S. Provisional Application No. 60/512,427 filed Oct. 20, 2003 and titled Swimming Pool Solar Heating Bag.

BACKGROUND OF THE INVENTION

[0002] This invention relates to heating of water by solar radiation.

[0003] Heating of water by means of electricity or gas is well known and effective. But, it is costly. Passive solar heating of water has been disclosed as an alternative. However, known apparatus and systems suffer from one or more of the following disadvantages. They are difficult to manufacture, are expensive, and are not easily portable or foldable.

SUMMARY OF THE INVENTION

[0004] The disadvantages discussed above are overcome in systems embodying the invention.

[0005] A solar heating system for heating a pool of water includes a water bag formed of materials which enable the water bag to be deflated and compressed so as to occupy little space, when not in use. When the water bag is in use it is inflatable and expandable so as to contain a substantial amount of water which can be heated by the rays of the sun absorbed by the water bag. A water bag embodying the invention can be formed of inexpensive non-porous materials (e.g., plastic, rubber or canvas) of a texture and color which can absorb the rays of the sun and heat the contents of the water bag. The water bag is very portable and can be set up so as to be filled with water which can be heated quickly and easily. When not in use the water bag can be folded or rolled up taking up very little storage space. It does not interfere with the use of the pool of water that is intended to warm. It can be set up any place, close to the pool of water or by using longer hoses it can be located away from the pool, where the best sunlight and solar heat is available. The water bag can be coupled via hoses and valves to a pool of water to permit water to flow through the bag continuously. Alternatively, the valves may be used to allow the bag to be filled with water from a pool of water and for the water to be held in the bag until it is heated for a predetermined period or time or until it reaches a predetermined temperature, before the heated water is discharged into the pool of water.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] In the accompanying drawings like reference characters denote like components; and

[0007] FIG. 1 is an isometric view (not to scale) showing two sheets for forming a solar heating water bag embodying the invention;

[0008] FIG. 1A is a simplified top view (not to scale) of two sheets bonded together to form a solar heating water bag embodying the invention;

[0009] FIG. 2 is a top view (not to scale) of the water bag of FIGS. 1 and 1A with the addition of: a) orifices for letting water into and out of the water bag; and b) ribs;

[0010] FIG. 2A is a cross-sectional view of the water bag of FIG. 2 showing the ribs and the sheets expanded relative to each other;

[0011] FIG. 3 is a top view (not to scale) showing a water bag embodying the invention located adjacent to a swimming pool;

[0012] FIG. 4 is a side view (not to scale) of the water bag in a deflated (not used) condition;

[0013] FIG. 4A is an expanded view (not to scale) of one end of the water bag;

[0014] FIG. 4B is a side view (not to scale) of the water bag of the invention in a rolled up condition;

[0015] FIG. 5 is a view (not to scale) of a water bag, embodying the invention, inflated to hold water and to be heated by the sun, positioned adjacent to a swimming pool;

[0016] FIG. 6 is a partial cut away view (not to scale) of a water bag embodying the invention and a partial schematic diagram of additional devices for controlling circulation of water into and out of a water bag embodying the invention;

[0017] FIG. 7 is a view (not to scale) of a system embodying the invention; and

[0018] FIG. 8 is a view (not to scale) of a simple water bag for use in systems embodying the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0019] A water bag 10 embodying the invention may be formed as shown in FIGS. 1, 1A, 2 and 2A. FIGS. 1 and 1A show two large rectangular sheets (12, 14) of polyvinyl chloride which may be overlaid on each other to form a pouch (a bag to hold water). In one embodiment, the sheets were 3 feet wide and 18 feet in length and 20 mil thick. It should be appreciated that the length (L) and width (W) of the sheets may vary over a wide range. Likewise, the thickness (t) of each sheet may vary over a wide range so long as the sheet remains pliable and expandable when water is introduced into the pouch. In the manufacture of the water bag, a top sheet 12 may be placed on top of a bottom sheet 14, of the same general dimensions. The top and bottom sheets (12, 14) are then bonded to each other, at their outer edges, by any suitable bonding means such as heat welding or glue or other bonding means. As shown in the figures, a seam 18 is formed at the outer edges of the sheets which runs along the width and the length (i.e., the entire perimeter) of the water bag. The seam 18 may be formed along a line a distance d1 from the edges of the sheets (see FIG. 4A). Alternatively, the seam 18 may extend for the full distance d1 from the edges of the sheets to provide a stronger, wider, bond between the two sheets. Along their length, the two sheets define a side identified as 109a, at the bottom, and a side identified as 109b, at the top. Along their width one side of the two sheets is identified as 108a, and the opposite side is identified as 108b.

[0020] FIG. 2 shows that seam 18 is formed along the entire outer perimeter of the water bag 10. In addition, two openings (orifices) 22 and 24 are shown to be formed on one of the surfaces (e.g., the top) of the water bag. One opening (e.g., 22) is for enabling water to be "inputted" into the water bag and the other opening (e.g., 24) is for enabling the water
to be let out of (exit) the water bag. In one embodiment of the invention one and one half (1.5) inch polyvinyl chloride fittings were heat welded into the openings (22 and 24) of the top layer 12 of the water bag. In FIG. 2 the intake port 22 and the discharge port 24 are placed at opposite ends of the water bag so that water going into one of the two ports will travel some distance before going out of the other port. As shown in FIGS. 2 and 2A (and as further detailed in FIG. 6, below) ribs 20 may be formed to help direct or control the water flow and help make the water bag lay flatter. FIG. 2A is intended to illustrate that the ribs 20 may be formed by bonding (joining or connecting) the top and bottom sheets along spaced apart lines to form parallel channels running along the length of the water bag through which the water can flow. The ribs 20 (also referred to as walls, wi, in FIG. 6) may extend (partly or mostly) along the length of the water bag. Alternatively, as shown in FIG. 6, the ribs 20 (or wi in FIG. 6) can extend along the length of the water bag, from one side of the water bag (e.g., 108a or 108b) close to, but not all the way to, the other side (e.g., 108b, 108a). A gap (gi) is left at each end to enable water to circulate. FIG. 2A also illustrates that, when water is inserted into the pouch 10, the top sheet tends to be pushed upward and the bottom sheet tends to be pushed downward.

[0021] FIG. 3 is a simplified top view showing a water bag 10 lying alongside a pool 30 of water 32. The pool 30 may include a filtration system and a pump (not shown) which pumps water out of an output port 34. An intake (input) hose 36 is connected between the output port 34 of the pool and the input opening 22 of the water bag. An output (discharge or return) hose 38 having an output 40 is connected between the output opening 24 and the pool 30 to direct the water flowing out of the output 40 of hose 38 back into the pool.

[0022] FIG. 4 is a view of a water bag seen from a side showing the water bag 10 when deflated (i.e., when all the water has been removed or evacuated). When the water is removed from within the pocket formed between the two sheets, the top sheet 12 then overlies and rests on the bottom sheet 14 with the weld seam 18 between the two sheets. The hose fittings formed on or about openings 22 and 24 are shown extending vertically up from the top sheet. However, it should be understood that the openings (e.g., 22, 24) may be formed on the bottom sheet; and/or one may be formed on the top sheet and one may be formed on the bottom sheet; and/or one or more openings may be formed along or about the seam 18.

[0023] FIG. 4A is an expanded view of an end region of the top and bottom sheets (12 and 14) with the seam weld 18 binding the two sheets. The thickness t2 and t3 of the two sheets 12 and 14 may be the same, but need not be so. The seam 18 may terminate a distance d1 before the outer edge of the sheets, or extend all the way. Where the seam ends a distance d1 before the outer edge, the distance d2 is negligible since the sheets will tend to lie on top of each other.

[0024] FIG. 4B is intended to show that when the water bag 10 is emptied of water it can be easily rolled up for storage or for moving the bag from spot to spot. Alternatively, the water bag 10 could be folded upon itself for storage or for moving.

[0025] FIG. 5 is a partially isometric view of the water bag 10 in an inflated condition with input hose 36 attached between output port 34 of the pool 30 and input opening 22 of the water bag. Water is pumped from port 34 through intake hose 36 into the water bag 10 and inflates the water bag; causing the water bag to expand. The water pumped into the water bag gets heated by solar radiation and then flows out via output opening 24 and output (discharge) hose 38 back into the pool 30. That is, the pressure from the pump (not shown) forces the water to flow through the return hose 38 back into the pool 30, as illustrated by the arrows in the figure. FIG. 5 also shows that the rays 58 of the sun incident on the water bag are absorbed by the water bag and are used to heat the water as it flows through the water bag 10. Note that the material used to form the water bag as well as the color (generally dark) of the water bag 10 are specifically selected to ensure maximum absorption of the solar radiation incident on the water bag, in order to best heat the water contained in the bag.

[0026] FIG. 6 is a cut away view of a solar heating system which includes a water bag or pouch 10. The water bag 10 shown in FIG. 6 is rectangular in shape having a front end 108a, an opposite, back, end 108b; a front side 109a, and an opposite, back, side 109b. As discussed above, two sheets of a pliable non-porous (impermeable) material (e.g., plastic, rubber or canvas) which hold water are bound or sewn together at their outer edges to form the water bag 10. In FIG. 6, the water bag has an input port 22 to enable water to be inserted into the water bag 10 and an output port 24 to let out water heated within the bag.

[0027] In FIG. 6, the water bag is ribbed, or seamed, to form intermediate interior walls (e.g., w1-w7) which define a multiplicity of channels or paths (e.g., C1-C8). The walls, wi, extend along the length of water bag, but not for the full length. There is a gap (gi) between each wall, and one end of the water bag (e.g., 108a, 108b). In FIG. 6, the walls starting at end 108a of the water bag extend close to, but not all the way, to the other end 108b. There is a gap (e.g., g1, g3, g5 and g7) between the end of each wall and the other end 108b of the water bag. Likewise, the walls starting at end 108b of the water bag extend close to, but not all the way, to the other end 108a. There is a gap (e.g., g2, g4, g6) between the end of each wall and the other end 108a of the water bag. The openings or gaps (gi) between the end of each wall wi and the corresponding side (108a, 108b) of the water bag allow water to flow from one channel (e.g., C1) to the next channel (e.g., C2). Thus, there are openings gi between the walls wi and the side 18a of the water bag to allow water to flow from one channel (e.g., C2) to the next channel (e.g., C3). So configured water can be pumped and flow from the pool of water 30 via tubing (hose) 36a and 36b into input port 22. The water can then flow along the channels (e.g., C1-C8) formed within the water bag until the water reaches output port 24. The water can then flow from output port 24 via tubing 38a, 38b back into the pool of water.

[0028] As the water flows through the channels from input 22 to output 24, it is subject to being heated by the solar heat absorbed by the water bag.

[0029] The system may be operated in several different modes. In one mode, a water pump 105 (which may be a pump integral to the water circulation and filtration system of the pool or an additional, independent, pump specifically used with the water bag of the invention) pumps water from
the pool via hose 36a and into the water bag via hose 36b and the water flows continuously through the water bag 10 and is then returned to the pool of water via hoses 38a, 38b.

[0030] In another mode of operation, a valve 107 may be inserted between the output port 24 of the bag and the pool of water. In FIG. 6, the input side of valve 107 is shown connected to port 24 via hose 38a and the output side of valve 107 is connected to the pool via hose 38b. The valve 107 may be selectively activated (manually or thermostatically) to prevent the water in the bag from flowing out continuously. Rather, the valve may be selectively shut to prevent the flow of water out of the bag until the water in the water bag has been heated for a period of time or until it reaches a certain temperature. This may be accomplished manually or automatically. An important aspect of the invention is the ability to deflate the water bag such that it is easily foldable and/or rolled up. To this end, optional, selectively enabled output ports (O1-O4) are shown formed adjacent to the side 108b of the water bag to enable the water in the water bag to be drained more quickly and effectively.

[0031] Thus, when the water bag is to be folded, tubes 36b and 38a may be detached from the input port 22 and the output port 24, respectively. Any water within the water bag 10 can then be evacuated by causing the water to exit through ports 22 and 24. In addition, if optional ports (e.g., O1-O4) are formed in the water bag, they may be activated (opened) to empty out the water in the water bag. Obviously, when the bag is in use the optional ports would normally be closed.

[0032] The materials used for the top and bottom sheets 12 and 14 can vary so long as they have similar characteristics to polyvinyl chloride and achieve similar results after construction; e.g., the ability to absorb solar energy, inflate and deflate with water pressure, and to be rolled or folded tightly. The thickness of the top and bottom sheets can also vary over a wide range so long as the desired results noted above are achieved.

[0033] Seams and ribs (20 and w1) of the type detailed in FIG. 6 and the other figures may be heat welded, sewn or glued. By way of example, canvas material may be used which can be sewn or glued. The shape and size of the water bag may vary widely.

[0034] The openings (e.g., 22, 24) and the fittings for the openings can vary in size and in the type of materials used.

[0035] The hoses (e.g., 36, 38) may vary in length and diameter and in their termination. For example, male or female plug-in or threaded hoses may be used. Intake and/or output hoses may also be permanently connected to the water bag.

[0036] As shown in FIG. 6, a valve 107 may be added to the output (discharge) hose to control water flow. A valve 108 may also be added to the intake hose to control the flow of water into the water bag.

[0037] In FIGS. 1-5 the water pump used to pump water into the pool is also used to cause water to flow into the water bag. Alternatively, an external water pump could be used to cause water to flow into the water bag as shown in FIG. 6.

[0038] In FIG. 7, a filter system pump 115 and a filter 117 which may be integral to the swimming pool 30, or independent thereof, may be used to pump water via hose 361 into the pool 30 or via hose 36a and valve 108 and hose 36b into the water bag 10. In FIG. 7, the water bag 10 includes an intake tube (¾ inch hose) which is formed along one side (108a) of the bag 10 and which would have different sized holes (1h-4h) distributed along sections of the tube to control the flow of water into the water bag. The water in the bag may be discharged via a discharge hose which empties into the pool 30 via hoses 38a, valve 107 and tube 38a.

[0039] FIG. 8 shows a simple water bag embodying the invention where an intake or discharge tube, 36 or 38, is inserted into an opening between the two sheets 12, 14 whose outer perimeter is bonded to form a pouch.

[0040] In the figures, the invention has been illustrated using a swimming pool in conjunction with the water bag. It should be understood that this is for purpose of illustration only, and that any pool of water such as a spa or pond may be used in conjunction with a water bag embodying the invention to use solar heat to warm up water introduce into the water bag which can then be discharged into the pool of water.

What is claimed is:

1. A water bag for heating water using solar radiation comprising:

   first and second sheets of pliable, expandable, non-porous material joined together at their outer edges to form a pouch which can hold water; the first and second sheets being of a material and color that can absorb solar radiation and convert it into heat;

   a first orifice formed in the pouch for enabling the first orifice to be coupled to a pool of water for enabling water to flow from the pool into the pouch and causing the pouch to expand and for enabling the rays of the sun incident on the pouch to heat the water in the pouch;

   a second orifice formed in the pouch for coupling said second orifice to the pool of water for enabling water to flow from the water bag into the pool of water; and

   wherein, when the water bag is not in use, the pouch may be deflated such that said first and second sheets lie one on top of the other, touching each other, with little air and water therebetween; and said pouch, when the water bag is in use, expanding to its fullest extent.

2. The water bag as claimed in claim 1, wherein, when the water bag is not in use, the sheets may be folded to occupy little space.

3. The water bag as claimed in claim 1, wherein, when the water bag is not in use, the sheets may be rolled-up to occupy little space.

4. The water bag as claimed in claim 1 wherein the sheets are formed of polyvinyl chloride.

5. The water bag as claimed in claim 1 wherein the pool of water is one of a swimming pool, a spa and a pond.

6. The water bag as claimed in claim 1 further including ribs formed along the length of the water bag, between the two ends of the bag, for producing channels within the water bag.

7. The water bag as claimed in claim 6, wherein the first and second orifices are located at opposite ends of the water bag.
8. The water bag as claimed in claim 6 wherein as hose and a valve are coupled to the second orifice to control the discharge of water from the water bag.

9. The water bag as claimed in claim 6 wherein as hose and a valve are coupled to the first orifice to control the flow of water into the water bag.

10. A system for providing solar heating for a pool of water, comprising:

   first and second sheets of expandable, pliable, non-porous material joined together to form a pouch which can hold water; the sheets being of a material having a texture and being generally of dark color in order to absorb the rays of the sun and heat the water in the pouch;

   the pouch having an input port at one end of the pouch for enabling the input port to be coupled via a hose to a pool of water and for enabling water to flow from the pool of water into the pouch;

   the pouch having an output port located on the pouch at a point relative to the input port to ensure the longest path of travel for the water to flow within the pouch;

   wherein the pouch when exposed to the sun heats up the water with which it is filled; and

   wherein when the pouch is not in use it can be emptied of water and said first and second sheets collapse and are in touch with each other for enabling the pouch to be tightly rolled or folded.

11. The system as claimed in claim 10, further including means for selectively enabling water to flow continuously through the pouch and for selectively enabling water to fill the pouch until certain conditions of time and temperature are met and the water in the pouch is then discharged.

12. A method for heating water using a water bag comprised of first and second sheets of pliable, expandable, non-porous material joined together at their outer edges to form a pouch which can hold water; the first and second sheets being of a material and color that can absorb solar radiation and convert it into heat and having a first orifice formed in the pouch for enabling the first orifice to be coupled to a pool of water for enabling water to flow from the pool into the pouch and causing the pouch to expand and for enabling the rays of the sun incident on the pouch to heat the water in the pouch and having a second orifice formed in the pouch for coupling said second orifice to the floor of water for enabling water to flow from the water bag into the pool of water and wherein, when the water bag is not in use, the pouch may be deflated such that said first and second sheets lie on one top of the other, touching each other, with little air and water therebetween comprising the steps of:

   selectively introducing water into the bag so the water can flow continuously through the bag and then discharge into a pool of water; and

   selectively introducing water into the bag and holding the water in the bag until the temperature reaches a desired level and then discharging the contents of the bag into a pool of water.

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