

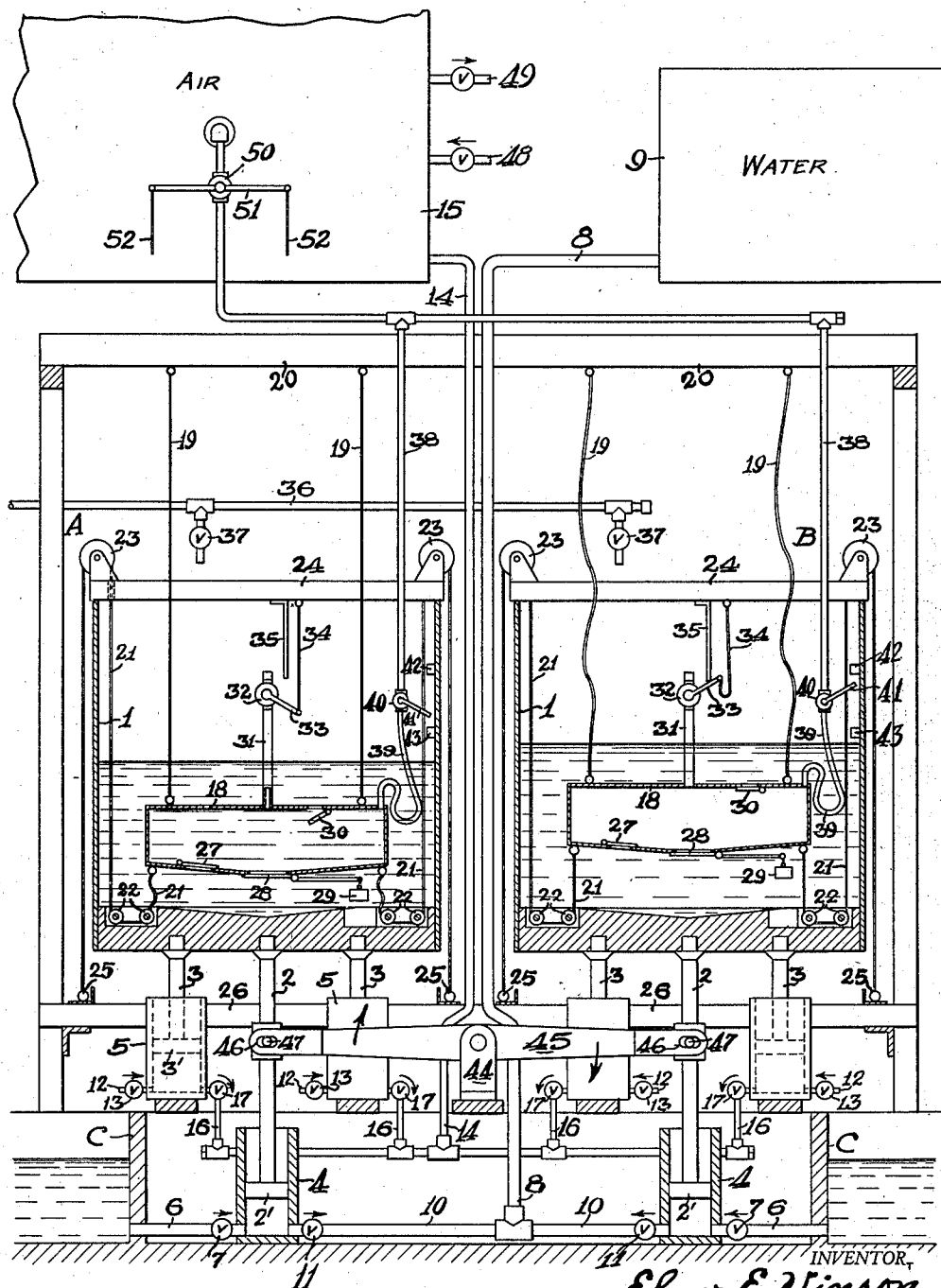
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PUMPING SYSTEM

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PUMPING SYSTEM

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This invention relates to improvements in pumping systems for raising quantities of water to suitable elevations where it may be available for use in generating electrical power or for other purposes.

Generally speaking, my invention comprises a pair of complementary pumping units which are alternately raised and lowered through the force of gravity by suitable means capable of shifting weights from one to the other, thereby continuously elevating quantities of water to a storage reservoir where it may be available for any one of a number of uses. The pumping units are identical in construction and operation and each comprises a vertically reciprocating water containing tank having a compression plunger thereon which operates in a compression chamber to force water to an elevated reservoir. The plungers of the two units are connected by a centrally pivoted walking beam which constitutes means whereby one tank is raised as the other is lowered, the tanks being alternately raised and lowered by means associated with each for automatically lightening the load of one and increasing the weight of the other.

The primary object of my invention is to provide improved pumping apparatus of the kind characterized, whereby quantities of water may be elevated to a desired height where it may be available for use in generating electricity or in performing any one of a number of other functions.

Other and further objects of my invention will be pointed out hereinafter, indicated in the appended claims or will be obvious to one skilled in the art upon an understanding of the present disclosure. For the purposes of this application I have elected to show herein certain forms and details of a pumping system representative of my invention; it is to be understood, however, that the embodiment of my invention herein shown and described is for the purpose of illustration only, and that therefore it is not to be regarded as exhaustive of the variations of the invention, nor is it to be given an interpretation such as might have the effect of limiting the claims, short of the true and most comprehensive scope of the invention in the art.

In the accompanying drawing the figure is a side elevation with certain parts in vertical section, of pumping apparatus embodying the preferred form of my invention.

The pumping system illustrated on the drawing comprises two identical complementary units A and B, the corresponding parts of which are de-

signed by similar reference characters. Each of the units comprises a water containing tank 1 mounted on plungers 2 and 3 which are secured to its bottom. The plunger 2 is centrally disposed with respect to the bottom of the tank and it carries a piston 2' at its lower end which operates vertically with reciprocating motion in a water compression cylinder 4. The plungers 3 also carry pistons 3' which operate vertically with reciprocating motion in air compression cylinders 5. Connecting the lower end of the cylinder 4 with a reservoir or other suitable source of water supply C is an intake pipe 6 having a check valve 7 which allows water to flow from the source of supply to the cylinder 4 but not in a reverse direction. Connecting the lower end of the water compression cylinder 4 with a vertical pipe 8 leading to an elevated tank or reservoir 9 is an outlet pipe 10 having a check valve 11 which allows water to flow from the cylinder 4 to the pipe 8 but not in a reverse direction. The air compression cylinders 5 are each provided at a point near its lower closed end with air intake means 12 having a check valve 13 which allows air to enter the said cylinder through said means but prevents air from proceeding from said cylinder in a reverse direction. Connecting the lower end of each of the air compression cylinders 5 with a vertical conduit 14 leading to a container 15 for compressed air, is an outlet pipe 16 having a check valve 17 which allows air to proceed from the said compression cylinder through the said outlet pipe but not in a reverse direction.

Mounted in the tank 1 and wholly submerged in a suitable amount of water contained therein, is a hollow container or float 18 adapted to be alternately filled with air and water. When the float is filled with water and is submerged beneath the surface of the water in the tank 1, it is supported by cables 19 which are suspended from a suitable frame member 20. Secured to opposite ends of the bottom of the float 18 are cables 21 which extend firstly over pulleys 22 secured to the bottom of the tank 1, then upwardly and over pulleys 23 supported on a beam 24 secured to the top end of the tank, and then downwardly outside the tank to anchorages 25 secured to a frame-member 26. The bottom of the float 18 is provided with a water intake opening which is normally closed by a valve member 27 which closes by gravity and is normally maintained in a closed position by compressed air in the float, but which is adapted to be opened by the outside water pressure when the com-

pressed air is exhausted from the said float. Located centrally in the bottom of the float is a water outlet opening which is controlled by a gate 28. A counter balancing weight member 29, rigidly secured to the gate and disposed at the opposite side of the gate's hinge, serves to normally maintain the gate in a closed position over the water outlet opening. The top of the float 18 is provided with another water inlet opening controlled by a valve member 30 which opens by gravity when compressed air is evacuated from the inside of the said float. The valve member 30 permits water to enter through the top of the float when the latter submerges so as to balance the upward pressure of water normally entering through the bottom intake opening which is controlled by the valve member 27. Mounted on the top of the float 18 is an upstanding air outlet pipe 31 having a valve 32 at its upper end which is provided with an outwardly disposed operating lever 33. The outwardly disposed end of the lever 33 is connected to a cable 34 which is secured to and suspended from the beam 24, the said cable serving to close the valve 32 when the bottom of the float reaches the bottom of the tank 1, thereby preventing any air from escaping from the said float. Secured to and extending downwardly from the beam 24 is a rigid bar 35, the lower end of which is positioned to intercept the operating lever 33 of the valve 32 to turn the latter to an open position when the top of the float becomes flush with the surface of the water in the tank, thereupon allowing compressed air in the float to escape and water to enter through the bottom opening controlled by the valve member 27.

Water is supplied to the tank 1 by a pipe 36 which has a control valve 37 associated therewith.

Leading from the compressed air container 15 is a pipe 38 having a flexible tubular extension 39 which is connected to the float 18. A valve 40 on the pipe 38, having an operating lever 41, serves to control the flow of compressed air from the container 15 to the float. Secured to the side of the tank 1 and positioned to intercept the operating lever 41 of the valve 40 when the tank moves up and down, are upper and lower spaced projecting trips 42 and 43. The upper trip 42 engaging with the operating lever 41 turns the valve 40 to a closed position while the lower trip engaging with the said lever opens the valve.

Pivotally supported at its center on a stationary supporting member 44 is a walking beam 45, the ends of the latter having slots 46 through which lugs 47 carried by the plungers 2 of the two units A and B extend. The downward movement of the tank 1 and the plunger 2 of one unit causes the walking beam 45 to actuate the tank and plunger of the other unit in an upward direction.

The compressed air container 15 is provided with valve controlled compressed air intake means 48 which is connected to a suitable source of supply for compressed air, and also with a valve controlled air exhaust means 49 for exhausting air from the container.

The compressed air carrying pipe 38 is provided with a valve 50 which has an operating rod 51 extending in opposite directions, the ends of the latter having chains or cords 52 suspended therefrom for permitting the convenient opening and closing of the said valve.

In priming the pumping system to commence

its operation, the valve 50 is first closed to prevent the passage of compressed air into and through the pipes 38. Compressed air of a suitable pressure is admitted to the compressed air container 15 to initially charge the same. The valves 40 and 32 are closed by moving their operating levers 33 and 41, respectively, to a downwardly slanting position and an upwardly inclined position. The floats 18 of both units are filled with water through the intake openings at their upper sides, thereupon causing them to be supported by their respective sets of cables 19, as indicated by unit A. Equal amounts of water are admitted to the tanks 1 from the supply pipe 36, to a depth equal to the length of the stroke of the plungers 2, plus the depth of the float 18 and plus enough additional depth to produce a certain degree of slack in the cables 21, as indicated by unit A. The two units are evenly balanced after equal amounts of water are admitted to the two tanks 1, and the walking beam 45 is then positioned horizontally, as illustrated on the drawing. The floats 18 of both units are each thereupon suspended from and supported by its respective set of cables 19, and each is submerged midway between the surface of the water and the bottom of its tank 1, as indicated by unit A. The floats 18 when in this position do not exert any pressure on the bottom of the tanks through the cables 21, nor on the plungers 2 and 3, the said floats and contents being supported entirely by the cables 19. The valve 50 is thereupon opened to allow the flow of compressed air from the container 15 through the pipes 38. The valve 40 on the pipe 38 of one of the units, as for instance unit B, is opened to allow compressed air to enter the float 18 of this unit so as to force the water therefrom into its associated tank 1 through the opening controlled by the valve 28. During this initial operation the weight member 29 is supported by any suitable outside means until the float is emptied of water. In subsequent operations weight member 29 rests on the bottom of the tank 1 while water is being expelled from the float. The water level in this particular unit thereupon rises, and the now buoyant float 18 exerts an upward pull on the cables 21 and a downward pull on the tank 1. The pressure thus exerted by the buoyant float 18 is equal to the weight of the water displaced by the float minus the weight of the material from which the float is made. It thus appears that the weight of the water previously confined in the float 18 plus the weight of the float itself (which had previously been supported by cables 19) is now added to the load in the tank. The additional weight now placed on the tank of unit B causes a downward pressure to be exerted thereby which is equal to the weight of the water expelled from the float, plus the weight of the float plus the buoyant pressure heretofore mentioned. The drawing illustrates unit B in the course of its downward stroke, while unit A is at the same time making its upward movement. When the downward stroke of unit B and the upward stroke of unit A are completed the water level in the tank 1 of unit B will be even with the top of the float 18 in this unit, and at the same time the water level in the tank of unit A will have risen above the top of the float of unit A a distance equal to the length of the stroke of plungers 2 and 3. At the end of this operation the trip 42 of unit B completes the closing of the valve 40 of this unit and prevents the passage of compressed air into

its associated float 18, while at the same time the bar 35 of the same unit opens its associated valve 32 allowing air to escape from the said float. Upon the discharge of the compressed air from the float 18 of unit B through its associated upright pipe 31, the said float sinks and becomes filled with water which enters through its bottom intake opening controlled by valve 27. The sinking or lowering of the float 18 of unit B causes the slack in cables 19 to be taken up and at the same time there is a corresponding slack produced in cables 21 (as illustrated in unit A).

With the downward stroke of the tank 1 of unit B, as above described, a reverse or upward movement occurs with respect to unit A. At the end of the upward stroke of the tank 1 of unit A the trip 43 opens the valve 40 to admit compressed air to the float of this unit, thereby causing the water contained therein to be expelled into the said tank. The cable 34 pulling upwardly on the operating lever 33 of valve 32 at the end of the upward stroke of unit A, causes the said valve to close, thereby preventing the escape of compressed air which is admitted upon the opening of the valve 40. Thus the excess load is shifted from unit B co-incidental with the shifting of the same load to unit A, and thereupon the strokes of the plungers in the respective units are reversed, unit A descending and unit B rising, until each unit reaches the end of its stroke, when the movements of the two units are again reversed. The automatic shifting of the load from one unit to the other, brought about by the operation of the valves of the floats 18, causes the alternate rise and descent of the tanks, plungers and pistons of the two units. With each upward stroke of the plunger 2 and pistons 2' water is drawn into the compression cylinders 4, and with each downward stroke of said plungers and pistons the water in the cylinders is forced through pipes 10 and 8 into the elevated reservoir 9. Similarly, air is drawn into the air compression cylinders 5 with each upward stroke of the plungers 3 and pistons 3', and then forced through pipes 16 and 14 into the compressed air container 15.

When water slightly in excess of the weight of the material of a float 18 has been forced therefrom by the entering of compressed air, the said float will rise until the slack in its associated cables 21 is taken up, and a corresponding slack will then be produced in the cables 19 which previously supported said float. The distance between the bottom of the said float and the surface of the water in its associated tank is thereupon lessened, thereby reducing the water pressure on the valve 28. The reduction of the water pressure on the valve 28 correspondingly lessens the air pressure required to open said valve. The said float is held in this position by the cables 21 until all of the water is expelled therefrom, whereupon the said float attains its maximum buoyancy and thereby exerts the full downward pressure on its associated tank.

While suitable means is shown and described for operating the valves 32 and 40, it is to be understood that electrical or other means may be satisfactorily employed without departing from the spirit of my invention. Likewise the valves 37 controlling the flow of water from the supply pipe 36 into the tanks 1 may be operated either by hand or automatically to replenish that water which might be lost through any cause such as evaporation.

Having described my invention, what I claim is:

1. A pumping system comprising a pair of re-

ciprocating water containing tanks each carrying a plunger; water compression cylinders within which the plungers reciprocate, each having water intake means and water outlet means; a centrally pivoted walking beam connected at its ends to the plungers; a continuous outside source of compressed air produced independently of the machine, a hollow float in each tank having compressed air inlet and outlet means and also water inlet and outlet means; means associated with each float for supporting the weight thereof when it descends; means associated with each float for causing compressed air from said source to enter and expel water therefrom whereby the float may become buoyant and rise in the water of its associated tank, and the said tank's load may be increased by the water expelled from the said float; means associated with each float for causing air to be discharged from the float to allow water to enter and cause the float to submerge in the water of its associated tank whereby the means associated with the float for supporting it when it descends may then take up the weight of the float from the tank; and means synchronized with the tanks for causing compressed air to enter one of the floats and water to exhaust therefrom while compressed air is being exhausted from the other float and water is being admitted thereto, whereby the weight of the loads of the two tanks may be alternately shifted from one to the other to cause the said tanks to alternately rise and fall and to thereby cause the operation of the plungers in their water compression cylinders.

2. A pumping system comprising a pair of reciprocating water containing tanks adapted to move in opposite directions as their loads alternately increase and decrease; a water compression cylinder associated with each tank having water inlet and water outlet means; a source of water supply connected to the inlet means of each cylinder; a water reservoir connected to the outlet means of each cylinder; a reciprocating plunger carried by each tank, and located in a compression cylinder; a hollow float in each tank having compressed air inlet and outlet means and also water inlet and outlet means; a continuous outside source of compressed air produced independently of the machine connected to the compressed air inlet means of each float; means associated with each float for supporting the weight thereof when it is filled with water and submerges in the water of its associated tank; means associated with each float for allowing compressed air to enter it and expel water therefrom into the water of its associated tank whereby the weight of the tank's load may be increased and the said tank may be moved in a downward direction; means associated with each float for causing air to be discharged therefrom to allow the water to enter it and cause it to submerge in the water of its associated tank, whereby the means associated with the said float for supporting it when it submerges may take up the weight of the said float from the tank to lighten the load of the latter; means associated with the tanks for causing one to be elevated by the downward movement of the other; and means synchronized with the tanks for alternately causing compressed air to enter one of the floats and water to exhaust therefrom and at the same time causing compressed air to exhaust from the other of the floats and water to enter the same, whereby a preponderant part of the weight of the loads of the two tanks may be alternately shifted from one to the other to cause them to alternately rise and fall and

thereby cause the operation of their respective plungers in the water compression cylinders.

3. A pumping system comprising a pair of reciprocating water containing tanks adapted to move in opposite directions as their loads are alternately increased and decreased; a plunger carried by each tank; water compression cylinders in which the plungers reciprocate, the said cylinders each having water inlet means and water outlet means, the inlet means being connected to a source of water supply and the outlet means being connected to a water container; a hollow float in each tank having compressed air inlet and outlet means and also water inlet and outlet means; a continuous source of compressed air produced independently of the machine connected to the compressed air inlet means of each float; cables connected with each float for supporting the weight thereof when it is filled with water and submerges in the water of its associated tank; means associated with each float and adapted to be actuated by the rise of the said float's associated tank for allowing compressed air to enter the said float and expel water therefrom into the water of its associated tank, whereby the weight of the load of the latter may be increased and the said tank may be actuated in a downward direction; means associated with each float and adapted to be actuated by fall of the said float's associated tank for causing air to be discharged therefrom to allow water to enter it and cause it to descend in the water of its associated tank, whereby the cables associated with the said float for supporting the latter when it descends may take up the weight of the said float from its associated tank to lighten the load of the latter; means associated with the tanks for causing one to be elevated by the downward movement of the other; and means synchronized with the tanks for alternately causing compressed air to enter one of the floats and water to exhaust therefrom and at the same time causing compressed air to exhaust from the other of the floats and water to enter the same, whereby a preponderant part of the weight of the loads of the two tanks may be alternately shifted from one to the other to cause them to alternately rise and fall and thereby cause the operation of their respective plungers in the compression cylinders.

4. A pumping system comprising a pair of reciprocating water containing tanks adapted to move in opposite directions as their loads are alternately increased and decreased; a plurality of plungers carried by each tank, one of the plungers of each tank being positioned in a water compression cylinder having inlet and outlet means and another of the plungers of each tank being positioned in an air compression cylinder having air inlet and outlet means; means supplying water to the inlet means of the water compression cylinder; a water reservoir connected to the outlet of the water compression cylinder; a compressed air container having means associated therewith for supplying compressed air from a source independent of the machine connected to the air outlet of the air compression cylinder; a hollow float in each tank having compressed air inlet means and air outlet means, and also water inlet and water outlet means; means connecting each compressed air inlet means of the floats with the compressed air container; means associated with each float for supporting the same when it submerges in the water of its associated tank; means associated with each float for causing compressed air to enter it and expel water therefrom

into its associated tank whereby the weight of the load of the said tank may be increased by the added expelled water; means associated with each float for causing air to be discharged from the float to allow water to enter and cause the float to submerge in the water of its associated tank whereby the means associated with the float for supporting it when it submerges may then take up the weight of the float from the tank; means synchronized with the tanks for causing compressed air to enter one of the floats and water to exhaust therefrom while compressed air is being exhausted from the other float and water is being admitted thereto whereby a portion of the weights of the loads of the two tanks may be alternately shifted from one to the other to cause the said tanks to alternately rise and fall and to thereby cause the operation of the plungers in their associated compression cylinders; and means associated with the tanks and adapted to be actuated by the downward movement of one of them, for elevating the other.

5. A pumping system comprising a pair of reciprocating water containing tanks each carrying a plunger; water compression cylinders within which the plungers reciprocate, each having water intake means and water outlet means; means for supplying the tanks and cylinders with water; a centrally pivoted walking beam connected at its ends to the plungers; a hollow water or air containing float in each tank, which is at all stages of the operation completely submerged in the water contained in the tank, each float having compressed air inlet and outlet means and also water inlet and outlet means; means associated with each hollow float for supporting the weight thereof in excess of the weight of the water displaced by it when it fills with water and descends in the water contained in the tank; a continuous outside source of compressed air produced independently of the machine; means associated with each float for causing compressed air from the said source to enter said float and expel water therefrom whereby the float may become a buoyant float and rise in the water of its associated tank; means connected with each air-filled buoyant float for exerting a downward pressure on its associated tank when the said buoyant float rises, the said downward pressure on the tank being further increased by the increased depth of water in the tank by the water expelled from the said float; means associated with each buoyant float for causing air to be discharged therefrom so as to allow water to enter and cause the float to descend in the water of its associated tank whereby the means associated with the float for supporting its weight in excess of the weight of the water displaced by it when it descends may take up said excess weight of the water-filled float from the tank; and means synchronized with the tanks for causing compressed air to enter one of the floats and water to exhaust therefrom while compressed air is being exhausted from the other float and water is being admitted thereto, whereby the weight of the load of one of the tanks is increased coincidentally with a decrease in the load of the other, thereby causing the said tanks alternately to rise and fall and thereby causing the operation of the plungers in their water compression cylinders.

6. A pumping system comprising a pair of reciprocating water containing tanks adapted to move in opposite directions as their loads alternately increase and decrease; a water compression cylinder associated with each tank having

water inlet and water outlet means; a source of water supply connected to the inlet means of each cylinder; a water reservoir connected to the outlet means of each cylinder; a reciprocating
 5 plunger carried by each tank and located in a compression cylinder; a hollow float in each tank, having compressed air inlet and outlet means, and also water inlet and outlet means; a continuous outside source of compressed air produced independently of the machine, the said
 10 source of compressed air being connected to the compressed air inlet means of each float; means associated with each float for supporting the weight thereof in excess of the weight of the water displaced by it when it is filled with water
 15 and descends in the water contained in its associated tank; means associated with each float for allowing compressed air to enter it and expel water therefrom into the water of its associated tank whereby the depth of water in the tank is
 20 increased and the weight of the tank's load is increased, thereby causing said tank to move in a downward direction; means associated with each float for causing air to be discharged therefrom
 25 to allow water to enter it and cause it to descend in the water of its associated tank, whereby the supporting means associated with the said float may take up the weight of the said float in excess of the weight of water displaced by it
 30 and thereby lighten the load of the tank; means associated with the tanks for causing one to be elevated by the downward movement of the other; and means synchronized with the tanks for alternately causing compressed air to enter
 35 one of the floats and water to exhaust therefrom and at the same time causing compressed air to exhaust from the other of the floats and water to enter the same, whereby the preponderant part of the weight of the loads of the two tanks
 40 may be alternately shifted from one to the other to cause them alternately to rise and fall and thereby cause the operation of their respective plungers in the water compression cylinders.

7. A pumping system comprising a pair of reciprocating water containing tanks adapted to
 45 move in opposite directions as their loads are alternately increased and decreased; a plunger carried by each tank; water compression cylinders in which the plungers reciprocate, the said cylinders each having water inlet means
 50 and water outlet means, the inlet means being connected to a source of water supply and the outlet means being connected to a water container; means for supplying water to each tank from an available source; a hollow float in each
 55 tank having compressed air inlet and outlet means and also water inlet and outlet means; a continuous outside source of compressed air produced independently of the machine, the said
 60 source of compressed air being connected to the compressed air inlet means of each float; means associated with each float for supporting the weight thereof in excess of the weight of water displaced by it when it is filled with water and
 65 descends in the water of its associated tank; means associated with each float and adapted to be actuated by the rise of the said float's associated tank for allowing compressed air to enter the said float and expel water therefrom into
 70 its associated tank, whereby the load of the tank may be increased and the said tank may be actuated in a downward direction; means associated with each float and adapted to be actuated by the fall of the said float's associated tank for
 75 causing air to be discharged therefrom so as to

allow water to enter it and cause it to descend in the water of its associated tank, whereby the supporting means associated with the said float may take up the weight of the said float in excess of the weight of water displaced by it, and
 5 thereby lighten the load of the tank; means associated with the tanks for causing one to be elevated by the downward movement of the other; and means synchronized with the tanks for alternately causing compressed air to enter one
 10 of the floats and water to exhaust therefrom and at the same time causing compressed air to exhaust from the other of the floats and water to enter the same, whereby a preponderant part of the weight of the loads of the two tanks may
 15 be alternately shifted from one to the other to cause them alternately to rise and fall and thereby cause the operation of their respective plungers in the compression cylinders.

8. A pumping system comprising a pair of reciprocating water containing tanks adapted to
 20 move in opposite directions as their loads are alternately increased and decreased; a plurality of plungers carried by each tank, at least one of the plungers of each tank being positioned in a
 25 water compression cylinder having inlet and outlet means and at least another of the plungers of each tank being positioned in an air compression cylinder having air inlet and outlet means; means for supplying water to the inlet means of
 30 the water compression cylinder; a water reservoir connected to the outlet of the water compression cylinder; a compressed air container having means associated therewith for supplying compressed air from a source independently of the
 35 machine, the said source of compressed air being connected to the air outlet of the air compression cylinder; means for supplying compressed air to said compressed air container from a source; a hollow float in each tank having compressed air
 40 inlet means connected to the compressed air container, also air outlet means and also water inlet and water outlet means; means associated with each float for supporting the same when it is filled with water and descends in the water of its
 45 associated tank; means associated with each float for causing compressed air to enter it and expel water therefrom into its associated tank thereby increasing the depth of water in the tank and consequently the pressure per square foot on the
 50 floor of the tank; means associated with each float for causing compressed air to escape from the float thereby allowing water to enter and cause the float to descend in the water of its associated tank whereby the supporting means associated
 55 with the float may take up the weight of the float in excess of the weight of the water displaced by it; means synchronized with the tanks for causing compressed air to enter one of the floats and water to exhaust therefrom while compressed
 60 air is being exhausted from the other float and water is being admitted thereto whereby a portion of the weights carried by the two tanks may be alternately shifted from one to the other to cause the said tanks to alternately
 65 rise and fall and cause the operation of the plungers in their associated compression cylinders; and means associated with the tanks and adapted to be actuated by the downward movement of one of them for elevating the other.

9. In pumping system, a pair of water containing tanks adapted to move alternately up
 70 and down with reciprocating motion; means associated with the tanks for causing the elevation of one by the downward movement of the other; 75

pumping means associated with each tank; a submerged float in each tank and adapted to be filled alternately with air and water, thereby alternately increasing and decreasing the weights of the loads carried by the tanks; means connected to a source of supply for supplying compressed air from a source outside of and independent of the machine to the floats; and means associated with the floats for causing the floats to be filled alternately with air and water to increase and decrease the weight of the load of their respective tanks, whereby one tank may descend while the other rises.

10. In a pumping system, a pair of water containing tanks adapted to move alternately up and down with the shifting of a certain weight from one to the other; water pumping means and means for compressing air associated with and actuated by each tank; means for supplying water to the pumping means from a source of supply; means associated with the tanks for causing the elevation of one by the downward movement of the other; a hollow container in each tank; means for supplying each container with compressed air from a source outside of and independent of the machine; means for filling the containers alternately with compressed air and water thereby alternately increasing and decreasing the weight of the containers and also of the loads carried by the tanks, whereby the said tanks may be moved alternately up and down.

11. In a pumping system, two vertically moving units connected by means whereby the descent of one causes the rise of the other, the said units being substantially alike as to construction, weight and component parts; each unit consisting of a water containing tank; a hollow container within the tank, having means for holding the same at all times completely submerged in the water contained in the tank; means for filling the hollow container with water from that contained in the tank, thereby decreasing the depth of water in the tank and the pressure on the bottom thereof; means for emptying the water from said container back into the body of water contained in the tank, thereby increasing the depth of water in the tank and also increasing the pressure on the bottom thereof, and, by the same action causing the said hollow container to become a buoyant float exerting an upward pressure; means for supporting said container when filled with water and preventing it from sinking to the bottom of the tank; means associated with the container and the tank for causing the buoyant pressure of said container, when water is removed therefrom, to be exerted as downward pressure upon its associated tank; means associated with each unit for pumping water to an elevation for any useful purpose.

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