(No Model.)

3 Sheets—Sheet 1.

J. W. GARRETT, Sr.

HYDRAULIC ENGINE.

No. 562,721. Patented June 23, 1896.

Fig. 1.

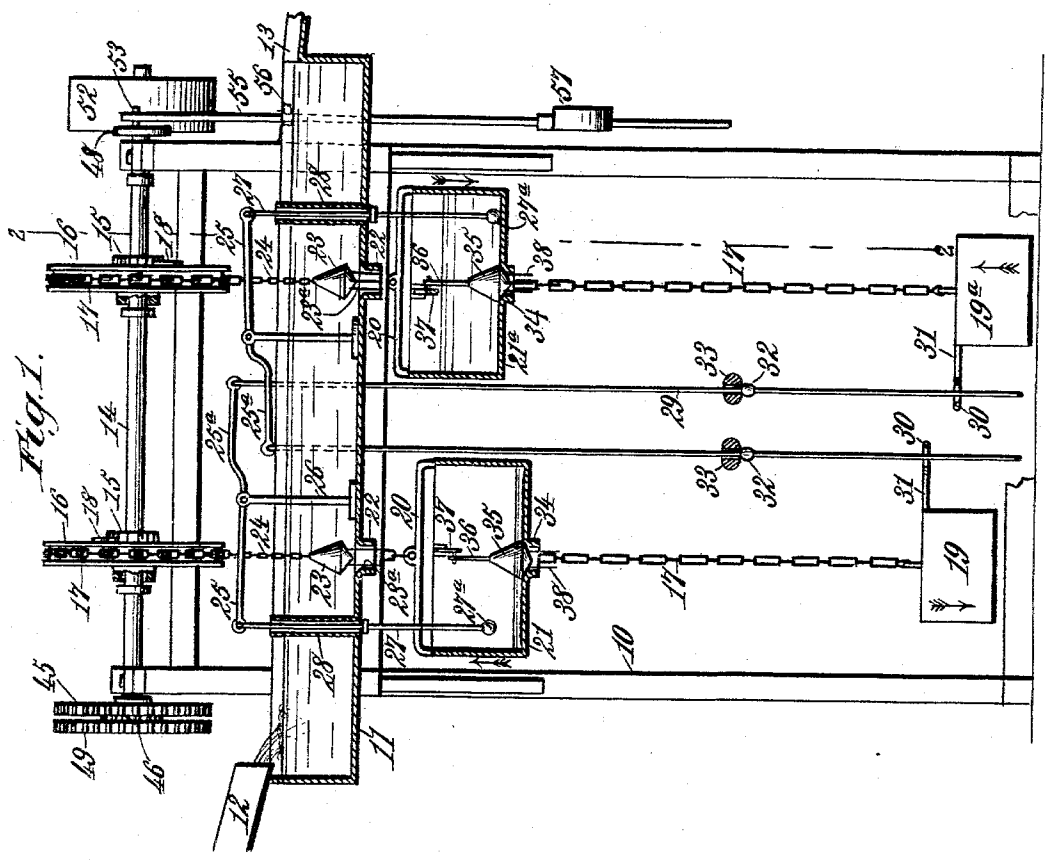
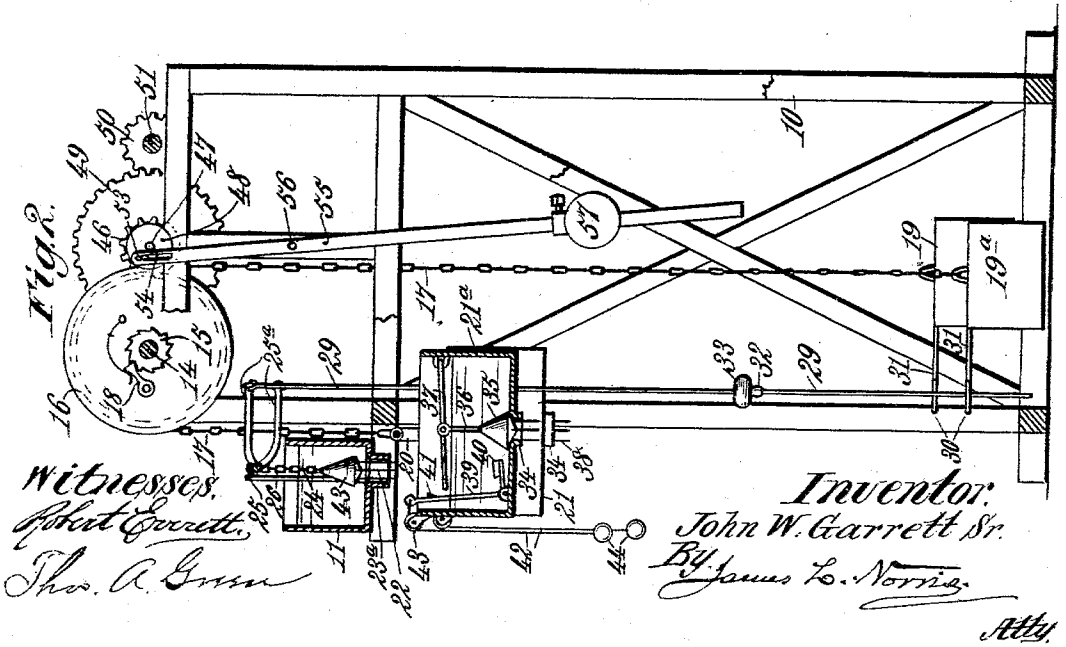


Fig. 2.



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(No Model.) 3 Sheets—Sheet 2.

J. W. GARRETT, Sr.

HYDRAULIC ENGINE.

No. 562,721. Patented June 23, 1896.

Fig. 1.

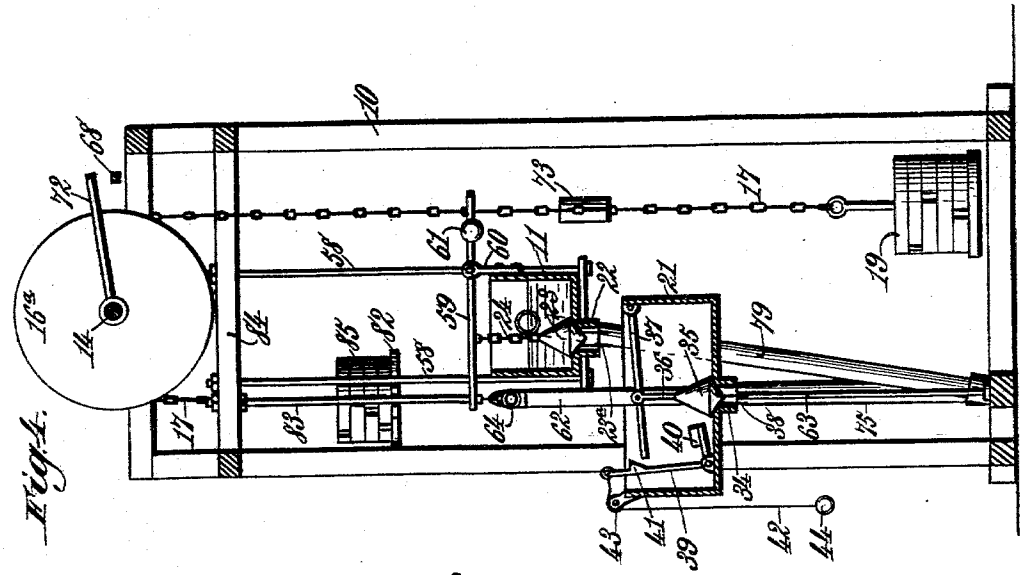
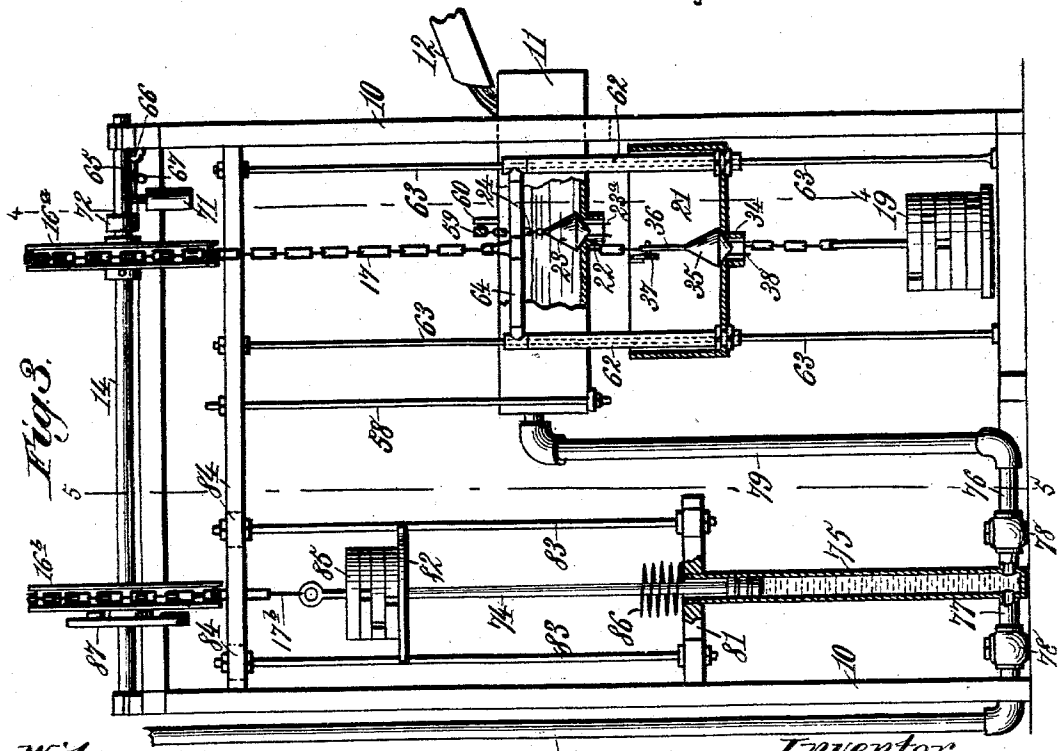


Fig. 3.



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(No Model.) 3 Sheets—Sheet 3.

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Fig. 4.

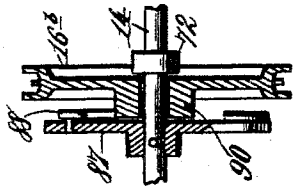


Fig. 6.

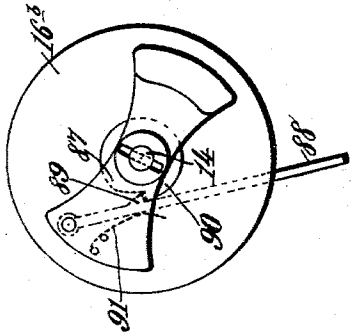
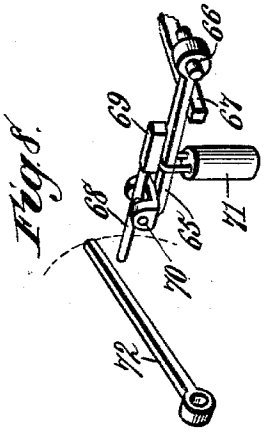


Fig. 8.



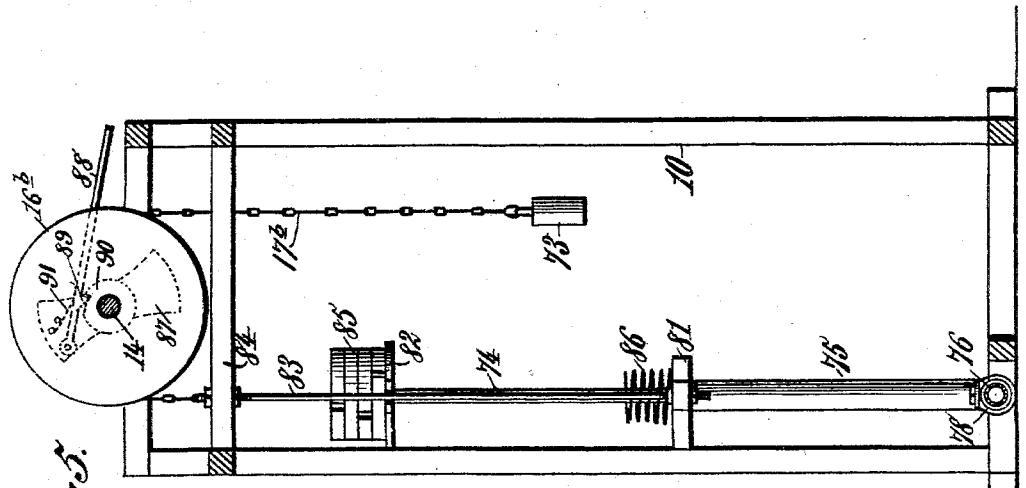


Fig. 5.

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UNITED STATES PATENT OFFICE.

JOHN W. GARRETT, SR., OF SPARTANBURG, SOUTH CAROLINA.

HYDRAULIC ENGINE.

SPECIFICATION forming part of Letters Patent No. 562,721, dated June 23, 1896.

Application filed July 25, 1895. Serial No. 557,123. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. GARRETT, Sr., a citizen of the United States, residing at Spartanburg, in the county of Spartanburg and State of South Carolina, have invented new and useful Improvements in Hydraulic Engines, of which the following is a specification.

This invention relates to hydraulic engines wherein the weight of water is employed for elevating or restoring a weight or weights connected with one or more self-emptying water-accumulating buckets, and in which an appropriate mechanism for the fall of the weight or weights may be utilized to economically develop power for various purposes.

The invention consists in features of construction and novel combination of parts and devices in a hydraulic engine or motor, as hereinafter more particularly described and claimed.

In the annexed drawings, illustrating the invention, Figure 1 is a partly-sectional front elevation of a hydraulic engine embodying my improvements. Fig. 2 is a vertical transverse section of the same on the line 2 2 of Fig. 1. Fig. 3 is a partly-sectional front elevation of a form of my hydraulic engine or motor adapted to the operation of a pump. Fig. 4 is a vertical transverse section of the same on the line 4 4 of Fig. 3. Fig. 5 is a similar view on the line 5 5 of Fig. 3. Figs. 6, 7, and 8 illustrate details of construction, hereinafter particularly described.

Referring, at first, more particularly to Figs. 1 and 2, the number 10 designates an upright frame or scaffolding constructed to support, near its top, a trough or tank 11, having at one end, or other suitable point, an inlet 12 for water taken from a stream or spring, and provided also with an overflow-outlet 13 at any desired point. The trough or tank 11 is preferably supported at the front upper portion of the frame 10 and may be somewhat long and narrow, as shown. At the top of the frame or scaffolding 10, above and to the rear of the trough 11, is journaled a rotatable shaft 14, to which ratchet-wheels 15 are secured at suitable intervals. Mounted loosely on the shaft 14, at one side of each ratchet-wheel 15, is a chain wheel or pulley 16, the periphery of which is preferably grooved to afford a guide-bearing for a chain 17, the ends of which hang in rear of the water tank or trough. One side of each chain wheel or pulley 16 is provided with a spring-pressed pawl 18, engaging the ratchet-wheel 15 in such manner as to cause a rotation of the shaft 14 when the wheel 16 is rotated by descent of a weight 19 or 19^a, secured to one end of the chain. The other end of each chain 17 connects with the bail 20 of a bucket 21 or 21^a, that has a vertical movement below the tank 11 and is extended partly beneath the same. Descent of the weight 19 or 19^a will raise the bucket 21 or 21^a at the other end of either chain 17 and at the same time will rotate the shaft 14 through the gearing with which the moving chain connects. On the other hand, when the bucket is supplied from the tank or trough 11 with a sufficient quantity of water to overbalance the connected weight 19 or 19^a, the bucket will descend and restore the said weight to its elevated position in readiness to again act upon and continue the rotation of the shaft. While the bucket 21 or 21^a is descending and the connected weight is ascending, the loosely-mounted chain-wheel 16 will be rotated backward and its pawl 18 will click back on the ratchet-wheel 15 without exerting at that point any driving action on the shaft 14 to which said ratchet-wheel is secured.

In the bottom of the water tank or trough 11 are provided outlets 22 for delivering water into the buckets 21 and 21^a, as required. Each outlet 22 is provided at its top with a suitable seat for a valve 23, suspended by a chain 24 from one arm of a two-armed lever 25, that is fulcrumed intermediate its ends to a standard 26, supported within the water tank or trough. To the end of the valve-supporting arm of each lever 25 is loosely jointed a rod 27, that is extended into the bucket 21 or 21^a through a perforation in the bottom of the tank or trough 11, each perforation provided for this purpose being guarded or protected against leakage by a tube 28, extended above the water-level in the tank, and each tube serving also as a guide for the rod passed through it. To the lower end of each rod 27 a ball 27^a may be attached, for contact with the bottom of the bucket when the latter has ascended a sufficient distance. Each two-armed lever 25 has

one of its arms, as 25ª, curved upward and rearward to the outside of the tank, and to the end of this lever-arm 25ª is loosely jointed a rod 29, that is extended down through an eye 30 on an arm 31, projecting from each weight 19 or 19ª, as shown. At a suitable point on each rod 29 is a projection 32, preferably adjustable and adapted to serve as a support for a weight 33, that is loose on the rod 29 and adapted to slide thereon.

It will be observed that the eye 30 presents an opening through which the projection 32 of the rod 29 may pass as the weight 19 or 19ª moves up or down, but this opening is not large enough to permit passage of the small weight 33, which will consequently be picked up by and supported on the said eye 30 when the weight 19 or 19ª has been caused to ascend a sufficient distance by the descent of the water-weighted bucket 21 or 21ª on the other end of the chain.

Each tank-valve 23 is preferably provided with a conical working face to correspond with a similar taper or beveling of the valve-seat, and to the under side of each of these valves are secured a series of guides 23ª, engaging in the corresponding tank-outlet 22, so as to prevent oscillation of the loosely-suspended valve and insure a proper seating.

In the bottom of each bucket 21 and 21ª is an outlet 34, controlled by a valve 35, suspended by a rigid valve-stem 36 from an arm 37, that has one end pivoted to the inner side of the bucket. The bottom of each bucket-valve 35 is provided with depending guides 38, that are also adapted to serve as stops and to elevate and open the valve, by contact with the base of the engine or motor, when the bucket has completed its descent. There is pivoted in the bottom of each bucket 21 and 21ª an angle-lever 39, having a weight 40 on its lower horizontal arm and a catch 41 on its upper or vertical arm.

To the upper end of each angle-lever 39 is attached one end of a cord 42, that is passed outward over a small pulley 43 at the top of the bucket. To the outer end of each cord 42 is attached a ball 44 of sufficient weight to overbalance the weight 40 and tilt the lever 39, so as to hold the catch 41 away from the arm 37 to which the bucket-valve 35 is connected. When the bucket 21 or 21ª has descended, by the weight of water therein, the ball 44 will first rest on the ground or base of the engine and thereby permit the weight 40 to throw the upper arm of the angle-lever 39 against the end of the arm 37 from which the bucket-valve 35 is suspended. Before the bucket has quite completed its descent the guide or guides 38 on the valve 35 will come in contact with the ground or base of the engine, and will thereby lift the valve and open the outlet from the bucket, so that the water will commence to escape therefrom. In the upward opening movement of the valve 35 the end of the arm 37 will be caused to engage the catch 41 of the angle-lever 39, and thus the valve 35 will be supported away from its seat as long as the ball 44 continues to rest upon the ground. By the descent of the water-weighted bucket the weight 19 or 19ª, on the other end of the chain 17, has been raised or restored to its elevated position, and as soon as sufficient water has escaped from the bucket the said weight will descend and the bucket will be again lifted. As the bucket rises the water continues to escape until the ball or weight 44 is lifted from the ground and reacts on the lever 39 to disengage it from arm 37, and permit the valve 35 to drop and close the outlet 34 by the time that the bucket has emptied itself.

In order to get a continuous rotation of the shaft 14, I have secured thereon two ratchet-wheels 15, actuated by the pawls 18 on two loosely-mounted chain-wheels 16. Two weights 19 and 19ª are employed to revolve the wheels 16, and two self-emptying water-weighted buckets 21 and 21ª are employed to restore or elevate the weights 19 and 19ª after they have successively acted to rotate the shaft. The weights 19 and 19ª descend slowly, one in advance of the other, and for a time they are acting simultaneously on the shaft 14 through the ratchet mechanism 15, that is fast thereon. On the other hand, the water-weighted buckets 21 and 21ª descend rapidly, by reason of the chain-wheels 16 being mounted loosely on the shaft 14 and having, consequently, no resistance to overcome in their backward revolution. By the time either weight 19 or 19ª has reached its lower limit of movement the bucket on the other end of chain 17 will have received from the tank or trough 11 a sufficient quantity of water to overbalance the weight to be raised. The bucket will descend rapidly, under the weight of water contained therein, there being no resistance to the free backward rotation of the loosely-mounted chain-wheel 16, and the weight 19 or 19ª will consequently be elevated rapidly before the other weight has completed its descent or ceased to act upon the shaft 14, which is thus always subjected to the driving action of either one weight or the other. Before the uppermost slowly-falling weight has fully descended, the other will be quickly raised and again commence a descent, and thus the continued rotation of the shaft 14 will be maintained.

By reference to Fig. 1, it will be seen that the lever mechanism of one tank-valve 23 has its rod 29 passed through the eye 30 of the weight that is connected with the bucket to be supplied with water through the tank-outlet controlled by the other valve 23 of the tank. When the weights 19 and 19ª are at or near their lowermost positions and the buckets are elevated, contact of the bucket-bottom with the lower end of rod 27 will open the tank-valve 23 to permit a flow of water into the bucket. Before either bucket, say 21ª, has descended sufficiently to release the rod 27 and permit the valve 23 to close, the weight, say

19, connected with the other bucket will have descended below the projection 32 of rod 29, thereby leaving the small weight 33 supported by or upon said rod, so as to overbalance the valve 23 and cause it to remain open until the bucket 21^a has received sufficient water to more than overbalance the weight 19^a and cause its rapid ascent. In the upward movement of either weight 19 or 19^a its eye 30 will lift the weight 33 that is holding open the tank-valve 23, controlling the opening through which water is passing to the bucket connecting with the other one of said weights 19 or 19^a, and thus either valve 23 will close when the bucket beneath the same has received sufficient water to more than overbalance the weight on the other end of the chain.

On the shaft 14 is a gear-wheel 45, Fig. 1, meshing with a pinion 46, Fig. 2, on a shaft 47, that carries a disk 48 at one end and a gear 49 at the other end. The gear 49 meshes with a pinion 50 on a shaft 51, from which power may be taken through belting with pulley 52, secured on said shaft. The disk 48 carries a wrist-pin 53, engaging a slot 54 in the upper arm of a pendulum-governor 55, fulcrumed at 56 to a convenient part of the engine-frame. On the lower arm of the pendulum 55 is secured a sliding weight 57, that may be adjusted up or down to regulate the oscillations of the pendulum and govern the speed of the engine or motor, as required.

In Figs. 3 to 8 I have shown some modifications of the apparatus that adapt it to the purpose of imparting a rocking movement or alternately opposite rotations to the shaft 14, the oscillations of which may be utilized to periodically elevate and release a weight or a weighted plunger for forcing water or other fluid. The frame 10 may support a water tank or trough 11 by means of suspending rods 58, Fig. 4, or otherwise. Only one self-emptying water-weighted bucket 21 will be ordinarily required, and to the other end of its supporting-chain 17 will be connected a weight 19, or preferably a series of detachable weights that can be increased or diminished as desired. In the bucket 21 is a valve mechanism, (indicated in Figs. 3 and 4 by the same reference-numbers and having the same features of construction and operation, as already described with regard to Figs. 1 and 2.) For the purpose of supplying water to the bucket 21 there is provided in the bottom of the tank or trough 11 an outlet 22, controlled by a valve 23 of the same construction as shown in Fig. 2. This valve is suspended by a chain 24 from a two-armed lever 59, Fig. 4, fulcrumed to a standard 60 on the tank and having its arms projecting, respectively, in front and rear of the same, the rear one of said arms being provided with a sliding weight 61 to counterbalance the valve.

In the ends or sides of the bucket 21, Figs. 3 and 4, are vertical guide-tubes 62, through which are passed vertical guide-rods 63, supported in the frame 10, and along which the bucket is arranged to rise and fall. The guide-tubes 62 are extended above the bucket and connected at their upper ends by a cross-bar 64, to which one end of the chain 17 is secured. The chain 17 is passed over a chain-wheel 16^a, that is rigid on the shaft 14 to rotate or rock it in one direction by descent of the water-weighted bucket 21, (at the same time raising the weight or weights 19,) while, on the other hand, descent of the weight will raise the self-emptying bucket and rotate the shaft 14 in an opposite or backward direction.

At the top of the frame 10, as shown in Fig. 3, is arranged a detent or stop lever 65, Fig. 8, that has one end pivoted at 66 to a convenient point on the frame. At a suitable distance from the fulcrum 66 is a rest 67, that normally supports the detent or lever 65 in a substantially horizontal position. The free end of the lever 65 has pivoted to its upper side an arm or extension 68, carrying a weight 69 on its inner end. This extension-arm 68 is so arranged that its outer end can be tilted down without disturbing the lever 65, but it cannot be raised without also lifting said lever, the position of the weight 69 being such as to hold the joint 70 rigid in one direction while permitting it to yield in the opposite direction to allow a downward movement of the free end of arm 68 independent of any movement of the part or lever 65, to which it is pivoted. From this lever 65 is suspended a weight 71, that may be moved from or toward the fulcrum 66 to increase or diminish the resistance offered by the lever to a lifting action thereon. The pivoted extension-arm 68 projects in the path of an arm 72, that is rigidly secured to the shaft 14 and which is so arranged that as the weight 19 descends and the shaft 14 is thereby rotated in a corresponding direction the said arm 72 will come down upon and slip by the extension-arm 68, that will tilt downward and not offer any obstruction to the rotation of the shaft 14 in that direction. Before the weight or weights 19 have quite completed their descent the cross-bar 64, carried by the upwardly-moving bucket 21, will come in contact with and raise the pivoted arm 59 from which the tank-valve 23 is suspended, and the valve-controlled tank-outlet being thus opened water will flow therefrom into the bucket. When the tank-valve 23 is thus opened, the shaft-arm 72 has moved to the under side of the extension-arm 68 of lever 65, and as soon as the bucket 21 tends to settle slightly under the weight of water accumulating therein the slight backward rotation of shaft 14 will carry the arm 72 against the under side of the arm 68, that is held down by the weighted lever 65 to which it is attached. The resistance offered by this weighted lever 65, to an upward movement of the arm 72, now on the under side of the lever extension 68, will be sufficient to prevent a further backward rotation of the shaft 14 for the time being and will thus hold the tank-valve 23 open, by the lifting action of cross-bar 64 on the valve-supporting arm 59, until the bucket

21 has received sufficient water to more than overbalance the weight or weights 19 on the other end of the bucket-chain, plus the resistance offered by the weighted detent-lever 65, that has previously prevented a backward rotation of the rigidly-mounted chain-wheel 16^a, from which the bucket 21 and weight or weights 19 are suspended. When, however, the bucket 21 becomes sufficiently weighted with water flowing thereto, the said bucket will descend, the tank-valve 23 will close down, the arm 72 will lift and pass by the weighted lever 65, and the weight or weights 19 will be restored to an elevated position. On completing its descent the bucket 21 will empty itself, as before described with reference to Figs. 1 and 2, and will be again lifted by descent of the weight or weights 19 on the other end of the chain, and thus by alternate action of the said weight or weights 19 and water-weighted self-emptying bucket 21 the shaft 14 will be alternately rotated in opposite directions.

For the purpose of utilizing the oscillations of the shaft 14 to work a pump, or to elevate a weight or weighted plunger or piston for forcing water or other liquid, there may be placed on the shaft 14 a loosely-mounted chain-wheel 16^b, Figs. 3 and 5. As shown in Fig. 5, there is supported on the loose chain-wheel 16^b a chain 17^b, having a small weight 73 attached to one end. The other end of this chain 17^b is secured to a weighted plunger 74, Fig. 3, adapted to work in a vertically-arranged pump barrel or cylinder 75, connecting with an inlet-pipe 76 and outlet-pipe 77 at the lower cylinder end. Check-valves 78, opening in proper direction, are provided in the pump inlet and outlet pipes. The pump inlet-pipe 76 may connect with and lead from an overflow-pipe 79 of the tank 11, if it is desired to utilize or force to a distance the water contained in said tank, or the water supply for the pump may be obtained from any other source. The pump outlet-pipe 77 may connect with a pipe 80, arranged to conduct water or other fluid to an elevated point. The top of the pump-cylinder 75 may be braced and steadied by a frame 81, connected with and forming part of the main frame of the apparatus. The plunger 74 carries a weight-supporting disk or plate 82, having engagement with and adapted to slide along vertical guide-rods 83, extended from the frame 81 to a cross-bar or cross-bars 84 of the main frame. On the disk or plate 82 are placed a number of detachable weights 85, surrounding the upper portion of the plunger 74 and which may be increased or diminished to correspond with the power required for properly operating the pump-plunger. A spiral spring 86 is supported on the frame 81 to take up the shock on the fall of the weighted plunger.

There is rigidly secured to the shaft 14, adjacent to the loosely-mounted chain-wheel 16^b, a counterbalanced arm 87, Figs. 3, 5, 6, and 7. One end of this counterbalanced arm 87 has pivoted thereto a swinging pawl-lever 88, carrying intermediate its ends a pawl-tooth 89 to engage the single tooth of a ratchet-wheel 90, that is rigid with one side of the loosely-mounted chain-wheel 16^b. A spring 91 is arranged on the arm 87 to press the pawl-tooth 89 into engagement with the one-toothed ratchet-wheel 90 when the swinging pawl-lever 88 is in proper position, one end of said lever 88 being extended or so far lengthened that at times it will come in contact with the frame 10 and be thereby disengaged from the ratchet-wheel.

While the empty bucket 21, Fig. 4, is being raised by descent of the weight or weights 19 the shaft 14 will be rotated in such direction as to cause the spring-pressed pawl-lever 88 to engage the ratchet-wheel 90, Figs. 5 and 6, and thereby rotate the loosely-mounted chain-wheel 16^b, Fig. 5, in proper direction to elevate the weighted plunger 74 of the pump; and the pump-cylinder 75 may meanwhile take its supply of water through the pipe 79, Figs. 3 and 4, from the tank 11, or elsewhere. Just before the weights 19 have completed their descent, whereby the bucket 21 and weighted plunger 74 are elevated, the pawl-lever 88, Fig. 5, will come in contact with and ride upon the top of the frame 10, thereby disengaging the pawl-tooth 89 from the ratchet-wheel 90, so as to permit the connected and loosely-mounted chain-wheel 16^b to revolve backward freely under the action of the weights 85, which carry downward the plunger 74 and cause it to force the fluid from the pump. Meanwhile the bucket 21 will receive a supply of water and by its descent will rotate the shaft 14 to again elevate the weight or weights 19, and at the same time the pawl-lever 88 will be carried into position to properly engage the ratchet-wheel 90 when the weight or weights 19 again descend.

It will be obvious that in either form of apparatus described the shaft 14 may be extended to provide for connection with any desired number of water-accumulating buckets and connected weights, according to the amount of power to be developed by the engine and the character and extent of work required from it. Whenever there is sufficient water for keeping the tank 11 supplied, the apparatus or engine may be usefully employed. Besides its use as a motor for pumps and for driving machinery the engine the engine may be readily adapted to other purposes requiring power.

What I claim as my invention is—

1. In a hydraulic engine, the combination of a shaft having a chain-wheel thereon, a chain engaged with and suspended from said wheel a weight attached to one end of the chain, a bucket attached to the other end of said chain and provided in its bottom with an outlet, a vertically-movable valve having stops or guides extended through said outlet to come in contact with the base of the engine and lift said valve on descent of the bucket,

a pivoted arm or support from which the said valve is suspended, a weighted catch-lever arranged in the bucket to engage the said arm or support and hold the valve open, a weight connected with the catch-lever and suspended below the bucket, a water tank or trough having a valved outlet for supplying the bucket, and valve-actuating mechanism operated by ascent of the bucket to open the tank-valve, substantially as described.

2. In a hydraulic engine, the combination of a shaft having thereon a rigidly-mounted chain-wheel and a loosely-mounted chain-wheel, a chain suspended on the rigidly-mounted wheel and having a weight secured to one end and a self-emptying bucket connected to the other end, a tank or trough for supplying water to said bucket to overbalance and elevate or restore the lowered weight, the alternate movements of said bucket and weight being arranged to actuate the shaft, a pump-cylinder, a weighted plunger working in said cylinder and suspended from a chain on the loosely-mounted chain-wheel, a ratchet-wheel on said loose chain-wheel, a counterbalanced arm carried on the shaft adjacent to said ratchet-wheel, and a swinging pawl-lever pivoted to said counterbalanced arm and adapted to engage said ratchet-wheel, substantially as described.

3. In a hydraulic engine, the combination with a shaft having a chain-wheel thereon, a chain engaged with and suspended from said wheel, and a weight attached to one end of the chain, of a self-emptying water-bucket attached to the other end of the chain and provided with an outlet, a valve arm or support pivoted in the bucket and having a valve suspended therefrom and provided on its under side with depending stops or guides extended through the outlet and adapted to come in contact with the ground or base of the engine and lift the said valve, a weighted catch-lever pivoted in the bucket and adapted to engage the valve-arm to hold the valve open, and a weight connected with the upper end of said catch-lever and suspended outside and below the bucket, substantially as described.

4. In a hydraulic engine, the combination of a shaft having a chain-wheel thereon and a chain suspended from said wheel, a self-emptying water-weighted bucket suspended from one end of said chain and a weight attached to the other end, a water tank or trough having a valved outlet for supplying water to the bucket, a tank-valve controlled by ascent of said bucket, an arm projecting from the chain-wheel shaft, and a weighted and jointed detent lever or arm fulcrumed to a support and projecting in the path of said arm, substantially as described.

5. In a hydraulic engine, the combination of a shaft having thereon a rigidly-mounted chain-wheel and a loosely-mounted chain-wheel provided on one side with a ratchet-wheel, said shaft carrying also a rigid arm adjacent to the rigidly-mounted chain-wheel and a counterbalanced arm adjacent to the loosely-mounted chain-wheel, a pump-cylinder, a weighted plunger adapted to work in said cylinder and suspended from a chain on the loosely-mounted chain-wheel, a swinging pawl-lever pivoted to the counterbalanced arm and having intermediate its ends a tooth to engage the ratchet-wheel on the loose chain-wheel, a chain suspended from the rigidly-mounted chain-wheel and having a weight on one end and a valved self-emptying bucket on the other end, a water tank or trough having a valved outlet above said bucket, valve mechanism for controlling the said tank-outlet from the said bucket, and a weighted and jointed detent-lever fulcrumed to a support and projecting in the path of the rigid arm adjacent to the rigidly-mounted chain-wheel, substantially as described.

6. In a hydraulic engine, the combination of a shaft having thereon a loosely-mounted chain-wheel and a rigidly-mounted chain-wheel, a chain engaged with the loosely-mounted wheel and having a small weight attached to one end and a weighted plunger suspended from the other end, a chain supported on the rigidly-mounted wheel and having a weight suspended from one end and a self-emptying bucket suspended from the other end, means for supplying water to said bucket when elevated and for causing its discharge when lowered, and ratchet mechanism for making the loose chain-wheel fast on the shaft in one direction of rotation to raise and release the weighted plunger, substantially as described.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JOHN W. GARRETT, SR.

Witnesses:
J. H. BLASSINGAME,
GEO. B. DEAN.