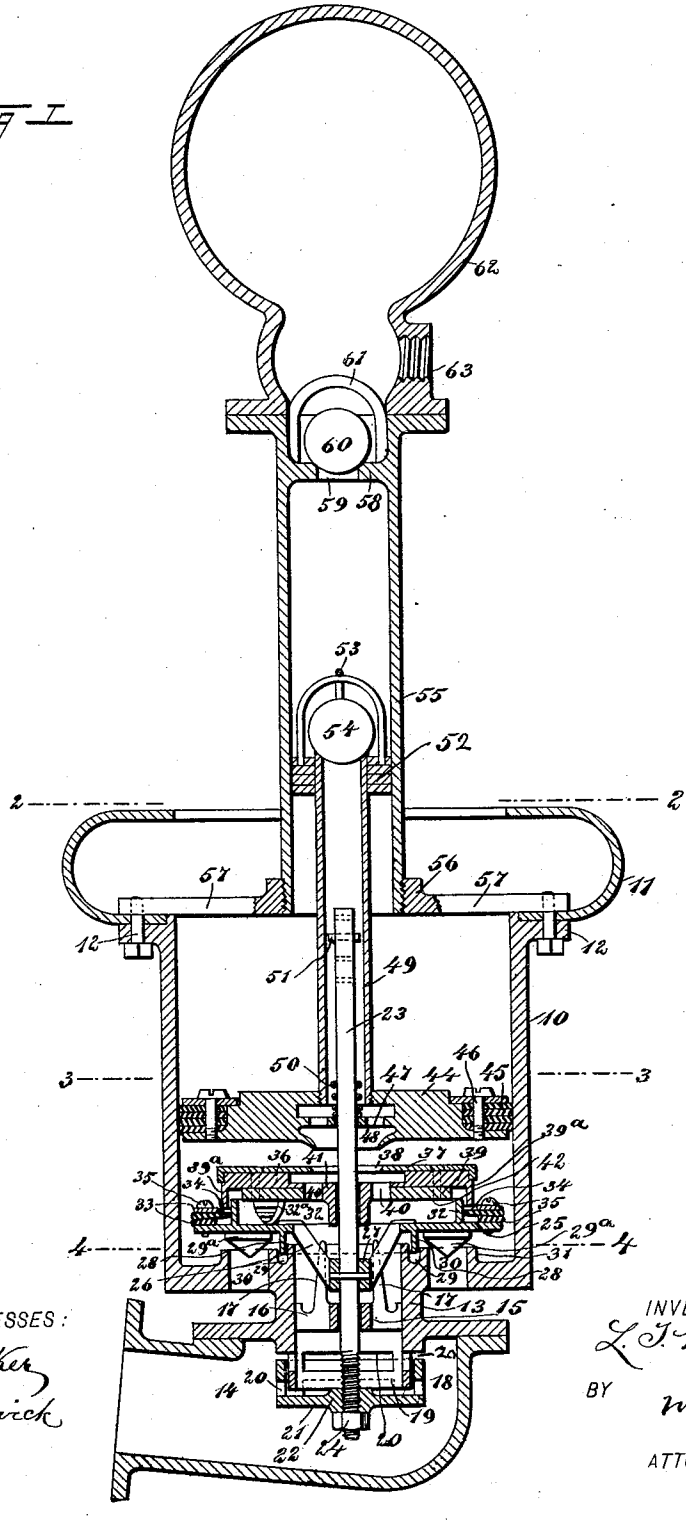
(No Model.) 2 Sheets—Sheet 1.

L. T. WEBSTER.

HYDRAULIC RAM.

No. 484,266. Patented Oct. 11, 1892.

Fig. 1.



WITNESSES:

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(No Model.) 2 Sheets—Sheet 2.

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Fig 2

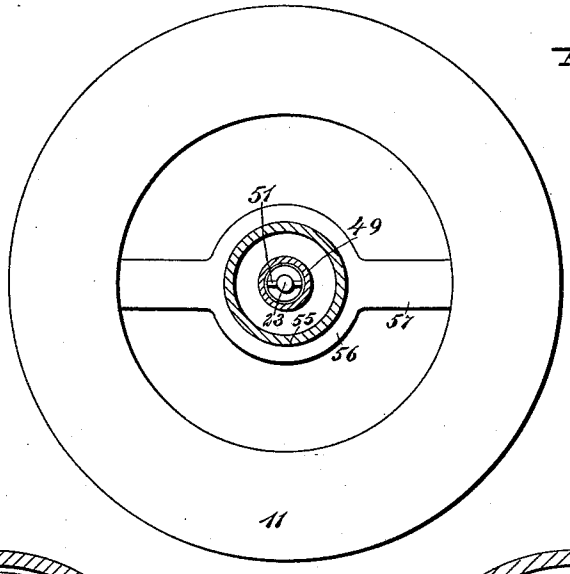


Fig 3

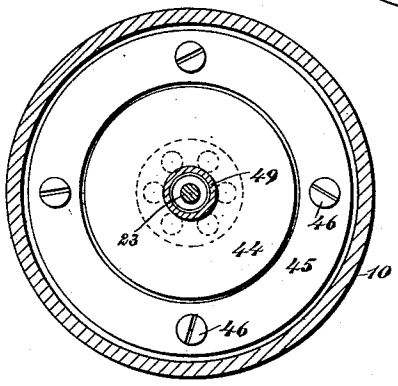


Fig 4

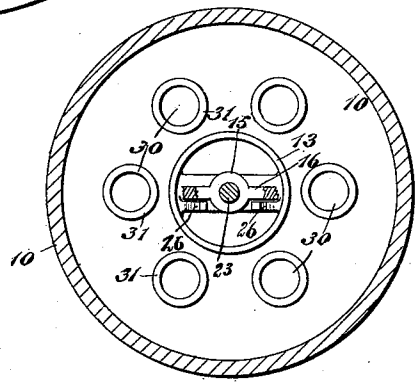


Fig 5

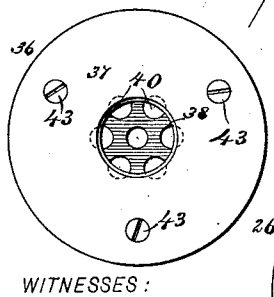


Fig 6

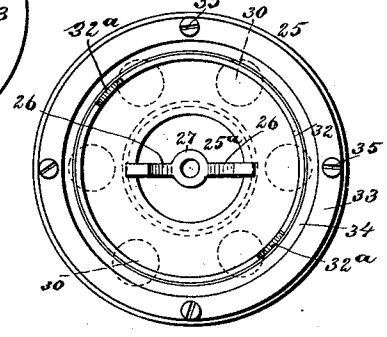
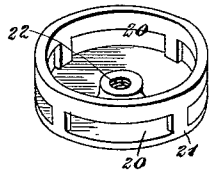


Fig 7



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UNITED STATES PATENT OFFICE.

LEWIS T. WEBSTER, OF NORTHFIELD, MASSACHUSETTS.

HYDRAULIC RAM.

SPECIFICATION forming part of Letters Patent No. 484,266, dated October 11, 1892.

Application filed November 25, 1891. Serial No. 413,041. (No model.)

To all whom it may concern:

Be it known that I, LEWIS T. WEBSTER, of Northfield, in the county of Franklin and State of Massachusetts, have invented a new and Improved Hydraulic Ram, of which the following is a full, clear, and exact description.

My invention relates to improvements in water-elevators or rams; and the object of my invention is to produce a simple, efficient, and durable machine which, acting under the impulse of a comparatively-small head of water, will elevate a quantity of water to any desired height within reasonable limits and will cause the water to be raised in a continuous stream.

To this end my invention consists in certain features of construction and combinations of parts, which will be hereinafter described and claimed.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar figures of reference indicate corresponding parts in all the views.

Figure 1 is a vertical cross-section of the entire machine. Fig. 2 is a sectional plan on the line 2 2 in Fig. 1. Fig. 3 is a sectional plan on the line 3 3 in Fig. 1. Fig. 4 is a section plan on the line 4 4 in Fig. 1. Fig. 5 is a detail plan view of the cap which rides on the outlet-valve plate. Fig. 6 is a detail plan view of the outlet-valve plate, and Fig. 7 is a detail perspective view of the outer portion of the main inlet-valve.

The machine is provided with a cylinder 10, which is open at the top and which has bolted to its top a circular extension 11, which is also open at top and bottom, and this extension enables the cylinder to hold sufficient water to cause the back-pressure to move the main piston quickly on its downstroke. The extension 11 is bolted to a top flange 12, which extends around the upper edge of the cylinder.

The lower end of the cylinder 10 is provided with a central inlet-pipe 13, which connects with an elbow 14, through which the water flows to the machine, and this elbow is constructed, preferably, so that it will have a downward inclination from its inlet to its central portion, so that the water will flow freely into it with as little resistance as possible. Arranged centrally in the inlet-pipe 13 is a collar 15, which is supported by cross-arms 16, which are secured to the walls of the pipe, and the arms have upwardly-extending prongs 17, which engage the arms of the outlet-valve plate, as described below, and serve as guides to prevent the valve-plate and the valve-rod from turning. At the lower end of the inlet-pipe 13 is a valve 18, comprising a cylindrical portion 19, which is open at the ends and is firmly secured to the pipe and which has also side ports 20 and an outer portion 21, which is also of cylindrical shape, but is closed at the bottom and has side ports 20, similar to the ports in the part 19. The outer portion 21 of the valve is of a little larger diameter than the inner portion, so that it may slide upon it, as best shown in Fig. 1. The outer portion of the valve is provided with a central hub 22, which is adapted to be screwed upon the lower end of a piston-rod 23, to which it is held by a nut 24, and it will thus be seen that the outer portion of the valve will move with the valve-rod. When the outer portion of the valve 21 is raised to its full height, the ports 20 will come opposite the solid adjacent portions of the valve, so that the valve will be closed; but when the outer portion of the valve is moved downward the ports 20 are opened and the water flows freely through them and up through the pipe 13 to the cylinder.

The outlet-valve plate 25 is provided with a central opening 25^a, through which the water may flow, and in this opening are depending arms 26, which support a hub 27, and the latter is keyed to the valve-rod 23, as best shown in Fig. 1. The valve-plate 25 is provided on its under side and adjacent to its central opening with an annular flange 28, which moves in a corresponding socket or slideway 29, and the flange and socket thus serve as guides for the valve-plate. On the under side of the valve-plate are also arranged series of depending conoidal plugs or valves 29^a, which register with and are adapted to project into openings 30 in the bottom of the cylinder 10, which openings are produced vertically in the raised portions 31 of the cylinder. It will thus be seen that when the outlet-valve plate 25 is raised the water in the cylinder may find an outlet through the openings or ports 30 and when the valve-plate is depressed the valves 29^a will tightly close said ports.

On the top of the valve-plate 25 is an upwardly-extending annular flange 32, which has water-ports 32ª therein, and on the extreme outer portion of the valve-plate and on the upper side are packing-rings 33 and 34, which are held in place by binding-screws 35. The middle packing-ring 34 is wider than the other rings between which it is held, and consequently its inner edge presses against the flange 32, and when the cap 36, which is carried above the valve-plate, is pressed downward its flange striking the packing-ring 34 will form a water-tight joint. The cap 36 is held loosely above the valve-plate 25 and is adapted to rest thereon, the object of the cap being to provide a suitable surface against which the water in the cylinder may press to effect the downstroke of the valve-plate 25, as hereinafter described. The cap 36 is provided with a plate 37 at the top, which has a central opening 38 to permit the passage of water through it, and which is secured to the body portion 39 of the cap, which portion is also provided with water-passages 40, extending vertically through it, and with a central hub 41, which is held to slide loosely on the valve-rod 23. The body 39 is also preferably provided on the under side with a weighted portion 42, which may be made of lead and which tends to hold it down in the cylinder and to increase its pressure on the valve-plate 25, so as to effect a quick downstroke of the latter. The several parts 37, 39, and 42 of the cap 36 are held together by screws 43, as shown in Fig. 5, and by dotted lines in Fig. 1.

Above the cap 36 is a piston 44, which is adapted to reciprocate in the cylinder 10 and which is provided with packing-rings 45 around its edge, the rings being held in place by screws 46, and as the rings fit snugly in the cylinder they will cause the piston to be raised by the incoming water and will prevent excessive leakage. The piston 44 is provided with vertical water-passages 47 and with a depending nozzle-like portion 48 on the under side, which nozzle is adapted to enter the opening 38 of the cap 36 and fit tightly therein. A hollow piston-rod or pipe 49 is screwed or otherwise secured to the top of the piston 44, and as it connects with the openings in the piston the water may flow upward into the pipe. This pipe 49 embraces loosely the upper portion of the valve-plate rod 23, which valve-rod projects upward through the piston 44, and within the pipe and around the piston-rod is a spiral spring 50, which is adapted to engage a pin 51 at the upper end of the valve-rod 23 when the piston 44 is raised, and the upward movement of the piston 44 will cause the spring to strike the pin and raise the valve-rod 23 and the valve-plate 25, so as to permit the water in the cylinder to be discharged through the ports 30. It will be seen that the machine would work without the spring 50; but it prevents excessive shock, and is therefore preferably used. It will be noticed that the pin 51 may be placed in either of a number of transverse holes in the valve-rod 23, which holes are indicated by dotted lines in Fig. 1, and by properly adjusting the pin the valve-plate 25 may be made to rise at the right time, so as to effect the return stroke of the piston 44.

The pipe 49 is provided at its upper end with packing-rings 52, which support a guard 53, in which is a ball-valve 54, which operates as a check-valve and rests in the upper end of the pipe 49. The packing-rings 52 are adapted to move snugly in the pump-barrel 55, which at its lower end is screwed or otherwise supported in a hub 56 on the cross-arms 57, the latter extending across the top of the cylinder 10, to which and the extensions 11 they are secured. Near the upper end of the pump-barrel 55 is a transverse partition 58, having a water-passage 59 through it, and a ball-valve 60 rests in this passage and is provided with a guard 61, which extends above it and prevents its displacement.

The pump-barrel 55 delivers into a hollow casting 62, which is secured to the top of the pump-barrel in the usual way and forms an air-chamber substantially like that in any ram or force-pump. This casting 62 has an outlet 63 near its lower end, to which the water-discharge pipe may be connected.

In the drawings, Fig. 1, I have shown the various parts contained in the cylinder in an intermediate position rather than in either an open or closed position, so that they could be more readily seen and understood. When the machine is in position for operation, the valve-plate 25 will be in its lowest position, so that the ports 30 will be closed. The valve 18 will consequently be open and the piston 44 will be in its lowest position—that is, it will rest upon the cap 36.

The operation of the machine is as follows: The water comes in under pressure through the elbow 14 and enters the ports 20 and flows upward through the openings in the various parts into the cylinder 10 and also up through the piston 44 into the pipe 49, and the pressure raises the check-valve 54 and the water enters the pump-barrel 55. The incoming water as it fills the cylinder 10 raises the piston 44, and the upward movement of the piston carries with it the pipe 49 and valve 54, thus forcing the water past the valve 60 and into the casting 62 toward the discharge-pipe. When the piston 44 reaches a desired point near the top of the cylinder 10, the spring 50 striking the pin 51 raises the valve-rod 23 and the valve-plate 25, thus opening the ports 30 and permitting the passage and escape of the water from cylinder 10 through said ports. The same upward movement of the valve-rod 23 also raises the outer portion 21 of the valve 18, thus with the aid of the pressure of the water closing said valve. The pressure of the water upon the outer portion 21 of the valve 18 when the valve is closed holds the raised outlet-valve plate 25 until the water in

the cylinder 10 shall have escaped through ports 30. At this time the piston 44 having settled upon cap 36, the nozzle-like portion 48 enters the opening 38 of the cap 36 and stopping the always slight leakage of water through valve 18 when closed, thereby confines the water in cap 36, which being of larger area and under equal pressure of water per inch overpowers the pressure upon valve 18 and forces it downward and opens the inlet-ports 20. At the same time this movement carries downward valve-plate 25 and carries the valves 29^a to again enter and close the ports 30. Water now being freely received into cylinder 10 and underneath piston 44, the pressure raises the piston 44, and at the same time the pressure downward upon the valve-plate 25 holds the ports firmly closed against the pressure of the water upon or against the valve 18 while piston 44 is being raised. When valve 18 is closed and valve-plate 25 is raised, the discharge-ports 30 being open, the water in cylinder 10 escapes, aided by the weight of the piston 44, and also by the weight of the water in cylinder 10, which when piston 44 is being raised flows outward into extension 11 and flows back again into cylinder 10 to aid by its weight in forcing downward piston 44 while the water is being discharged through ports 30, which when done valve 18 and discharge-ports 30 are simultaneously opened and closed, and this movement will be repeated, so that the piston 44 will constantly reciprocate in the cylinder 10. The water which enters the pump-barrel will be forced upward into the casting 62 and the water in the casting under the combined pressure from beneath and the air-pressure from above will flow out in a stream through the opening 63 and into the discharge-pipe which connects with said opening.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination, with two differential cylinders each having an imperforate piston, a tube connecting the two pistons and opening at its ends into the said cylinders to conduct the water from the lower part of the larger cylinder into the smaller upper cylinder, and a check-valve operating over the upper end of the said tube, of a central leaking inlet-valve connected with the lower end of the larger cylinder and an exhaust or outlet valve in the bottom of the larger cylinder to exhaust the water therefrom to permit the descent of the pistons, said inlet and exhaust valves being connected together and adapted to be operated by the rise of the pistons, substantially as set forth.

2. The combination, with the differential cylinders, the two imperforate pistons having a tube connecting them and the two cylinders at opposite sides of said pistons to conduct water from the lower to the upper cylinder, a check-valve closing the upper end of the tube within the upper cylinder, and a check-valve in the smaller upper cylinder above its piston, of a central leaking inlet-valve in the bottom of the larger cylinder and an exhaust or outlet valve also in the bottom of the larger cylinder to exhaust the water and permit the pistons to descend, a rod connecting the two valves, extending up into the piston-tube and provided with a projection to be engaged by the lower piston in its upward movement, substantially as set forth.

3. The combination, with the differential cylinders and their pistons, a tube connecting the two pistons and the two cylinders at opposite sides thereof to conduct water from the lower to the upper cylinder, and check-valves in the upper cylinder and upper end of said tube, of a central inlet-pipe in the bottom of the larger cylinder and having lateral apertures exterior thereto, a cap-like valve operating on said leaking inlet-pipe and having lateral openings, exhaust-outlets in the bottom of the said cylinder, a centrally-apertured valve-plate in the cylinder and having plugs on its lower side to close said outlets, and a rod connecting said valve and plate and operated by the upward movement of the pistons, substantially as described.

4. The combination, with the differential cylinders having pistons, a tube connecting the two pistons to conduct the water from the lower into the upper cylinder, a flange 48 on the lower side of the larger piston, and a check-valve for the upper end of the said tube, of a central inlet-valve in the bottom of the larger cylinder, exhaust-outlets also in the bottom of said cylinder exterior to the inlet-valve, an exhaust or outlet valve comprising a plate having a central opening to permit the passage of water from the inlet-valve and provided on its lower face with plugs to close the exhaust-outlets, a flanged cap resting on the upper side of the said plate and having a central opening to closely embrace the piston-flange 48, and means for simultaneously operating the inlet and exhaust valves from the said pistons, substantially as set forth.

5. The combination, with the main cylinder having a central inlet in its bottom, provided with a leaking-valve, an annular channel 29 in the bottom of the cylinder, exhaust-outlet apertures beyond said channel, of the valve-plate 25, having a central opening, an annular flange 28, entering channel 29, plugs closing the exhaust-outlet apertures, a notched annular flange 32 on the upper side of the valve-plate, horizontal annular packing 34 concentric therewith, the centrally-apertured cap having a depending flange 39^a resting on said packing, and connections between the said valve-plate and inlet-valve, substantially as set forth.

6. The combination, with the differential cylinders, the lower larger cylinder being open at its upper end and provided with the extension 11, the imperforate pistons having a tube connecting them and conducting the

water from the lower into the upper cylinder, and a check-valve for the upper end of said tube, of the inlet-valve at the bottom of the cylinder, an exhaust-valve also in the lower part of the cylinder and connected with the inlet-valve, and means for operating said valves by the upward movement of the pistons, substantially as set forth.

7. The combination, with the differential cylinders and the pistons therein having a connecting-tube to conduct the water from the lower into the upper cylinder, a central inlet-tube 13 in the bottom of the larger cylinder and having lateral apertures and a guide-collar 15, provided with upward-extending arms 17, and exhaust-outlet apertures 30 in the bottom of the said cylinder beyond the plate inlet-tube 13, of the leaking inlet-valve 18, inclosing the lower end of the inlet-tube and having lateral apertures, the valve 25, having a central collar 27, arms 26, guided by arms 17, and plugs 29^a, closing the outlets 30, the centrally-apertured cap 36, resting upon valve-plate 25, and the rod 23, connecting the valve 18 and plate 25, extending up into the water-conducting tube and provided with a projection 51, to be acted upon when the pistons move upward, substantially as set forth.

LEWIS T. WEBSTER.

Witnesses:
CHAS. H. WEBSTER,
ARTHUR W. PROCTOR.