(No Model.) 3 Sheets—Sheet 1.

LA VERNE W. NOYES.

HYDRAULIC PUMP.

No. 568,409. Patented Sept. 29, 1896.

Fig. 1.

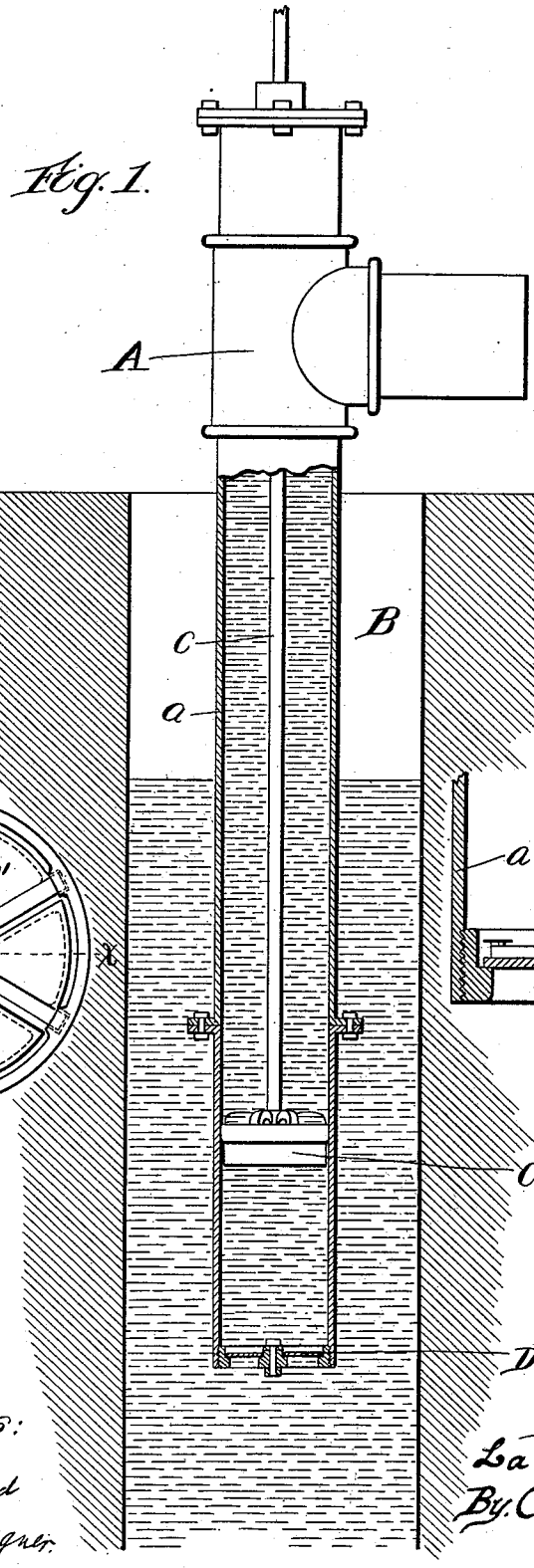

Fig. 2

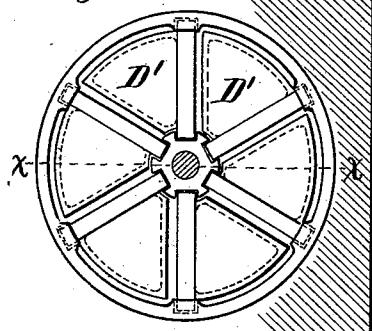

Fig. 3.

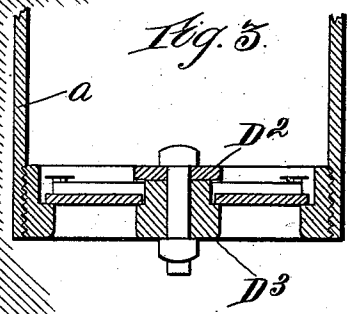

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Fig. 4.

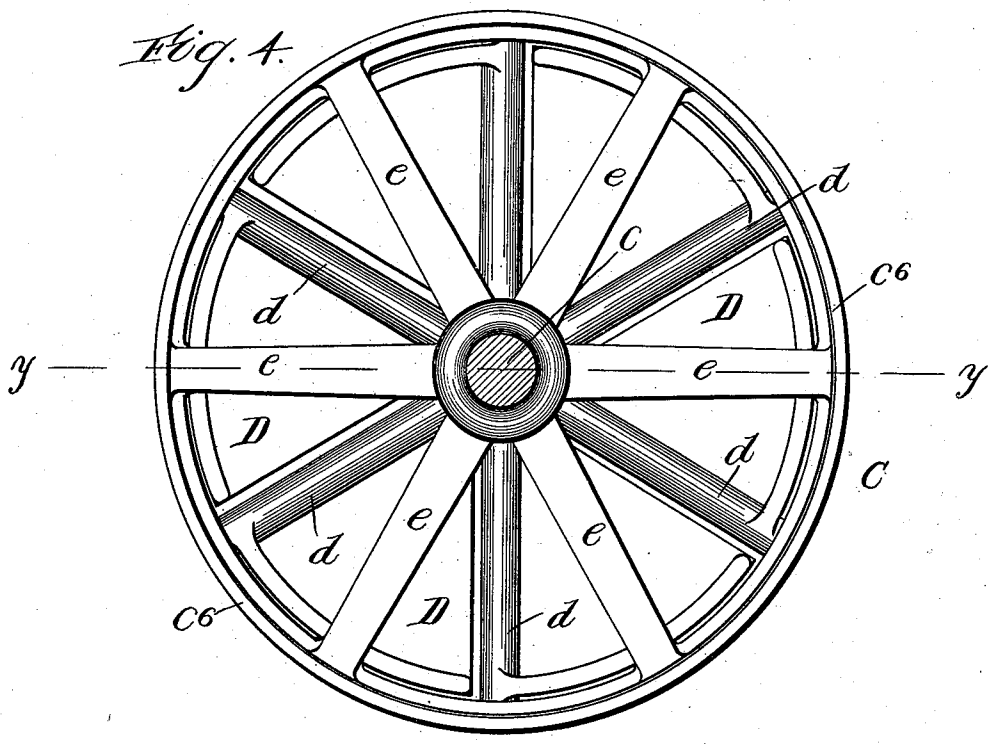
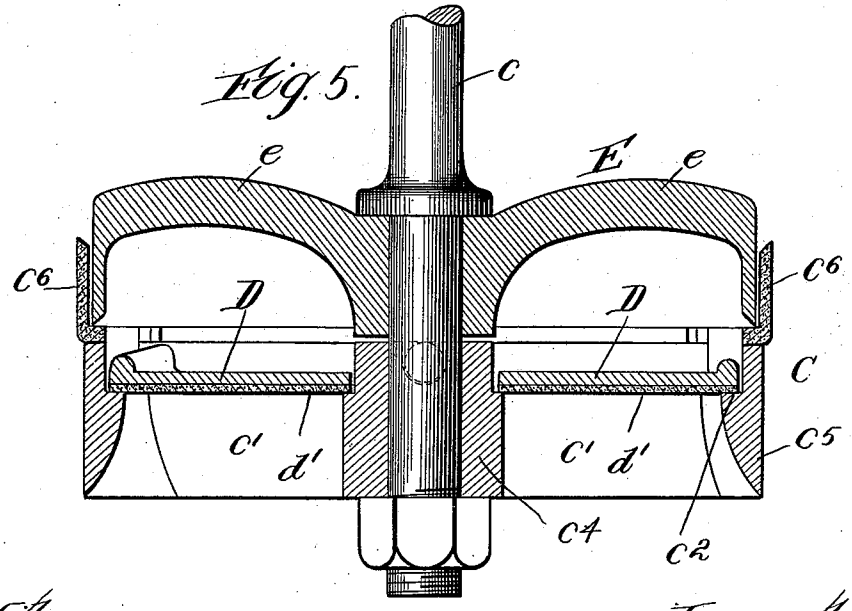


Fig. 5.



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(No Model.) 3 Sheets—Sheet 3.

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Fig. 6.

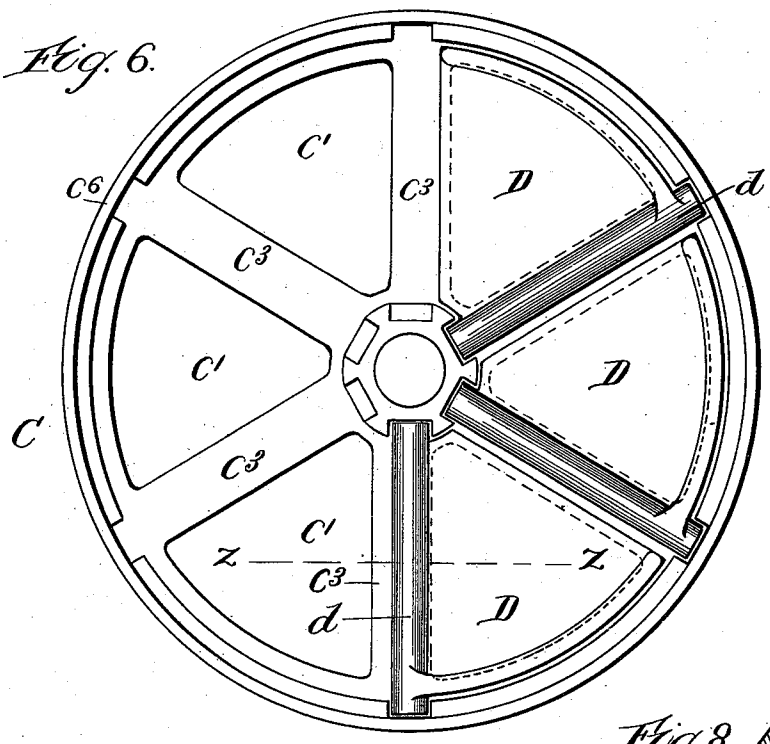


Fig. 8.

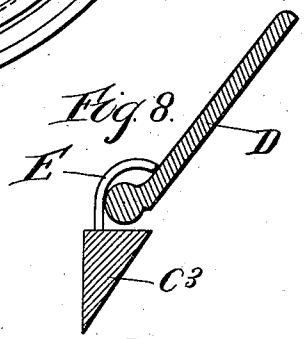
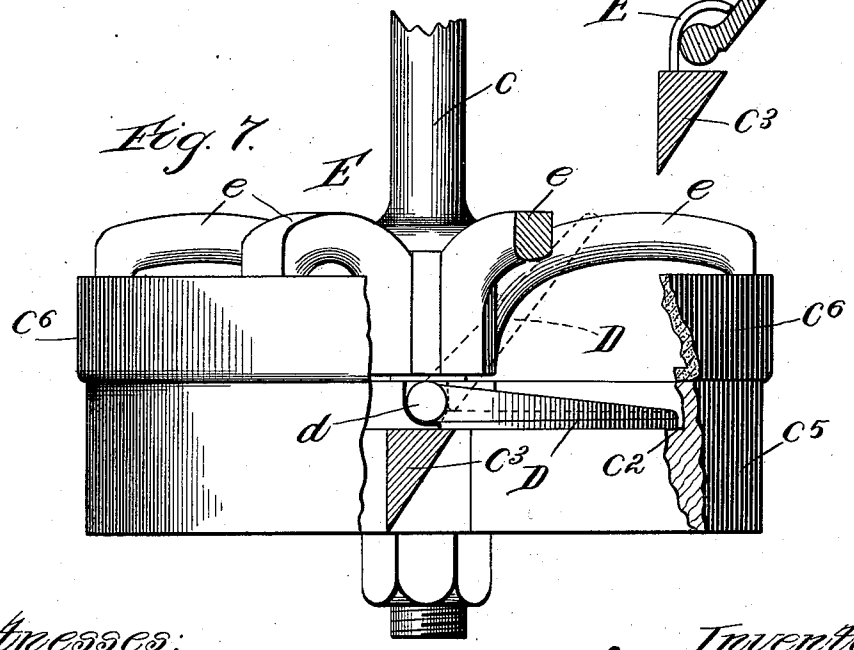


Fig. 7.



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UNITED STATES PATENT OFFICE.

LA VERNE W. NOYES, OF CHICAGO, ILLINOIS.

HYDRAULIC PUMP.

SPECIFICATION forming part of Letters Patent No. 568,409, dated September 29, 1896.

Application filed October 14, 1895. Serial No. 565,579. (No model.)

To all whom it may concern:

Be it known that I, LA VERNE W. NOYES, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Hydraulic Pumps, of which the following is a specification.

My invention relates to hydraulic pumps of the kind in which the water is raised by a valved reciprocating plunger. In pumps of such character the valve of the plunger opens as the plunger descends through the body of water, and hence the instant the plunger begins its upstroke the valve is subject to the opposition of a superposed body of water which enforces a sudden closure on the part of the valve. In practice the successive shocks and strains incident to the successive sudden closures of the valve cause frequent breakage and undue wear, thereby entailing considerable expense and annoyance, especially in large pumps where the movement of the valve is greater than in small pumps.

The primary object of my invention is to overcome the foregoing defects, and to such end I provide the plunger with a plurality of ports and corresponding set of substantially radially-hinged valves, all arranged to open the same way and also opening to a determinate extent, which is limited to an inclined position on the part of each raised valve. During the downstroke of the plunger through the body of water within the pump-barrel the valves will severally open and rise to an inclined position, and the water passing up through the ports will be deflected by the inclined valves in a substantially tangential direction, which will cause a rotary circulation of water over and adjacent to the plunger and valves, and at the concluding portion of the downstroke of the plunger such rotary circulation of water acting against the upper sides of the valves will commence to close the latter, and will also effect their closure before possibility of a sudden closure and shock as a result of the upward movement of the plunger against the resistance of the superposed body of water.

As a matter of further improvement and preferred arrangement the plunger is provided with sector-shaped ports and correspondingly-shaped valves, in which way a large area of portage can be secured, it being observed that with such construction the ports can be separated by the comparatively narrow radially-arranged webs or partitions, which therefore leave a large area of portage through the plunger.

As a matter of further improvement I also provide the pump-barrel with check-valves arranged as hereinbefore described in connection with the plunger, and for a similar purpose.

In the accompanying drawings, Figure 1 represents in part elevation and part vertical central section a pump embodying my invention, the pump being shown sunk within a well. Fig. 2 is a top plan view, on a larger scale, of the valve devices at the lower end of the pump-barrel. Fig. 3 is a section taken vertically and centrally through the lower valved portion of the pump-barrel on line $x\,x$ in Fig. 2. Fig. 4 is a top plan view of the plunger on a larger scale. Fig. 5 is a section on line $y\,y$ in Fig. 4. Fig. 6 is a top plan view of a plunger having a different form of stop. Fig. 7 shows the plunger in side elevation with a portion broken away. Fig. 8 is a detail showing a section on line $z\,z$ in Fig. 6 and illustrating another form of stop.

The pump A is represented with its barrel a partially submerged in a body of water within a well B. The reciprocating plunger C is arranged to work within the barrel, and is provided with the usual rod c, which can be operated by any suitable means. The plunger is provided with a plurality of ports c', arranged in annular series about the center of the plunger, and a corresponding set or series of valves D for opening and closing said ports. The valves are hinged so as to swing about axes which are radial or substantially radial to the center of the plunger. The hinge connections between these radially-hinged valves and the plunger could be flexible, although I prefer providing pintle or pivotal connections between the valves and the plunger, and to such end I have shown as one mode of arrangement each valve provided with a rounded bearing portion or pintle d, arranged to work in suitable bearings in the plunger. The downward movement of

the valves is limited by their seats c^2, and their upward movement can be limited by any suitable arrangement of stops.

As a convenient and desirable form of stop device I provide a spider E, arranged upon the plunger so that its arms *e* will extend over the valve and provide stops for limiting the extent to which the valves can open during the downstroke of the plunger through a body of water within the pump-barrel, as illustrated in Fig. 7, in which the valve in an open condition is indicated in dotted lines. Other forms and arrangements of stops can, however, be employed for the purpose of arresting the upward swing of the valves when the latter reach a proper degree of inclination, it being understood that during the downstroke of the plunger through the body of water the valves should open to an extent to permit a suitable flow of water through the ports and at the same time stand at an angle which shall insure deflection of the water, so as to cause a rotary circulation above the plunger. In Fig. 7 the valve indicated in dotted lines is shown standing at about an angle of forty-five degrees, although I do not, however, confine myself to such precise angle.

The valves all open the same way, that is to say, each valve of the entire set or series opens in the direction in which the preceding and succeeding valves open, whereby the water passing up through the ports will be deflected, so as to cause a rotary circulation of water over the valves and plunger and permit such rotary current to act against and close simultaneously the valves at the concluding portion of the downstroke of the plunger. It may be observed in this connection that the rotary circulation of the water is caused by a deflection in a direction which is non-radial with reference to the surface of the plunger, that is to say, the rising water is deflected neither directly inward nor directly outward by the valves, but is given more or less of a side sweep, and also that the most efficient action is obtained by causing the water to be deflected in a direction substantially at right angles to the radii of the plunger, or, in other words, in a substantially tangential direction. An arrangement procuring this latter result, one form of which is herein shown, is considered a matter of further and specific improvement.

I have demonstrated by practical tests of my improved pump that the plunger will work without shock and jar at the end of its downstroke and that the foregoing statements of advantages are based on facts.

In Fig. 8 the spider is dispensed with and a stop E′, which limits the upward movement of the valve, is arranged upon the partition c^3.

I prefer to provide sector-shaped valves and correspondingly-shaped ports, in which way I secure a large area of portage and a consequent large flow of water through the plunger, it being observed that with such arrangement the plunger can consist, essentially, of the skeleton frame comprising a centrally-arranged hub c^4 and an annular rim c^5, connected with such hub by the radially-arranged arms or webs c^3, which separate the ports from one another and which also provide valve-seats and bearing portions. While, however, I regard such arrangement as a matter of further improvement in detail, I do not limit myself to such precise form, but include other obvious forms involving the principles of my invention. I also provide a similar valve at the lower end of the barrel, as in Figs. 1, 2, and 3, in which the check-valves D′ correspond in arrangement with the valves of the plunger. The valves D′ are also understood to be limited in their upward movement by stops arranged to arrest the valves when they reach a proper inclined position, and for such purpose I can arrange a spider over the same or provide other obvious stop arrangements, a simple arrangement (shown in Fig. 3) being a circular stop D^2, arranged over the valves and supported by the centrally-positioned hub D^3.

The valves or their seats can be provided with any suitable packing, a simple arrangement being to provide the valves D and D′ with layers *d*′ of leather or the like. The plunger C is also preferably provided with a packing-ring c^6, which fits against the inner wall of the pump-barrel.

In addition to the foregoing-described feature of causing a rotary circulation of water which serves as a means for closing the pump-valves at proper moments, it will be seen that the set of ports thus arranged in annular series can be separated by comparatively thin radially-arranged webs or partitions, and that when the valves are open and in inclined positions the passages formed by the several ports will be continued by a series of inclined passages which are separated from one another by the open valves, and hence formed between such valves when the latter are in open and in inclined positions, and that under such conditions the free upper edge of each open valve will substantially overhang the lower edge or pintle portion of a succeeding valve. This arrangement provides a large inlet area of waterway and offers no material impediment to the free flow of water, which is not arrested or interrupted by the valves, but simply diverted in a direction to produce a rotary circulation within the pump-barrel. The action and efficiency of the pump will therefore be increased by such arrangement and the free flow of an increased quantity of water will be insured, it being observed that when the valves are open each inclined passage is formed between two parallel valves respectively hinged adjacent to and at opposite sides of a port, and that the area of such port is continued throughout the open space or passage which is formed between the two valves; also, that the water from the ports will flow uninterruptedly over the inclined

top sides of valves hinged adjacent to the ports.

What I claim as my invention is—

1. The pump-plunger provided with a plurality of ports, and a plurality of valves, the valves being arranged to form, when in an open condition, a set of deflectors correspondingly inclined in a direction to cause a non-radial deflection of the water passing up through the ports, whereby a rotary circulation of the water is produced over the plunger which operates as a means for effecting a closure of the valves, substantially as set forth.

2. The pump-plunger provided with a plurality of ports, and a plurality of valves, the valves being arranged to form, when in an open condition, a set of deflectors correspondingly inclined in a direction to cause a substantially tangential deflection of the water passing up through the ports, substantially as described.

3. The pump-plunger provided with a series of ports, and a series of substantially radially-hinged valves all opening the same way and also opening to an extent to form inclined deflectors which serve to cause a rotary current of water over the plunger during its downstroke, and permit such rotary current to effect the closure of the valves, substantially as described.

4. The pump-plunger provided with a series of sector-shaped ports, and a corresponding series of valves arranged to form, when in an open condition, a set of deflectors inclined in a direction to produce a rotary current of water during its upward flow through the ports; and means for checking the upward movements of the valves when the latter are in a suitably-inclined position, substantially as set forth.

5. The pump-barrel having a check-valve arrangement comprising a plurality of ports and corresponding valves, all arranged to open the same way, and to provide, when in an open condition, a set of deflectors inclined in a direction to cause a rotary current of water over the valves during the upward flow of water through the ports, substantially as set forth.

6. A hydraulic pump provided with a series of ports, and a set of valves therefor arranged and limited to open to inclined positions, the valves being relatively positioned to form when open, a series of correspondingly-inclined deflectors arranged to cause a rotary circulation of water and serving to provide opposite walls for correspondingly-inclined passages formed by spaces between said open valves and leading from the ports, substantially as described.

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