May 21, 1957 E. R. HAYDEN 2,792,785

DOUBLE-ACTION PUMP

Filed May 24, 1954 2 Sheets-Sheet 1

Fig 1.

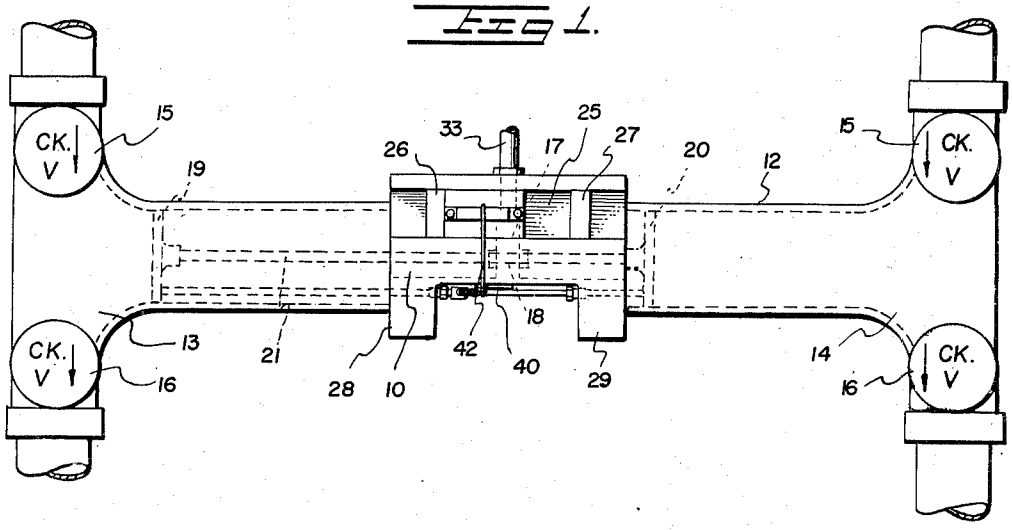
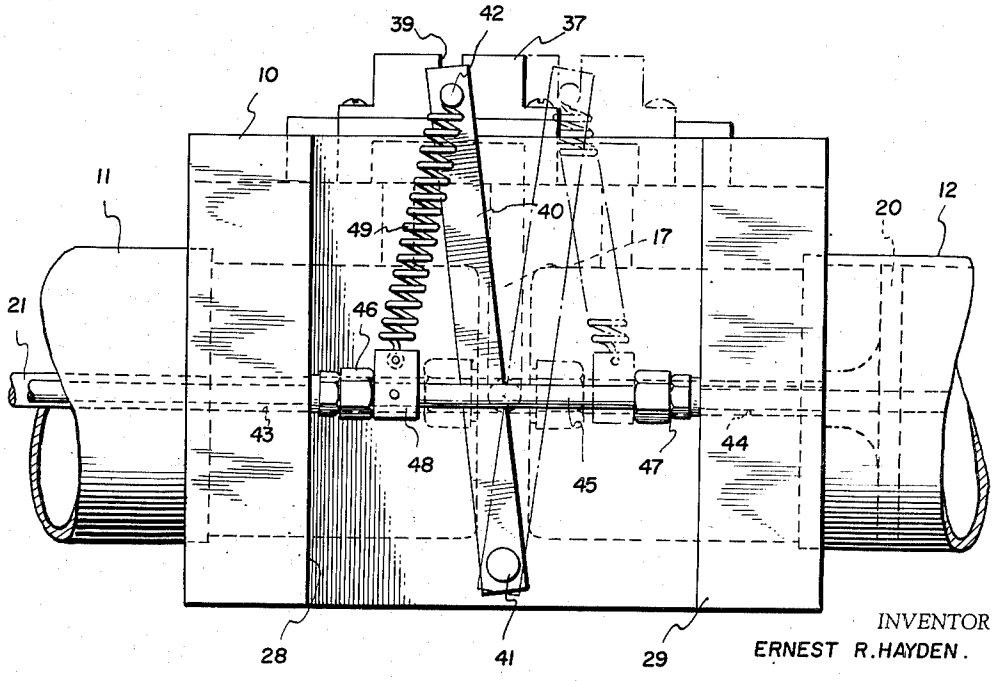


Fig 2.



INVENTOR
ERNEST R. HAYDEN.

BY Adams Howard & McLean
ATTORNEYS

May 21, 1957 E. R. HAYDEN 2,792,785

DOUBLE-ACTION PUMP

Filed May 24, 1954 2 Sheets-Sheet 2

FIG 3.

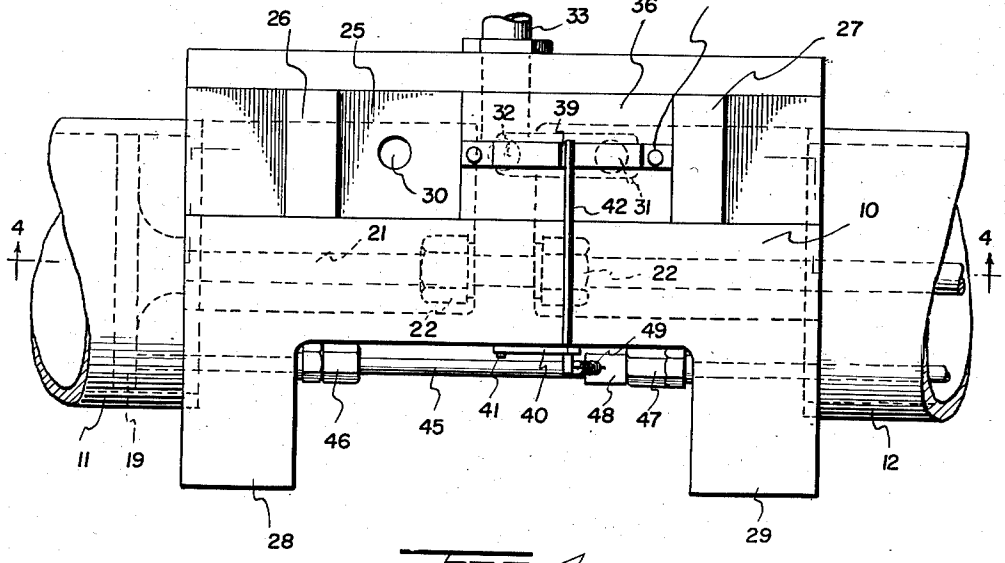
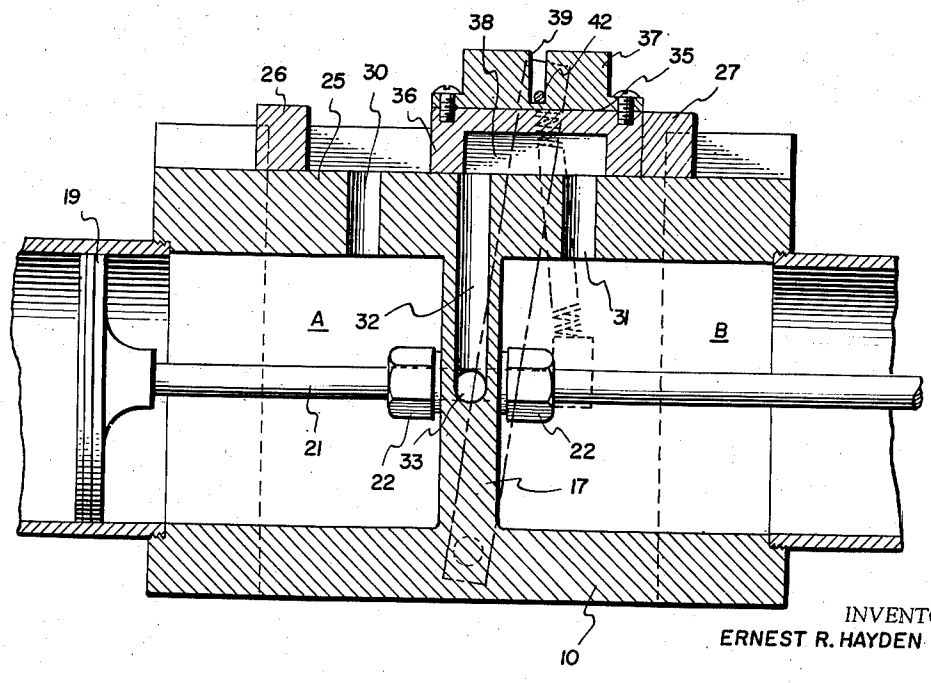


FIG 4.



INVENTOR
ERNEST R. HAYDEN

BY Adams Howard & McLean
ATTORNEYS

United States Patent Office 2,792,785 Patented May 21, 1957

2,792,785

DOUBLE-ACTION PUMP

Ernest R. Hayden, Bryant Pond, Maine

Application May 24, 1954, Serial No. 431,676

3 Claims. (Cl. 103—51)

This invention relates to vacuum actuated pumps and in particular, this invention provides a double-acting reciprocating pump powered by a self-contained double-acting reciprocating motor in which the motor is driven by atmospheric pressure through alternate connection between an exhausting means and the atmosphere.

A principal object of this invention is to provide a portable water pump having a self-contained motor operable by simple connection to an evacuating or exhausting means, for example, by connection to the intake manifold of the engine of an automobile or a piece of mobile farm equipment, such as a tractor.

It is also an object of this invention to provide a portable water pump of simple, light-weight, durable construction which is capable of handling relatively large amounts of water for emergency fire fighting at isolated locations on farms and the like and for other purposes where the installation of a water pump could not be an anticipated necessity or would be economically unsound because of a temporary water requirement.

The vacuum actuated double-acting pump which is contemplated by this invention accomplishes the above objects by utilizing essentially a continuous cylinder to house both pump and driving motor and by utilizing each piston as both a pumping piston and a motor piston. Thus, the pump which is contemplated by this invention includes a cylinder having a pair of interconnected pistons reciprocable therein and separated by a fluid-tight partition which extends across the cylinder. The outer ends of the cylinder are connected through suitable suction valves to the source of water, and suitable discharge valves are provided for delivery of the pumped water. The center of the cylinder is connected by a pair of ports, from opposite sides of the partition, to a spring-loaded, toggle controlled, slide valve which alternately connects the ports to the exhaust means while at the same time alternately exposes the unconnected port to the atmosphere. The toggle is snapped from one connection to the other in coordination with reciprocation with the pistons so that as one piston is fully extended toward the outer end by exposure of its respective inner port to the atmosphere and by connection of the inner port on the other side of the partition to the vacuum, the slide valve changes position and reverses the direction of the pistons.

For a more complete understanding of the principles of this invention and of the manner in which the above and other objects are accomplished, reference is made to the appended drawings in which:

Figure 1 is a plan view of the pump with discharge and suction water lines and the vacuum line broken off;

Figure 2 is a fragmentary front elevation of the device shown in Figure 1 on a somewhat enlarged scale and showing in dashed lines the alternate position of the spring-loaded toggle valve controller and valve;

Figure 3 is a fragmentary plan view of the device shown in Figure 1 on the same scale as Figure 2 with the toggle and valve in opposite position to that shown in Figure 1; and

Figure 4 is a sectional view of the device on the same scale as Figure 2 taken along line 4—4 in Figure 3.

In the drawings the reference numeral **10** indicates the pump base which is a hollow rectangular block having a circular, threaded opening at each end, into one of which is engaged a cylindrical barrel **11** and into the other of which is engaged a cylindrical barrel **12**. Barrels **11** and **12** are respectively provided with T-shaped outer ends **13** and **14**. Each end **13** and **14** is provided with a suction inlet valve **15** and a discharge outlet valve **16** which are conventional shape, size and construction.

The center of base **10** is transversely divided by partition **17** having an opening **18** axially aligned with barrels **11** and **12**. Pistons **19** and **20** are positioned in barrels **11** and **12**, respectively, for reciprocating movement in sliding engagement with the inner walls of the cylinders. A piston rod **21** positioned axially through cylinders **11** and **12** and passing through opening **18** in partition **17** is fixed at its opposite ends to pistons **19** and **20**, thus providing opposing action of pistons **19** and **20**. Piston rod **21** passes through opening **18** in fluid-tight sliding engagement provided by conventional packings and bushings indicated generally by the reference numeral **22**.

Referring more specifically to Figures 3 and 4, it will be observed that base **10** is provided with a flat, longitudinal, recessed surface **25** on its upper face limited lengthwise by stops **26** and **27** and is provided along one side at each end with transverse flanges **28** and **29**. Chamber A, which extends from partition **17** in base **10** into cylinder **11**, is connected by means of a port **30** in base **10** opening exteriorly in face **25**. Chamber B, which extends from partition **17** in base **10** into cylinder **12**, is connected by a port **31** in base **10** which opens into face **25**. Ports **30** and **31**, it will be observed, are considerably off-center as they enter chambers A and B, respectively, but are aligned centrally in recessed surface **25**. Positioned equidistant between ports **30** and **31** in face **25** is a third port **32** which extends approximately half-way into base **10** in a diagonal direction passing through a portion of partition **17**, and which emerges through the rear side of base **10** where it is connected to a suitable exhausting means (not shown) by connection **33**.

Exhaust port **32** is connected with either port **30** or port **31** by a valve which is reciprocable lengthwise on surface **25** between stops **26** and **27**. Valve **35** includes a lower sliding portion **36** and an upper flange **37**. Sliding portion **36** is essentially rectangular and is provided in its undersurface, which is in sliding contact with surface **25**, with a groove **38** of length equal to the distance between the outside edges of ports **32** and **31** and ports **32** and **30** and is aligned with the line of openings of ports **30**, **32** and **31** in face **25**. Thus, when valve **35** abuts flange **26**, as shown in Figures 1 and 2, chamber A is in communication with the exhaust means through port **30**, groove **38** and port **32** while chamber B is open to the atmosphere and, conversely, when valve **35** is in a position abutting flange **27**, chamber B is in communication with the exhaust means while chamber A is open to the atmosphere.

The upper flange **37** on valve **35** has a vertical slot **39** extending down from its top. Referring more specifically to Figures 2 and 3, it will be observed that a toggle arm **40** is affixed at its lower end to base **10** by a pivotal connection **41** located near the bottom of the side of base **10** centrally between flanges **28** and **29**. The upper end of toggle arm **40** is provided with a crank pin **42** affixed thereto and extending at right angles to arm **40** above the upper face of base **10** and resting in slot **39**. Thus, arm **40** can oscillate between two positions in which

crank pin 42 drives valve 35 between a position abutting stop 26 and a position abutting stop 27.

Flanges 28 and 29 are provided with passages 43 and 44 parallel to the axis of cylinders 11 and 12 which extend between the inside exterior faces of flanges 28 and 29, respectively, and the interior of chambers A and B, respectively. An elongated pin 45 extends through passages 43 and 44 and is reciprocable therethrough. Fluid-tight sliding engagement of pin 45 is insured by bushings 46 and 47 as it emerges from openings 43 and 44, respectively. Pin 45 has a bracket 48 affixed to its center and thus can reciprocate between a position in which bracket 48 abuts bushing 46 and a position in which bracket 48 abuts bushing 47. A coil spring 49 is affixed under tension at one end to bracket 48 and at the other end to the upper end of toggle arm 40. Thus, reciprocation of pin 45 between its two positions will produce a snap action of toggle arm 40 between its two positions and consequently snap valve 35 between its two limiting positions of movement. The length of pin 45 is adjusted so that its ends in each of chambers A and B abut pistons 19 and 20, respectively, near the end of their travel inwardly toward base 10 when pin 45 is in its position most extended into the chamber.

In operation suction valves 15 are connected by separate or common connection to a water supply, for example, to a duck pond, creek or the like, and discharge lines leading from valves 16 are connected by separate or common connection to a nozzle, storage tank or the like. Exhaust connection 33 is connected to a suitable evacuating means, such as the intake manifold of a farm tractor.

Assuming an initial position of valve 35 abutting stop 26, chamber A is exhausted to the subatmospheric pressure by the intake manifold of the farm tractor to which it is connected by means of valve 35. Atmospheric pressure acting on the inside of piston 20 forces it to extend outwardly expelling water contained in cylinder 12 through its respective discharge valve 16. At the same time piston 19 is retracted drawing water into cylinder 11 through its respective suction valve 15 until piston 19 abuts the end of pin 45 in chamber A and reciprocates pin 45 from a position in which bracket 48 is adjacent to bushing 46 to a position in which bracket 48 passes the center of the space between bushing 46 and 47. The increased tension on coil 49 and the unstable position of toggle arm 40 causes toggle arm 40 to snap to a position as shown in dashed lines in Figure 2. As coil 49 takes up the slack, bracket 48 continues to travel to a position abutting bushing 47. Valve 35, drawn by crank pin 42, abuts stop 27. At this point port 30 is exposed to the atmosphere and air rushes into chamber A. At the same time chamber B through the change in position of valve 35 is connected to the evacuating means and is exhausted and the reverse operation ensues, that is, pistons 19 and 20 reciprocate in the opposite direction, expelling the water drawn into cylinder 11 and drawing fresh water into cylinder 12.

From the preceding description it will be apparent that the vacuum actuated double-action pump of this invention is susceptible of a number of variations, particularly in the construction of the cylinders, base and valve. Valve actuation, for example, can be obtained by extending an elongated pin (in place of pin 45) alongside both cylinders and utilizing J-shaped ends which enter the outer ends of the cylinders to cause actuation and reciprocation of the pin by contact with the outer faces of the pistons. The slide valve 35 and toggle arm 40 may be positioned in the same face of base 10. Port 32 may even be extended through toggle arm 40 rather than through base 10. The construction of a separate casting for base 10 can be eliminated and a single cylinder employed. The T-connection at the outer ends of the cylinders, of course, is merely one conventional variation and its structure forms no part of this invention except insofar as suitable suction and discharge valves must be provided.

I claim:

1. A vacuum actuated double-action pump comprising an elongated cylinder, a flat portion on the exterior of said cylinder, a transverse partition within said cylinder dividing the interior thereof into a first chamber and a second chamber longitudinally aligned with each other, a piston in each such chamber positioned in sliding engagement with the inner wall of the cylinder and reciprocable within the chamber, means interconnecting said pistons, a valved inlet and a valved outlet at the outer end of each said chamber, a pair of openings in said flat portion on the exterior of the cylinder, a first port communicating one of said openings with the inner end of the first chamber, a second port communicating the other of said openings with the inner end of the second chamber, exhaust means including an exhaust port for connection with an evacuating device in sliding contact upon said flat surface, said exhaust means being reciprocable between a first position with said exhaust port communicating with said first port and a second position with said exhaust port aligned with said second port, a spring-loaded toggle arm connected to said reciprocable exhaust means for rapidly shifting said exhaust means between said first and second positions, and means operatively connected to said spring-loaded toggle arm actuated in coordination with the position of said pistons to shift said toggle arm from said first to said second positions as the piston in said first chamber approaches the inner end thereof and to shift said toggle arm from said second position to said first position as the piston in said second chamber approaches the inner end thereof.

2. A vacuum actuated double-action pump comprising an elongated cylinder, a flat portion on the exterior of said cylinder, a transverse partition within said cylinder dividing the interior thereof into a first chamber and a second chamber longitudinally aligned with each other, a piston in each such chamber positioned in sliding engagement with the inner wall of the cylinder and reciprocable within the chamber, a rod passing through said partition in fluid-tight sliding connection therewith, said rod being affixed to said pistons at its ends, a valved inlet and a valved outlet at the outer end of each said chamber, a pair of openings in said flat portion on the exterior of the cylinder, a first port communicating one of said openings with the inner end of the first chamber, a second port communicating the other of said openings with the inner end of the second chamber, exhaust means including an exhaust port for connection with an evacuating device in sliding contact upon said flat surface, said exhaust means being reciprocable between a first position with said exhaust port communicating with said first port and a second position with said exhaust port aligned with said second port, a spring-loaded toggle arm connected to said reciprocable exhaust means for rapidly shifting said exhaust means between said first and second positions, and means operatively connected to said spring-loaded toggle arm actuated in coordination with the position of said pistons to shift said toggle arm from said first to said second positions as the piston in said first chamber approaches the inner end thereof and to shift said toggle arm from said second position to said first position as the piston in said second chamber approaches the inner end thereof.

3. A vacuum actuated double-action pump comprising an elongated cylinder, a flat portion on the exterior of said cylinder, a transverse partition within said cylinder dividing the interior thereof into a first chamber and a second chamber longitudinally aligned with each other, a piston in each such chamber positioned in sliding engagement with the inner wall of the cylinder and reciprocable within the chamber, a rod passing through staid partition in fluid-tight sliding connection therewith, said rod being affixed to said pistons at its ends, a valved inlet and a valved outlet at the outer end of each said chamber, a pair of openings in said flat portion on the exterior of the cylinder, a first port communicating one

of said openings with the inner end of the first chamber, a second port communicating the other of said openings with the inner end of the second chamber, exhaust means including an exhaust port for connection with an evacuating device in sliding contact upon said flat surface, said exhaust means being reciprocable between a first position with said exhaust port communicating with said first port and a second position with said exhaust port aligned with said second port, a spring-loaded toggle arm connected to said reciprocable exhaust means for rapidly shifting said exhaust means between said first and second positions, and a reciprocable pin connected at its center to the spring loading the toggle arm and positioned parallel to said piston rod with the ends of said pin extending into said chambers for actuation by the inner faces of said pistons as they approach the inner ends of their respective chambers to shift said toggle arm from said first to said second positions as the piston in said first chamber approaches the inner end thereof and to shift said toggle arm from said second position to said first position as the piston in said second chamber approaches the inner end thereof.

References Cited in the file of this patent

UNITED STATES PATENTS

Re. 2,256	Thatcher	May 22, 1866
533,817	Keenan	Feb. 5, 1895
2,604,310	Brown	July 22, 1952