Jan. 6, 1959 W. H. PORTER 2,867,176

EQUALIZED FLUID PUMP

Filed Dec. 22, 1955

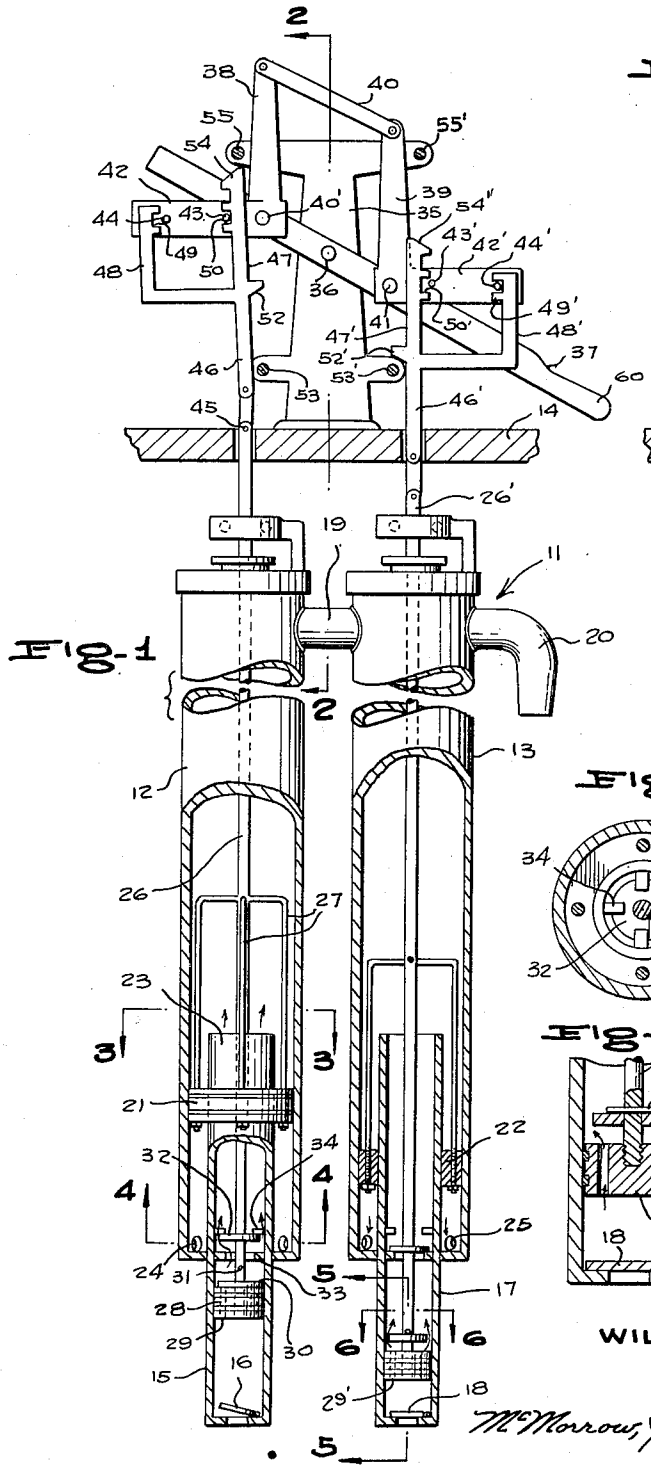


Fig-1

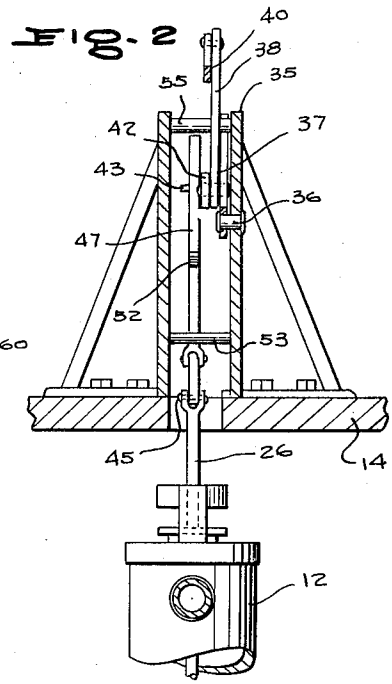


Fig-2

Fig-3

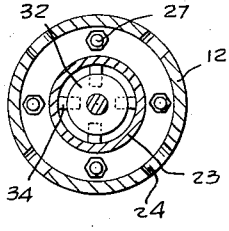


Fig-4

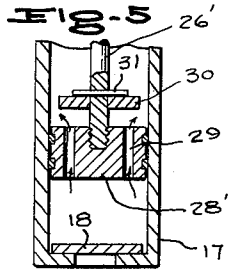


Fig-5

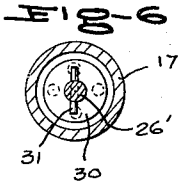


Fig-6

INVENTOR.

WILLIAM H. PORTER

BY

McMorrow, Berman & Davidson

ATTORNEYS

United States Patent Office

2,867,176

Patented Jan. 6, 1959

2,867,176

EQUALIZED FLUID PUMP

William H. Porter, Phoenix, Ariz.

Application December 22, 1955, Serial No. 554,725

5 Claims. (Cl. 103—183)

This invention relates to improvements in pumps, and more particularly to a pump of the type having an oscillating driving member, which pumps fluid responsive to oscillation of the driving member in either direction, and which is provided with means to equalize the amount of force required on the driving member for both directions of oscillation of said driving member.

A main object of the invention is to provide a novel and improved pump of the type having an oscillating operating member, said pump having means to equalize the amount of force required on the operating member thereof for the opposite movements of said operating member, the improved pump being simple in construction, being efficient in action, and being arranged so that fluid may be lifted to a substantial height without requiring any considerable amount of additional force applied to the operating member of the pump.

A further object of the invention is to provide an improved pump of the type having an oscillating operating lever arranged to pump fluid in both directions of oscillation of the lever, said pump being relatively inexpensive to manufacture, being durable in construction, and being provided with automatic means for equalizing the amount of force required on its operating lever for the opposite strokes of the piston elements of the pump.

Further objects and advantages of the invention will become apparent from the following description and claims, and from the accompanying drawings, wherein:

Figure 1 is a front elevational view, partly in vertical cross section, showing an improved pump constructed in accordance with the present invention.

Figure 2 is a vertical cross sectional view taken on the line 2—2 of Figure 1.

Figure 3 is an enlarged horizontal cross sectional view taken on the line 3—3 of Figure 1.

Figure 4 is an enlarged horizontal cross sectional view taken on the line 4—4 of Figure 1.

Figure 5 is an enlarged vertical cross sectional detail view taken on the line 5—5 of Figure 1.

Figure 6 is an enlarged horizontal cross sectional view taken on the line 6—6 of Figure 1.

Referring to the drawings, the improved equalized pump is designated generally at **11** and comprises a pair of stationary vertical cylinders **12** and **13** which are mounted in any suitable manner below a horizontal support **14**, as illustrated. The cylinder **12** is provided at its lower end with a fluid intake conduit **15** having the upwardly opening flap valve **16** in its bottom end, arranged to open in response to suction developed in the conduit **15**, to admit liquid into said conduit from below. Similarly, the cylinder **13** is provided at its bottom end with an intake conduit **17** provided with the upwardly opening flap valve **18** which is normally closed and which is arranged to open in response to the development of suction in conduit **17**, to admit liquid into said conduit.

The top portions of the cylinders **12** and **13** are connected together, as by a horizontal cross conduit **19**, the top portion of the cylinder **13** being connected to a discharge conduit **20**.

The respective cylinders **12** and **13** are provided with respective pistons, designated generally at **21** and **22**. Thus, the piston **21** comprises an annular main body portion disposed between the upper extension **23** of conduit **15** and the inside wall surface of cylinder **12**, the piston **21** being provided with suitable sealing means to provide a slidable sealing contact with the members **23** and **12**. The bottom end of cylinder **12** is vented to atmosphere by the ports **24**, and the bottom end of the cylinder **13** is similarly vented to atmosphere by the ports **25**.

The piston **21** is provided with a vertical piston rod **26** which is rigidly connected to the annular main body of the piston, as by the brace rod elements **27** overlying and spaced a substantial distance above the top end of the conduit extension **23**. The piston rod **26** extends downwardly and axially through the extension **23** and has secured to its bottom end a smaller piston member **28** which slidably and sealingly engages inside the inlet conduit **15**. The piston element **28** is provided with vertical ports **29** and with a vertically movable valve washer **30** which normally covers the top ends of the ports **29**, but which is elevated responsive to downward movement of the piston element **28** to allow liquid to pass through the vertical ports **29** when the piston element **28** is moved downwardly in the conduit **15**. Upward movement of the washer **30** is limited by the provision of a transversely extending pin **31** in the piston rod **26**.

A similar washer valve **32** is slidably engaged on the piston rod immediately above a centrally apertured horizontal partition wall **33** provided in conduit **15**.

Upward movement of the valve washer **32** in the conduit **15** is limited by the provision of internally projecting stop pins **34** provided in the conduit **15**, said stop pins being spaced above the partition member **33**, as is clearly shown in Figure 1.

The cylinder **13** is provided in its intake conduit element **17** with a small piston **28'** and with valve structure associated with said piston similar to that above described in connection with the piston **28** of the conduit **15**.

It will be readily apparent that when the piston **21** moves downwardly the valve structure in the conduit **15** opens to allow liquid to move upwardly into the conduit extension **23**, and that when the piston **21** moves upwardly the aforesaid valve structure closes, whereby the liquid is lifted vertically in cylinder **12** and is delivered through conduit **19** and through the upper portion of cylinder **13** to the discharge conduit **20**. The same action takes place in the cylinder **13**, in alternate sequence with that occurring in the cylinder **12**, by structure presently to be described.

Mounted on the support **14** is the upstanding support element **35** located substantially midway between the piston rods associated with the respective cylinders **12** and **13**, said rods being shown at **26** and **26'**. Pivotally connected at **36** to the intermediate portion of the upstanding support element **35** is a lever **37**, said lever having pivotally connected thereto respective arms **38** and **39**, the pivotal connections **40'** and **41** of said arms to the lever **37** being spaced equal distances on opposite sides of the pivot connection **36**. The top ends of the arms **38** and **39** are connected by a link bar **40**.

Arm **38** is provided at its lower portion with the horizontally extending bar element **42** provided at respective points spaced from the pivot connection **40** with respective abutment pins **43** and **44**. Pivotally connected at **45** to the top end of piston rod **26** is a substantially vertical link bar **46**, said link bar being formed with a first upstanding arm **47** and with a second upstanding arm **48** spaced from the arm **47** and being located a substantial distance further from the pivot connection **36** of lever **37** than the upstanding arm **47**, as is clearly shown in Figure 1. Arm **48** is formed with an inwardly directed

notch 49 engageable with the pin 44 when the lever 46 is oscillated in a direction toward the pivot connection 36, and arm 47 is formed with a similar inwardly directed notch 50 engageable with the pin 43 when the link member 46 is oscillated away from the pivot connection 36.

Arm 47 is formed with a first cam lug 52 engageable with a pin 53 on the lower portion of support element 35 when the piston 21 reaches its lowermost position in the cylinder 12, to oscillate the link member 46 away from the pivot connection 36, and to cause notch 50 to interengage with the pin 43. The top end of arm 46 is formed with a cam element 54 engageable with a pin 55 on the top portion of the support element 35 to oscillate the link bar 46 toward the pivot connection 36 when the piston 21 reaches the uppermost position thereof in the cylinder 12, to cause notch 43 to disengage from pin 50 and to cause notch 49 to engage with pin 44.

Pivotally connected to the top end of piston rod 26' of the cylinder 13 is a substantially vertical link member 46' similar to the link member 46 and having spaced upstanding arms 47' and 48', the link members 46 and 46' being substantially symmetrically arranged relative to the pivot connection 36 when lever 37 is horizontal. Arm 47' has the notch 50' interengageable with a pin 43' on the base bar 42' of member 39 when link 46' is oscillated away from pivot connection 36, and arm 48' has a notch 49' engageable with a pin 44' on member 42' when the link member 46' is oscillated toward the pivot connection 36. Arm 47' is provided with a cam lug 52' engageable with a pin 53' on support element 35 to oscillate the link 46' away from pivot connection 36 when piston 22 reaches its lowermost position in cylinder 13, and the top end of arm 47' is provided with a cam element 54' engageable with a pin 55' on the support element 35 to oscillate link member 46' toward the pivot connection 36 when piston 22 reaches its uppermost position in the cylinder 13.

Since the members 38 and 39 are linked together by the link 40, the members 42 and 42' remain parallel at all times. As piston 21 reaches its uppermost position, piston 22 reaches its lowermost position, whereby link member 46 is oscillated toward the pivot connection 36, causing notch 49 to engage with pin 44, and link 46' is oscillated away from the pivot connection 36, causing notch 50' to engage with pin 43'. Thus, for the following downward stroke of piston 21 and upward stroke of piston 22, the major portion of the upward force applied to the handle 60 of the lever 37 is employed to lift the liquid in cylinder 13, and only a small portion of said force is applied to the piston rod 26 to depress the piston 21 in cylinder 12. Similarly, when piston 21 reaches its lowermost position and piston 22 reaches its uppermost position, link 46 is oscillated away from pivot connection 36 and link 46' is oscillated toward pivot connection 36, whereby notch 43 engages with pin 50 and notch 44' engages with pin 49'. Thus, in the ensuing downward stroke of the handle 60, due to the symmetry of the linkage elements relative to the pivot connection 36 of the lever 37, substantially the same force is required to be applied downwardly on the handle as was previously required to elevate the handle, and substantially the same distribution of the force takes place, a major portion of the force applied to the lever being employed to lift the liquid in cylinder 12 and only a small proportion of this force being employed to lower the piston 22 in the cylinder 13.

From the above discussion, it will be readily apparent that the force required to raise and lower the handle 60 of lever 37 is substantially equalized by the operation of the above described linkage, and that uniform flow is provided from the conduit 20 regardless of which direction the lever 37 is oscillated.

While a specific embodiment of an improved pump has been disclosed in the foregoing description, it will be understood that various modifications within the spirit of the invention may occur to those skilled in the art. Therefore, it is intended that no limitations be placed on the invention except as defined by the scope of the appended claims.

What is claimed is:

1. In a pump, a stationary vertical cylinder having fluid intake means at its lower end and fluid discharge means at its upper end, a piston in said cylinder, said piston having a piston rod connected thereto, valve means in said piston formed and arranged to open when the piston is moved downwardly and to close when the piston is moved upwardly in the cylinder, a support, a lever pivoted to said support, and means for reciprocating the piston responsive to oscillation of the lever, said means including a link member pivotally connected to said piston rod for movement toward and away from the pivot connection of said lever, a first upstanding arm on the link member and located relatively close to said pivot connection, a second upstanding arm on the link member located relatively far from said pivot connection, a first projection on said support, a first cam element on said link member engageable with said projection when the piston reaches its lowermost position in the cylinder, means drivingly connecting the first upstanding arm to the lever responsive to the engagement of said cam element with said projection, a second projection on said support, a second cam element on said link member engageable with said second projection when the piston reaches its uppermost position in the cylinder, and means drivingly connecting the second upstanding arm to the lever in place of the first arm responsive to the engagement of said second cam element with said second projection.

2. In a pump, a stationary vertical cylinder having fluid intake means at its lower end and fluid discharge means at its upper end, a piston in said cylinder, said piston having a piston rod connected thereto, valve means in said piston formed and arranged to open when the piston is moved downwardly and to close when the piston is moved upwardly in the cylinder, a support, a lever pivoted to said support, and means for reciprocating the piston responsive to oscillation of the lever, said means including a link member pivotally connected to said piston rod for movement toward and away from the pivot connection of said lever, a first upstanding arm rigidly connected to the link member and located relatively close to said pivot connection, a second upstanding arm rigidly connected to the link member parallel to the first arm and located relatively far from said pivot connection, a first transverse projection on the lower portion of said support, a first cam element on said link member and having an inclined bottom edge engageable with said projection to rotate said link member outwardly when the piston reaches its lowermost position in the cylinder, means drivingly connecting said first upstanding arm to the lever responsive to the outward rotation of said link member, a second tranverse projection on the upper portion of said support, a second cam element on said link member having an inclined top edge engageable with said second projection to rotate the link member inwardly when the piston reaches its uppermost position in the cylinder, and means drivingly connecting the second upstanding arm to the lever in place of the first arm responsive to the inward rotation of said link member.

3. In a pump, a stationary vertical cylinder having fluid intake means at its lower end and fluid discharge means at its upper end, a piston in said cylinder, said piston having a piston rod connected thereto, valve means in said piston formed and arranged to open when the piston is moved downwardly and to close when the piston is moved upwardly in the cylinder, a support, a lever pivoted to said support, and means for reciprocating the piston responsive to oscillation of the lever, said means including

a link member pivotally connected to said piston rod for movement toward and away from the pivot connection of said lever, a first upstanding arm rigidly connected to the link member and located relatively close to said pivot connection, a second upstanding arm rigidly connected to the link member parallel to the first arm and located relatively far from said pivot connection, a first transverse projection on the lower portion of said support, a first cam element on the lower portion of said link member having an inclined bottom edge engageable with said projection to rotate said link member outwardly and away from said support when the piston reaches its lowermost position in the cylinder, means drivingly connecting said first upstanding arm to the lever responsive to the outward rotation of said link member, a second transverse projection on the upper portion of said support, a second cam element on the top end of said link member having an inclined top edge engageable with said second projection to rotate the link member inwardly and toward the support when the piston reaches its uppermost position in the cylinder, and means drivingly connecting the second upstanding arm to the lever in place of the first arm responsive to the inward rotation of said link member.

4. In a pump, a pair of stationary vertical cylinders, each having fluid intake means at its lower end and fluid discharge means at its upper end, respective pistons in the cylinders, said pistons having piston rods connected thereto, valve means in the pistons formed and arranged to open when the pistons move downwardly and to close when the pistons move upwardly, a support, a lever pivoted to said support at a point located substantially midway between the axes of the cylinders, respective link members pivotally connected to the piston rods, means drivingly connecting the link members to respective portions of the lever on opposite sides of the pivot connection and being formed and arranged to move the pistons in opposite directions in their cylinders responsive to oscillation of the lever in either direction, each link member being mounted for oscillation toward and away from the pivot connection, said last named means including a pair of upstanding arms on each link member spaced from the pivot connection, one arm being relatively close to the pivot connection and the other arm being relatively far from the pivot connection, respective transverse projections on the lower portions of the opposite sides of the support, respective cam elements on the lower portions of the link members engageable with said projections and formed and arranged to rotate each link member outwardly when its associated piston reaches its lowermost position, means drivingly connecting the upstanding arm of each link member nearest the pivot connection to the lever when the link member is rotated outwardly, respective transverse projections on the opposite sides of the upper portion of the support, respective

further cam elements on the upper portions of the link members engageable with said last-named projections and formed and arranged to rotate each link member inwardly when its associated piston reaches its uppermost position, and means drivingly connecting the upstanding arm of each link member furthest from the pivot connection to the lever responsive to inward rotation of the link member.

5. In a pump, a pair of stationary vertical cylinders, each having fluid intake means at its lower end and fluid discharge means at its upper end, respective pistons in the cylinders, said pistons having piston rods connected thereto, valve means in the pistons formed and arranged to open when the pistons move downwardly and to close when the pistons move upwardly, a support, a lever pivoted to said support at a point located substantially midway between the axes of the cylinders, respective substantially vertical link members symmetrically arranged relative to the pivot connection of the lever and pivotally connected to the piston rods, means drivingly connecting the link members to respective portions of the lever on opposite sides of the pivot connection and being formed and arranged to move the pistons in opposite directions in their cylinders responsive to oscillation of the lever in either direction, each link member being mounted for oscillation in the common vertical plane of the link members toward and away from the pivot connection, said last named means including a pair of upstanding arms on each link member spaced at different horizontal distances from the pivot connection, one arm being relatively close to the pivot connection and the other arm being relatively far from the pivot connection, respective transverse projections on the lower portions of the opposite sides of the support, respective cam elements on the lower portions of the link members engageable with said projections and formed and arranged to rotate each link member outwardly when its associated piston reaches its lowermost position, means drivingly connecting the upstanding arm of each link member nearest the pivot connection to the lever when the link member is rotated outwardly, respective transverse projections on the opposite sides of the upper portion of the support, respective further cam elements on the upper portions of the link members engageable with said last-named projections and formed and arranged to rotate each link member inwardly when its associated piston reaches its uppermost position, and means drivingly connecting the upstanding arm of each link member furthest from the pivot connection to the lever responsive to inward rotation of the link member.

References Cited in the file of this patent

UNITED STATES PATENTS

2,744,468 Porter ---------- May 8, 1956