Oct. 23, 1928. 1,688,978

J. McCALLUM ET AL

RECIPROCATING PUMP

Filed Oct. 25, 1926 2 Sheets-Sheet 1

Fig. 1.

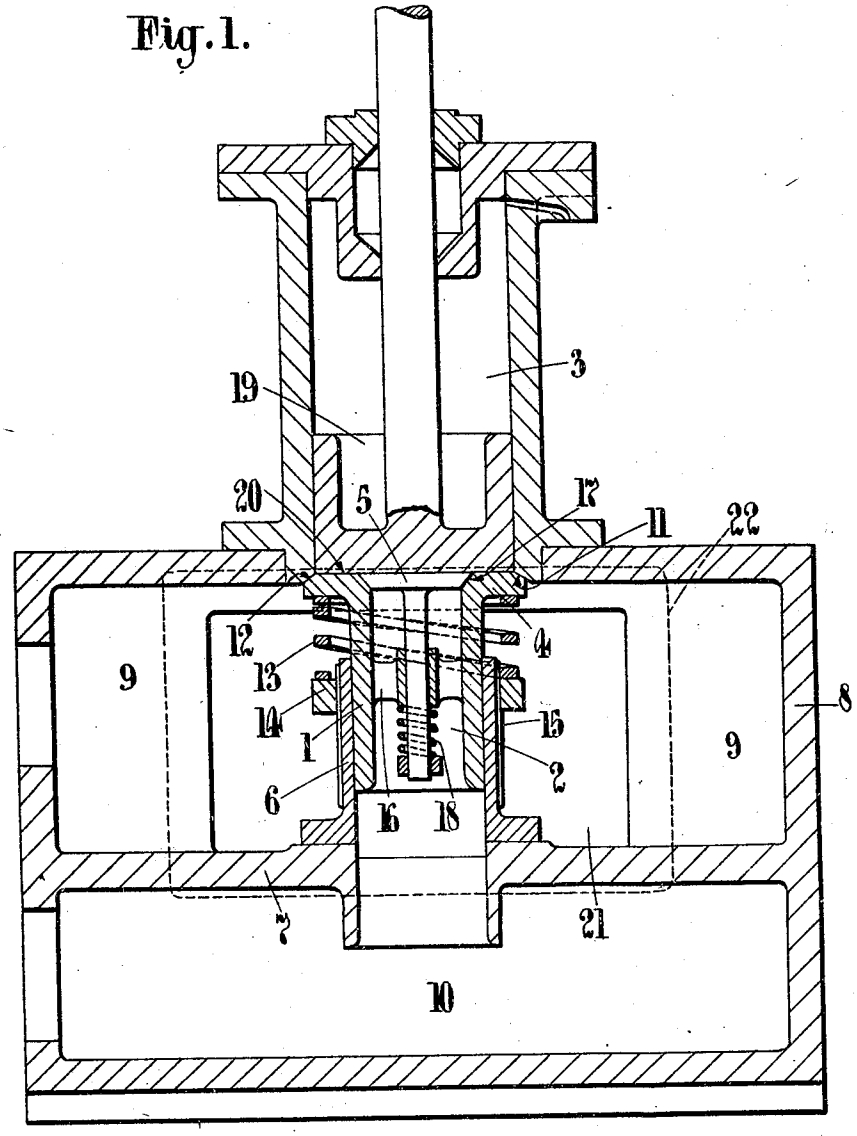

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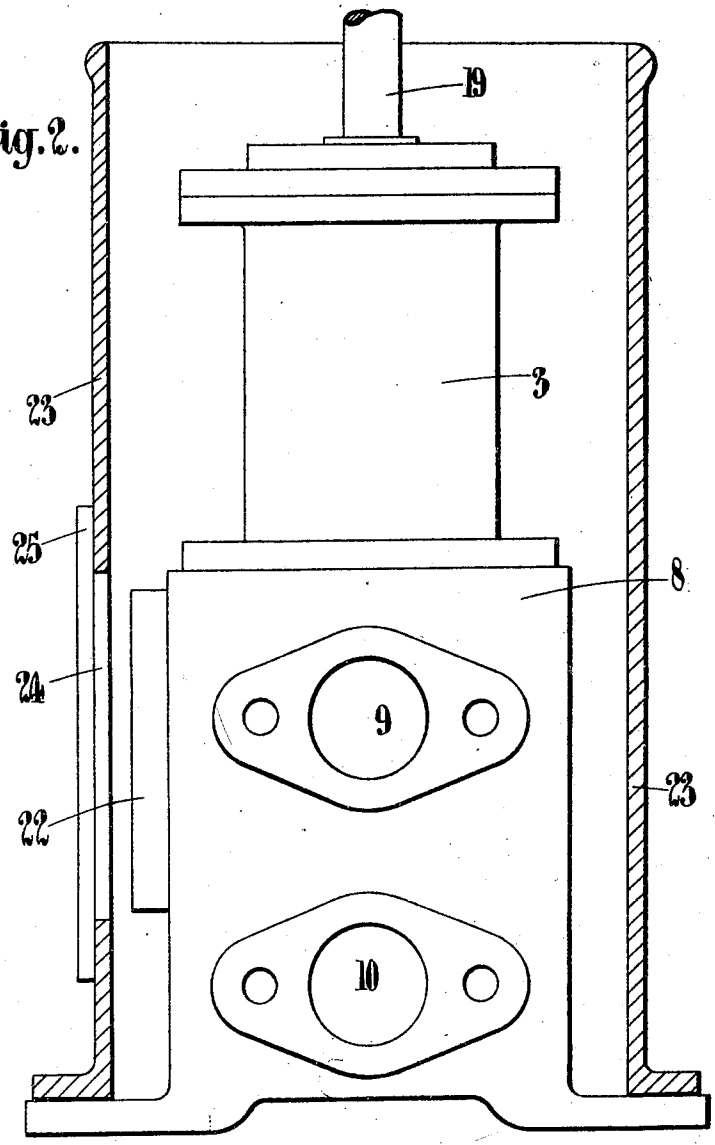
Fig. 2.



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UNITED STATES PATENT OFFICE.

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RECIPROCATING PUMP.

Application filed October 25, 1926, Serial No. 144,124, and in Great Britain October 31, 1925.

This invention relates to reciprocating pumps, and its object is to provide a pump of this kind in which no clearance space between the end of the plunger and the end of the pump barrel is necessary.

According to the present invention, a reciprocating pump is provided in which the end of the pump barrel is constituted by a valve structure comprising suction and delivery valves adapated to open automatically at the alternate suction and delivery strokes respectively of the pump plunger, which structure is so arranged that the delivery valve thereof is pressed by spring means against a seating on the adjacent part of the pump barrel and the suction valve is pressed by spring means against a seating on the adjacent part of the delivery valve, the arrangement of the pump being such that the pump plunger comes into contact with the adjacent surface of the valve structure at or near the end of each outward stroke and forces open the delivery valve against the action of the resilient means so as to completely expel the fluid drawn into the barrel at the preceding inward stroke.

In this kind of reciprocating pump, as is well known, no clearance space between the end of the plunger and the end of the pump barrel is necessary, the plunger coming into contact with the adjacent surface of the valve structure at or near the end of each outward stroke and forcing open the delivery valve against the action of its spring means so as to completely expel the fluid drawn into the barrel at the preceding inward stroke.

According to the present invention, we provide a reciprocating pump of the kind stated comprising a casing constituting a supporting base for the pump, a pump barrel mounted on the said casing, and valve means comprising a stationary structure and a movable structure forming concentric suction and delivery valves at the end of the pump barrel, the arrangement being such that the whole valve means when desired can be readily removed from the casing en bloc. Preferably the arrangement is also such that variation can be made in the pressure of the delivery valve against the end of the pump barrel.

In the casing, a separate suction chamber may be formed below the valve means. Moreover, in order to vary the pressure of the delivery valve and adapt the whole valve means for ready removal as aforesaid, we may provide a screw adjustment device adapted to operate on the spring means of the delivery valve.

Preferably the valve structure comprises a delivery valve and a suction valve both concentric with the pump barrel and having their upper surfaces in the same plane, the delivery valve being pressed by spring means against a seating on the contiguous part of the pump barrel and the suction valve being pressed by spring means against a seating on the adjacent part of the delivery valve.

A convenient form of the invention as applied to a vertical plunger pump is illustrated, by way of example, in the annexed drawing, in which:—

Fig. 1 is a view of the pump in half-sectional elevation;

Fig. 2 is a side view of the pump (in outside elevation) and a housing (in section) for lagging purposes.

Referring to the drawing:—

The valve structure of the pump comprises a cylindrical sleeve 1, the interior of which is adapted to constitute part of the suction passage 2 leading into the pump barrel 3. The delivery valve 4 of the pump consists of a bevelled annular collar formed outside and at the top of the sleeve 1, and, as clearly shown in Fig. 1, said valve 4 is substantially of the same diameter as the pump barrel 3. The suction valve 5 is formed by a mushroom piece of which the upper surface is normally flush with the upper surface of the delivery valve 4 (see Fig. 1), the suction valve 5 and delivery valve 4 being concentric with each other.

The sleeve 1 of the valve structure is slidable vertically in a gland 6 supported directly beneath the pump barrel 3 by a horizontal wall 7 forming part of a casing 8 which encloses the valve structure. The delivery chamber 9 of the pump is formed by the part of the casing 8 above the wall 7, the suction chamber 10 being formed by the portion of the casing below said wall.

On the bottom edge of the pump barrel 3, a bevelled seating 11, corresponding to the bevelled edge 12 of the delivery valve 4, is provided, the delivery valve being held on this seating 11 by a spring 13 arranged outside the sleeve 1 between the valve 4 and a screw-threaded collar 14 adjustable on the screw thread 15 of the gland 6.

The suction valve 5 is slidable vertically in

a spider 16 formed integral with the sleeve 1 and is normally held down upon its annular seating 17 flush with the delivery valve 4 by means of a spring 18.

During the upward stroke of the pump plunger 19, the suction valve 5 is drawn upwards against the pressure of the spring 18, so as to admit fluid to the barrel 3 of the pump. Throughout this stroke the delivery valve 4 is held against its seating 11 by the spring 13. On the downward stroke of the plunger 19, the delivery valve 4 is forced off its seating 11 against the pressure of said spring 13 and fluid is forced out of the barrel 3 through the delivery valve 4, the suction valve 5 being held closed by its spring 18.

The stroke of the plunger 19 is such that slightly before the end of the outward stroke, the end of the plunger comes into contact with the plane or flush upper surface 20 of the valve structure, thereby completely expelling all the fluid between the said plunger 19 and the said surface 20. The valve structure, under the action of the spring 13, follows up the plunger 19 until the structure is brought to rest by contact of the delivery valve 4 with its seating 11 on the pump barrel 3.

In order to ensure that the valve structure does so follow the plunger 19, the spring 13 should have sufficient strength to overcome the tendency of the fluid to pass upwards behind the plunger 19 and exert pressure on the top 20 of the valve structure. For this purpose, the spring 13 is made, in practice, so that the pressure exerted thereby exceeds the pressure that would be exerted by the fluid on the area at the top of the valve structure representing the difference in area between the upper surface 20 of said structure and the annular under surface of the delivery valve 4.

By means of the screw adjustment 14:15, the valve structure along with the gland 6 can be removed en bloc from the casing 8 through the opening 21, which latter is normally closed by the fluid tight door 22. To allow the valve structure and gland 6 to pass through said opening 21, the collar 16 is first turned on the said gland so as to move downwards from the delivery valve 4. This downward movement of the collar 16 releases the pressure of the spring 13 on the valve structure so that the same can slide down within the gland 6, thereby reducing the overall height of said structure and gland, and making possible their removal and subsequent replacement en bloc. The screw adjustment 14:15 also enables small adjustments to be made in the pressure of the spring 13.

In Fig. 2, a housing 23 is shown, the purpose of which is to provide an enclosed space round the pump for insulating purposes, lagging material being packed between the outside of the pump and the inside of the said housing. Opposite to the door 22 of the casing 8, the housing 23 is provided with an opening 24 fitted with a cover 25, by which means access is readily obtained to the said opening 21 and the valve structure, the lagging between the cover 25 and the door 22 being in the form of a rectangular plug movable with the cover 25.

With the foregoing arrangement, it will be understood that since no clearance space is required between the end of the plunger and the end of the pump barrel, the fluid drawn into said barrel at each suction stroke of the plunger is completely expelled by the next delivery stroke. In this manner, a pumping action is obtained which is much more efficient than those effected by apparatus hitherto known.

It will be understood, of course, that the surface of the pump plunger adjacent the valve structure should be made to correspond with the upper surface of said structure, in order that the contact between the two surfaces may be complete.

Having now fully described our invention, what we claim and desire to secure by Letters Patent is:—

1. A pump having, in combination, a barrel, a plunger adapted to be reciprocated therein, a casing at one end of the barrel, a partition dividing the casing into a suction chamber and a delivery chamber, a gland supported by said partition concentric with the barrel and open to the suction chamber, a hollow delivery valve slidable in the gland, a seating on the adjacent annular edge of the barrel for said valve, spring means concentrically disposed around the exterior walls of said valve for constraining said valve to its seat for displacement by the plunger, a suction valve slidable within the delivery valve, a seating on the delivery valve for the suction valve such that when said valve is closed the inner surface is flush with the inner surface of the delivery valve, and spring means disposed within said delivery valve for seating the suction valve.

2. A pump having, in combination, a barrel, a plunger adapted to be reciprocated therein, a casing at one end of the barrel, a partition dividing the casing into a suction chamber and a delivery chamber, a gland supported by said partition concentric with the barrel and open to the suction chamber, a hollow delivery valve slidable in the gland, a seating on the adjacent annular edge of the barrel for said valve, spring means constraining said valve to its seat for displacement by the plunger, a suction valve slidable within the delivery valve, a seating on the delivery valve for the suction valve such that when said valve is closed the inner surface is flush with the inner surface of the delivery valve, spring means for seating the suction valve, and independent means for regulating the force exerted by both the aforesaid spring means.

3. A pump having, in combination, a barrel,

a plunger adapted to be reciprocated therein, a casing at one end of the barrel, a partition dividing the casing into a suction chamber and a delivery chamber, a gland having screw threads on the exterior thereof and supported by said partition concentric with the barrel and open to the suction chamber, a hollow delivery valve slidable interiorly of said gland, a seating on the adjacent annular edge of the barrel for said valve, spring means constraining said valve to its seat for displacement by the plunger, a suction valve slidable within the delivery valve, a seating on the delivery valve for the suction valve such that when said valve is closed its inner surface is flush with the inner surface of the delivery valve, spring means for seating the suction valve, and means engaging the screw threads on said gland for regulating the force exerted by first mentioned spring means.

4. A vertical plunger pump comprising, in combination, a pump barrel, a plunger adapted to reciprocate therein, concentric suction and delivery valves constituting a valve structure forming the end of the pump barrel, a casing having an upper and a lower chamber communicating with each other through the suction valves, pump barrel and delivery valve, a seating on the delivery valve for the suction valve, a seating on the adjacent annular edge of the pump barrel for the delivery valve, and independent spring means concentrically surrounding the exterior of the reciprocatory portions of each of said valves to hold the said valves resiliently on their seatings, whereby the end of the pump plunger corresponding with the upper surface of the valve structure comes into contact with said surface at or near the end of each outward stroke, and acts to force open the delivery valve.

5. A reciprocating pump of the kind stated comprising a casing constituting a supporting base for the pump, a pump barrel mounted on the said casing, and valve means comprising a stationary structure and a movable structure forming concentric suction and delivery valves at the end of the pump barrel, the arrangement being such that the whole valve means when desired can be readily removed from the said casing en bloc.

6. In a reciprocatory pump a casing, a piston mounted for movement within said casing, a seat formed on the end of said casing, a supporting structure adjacent said casing, a cylindrical gland carried by said supporting structure and aligned with the axis of said casing, screw threads on the exterior of said gland, a screw threaded flange engaging said screw threads and adjustable thereon, a valve slidably mounted in the interior of said gland and positioned to seat against said casing, an expansion spring extending between said valve and said flange and arranged to variably control the pressure at which said valve is seated against said casing, and an auxiliary valve carried interiorly of said first mentioned valve, and spring means positioned within said first mentioned valve for normally closing said auxiliary valve with respect to said first mentioned valve.

In testimony whereof we affix our signatures.

JOHN McCALLUM.
HARRY PERCIVAL HARVEY ANDERSON.