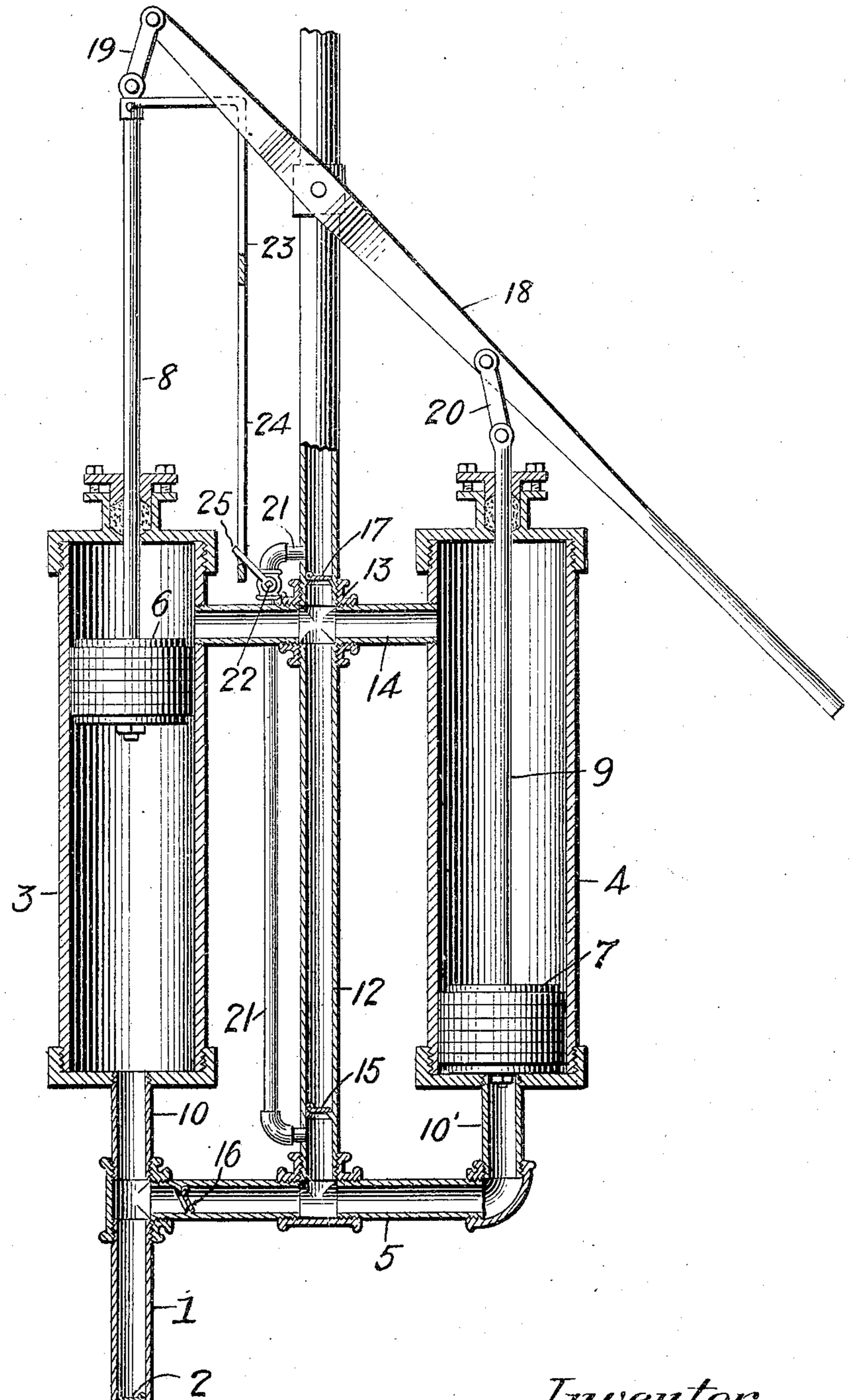
No. 877,583. PATENTED JAN. 28, 1908.

D. M. McLAUGHLIN.

BALANCED PUMP.

APPLICATION FILED OCT. 4, 1907.



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UNITED STATES PATENT OFFICE.

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BALANCED PUMP.

No. 877,583. Specification of Letters Patent. Patented Jan. 28, 1908.

Application filed October 4, 1907. Serial No. 395,857.

To all whom it may concern:

Be it known that I, DANIEL M. McLAUGHLIN, a citizen of the United States, residing at Louisville, county of Jefferson, State of Kentucky, have invented certain new and useful Improvements in Balanced Pumps; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The object of my invention is to provide a balanced pump of simplified construction and increased efficiency of operation, the parts being so arranged that the two members of the pump discharge into a common stand pipe, the pressure of water in which is intermittently admitted to the pistons of the respective cylinders, in order to substantially balance the same, and thereby reduce the energy required to operate the pump to substantially that required to lift the amount of water discharged during each stroke of the brake.

In the accompanying drawing the figure is a vertical longitudinal section through a pump embodying the invention.

Referring to the drawings, 1 indicates an intake pipe provided with a gravity seated check valve 2 in its lower end. Said intake 1 communicates with left-hand cylinder 3 by means of a connection 10, and with right-hand cylinder 4 through cross connection 5 and short pipe section 10′. A piston 6 suitably packed to closely fit cylinder 3 is adapted to reciprocate in the latter, and a corresponding piston 7 is located in cylinder 4. Said pistons 6 and 7 are adapted to be moved in opposite directions for each stroke of the brake 18, by means of the piston rods 8 and 9, which are connected to said brake 18 by links 19 and 20, respectively.

In cross connection 5 there is mounted a gravity seating check valve 16, and substantially midway of said section 5, there is connected a vertical stand pipe 12 which extends to the desired height of the discharge from the pump. Above the connection of stand pipe 12 with cross section 5 is mounted a gravity seating check valve 15. At a point opposite the upper limits of the piston strokes in the respective cylinders 3 and 4, the stand pipe 12 is connected by pipe section 14 with said cylinders, preferably by means of a cross coupling 13. Said stand pipe is provided with a check valve 17 above said coupling 13.

In order to admit the pressure which maintains in the stand pipe above the check valve 17 to the respective pump cylinders to substantially balance the pistons therein in their reciprocal motion, I provide a by-pass 21 consisting of a pipe section connecting the upper portion of said stand pipe above said valve 17 with the lower portion of said stand pipe, preferably below check valve 15, whereby the pressure in the pump cylinders above the pistons may be maintained substantially equal to that in the stand pipe, and the pressure tending to oppose the upward movement of one piston will be substantially couterbalanced by the corresponding pressure which assists the downward movement of the other piston. It is to be noted further, that the position of the by-pass 21 prevents the accumulation of air, or, on the other hand, the formation of a vacuum or a reduction of pressure in the system to the right of check valve 16 and below check valve 15, in that it insures the space indicated being always completely filled with water at stand pipe pressure. It frequently happens in pumps of this character that the discharge cylinder, as 4, is not completely filled during the suction stroke of the piston 7, and the down stroke of the piston would therefore produce a heavy impact blow on the body of water below it, which would severely strain the apparatus and jar the operator. Inasmuch as the by-pass 21 is open during the down stroke of the piston 7, the entire space between said piston and check valve 16 will be kept completely filled with water at stand pipe pressure, any disparity between the amount of water delivered from cylinder 3 to cylinder 4 being compensated by a back flow of water from the stand pipe, so that under no conditions could a vacant space be left below piston 7. Furthermore, during the operation of high pressure pumps, more or less air will be carried in with the water, and will gradually accumulate below the pistons, thereby interfering with the proper operation of the pump. In order to avoid this difficulty, it has been customary to provide the cylinders of high pressure pumps with pet cocks which are opened from time to time to permit the air to escape. The by-pass 21 which serves to keep the entire system behind check

valve 16 full of water under stand pipe pressure prevents the accumulation of air and insures that any air which gets into the system will be driven out with the water by way of the stand pipe. The equalization of the pressure in the system above and below check valves 15 and 17 by way of the by-pass 21 also prevents a vacuum being formed in the system at any point behind check valve 16, and moreover insures that the check valves will seat themselves by gravity alone and not be forced violently to their seats by a predominant pressure from above which would tend to injure the valves and render the operation of the pump noisy. If it were possible to maintain both pistons absolutely water and air tight in their respective cylinders, it would be sufficient to admit or produce the desired pressure in the upper portions of both cylinders to effect this balancing operation, but in view of the fact that one or both pistons are subject to leakage, it is found desirable to renew the pressure from time to time, and a convenient means for effecting this is to provide the by-pass 21, with a valve 22, preferably in the form of a turning plug, which is alternately opened and closed by the movement of the pump brake. For instance, in the position of the parts shown in the drawing, valve 22 has been closed by the engagement of the handle 25 of said valve with the lower portion of an arm 23 provided with an elongated slot 24, through which said handle 25 projects. Conversely, valve 22 is opened at the end of the opposite movement of the pump brake 18 by the opposite end of slot 24 engaging said handle 25. It will thus be seen that the pressure in stand pipe 12 above check valve 17 is intermittently admitted to the portion of the stand pipe below said check valve, and therefore to the portions of the pump cylinders 3 and 4 above the respective pistons, and also to the portion of cylinder 4 below the piston 7.

The operation of the apparatus is substantially as follows. Assuming the parts of the apparatus to be the positions shown, and the pump, including the stand pipe, to be full of water, when it is desired to operate the pump to discharge water from the top of the stand pipe, the pump brake 18 is elevated, thereby depressing piston 6 and elevating piston 7. The downward movement of piston 6 forces the water in cylinder 3, below said piston, out of said cylinder past check valve 16, and the simultaneous upward movement of piston 7 permits the water forced out of cylinder 3 to enter cylinder 4 below said piston 7, so that the movements of the respective pistons are substantially balanced. When piston 7 moves downward, piston 6 ascends; the former forces the water from the cylinder 4 through pipes 10′ and 5 into stand pipe 12, check valve 16 being closed; at the same time piston 6 draws a charge of water from the source through intake 1 and past check valve 2. It will thus be seen that cylinder 3 and piston 6 serve to draw the water from the source on one stroke and to deliver the same to cylinder 4 below piston 7 on the opposite stroke, and piston 7 operating in cylinder 4 serves the purpose of forcing the water, initially drawn from the source by piston 6, into and through the stand pipe 12. Check valve 16 prevents any water, which has passed the same, returning, so that all water below piston 7 must enter the stand pipe where its backward flow is prevented by check valves 15 and 17. It will be noted that under these conditions, the pressure in the cylinders above the pistons will be that substantially produced by the downward stroke of piston 7, for the reason that the space in the rear of the pistons is directly open to such pressure, consequently the resistance to the upward movement of piston 6 is counterbalanced by the downward pressure on the rear of piston 7 and the energy required to operate the pump will be that required to lift the charge of water ahead of piston 7 through the stand pipe. During the downward movement of piston 7, valve 22 in by-pass 21 is open, and serves the two-fold purpose of admitting the stand pipe pressure behind the pistons 6 and 7, and also permitting the water discharged by piston 7 to pass directly into the stand pipe above check valve 17. When piston 7 reaches the lower limit of its stroke, valve 22, in by-pass 21, is closed by the engagement of handle 25 by the lower end of slotted rod 23, thereby cutting off communication between the stand pipe and cylinder 4 below piston 7, so that the downward movement of piston 6 requires only energy enough to move the water in cylinder 3 below said piston into cylinder 4 below piston 7, the counterbalancing pressure on the rear faces of said pistons being maintained, however, by the intermittent opening of said valve 22, as described.

It will be noted that this construction of balanced pump may be employed in lieu of the ordinary force pump now generally in use, with a resultant saving of the energy required to operate the same, and that by making one of the pistons and cylinders serve as an intake while the other operates to force the water into the stand pipe and by subjecting both cylinders and pistons in the rear of the latter to a pressure substantially equal to that in the stand pipe, an accurate balancing of the pump is effected and the work required to operate the pump will be limited to that necessary to effect the lifting of the charge of water. The construction and arrangement described also admits of the utilization of the full effect of the air pressure in the reservoir, for the reason that air is excluded from the cylinders in the rear of the pistons. The construction also obviates the

necessity of submerging the pump, prevents the respective cylinders losing their so-called back pressure, and at the same time prevents leakage of water from the stand pipe back past the pistons, which is effected by the closure of valve 22 and by-pass 21 when the pump brake is in the normal position shown, as no water can then pass backwards from the stand pipe by reason of the interposed check valve 17. By providing the pump with gravity closing check valves, the action is prompt and effective and the loss due to slow acting and leaky valves is obviated. It will also be apparent that by duplicating the mechanism described, the pump may be readily converted into one that will lift water during both strokes of the brake; that is to say, instead of employing the principle in the single acting pump as shown, it may be applied to a double acting pump.

What I claim is:—

1. In a balanced pump, the combination of two cylinders, oppositely moving pistons in said cylinders, a stand pipe connected with said cylinders below the pistons, a connection between the stand pipe and said cylinders above the pistons, a check valve in said stand pipe above the upper connection thereof with the cylinders, and means operated by the movement of one piston for intermittently admitting pressure from the upper part of said stand pipe to the cylinders behind the pistons.

2. In a balanced pump, the combination with two cylinders, oppositely moving pistons in said cylinders, a common intake for said cylinders, a common stand pipe connected to said cylinders below the pistons, a connection between said stand pipe and the cylinders above the pistons, a check valve in said stand pipe above said connection, a by-pass connecting the stand pipe above the check valve with the stand pipe below the same, a valve controlling said by-pass, and means operated by the pump brake for alternately opening and closing said valve.

3. In a balanced pump, the combination of an intake cylinder, a discharge cylinder communicating therewith, oppositely moving pistons in said cylinders, a stand pipe communicating with the discharge cylinder below the piston, check valves in the connection between the cylinders and in the stand pipe respectively, and a by-pass around the check valve in the stand pipe.

4. In a balanced pump, the combination of an intake cylinder, a discharge cylinder communicating therewith, oppositely moving pistons in said cylinders, a stand pipe communicating with the discharge cylinder below the piston, connections between the stand pipe and the cylinders above the pistons, check valves in the connection between the cylinders and in the stand pipe respectively, and a by-pass around the check valve in the stand pipe.

5. In a balanced pump, the combination of an intake cylinder, a discharge cylinder communicating therewith, oppositely moving pistons in said cylinders, a stand pipe communicating with the discharge cylinder below the piston, check valves in the connection between the cylinders and in the stand pipe respectively, a by-pass around the check valve in the stand pipe, a valve in said by-pass, and means to operate said valve, whereby the same is open during the down stroke of the discharge piston and closed during the down stroke of the intake piston.

6. In a balanced pump, the combination of an intake cylinder, a discharge cylinder, a connection between said cylinders below the pistons thereof, a check valve in said connection, oppositely moving pistons in said cylinders, a stand pipe communicating with the discharge cylinder below the piston, a check valve in said stand pipe, connections between said stand pipe and the cylinders behind the pistons and opening into said stand pipe below the check valve therein, a by-pass around the check valve in the stand pipe, and means to operate said valve, whereby the same is open during the down stroke of the discharge piston and closed during the down stroke of the intake piston.

In testimony whereof I affix my signature, in presence of two witnesses.

DANIEL M. McLAUGHLIN.

Witnesses:

JAMES QUARLES,

MARGUERITE J. GOTTLIEB.