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PATENTED JUNE 27, 1905.

C. E. LEWIS, J. DICK & L. H. BOWMAN.

HYDRAULIC VALVE.

APPLICATION FILED NOV. 14, 1903.

2 SHEETS—SHEET 1.

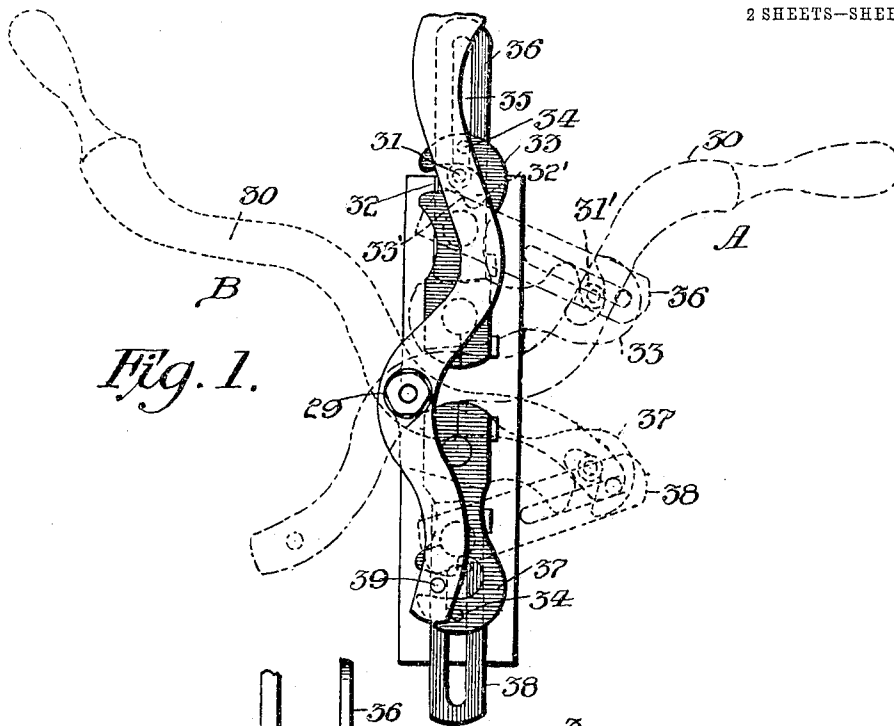


Fig. 1.

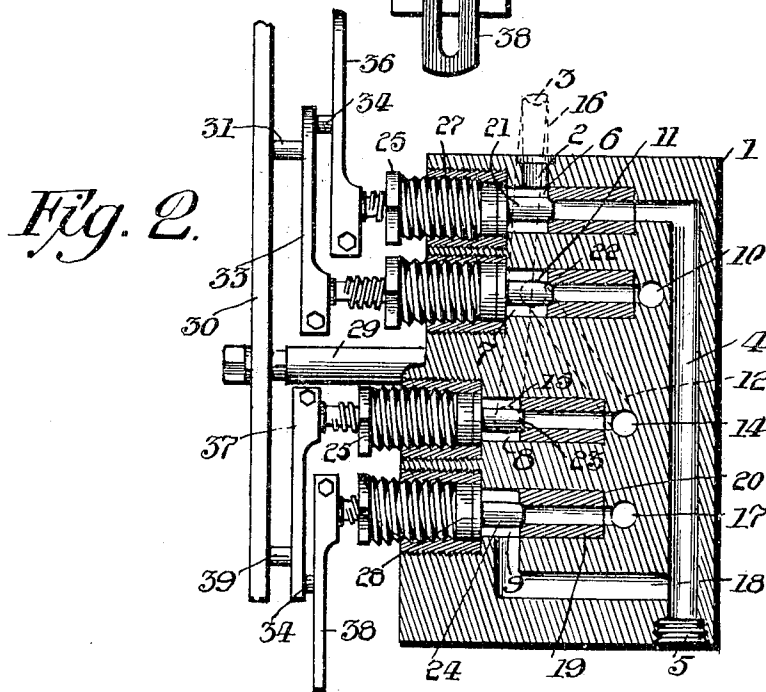


Fig. 2.

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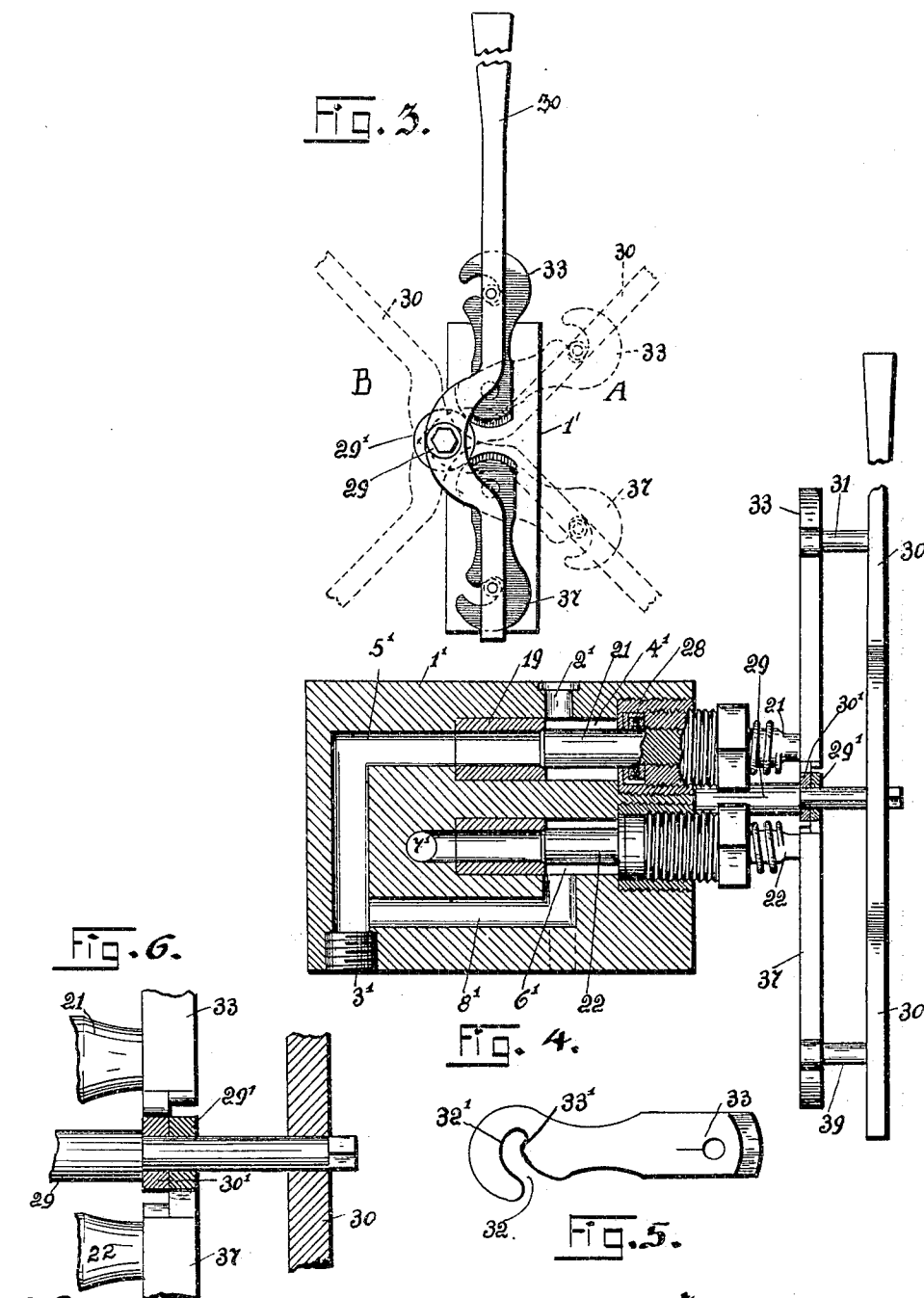
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2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

CHARLES E. LEWIS AND JOHN DICK, OF BRADDOCK, AND LEE H. BOWMAN, OF MUNHALL, PENNSYLVANIA.

HYDRAULIC VALVE.

SPECIFICATION forming part of Letters Patent No. 793,308, dated June 27, 1905.

Application filed November 14, 1903. Serial No. 181,228.

To all whom it may concern:

Be it known that we, CHARLES E. LEWIS and JOHN DICK, residing at Braddock, and LEE H. BOWMAN, residing at Munhall, in the county of Allegheny and State of Pennsylvania, citizens of the United States of America, have invented certain new and useful Improvements in Hydraulic Valves, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to certain new and useful improvements in hydraulic valves, and has for its object to construct a perfectly-balanced hydraulic valve and to provide means for opening and closing the exhaust-port through the medium of the same lever used for the opening and closing of the valve controlling the pressure-inlet.

A further object of the present invention is to provide a four-way valve in which a single lever is employed for opening and closing the inlet-ports and exhaust-ports.

The present invention is an improvement on the device shown, claimed, and described in the application filed October 13, 1902, Serial No. 127,125, by C. E. Lewis and John Dick, and which has matured in Patent No. 749,136, issued January 5, 1904, and in the present application there is involved the same improvements in connection with the valve-seats and valve as is shown in the prior application above noted.

In describing the invention in detail reference is had to the accompanying drawings, forming a part of this application, and wherein like characters of reference indicate like parts throughout the several views, in which—

Figure 1 is an end elevation of a four-way hydraulic valve constructed in accordance with our invention, showing the operating-lever in full lines in the closed position of the valves and in dotted lines showing its two positions for opening the two sets of valves. Fig. 2 is a central vertical sectional view of a four-way valve constructed in accordance with our invention, showing all of the valves closed. Fig. 3 is an end elevation of the two-way valve constructed in accordance with our invention, showing the two positions of the operating-

lever in dotted lines. Fig. 4 is a central longitudinal sectional view of a two-way valve constructed in accordance with our invention, showing the valves closed. Fig. 5 is a detached plan view of one of the connecting arms or cranks between the valve-stem and the operating-lever. Fig. 6 is a detail enlarged side elevation, partly in section, of the valve-stems, bearing-rollers, supporting-post, and operating-lever.

In this application the improvements over the prior invention reside particularly in the actuating means of the valves, and to this feature the detail description will be more closely confined, as in the prior device referred to, where, using a four-way valve, we provide a valve-body 1 made in suitable shape and provided with a pressure-inlet 2, with which the pressure-line is connected. This pressure-inlet 2 communicates, through port or passage-way 4, with the pressure-outlet 5, leading to the machine or device (not shown) to be operated. In the four-way valve such as herein shown the valve-body is provided with four valve-chambers 6, 7, 8, and 9, respectively. Of these valve-chambers the chambers 6 and 8 are inlet-chambers, while the chambers 9 and 7 are exhaust-chambers, coacting, respectively, with the chambers 8 and 6. The exhaust-chamber 7 communicates with the exhaust-port 10, and has an inlet-port 11 connected by a by-pass 12 with the port 14, that communicates with chamber 8, the latter chamber having an inlet-port 15 connected by a by-pass or port 16 with the inlet of pressure-line 3. Port 14 is connected with the opposite end of the cylinder to that to which port 5 is connected. The by-pass or port 16 is generally piped or tapped into or connected to the pressure-line 3 and extended around the side of the valve-body to connect with the inlet-port 15. The valve-chamber 9 has an exhaust-port 17, and a by-pass or port 18 connects chamber 9 with the port or passage-way 4 near the pressure-outlet 5. In each of the valve-chambers 6, 7, 8, 9 is a valve-seat 19, which is in the form of a sleeve, the lower end of the same abutting against the shoulder 20, formed therefor in the valve-body. This sleeve is simply driven

into the valve-body, and the upper end thereof forms a seat for the respective valves 21, 22, 23, and 24. When it is necessary to regrind the valve-seat, it may be easily accomplished by simply removing the valve and inserting a tool through the valve-chamber into engagement with the upper end of the sleeve. Each of the valves comprises a stem, the one end of which forms a valve proper. The stems are threaded into the work through an interiorly-threaded nut 25, threaded into the socket provided therefor in the valve-body or into the threaded collar or bushing 27, that is in turn threaded into the socket in the valve-body. The latter is the preferred form of construction, as in event of wear it is only necessary to remove the bushing or sleeve 27 without requiring a new nut 25. These nuts 25 are provided with wrench-receiving portions in order that they may be easily manipulated. In the four-way valve the threads on the stems of each valve 21 23 are of less pitch than the threads on stems of valves 22 24, the respective nuts 25 being correspondingly threaded. This is done so that when the lever-controlling valve is operated the valve 22 or valve 24, as the case may be, will move faster than valve 21 and valve 23, whereby in the opening of the valves valves 22 24 will open more rapidly than valves 21 23 and in the closing of the same will close more rapidly than said valves 21 23. The object of having the exhaust-valves travel the faster is to provide space more rapidly for the exhaust, and by the pressure-valve stems traveling slower the pressure inlet or inlets will be checked to a greater extent than the exhaust. On each of the valve-stems is a packing 28 of the particular form of construction which is shown and described in detail in the prior application herein referred to and which is hence not shown in detail herein.

Suitably supported from the valve-body, as by a post 29, is an operating-lever 30, which controls each of the four valves in the four-way-valve construction. To accomplish this, the said lever 30 is pivotally mounted on said post 29 intermediate the ends of the former, and above the post the said lever carries on its inner face a pin 31, which engages in the notch or slot 32, provided in the crank 33 near the free end thereof. This crank 33 is connected to the end of stem of valve 22 and carries a pin 34, which engages in slot 35, provided in the crank 36, that is connected to the end of stem of valve 21. The notch or slot 32 made in crank 33 curves downwardly toward the fastened end of the crank, as at 32', forming a shoulder 33', against which the pin 31 will engage as the lever 30 is being moved in one direction, so as to carry the crank 33 therewith until the closed position of the valve is reached, at which time the pin 31 will be in position to ride out through slot 32 in case further movement is imparted to le-

ver 30. During this movement of lever 30 pin 34, engaging in slot 35 in crank 36, carries the latter crank therewith, whereby to close valve 21 or to open the same, according to the direction in which the lever 30 is being moved. Connected to the end of the stem of valve 23 is a crank 37, exactly similar in construction to crank 33, and connected to the end of stem of valve 24 is a crank 38, exactly similar in construction to crank 36. The lever 30 carries near its lower end a pin 39 to engage in the slotted portion of crank 37, and this latter crank 37 carries a pin 34 to engage in the slot in crank 38.

As shown in Figs. 1 and 2, the valves are all in the closed position, and assuming it is desired to operate valves 21 22 the lever 30 is moved to position A. (Shown in dotted lines in Fig. 1.) As the lever 30 is moved in this direction pin 31 carries crank 33 therewith and pin 34 carries crank 36 therewith, turning the stems of the valves, so as to open the valves. The threads on stem of valve 22 being of greater pitch than the threads on stem of valve 21, it is to be noted that crank 33 needs to be moved only to substantially a right angle to the valve-body in order to open valve 22, while the crank 36 will at the same time travel to position substantially at an obtuse angle to the valve-body. As the lever 30 is moved in the reverse direction the pin 31, engaging on shoulder 33', carries crank 33 to the vertical position and pin 34 carries crank 36 also to the vertical position to close the valves, and when the valves are brought to this closed position the slot 32 and pin 31 are in such relation to each other that a further movement of the lever 30 toward the left will permit pin to ride out of slot 32, leaving the valves closed. This movement of the lever 30 toward the left or toward dotted-line position B moves a portion of the lever below the pivoted point toward the right and operating valves 23 24 in the same manner as above described for valves 21 22. The return of the lever to the full-line position as seen in Figs. 1 and 2 leaves all of the valves in the closed position.

In Figs. 3 and 4 we show the same principle applied to a two-way valve, in which 1' indicates the valve body or casing; 2', the pressure-inlet port; 3', the port leading to the cylinder of the device to be operated. (Not shown.) The pressure-line (not shown) connects with the inlet 2', the latter communicating with valve-chamber 4', which chamber is in communication with port 3' through port or passage-way 5'. The exhaust-chamber 6' communicates with the exhaust-port 7' and also with port or passage-way 5' through port or by-pass 8'. The valve-seat 19 and valves 21 22, together with their stems, are of the same form of construction as heretofore described. In this two-way valve the threads on valve 22 are or may be of the same pitch

as those on valve 21, and since but two valves are to be controlled—namely, the inlet-controlling valve and the exhaust-controlling valve—we dispense with cranks 36 38 and employ only the cranks 33 37, which are of the same form of construction as those shown and described in detail in connection with the four-way valve. The movement of lever 30 toward dotted-line position A opens the inlet-valve, while the movement of the said lever in the opposite direction to dotted-line position B closes the inlet-valve and opens the exhaust-valve. It is to be noted that in the two-way valve the threads on stems of valves 21 22 are oppositely or reversely inclined, whereby the movement of the lever 30 toward position A opens the inlet-valve without opening the exhaust-valve and the movement of the lever 30 from its position A to position B closes the inlet-valve and opens the exhaust-valve. The movement of the lever from its vertical position to position B, assuming both valves to be closed, opens the exhaust-valve without actuating the inlet-valve. In the four-way-valve construction, however, the threads on stems or valves 21 22 are inclined in the same direction, the threads on stem of valve 22 having a greater degree of pitch than the threads on stem of valve 21, and the threads on stems of valves 23 24 are inclined in the same direction with respect to each other, but at a reverse inclination to the threads on stems of valves 21 22, and when the operating-lever 30 is moved from the closed position to position A valves 21 22 are both opened, it being understood, of course, that the inlet leads to one end of the cylinder (not shown) and the outlet or exhaust to the opposite end of said cylinder. The operation is of course the same with respect to valves 23 24 when the lever is moved from the closed position to position B.

It is to be observed that the pitch of the threads on valves 21 22 could be the same, as could the pitch of threads on valve 23 24, provided the leverage connection with the valves is so as to give a greater throw of the exhaust-valve than is imparted to the inlet-valves with the movement of the operating-lever.

We preferably employ case-hardened rollers 31' on the pins 31, 34, and 39 to decrease the friction and give longevity to the parts.

As shown in Figs. 3, 4, and 6 of the drawings, we may employ bearing-rollers for the inner ends of the cranks 33 37. To this end rollers 29' 30' are mounted on the post 29 and are engaged by the inner ends of cranks 33 37, respectively, the cranks being cut away on one side adjacent the inner end, (see Figs. 4, 5, and 6,) so that crank 33 will only bear on roller 30' and crank 37 will only bear on roller 29', the said cranks being of course rounded at their inner ends where they bear on the rollers. This provision of the bearing-rollers for the inner ends of the cranks is

shown in connection with the two-way valve; but it will of course be evident that we may employ same with the form of valve shown in Figs. 1 and 2.

In the practice of the invention it will be noted that various changes may be made in the details of construction without departing from the general spirit of our invention.

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

1. In a hydraulic valve the combination with a valve-body having an inlet-port, a valve with a threaded stem controlling said inlet-port, an exhaust-port, a valve with a threaded stem controlling the exhaust-port and a crank secured to each stem, of a pivoted lever adapted when moved to one side to move the crank on one stem and turn one of the valves, and when moved to the other side to move the crank on the other of said stems and turn the other of said valves.

2. In a hydraulic valve, a valve-body formed with inlet and exhaust ports, valve-chambers communicating with said ports, valves arranged in said chambers, cranks connected to said valves, said cranks having their outer ends notched, a lever pivoted intermediate of said cranks, and pins adapted to alternately engage in the notches of the cranks accordingly as said lever is moved to one side or the other of a fixed point.

3. In a valve the combination of a valve-body having an inlet-port and an exhaust-port, a valve-chamber in communication with the inlet-port, a valve-chamber in communication with the exhaust-port and a passage leading from each chamber to a common port, with a rotatable valve arranged in each chamber, a pivoted lever adapted to be moved in opposite directions relatively to a fixed point and means for positively connecting said lever with one of said valves throughout its entire movement to one side of said point and for releasing it from its connection with said valve and positively connecting it with the other valve when said lever is moved to the other side of said fixed point.

4. In a hydraulic valve the combination with a valve-body having a set of four chambers, inlet-ports leading to two of said chambers and exhaust-ports leading to the other of said chambers, a valve in each chamber a crank on each valve, and a pivoted lever, of means whereby when said lever is reciprocated on one side of a fixed point it will connect with and positively move in both directions two of said valves and when reciprocated on the other side of said point it will connect with and positively move in both directions the other two of said valves.

5. In a hydraulic valve, a valve-body having an inlet-port, a valve-chamber in communication with the inlet-port, an exhaust-port, a valve-chamber in communication with the ex-

haust-port, a third port in communication with
both said chambers, a valve-seat in each of said
chambers, a valve operating in each chamber
and engaging the seat therein, cranks connect-
5 ed to the stems of said valves and provided
with slots, an operating-lever pivotally sup-
ported from the body for actuating each of
the valves and movable to opposite sides of
its pivotal point to operate the valves, pins
10 movable by said lever, one of which is adapt-
ed on the movement of the lever in one direc-
tion to engage in the slot in the crank of one

valve and the other of which is adapted, on the
movement of the lever in the reverse direction
to engage in the slot in the crank of the other 15
valve, and rollers on said pins.

In testimony whereof we affix our signatures
in the presence of two witnesses.

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JOHN DICK.

LEE H. BOWMAN.

Witnesses:

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E. E. POTTER.