

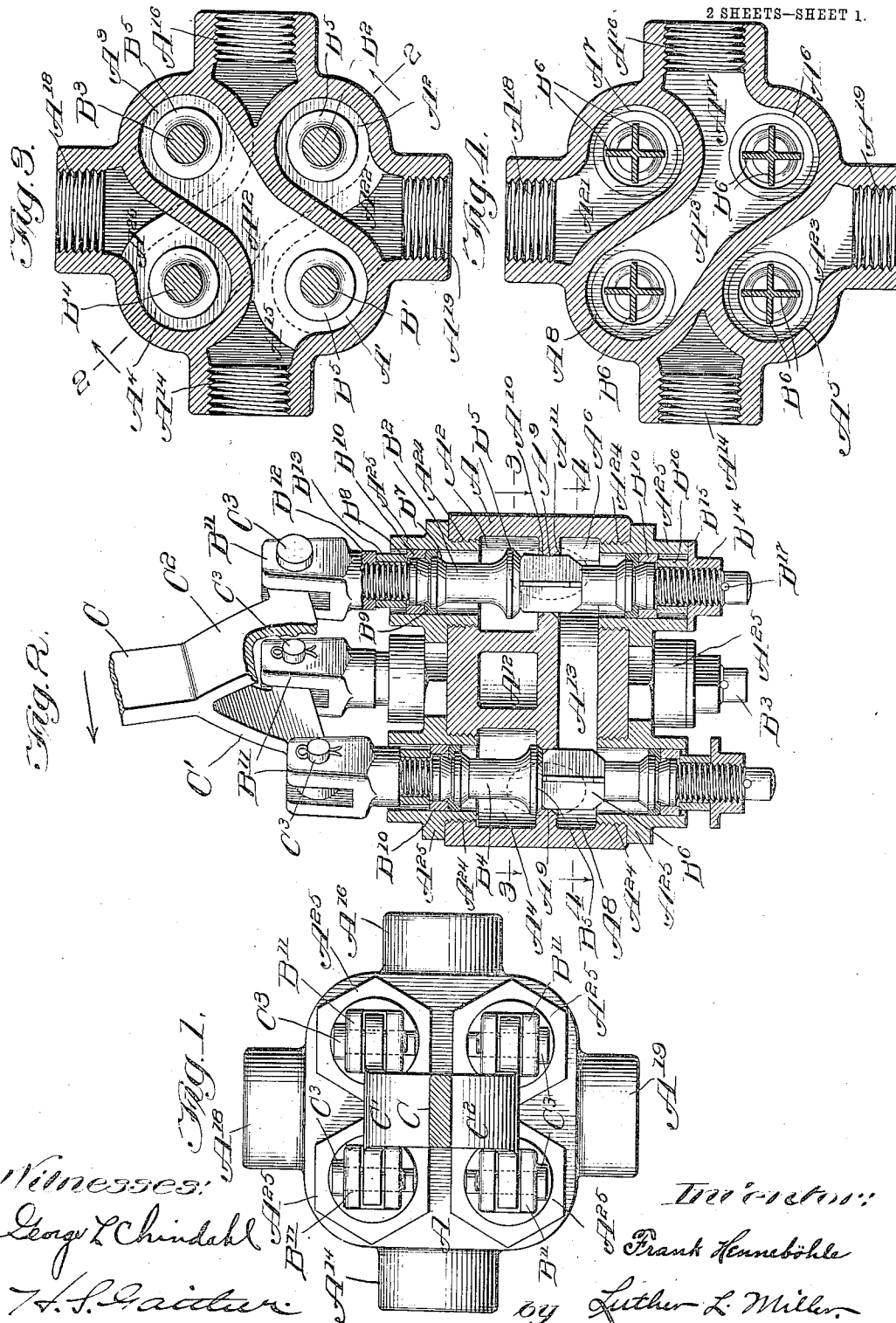
No. 817,773.

PATENTED APR. 17, 1906.

F. HENNEBÖHLE.
BALANCED HYDRAULIC VALVE.

APPLICATION FILED JUNE 27, 1904.

2 SHEETS—SHEET 1.



Witnesses:
George L. Chindahl
H. S. Gaiter

Inventor:
Frank Henneböhle
by Luther L. Miller,
his attorney

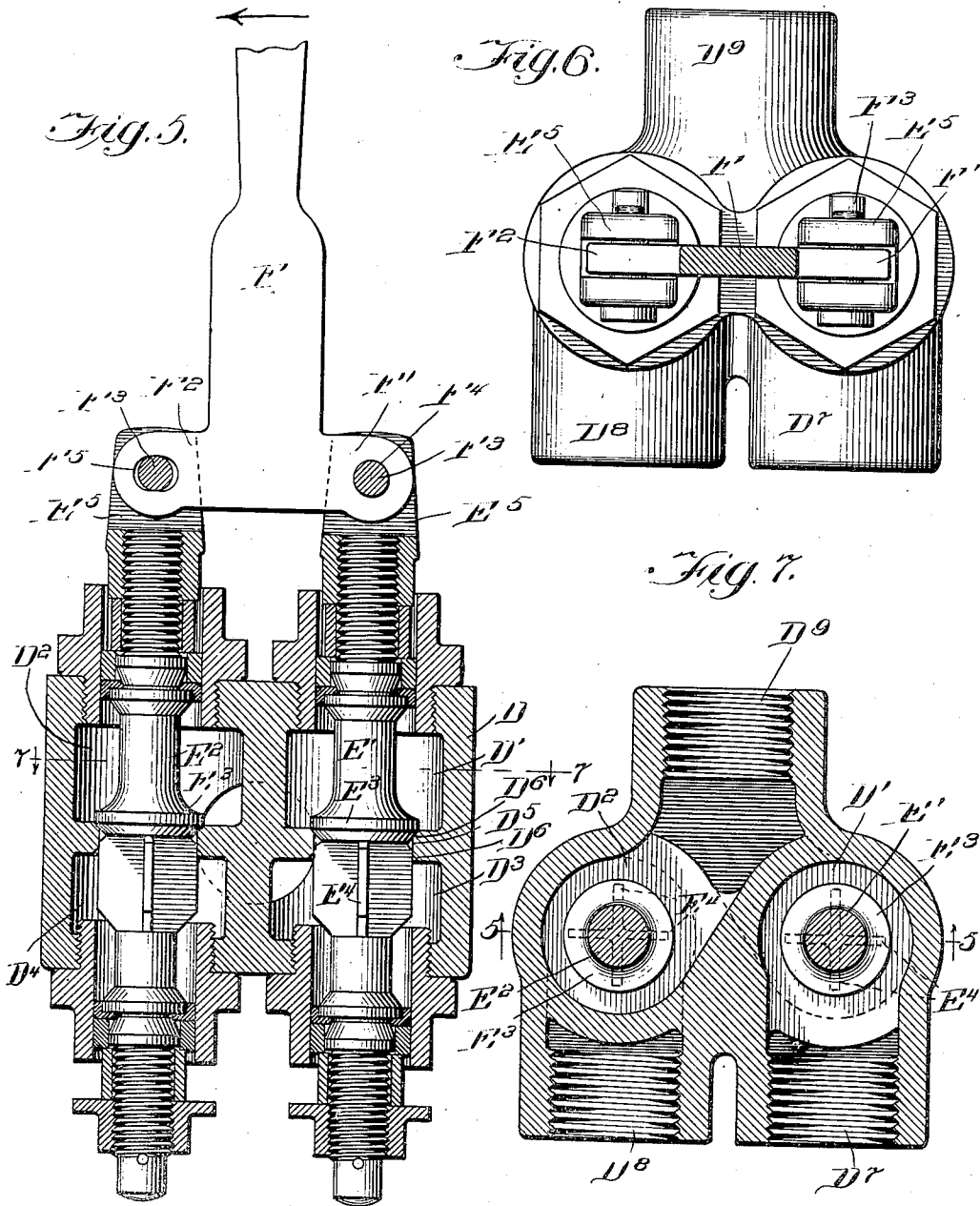
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UNITED STATES PATENT OFFICE.

FRANK HENNEBÖHLE, OF CHICAGO, ILLINOIS.

BALANCED HYDRAULIC VALVE.

No. 817,778.

Specification of Letters Patent.

Patented April 17, 1906.

Application filed June 27, 1904. Serial No. 214,381.

To all whom it may concern:

Be it known that I, FRANK HENNEBÖHLE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Balanced Hydraulic Valves, of which the following is a specification.

This invention relates to valves for controlling the inlet and the outlet to a hydraulic cylinder.

One of the objects of the invention is the production of a valve of this character which shall be perfectly balanced when being operated.

A further object of the invention is the production of a valve the body of which is reversible to bring a new set of valve-seats into use when one set has become worn.

The invention further relates to the general improvement of valves of the character mentioned.

In the accompanying drawings, Figure 1 is a top plan view of a valve embodying the features of this invention, the upper end of the operating-lever being represented as broken away. Fig. 2 is a vertical central section through the valve on dotted line 2 2 of Fig. 3. Fig. 3 is a horizontal section through said valve on dotted line 3 3 of Fig. 2. Fig. 4 is a similar view on dotted line 4 4 of Fig. 2. Figs. 5, 6, and 7 illustrate my invention as applied to a three-way valve for use in connection with a single-acting hydraulic cylinder. Fig. 5 is a vertical central section through said valve, taken on the plane of dotted line 5 5 of Fig. 7. Fig. 6 is a top plan view of the valve, the upper end of the operating-lever being broken away. Fig. 7 is a horizontal sectional view taken on the plane of dotted line 7 7 of Fig. 5.

In the production of a valve embodying this invention I provide a casing A, comprising valve-chambers A', A², A³, and A⁴ and discharge-chambers A⁵, A⁶, A⁷, and A⁸ beneath said valve-chambers, which valve-chambers and discharge-chambers are connected in vertical pairs by openings A⁹, the upper and lower ends of the walls of which openings are formed into valve-seats A¹⁰ and A¹¹. The valve-chambers A' and A³ are connected by a port A¹², and the discharge-chambers A⁶ and A⁸ are likewise connected by a port A¹³, said ports A¹² and A¹³ extending substantially at a right angle to each other. In one side of the casing is an inlet-opening A¹⁴,

communicating with the valve-chamber A' by means of the port A¹⁵, and at the opposite side of the casing is an outlet-opening A¹⁶, which by means of the port A¹⁷ communicates with the discharge-chamber A⁶. In the remaining sides of the casing A, I form openings A¹⁸ and A¹⁹, the former of which is connected by the port A²⁰ with the valve-chamber A⁴ and by means of the port A²¹ with the discharge-chamber A⁷, while the latter opening A¹⁹ is placed in communication with the valve-chamber A² by means of the port A²² and with the discharge-chamber A⁵ by means of the port A²³. In the upper end of each of the valve-chambers A', A², A³, and A⁴ and the lower end of each of the discharge-chambers A⁵, A⁶, A⁷, and A⁸ is an opening A²⁴, which opening is screw-threaded to receive the externally-screw-threaded bushing A²⁵.

Valve-stems B', B², B³, and B⁴ are adapted to lie within the valve-chambers A', A², A³, and A⁴, respectively, and are provided with valve-closures B⁵, intended to be seated upon the valve-seats A¹⁰. Upon each valve-stem beneath the closure B⁵ are formed radial guide-wings B⁶. The opposite ends of the valve-stems are screw-threaded for a purpose to appear later herein. Near each of its ends each of the valve-stems is provided with two integral peripheral rings or collars B⁷ and B⁸, the outer one, B⁸, being somewhat less in diameter than the collar B⁷. A packing ring or washer B⁹ is adapted to be slipped over the collar B⁸ and to lie in the space between said collars, being held in said space by means of a ring B¹⁰, fitting over the collar B⁸ and constituting a piston on the valve-stem within the bushing A²⁵. Said bushing thus serves as a cylinder for the piston B¹⁰. The piston B¹⁰ at the upper end of the valve-stem is held in place by means of a yoke B¹¹, having a threaded socket B¹², adapted to receive the screw-threaded upper end of the valve-stem, a sleeve B¹³ being interposed between said piston and said socket. The piston B¹⁰ at the lower end of the valve-stem is secured thereon by means of a nut B¹⁴, having an annular flange B¹⁵, adapted to contact with the lower end of the bushing A²⁵, and thus limit the extent of upward movement of the valve-stem. A sleeve B¹⁶ surrounds the valve-stem between the piston B¹⁰ and the upper side of the nut B¹⁴. The nut is locked in position on the valve-stem by means of the pin B¹⁷.

An operating-lever C, bifurcated at its

lower end to form two T-shaped arms C' and C², is provided for moving the valve-stems, the transverse extremities of said T-shaped arms being pivotally connected with the yokes B¹¹ by means of pins C³.

In use the valve is connected through the inlet-opening A¹⁴ with the compressing means and through the openings A¹⁸ and A¹⁹ with the opposite ends of the hydraulic cylinder to be actuated. The outlet-opening A¹⁶ communicates with a discharge-pipe. (Not shown.)

Assuming that the hydraulic cylinder and the valve are filled with water under pressure, the operation is as follows: The pressure-water entering the inlet A¹⁴ passes through the port A¹⁵ to the valve-chamber A' and from this chamber through the port A¹² to the valve-chamber A³, in which chambers A' and A³ the pressure-water stands. Moving the operating-lever C in the direction of the arrow in Fig. 2 raises the closures B⁵ of the valve-stems B² and B³ from their seats A¹⁰, permitting pressure-water to flow to the hydraulic cylinder through the port A²¹ and the opening A¹⁸. This movement of the operating-lever also permits discharge-water to flow from the opposite end of said hydraulic cylinder through the opening A¹⁹ in the valve-casing through the port A²² into the valve-chamber A² and to discharge therefrom into the discharge-chamber A⁶, thence through the port A¹⁷ and the outlet A¹⁶. A movement of the operating-lever in the opposite direction raises the valve-stems B' and B⁴, lifting the closures B⁵ from their seats A¹⁰ and permitting pressure-water to flow from the valve-chamber A' through the opening A⁹, the discharge-chamber A⁵, the port A²³, and the opening A¹⁹ to that end of the hydraulic cylinder which was recently discharged. The movement of the operating-lever last mentioned also opened the discharge from the opposite end of said hydraulic cylinder through the opening A¹⁸, the port A²⁰ into the valve-chamber A⁴, through the opening A⁹ into the discharge-chamber A⁸, through the port A¹³ into the discharge-chamber A⁶, and through the port A¹⁷ to the outlet-opening A¹⁶.

The closure B⁵ upon each of the valve-stems being slightly larger in cross-sectional area than the piston B¹⁰ at the upper end of the valve-stem, the pressure-water standing in the valve-chamber tends when the closure is seated to hold said closure in such position. When the closure is raised from its seat, pressure is exerted upon both sides of the closure and in opposite directions upon the pistons B¹⁰ at the opposite ends of the valve-stem, thereby balancing the valve.

When the valve-seats A¹¹ become worn, the valve-seats A¹¹ may be brought into use by inverting the valve-casing A with relation to the valve-stems B', B², B³, and B⁴.

This may be done by withdrawing the valve-stems, (first removing the bushings A²⁵, the yokes B¹¹, and the nuts B¹⁴), inverting the valve-casing, and replacing the valve-stems, yokes, bushings, and nuts. When so inverted, the valve is turned end for end in order to make the opening A¹⁶ the inlet and opening A¹⁴ the outlet.

In Figs. 5, 6, and 7 a hydraulic valve is shown, by means of which pressure-water may be supplied to and removed from a single-acting hydraulic cylinder. In this modified form a casing D is provided with valve-chambers D' and D² and with discharge-chambers D³ and D⁴, connected in pairs, respectively, by means of the openings D⁵, the upper and lower ends of the walls of which openings are inclined to form valve-seats D⁶. In one side of the casing are an inlet-opening D⁷ and an outlet-opening D⁸, and on the opposite side is an opening D⁹, through which the valve may be placed in communication with a hydraulic cylinder. (Not shown.) Valve-stems E' and E² extend through the valve-chambers D' and D², respectively, each of said valve-stems having a closure E³ and guide-vanes E⁴. The upper end of each of the stems carries a yoke E⁵, secured to said stem by means of a screw-thread connection. An operating-lever F, having two oppositely-extending arms F' and F² at its lower end, is connected with the yokes E⁵ by means of pivot-pins F³ in said yokes extending through openings F⁴ and F⁵ in said arms F' and F², respectively, the opening F⁴ being slightly elongated to permit of a sliding movement of the pin F³ therein. The remaining parts of this modified form of valve are the same as in the form shown in Figs. 1 to 4.

In the operation of the valve last described pressure-water enters the valve-chamber D' through the inlet-opening D⁷. A movement of the operating-lever F in the direction of the arrow, Fig. 5, permits the pressure-water to pass from the chamber D' through the opening D⁵, through the discharge-chamber D³, and thence through the opening D⁹ to the hydraulic cylinder. By moving the operating-lever F in the opposite direction the closure E³ of the valve-stem E² is lifted from its seat and water is permitted to escape from said hydraulic cylinder through the opening D⁹, the discharge-chamber D⁴, and the outlet D⁸.

My invention is not restricted to the precise construction and arrangement shown and described herein, as such construction and arrangement may be modified or varied by those skilled in the art without departing from the spirit and scope of the invention.

I claim as my invention—

1. In a valve, in combination, a valve-casing having a valve-chamber and a discharge-chamber therein alined with each other and connected by an opening, valve-seats being

provided at opposite sides of said opening; a cylinder for each of said chambers, alined therewith, said cylinders being removable; a valve-stem extending through said chambers and cylinders; a valve-closure on said stem for closing communication between the valve-chamber and the discharge-chamber, said closure being adapted to be seated upon either of said valve-seats; a piston on said valve-stem for each of said cylinders; removable means on one end of said valve-stem for attaching an operating-lever thereto; and removable means on the other end of said stem for limiting the extent of its movement in one direction.

2. In a valve, in combination, a valve-casing having a valve-chamber and a discharge-chamber therein alined with each other; cylinders alined with said chambers and removably secured to the opposite sides of said casing; a valve-stem extending through said chambers and cylinders; a valve-closure on said stem for closing communication between the valve-chamber and the discharge-chamber; two collars fixed with relation to said valve-stem within each of said cylinders; a packing-ring adapted to lie between said collars; a ring forming a piston for said cylinder and adapted to fit over one of said collars for holding said packing-ring in place; and means for holding said ring in place comprising a yoke having a screw-thread connection with said valve-stem.

3. In a valve, in combination, a valve-casing having a valve-chamber and a discharge-chamber therein alined with each other and connected by an opening, valve-seats be-

ing provided at opposite sides of said opening; bushings having a screw-thread engagement with the opposite sides of said valve-casing and forming cylinders alined with said chambers; a valve-stem extending through said chambers and cylinders; a valve-closure on said stem adapted to be seated upon either of said valve-seats; a piston on said valve-stem for each of said cylinders, said pistons having the same area exposed to the pressure fluid; removable means on one end of said valve-stem for attaching an operating-lever thereto; and a nut on the lower end of said stem for limiting the extent of its opening movement.

4. In a valve, in combination, a valve-casing having valve-chambers and discharge-chambers therein in alined pairs; a cylinder for each of said chambers, alined therewith, said cylinders being removable; a valve-stem extending through each alined series of chambers and cylinders; a valve-closure on said stem for closing communication between the valve-chamber and the discharge-chamber; a piston on said valve-stem for each of said cylinders, said pistons having the same area exposed to the pressure fluid; a nut on the lower end of each stem for limiting the extent of its opening movement; a bifurcated lever for moving said valve-stems; and a yoke having a screw-thread engagement with one end of each of said valve-stems for attaching said lever thereto.

FRANK HENNEBÖHLE.

Witnesses:

L. L. MILLER,

GEORGE L. CHINDAHL.