

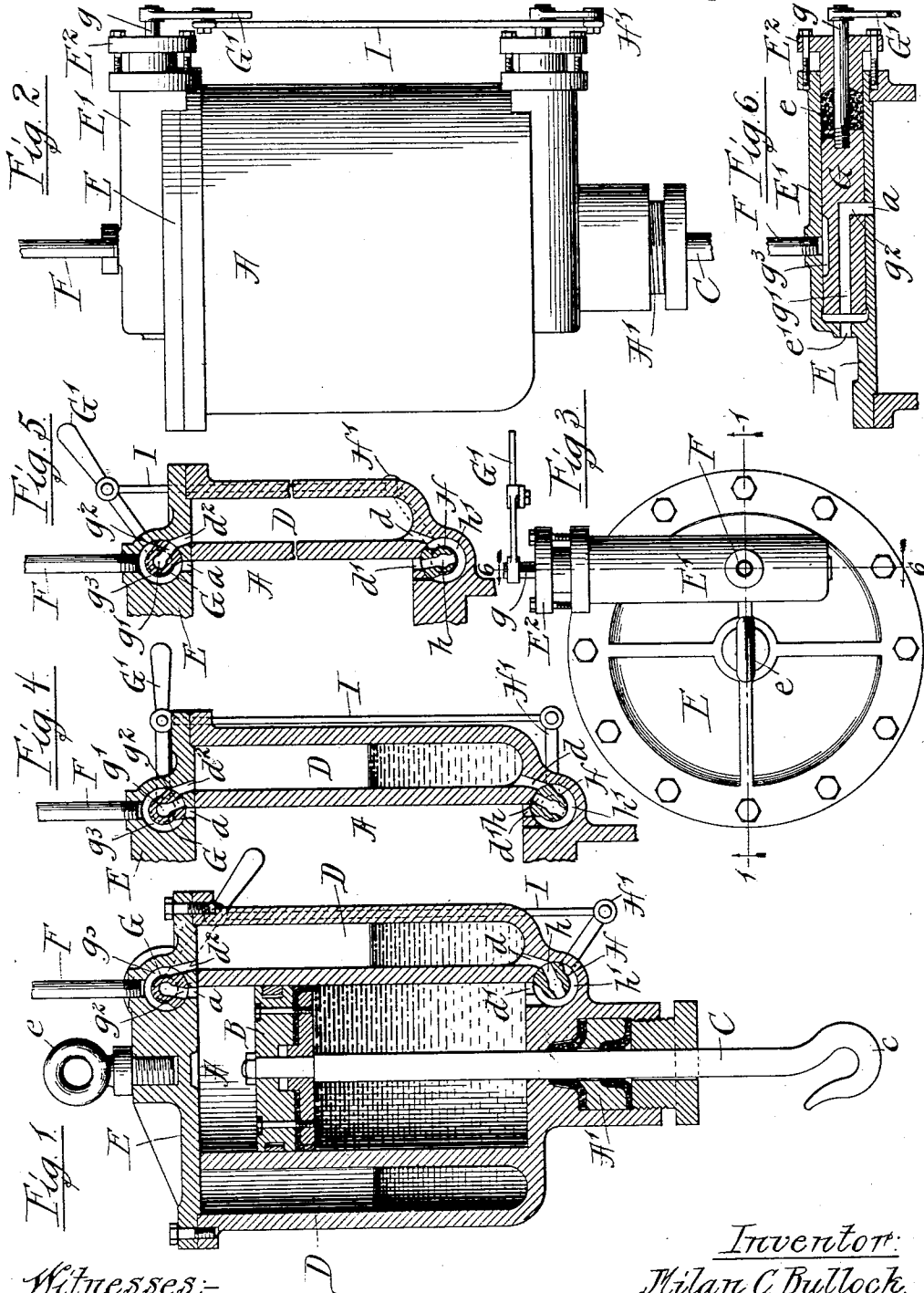
(No Model.)

2 Sheets—Sheet 1.

M. C. BULLOCK.
HYDRAULIC LIFT.

No. 580,154.

Patented Apr. 6, 1897.



Witnesses:-
John W. Adams.
Clinton Hamblin

Inventor:
Milan C. Bullock.
by: - Mayhew, Poole & Brown.
his Attys.

(No Model.)

2 Sheets—Sheet 2.

M. C. BULLOCK.
HYDRAULIC LIFT.

No. 580,154.

Patented Apr. 6, 1897.

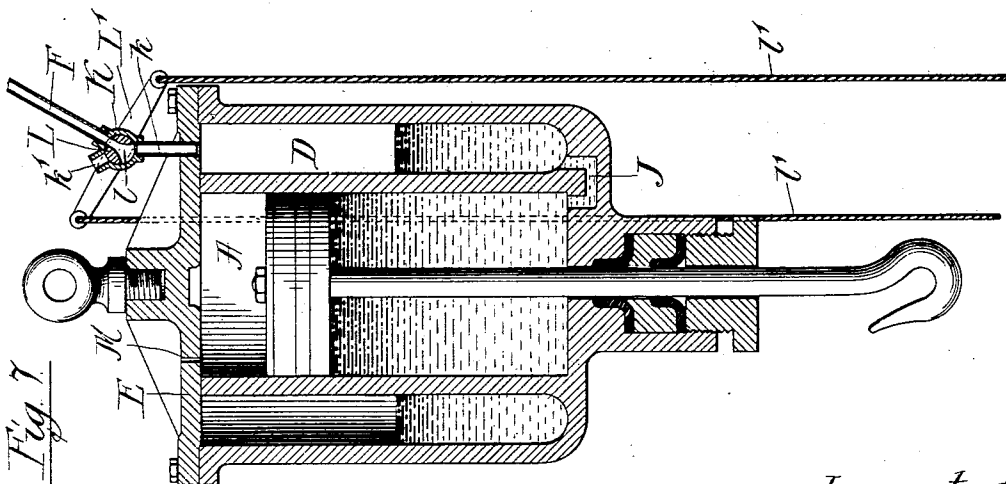


Fig. 7

Witnesses:-

John W. Adams
Clinton Hamblett

Inventor:-

Milan C. Bullock

by:- *Wayne, Poole, & Brown*
his Attys

UNITED STATES PATENT OFFICE.

MILAN C. BULLOCK, OF CHICAGO, ILLINOIS.

HYDRAULIC LIFT.

SPECIFICATION forming part of Letters Patent No. 580,154, dated April 6, 1897.

Application filed August 15, 1895. Serial No. 559,354. (No model.)

To all whom it may concern:

Be it known that I, MILAN C. BULLOCK, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Hydraulic Lifts; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in devices for lifting or the like of that kind in which a cylinder containing a piston is employed as a means of applying the actuating power, and more particularly to a novel form of such device in which pressure is directly applied to the piston by means of water and pressure is transmitted to the water through the medium of compressed air.

A device embodying my invention is more particularly adapted for use in machine-shops and foundries for handling heavy pieces of metal, but it is equally adapted for hoisting wherever a portable apparatus for such purpose is needed.

In the accompanying drawings, illustrating my invention, Figure 1 is a view in central axial section of a lifting apparatus embodying an approved form of my invention. Fig. 2 is an external side elevation thereof. Fig. 3 is a plan view thereof. Figs. 4 and 5 are detail sections illustrating changed positions of the valve thereof. Fig. 6 is a detail section taken on line 6 6 of Fig. 3. Fig. 7 is a detail section illustrating a more simple form of my apparatus embodying the main features of my invention.

As shown in said drawings, Figs. 1 to 6, A indicates a water-cylinder which is closed at its upper and lower ends and contains a piston B, attached to a piston-rod C, which latter extends through a stuffing-box A' in the lower head of the cylinder and is provided at its lower end with a hook *c* or other means of attachment to the load to be lifted.

D indicates a closed water and air chamber which is attached to the cylinder A and in this instance is of annular form and surrounds the cylinder A, the same being formed by an annular external wall cast integral with the cylinder-wall and joined to the same at its bottom. The cylinder and chamber are

closed by a common head E, which is shown as provided with a strong eye *e*, by which the apparatus may be supported from an overhanging support. The tank D is connected at its bottom with the cylinder A by passages *d* and *d*² and an intervening valve through which water contained in the tank may pass to the lower end of the cylinder beneath the piston therein.

F indicates an air-supply pipe through the medium of which air under pressure may be supplied to the tank D above the water therein, the intent being that the air-pressure acting on the top of the water in the chamber will force the same therefrom into the cylinder beneath the piston, and thus lift the latter with the load attached to the piston-rod. The said air-pipe F will be connected with any suitable source of air-supply, such as an air-pump operated by a suitable motor.

The chamber D is provided with an air passage or port *d*³, through which air may enter the chamber or may be allowed to escape to permit water to flow from the cylinder backwardly into the chamber, and thus allow the descent of the piston. In connection with the air-supply pipe will be provided a suitable valve, herein shown in the form of a rotating plug-valve, by which air may be admitted to and be allowed to escape from the chamber, as desired. The cylinder A is provided at its top with an exhaust-port *a* for the air which must necessarily escape when the piston rises. I also provide the passage between the chamber and cylinder with a valve H, herein shown as having the form of a rotating plug-valve, by means of which the passage of water backward from the cylinder to the chamber D may be cut off, thereby locking the piston and the load from descending when the valve is closed, it being obvious that any descent of the piston will be impossible except when the valve is open.

The valves G and H illustrated are of special form, and they are actuated by a single actuating device, so that both may be moved together in the operation of the apparatus. These valves, as shown in the drawings, are constructed as follows: First referring to the valve G, the same is constructed to control not only the passage of air from the air-supply pipe F to the chamber D and its exit from

said chamber, but to also control the exhaust air-passage a , and for this purpose the same is made as follows: Said valve, as clearly shown in Figs. 3 and 6, is located within a cylindric casing E' , formed on the top of the casing E and closed at its outer end by means of a gland E^2 , between which and the end of the valve-plug G is located a suitable packing e' to prevent the escape of air from the valve.

The plug is provided with a valve-stem g , which extends outwardly through the packing e' and gland E^2 and has connected with it an actuating-lever G' , preferably extended to form a handle by which it may be actuated.

In the plug G is an axial passage g' , connecting with a transverse passage g^2 , which is arranged in the same plane with the air-exit opening a of the cylinder and the port d^2 of the chamber and is adapted for communication with said exit-opening and port when the plug is turned to the proper positions for this purpose. The passage g' extends to the inner end of the plug, and the casing E^2 at such inner end of the plug has an exit-opening e' to allow the escape of air. It follows from this construction that when the plug is turned to bring the radial passage g^2 opposite the port a the top of the cylinder will be brought into communication with the outer air, as seen in Figs. 1 and 6. The said passage g^2 is also adapted to establish communication of the chamber with the open air through the port d^2 when the plug is turned into the proper position for this purpose, as seen in Fig. 5. The valve-plug G is also provided with a groove g^3 , extending part way around the same and adapted to form a passage for air from the air-pipe F to the port d^2 or to the port a , as desired.

The operation of the valve G thus made is as follows: When it is desired to lift the load, the piston B being at the bottom or lower part of the cylinder A , the valve is turned to bring the passage g^2 opposite the port a , at which time the grooves g^3 will be in communication with the passage d^2 , as clearly seen in Fig. 1. Air will now pass from the supply-pipe F to the chamber D and will act to force the water therefrom into the cylinder A beneath the piston thereof, and thus raise said piston. As the piston rises air in the upper part of the cylinder A will escape therefrom through the port a and passage g^2 of the valve-plug. The load having been lifted to a desired point, if it now be desired to stop the influx of air the plug G is turned to bring the passage g^2 opposite that part of the valve-casing between the ports a and d^2 , at which time both of said ports will be covered or closed by the parts of the plug at either side of said radial passage, as clearly seen in Fig. 4. If it now be desired to lower the load, the plug G is further turned, so as to bring the passage g^2 opposite the port d^2 and to bring the groove g^3 in communication with the port a . In this position of the plug, as seen in Fig. 5, air under pressure will pass from the pipe

F to the top of the cylinder, while the air within the chamber D will escape therefrom through the port d^2 and passage g^2 to the outer air, the water being forced out of the cylinder A and into the chamber D as the air escapes from said chamber. The piston will of course descend under the action of the load by merely permitting the escape of air from the chamber without air-pressure above the piston, but its movement is hastened by admitting air-pressure to the top of the piston. To now refer to the lower or locking valve H , the same consists of a plug which is provided with a transverse passage h and a groove or passage h' , which extends partially around the circumference of the same and into which the passage h extends. Said valve-plug is mounted in a cylindric seat formed in the metal of the cylinder, and the passage d leads from the chamber D to the valve-seat, and the other passage d' leads from said seat into the bottom of the cylinder. The valve is placed in position to permit the passage of water from the chamber to the cylinder by so turning it that the end of the passage h is opposite the passage d , while one end of the groove h' communicates with the passage d' . This position of the plug is shown in Fig. 1. If it be desired to cut off communication between the chamber and cylinder, so as to positively lock the piston from descending under the weight of the load, the valve is turned to bring the end of the passage h between the passages d and d' , at which time the surface of the plug at both sides of said passage H will cover the passages d d' , as seen in Fig. 4. If it be now desired to lower the load, the plug H is further turned, as seen in Fig. 5, to bring the passage h in connection with the passage d' , at which time water may pass from the cylinder to the said chamber.

By the special construction described in the two valve-plugs G and H they are adapted to be placed in position for proper coaction by an equal extent of angular movement, and in order that both may be actuated at the same time the lower plug H is provided with an actuating-lever H' , which is connected with an actuating-lever G' by a connecting-rod I . By so connecting and constructing the valves the advantage is gained that both valves may be moved for controlling the action of the piston by actuating one movable part, such as the lever G' . The simultaneous action of the two valves will be readily understood by inspection of Figs. 1, 4, and 5, from which it will be seen that by turning both valves in the same direction from the position shown in Fig. 1 they will first be brought into position for stopping the upward movement of the piston and locking it from further movement, and thereafter for permitting downward movement of the piston through the outward escape of air from the chamber D and the backward flow of water from said cylinder to the chamber.

It will of course be understood that where the hoisting device is suspended from an elevated support or is for other reason inaccessible to the operator a suitable connection may be made by chains or otherwise for actuating the valves from the point at which the operator may be stationed. It will be understood, moreover, that in a machine-shop a number of such hoisting devices may be located at different points and branch air-pipes may lead thereto from a common supply-pipe receiving air under pressure from an air-compression engine. Moreover, the air-supply may be carried to the hoisting device through flexible pipe or hose, thus enabling the same to be moved or shifted from place to place as desired.

While the special construction illustrated in Figs. 1 to 6, as above described, has important advantages in point of cheapness and simplicity of construction and ease of manipulation and management, yet certain of the main parts or features of my invention may be embodied in other forms of apparatus embracing fewer parts than illustrated in said figures. To illustrate what is here meant, I have shown in Fig. 7 a form of hoisting device much more simple than that shown in the other figures. In this instance a cylinder A and chamber D are employed, which are arranged in the same manner as hereinbefore described and are closed by means of a single head E. In this instance a passage J is provided between the cylinder A and chamber D, which passage is without any valve, so that it is always open. F in this case indicates an air-supply pipe which is connected with a valve-casing K, which casing is connected with the chamber D by a pipe *k* and is provided with an air-exit passage *k'*. Within the valve-casing is provided a plug L, having a transverse passage *l*, which is made of considerable width at the side of the plug adjacent to the pipe *k*, so that the passage will always remain in communication with the pipe when the plug is turned or oscillated.

The small end of the passage *l* may, by the turning of the plug, be brought into connection with the pipe F or air-escape passage *k'* at will, so that by turning the plug air may either be delivered under pressure to the chamber D or may be allowed to escape therefrom. A yoke L', attached to the valve-plug L and provided with hanging ropes *l'*, offers a convenient means for turning or actuating the valve. To permit the escape of air from the upper end of the cylinder and its admission thereto, a small relief-passage M is made in the cylinder-head E. The operation of this device is practically the same as that before described. In this instance, however, there is no locking-valve for holding the water within the cylinder A, so that descent of the load when stationary is prevented solely by the air-pressure within the chamber, which latter is maintained by the closing of the air-

valve L. In this instance, moreover, the descent of the load is permitted merely by the escape of air from the chamber D through the escape-passage *k'*, and no air is forced into the top of the cylinder, air at such time entering through the ports *m*, so as to prevent formation of a vacuum in the upper end of the cylinder. This form of apparatus, while useful for many purposes, is not as advantageous as that shown in Figs. 1 to 6, for the reason that any slight leakage of air from the chamber D will result in the gradual descent of the piston under the weight of the load as the air escapes.

Among the many important advantages gained by the employment of water-pressure as a means for directly actuating the piston of a lifting or power-applying device, together with air-pressure as a means for transmitting pressure to the water, is that the irregularity of action, due to the elastic character of air, is in such case largely eliminated, inasmuch as no movement of the load can take place without the passage of water from the chamber D to the cylinder A, or vice versa, thereby giving steadiness of movement in the starting and stopping of the parts and at all other times. A special advantage is gained by the use of a locking-valve between the water-cylinder and the chamber, for the reason that, water being incompressible and it being much easier to make valves water-tight than air-tight, the piston may be positively locked by such valve at any point without liability of its descending by leakage past the valves under a heavy load.

I claim as my invention—

1. A portable hoisting apparatus, comprising a water-cylinder and a closed air-chamber, which are rigidly attached together, are connected by a water-passage at their lower ends, and are provided with a common supporting means, a piston in the cylinder provided with a piston-rod which protrudes through the lower head of the cylinder and is provided with load-attaching means, and an air-supply pipe connected with the top of the air-chamber, said air-chamber having an exhaust-passage opening from its top into the open air, and means for controlling the said air-supply pipe and exhaust-passage, substantially as described.

2. A portable hoisting apparatus, comprising a water-cylinder and a closed air-chamber, which are rigidly attached together, are connected by a water-passage at their lower ends and are provided with a common supporting means, a locking-valve in said passage connecting the cylinder and air-chamber, a piston in the cylinder provided with a piston-rod which protrudes through the lower head of the cylinder and is provided with load-attaching means, and an air-supply pipe connected with the top of the air-chamber and provided with a controlling-valve; said air-chamber having an exhaust-passage opening

from its top into the open air, and also provided with a controlling-valve, substantially as described.

3. A portable hoisting apparatus, comprising a water-cylinder and a closed air-chamber which are rigidly attached together, are connected by a water-passage at their lower ends, and are provided with a common supporting means, a locking-valve in said passage connecting the cylinder and air-chamber, a piston in the cylinder provided with a piston-rod which protrudes through the lower head of the cylinder and is provided with load-attaching means, an air-supply pipe connected with the top of the air-chamber; said air-chamber having an exhaust-passage which opens from its upper end into the open air, and means for controlling said air-supply pipe and exhaust-passage having operative connection with said locking-valve, whereby all of said passages may be simultaneously opened or closed, substantially as described.

4. A portable hoisting apparatus comprising a water-cylinder and a closed air-chamber, of annular form, which surrounds the said cylinder and is connected at its bottom with the bottom of said water-cylinder by a water-passage, said cylinder and air-chamber being provided with common supporting means, a piston in the cylinder provided with a piston-rod which protrudes through the lower head of the cylinder and is provided with load-attaching means, and an air-supply pipe connected with the top of the air-chamber having an exhaust-passage opening from its top into the open air and also provided with a controlling-valve, substantially as described.

5. The combination with a cylinder provided with a piston and piston-rod, of a closed

chamber communicating at its lower end with the cylinder, a locking-valve in the passage between the chamber and cylinder, an air-supply passage connected with the top of the chamber, an air-exit passage also communicating with the top of the chamber, an air-exit port in the top of the cylinder, a single valve controlling the said air-supply and air-exit passages and a connection between said valve last mentioned and said locking-valve by which both of said valves may be moved together, substantially as described.

6. The combination with a cylinder provided with a piston and piston-rod, of an air-chamber, a passage connecting the bottom of the air-chamber with one end of the cylinder, a rotating plug-valve for controlling said passage, said plug-valve being provided with a transverse passage and a circumferential groove or recess communicating therewith, an air-supply pipe, air-exit passages leading from the top of the air-chamber and from the said cylinder, a plug-valve for controlling the said air-supply passage and exit-passages containing an axial passage leading radially through the side of the plug and a circumferential groove in the same plane therewith and means connecting said valves with each other by which they may be moved together, substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature, in presence of two witnesses, this 19th day of June, A. D. 1895.

MILAN C. BULLOCK.

Witnesses:

C. CLARENCE POOLE,
ALBERT H. GRAVES.