(No Model.)

R. CAREY.

HYDRAULIC LIFT.

No. 477,294. Patented June 21, 1892.

FIG. 2

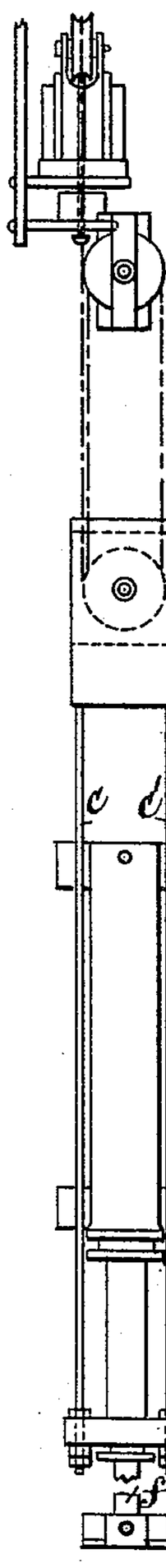

FIG. 1

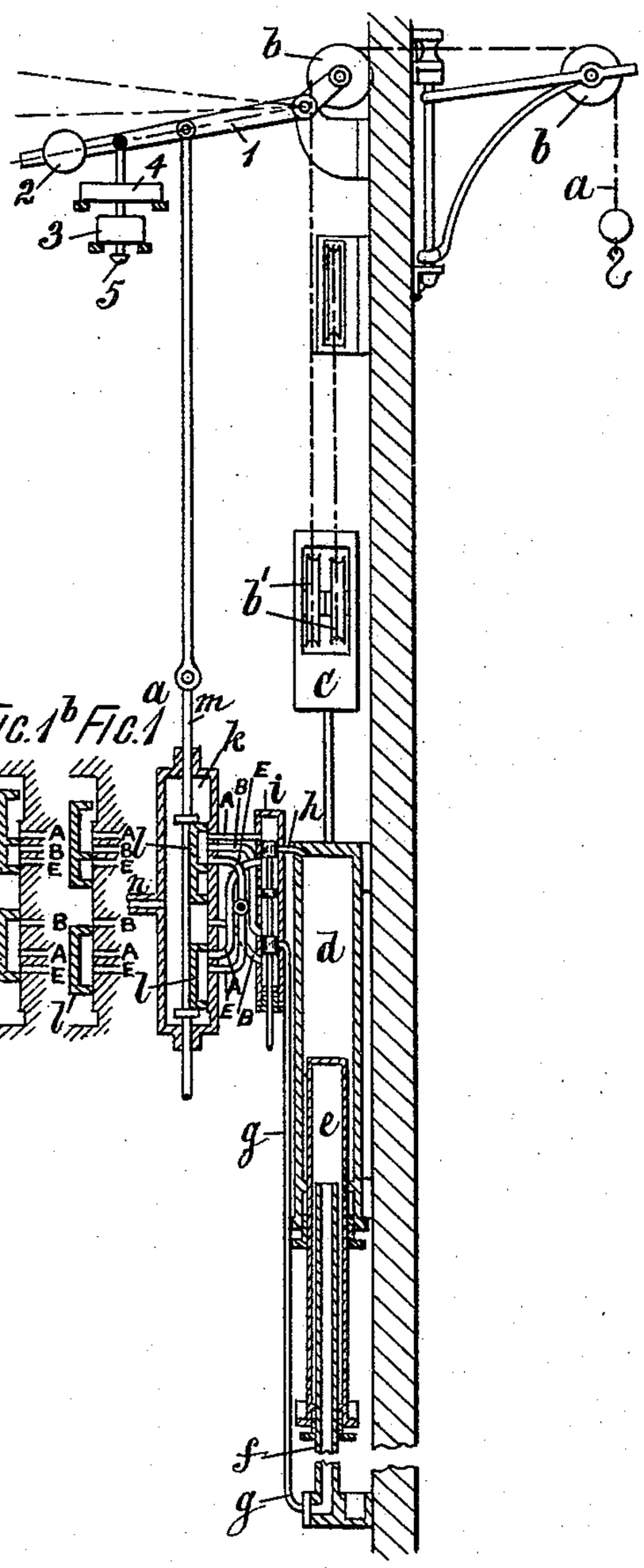

FIG. 1b FIG. 1

Witnesses:-
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UNITED STATES PATENT OFFICE.

ROBERT CAREY, OF LONDON, ENGLAND.

HYDRAULIC LIFT.

SPECIFICATION forming part of Letters Patent No. 477,294, dated June 21, 1892.

Application filed April 27, 1891. Serial No. 390,701. (No model.)

To all whom it may concern:

Be it known that I, ROBERT CAREY, engineer, a subject of the Queen of Great Britain, residing at London, in the county of Middlesex, England, have invented new and useful Improvaments in Hydraulic Lifts, of which the following is a specification.

My invention relates to hydraulic lifting or hoisting machinery, in which the lift to be lifted is raised by the admission of water to one or more suitable cylinders containing pistons or plungers connected with the lifting-gear.

It has for its objects novel methods of constructing and operating such hydraulic lifts by which the power required and the quantity of water consequently used are varied automatically, according to the weight which is being lifted or lowered, while the entire apparatus is simple, inexpensive, safe, and economical in the quantity of water used. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a vertical section, and Fig. 2 a front view, illustrating a hoist. Figs. 1^a and 1^b show different positions of the valves.

Similar letters and figures refer to similar parts throughout the several views.

Supposing that my invention is to be applied to a lift as shown in Figs. 1 and 2, in which the cage for passengers or other weights to be lifted is suspended from one or more ropes or chains, which after passing over suitable pulleys are passed under a pulley or pulleys carried by a heavy or loaded movable block, which by its descent in suitable guides raises the lift and its load, aided, if necessary, by the pressure of water upon one or more pistons or plungers contained in cylinders suitably arranged, I arrange and fix below the heavy movable block a vertical cylinder closed at its upper end and having fitted into its lower open end, with the intervention of suitable packing, a hollow plunger of less diameter closed at its upper end and having fitted into its lower open end a fixed hollow plunger passing through suitable packing, and open at its upper end and firmly fixed at its lower closed end to a suitable foundation. The lower end of the lower movable plunger is provided with lugs to which chains or rods are attached, which are connected at their upper ends to the movable weight, and suitable valves are arranged and operated automatically, as hereinafter described, by which water under sufficient pressure can be admitted and discharged from the upper fixed cylinder and the lower fixed plunger, as described. If, now, both the latter are connected with the exhaust or discharge pipe for the water, the intermediate cylinder and the chains and movable weights can descend by their own weight, which is so proportioned as to raise the cage and any light load contained therein. If a heavier load is to be raised, the valve is automatically altered, so that water under pressure is admitted to both cylinders, and the weight of the movable weight is then aided by the pressure of water upon the upper end of the movable ram, the effective area of which is, however, reduced by the area of the lower fixed plunger. To lift a still heavier load, water is admitted by the still further automatic alteration of the valve to the upper fixed cylinder, while the lower fixed plunger is connected with the exhaust, and the movable weight is then aided by the pressure of water upon the upper end of the movable ram without deduction.

In order to lower light and moderate loads, the lower fixed plunger is connected with the water-pressure and the upper fixed cylinder with the exhaust, so that part of the movable weight is raised by the pressure of water upon the upper end of the movable ram.

To lower the heaviest loads, the valve is aumatically altered, so that both the upper fixed cylinder and the lower fixed plunger are opened to the exhaust, and the load in the lift then has to lift the movable weight.

It will be understood, therefore, that in the arrangement described three degrees of power can be obtained in lifting.

Figs. 1 and 2 illustrate the arrangement just described. The weight to be lifted or lowered is suspended to the chain *a*, which, after passing over the pulleys *b b*, is shown passing round pulleys *b' b'* in the heavy movable block *c*, the descent of which therefore raises the weight to be lifted through a greater distance. *d* is a fixed vertical cylinder closed at its upper end and having a stuffing-box at its lower end, through which passes the hollow

plunger *e*, which is also closed at its upper end and has at its lower end a stuffing-box, through which passes a hollow plunger *f*, firmly fixed to a foundation and into which water under pressure can be admitted through the pipe *g*. Water can also be admitted into the cylinder *d* through a pipe *h*. These pipes *g* and *h* communicate with a small valve-chamber *i*, containing valves which can be raised or lowered by a spindle passing out through a stuffing-box and connected to a rope or lever which can be worked by an attendant from any convenient place, or if the weight to be raised is an ordinary lift it can be worked by a person in such lift. The valve-chamber *i* communicates by the pipes shown with the larger valve-chamber *k*, containing the valves *l*, which are actuated by a rod *m*, passing out through a stuffing-box. The upper part of the valve relates to the adjustments for lifting and the lower part for lowering.

n is the pipe, which admits water under sufficient pressure to the chamber *k*, and E is a pipe communicating with an exhaust or discharge for the water. The valve-chambers *i* and *k* are also connected by the ports and pipes A B, as shown.

In the position shown in Fig. 1 the pipes *g* and *h* are closed and the plunger *e* cannot move. This plunger is connected to the heavy block *c*, as shown in Fig. 2. If now the valves in the chamber *i* are moved down the pipes *g* and *h* become connected through the upper pipes A and B and the valve *l* with the exhaust-pipe E, and all pressure being removed from the fixed cylinder *d* and the hollow plunger *e* the movable weight *c* descends and by its weight lifts any light load on the chain *a*. If a heavier load is to be raised, the valve *l* is raised to the position shown in Fig. 1[a], and the water then passes under its upper edge and through A to the cylinder *d*, and also through B and *g* to the interior of the hollow plunger *e*, and the weight of the block *c* is aided by the pressure of water upon the upper end of the ram *e*, the effective area of which is, however, reduced by the area of the lower fixed plunger *f*. To lift a still heavier load, the valve *l* is further raised to the position shown in Fig. 1[b], and the water still passes through A and the pipe *h* to the cylinder *d*, while the hollow fixed plunger *f* is connected through the pipes *g* and B and the valve *l* with the exhaust E, and the weight *c* is then aided by the pressure upon the plunger *e* without deduction. In order that the position of the valve may be varied automatically, as described, according to the weight to be lifted, one of the pulleys *b b*, round which the chain or rope *a* passes, is carried by a lever 1, the other end of which carries a weight 2, which retains the lever in its position when the lightest load is being raised. Movable properly-proportioned weights 3 and 4 are arranged so as to be lifted in succession by the rod 5, attached to the lever 1 as the weight of the load to be lifted increases. To the lever 1 a rod is also connected, which actuates the valve-spindle *m* and the valve *l*, bringing the latter into the several positions shown in Figs. 1, 1[a], and 1[b], as already described.

In order to lower weights upon the chain *a*, the starting-valve in *i* is moved up instead of down, and to lower a light or moderate weight the hollow fixed plunger *f* is connected with the water-pressure through the lower pipe B and the pipe *g*, while the cylinder *d* is connected with the exhaust E through the lower pipe A and the pipe *h*, so that part of the movable weight *c* is balanced by the pressure of water inside the upper end of the movable ram *e*. The same arrangement of the valve for lowering is used in Figs. 1 and 1[a].

To lower heavier loads, the valve *b* is automatically altered to the position shown in Fig. 1[b], and the cylinder *d* is then open to exhaust E through the lower pipe A and *h*, the hollow plunger *f* being also connected with the exhaust through the lower pipe B and *g*.

It is to be understood that I do not confine myself to the particular methods of construction and arrangement nor to the details of the several valves and other parts, which may be varied and modified more or less, as may be found advisable in the different circumstances and conditions in which the apparatus is to be used, my invention consisting substantially of any form of arrangement of valves set automatically into their proper position by the varying pull upon the rope or chain from which the cage or load is suspended in the case of suspended lifts or cranes.

What I claim, and desire to secure by Letters Patent, is—

1. In combination with a fixed tubular plunger *f* and a pipe communicating therewith, a movable hollow plunger fitting over the said fixed plunger and closed at the upper end, a fixed cylinder open at the lower end to receive the said movable piston, a pipe entering the said cylinder, valves controlling the passage of fluid through the said pipes to or from the said cylinder and movable plunger, as needed, a heavy pulley-block supporting the weight to be lifted or lowered and connected to the said movable plunger, a movable weighted lever provided at one end with a pulley carrying a lifting chain or cable, which is connected to said heavy pulley, an auxiliary valve-chamber, and operating connections between the valves in this chamber and said movable lever, substantially as and for the purpose set forth.

2. In combination with the fixed hollow plunger *f* and the pipe *g*, communicating therewith, a plunger *e*, closed at the top and movable over the same, a fixed cylinder *d*, receiving the upper end of the said movable plunger, a pipe *h*, extending into the said cylinder, a valve-chamber *i*, communicating

with the said cylinder and movable plunger through the said pipes, valves in the said chamber closing and opening the said pipes, a second valve-chamber provided with pipes A B E, making communication with the valve-chamber *i* and said second valve-chamber, as shown, valves *l*, controlling the said pipes, the rod *m* of the said valves *l*, the weighted lever 1, to which the said rod is connected, a weighted pulley carrying block *c*, connected to the said movable plunger and moving therewith, and a chain provided at one end with means for supporting the weight to be lifted and lowered and passing over the pulleys of the said block, and a pulley mounted on the said lever in order that any variation in the weight to be lifted may shift the valves in the valve-chamber aforesaid, and thus direct the supply or withdrawal of fluid to or from either side of the said hollow movable plunger to compensate for such change, substantially as set forth.

In testimony whereof I have hereunto set my name in the presence of two witnesses.

ROBERT CAREY.

Witnesses:

ARTHUR E. EDWARDS,

HAROLD KENNEDY.