C. A. CHANDLER.

HYDRAULIC ELEVATOR.

No. 177,688. Patented May 23, 1876.

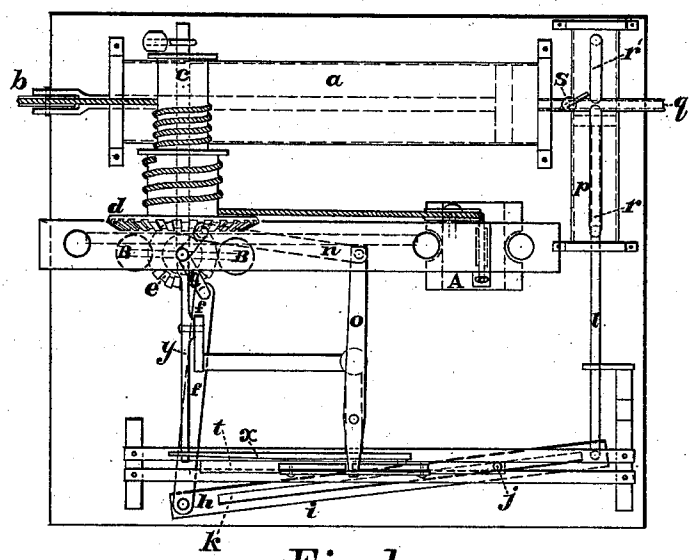

Fig. 1

Fig. 2

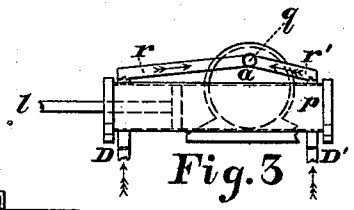

Fig. 3

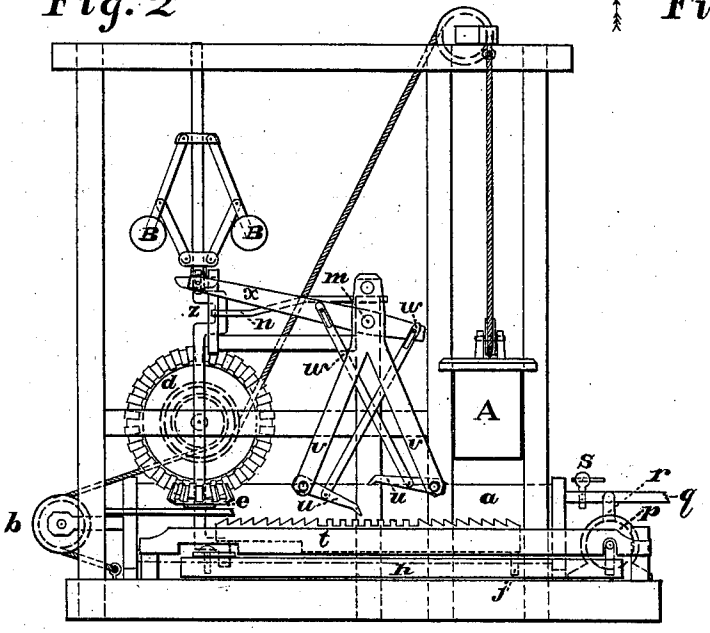

Fig. 4

Witnesses;

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CLARENCE A. CHANDLER, OF EAST BRIDGEWATER, MASSACHUSETTS.

IMPROVEMENT IN HYDRAULIC ELEVATORS.

Specification forming part of Letters Patent No. **177,688**, dated May 23, 1876; application filed April 17, 1876.

To all whom it may concern:

Be it known that I, CLARENCE A. CHANDLER, of East Bridgewater, in the county of Plymouth and State of Massachusetts, have invented a new and useful Improvement in Hydraulic Elevators, which improvement is fully set forth in the following specification, reference being had to the accompanying drawings.

The object of my invention is to economize in the amount of water used to operate hydraulic elevators. This I accomplish by means of certain devices, whereby the amount of water used is proportional to the load raised; and also the load which is brought down forces back into the reservoir an amount of water nearly equal to that which was used to raise said load. Said devices consist of the combination, in a hydraulic elevator, of a common force-pump, which forces the water that has been discharged from the main cylinder of the elevator back into the supply-pipe of said cylinder. The pump-piston is worked by a lever, which has a movable fulcrum. Said lever receives a reciprocating motion about its fulcrum by means of a connecting rod or link, which is attached to a crank-shaft that receives a circular motion alternately from the piston of the main cylinder and the carriage of the elevator. The fulcrum receives its motion from a rack, which slides on guides or ways. Said rack is moved backward or forward on its guides by means of pawls attached to a bifurcated lever that receives an oscillating motion from the above-mentioned crank-shaft. The direction and amount of motion given to the rack by said pawls is controlled by a governor.

In the accompanying drawings, Figure 1 represents a plan of my invention. Fig. 2 represents a longitudinal section of rack, fulcrum, and lever. Fig. 3 represents a force-pump and pipe-connections. Fig. 4 represents an elevation of my invention.

In the drawings, *a* represents the main cylinder, into which water is admitted through the supply-pipe *q* and valve *s*. *b* is the piston-rod, which is provided with a pulley, over which a rope passes. One end of this rope is made fast to a staple, while the other end is wound around a drum, *c*. Another rope is wound around this drum, and is used to lift the carriage A. Fastened to the drum *c* is a bevel-geared wheel, *d*, which drives a smaller bevel-geared wheel, *e*. The wheel *e* is fastened to the shaft on which are the cranks *z* and *g*. *f* represents a connecting rod or link, which is fastened to the crank *g* and to the end of the lever *h*. To the other end of this lever *h* is attached the piston-rod *l* of the force-pump *p*. *t* represents a rack, which moves on suitable guides, having a pin, *j*, which works in the slot *k* of the lever *h*, and serves as the fulcrum to this lever. *n* represents a connecting-rod, which communicates motion from the crank *z* to the lever *o*, which causes the bifurcated lever *v v* to oscillate about the pivot *m*. *u u* are pawls, which are attached to the lower ends of the bifurcated lever *v v*. *w w* represent rods, which are attached to the pawls *u u* and to the lever *x*. Therefore either or neither of the pawls *u u* can be made to work in the rack *t* by the tipping of the lever *x* about the pivot *m*. The lever *x* is tipped by the lever *y*, which is worked by the governor B B. *q*, in Fig. 3, represents the supply-pipe of the cylinder *a*; *r r'*, pipes that are attached to the ends of the common force-pump *p*, and leading into the supply-pipe *q*.

It will be seen that if the piston be drawn in the direction of, and by, the piston-rod *l*, water will be drawn in through the pipe D', and the water which had been previously drawn into the pump through D will be forced up through the pipe *r* into the supply-pipe *q*. On the return of the piston water is drawn through the pipe D, and the water which entered at D' is forced through *r'* into the supply-pipe *q*. Therefore, by this arrangement the pipe *q* serves two purposes: First, to conduct water from the reservoir to the cylinder *a*; and, second, to conduct water from the pump *p* to the reservoir.

The operation of my invention is as follows: The water being let into the cylinder *a*, forces out the piston-rod *b*, thereby revolving the drum *c*, which winds up the rope that supports the carriage A, and thus causes the carriage to rise. The motion of the drum *c* is also communicated, by means of the geared wheels *d* and *e*, the crank *g*, and connecting-rod *f*, to the lever *h*, thereby causing a greater or less motion of the pump-rod *l*, according

to the position of the fulcrum *j*. If there is a light load on the carriage A it has a tendency to move faster than when heavily loaded. The governor will therefore tip the lever *x*, and cause the pawl *u* to move the rack *t* and fulcrum *j* farther from the pump-rod *l*, thereby increasing the motion of the pump-rod, and, therefore, the amount of water pumped. In this manner an amount of water approximately equal to that which caused the surplus power in the cylinder *a* is pumped back into the supply-pipe. As soon as the fulcrum *j* has assumed such a position that the force required to work the pump, added to that required to lift the load and overcome necessary friction, is equal to the force on the piston of the cylinder *a*, the balls of the governor assume a medium position, and neither pawl works in the rack *t*. Therefore the fulcrum remains stationary until the carriage begins to stop, when the balls of the governor fall, and the fulcrum is worked to its position nearest the pump-rod, thus rendering the elevator capable of starting again with its maximum load. In lowering a load the force of its whole weight, minus that required to overcome friction, is communicated through the rope which supports the carriage, the drum *c*, the gear-wheels *d* and *e*, crank *g*, and connecting-rod *f* to the lever *h*, and hence to the pump-rod *l*. The heavier the load the greater the tendency to move fast. Therefore, in lowering a heavy load the governor will cause a similar result as when raising a light load, viz: The balls will recede from each other, and thus, by mechanism already described, adjust the fulcrum *j* so that the resistance at one end of the lever *h* approximately balances the force applied at the other end.

What I claim as my invention is—

1. In a hydraulic elevator, the combination of a force-pump, *p*, and lever *h*, having a movable fulcrum, connected with the piston of the cylinder *a*, substantially in the manner described, and all operating together substantially as herein shown, and for the purpose set forth.

2. In combination with the pump *p* and lever *h*, the rack *t*, to which is attached the movable fulcrum *j* of the lever *h*, with the pawls *u u*, the bifurcated lever *v v*, operated by the levers *o* and *n* and crank *z*, and governed by the rods *w w*, the levers *x* and *y*, and governor B B, substantially as described, and for the purpose set forth.

3. In combination with the force-pump *p* and supply-pipe *q* of the cylinder *a*, the pipes *r r'*, substantially as described, and for the purpose set forth.

CLARENCE A. CHANDLER.

Witnesses:
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