C. H. MORGAN.

Water-Pressure Crane.

No. 163,511. Patented May 18, 1875.

Fig. 4.

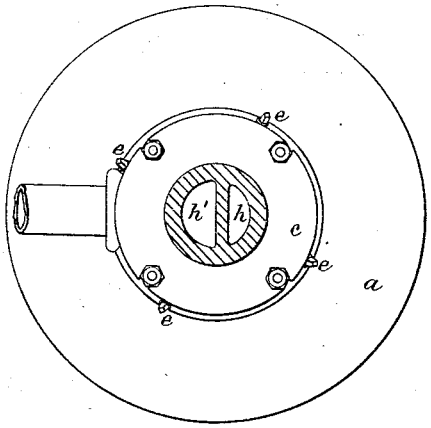


Fig. 3.

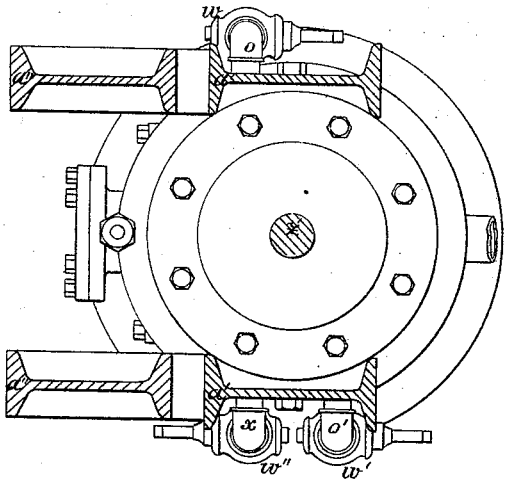


Fig. 2.

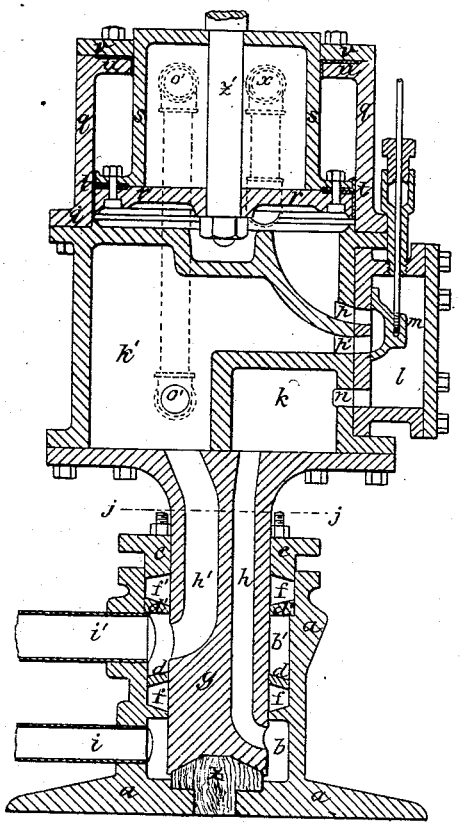
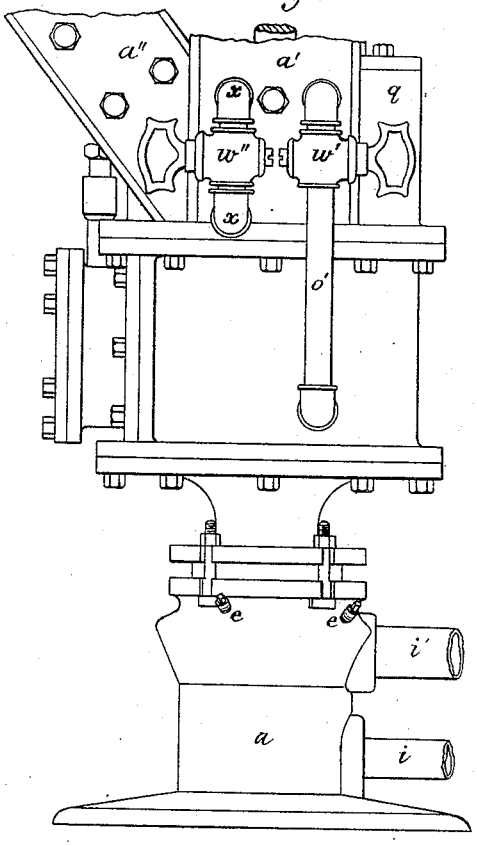


Fig. 1.



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CHARLES H. MORGAN, OF WORCESTER, MASSACHUSETTS.

IMPROVEMENT IN WATER-PRESSURE CRANES.

Specification forming part of Letters Patent No. **163,511**, dated May 18, 1875; application filed February 17, 1874.

To all whom it may concern:

Be it known that I, CHARLES H. MORGAN, of Worcester, in the county of Worcester and State of Massachusetts, have invented new and useful Improvements in Water-Pressure Cranes; and I do hereby declare that the following is a full, clear, and accurate description thereof, reference being had to the accompanying drawings and to the letters of reference marked thereon.

The nature of my invention consists in organizing a water-pressure crane with two passages through its step-spindle and step-casing, so that independent water-engines on the crane for various purposes, such as lifting, traversing the load back and forth on the crane-arm, and revolving the crane, may take water under pressure from one passage and return their exhaust water to the other.

In my improved crane the lifting-engine is so arranged that when only half its full capacity is needed, only half the volume of water for each full stroke need be taken from the pressure-passage that would be required for a complete stroke of full capacity; also, for rapid work, the piston may be forced down as well as up.

These ends are accomplished by means of connections opened and closed by valves between the top and bottom of the cylinder; also between the top of the cylinder and the exhaust and pressure passages above mentioned, combined with what I call a differential piston. This piston consists of a plunger whose area in cross-section may be half that of the cylinder, fastened at the bottom to a disk, which disk is fitted water-tight to the inside of the cylinder by means of packing.

These improvements will be fully understood by reference to the following specifications and accompanying drawings, in which—

Figure 1 is a side elevation. Fig. 2 is a vertical section at the plane of the paper in Fig. 1. Fig. 3 is a plan. Fig. 4 is a cross-section at *j j*, Fig. 2.

The same letters on the various figures refer to like parts.

a a is the step-casing, in which is the step *z*, of hard wood, on which the crane revolves, and the annular spaces *b* and *b*. Between these annular spaces is a packing, *f*, confined in place by the screws *e e* pressing on the packing-ring *d*. Above the annular space *b'* is a packing, *f*, confined in place between the packing-ring *d'* and the gland *c*. Opening into the annular spaces *b* and *b'* are the supply and discharge pipes *i* and *i'* and the passages *h* and *h'* in the step-spindle *g*—the smaller passage, *h*, for water-pressure, and the larger one, *h'*, for exhaust water. *k* and *k'* are chambers in the passages *h* and *h'*, with which, respectively, the pipes *o* and *o'* connect the top of the cylinder *q q*, each pipe containing a valve, *w* and *w'*. The ports *n* and *p'* also open from these chambers into the valve-chest *l*. Other pipes may connect with the chambers *k* and *k'*, for the purpose of operating independent engines on the crane for such work as traversing the load back and forth on the crane-arm and revolving the crane. The pipe *x*, containing the valve *w''*, connects the top and bottom of the cylinder *q q*. Within the valve-chest *l* is a slide-valve, *m*, to supply and exhaust the cylinder *q q*. Within the cylinder *q q* is the differential piston *r s*, made up of the plunger *s*, whose horizontal area may be one-half that of the cylinder *q* and the disk *r*, which is fastened to the bottom of the plunger, and fitted with a packing at *t t* to the inside of the cylinder *q*. The plunger *s* is also packed at *u u*, where it passes out of the cylinder-head *v v*. *a' a''* show how the feet of the masts and struts of the crane are joined to the cylinder *q*, and so are made one with it.

Having now described the construction of the several parts of my improvement in water-pressure cranes, I will proceed to describe their operation.

Having admitted the water under pressure to the supply-pipe *i*, and filled the annular space *b*, the passage *h*, chamber *k*, and valve-chest *l* press down the valve *m* till the port *p* is open. The water rushes in, filling the cylinder *q* as the piston *r s* is forced upward. Draw back the valve *m* to the position shown on Fig. 2, and the piston falls as the water exhausts from the cylinder *q* through the ports *p* and *p'*, chamber *k'*, passage *h'*, and annular space *b'* to the discharge-pipe *i'*. Should it be desired to hasten the exhaust, open the valve *w*, Fig. 3, in the pipe *o*, and admit water from the pressure-chamber *k* to the top of the cyl-

inder q, which will force the piston r s down. If only half of the lifting capacity of the crane be needed, the valves w and w' being closed, open the valve w'' in the pipe x x, Fig. 1, connecting the top and bottom of the cylinder q. Open the valve m; the water will first fill the top of the cylinder q through the pipe x. Then the piston will begin to rise with a force due to the difference of areas of the top and bottom of the piston, which, in this case, is one-half. The water in the top of the cylinder q will be forced to return through the pipe x x and mingle with the incoming feed-water. When the valve m is again returned to the position shown in Fig. 2 the piston will begin to descend, and half the water in the cylinder below the piston r s will be drawn back through the pipe x x to the top of the cylinder by the vacuum created by the falling piston. The remaining half of the exhaust water will pass off through the valve m to the discharge-pipe i'. Opening again the valve m, the piston r s will at once begin to rise, as the pipe x x and top of the cylinder q are already full. The process of emptying the top of the cylinder into the bottom and refilling the top from the bottom will continue with each stroke of the piston. It will be seen that by this process only half of the cylinder volume is drawn from the pressure-passage h for each full stroke of the piston. For rapid work, when only half the lifting capacity of the crane is needed, the valves w' and w'' being closed, admit the water-pressure to the top of the cylinder q through the valve w in the pipe o. Open the valve m and the piston r s will begin to rise. The water from the top of the cylinder will be forced back through the pipe o to the chamber k, and will mingle with the ingoing water from the pressure-passage h. When the valve m is returned to the position shown in Fig. 2, the water in the cylinder q will be rapidly expelled because of the pressure on the top of the piston through the pipe o. In this process each stroke of the piston discharges a full cylinder of water from the feed-pipe, but the working of the crane is much accelerated. It is obvious that the loads are lifted by their attachment to the piston-rod z'.

Having set forth the nature, construction, and operation of my invention, what I claim, and desire to secure by Letters Patent, is—

1. In combination with the stand-case a of a water-pressure crane, and the step-spindle g turning therein, the annular spaces b b' and gland c, and interposed packing between them, and the pressure and discharge passages h h', as and for the purpose described and represented.

2. In combination with the step-spindle g, and the vertical passages h h' through it, the chambers k and k', ports n p p', and valve and valve-chest m l, as and for the purpose described and represented.

3. In combination with the cylinder q, the differential piston r s and lifting piston-rod z', as and for the purpose described and represented.

4. In combination with the water-chambers k and k', cylinder q, and differential piston r s, the connecting-pipes o, o', and x, and valves w, w', and w'', all as and for the purpose described and represented.

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Witnesses:

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