No. 667,312.

Patented Feb. 5, 1901.

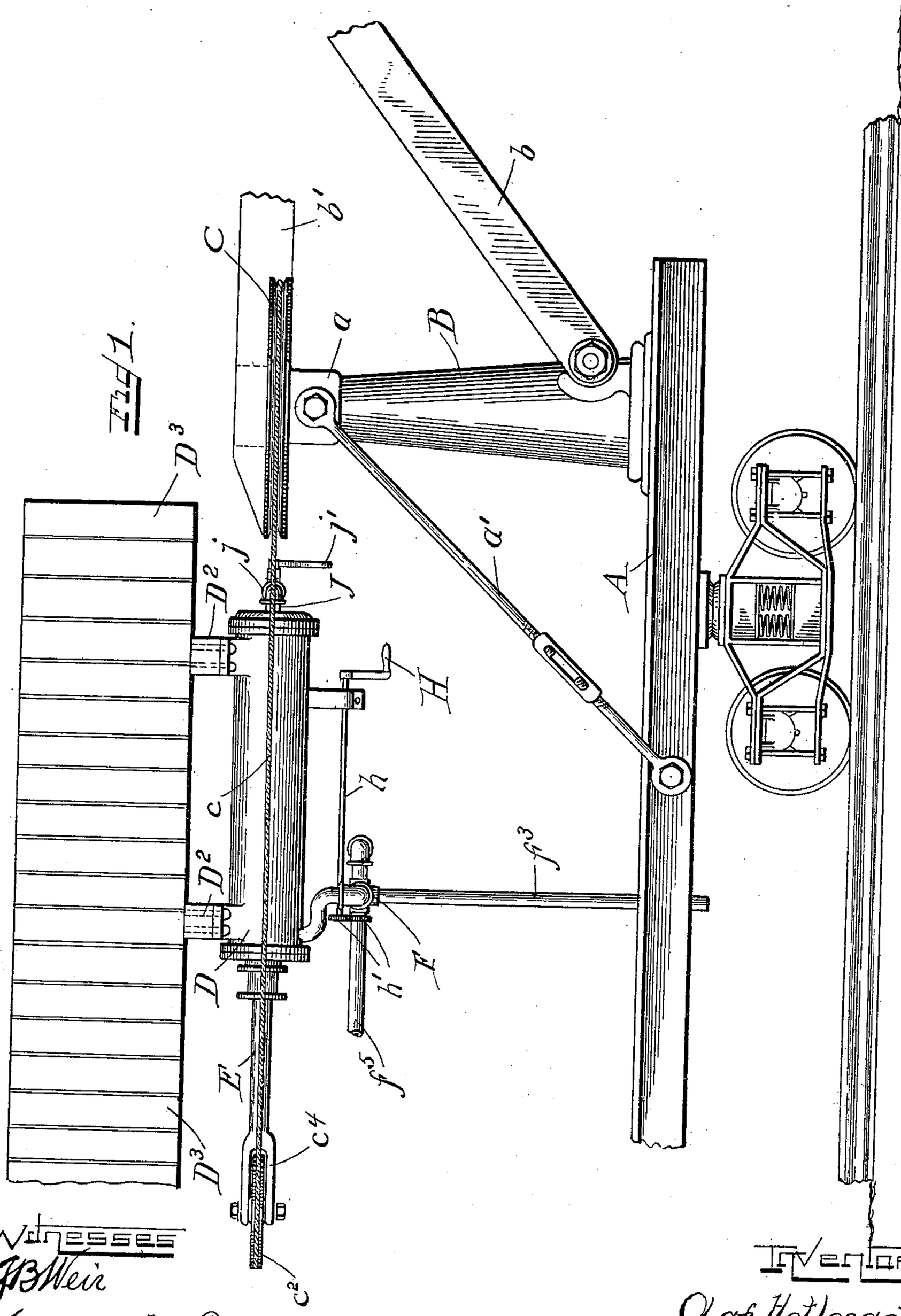
O. HETLESAETER.

SWINGING MECHANISM.

(Application filed Feb. 24, 1900.)

(No Model.)

2 Sheets—Sheet 1



Witnesses

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Fig. 2.

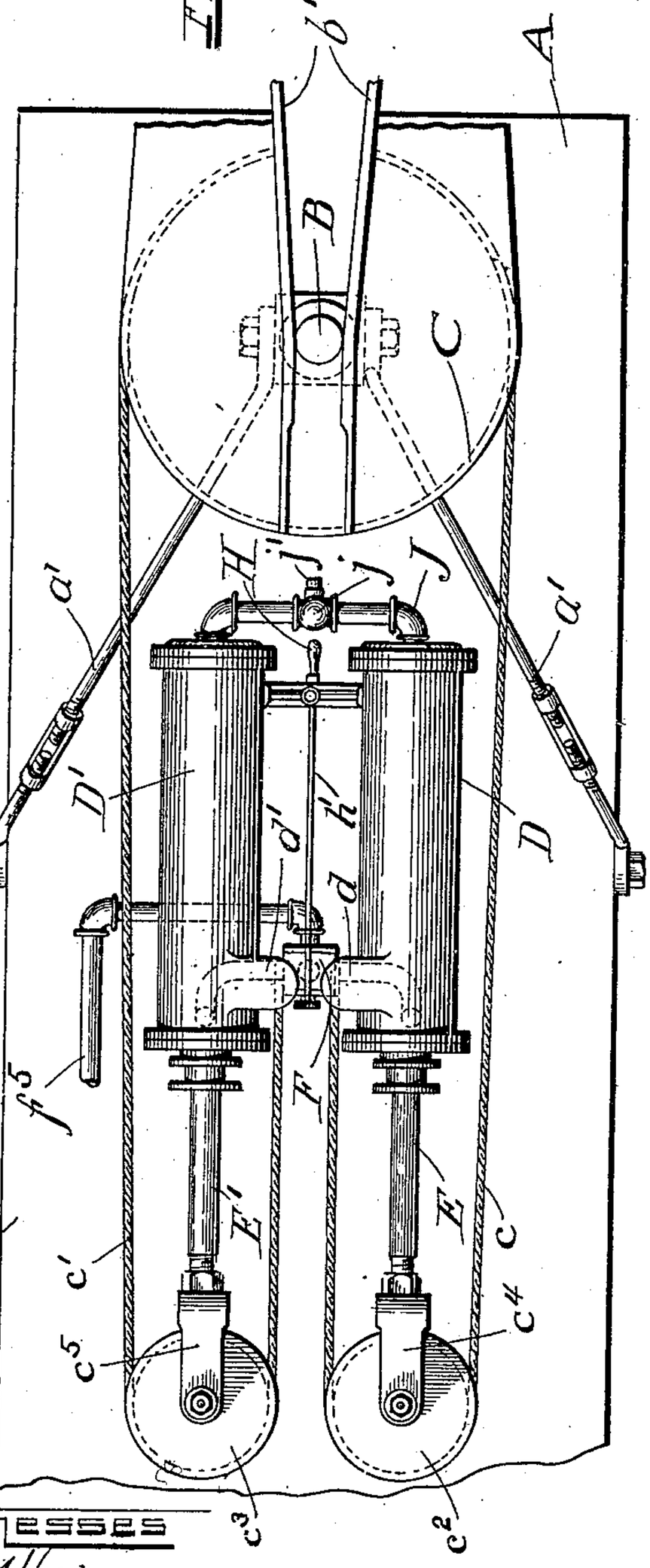
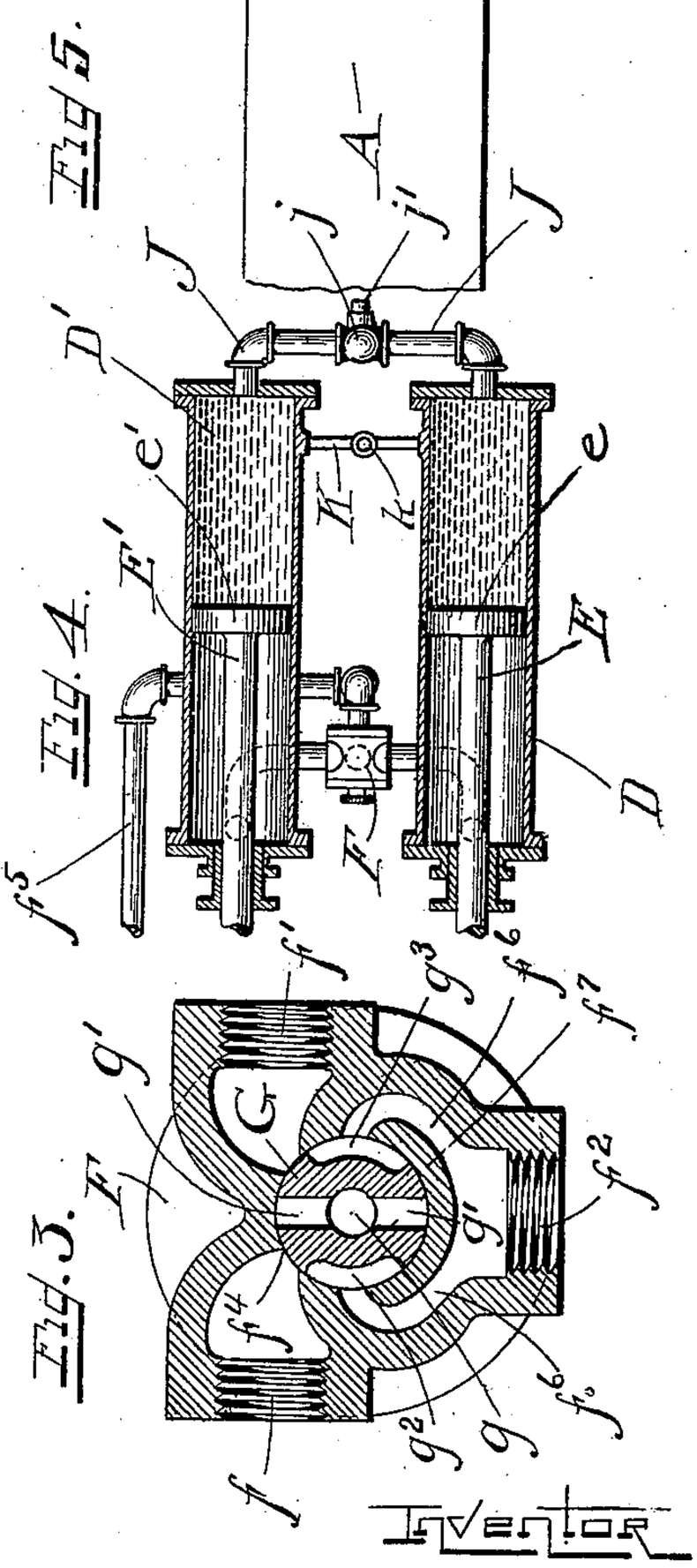


Fig. 5.



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UNITED STATES PATENT OFFICE.

OLAF HETLESAETER, OF CHICAGO, ILLINOIS.

SWINGING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 667,312, dated February 5, 1901.

Application filed February 24, 1900. Serial No. 6,326. (No model.)

To all whom it may concern:

Be it known that I, OLAF HETLESAETER, a citizen of the United States, residing in the city of Chicago, county of Cook, and State of Illinois, have invented a new and useful Improvement in Swinging Mechanisms, of which the following is a specification.

My invention relates to swinging mechanisms for cranes, pivot-guns, and other objects which acquire considerable momentum during their swinging motion and which it is desirable shall be rotated with speed and accuracy.

The objects of my invention are, first, to provide mechanism having great efficiency in bringing the swinging parts to a state of rest and having means for storing and again utilizing the energy due to the momentum of said parts, and, second, to provide the other details hereinafter set forth. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of the swinging mechanism together with a crane whereto the mechanism is connected and a railway-car whereon said crane and mechanism are mounted. Fig. 2 is a plan view of the mechanism and also shows a portion of the crane and car as in Fig. 1. Fig. 3 is a sectional view of the valve whereby the passage of the steam or other operating-gas to and from the crane-swinging cylinders is controlled. Fig. 4 is a central sectional view in plan of the crane-swinging cylinders. Fig. 5 is a diagrammatic plan view of the crane and car and shows the crane in various positions.

Similar letters refer to similar parts throughout the several views.

A represents a railway-car whereon the crane and crane-swinging mechanism are mounted. The crane-mast B consists of an upright member so stepped on said car A as to be revoluble about a vertical axis and is laterally braced at its upper extremity by the collar a, which latter is guyed by the rods a' a', extending to the platform of said car. The crane-jib b is secured to said mast, near the lower extremity thereof, and the jib-stay b' is secured to said mast, near the upper extremity thereof. Said jib and jib-stay, which project in the same direction, are fastened together at their forward extremities and in conjunction with said mast constitute the swinging crane.

Secured to the jib-stay b' concentrically with the axis of the mast B is the swinging circle C, whereby the lateral position of the crane-arm is governed. Said circle C is grooved to receive the swinging cables c c', and said cables, which are attached to the jib-stay b', extend therefrom rearwardly along said grooved circle C, and thence train around the sheaves c^2 c^3. From said sheaves c^2 c^3 said cables extend in a forward direction and are securely attached to the lugs d d', formed upon the cylinders D D'. As one extremity of each of said cables is thus fixed and the other extremity thereof is attached to the crane, the relative positions of said sheaves determine the lateral position of the crane. The sheaves c^2 and c^3 are carried by the yokes c^4 and c^5, fastened to the outer rear extremities of the piston-rods E E', respectively. Said piston-rods are operated by the pistons e e', working within said cylinders D D', respectively. Said cylinders are of the ordinary pattern, and both the cylinders and their adjuncts are similar in construction and symmetrical with respect to each other, but are distinguished from each other for convenience of description, the cylinder denoted D lying upon the right and the cylinder D' upon the left looking from said cylinders toward the crane. Said cylinders are preferably horizontal, parallel, and adjacent and so placed that their axes are at the same height as the swinging circle C and their piston-rods E E' extend in a direction away from said circle. Said cylinders are suspended from the beams D^2 D^2 of the car-roof D^3 or may be otherwise suitably supported. At their rear extremities or their extremities adjacent to the piston-rods E E' said cylinders D D' have pipe connections with the operating-valve F, said connections affording means of entrance and exit of steam to and from said cylinders. Said valve (shown in section in Fig. 3) has openings f and f', connecting with the cylinders E and E', respectively, and an opening f^2, connecting with the exhaust-pipe f^3. Said valve has a center bore f^4, which is connected with the steam-supply pipe f^5 and receives the valve-core G. The openings f and f' connect directly with said center bore f^4, and the

opening f^2 has the passages f^6 f^6, branching around the wall f^7, and thence connecting with said bore f^4.

The rotary valve-core G has a steam-passage g extending therein along the axis of rotation thereof, said passage g communicating with the said supply-pipe f^5. The ports g' g' in said core extend in opposite directions from said passage g in such a manner that said ports may be brought into connection with either the opening f or f'. The ports g^2 g^3 are symmetrically located upon opposite portions of the core G, in the periphery thereof, and are so formed that when said core is rotated sufficiently in one direction the port g^2 connects the openings f f^2, and when said core is rotated in the opposite direction the port g^3 connects the openings f' f^2.

The passages in the valve F and valve-core G are so related that when the passage f is open to exhaust the passage f' receives live steam and when the passage f' is open to exhaust the passage f receives live steam; but the steam-lap is greater than the exhaust-lap in order that one of the said passages may be open to exhaust without necessitating the opening of the opposite passage to steam.

The position of the valve-core G in the valve F is governed by means of the hand-lever H, which is preferably located near the forward extremity of the cylinders D D' and is connected with said valve-core G by means of the rod h and gears h' or in any other suitable manner.

The pipe J forms a connection between the cylinders D and D' at the extremities thereof opposite to the extremities which are connected with the operating-valve F. Said pipe J has therein the valve j, which is an ordinary globe-valve or of other suitable pattern and affords means whereby the passage of fluid through said pipe may be prevented at the will of the operator. Said valve j is operated by means of the hand-lever j', and said lever and the lever H, above mentioned, are preferably so located that both may be within the reach of a single operator. Connecting said cylinders D and D' at the extremities thereof adjacent to said pipe J is the by-pass K, which consists of a pipe of small diameter having therein the valve k. By means of said valve, which may be a globe-valve or of other suitable pattern, the passage of fluid through said pipe may be regulated or entirely prevented, said valve serving to virtually vary the diameter of said pipe K.

The mechanism is adjusted for operation by bringing the crane to a central position, as indicated by the full lines and the letter of reference w in the diagram, Fig. 5. When the crane is in said position w, the pistons e e' are brought to positions midway between the extremities of their respective cylinders, and the swinging cables are trained around the swinging circle C and sheaves c^2 c^3 and made fast in the manner above described. The pipe J and the adjacent halves of the cylinders D and D' are then completely filled with water.

In operation when the crane is in a state of rest the valve F is shut, so that steam cannot enter either of the cylinders D D'.

Referring to the diagram, Fig. 5, when it is desired to swing the crane from one position to another—as, for example, from position w to the position x toward the left, in the direction of the arrow—the valves j and k in their respective pipes J and K are opened and the valve F is so set that steam may pass from the supply-pipe f^5 into the cylinder D, while the cylinder D' is thus opened to exhaust. The live steam entering the cylinder D forces the piston e, together with the piston-rod E and sheave c^2, in a forward direction, thus tending to slacken off the cable c. At the same time the forward motion of the piston e forces the water in the forward end of said cylinder D to pass therefrom through the pipe J and into the cylinder D'. As water is incompressible, the water entering the cylinder D' forces the piston e' therein toward the rear end thereof, thereby moving the piston-rod E' and sheave c^3, so as to exert tension in the cable c'. One extremity of each of said cables being fixed, the slackening off of the cable c and the tightening of the cable c' causes the crane to swing toward the position x upon the left. If it is desired to stop the crane at any position x, when said crane reaches a point somewhat ahead of said position x—as, for example, the position y, Fig. 5—the valve-core G is momentarily rotated to such a position that the cylinder D is open to exhaust and the cylinder D' receives live steam. While the valve-core is in this position the pressure in the cylinder D is quickly reduced to atmospheric pressure and the pressure in the cylinder D' raised to the live-steam pressure. As soon as this condition is reached the valve F is completely closed, so that gas can neither enter nor leave said cylinders D D'. The motion of the reciprocating parts is not, however, immediately arrested, for the momentum of the crane exerts tension on the cable c and at the same time slackens the cable c'. The tension of the cable c forces the sheave c^2 and the piston e in the cylinder D in a forward direction, thereby forcing the water from cylinder D into cylinder D'. The water entering the cylinder D' forces the piston e' toward the rear against the pressure of the steam in cylinder D', and the piston-rod E' is forced outward, thereby keeping the cable c' taut and preventing it from becoming untrained. The continued motion of the crane after the valve F has been shut raises the pressure in the cylinder D' greatly above the live-steam pressure, and at the same time a partial vacuum is created in the cylinder D. When the momentum of the crane and reciprocating parts is overcome by the effects of the increasing pressure in cylinder D' and the vacuum in cylinder D and the crane is brought to rest at

said point *x*, the operator closes the valve *j* in the pipe J. The closure of said valve *j* prevents the escape of water from the cylinder D′ by way of the pipe J, and the piston *e′* is therefore prevented from returning toward the forward end of the cylinder D′, even though the steam-pressure in the rear end thereof be extremely great.

In order to prevent the shock which would follow if the valve *j* were closed when the crane is moving rapidly, the valve *k* in the by-pass K is left open during the operation of the mechanism, thus affording means of escape for a sufficient amount of water from the cylinder wherein the volume of water was decreasing to relieve the parts of undue strains. The friction of the water passing through said pipe K will vary in direct proportion to the speed of the crane, and as the diameter of said by-pass is small the amount of water thus passing through will be small and will not materially lessen the operator's control over the mechanism. By means of the valve *k* the amount of water passing through the pipe K may be regulated.

When the crane is to be held in one position for a considerable time, the valve *k* is closed in order to prevent the water from gradually escaping through said pipe K away from the cylinder having the high pressure. When the crane is next to be swung in the opposite direction, the valve *j* is opened and water permitted to pass through the pipe J, the valve F still remaining closed. The steam which was compressed in the cylinder D′ during the stopping of the crane being under great pressure acts upon the piston *e′* and forces said piston in a forward direction, thus causing the water to pass from the cylinder D′ into the cylinder D and causing the crane to be swung toward the right.

When the crane has swung to such a point that the pressure in the cylinder D′ is reduced, so as to be approximately equal to the live-steam pressure, the valve F is so set that live steam is admitted to said cylinder D′ and the cylinder D is open to exhaust. The pressure of the steam continues the motion of the crane to the right by forcing the piston *e′* in a forward direction, the operation of the reciprocating parts being the reverse of the operation in swinging said crane toward the left, as above described.

If the crane is to be brought to rest at a given point—as, for example, position *w*, Fig. 5—the valve-core G is momentarily rotated so as to admit steam into the cylinder D and open cylinder D′ to exhaust at a time when the crane has reached a position somewhat ahead of position *w*—as, for example, position *z*. The valve F is then quickly closed and compression takes place in said cylinder D, and a partial vacuum is produced in the cylinder D′ in a manner similar to the manner of operation above described.

When the crane is brought to a state of rest, the valve *j* is closed and the crane is thereby held stationary. It follows, therefore, that when the crane is stopped at any point the high pressure in the one cylinder and the partial vacuum in the other cylinder are available for imparting a great initial impetus to start said crane in the return direction—that is, the energy of motion of the crane has been transformed or converted into potential energy, which may be reconverted so as to move said crane. The advantages of these features of my invention are obvious, both with respect to the saving in steam consumption and in the rapidity with which the crane or other object may be operated.

By so constructing the valve F that the steam-lap is greater than the exhaust-lap, either one of the openings *f* and *f′* may be opened to exhaust without introducing steam into the opposite one of said openings, and the pressures in said cylinders may therefore be equalized to atmospheric pressure, thereby enabling the crane to be left in any position even when the valves *j* and *k* are open.

Although I prefer to employ steam and water as the operating fluids, other gases may be substituted for steam and other liquids for water.

It will be understood that the liquid in the cylinders is at all times confined therein and that there is no necessity for connections to auxiliary vessels of any kind. Moreover, the liquid is under no gage-pressure at any time except such pressure as may be communicated to the liquid by the pistons. It will be understood also that the steam-valve and the water-valve operate independently of each other, thus rendering it possible to effect a cushioning of the pistons against steam having a pressure equal to or greater than the boiler-pressure. The water connections are for locking the pistons in position after the latter have come to rest.

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

1. A swinging mechanism comprising a pair of cylinders, connections for liquid between said cylinders at one end thereof, a valve in said connections, a second valve operating independently of the first-mentioned valve, and having connections to each of said cylinders at the ends thereof opposite to the liquid connections above mentioned, said second valve also having connections to a source of supply of compressed gas.

2. In a swinging mechanism, the combination of a pair of cylinders adapted to receive liquid upon one side of their pistons, pistons in said cylinders, direct connections between the liquid ends of said cylinders, a valve for independently controlling the passage of liquid through said connections, means for controllably supplying gas under pressure to the other ends of said cylinders for operating said pistons, and means for transmitting the motion of said pistons to the object to be swung.

3. In a swinging mechanism, the combination of cylinders adapted to receive liquid

upon one side of their pistons, pistons in said cylinders, pipe connections joining the liquid ends of said cylinders, a valve in said connections, a second independent valve and connections for controllably supplying gas to the other ends of said cylinders for operating said pistons, connections between said pistons and the object to be swung whereby the position of said pistons determines the position of said object to be swung, and a by-pass forming a separate connection between the liquid ends of said cylinders for preventing undue strain on the mechanism.

4. In a swinging mechanism, the combination of cylinders adapted to receive liquid upon one side of their pistons, pistons in said cylinders, connections joining the liquid ends of said cylinders, a valve in said connections, an independent valve for controllably supplying gas to the other ends of said cylinders for operating said pistons, connections between said pistons and the object to be swung whereby the position of said pistons determines the position of said object to be swung, a by-pass forming an independent connection between the liquid ends of said cylinders for preventing undue strain on the mechanism, and a valve in said by-pass for regulating the passage of water through the same.

5. In a swinging mechanism, a pair of cylinders adapted to receive liquid upon one side of their pistons, and compressed gas upon the other side of their pistons, the sole connections of each of said cylinders at the liquid end thereof being to the liquid end of the other of said cylinders, means for controlling the flow of liquid between the liquid ends of said cylinders and a valve operating independently of the other controlling parts of the device, for controlling the supply of compressed gas to said cylinders.

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