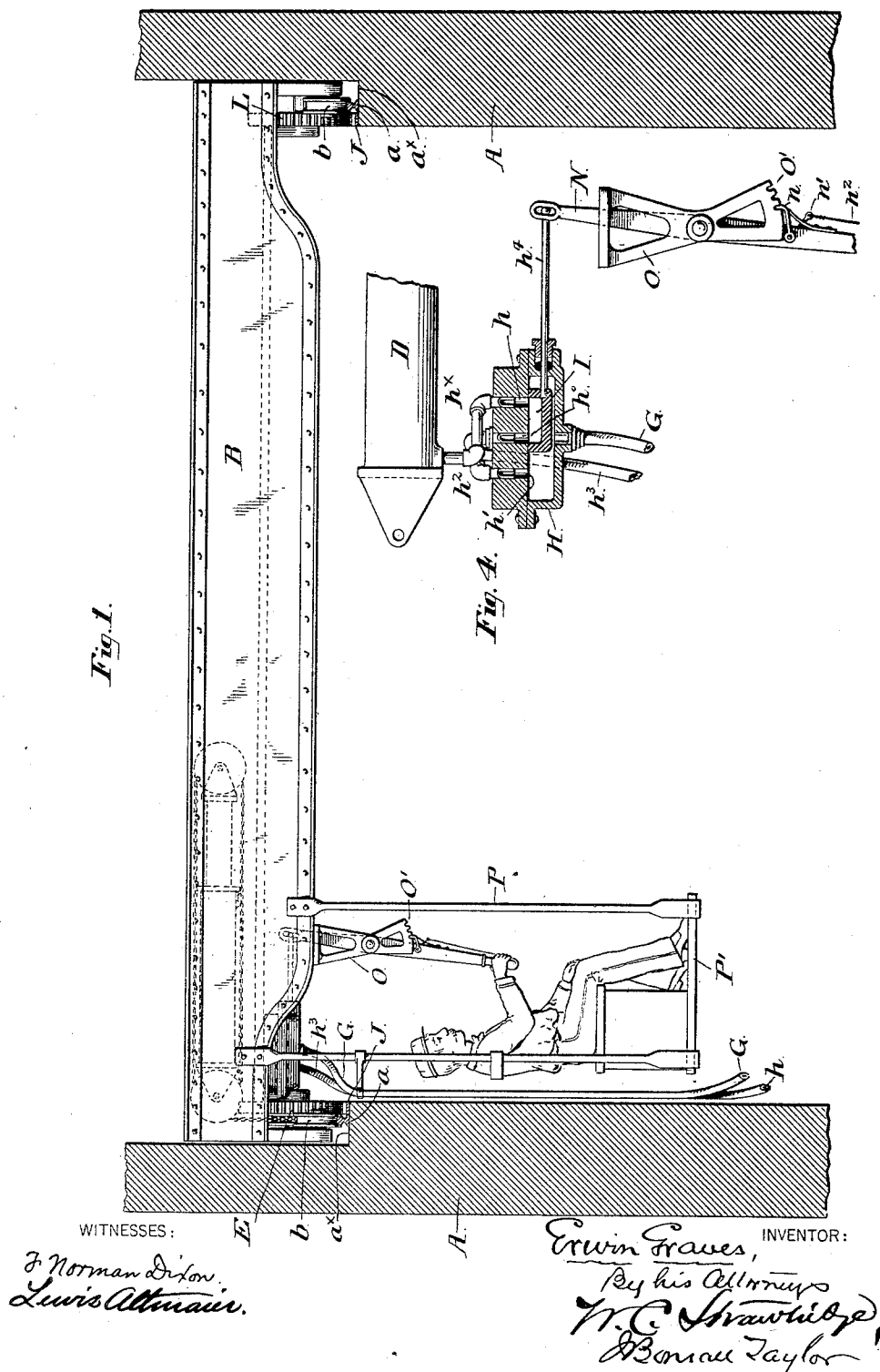


3 Sheets—Sheet 1.

No. 462,637.

Patented Nov. 3, 1891.



(No Model.)

3 Sheets—Sheet 2.

E. GRAVES.
HYDRAULIC CRANE.

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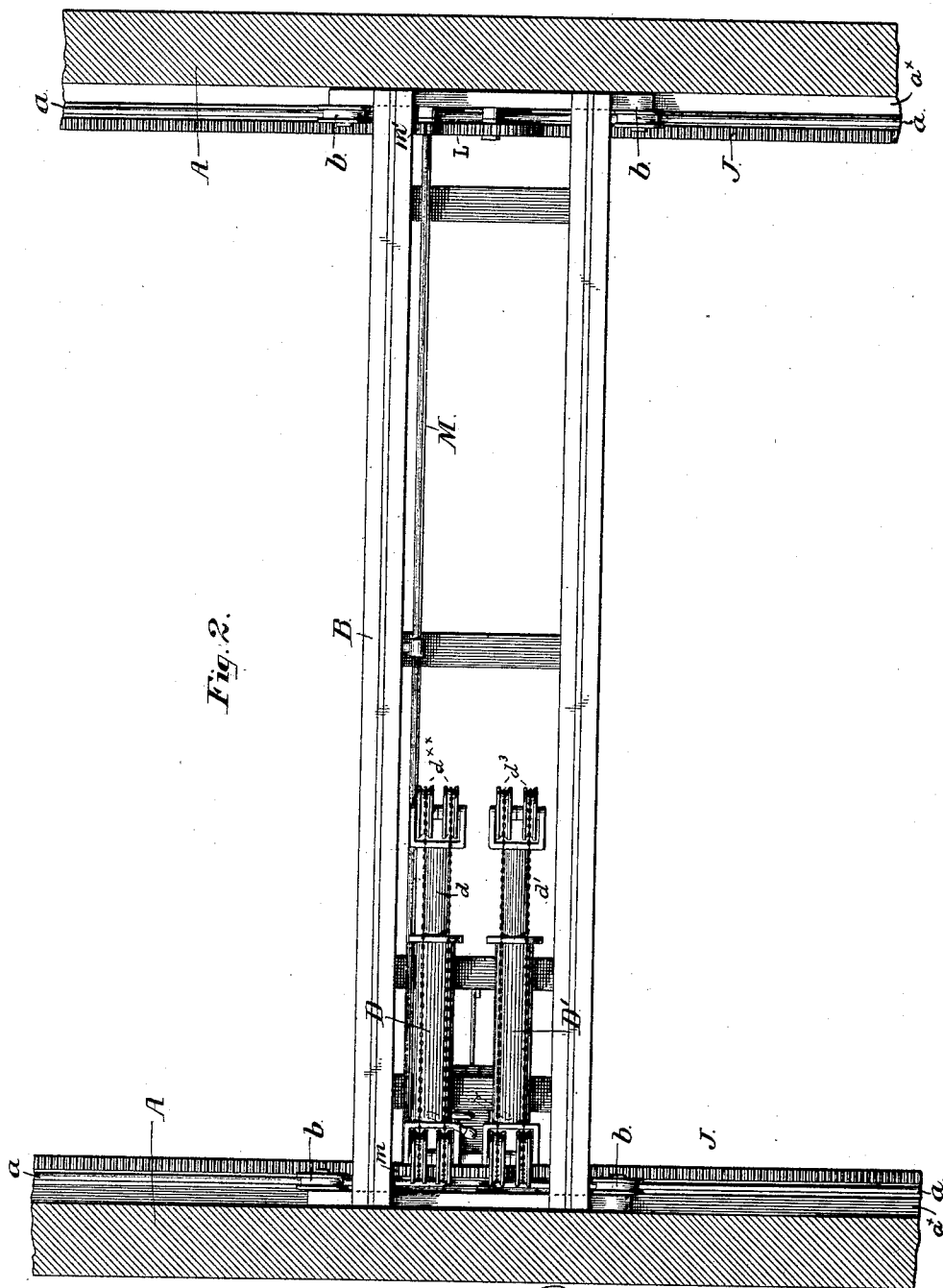


Fig. 2.

WITNESSES:

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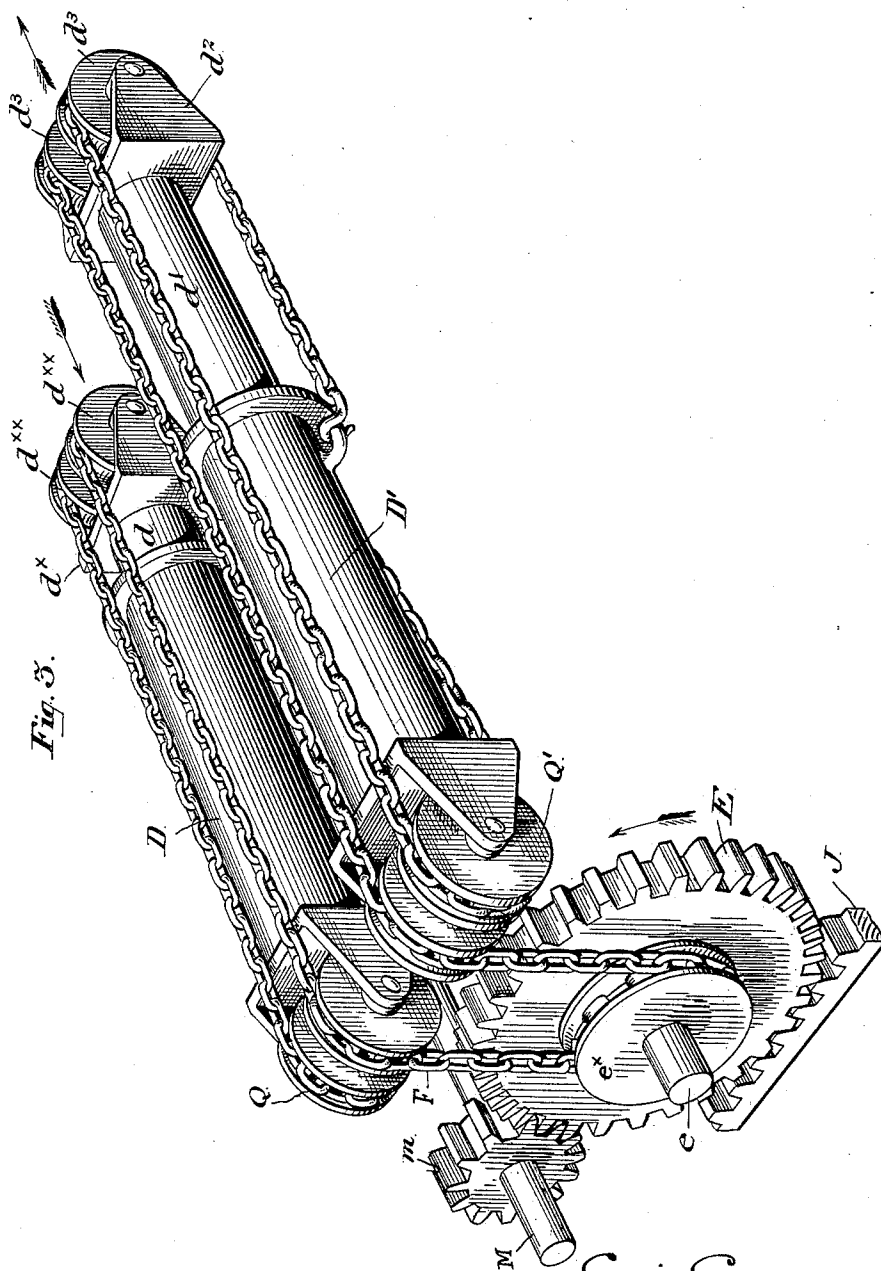
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3 Sheets—Sheet 3.

E. GRAVES.
HYDRAULIC CRANE.

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Patented Nov. 3, 1891.



WITNESSES:

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INVENTOR:

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UNITED STATES PATENT OFFICE.

ERWIN GRAVES, OF CAMDEN, NEW JERSEY, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO WALTER WOOD, OF PHILADELPHIA, PENNSYLVANIA.

HYDRAULIC CRANE.

SPECIFICATION forming part of Letters Patent No. 462,637, dated November 3, 1891.

Application filed February 6, 1890. Renewed October 5, 1891. Serial No. 407,676. (No model.)

To all whom it may concern:

Be it known that I, ERWIN GRAVES, a citizen of the United States, residing at Camden, in the county of Camden, and State of New Jersey, have invented certain new and useful Improvements in Hydraulic Cranes, of which the following is a specification.

My invention relates generally to mechanical cranes designed and arranged to elevate and transport from place to place within the area over which they are erected various loads.

The particular type of crane to which my invention relates is that in the organization of which resort is had to a transverse bridge mounted for travel upon ways which extend lengthwise of the area over which the cranes operate, and upon which bridge is in turn mounted and adapted to be moved crosswise or transversely of said area a carriage which through appropriate tackle directly receives the weight of the load to be moved.

It is the object of my invention to provide the bridge referred to with novel mechanism, the operation of which occasions its travel, and which mechanism is adapted to be operated by power in the form of pressure, whether hydraulic, steam, or pneumatic,—and also to provide a suitable conduit or connection by which to carry from a fixed source of supply to said bridge operating mechanism and regardless of the variations of position of the traveling bridge, the pressure necessary to operate it, the result of which arrangement is that while the necessary pressure is constantly supplied to the bridge operating mechanism the bridge itself is relieved of the weight of the apparatus required to produce such pressure.

In the drawings I illustrate and herein I describe a preferred form of a convenient embodiment of my invention, the particular subject matter claimed as novel being hereinafter definitely specified.

In the drawings, Figure 1 is a side elevational view of the bridge of a hydraulic or other crane, provided with traction or driving mechanism embodying my invention. Fig. 2 is a top plan view of the same. Fig. 3 is a view in perspective of the pair of cylinders and pistons, the main driving wheel and its

chain hub, the chain, a portion of the rack, a portion of the idler shaft, and one of the idler toothed wheels, the employment of which my invention comprehends. Fig. 4 is a fragmentary detail of a portion of one cylinder, the valve (shown in cross section), and the valve-operating handle.

Similar letters of reference indicate corresponding parts.

In the drawings, A A are the side walls of an inclosure within which the apparatus is supposed erected,—upon brackets or shoulders a^x extending along which are conveniently set the bridge rails or ways a , which, however, may, of course, be otherwise supported.

B is a bridge which transversely spans the inclosure, and b are wheels or rollers adapted to the rails a , supporting the bridge, and mounted upon suitable axles in its extremal portions. The bridge itself may be structurally of any preferred form. I do not herein show or describe the carriage and its tackle block with which said bridge is in practice to be provided, inasmuch as they form no part of the present invention, and are, moreover, old and well understood devices unconnected with and in no wise dependent upon the distinctive bridge-driving mechanism in which my invention resides.

D D' are a pair of hydraulic cylinders, mounted upon the bridge, conveniently, as shown in the drawings, in parallelism with each other and the bridge, and near one of its ends. Each cylinder is provided with a piston, which pistons are respectively designated d d' . The outer end of the piston d is provided with a bracket d^x embodying a pair of lugs in which is mounted an axle provided with one or more sheaves d^{xx} and the outer end of the piston d' is similarly provided with a bracket d'^x embodying a pair of lugs in which is mounted an axle provided with one or more sheaves d'^x .

The cylinders D and D' are each in communication with a source of regulated hydraulic pressure, which pressure operates, in a manner hereinafter described, to throw said pistons alternately forward,—and the alternate throw of said pistons is, in accordance

with my invention, by means of suitable gearing or operative connections, utilized to occasion the travel of the bridge upon its rails. This gearing is conveniently of the following description:

E is that one of a pair of driving wheels which I term the "main driving wheel," the same being conveniently mounted upon an axle *e* suitably and idly journaled in the framework of the bridge, and *e*^x is a chain hub or wheel embodying a series of depressions adapted to receive the links of a chain and also mounted upon said axle *e*. In the construction shown the wheel E, axle *e*, and hub *e*^x, all rotate together,—but if the hub and wheel are connected they may run idly on a fixed axle.

F is a chain which is bent upon said chain hub, and is as to one end portion carried across a sheave *d*^{xx} at the free end of the piston *d* and secured to a relatively fixed point of support,—and is as to its other end portion carried across a sheave *d*³ at the free end of the piston *d*¹ and similarly secured.

The operation of the cylinders will perhaps be best understood from an examination of Fig. 3 in which the pressure is supposed to be entering, so to speak, the cylinder D¹ and to be exhausting from the cylinder D. As the piston *d*¹ is forced outward by the pressure behind it, it takes up a proportionate amount of the chain F,—which taking up of said chain, inasmuch as it is engaged in or meshed with the chain hub, occasions the rotation of the main driving wheel E, and also drags or forces the piston *d* back into its cylinder D. When the pressure is permitted to enter the cylinder D and exhaust from the cylinder D¹ the movement of the chain is reversed and the chain hub and driving wheel rotated in the opposite direction.

In the practice of my invention, I prefer to employ the multiplying arrangement shown in Fig. 3—in which the outer end of each piston is provided with two or more of the sheaves described, and the inner end of each cylinder, or some neighboring fixed point of support, is provided in connection with each set of such piston sheaves, with two or more companion sheaves, one set of which is designated Q and the other set Q'; and in which each extremital portion of the chain is applied to a given piston by being first led over one of its piston sheaves, then over one of the companion or cylinder sheaves, then over the other piston sheave, and then over the corresponding other cylinder sheave—whereby the desired multiplication is attained—and by having its end secured to the outer end of the cylinder or other point of attachment. By this arrangement, it will be understood, the amount of chain taken up by the throw of a piston and consequently the length of corresponding travel of the bridge, will be increased proportionately to the number of times the said chain is doubled.

G is a flexible or suitably jointed pipe leading from any suitable source of hydraulic sup-

ply, and terminating in a valve chamber H mounted on the bridge. This valve chamber embodies two cylinder ports *h* *h*¹, of which the port *h* is in communication by means of a short section of pipe *h*^x with the hydraulic cylinder D at a point below its piston—and the port *h*¹ is in communication by means of a short section of pipe *h*² with the hydraulic cylinder D¹ at a point below its piston. The valve chamber also embodies an exhaust-port *h*^o from which leads an exhaust pipe *h*³—and which is conveniently situated midway between the two ports *h* *h*¹.

I is a valve of an ordinary type adapted to slide within the valve chamber and to alternately control the ports *h* *h*¹ by permitting the pressure in the chamber to have alternate access to said ports, while in either position lead to the exhaust is constant. Whenever, therefore, under this arrangement, the hydraulic pressure is permitted to enter one cylinder, the lead is at the same time given to the exhaust from the other cylinder, so that the two pistons are alternated in operation, one moving out while the other moves in. When, however, it is desired to secure the bridge in a given position, the valve I is placed in an intermediate position so as to cover the exhaust port and give the lead to the pressure into both cylinders, which thereupon become equalized and hold the bridge fixedly.

The pipes G and *h*³ are of such length and flexibility as to be always in communication with the valve chamber and to accommodate themselves to all movements and positions of the bridge.

In the form of apparatus represented in the drawings I provide two racks J, alongside of and coextensive in length with the rails *a*,—and form the main driving wheel, E, as a toothed wheel, adapted to engage the rack on the side of the building or inclosure near which said driving wheel is located. As therefore, the reciprocation of the pistons pulls the chain in one direction or the other and thereby rotates the driving wheel, the latter by engagement with the rack propels the bridge forward or backward according to the direction of its rotation.

In order to equalize the operation and apply the power received by the main driving wheel alike to both ends of the bridge, I resort to the following arrangement: At the end of the bridge opposite that on which the cylinders are shown as located, is suitably journaled a second or counter part driving wheel L, which is toothed and adapted to mesh with the teeth of the second rack.

M is an idler shaft, suitably mounted for rotation in, and extending from end to end of, the bridge,—and upon this shaft is mounted at the cylinder-provided end of the bridge a toothed idler pinion *m* in engagement with the main driving wheel, and upon its opposite end a second toothed idler pinion, *m*¹, in engagement with the second driving wheel. The idler shaft and its pinions, as will be ob-

vious, transmit to the second driving wheel a portion of the motion or power received by the first driving wheel.

The valve may be manipulated in any convenient manner. I find it convenient to connect to the outer end of its stem h^1 a lever N pivoted intermediately of its length to any point of fixed support, as, for instance, the depending bracket O,—by the movement of which lever in one or the other direction the valve stem and valve are reciprocated. The bracket is conveniently provided with a segmental series of notches o' , and the handle is provided with a hook n which under the actuation of a spring mounted in connection with it is adapted to engage with said notches,—and to lock the handle in desired positions of adjustment. The pivot upon which the hook is rigidly secured is provided with an arm n' constituting the whole a bell crank lever, and to said arm a cord or wire n^2 is attached and extends down to the point at which the handle is designed to be grasped, so that the operator when he grasps the handle to move it to a new position of adjustment may by a pull upon said cord first unlock it. In the vicinity of said handle or lever N I provide an operator's platform, on which the operator who manipulates the valve is carried. The platform may be constructed in any convenient manner. That shown in the drawings consists merely of depending hangers P attached to the framework of the bridge and to the lower ends of which the platform P' is secured.

Although I have herein described the pistons as being operated by hydraulic pressure, that being the power to which in practice I prefer to resort, it is obvious that pneumatic, steam, or other power, might with good results be supplied to cylinders and pistons of the substantial character herein described and therefore that the term "hydraulic pressure" in the claims is employed to include all such operating agents.

Having thus described my invention, I claim and desire to secure by Letters Patent:

1. In combination with bridge ways or rails, a bridge adapted to travel on said ways, a pair of hydraulic cylinders and pistons mounted on said bridge, bridge driving mechanism operated by said pistons, a valve chest in communication with both cylinders and containing a valve, and a flexible pipe leading to said valve chest, substantially as set forth.

2. In combination with bridge ways or rails, a bridge adapted to travel on said ways, a rack extending in parallelism with such ways, a toothed wheel mounted in said bridge in mesh with said rack, a chain hub mounted in connection with said wheel, a pair of hydraulic cylinders and pistons mounted on said bridge, a chain bent as set forth upon said pistons

and around said chain hub, and means for supplying hydraulic pressure to said cylinders, substantially as set forth.

3. In combination with bridge ways or rails, a bridge adapted to travel on said ways, racks extending in parallelism with said rails or ways, a main toothed driving wheel mounted in one end of said bridge and engaged with a rack, a chain hub mounted for rotation in connection with said wheel, a second toothed driving wheel mounted at the opposite end of the bridge and engaged with a second rack, an idler shaft bearing toothed idler pinions each of which idler pinions is engaged with one of the said toothed wheels, a pair of hydraulic cylinders and pistons mounted on said bridge, a chain bent as set forth upon said pistons and around the chain hub, and means for supplying hydraulic pressure to said cylinders, substantially as set forth.

4. In combination with bridge ways or rails, a bridge adapted to travel on said ways, a rack extending in parallelism with said ways, a toothed wheel mounted in said bridge in mesh with said rack, a chain hub mounted in connection with the said wheel, a pair of hydraulic cylinders and pistons mounted on said bridge, a chain bent upon said pistons and around said chain hub, a valve chest mounted on said bridge, containing a valve and embodying supply ports in communication respectively with the two cylinders, and also embodying an exhaust port, and a flexible pipe leading to said valve chest, substantially as set forth.

5. In combination with bridge ways or rails, a bridge adapted to travel on said ways, a pair of hydraulic cylinders and pistons mounted on said bridge—bridge driving mechanism operated by said pistons, a valve chest in communication with both cylinders and containing a valve, a valve stem, a handle for operating said stem, and means for locking said handle in given positions, substantially as set forth.

6. In combination with bridge ways or rails, a bridge adapted to travel on said ways, a pair of hydraulic cylinders and pistons mounted on said bridge, bridge driving mechanism operated by said pistons, a valve chest mounted on the bridge in communication with both cylinders, and containing a valve, means for supplying hydraulic pressure to said valve chest, a valve stem, and an operator's platform secured to said bridge in the vicinity of said valve, substantially as set forth.

In testimony that I claim the foregoing as my invention I have hereunto signed my name this 4th day of February, A. D. 1890.

ERWIN GRAVES.

In presence of—

F. NORMAN DIXON,
LEWIS ATTMAIER.