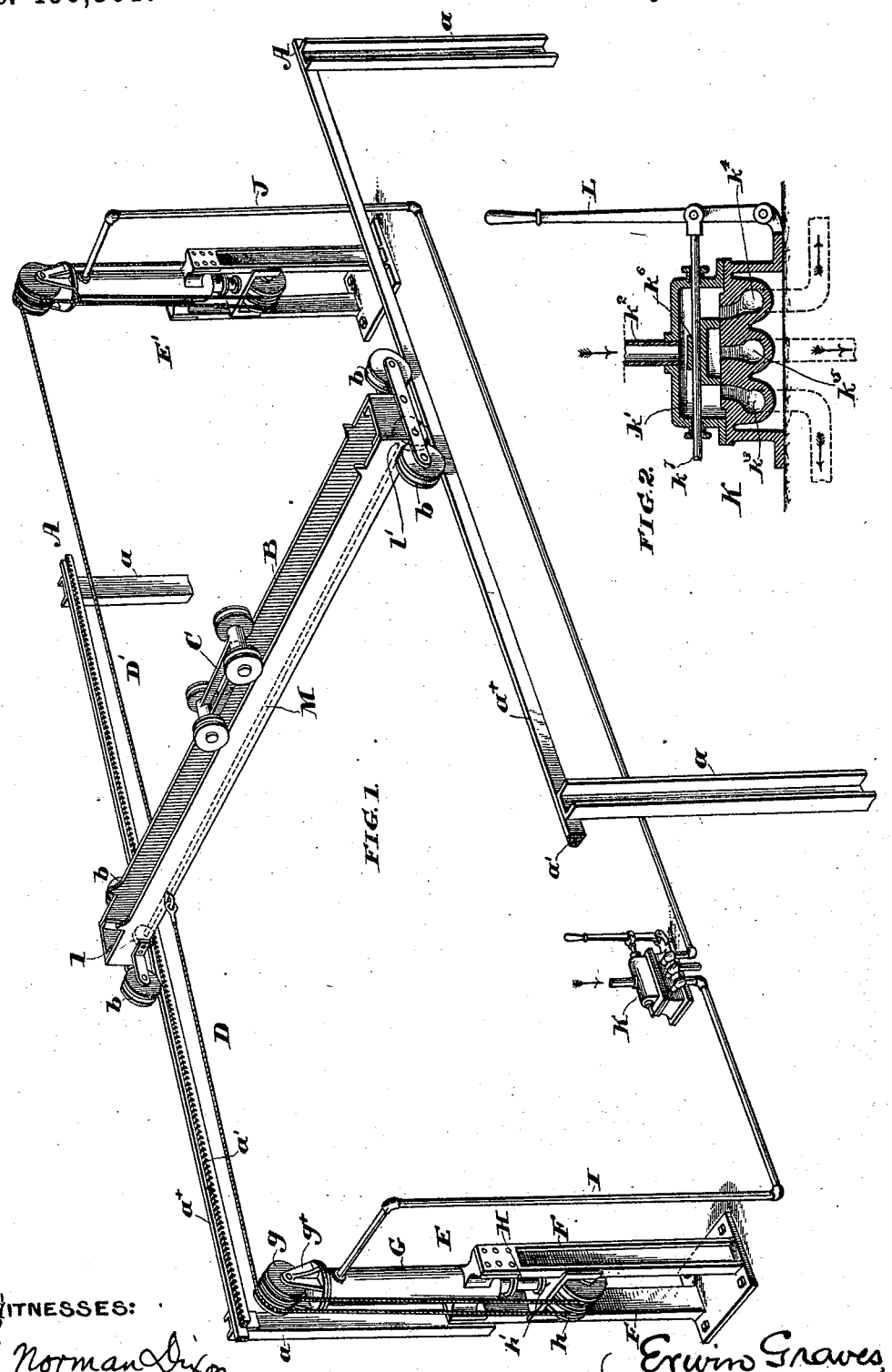
(No Model.)

E. GRAVES.

HYDRAULIC TRAVELING CRANE.

No. 456,361. Patented July 21, 1891.



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HYDRAULIC TRAVELING CRANE.

SPECIFICATION forming part of Letters Patent No. 456,361, dated July 21, 1891.

Application filed April 15, 1890. Serial No. 347,972. (No model.)

To all whom it may concern:

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

My invention relates to the class of apparatus in which tracks, extending in parallelism over the area with respect to which the apparatus operates, support a traveling bridge upon which in turn is mounted a carriage which receives the weight of the load to be elevated and transported. The necessarily large size of engine required to furnish the power to propel a heavily weighted crane of the foregoing character,—the desirability of escaping the limitations as to size which the restricted space afforded by the surface of the bridge imposes,—the desirability of having the engine located at a point where it is not only readily accessible for inspection oiling and repairing, but also protected from dust and exposure,—and the desirability of lightening as far as possible the weight of the bridge and its load,—all render it a desideratum, in apparatus of this character, that the motor should be stationary and located upon the ground, and that from such fixed position it should, by appropriate connective gearing, operate and control the bridge.

My invention aims to provide a crane which shall fulfill the desirable conditions indicated; in which connective gearing of simple character shall transmit the propelling power of the motor to the bridge is provided; and in which hydraulic pressure shall be utilized as the bridge driving power, and by a suitable arrangement of pipes so distributed that a portion of the bridge-operating gearing otherwise necessary may be dispensed with.

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 view in perspective of an apparatus conveniently embodying my invention, and Fig. 2 is a vertical, longitudinal, sectional, elevation of the operating valve.

In the drawings, A A are the bridge-ways or tracks, conveniently mounted upon supports *a*. Each bridge-way conveniently consists of a rail $a^{\times}$ and a longitudinal rack a' extending in parallelism with it.

B is the bridge, the same being of any preferred construction, and being provided with flanged rollers *b* adapted to the rails $a^{\times}$. These rollers, of which two are shown at each end of the bridge, take the weight of the bridge, and carry it backward and forward under the stress of the operating ropes, whereof hereinafter.

C is a carriage mounted upon the bridge, and designed to receive the weight of the load to be carried and to transport it transversely to the inclosure. To such end the carriage is in practice equipped with suitable rope connections or equivalent devices through which it may be propelled and through which also the load may be elevated and secured to it. Illustration of these connections is omitted as immaterial to the subject matter herein claimed.

D D′ are two ropes, both secured to the bridge, and each also secured to a separate power-operated device or motor adapted to effect a pull upon it.

D, Fig. 1, is the left hand rope, and D′ the right hand rope. These ropes are respectively represented as existing on opposite sides of the bridge, and as each having one extremity secured to a staple or eye attached to the bridge.

E E′ are two hydraulic motors or rams structurally independent of each other and preferably occupying positions at opposite ends of the inclosure, the motor designated E being at the left and the motor E′ at the right hand end thereof. These motors are duplicates of each other, and I therefore confine the following description to but one of them, namely E:—

F are a pair of vertical standards, which support in a vertical position between their upper ends a hydraulic cylinder G. The upper end of this cylinder is conveniently provided with sheaves *g*, of which two are shown in the drawings. These sheaves are mounted upon an axle which is supported in lugs $g^{\times}$ erected upon the cylinder head. Within the

cylinder plays a plunger or piston, the rod H of which protrudes through the lower cylinder head, and as to its outer or free end is equipped with sheaves h, two being shown, which are mounted upon an axle conveniently supported in a bracket head being a cross piece h' the ends of which are equipped with downwardly-extending lugs in which said axle is journaled. The breadth of the bracket head is preferably such as to extend between the respective inside faces of the two supports F, which therefore constitute a guide for the vertical movement of the bracket head and piston.

The bridge-operating rope which is connected with the hydraulic cylinder and piston under consideration, may be a textile or metal rope or a chain, and is led from the bridge over one of the sheaves g, then down to and around one of the sheaves h, then up again to and around the second sheave g, then down to and around the second sheave h, and is then, as to its free end, secured to the cylinder. As will now be apparent, when the piston is forced outward, the rope which is engaged with its sheaves will be taken up to an extent proportioned to the number of times it is longitudinally doubled around the cylinder and piston, and, as will be understood, by suitable multiplication of the number of the sheaves, a rope sufficiently long to extend along any desired length of apartment may be applied and operated. One rope and motor such as the foregoing being so mounted and connected with the bridge as to pull it in one direction, and another rope and motor of precisely similar character being so mounted and connected with the bridge as to pull it in an opposite direction,—it is apparent that, in order to secure the most advantageous result, both motors should co-operate in such manner that as one rope is taken up the other will be correspondingly slackened. This co-operation is conveniently effected in the manner hereinafter described.

I prefer to operate the pistons by hydraulic, as opposed to steam pneumatic or kindred, pressure, but I do not restrict myself to hydraulic pressure.

I is a pipe, tube or its equivalent, leading into the cylinder of the motor E, and J is a similar pipe leading into the cylinder of the motor E'. These pipes both preferably lead from a common valve K, situated at some convenient point within the building. In practice the pipes I and J may be led beneath the floor and through the wall of the apartment or inclosure in such manner as will prevent them from taking up room or presenting any obstruction to the work ordinarily carried on in the apartment. The valve K is of an ordinary type, k' being a pressure chamber, k^2 a pressure supply pipe leading thereinto, k^3 a port leading to the pipe I, k^4 a port leading to the pipe J, k^5 an exhaust port, k^6 a slide valve, and k^7 a valve stem the central portion of which is secured to the valve k^6 and the extremities of which pass out through suitably packed openings in opposite ends of the pressure chamber. The valve as an entirety will, when the respective extremities of its stem pass out of the pressure chamber, remain without locking in whatever position it may be set.

L is a lever the lower end of which is pivoted to the lower portion of the valve casing, and the intermediate portion of which is engaged with one extremity of the valve stem, so that said lever operates as a valve moving stem.

In the operation of the crane to carry the bridge in one or the other direction it is necessary (according to the direction of the desired movement) that the pressure should exist in one of the pipes I and J, and that the lead should be given to the exhaust from the other, in order that the piston of the cylinder so receiving the pressure may be protruded and thereby take up its rope and draw the bridge toward it, and that the piston of the cylinder which is exhausted may be retracted under the pull of its rope occasioned by the moving away of the bridge.

In Fig. 2 the valve k^6 is shown as covering the exhaust port and permitting the pressure to enter both pipes I and J. This holds the bridge firmly in one position. In order to move the bridge in one or the other direction, the valve is simply moved to the right or left as desired.

It is apparent that the arrangement described is very simple and compact, a complex system of operating ropes is dispensed with, and a direct pull exerted upon the bridge in whichever direction it is desired to draw it. The hydraulic rams are, as shown, inverted, and this arrangement is resorted to in order that in the event of the shutting off of the hydraulic pressure from both pipes I and J contemporaneously, the pistons will not drop down into their cylinders and permit the disengagement of the ropes from the sheaves as would be the case were the cylinders beneath and the pistons uppermost. In the arrangement shown in the drawings the drop of the pistons tends to take up the rope and not to release it.

Of course it is to be understood that, while I prefer to place the hydraulic rams at the extremities of the apartment as shown, and to place them in a vertical position, I do not restrict myself thereto, as it is clearly within the scope of my invention to arrange the rams at other points or in other positions,—it being in such arrangement only necessary to make such changes in the direction in which the operating ropes are led to the rams, and to apply the appropriate intermediate pulleys, to enable me to carry into effect very different arrangements in the sense of mere dispositions of the rams.

To prevent the swaying, impacting, or unequal movement of the ends of the bridge, in its travel, I prefer to provide the bridge ways

with the racks a' referred to, and to provide the bridge with the axle M which is equipped with two toothed wheels $l\ l'$, the wheel l being in mesh with one, and the wheel l' in mesh with the other, of said racks. As is apparent therefore, it will be impossible for one end of said bridge to travel in advance of the other, for the reason that any movement taken by one end will be positively transmitted to the other.

Having thus described my invention, I claim:

1. In combination with bridge ways or rails, a bridge mounted upon said ways, two hydraulic motors, and suitable connections leading from said bridge in opposite directions, and respectively connected with said motors, substantially as set forth.

2. In combination with bridge ways or rails, a bridge mounted upon said ways, two hydraulic motors connected with a common source of hydraulic pressure, and independent rope connections leading from said motors to said bridge, and approaching said bridge in opposite directions, substantially as set forth.

3. In combination with bridge ways or rails, a bridge mounted upon said ways, two hydraulic motors, a source of hydraulic pressure, pipes leading from said source of hydraulic pressure respectively to said motors, and flexible connections by which said motors are respectively connected to said bridge to occasion its travel in opposite directions, substantially as set forth.

4. In combination with bridge ways or rails, a bridge mounted upon said ways, a pair of hydraulic motors, a pair of ropes, each of which is secured as to one end to the bridge, and as to the other end portion engaged with one of the motors and fixedly secured, substantially as set forth.

5. In combination with bridge ways or rails, a bridge mounted upon said ways, a pair of structurally independent hydraulic cylinders and pistons substantially as described, a valve controlled source of hydraulic pressure in communication with both cylinders, a pair of ropes each of which is secured as to one end to the bridge and as to its other end portion engaged with the motor sheaves, and fixedly secured, substantially as set forth.

6. In combination with bridge ways or rails, a bridge mounted upon said ways, two hydraulic motors provided with sheaves and situated in adjacency to opposite respective ends of the ways, a source of hydraulic pressure, pipes leading from said source of pressure respectively to said motors, and a pair of ropes each of which is secured as to one end to the bridge and as to its other end portion engaged with the motor sheaves and fixedly secured, substantially as set forth.

7. In combination with bridge ways or rails, embodying racks, a bridge mounted upon said ways, a shaft mounted in said bridge and equipped with toothed wheels engaged with said racks, a pair of hydraulic motors connected with a common source of hydraulic pressure, and flexible connections by which said motors are respectively connected to said bridge, substantially as set forth.

In testimony that I claim the foregoing as my invention, I have hereunto signed my name this 14th day of April, A. D. 1890.

ERWIN GRAVES.

In presence of—
J. BONSALL TAYLOR,
F. NORMAN DIXON.