(No Model.) 2 Sheets—Sheet 1.

E. GRAVES.

HYDRAULIC CRANE.

No. 456,360. Patented July 21, 1891.

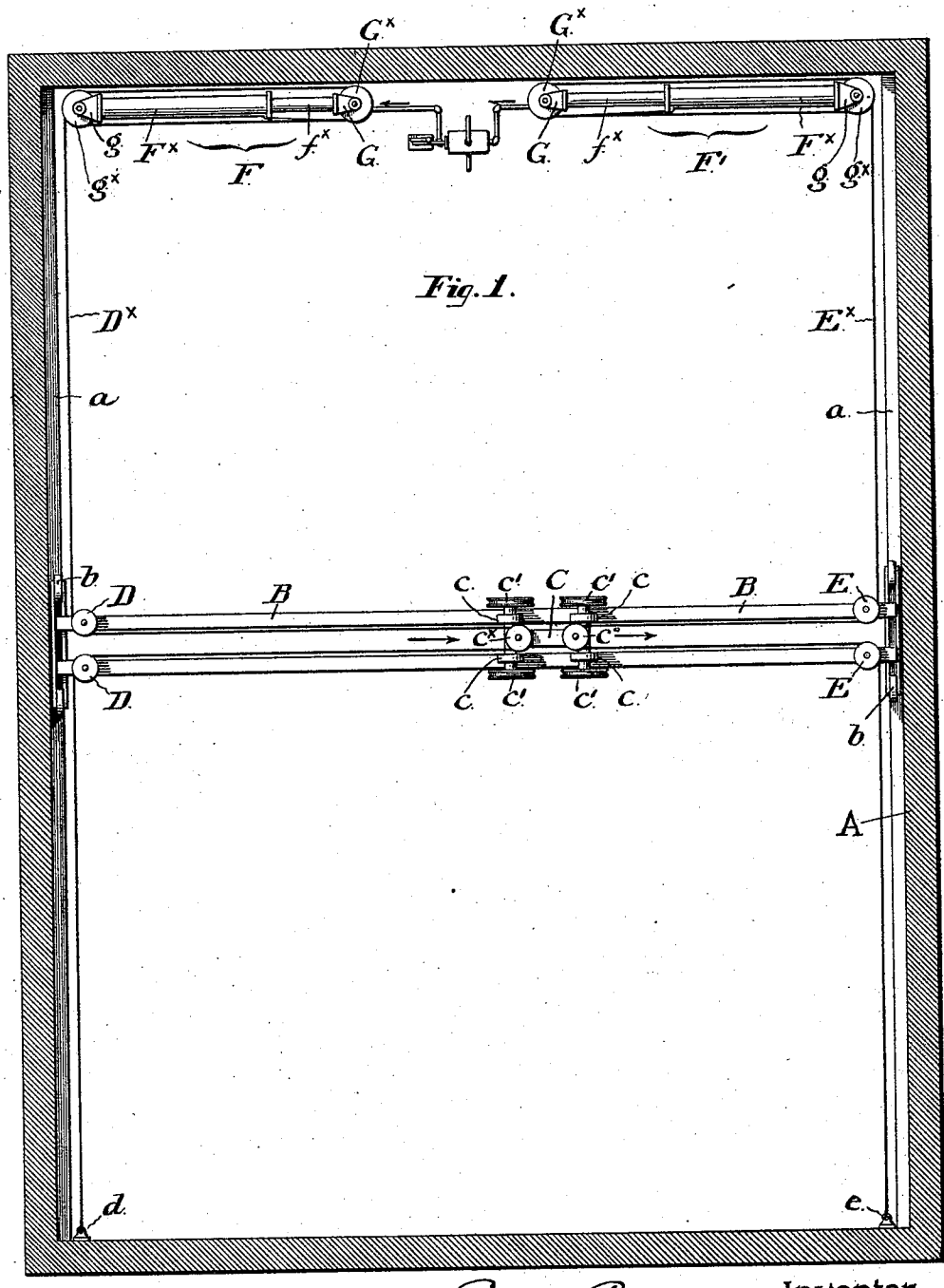


Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

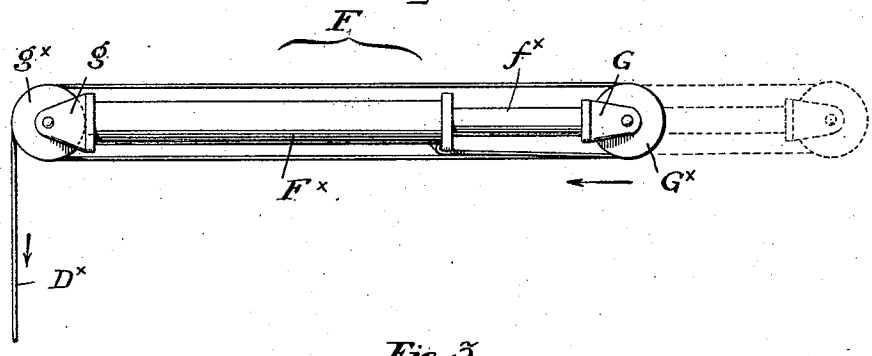


Fig. 3.

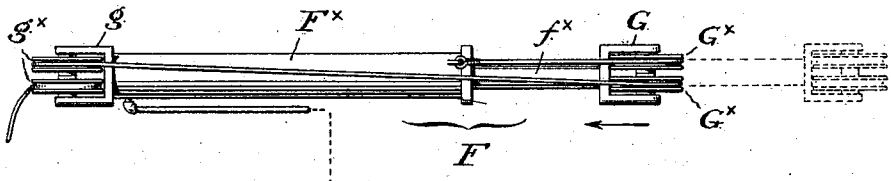
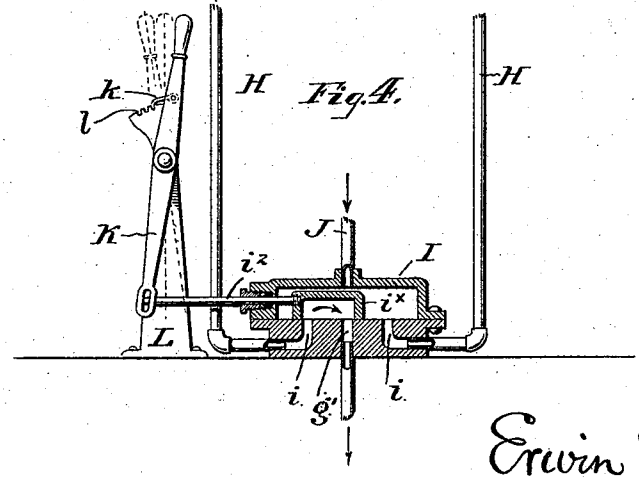


Fig. 4.



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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. 456,360, dated July 21, 1891.

Application filed February 6, 1890. Serial No. 339,480. (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 improvements, although applicable in connection with hoisting and traction apparatus of various organizations, relate generally to cranes of the class in which a carriage or conveyer provided with load-elevating devices is mounted and adapted to move to and fro upon a bridge which is itself arranged for movement upon a track,—and my said improvements relate specifically to the means for occasioning the travel of the carriage.

It is the object of my invention to provide,—by a novel arrangement of the system of ropes through which the said carriage is propelled, and by the organization and combination therewith of a motor in which hydraulic pressure is utilized for operating said ropes,—an economical, and uniformly and positively operating means for occasioning the travel of said carriage.

In the drawings I illustrate and herein I describe a good 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 top plan view of a bridge mounted upon ways, a carriage mounted in said bridge, carriage operating ropes, and a pair of hydraulic or other cylinders, together embodying my invention. Fig. 2 is a plan of one of the cylinders, showing the side faces of its sheaves,—and Fig. 3 is a side view of one of the cylinders, showing the edges of its sheaves. Fig. 4 is a central vertical longitudinal sectional elevation of a valve for the cylinders, illustrating in full lines the operating handle of said valve, and the pipes into which lead the ports of said valve.

Similar letters of reference indicate corresponding parts.

In the drawings, A indicates the walls of a quadrangular inclosure in which the apparatus is located,—formed as a part of or connected with the longer walls of which inclosure are a pair of rails *a*, on which the bridge B bears and travels by means of its rollers *b*. As such bridges as that represented, together with means for occasioning their travel, are, broadly considered, old, I do not deem it necessary to herein illustrate or describe any means whereby such travel is effected, such means being entirely independent of the devices and arrangements in which my invention resides. Suffice it to say however that in the practical employment of my improved apparatus any usual and preferred form of appliances may be resorted to to occasion the travel of the bridge.

C is the carriage, the same being as to its general character of any preferred construction and being provided with running gear—consisting, in the carriage shown, of four rollers *c*,—by means of which it travels in either direction upon the bridge B.

c' are what I term rope wheels, of which four, mounted upon the axles of the rollers *c* and overhanging the edges of the bridge B, are shown in the drawings. These rope wheels are employed in connection with the mounting and operation of the tackle or ropes which lift the load which the carriage is intended to carry,—but which ropes are herein omitted for the same reason as that given for the omission of the bridge-operating mechanism.

$c^{\times}$ c° are a pair of sheaves, mounted, conveniently in horizontal positions upon vertical axles, at opposite ends of the carriage.

D D are a pair of sheaves, mounted at the left hand end of the bridge (Fig. 1) and E E are a corresponding pair of sheaves, mounted at the right hand end of said bridge. These sheaves are all preferably arranged in horizontal positions to correspond with the sheaves of the carriage.

$D^{\times}$ is the left hand carriage rope, as to what I term its outer end secured to a keeper *d*, or other point of attachment, which is one of a pair at one end of the inclosure, and as to its intermediate portion passing around one of the sheaves D, then around the carriage sheave $c^{\times}$, then around the other sheave D, and then off to the point where it is secured to the motor.

$E^{\times}$ is the right hand carriage rope, as to what I term its outer end secured to a keeper *e*, which is the other of the pair mentioned,

and as to its intermediate portion passing about one of the sheaves E, then around the carriage sheave c°, then about the other sheave E, and then off to the point where it is secured to a motor.

As will be apparent traction upon the rope $D^{\times}$ will, if the rope $E^{\times}$ be correspondingly slackened, positively draw the carriage toward the left hand end of the bridge, while traction upon the cord $E^{\times}$ will, if the rope $D^{\times}$ be correspondingly slackened, positively draw the carriage to the right hand end of the bridge.

The means which I employ to effect the pull upon one rope and the corresponding relaxation of the other rope, are a pair of hydraulic cylinders and pistons or plungers which are conveniently associated in their operation by reason of being in communication with a common source of hydraulic pressure which is controlled by a single valve.

F F′ are the pair of hydraulic cylinders and pistons referred to, the left hand piston being connected with and operating the left hand rope $D^{\times}$, and the right hand piston being connected with and operating the right hand rope $E^{\times}$.

As the two cylinders and pistons are precisely similar, a description of one will suffice. $F^{\times}$ is a hydraulic cylinder, the same being of any preferred size and arrangement, within which a piston $f^{\times}$ is fitted for reciprocation.

G is a bracket applied to the outer extremity of the piston, and g is a bracket applied to the opposite end of the cylinder. Each bracket embodies a pair of ears which serve to support an axle. Upon the axle of the bracket G are mounted two piston sheaves $G^{\times}$ while upon the axle of the bracket g are likewise mounted two cylinder sheaves $g^{\times}$. The carriage ropes are applied to their respective pistons conveniently by being led each to its appropriate piston and first over one cylinder sheave $g^{\times}$, then over a piston sheave $G^{\times}$, then over the second cylinder sheave $g^{\times}$, and then over the second piston-sheave $G^{\times}$, and by each having its extremity attached to a keeper conveniently secured to or forming a part of the cylinder $F^{\times}$. The number of sheaves employed and the number of times each rope is carried around its cylinder and piston, will in practice depend upon the relative proportions of said pistons and the bridge upon which the carriage travels, it being desirable that a piston should when forced out to the limit of its movement take up a sufficient length of the rope to occasion the travel of the carriage from one end of the bridge to the other.

H H are pressure supply pipes. These pipes lead one from each of two pressure supply ports i of a valve I, into the respective cylinders behind the pistons, so that the pressure which they supply tends according to the cylinder to which it is applied to force a piston outward. The valve I may be of any preferred construction and may be situated wherever convenient. It is constructed as an ordinary slide valve, having two pressure supply ports i already mentioned, and an exhaust port g' between said supply ports.

J is the pressure supply pipe leading into the valve chamber.

$i^{\times}$ is the valve proper, adapted to control the ports, and provided with a valve stem i^{2} which passes out through a suitable stuffing box in the end of the valve chamber, and is at its outer end secured to the operating handle K.

The handle K is conveniently pivoted to a standard or support L and is provided with a hook k, while the standard is provided with a series of notches l so that the handle may, by the engagement of its hook with a given notch, be locked in given positions to secure the valve in desired adjustments.

In Fig. 1 pressure is supposed to be entering the right hand cylinder, and therefore the piston is being forced outward in the direction of the arrow,—the right hand rope is being taken up by said cylinder and piston,—and consequently the carriage is supposed as being drawn toward the right hand end of the bridge. The valve, to effect this operation, is supposed in the position shown in Fig. 4, with the pressure leading into the right hand pipe H, and the pressure theretofore existing in the left hand cylinder exhausting through the other pipe H, under the valve $i^{\times}$, and out through the exhaust port and its connected pipe. While, therefore, the carriage is being drawn to the right hand side of the building, it takes up or draws with it the left hand rope, and by the consequent pull upon said rope retracts the left hand piston into its cylinder.

When it is desired to occasion the travel of the carriage to the left hand end of the bridge, a correspondingly opposite operation takes place, and by the shifting of the valve-operating handle K the valve is moved to the opposite end of its chamber, the pressure is forced into the left hand cylinder, and the lead given to the exhaust from the right hand cylinder.

It is obvious that when the cylinders are not active the longitudinal position of the carriage upon the bridge is not affected by the travel of the latter, as all the carriage sheaves will run idly against the standing carriage ropes.

It will be apparent that the arrangement of the carriage ropes shown and described, wherein their outer ends are attached to fixed points, and the intermediate portions of the ropes in the form of bights passed around the carriage sheaves is of considerable practical value, inasmuch as if the ends of said rope were attached directly to the carriage both carriage ropes would have to be taken up by the pistons as fast as the bridge approached the end of the building in which said pistons were located, independently of any movement of the carriage upon the bridge,—a condition which would of course render necessary a more

complicated system of motors. In the arrangement to which I resort the amount of rope necessary to be taken up by a piston to effect a given travel of the carriage is invariable whatever the position of the bridge.

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.

I disclaim the combination with a pair of parallel, longitudinal supports, a transverse bridge traveling thereon, and actuating mechanism for said bridge, of a carriage capable of transverse movement along said bridge, a pair of sheaves mounted upon opposite sides of said carriage, a pair of ropes leading from a point exterior to said bridge to the respective ends thereof, thence to and around said sheaves, respectively, thence returning to the respective ends of the bridge, and thence passing to anchoring points exterior to the bridge, said ropes being provided with suitable guiding and supporting pulleys upon the bridge, and actuating devices for said ropes whereby the transverse shifting of the carriage along the bridge is effected, but the bridge movement is permitted without change of position of the carriage relatively to the bridge. My invention, as hereinafter claimed, is limited to the use of a carriage which runs upon the bridge and is thence supported thereby instead of being suspended beneath the bridge by means of the carriage-actuating ropes.

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

1. In combination with bridge tracks, a bridge adapted to travel on said tracks, a carriage adapted to travel on said bridge, two correspondent ropes each of which is at its free extremity affixed to a point of attachment at or near the end of the tracks, is then led in the direction of the length of the bridge tracks to a given end of the bridge, then in to the carriage on said bridge, then out again to the same end of the bridge, and then in the direction of the length of the tracks but away from the point of attachment to a suitable motor, such, for instance, as the hydraulic ram to which it is attached, substantially as set forth.

2. In a crane, the combination of bridge tracks, a bridge adapted to travel on said tracks, a carriage adapted to travel on said bridge, a pair of oppositely acting hydraulic cylinders and pistons connected with a common source of hydraulic supply, and a system of ropes bent about the pistons and cylinders and also about sheaves carried by the carriage, substantially in the manner set forth, and having their free extremities secured to points of fixed attachment, substantially as set forth.

3. In combination with bridge ways, a bridge adapted to travel along said ways, a carriage mounted upon said bridge and adapted to travel along the same, and two carriage ropes both extending along the line of travel of the bridge, one rope at one end of said bridge and the other rope at the other end of said bridge, and each intermediately of its length led in to the carriage, looped around a portion of the same, and led out again, substantially as set forth.

4. In combination with bridge ways, a bridge adapted to travel along said ways, a pair of sheaves at each end of and upon said bridge, a carriage mounted for travel upon said bridge, sheaves mounted on said carriage, and two carriage ropes both extending along the line of travel of the bridge, one existing at one end of the bridge and the other at the other end of said bridge, the intermediate portion of each rope passing over or around one pair of bridge sheaves and in to the carriage and around a given carriage sheave and out again, substantially as set forth.

5. In combination with a pair of hydraulic cylinders and pistons, a bridge, tracks along which said bridge may travel, sheaves mounted upon each end of said bridge, a carriage mounted for travel along said bridge, carriage sheaves, two carriage ropes extending along the line of travel of said bridge at opposite ends thereof, the intermediate portion of each rope passing over or around the bridge sheaves nearest to it and each also around its appropriate carriage sheave, and each rope being fixed as to one end and as to its other end bent upon one of the hydraulic pistons, substantially as set forth.

6. In combination with a bridge, tracks upon which said bridge is adapted to travel, sheaves mounted upon the extremity of said bridge, a carriage mounted for travel along said bridge, carriage sheaves, two carriage ropes extending at opposite ends of the bridge along the line of travel of said bridge, the intermediate portion of each rope passing over or around bridge sheaves and around its appropriate carriage sheave, a pair of hydraulic pistons and cylinders, a valve casing, pipes leading from the valve casing to the hydraulic cylinders, a pipe supplying hydraulic pressure to said valve casing, one extremity of each of the said carriage ropes being led over or bent upon its appropriate one of said hydraulic pistons, 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, 1890.

ERWIN GRAVES.

In presence of—
F. NORMAN DIXON,
LEWIS ALTMAIER.