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J. GRAHAM, Jr. & E. GRAVES.

HYDRAULIC TRAVELING CRANE.

No. 422,399. Patented Mar. 4, 1890.

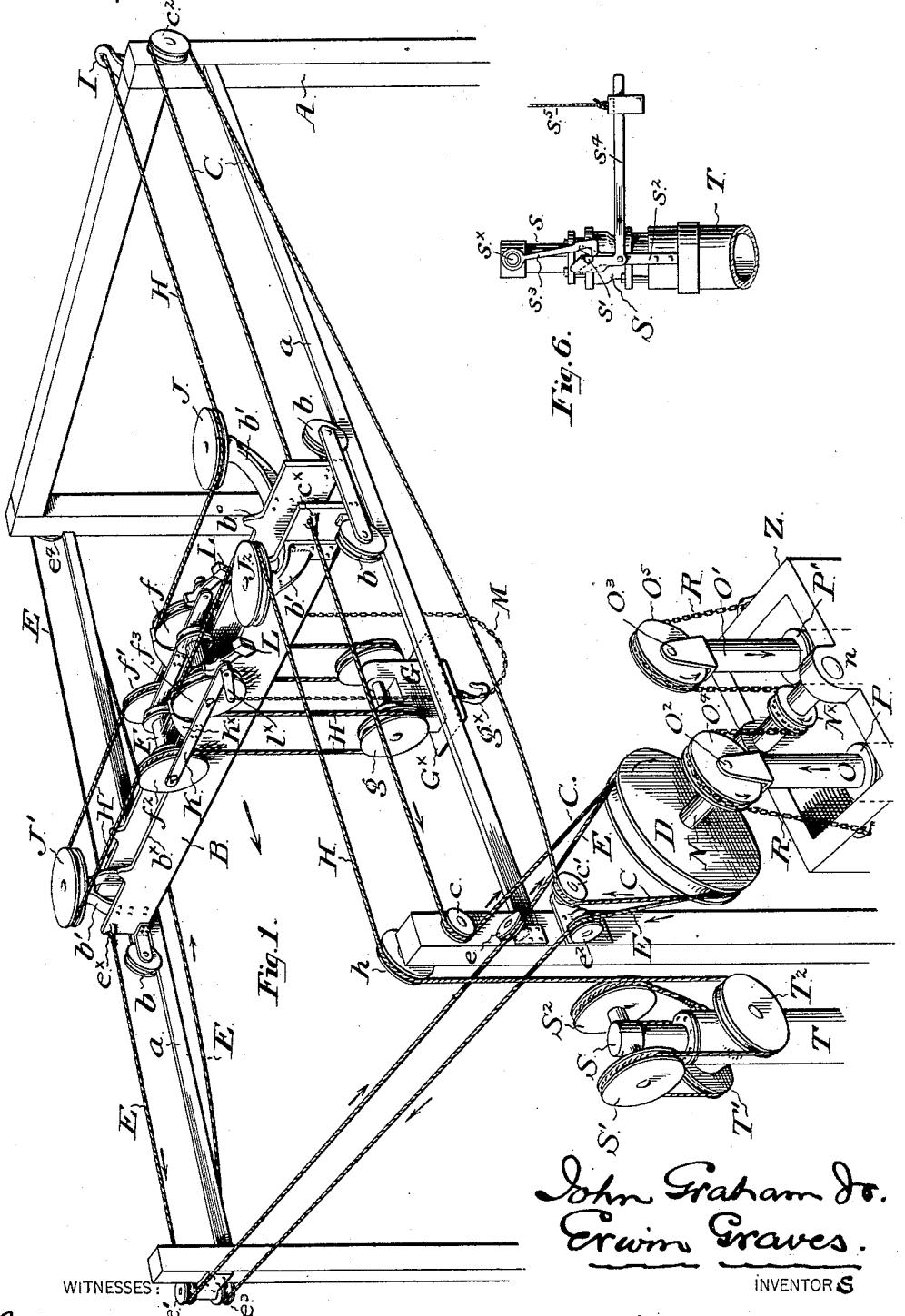

Fig. 1.

Fig. 6.

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Fig. 2.

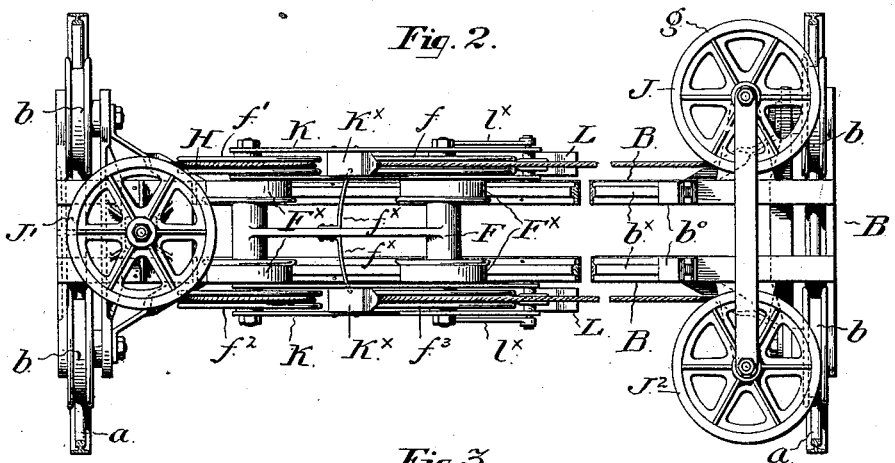

Fig. 3.

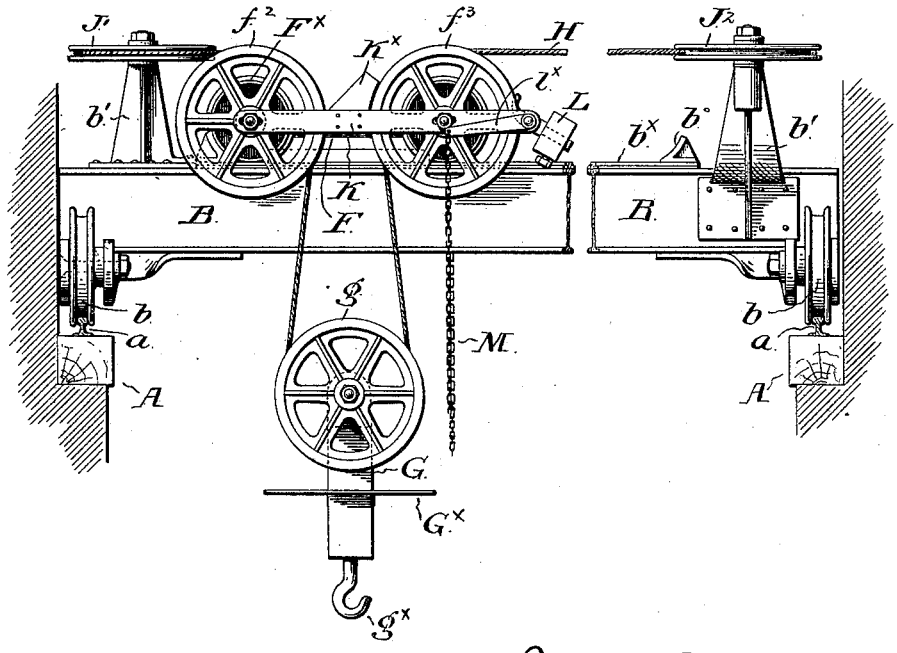

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Fig. 4.

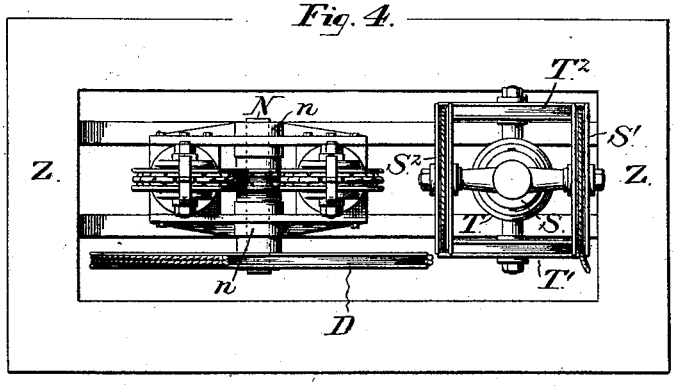
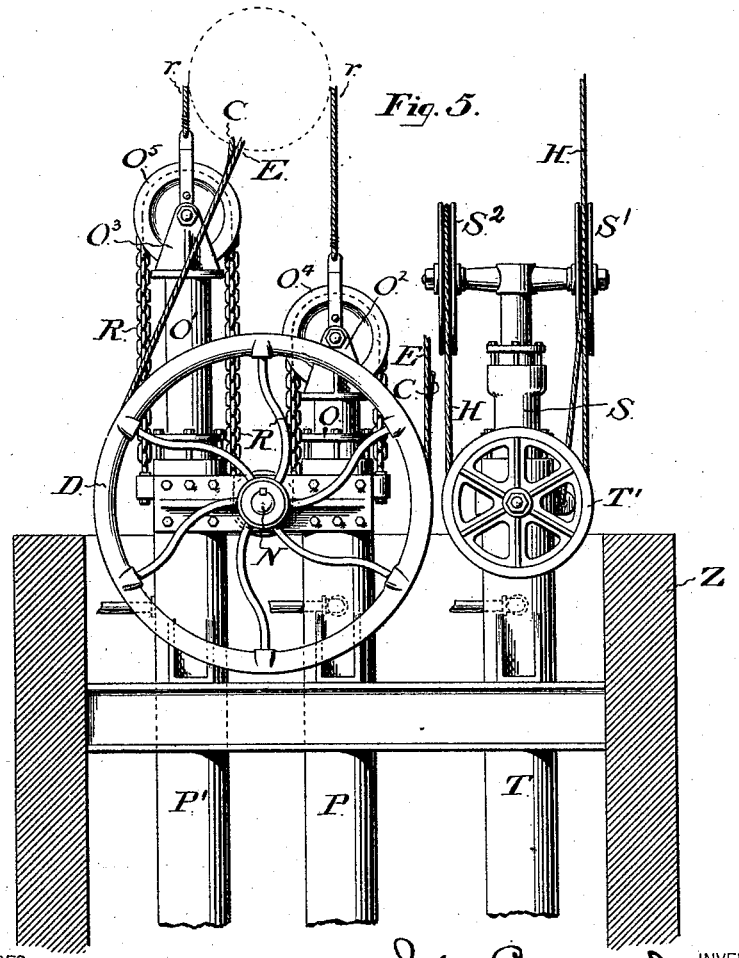


Fig. 5.



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UNITED STATES PATENT OFFICE.

JOHN GRAHAM, JR., AND ERWIN GRAVES, OF CAMDEN, NEW JERSEY.

HYDRAULIC TRAVELING CRANE.

SPECIFICATION forming part of Letters Patent No. 422,399, dated March 4, 1890.

Application filed October 22, 1889. Serial No. 327,824. (No model.)

To all whom it may concern:

Be it known that we JOHN GRAHAM, Jr., and ERWIN GRAVES, both citizens of the United States, and both residents of Camden, in the county of Camden, and State of New Jersey, have jointly invented certain new and useful Improvements in Hydraulic Traveling Cranes, of which the following is a specification.

Our invention comprehends an apparatus designed to elevate from the ground and to transport to different parts of the area over which it extends, such weighty objects as are to be handled in the foundries, engineering works, quarries, and similar places where mechanism of this character is employed.

The object of our invention is to provide a simple and efficient apparatus of the foregoing character, and to utilize in obtaining the power necessary to operate the same a suitably arranged and connected hydraulic engine.

In the accompanying drawings we illustrate and herein we describe a good form of a convenient embodiment of our invention, the particular subject matter claimed as novel being hereinafter definitely specified.

In the drawings, Figure 1 is a view in perspective illustrative of an entire apparatus or plant conveniently embodying our invention. Fig. 2 is a top plan view of the bridge, showing the carriage in place thereon. Fig. 3 is a side elevational view of the bridge and carriage. Fig. 4 is a top plan view of the hydraulic pistons which we utilize as motors, and Fig. 5 is a side elevational view of the same. Fig. 6 is a detail of the hydraulic cylinder and piston operating the fall rope, illustrating the arrangement by which the external piston may be coupled to the internal piston or to the cylinder at will.

Similar letters of reference indicate corresponding parts.

In the drawings, A represents a supporting frame-work, which may be of any convenient form, and which, when the apparatus is erected within a building may be a part of such building. Two ways or rails *a* extend in parallelism from end to end of the frame-work, and upon them rests, and, under suitable actuation, travels, what we term the bridge B. This bridge extends transversely across from rail to rail, and is provided with suitable grooved rollers or wheels *b* which run upon the rails. It is desired to cause this bridge to travel in either direction from end to end of the rails, and this we conveniently accomplish by a pair of bridge cables C and E both of which pass around a motor drum D, and both ends of one of which are oppositely attached to one extremital portion of the bridge, while both ends of the other of which are similarly oppositely attached to the other extremital porton of said bridge. The end portions of each of these cables as they are respectively led to their respective points of attachment to the bridge, are, by means of suitably mounted sheaves or pulleys, so disposed that they respectively approach said bridge in opposite and approximately horizontal directions, and are respectively attached to oppositely disposed hooks or keepers $c^{\times}$ $e^{\times}$ thereon.

In the special arrangement represented in the drawings, that portion of the cable C the end of which is attached to the side of the bridge nearest the drum D, runs over a sheave *c*, and that portion of said cable the end of which is attached to the other side of the bridge runs over the sheaves c' and c^2. While, upon the other hand, that portion of the cable E the end of which is attached to the side of the bridge nearest the drum runs over the sheaves *e* and e', and that portion of said cable the end of which is attached to the other side of said bridge runs over the sheaves e^2 e^3 and e^4. It will be observed from an inspection of the drawings that the sheave c' is not necessary to the working of the apparatus. It is however convenient to employ it. It will, from the foregoing explanation, now be understood that, according to its direction, rotation of the motor drum D will occasion the travel of the bridge in one or the other direction; and that, the cables being bent upon the drum, they will remain taut in any position of the bridge. The body portion of the bridge B supports or embodies carriage ways $b^{\times}$, which are co-extensive with its length, and the ends of which are provided with abutments or stops b°; and said bridge also at points exterior to the abutments supports or embodies arms b', preferably three in number and each of which is equipped

with a horizontal sheave which we term a bridge-sheave. Two of said sheaves J J^2 are situated at opposite sides of the end of the bridge nearest the motor drum, while the other sheave J′ is situated at the other end of the bridge.

F is what we term the carriage, the same being a frame conveniently provided with two pairs of grooved wheels $F^\times$ fitted to run upon the ways $b^\times$. The axles of the wheels $F^\times$ are prolonged so as to project beyond the sides of the bridge, and a vertical carriage sheave is mounted free for rotation upon each end of said axles. A fall block G is employed in connection with the carriage, and is provided with fall sheaves *g*, preferably two in number, with a shield plate $G^\times$, and with a grappling or other hook $g^\times$. The shield plate is provided to protect the sheaves *g* from damage from hot castings engaged by the hook $g^\times$.

The carriage and block are operated through the instrumentality of what we term the fall rope, H, which at its outer end is secured to a bracket I or other fixed point of attachment. From the bracket I this rope passes first about the bridge sheave J, thence through the carriage and fall block by passing over the sheave *f*, under the sheave, *g*, and over sheave *f′*, thence around the bridge-sheave J′, thence again through the carriage and fall block by passing over the sheave f^2, under sheave *g*, and over sheave f^3, thence around bridge sheave J^2, and thence off to a motor, incidentally passing over sheave *h*.

In order to facilitate the manipulation of the carriage and to render its operation as perfect as possible, we provide a braking contrivance, a good form of which is the following: K K are two slide bars one of which is supported on each side of the carriage by means of longitudinal slots formed in them and into which the ends of the axles of the carriage wheels take. By means of the longitudinal form of the slots the bars are capable of a predetermined independent horizontal movement. Each bar is provided with a shoe $K^\times$, conveniently of curved contour as shown, one of said shoes facing the carriage sheave *f* and the other facing the carriage sheave f^3. The bars and their connections are counterparts of each other, and we therefore for simplicity confine the description to but one of them. A bar is conveniently composed of two duplicate members, similarly slotted, and arranged one on each side of the carriage-sheaves appertaining to the side of the carriage to which said composite bar belongs. The shoe mentioned is as to its basal portion disposed between said members and incidentally serves to unite them. At what we term the forward end of the carriage there is provided a pivoted block L conveniently having a curved bearing face which is adapted to make contact with a sheave in connection with which it is mounted, and which is also provided with a rearwardly extending enlarged portion which serves as a counter weight to maintain the block normally out of contact with said sheave. Upon a prolongation of the pivot of the block L is mounted an arm $l^\times$, by which said pivot and block may be rocked. M is an operating rope, or chain, the ends of which are respectively attached to the two arms $l^\times$ with which the carriage is provided. When, therefore, one end of the rope M is pulled to depress a given arm $l^\times$ the curved face of the block of said arm will come into contact with the sheave it faces, and further depression of the arm will, therefore, occasion the drawing forward of the bar K, which, by virtue of its longitudinal slots, slides along, as stated, and carries the shoe mounted on said bar forward until it binds the fall rope against the sheave. $f^\times$, Fig. 2, are two curved spring plates, secured to any convenient part of the frame of the carriage, and each of which is entered in or attached to one of the brake shoes, the resilience of which springs tends to normally maintain said shoes out of contact with the sheaves.

The operation of so much of the apparatus as we have now described will be readily understood. Rotation of the drum D in either direction will, through the instrumentality of the bridge cables, occasion a corresponding travel of the bridge. By such ordinary travel of the bridge the vertical position of the block will be unaffected, the sheaves of the bridge, carriage, and fall block simply rotating idly against the fall rope, which does not then move.

The vertical movement of the fall block is ordinarily effected by the taking in or paying out of the fall rope by the motor with which it is connected. The travel of the bridge may, however, be utilized to occasion the travel of the carriage on the bridge in the following manner:—Assume the motor drum rotating in such direction as to occasion the travel of the bridge in the direction of the arrow in Fig. 1;—If, then, the brake be applied to the sheave *f*, said sheave will cease to rotate, the fall rope will be bound to it, and the pull of the point of attachment I upon said fall rope will, in the travel of the bridge, draw said carriage to the end of the bridge nearest the eye. If on the other hand the brake be applied to the sheave f^3, said sheave will cease to rotate, the fall rope will be bound to it, and the pull of the point of fixed attachment upon said rope will, in the travel of the bridge, tend to draw said carriage to the end of the bridge farthest from the eye in Fig. 1. When the bridge is caused to travel in the direction opposite to that of the arrow of Fig. 1, the fall rope motor at the near end of the fall rope then constituting a point of fixed attachment, the application of either brake will produce an effect the reverse of that described as resulting from its application when the bridge was caused to travel in the direction of the arrow.

Passing now to the consideration of the arrangement of hydraulic motors, especially

shown in Figs. 4 and 5, which, as stated, we employ to actuate the moving device described;—N is the shaft upon which the motor drum D is mounted and with which it rotates. This shaft is provided with a sprocket wheel $N^{\times}$, and is journaled in bearings *n* supported upon an adjacent portion of a framework Z. O O′ are a pair of hydraulic pistons, situated respectively on opposite sides of the wheel $N^{\times}$, and mounted in a pair of hydraulic cylinders P P′, which are each at their bases in communication in the usual manner with separate force-pump-controlled sources of fluid supply. Within pairs of suitable supports O^2 and O^3 formed in any preferred manner upon the upper ends of the pistons, are journaled rollers o^4 and o^5, preferably formed as sprocket or chain wheels. A chain R, the ends of which are fixedly secured to the frame Z passes in endless relationship over the sprocket wheel O^4, under the sprocket wheel $N^{\times}$, and over the sprocket wheel O^5. A rope or chain *r* secured to the upper ends of the pistons passes over a wheel supported overhead. When the lead is given to the pressure into the cylinder P, said pressure is contemporaneously shut off from the piston P′ and the lead given to the exhaust from the latter, with the result that the piston O will ascend and the piston O′ descend, the rope *r* tending to establish a common rate of speed in the two movements. As the piston O ascends it takes up the chain R, and said chain by its engagement with the sprocket wheel $N^{\times}$, as it is drawn toward said piston O, occasions the rotation of said sprocket wheel and consequently of its shaft and connected drum. The chain R is, by the slow descent of the piston O′, accurately held in its engagement with the sprocket wheel. The pistons, O′ O′, are each of such sufficient length, as, when forced upward to the limit of their respective movements, to occasion the travel of the bridge to the end of its tracks in the one or the other direction. It is, therefore apparent, that the pair of hydraulic pistons, belonging as they do to a most economical class of motors, being capable of producing a positive alternating rotation of the drum shaft, and being likewise capable of occasioning a continuous rotation of the drum shaft proportioned to the length of the apartment in which the apparatus is erected,—constitute an efficient engine especially appropriate to this class of apparatus.

The motor employed to operate the fall rope preferably consists of a third hydraulic piston, S, mounted in a hydraulic cylinder T, which latter similarly to the other cylinders, is in communication with a separate force-pump-controlled source of fluid supply. T′ T^2 are two grooved wheels which are stationary in the sense of being incapable of other than rotatory movement, and which, to such end, are conveniently journaled upon studs projecting from opposite sides of the cylinder T. S′ S^2 are two other grooved wheels which are adapted and intended to move up and down with the piston S, and to that end are conveniently journaled upon studs projecting from opposite sides of the top of said piston. The axes of the wheels S′ S^2 are preferably right angular with respect to the axes of the wheels T′ T^2. The inner end portion of the fall-rope passes under the wheel T^2, over the wheel S′, under the wheel T′, over the wheel S^2, and down to a point of fixed attachment, conveniently a stud or projection from the cylinder T. When the lead is given to the pressure into the cylinder T its piston is of course elevated and carries the wheels S′ S^2 away from the wheel T′ T^2, with the result that the fall rope is taken up by and proportionately to the increased separation of said pairs of wheels. As the inner end of the rope is secured to a fixed point of attachment, the only portion of the rope which can be taken up is that between the carriage and the fall block, and as said taking up progresses the fall block is in consequence elevated, and with it any load which may be attached to it. When the lead is given to the exhaust from out said cylinder T, said pairs of wheels S′ S^2, T′ T^2, approach each other and the slack of the rope is taken up by the consequent dropping of the fall block.

In the interest of economy we prefer to provide the piston S with an inner or contained piston *s* in order that when a light load is to be lifted, only such lesser force as may be necessary to lift said smaller piston and lighter load will be brought into action,—and the provision to which we, to such end, resort is in Fig. 6 plainly shown:—In said figure the piston S is provided with a side stud *s′*, a pivot-arm s^2 is attached to the cylinder T, and provided with a hook adapted to engage with the stud *s′*, and also with a weighted projecting arm s^4 by which it is normally kept in engagement with said stud. By this means the larger piston S is held down, and, therefore, when out of action, its normal condition, constitutes in effect a part of the cylinder T. The piston *s* is also provided with a side stud $s^{\times}$, on which is mounted a pendent hook s^3, adapted, when the arm s^2 is disengaged from the stud *s′*, to itself engage said stud, and lock said pistons together so that they may act as one. A cord s^5, may be attached to the arm s^4, and lead to the point at which the valves which control the fluid pressure are located, so that the connection and disconnection of the piston S may be controlled by the person manipulating the valve. If desired a series of these inner and outer pistons may be employed.

Having thus described our invention, we claim:—

1. In combination with tracks, a roller-provided bridge adapted to travel thereupon, a motor drum mounted upon a shaft, ropes leading from said drum to opposite sides of the bridge, a chain wheel also mounted upon said shaft, a pair of hydraulic pistons and cylinders, chain wheels mounted upon said

pistons, and a chain in engagement with said three chain wheels, substantially as set forth.

2. In combination with tracks, a roller-provided bridge embodying carriage ways and adapted to travel on said tracks, a drum, ropes leading from said drum to opposite sides of said bridge, a motor for operating said drum, a carriage provided with sheaves, a fall block provided with sheaves, and a fall rope one end of which is attached to a point of fixed attachment, the intermediate portion of which is engaged with the sheaves of the carriage and fall block, and a motor to which the other end of the fall rope is connected, substantially as set forth.

3. In combination with tracks, a roller-provided bridge embodying carriage ways and adapted to travel on said tracks, a motor drum, ropes leading from said drum to opposite sides of said bridge, a motor for operating said drum, a carriage provided with sheaves, a fall block provided with sheaves, a fall rope engaged with the sheaves of the carriage and fall block, and a hydraulic cylinder and piston, adapted to operate said fall rope, substantially as set forth.

4. In combination with tracks, a roller-provided bridge embodying carriage ways and adapted to travel on said tracks, a drum, ropes leading from said drum to opposite sides of said bridge, a motor for operating said drum, a carriage provided with sheaves, a fall block provided with sheaves, a wheel-provided hydraulic cylinder, a wheel-provided piston mounted in said cylinder, and a fall rope engaged with the sheaves of the carriage and fall block and also engaged with the wheels of said piston and cylinder, substantially as set forth.

5. In combination with tracks, a roller-provided bridge embodying carriage ways and adapted to travel on said tracks, a drum, ropes leading from said drum to opposite sides of said bridge, a motor for operating said drum, a carriage provided with sheaves, a fall block provided with sheaves, a wheel-provided hydraulic cylinder, two pistons one within the other situated within said cylinder, rope wheels mounted upon the upper end of the inner cylinder, means for at will locking the exterior piston to the interior piston or to the cylinder, and a fall rope engaged with the sheaves of the carriage and fall block and also engaged with alternate rope wheels of the piston and cylinder, substantially as set forth.

6. In combination with tracks, a roller-provided bridge embodying carriage ways and adapted to travel on said tracks, a drum, ropes leading from said drum to opposite sides of said bridge, a motor for operating said drum, a carriage provided with sheaves, a fall block provided with sheaves, a hydraulic cylinder provided with rope wheels, two pistons one within the other situated within said cylinder, a projection attached to the exterior cylinder, hooks connected respectively with the inner piston and the cylinder and adapted to engage said projection, rope wheels mounted upon the upper end of the inner cylinder, and a fall rope engaged with the sheaves of the carriage and fall block and also engaged with alternate rope wheels of the piston and cylinder, substantially as set forth.

7. In combination with tracks, a roller-provided bridge embodying carriage ways and adapted to travel on said tracks, a drum, ropes leading from said drum to opposite sides of said bridge, a motor for operating said drum, a carriage provided with sheaves, brakes adapted to control carriage sheaves, a fall block provided with sheaves, and a fall rope one end of which is attached to a point of fixed attachment and the intermediate portion of which is engaged with the sheaves of the carriage and fall block, and a motor to which the other end of the fall block rope is connected, substantially as set forth.

8. In combination with tracks, a bridge embodying carriage ways, provided with sheaves and rollers, and adapted to travel on said tracks, a drum, ropes leading from said drum to opposite sides of said bridge, a motor for operating said drum, a carriage provided with wheels and sheaves, a sliding bar provided with a brake shoe adapted to be carried by the movement of said bar into and out of contact with a carriage sheave, a weighted block mounted upon said bar, adapted to move into and out of contact with the side of the sheave opposite to that with which the brake shoe makes contact, an operating arm connected to said block, a fall block provided with sheaves, a fall rope one end of which is attached to a point of fixed support, and the intermediate portion of which is engaged with the sheaves of the carriage and fall block, and a motor to which the fall block rope is connected, substantially as set forth.

9. In combination with tracks, a roller-provided bridge embodying carriage ways and adapted to travel on said tracks, a motor drum mounted upon a shaft, ropes leading from said drum to opposite sides of the bridge, a chain wheel also mounted upon said shaft, a pair of hydraulic pistons and cylinders, chain wheels mounted upon said pistons, a chain in engagement with said three chain wheels, a carriage provided with sheaves, a fall block provided with sheaves, a hydraulic cylinder provided with rope wheels, a piston mounted in said cylinder and also provided with rope wheels, and a fall rope engaged with the sheaves of the carriage and the fall block and also engaged with alternate wheels of said piston and cylinder, substantially as set forth.

10. In combination with tracks, a roller-provided bridge embodying carriage ways and adapted to travel on said tracks, a motor drum mounted upon a shaft, ropes leading from said drum to opposite sides of the bridge, a chain wheel also mounted upon said

shaft, a pair of hydraulic pistons and cylinders, chain wheels mounted upon said pistons, a chain in engagement with said three chain wheels, a carriage provided with sheaves and brakes, a fall block provided with sheaves, a hydraulic cylinder provided with rope wheels, a piston mounted in said cylinder and also provided with rope wheels, and a fall rope engaged with the sheaves of the carriage and fall block and also engaged with alternate wheels of said piston and cylinder, substantially as set forth.

11. In combination with tracks, a roller-provided bridge embodying carriage ways and adapted to travel on said tracks, a motor drum mounted upon a shaft, ropes leading from said drum to opposite sides of the bridge, a chain wheel also mounted upon said shaft, a pair of hydraulic pistons and cylinders, chain wheels mounted upon said pistons, a chain in engagement with said three chain wheels, a carriage provided with sheaves, a fall block provided with sheaves, a hydraulic cylinder provided with rope wheels, two pistons, an outer and an inner, mounted in said cylinder, means for at will locking the outer piston to the inner or to the cylinder, rope wheels mounted in connection with said pistons, and a fall rope engaged with the sheaves of the carriage and fall block and also engaged with alternate wheels of said piston and cylinder, substantially as set forth.

In testimony that we claim the foregoing as our invention we have hereunto set our hands this 21st day of October, 1889.

JNO. GRAHAM, JR.
ERWIN GRAVES.

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