(No Model.)

3 Sheets—Sheet 1.

A. E. BROWN.

HOISTING AND CONVEYING MACHINE.

No. 281,446. Patented July 17, 1883.

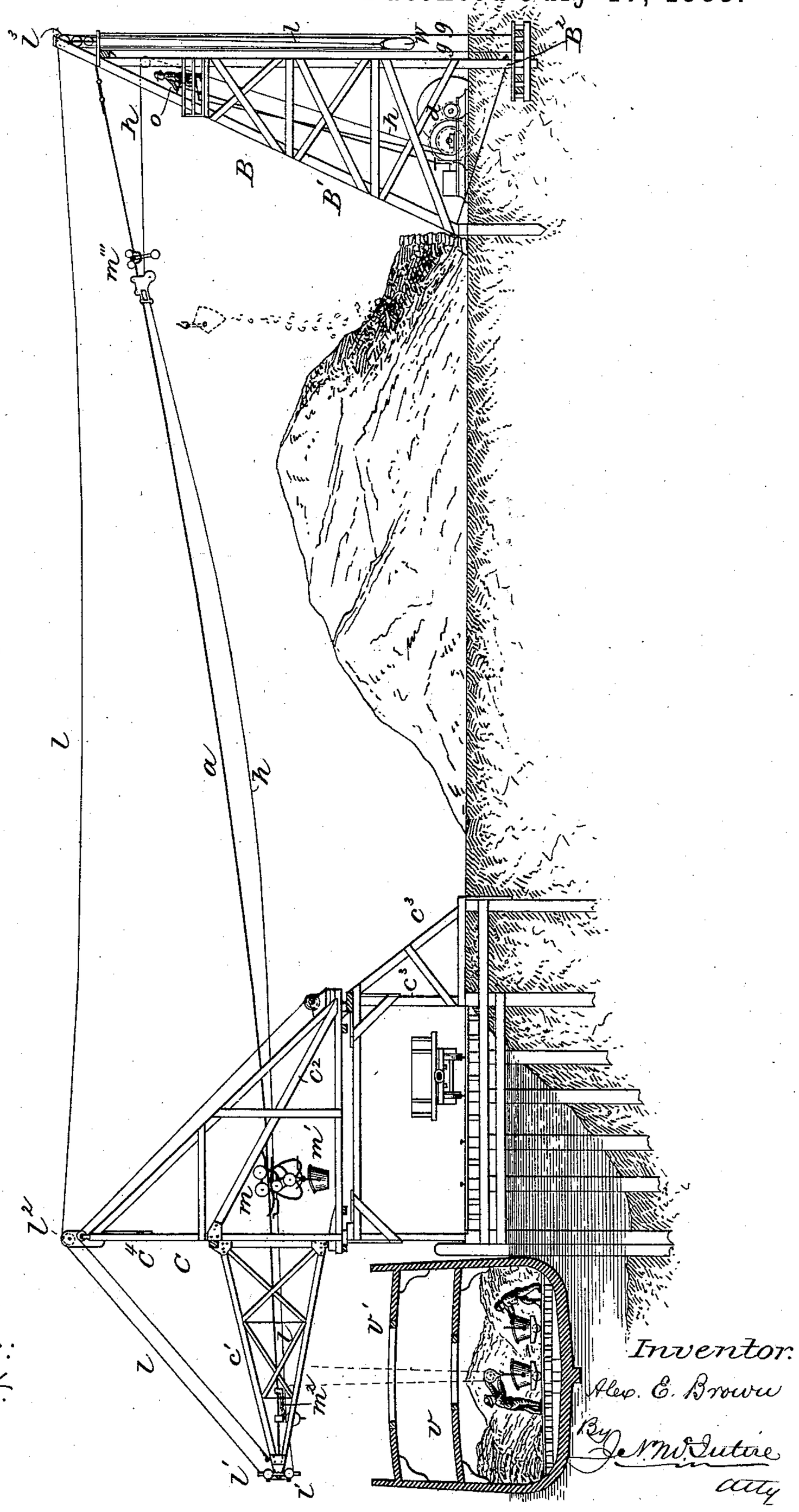

Fig. 1.

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Inventor:
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(No Model.) 3 Sheets—Sheet 2.

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Fig. 2.

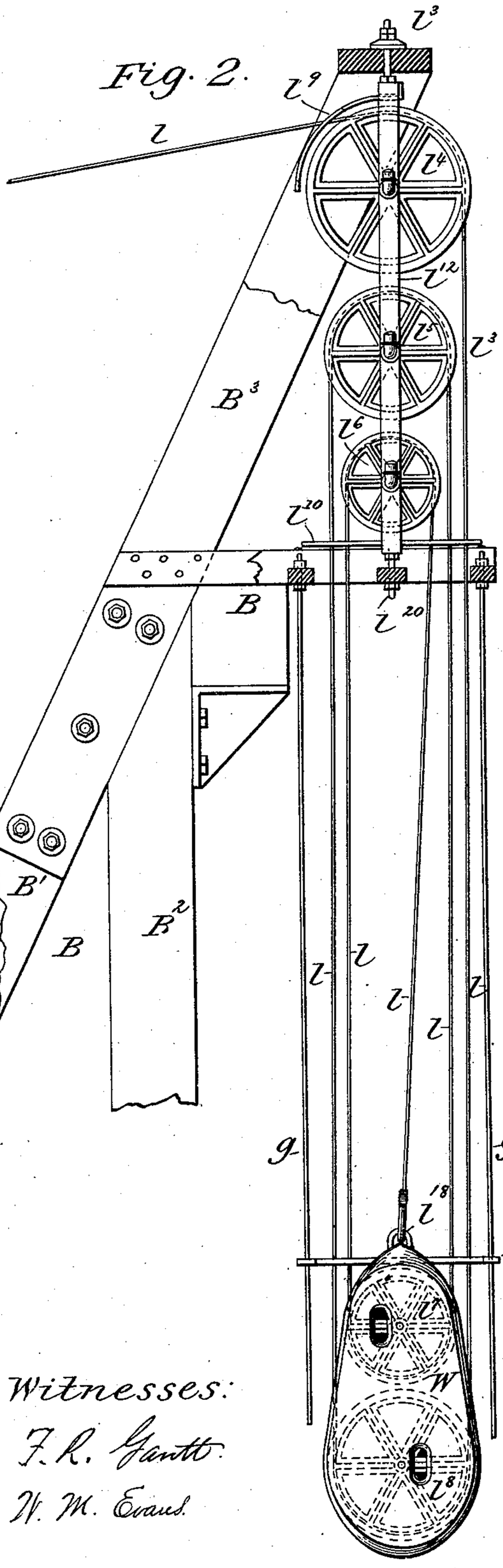


Fig. 3.

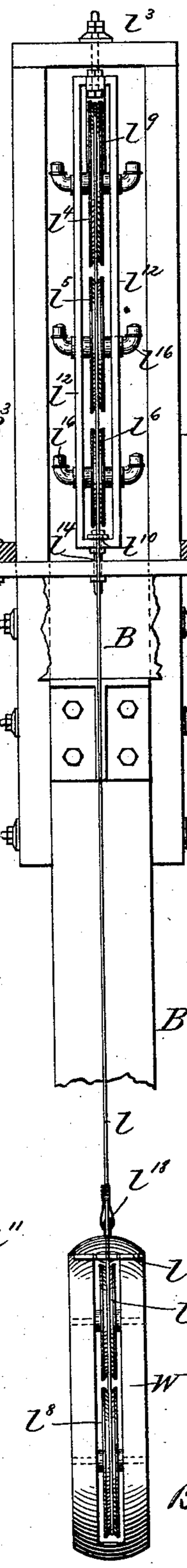
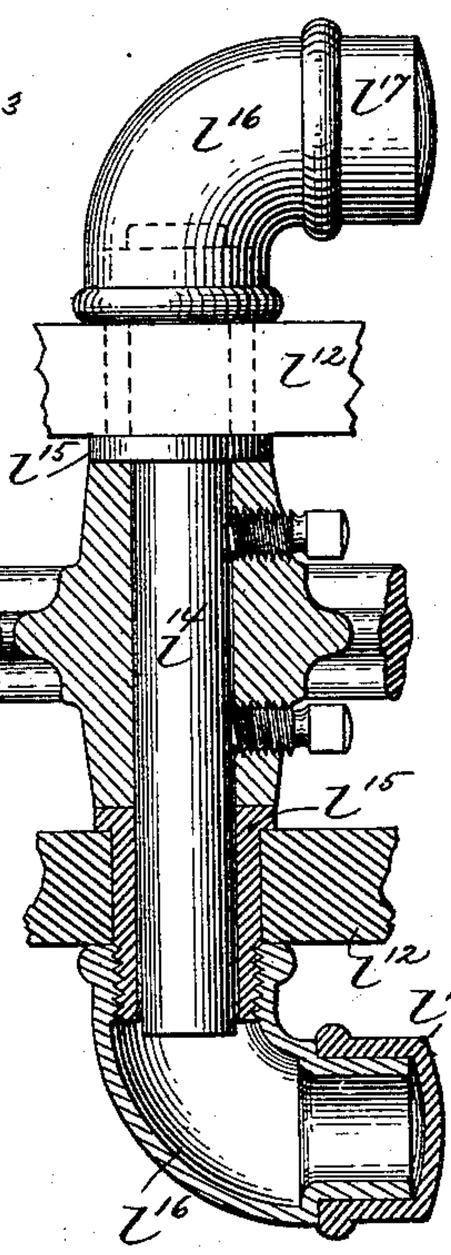


Fig. 4.



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(No Model.) 3 Sheets—Sheet 3.

A. E. BROWN.

HOISTING AND CONVEYING MACHINE.

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Fig. 6.

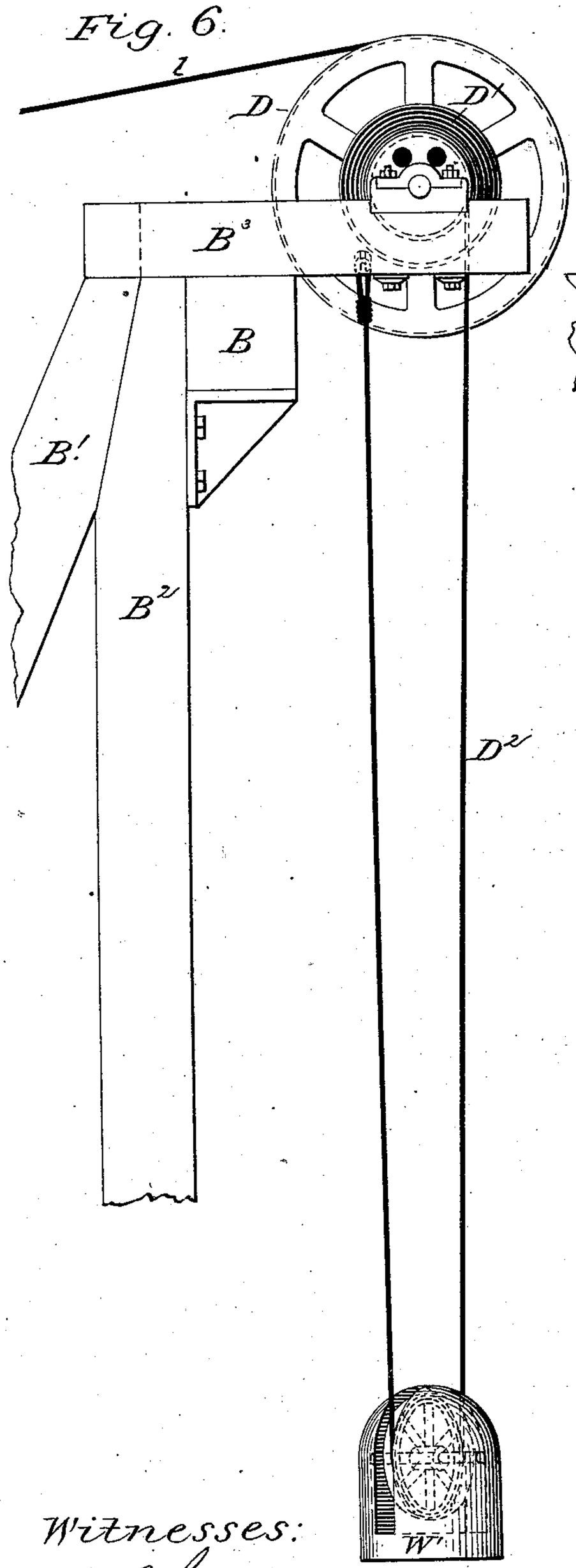
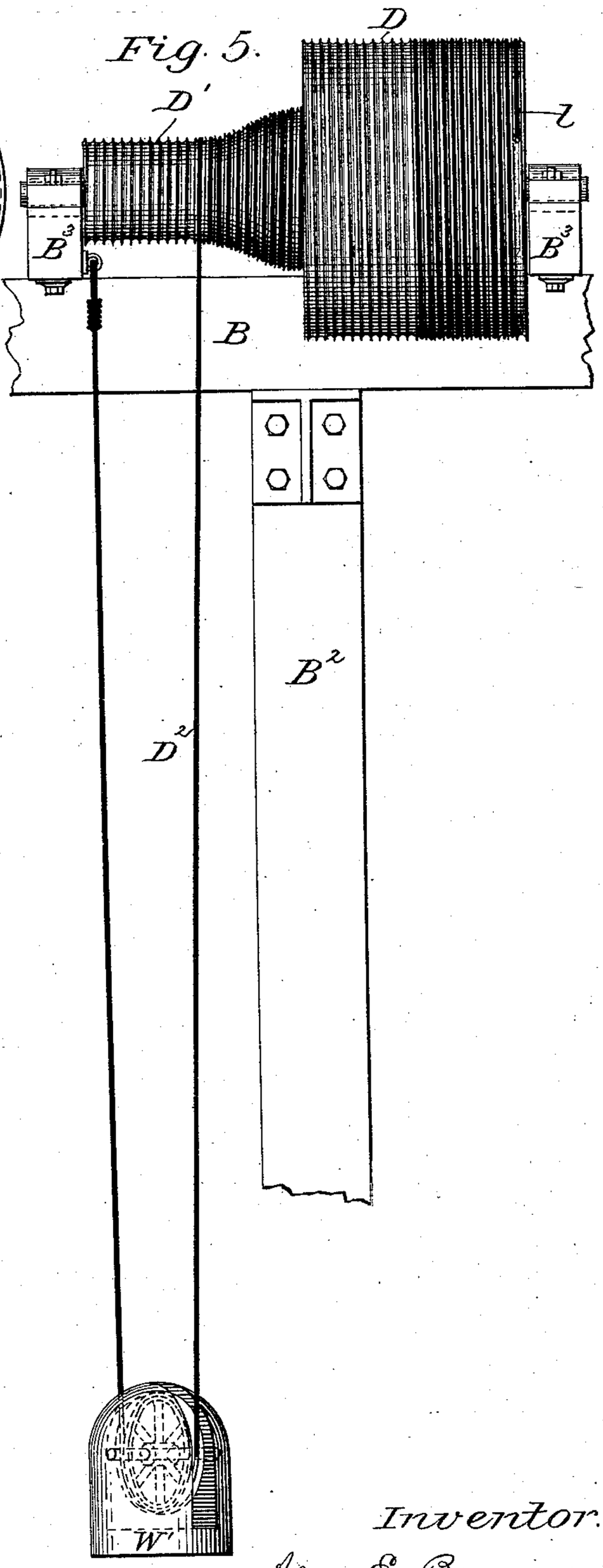


Fig. 5.



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UNITED STATES PATENT OFFICE.

ALEXANDER E. BROWN, OF CLEVELAND, OHIO.

HOISTING AND CONVEYING MACHINE.

SPECIFICATION forming part of Letters Patent No. 281,446, dated July 17, 1883.

Application filed April 26, 1883. (No model.)

To all whom it may concern:

Be it known that I, ALEXANDER EPHRAIM BROWN, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Hoisting and Conveying Machines; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, making part of this specification.

My invention relates to certain improvements in hoisting and conveying machines that are designed to operate on cable or wire tramways of limited length, and where the motions of said machine, in hoisting and conveying along on such tramways, are designed to be produced and controlled by means of the hoist-rope of said machine, the said rope being manipulated at a point distant from the machine.

Ordinarily, machines of this class are designed to work on tramways which are suspended at an angle or a grade with a horizontal line, in order that one of the movements of the machine along the tramway shall be produced by the action of gravity upon the traveling carriage or machine, while the reverse movement (up the grade) is produced by the pull of the hoist-rope of the machine. In the common form of this class of tramways is employed a tightly-stretched rod or wire rope between two piers of unequal heights. This grade varies in every part of the length of the cable, determined by the curve due to the natural sag of the same. The grade of this cable tramway is still further affected by the concentrated load of the machine as it travels along the different parts of the tramway. The greater the concentrated load of the machine the greater will be the variation of the grade of the cable out of its natural curve. From these considerations it may be easily seen that at a point near the lower end of a suspended cable tramway the grade will be much less than that at points nearer the higher end, and if the weight of the machine and its load be near the lower end of this tramway there may be produced so much sag at this point that there will be an upgrade from the machine to the extreme lower end of the cable, and in practice generally the average grade of this class of tramways is such that this upgrade against the travel of the carriage near the lower end of the cable nearly always occurs with heavy loads; or if there is not an upgrade produced, the downgrade will be so small as to cause little or no tendency of the machine to travel to the lower end of the cable. Again, the hoist-rope of the machine at all times exerts a back pull on the machine, due to its weight, and it is evident that the longer this hoist-rope is the greater will be the back pull on the machine; and in most cases this back pull of the hoist-rope as it pays out will be sufficient to counteract all tendency of the machine to run downgrade long before the machine reaches the lower end or limit of the cable tramway. In consequence of these facts, cable tramways as heretofore used (particularly those of the class mentioned) could not be employed where it was requisite for the machine to travel over the entire length of the tramway, or to the extreme lower end of the same, because the dead or lowest sag point of the cable, produced by the machine and its load on said cable, was so far from the lower end of the tramway as to leave a large portion of the same useless. For these reasons cable tramways have not heretofore been successfully used in places where it was necessary that the machine should travel beyond this dead or sag point—such places, for instance, as in unloading vessels, where the downgrade end of the cable should be at the vessel and project over it in order to reach the center of the hatch of the same, as shown in Fig. 1.

Now, my invention has for its main object to overcome all these difficulties successfully and cause the machine to travel throughout the entire length of the tramway with ease and rapidity, even though the latter may have formed in it a considerable upgrade (against the run of the machine) at the lower or vessel end of the tramway.

To this main end and object my invention consists in the employment of a counter-weight suitably suspended to some frame-work (ordinarily to one or the other of the two piers of the cable or track) by means of a block and pulleys or drums of proper shape and form, the free end of the line or rope which suspends this counter-weight being so arranged with reference to the tramway and machine, and so connected thereto, as to always exert a

pull upon the machine-carriage along the tramway in a direction opposed to the pull of the hoist-rope of the same. The sheaves or drums and lines of this counter-weight may be so proportioned that the machine in its travel upgrade will lift the counter-weight any desired proportional distance to that moved over by the machine—as, for instance, the counter-weight may have five pulleys or sheaves over which the counter-weight line passes, making thus a distance of one foot raised of the counter-weight for every five feet of run upgrade of the machine. This proportion is the one I ordinarily use in practice with this class of tramways.

In the accompanying drawings, Figure 1 is a side elevation of a cable tramway and its piers, illustrating the unloading of a vessel, and having embodied therein my invention. Figs. 2 and 3 show, respectively, enlarged detail side and end elevations of counter-weight blocks and their connections to the top of back pier frame-work. Fig. 4 shows an enlarged sectional view of the journal of the sheaves of the pulley-block frame. Figs. 5 and 6 show, respectively, side and end elevations of a modified form of counter-weight attachment.

In Figs. 1, 2, 3, and 4 the same part will be found designated by the same letter of reference.

a is the wire-rope tramway, stretched between the rear upgrade pier, B, and the vessel end or downgrade pier *c*.

c' is a hinged frame so arranged that, when desired, it may be lowered over the vessel *v*, carrying with it the end of the cable tramway *a*, which is permanently secured to the end of this projecting bridge or frame. From Fig. 1 it will be seen that the cable tramway projects over and across the hatch *v'* of the vessel *v*. (Shown in section.) The frame-work c^2 and c^3, as is plainly seen, forms an abutment to act against the pull of the cable tramway of this front pier, as do also the parts B' and B^2 of the back pier, B. The hoist-rope of the machine *h* passes over the sheave of the upgrade-stop m^3 to the hoist-drum of the engine D, which is controlled by the operator at *o*.

m' is a bucket or load suspended from the hoisting and conveying machine carriage *m*.

m^2 is a downgrade-stop clamped to the cable tramway at the proper position over the hatch of the vessel to cause the change of motion of the load or bucket of the machine from the motion along the tramway to one vertically into the vessel or from the vessel, as the case may be. The upgrade-stop m^3 serves a like purpose of changing the horizontal motion of the load of the machine along the cable to a vertically raising or lowering direction; or it serves as the means of automatically dumping the load at any desired point along the tramway. The movements of the machine *m* and its load along the tramway from the downgrade-stop to the upgrade-stop are produced by the pull of the hoist-rope *h*, and are controlled by the operator at *o*. The reverse motion of the machine downgrade to the stop m^2 over the vessel (in this case) is produced partially by gravity and partially by the pull of the counter-weight line *l*, which is attached to the machine-carriage, and passes thence over guide-sheaves *l* on the end of the projecting frame *c'*, and the top sheave, l^2, on the frame, (on the top of the pier-timber c^4,) and from thence to the sheave-block l^3 on top of the back pier, B, over the sheaves in the counter-weight *w*, to which the end is fastened.

g g, Fig. 2, are guide-rods for the counter-weight *w*.

From this arrangement of parts it will be readily seen that any desired pull may be produced at all times in a downgrade direction on the machine *m* by properly proportioning the weight *w*, in its extent of travel, to that of the machine *m* along the tramway. The amount of the pull of the counter-weight line *l* on the machine *m* may be determined by the desired sag to be allowed in the hoist-rope *h* when it is fully paid out; or it may be determined in reference to the grade of the tramway *a*, if the sag of the hoist-rope *h* is of no material consideration; but it should be enough to cause sufficient tension on the hoist-rope *h* to overcome its back pull, plus the friction of the machine and its parts, and any upgrade there may be against the machine at the lower end of the tramway *a*. Thus with the weight properly proportioned it is evident that there is always a tension on the hoist-rope *h*. For all positions and motions of the machine *m* up and down the tramway *a* the machine is always under the perfect control of the operator at *o*, since he has perfect control, through the action of the engine and drum *p*, of the hoist-rope *h*. It is also evident that with the weight *w* of sufficient amount the machine *m* will start and move, when allowed, by the paying out of the hoist-rope *h* to the extreme limit of the downgrade end of the tramway—that is, it will even start from the dead or sag point of the tramway and run to the stop m^2 over the vessel *v* as certainly as if it started on the steep grade of the cable, as at m^3. From this it will be seen that the whole length of the cable tramway, by the use of my invention, may be utilized for the run of the carriage or machine.

It is evident that in rail or trestle tramways that have little or no downgrade, this counter-weight, properly arranged in connection with the hoisting-machine, might be used solely to cause the run of the machine in the opposite direction to the pull of the hoist-rope; and while I do not wish it to be understood that my invention is applicable only to cable tramways, yet it is designed more particularly for them, as the ordinary conditions in practice are such that rail or trestle tramways can be built with sufficient grade to cause the necessary downgrade motion of the machine without the aid of a counter-weight arrangement, while with the cable tramway it is entirely different, it being very unusual to

have the grade sufficient of itself to allow the machine to work by gravity alone throughout its entire length. In the movements of the machine *m* up and down the tramway *a* it is evident that there may occur many times sudden starts and reversals of its motion, thus instantaneously acting on counter-weight line *l*, causing the counter-weight *w* to raise or lower, as the case may be. In practice I make the counter-weight rope *l* usually small or light in comparison with the hoist-rope *h*, and therefore, if it be subjected to too sudden or too great strains, it would be liable to rupture or to break if this strain were as suddenly transferred to the heavy counter-weight *w*. To render an accident of this kind impossible, I prefer to place my counter-weight blocks *l'* and *w* at some distance from the front pier or lower end of the tramway, as in Fig. 1, where I have shown the weight suspended from the back pier, B. It will be seen from this that the counter-weight line *l* must span the distance from l^2 to l^3, between the front and back piers, and that as this length of counter-weight line is of considerable weight it will have as much natural sag as will just balance the pull on it due to the counter-weight. Now, any increase of pull on the line or any addition to the counter-weight will have the effect of reducing the deflection of this free span of this line. The first effect of any sudden pull on the end of this line will be simply to diminish the deflection of the line *l*, instead of overcoming instantly the momentum or inertia of the weight *w*, and from this it will be seen that this free span from l^2 to l^3 of this counter-weight line *l* will act in the same manner as a very perfect spring in transmitting strains to the counter-weight *w*. Therefore all the strains due to the pull of the machine on the counter-weight line *l* are transferred gradually in overcoming the inertia of the counter-weight *w*. Consequently there is no liability of this line breaking on account of any sudden or unusual motions and stoppages of the machine *m*.

In the pulley-block l^3 the sheaves l^4 l^5 l^6 are all arranged in the same plane, as are also the sheaves l^7 l^8, which I prefer to place in the weight *w* itself, which is so constructed as to constitute the counter-weight and block combined. The sheaves l^4, l^5, l^6, l^7, and l^8 are graded in size, in order that the vertical lines *l l*, &c., may be as nearly parallel as possible. The frame l^{12} of the pulley-block l^3 is composed of a bar of iron made into the oblong shape shown, and to the top of it is fastened the slotted rope-guide l^9, and to the bottom a similar guide, l^{10}. This block l^3 is suspended from the frame-timbers or their equivalent, B^3, by means of a bolt and washer. The bolt l^{20} holds the lower end of this frame in position, and serves also as a pivot for same.

Fig. 4 shows a detail sectional view of the journal of the sheaves in this pulley-block frame l^{12}. l^{14} shows the pin of the sheaves, which is tightly set-screwed, so as to turn with the sheaves, but loose in the bushings l^{15}, which pass through the frame l^{12}, as shown. These bushings project through the frame l^{12}, and have on their projecting outer ends threads to receive the interiorly-threaded elbows l^{16}. These elbows, screwing up tight to the frame, hold these journal-bushings securely in place, and at the same time act as oil-cups to lubricate the running parts. l^{17} is a cap to this elbow or oil-cup.

The weight *w* is cast in the form shown, and its sides are drilled to receive the pins of the sheaves l^7 and l^8. Oil-chambers may be cast in the sides of this weight, through which the sheave-pins may be kept lubricated for a considerable time. l^{11} is a slotted guide for the ropes *l l*, and also for the weight itself by means of the guide-rods *g g*. l^{18} is an eye in the top of counter-weight *w*, to which is fastened one end of the counter-weight line, as shown. This arrangement and construction of counter-weight, block, and pulleys I have put into thoroughly successful practice. I do not wish it to be understood that I limit myself to this special form or arrangement of counter-weight, block, and pulleys, nor to any special detail of construction or mode of application to the machine, for the counter-weight may be placed on the front pier, or at any other desired place. Even the free span l^2 l^3 may be dispensed with by substituting for it, as an equivalent, a suitable cushion or spring connected to either the sheave-block l^3 or to the weight *w* itself in such a way as to relieve any jars or sudden pulls on the counter-weight rope *l* that may occur. For the counter-weight arrangement shown in Figs. 2 and 3 suitable drums or drum-cone and weight may be substituted, as shown in side and end elevation in Figs. 5 and 6. The line *l* from the machine in Figs. 5 and 6 is connected to the drum D, upon which it may wind or unwind in the different movements of the machine along the cable.

D′ is a properly-proportioned drum or cone-drum on the same shaft with the drum D. From this small drum the counter-weight *w* may be either directly suspended by the line D^2, or the weight itself may have one or more pulleys, as shown, and the end of the line be fastened to the frame shown. With this arrangement any pull on the line *l* will tend to raise the weight *w* by unwinding the line *l* from the drum D and winding up the line D^2 upon the drum D′, and, inversely, any slacking of the line *l* will cause the weight *w'* to lower and the line *l* to wind upon the drum D and the unwinding of the line D^2. By this arrangement of drum and cone and counter-weight almost any desired variable pull upon the carriage-frame *m* may be produced, as well as a constant amount, as is the case with the arrangement shown at Figs. 2 and 3. For instance, if it be desired to reduce the downgrade pull of the line *l* upon the machine as the machine ascends the higher or steeper grades of the tramway *a*, this may be easily done by a construction and arrangement such as shown at Figs. 5 and 6, where D is a cylinder or drum, and D′ is a properly-

constructed drum and cone. The relative diameters at the different points of the drum D′ to the drum D determine the relative pull of the line *l* to the counter-weight *w*′—that is, as the line *l*, through the travel of the machine upgrade, pays off from the drum D, it winds the rope D^2 of the counter-weight onto the cone-drum D′. Now, as the diameter D′ lessens as D^2 winds upon it, the leverage of the counter-weight on the drum D in the same proportion diminishes, and consequently the pull upon the line *l* is less as the machine ascends up grade.

From the foregoing it will be seen that various constructions or arrangements of my invention may be made, and yet embody the gist of my improvements.

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

1. The combination, with a cable tramway, and a conveying or hoisting and conveying machine adapted to travel upwardly upon said tramway by the pull of the hoist-rope of the same, of a counter-weight so constructed and arranged with reference to the said tramway, and so connected to the said conveying or hoisting and conveying machine frame, that by means of a suitable rope or ropes said counter-weight exerts at all times a pull upon the machine in opposition to the hoist-rope of the same, substantially as and for the purposes herein described.

2. In combination with the piers and cable tramway, a conveying or hoisting and conveying machine or carriage and a counter-weight so connected (by means of a suitable rope) with the machine or carriage as to always cause a pull on said machine in opposition to the hoist or pulling-up rope of same, and so situated in respect to the tramway-machine and piers that the rope from the counter-weight to the machine will have a free span of considerable length for the purpose of relieving all sudden jars or shocks, as described.

3. In combination with a hoisting and conveying machine cable tramway arranged to project over the vessel by means of a suitable bridge, beam, or apron, a sheave or sheaves connected to the end of said bridge, beam, or apron, and a counter-weight with its sheaves and rope so arranged and connected to the hoisting and conveying machine as to relieve all sudden jars or shocks, as described, the pulling-rope of said counter-weight, however, passing from the machine over the sheave or sheaves on the end of the projecting bridge, beam, or apron, and thence to the counter-weight, as and for the purpose herein set forth.

4. The sheave-block *l*, with one or more sheaves, constructed and arranged as herein set forth.

5. A counter-weight *w*, so constructed and arranged as to form a combined weight and sheave-block, substantially as described.

In witness whereof I have hereunto set my hand and seal this 23d day of April, 1883.

ALEXANDER EPHRAIM BROWN. [L. S.]

Witnesses:

SAML. GIBBONS,

GOTTLIEB GENDER.