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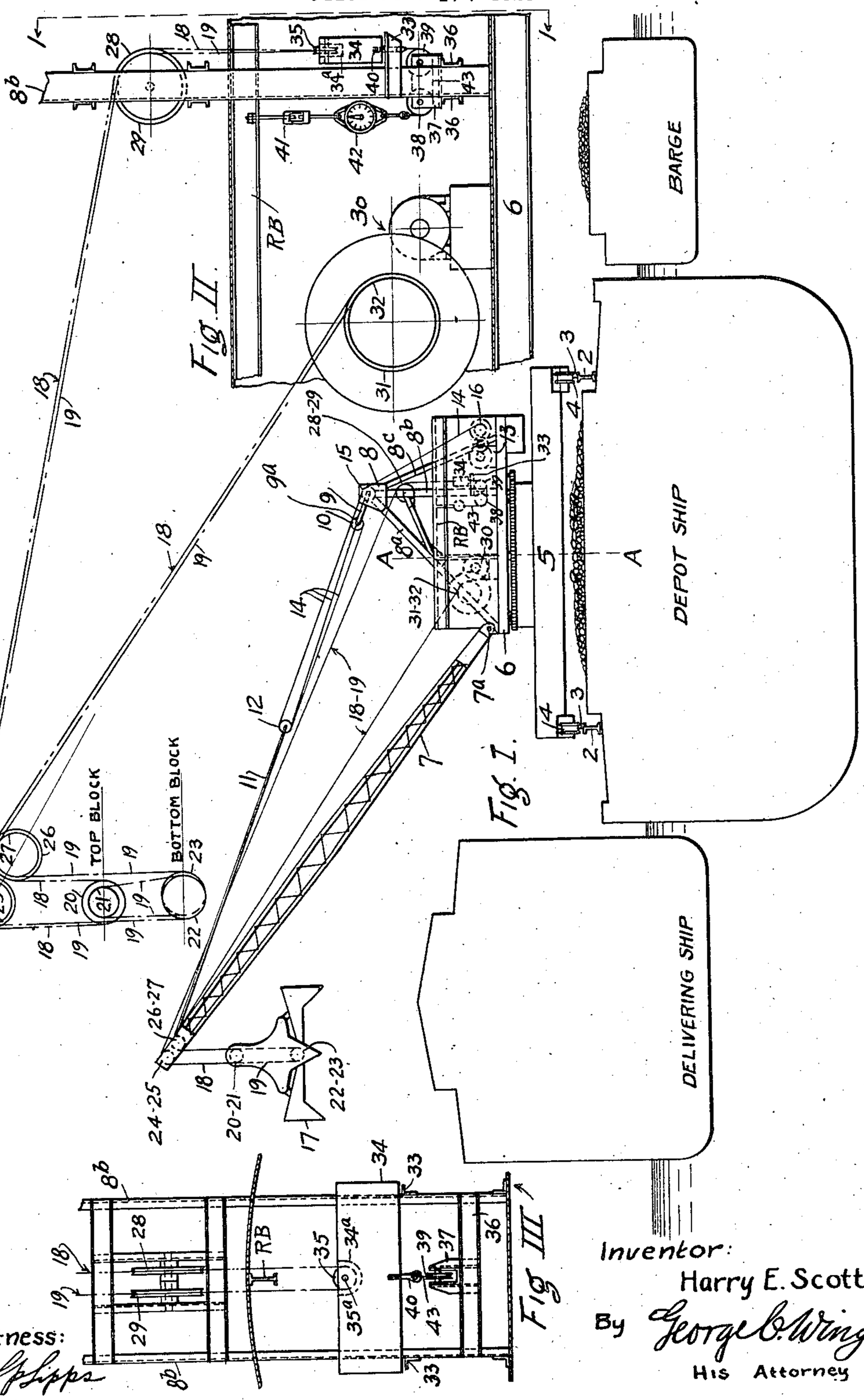

FIG. I.

FIG. II.

FIG. III.

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UNITED STATES PATENT OFFICE.

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MEANS FOR WEIGHING LOADS.

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To all whom it may concern:

Be it known that I, HARRY E. SCOTT, a citizen of the United States, residing in the city of Cleveland, county of Cuyahoga, and State of Ohio, have invented a new and useful Means for Weighing Loads, of which the following is a full, clear, and exact description, reference being made to the accompanying drawings, which form a part of the specifications, wherein similar parts are designated by the same numerals in each case.

The invention relates to and comprises such forms of machines and mechanisms as overhead cranes, man-trolleys, rope systems, bridge tramways, and boom cranes of all kinds, wherein loads are hoisted or lowered vertically by means of load-sustaining pulley-systems and winding drums, and, with appropriate adaptations, it is directly applicable to any such.

In order to understandingly illustrate the invention for the purpose of this application, I have taken a form of the invention that is represented in a combination of the same with a revolvable crane, a class of hoisting machine where a boom is hinged to one side of the supporting frame, and is movable vertically about such point.

In consequence of the variable radii of the booms however, as well as the changeable relation of the same to the crane body itself, such machines are neccessarily provided with special ballast so disposed upon the body as to counter balance the overhang of the boom when at certain points of its vertical or horizontal movement.

Such type of machine therefore, will not only be serviceable in explaining the invention in its broader sense, but, because of the ballast feature peculiar to that type, will further illustrate particular combinations, covered by corresponding claims I make, wherein such feature is a distinguishing element.

In respect to such particular combinations, as will be manifest from what later appears, the bucket counterpoise, being always a precise and separate unitary mass of less weight than required for the counterweight of the crane, is itself arranged to take the place of a corresponding portion of the last named counterweight, thereby advantageously cooperating, in a patentable sense, with the machine it improves.

Similarly, the arrangement for directing the boom hoisting ropes and the load sustaining ropes, downwardly to their respective anchorages, over sheaves that are located in line with or at substantially, a common point, is another patentable advantage of the invention when applied to hoisting machinery characterized by movable booms.

In the drawing, Fig. I shows a boom-crane, whose mechanisms are arranged according to the objectives of the invention, mounted upon the deck of a boat or depot ship. The "barge" is the source of supply and the "delivering ship" is the boat that is to be served by the crane on the "depot ship." Fig. II is an enlarged fragmentary view of the bucket hoisting and weighing mechanisms indicated in Fig. I, and Fig. III is a view of Fig. II viewed from the rear, or, in the directions indicated by the arrows at line 1, 1.

2, 2 are track-girders mounted upon the deck of the depot ship.

3, 3 are T-rails mounted upon track-girders 2, 2 and on which wheels 4, 4, of a sub-frame or truck 5, are adapted to travel.

Mounted upon the sub-frame 5 and adapted to rotate about the axis A, A is a superstructure 6 provided with a boom 7 and a back-stay 8.

The back-stay 8 is made up of component members 8^a, 8^b, and 8^c.

A bridle 9 carrying sheaves 10 is fastened to the apex of the back-stay 8.

The boom 7 is pivotally fastened to the superstructure 6 at 7^a and carries at its outer end one end of a back-stay rod 11.

Sheaves 12, 12 are located at the inner end of the rod 11.

Mechanism for hoisting and lowering the boom is located at 13 in the cab of the superstructure 6.

A boom hoisting and lowering rope 14 is fastened to the bridle 9 at 9^a and extends to the underside of one of the sheaves 12; passing around the same it extends to and around the sheave 10, thence forward to and around the other sheave 12, thence to and over a sheave 15 located at the apex of the back-stay, thence downwardly and to the rear to a drum 16, for the boom hoisting and lowering mechanism located at 13, to which mechanism the rope is secured.

A grab bucket 17 is shown as suspended from the head of the boom by ropes 18 and 19.

20 and 21 are sheaves in the top-block of the grab bucket.

22 and 23 are sheaves in the bottom-block of the grab bucket.

24, 25, 26 and 27 are sheaves in the head of the boom, and 28 and 29 are sheaves in the back stay.

By thus locating the sheaves 28 and 29 in as close proximity as practicable to the sheave 15, the leads of the load hoisting ropes 18 and 19 will be nearly parallel with and adjacent to those of the boom hoist-rope 14, and the force and pull due to the bucket counterpoise 34, for this reason will serve as an auxilliary force for holding up the boom. In consequence a smaller size of boom hoisting motor, and a corresponding reduction of the amount of electrical current, is made possible.

Hoisting mechanism 30, located upon the superstructure to the rear of the boom-foot 7^a, is provided with rope drums 31 and 32.

Fastened to the back-stay member 8^b, near its lower end, are counterweight rests or supports 33, 33 that, at times, support a bucket-counterweight or poise 34. To eliminate the tare from the dynamometer readings, this counterweight should be heavy enough to balance a weight in the nature of tare, represented by the bucket, and its rope and tackle when lowered below the boom to a predetermined distance. The weight of the counterweight 34, in the arrangement shown, will therefore be one half such tare.

A mortise 34^a extending into the counterweight 34 from the top surface, and centrally thereof, accommodates a sheave 35 which is held in place by the axle 35^a. When the bucket counterweight 34 is located vertically below the back-stay 8, as indicated, it will be in position to counterpoise the crane itself and, to such extent, will also serve in place of special ballast for the purpose.

In Fig. II the several sheaves and drums are shown with different diameters to more clearly illustrate the diagram.

The rope 18 is fastened at its one end to the rope-drum 31 and extends to and over the sheave 26 at the head of the boom, thence downwardly to and around the top-block sheave 20, thence upwardly to and over the boom-head sheave 24, thence backwardly to and over the backstay sheave 28, thence downwardly to and under the counterweight sheave 35. This rope 18, is known as the bucket sustaining rope.

The rope 19, known as the bucket closing and opening rope, is fastened at its one end to the drum 32 and extends to and over the boomhead sheave 27, thence downwardly to and around the bottom-block sheave 23, thence upwardly to and around the top-block sheave 21, thence downwardly to and around the bottom-block sheave 22, thence upwardly to and over the boomhead sheave 25, thence backwardly to and over the backstay sheave 29, thence downwardly to and under the counterweight or equalizing sheave 35.

In the drawing the ropes 18 and 19 are shown as one continuous rope extending from the drums over the system of sheaves with a bight hanging from the rear of the backstay sheaves 28 and 29 in which the equalizing sheave 35 in the counterweight 34 is hung. Separate or individual bucket ropes may be used instead of a continuous rope. If separate ropes are used it will be necessary to provide other means for equalizing the rope. A swingletree equalizer would answer the purpose.

In a boom-crane rope-and-sheave system of the kind shown and described, the forces produced by the bucket and its load are resisted by the dead-end and live-end anchorages of the ropes. Each anchorage sustains half of the tare or half of the tare and load as the case may be. Since the dead-end of the ropes 18 and 19 carry only half of the material load it will, of course, be necessary to so calibrate the dynamometer that it will register twice the amount it actually weighs, and since the counterweight 34 is designed to carry or equalize only half the weight of the empty bucket, as explained, and none of the material load, an anchorage must be provided to hold the counterweight to a predetermined limit of travel in order to counteract the force produced by the weight of the material load. In the illustrations, the ridgebeam RB of the cab on the superstructure is used as such an anchorage. The floor beams, in some cases, might afford a convenient anchorage.

Cross-beams 36, 36 near the bottom of the back-stay members 8^b, 8^b, carrying a sheave-support 37 whose sheaves 38 and 39 stand in a plane that passes through the ridge beam and the axle 35^a at right angles to the plane of the sheave 35 in the counterweight 34, the sheave 39 having that part of its score that is diametrically away from the sheave 38 tangent to the plane that passes through the sheave 35.

On the underside of the counterweight 34, and in the plane just referred to, an eye-bolt 40 is fastened.

Directly above the sheave 38 and in line with that part of its score that is diametrically opposite the sheave 39 a turn-buckle-rod 41 is suspended from the anchorage RB.

A dynamometer, or other weighing mechanism 42, is supported by the rod 41. A rope, or other flexible connection 43, is fastened at its one end to the eye-bolt 40 and passes down under the sheaves 39 and 38, then up to the dynamometer where its other end is operatively fastened to the same.

It is obvious from the foregoing descrip-

tion that when the bucket is lowered onto a pile of material to gather a load the counter-weight 34 will descend until it encounters the stops 33, 33 where it will rest until the bucket is hoisted off the pile. As soon as the bucket, with a load, has been hoisted clear of the material and is freely suspended by the ropes 18 and 19, the stops 33, 33 will be relieved of the weight of the counterweight and the dynamometer will register the weight of the material in the bucket, which of course will be that portion of the total load sustained that is not balanced by the counterweight 34.

If the dynamometer is calibrated or adjusted to read zero when the bucket is in a predetermined position with relation to the boom-head, and, if all the readings are made when the bucket has reached approximately that position and is there held for the purpose, the best results will be had.

A modified form of the dead-end side of the rope system may be had by eliminating the counterweight 34, in which case, the rope 43 would have to be attached to a sheave-case of the sheave 35. The form first described is the better and more practical one because a smaller capacity dynamometer can be used as the counterweight 34 absorbs the tare load, also any shock, such as, for instance, the dropping of the bucket and catching it on the lines 18 and 19, would be partially absorbed by the counterweight, eliminating undue and excessive strains on the dynamometer.

Although the connection between the counterpoise 34, and the suspended weighing mechanism 42, is shown as flexible, it is not intended to limit the invention, in its broader scope, to that form; any other arrangement that has a certain degree of lost motion, and is not rigid, or integral with the parts joined, will equally comprise the idea involved.

Having described my said invention and shown and explained a concrete application of the same, what I claim and wish to protect by Letters Patent, is as follows:—

1. A means for weighing the loads of hoisting and lowering machines in transit, comprising the combination, on such machines, of a winding drum, a freely disposed counterweight of suitable weight to balance the tare of the loads sustained, bucket sheaves, a boom, a load-sustaining pulley system having the rope-member thereof operatively reaved through the bucket sheaves to be sustained and the head of the boom, with its live end attached to said winding drum, and its dead end connected to said counter weight, together with means for limiting the downward travel of said counterweight to a predetermined point, and mechanism, in operative relation to said counterweight, for measuring the force exerted by the load during any upward movements of the counterweight from said point, substantially as shown and described.

2. In revolvable cranes, a means for weighing the loads in transit, comprising the combination of a winding drum, bucket sheaves, a counterweight of suitable weight to balance the tare of the loads sustained, a boom freely disposed at a predetermined limit of downward travel with respect to the same, a load-sustaining pulley system having rope-members leading from the winding drum through the bucket sheaves and sheaves at the head of the boom, backwardly to and over sheaves at an elevated point on the superstructure of the crane, and thence downwardly to and into supporting connection with the counterweight, together with suitable mechanism on the crane, in operative relation with the counterweight, for measuring the dynamic force of the load during the upward movement of the counterweight from its stated limit and place, substantially as shown and described.

3. In a revolvable crane having a vertically movable boom and a pulley system for raising and lowering the same with the rope-member thereof leading over an elevated sheave on the superstructure of the crane, downwardly to a winding drum for the same, the combination, with a second winding drum on the crane, a counterweight freely disposed below said sheave at a predetermined limit of travel with respect to the crane, bucket sheaves, a load-sustaining pulley system having rope-members leading from the second drum through the bucket sheaves and sheaves at the head of the boom for the purpose, backwardly to and over sheaves at a point on the superstructure of the crane in close proximity to said elevated sheave, and thence downwardly to and into supporting connection with said counterweight, the said counterweight being of sufficient weight to balance the tare of the loads when freely suspended by said load-sustaining pulley system, together with suitable mechanism on the crane, operatively related to the counterweight, for measuring the dynamic force of the load sustained during the upward movements of the counterweight from its stated limit and place, substantially as shown and described.

4. In revolvable cranes, a means for weighing the loads in transit, comprising the combination of a winding drum, a boom, a counterweight against the overturning movement of the crane, having a separable portion thereof that is freely disposed at a predetermined limit of downward travel with respect to the crane, and of suitable weight to balance the tare of the load when freely suspended against the same by the load-sustaining pulley system hereinafter

specified, a load-sustaining pulley system having a rope-member that leads from said winding drum through the bucket sheaves and sheaves at the head of the boom provided for the purpose, backwardly to and over sheaves provided for the purpose at an elevated point on the superstructure of the crane, and thence downwardly to and into supporting connections with said separable portion, together with suitable mechanism on the crane, in operative relation to said portion for measuring the dynamic force of the loads during the upward movements of the counterweight separable portion from its stated limit and place, substantially as shown and described.

5. In a movable crane having a vertically movable boom and a pulley-system for raising and lowering the same with the rope member thereof leading over an elevated sheave on the superstructure of the crane downwardly to winding drum provided for the purpose, the combination of a counterweight against the overturning movement of the load having a separable portion thereof that is freely disposed at a predetermined limit of downward travel with respect to the crane, and of a suitable weight to balance the tare of the load when freely suspended against the same by the load-sustaining pulley system hereinafter specified, winding drums for the rope-members of said pulley system last above named, a load sustaining pulley system having rope-members that lead from their winding drums, through the bucket sheaves, and sheaves at the head of the boom provided for the purpose, backwardly to and over sheaves provided for the purpose at a point on the superstructure of the crane, in close proximity to said elevated sheave, and thence downwardly to and into supporting connection with said separable portion, together with suitable mechanism on the crane, in operative relation to said portion, for measuring the dynamic force of the loads during the upward movements of said counterweight portion from its stated limit and place.

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Witnesses:
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