

No. 683,246.

Patented Sept. 24, 1901.

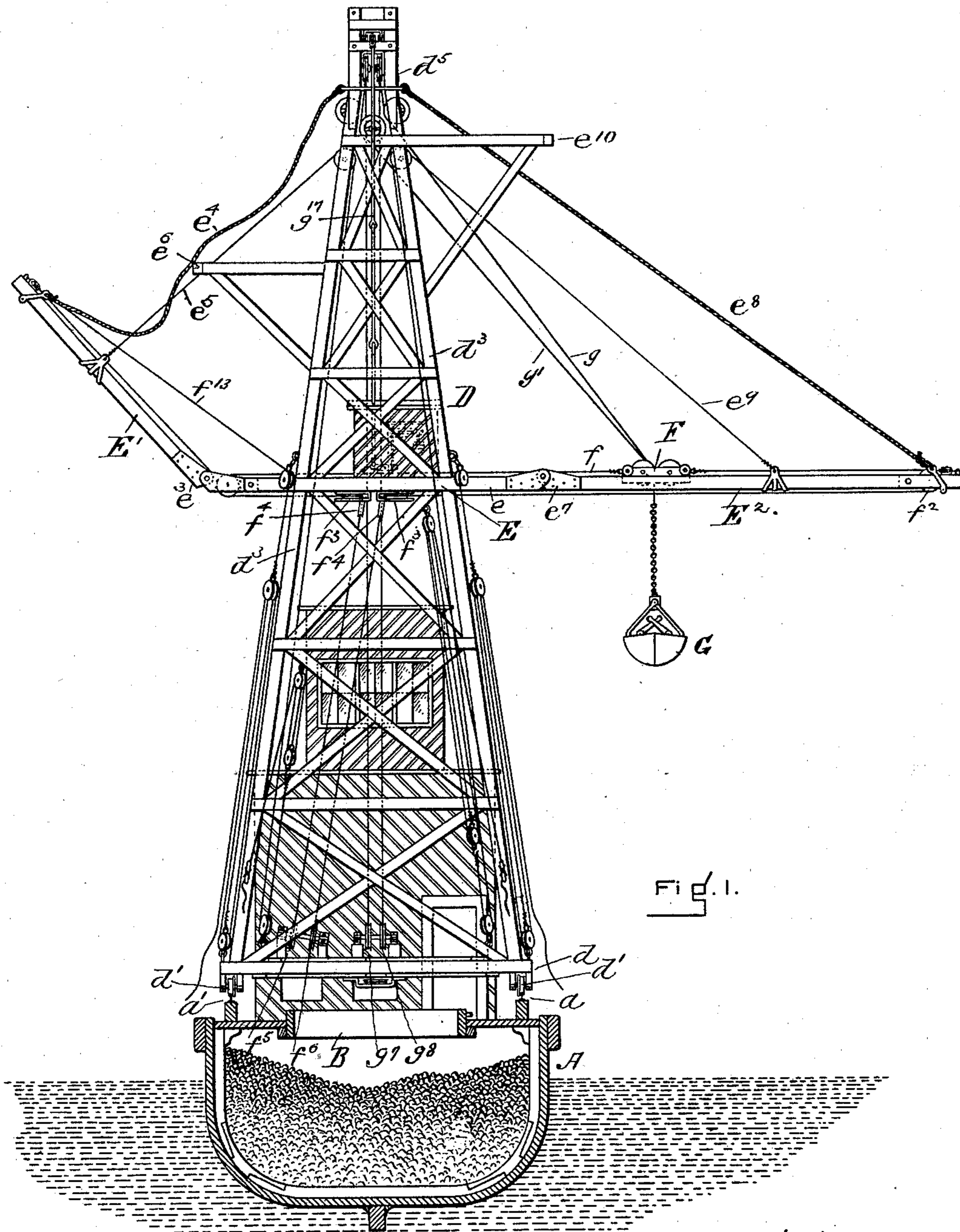
J. CAMPBELL.

LIGHTER OR BARGE FOR HANDLING COAL OR OTHER MATERIAL.

(Application filed Nov. 16, 1900.)

(No Model.)

7 Sheets—Sheet 1.



WITNESSES:

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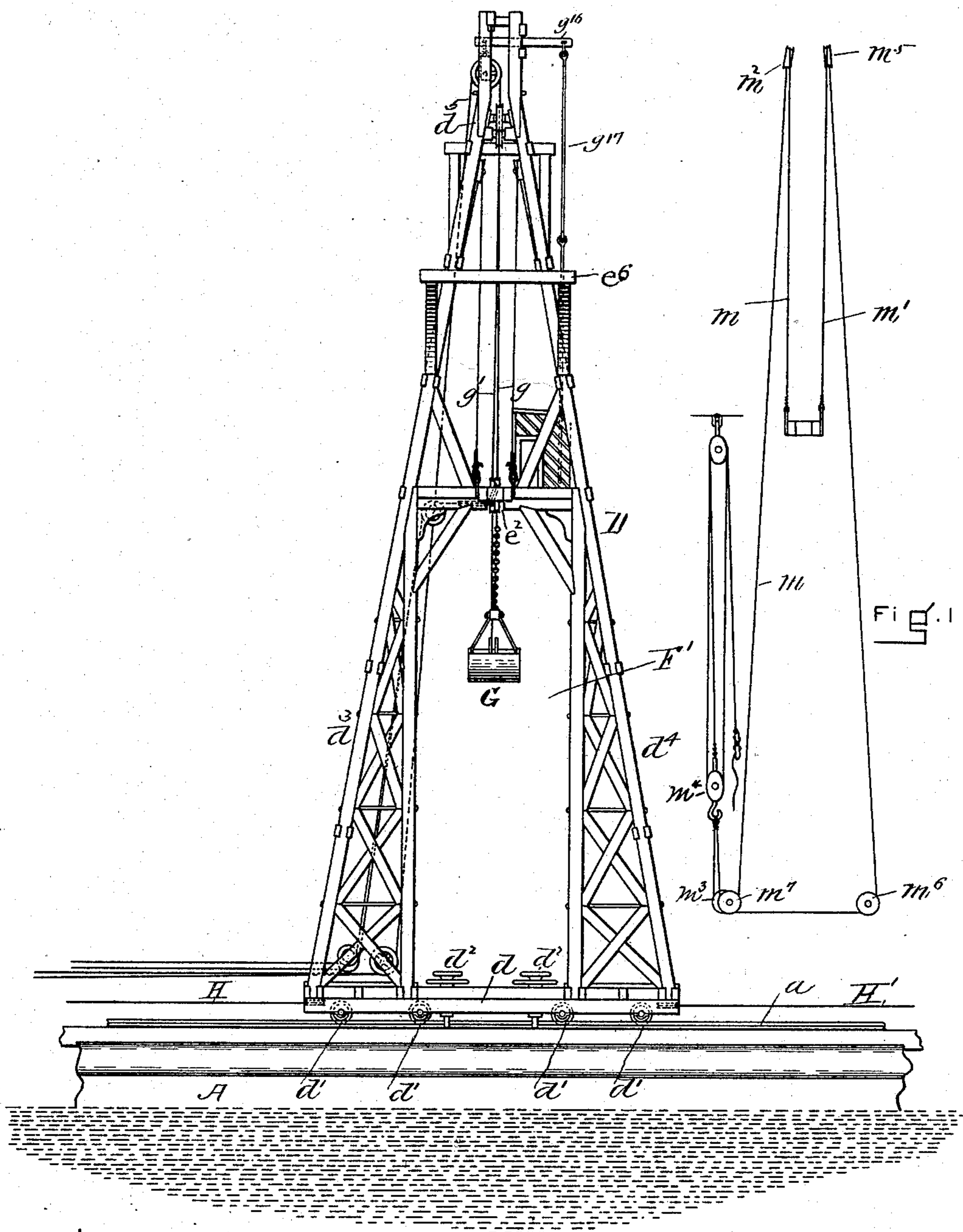
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7 Sheets—Sheet 2.



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Fig. 2.

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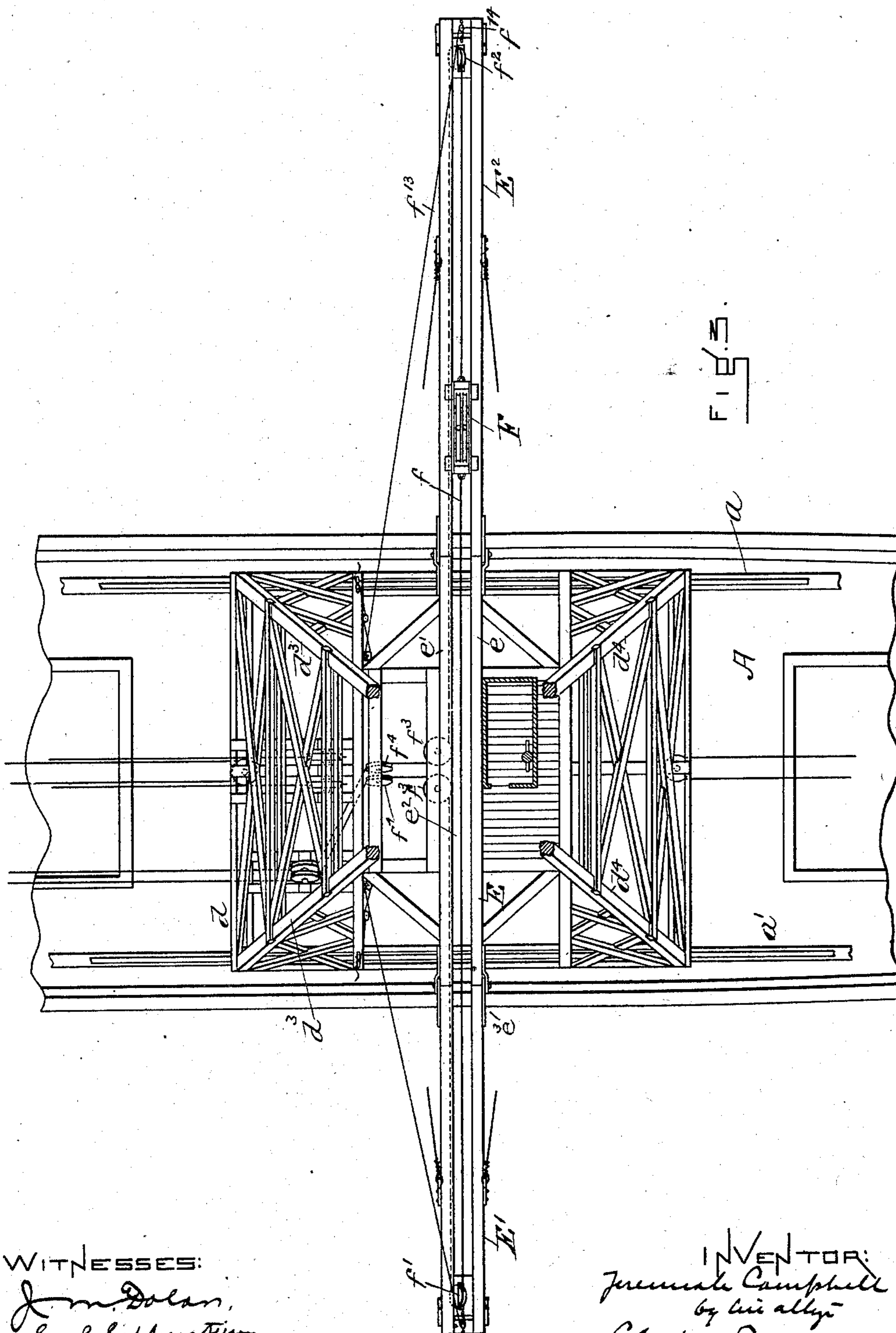
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7 Sheets—Sheet 3.



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7 Sheets—Sheet 4.

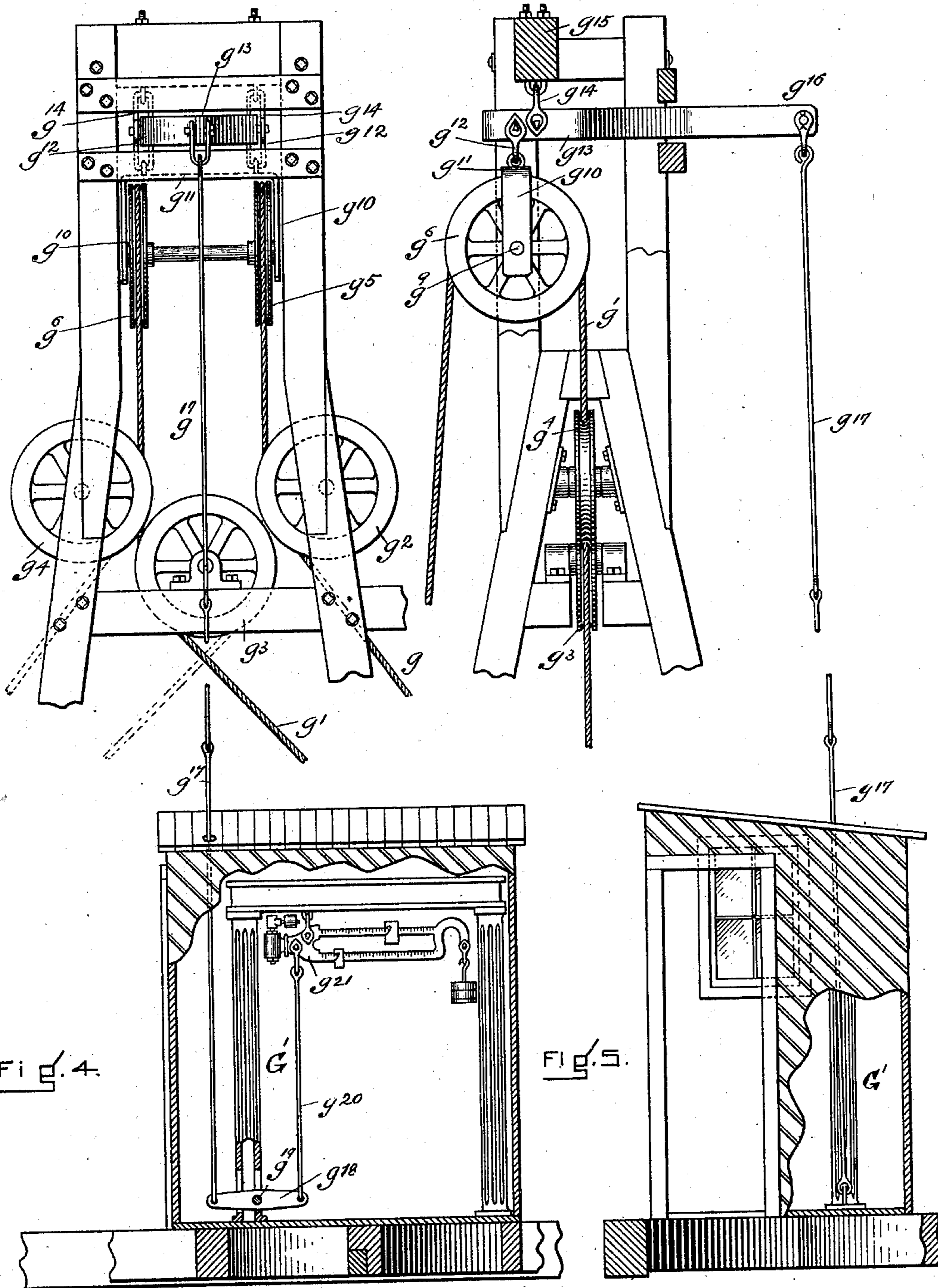


FIG. 4.

FIG. 5.

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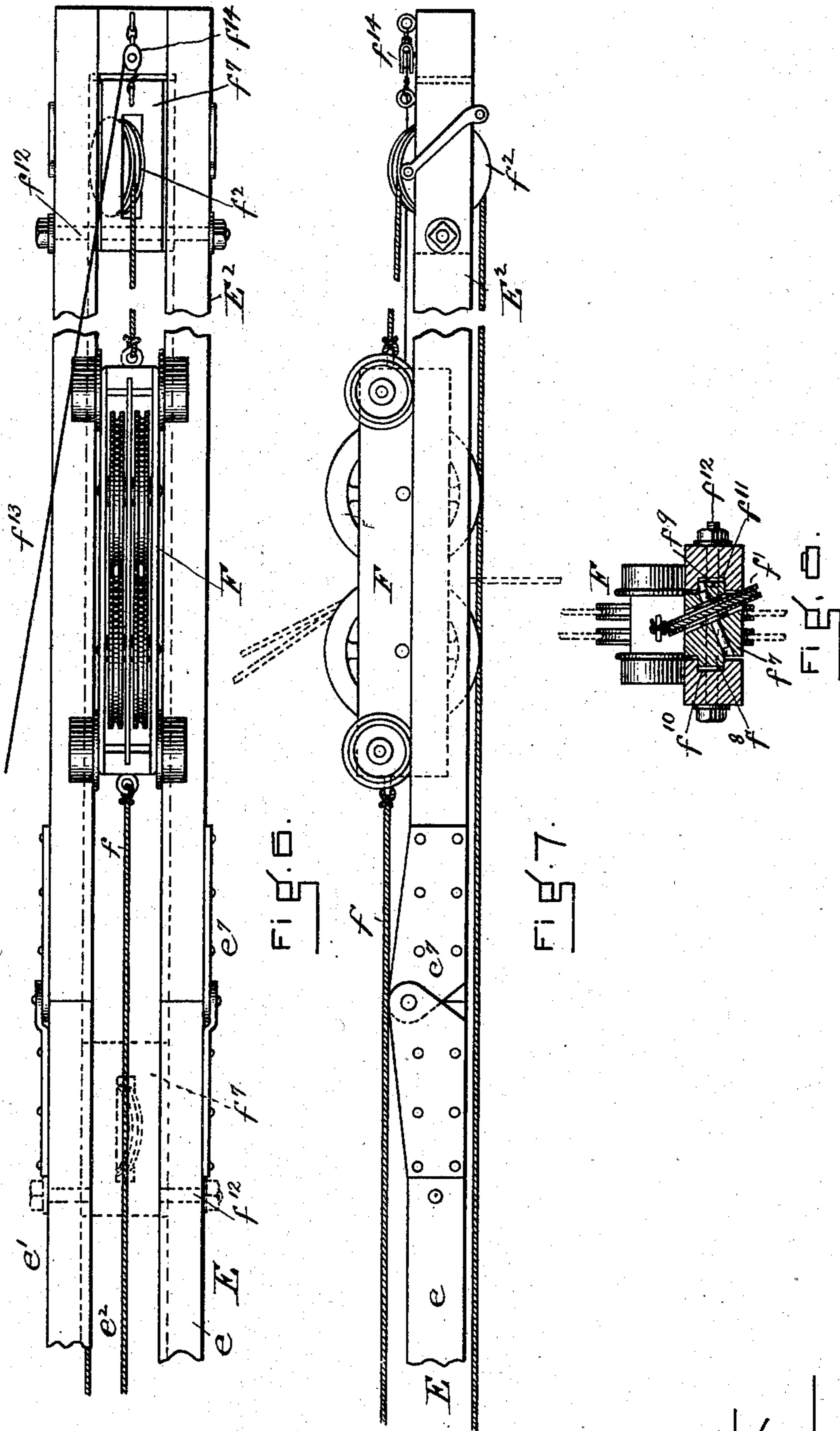
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7 Sheets—Sheet 5.



WITNESSES:

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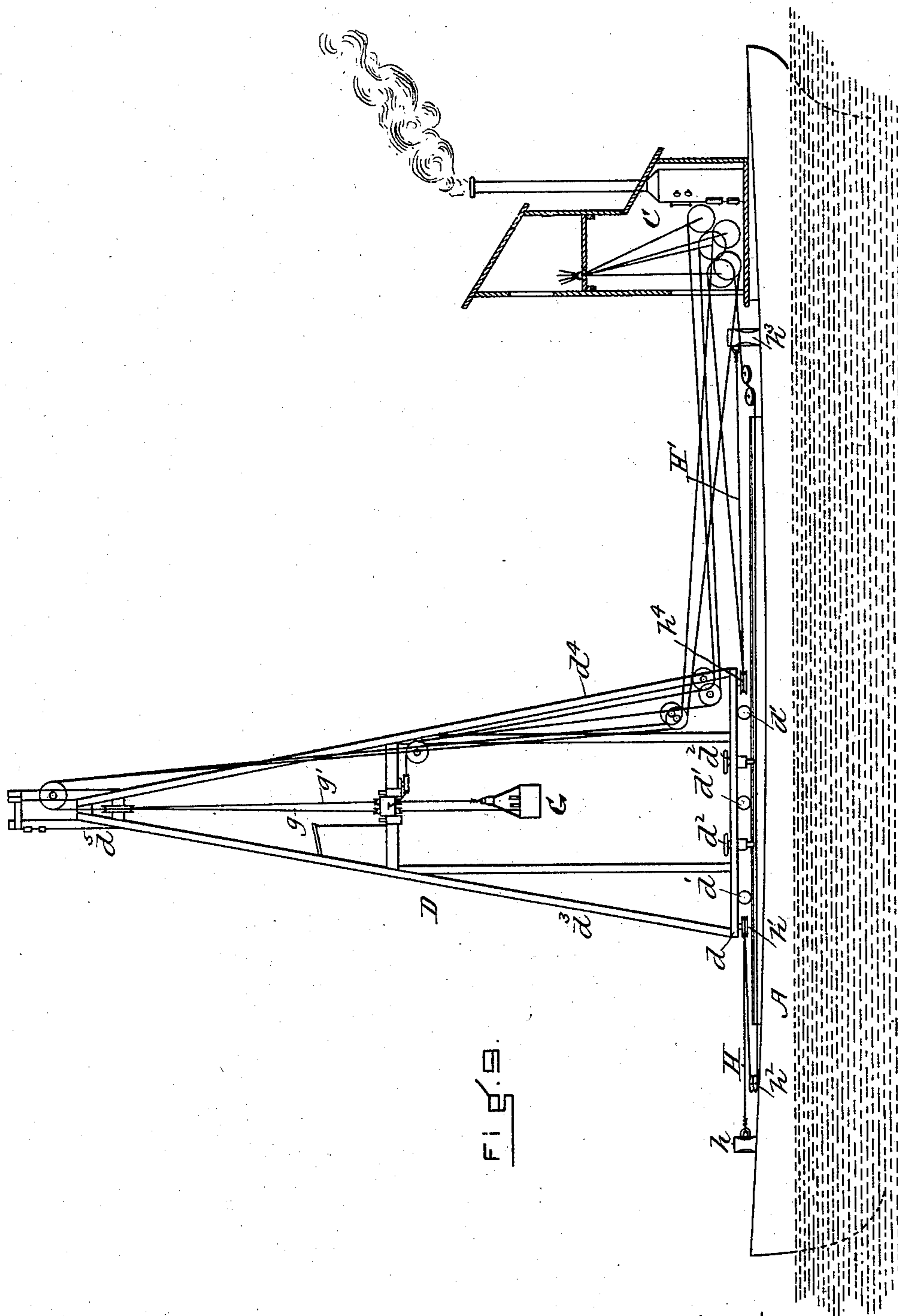
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7 Sheets—Sheet 6.



WITNESSES:

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7 Sheets—Sheet 7.

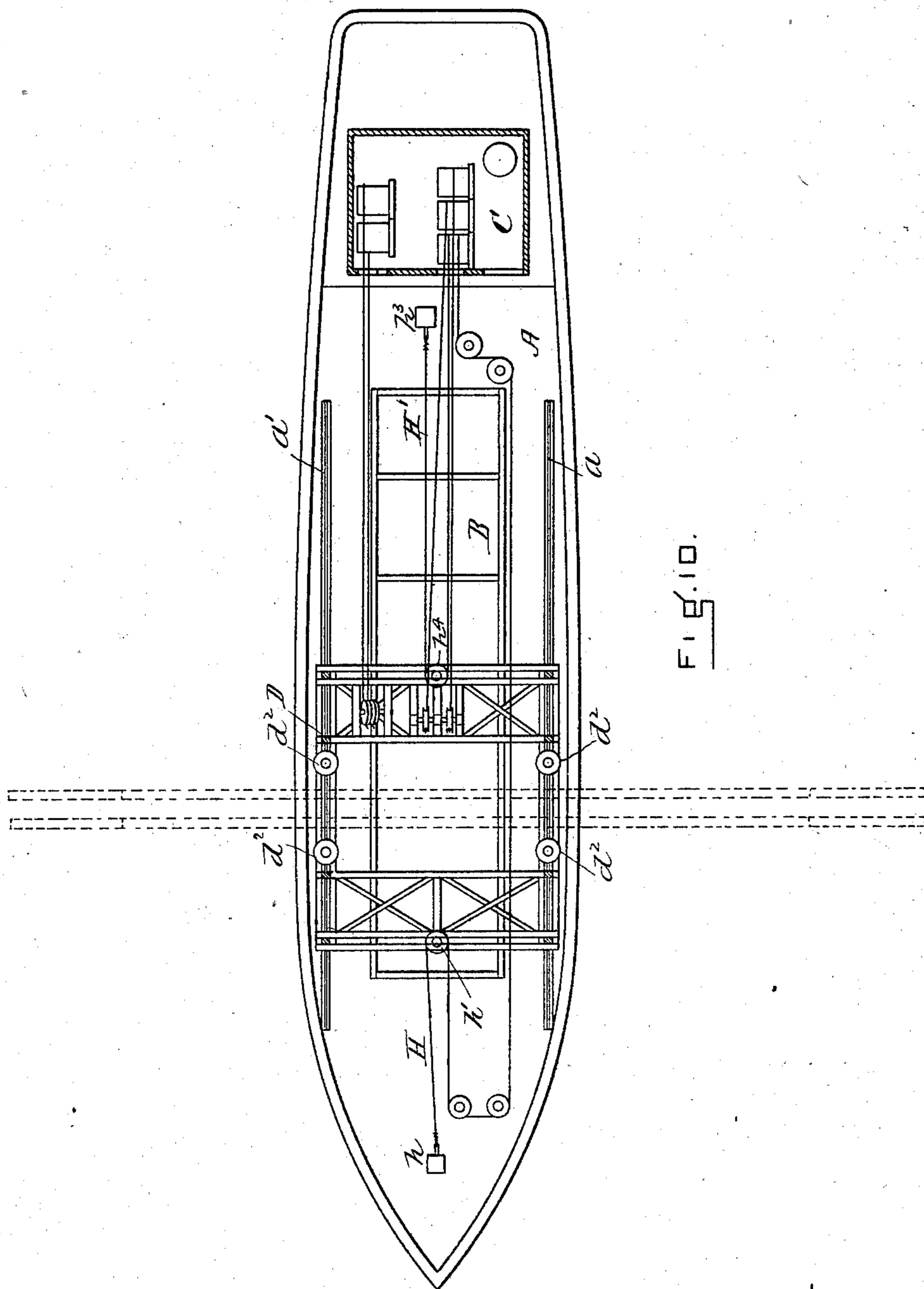


FIG. 10.

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UNITED STATES PATENT OFFICE.

JEREMIAH CAMPBELL, OF NEWTON, MASSACHUSETTS.

LIGHTER OR BARGE FOR HANDLING COAL OR OTHER MATERIAL.

SPECIFICATION forming part of Letters Patent No. 683,246, dated September 24, 1901.

Application filed November 16, 1900. Serial No. 36,692. (No model.)

To all whom it may concern:

Be it known that I, JEREMIAH CAMPBELL, a citizen of the United States, and a resident of Newton, in the county of Middlesex and State of Massachusetts, have invented a new and useful Improvement in Lighters or Barges for Handling Coal or other Material, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification, in explaining its nature.

The invention relates to a lighter, barge, or similar vessel for transporting material, provided with means for accomplishing its own loading from a stationary pile of material, whether located on a stationary support, like a wharf or land, or upon a movable support, like a barge or lighter, and whether said pile of material is upon one side or the other of said lighter or barge—such, for instance, as would be the condition if another lighter or barge were interposed between it and the pile of material from which the lighter or barge was being loaded.

The invention is adapted also to be used in delivering the load of the lighter or barge in a similar way—that is, to deliver it to other lighters, barges, or any type of vessel and at either side of the barge desired, or alternately to vessels on both sides of the barge, or to vessels separated from the barge by other vessels, or to stations on land or wharf at either side of the barge.

The invention is further adapted to transfer material from one point more or less removed from one side of the barge or lighter to a point more or less removed on the other side and without handling or unloading on the lighter or barge.

The invention further relates to means for weighing the material while it is being loaded or unloaded and while in the transferring grab, shovel, or bucket.

I will now describe the invention in connection with the drawings, wherein—

Figure 1 is a view in vertical cross-section of a barge or lighter and in elevation of the material-handling apparatus mounted thereon. Fig. 2 is a view in side elevation of a portion of the barge or lighter and of the apparatus. Fig. 3 is a view in plan of a portion of the barge or lighter and of the ap-

paratus. Figs. 4 and 5 are views in detail, enlarged, representing devices for weighing material which is being transported. Figs. 6, 7, and 8 are detail views of one of the trolley-booms and of a trolley mounted upon it and of means for adjusting the trolley-actuating rope and rope-blocks, to which reference will be hereinafter made. Fig. 9 is a view in elevation of the complete barge and handling apparatus. Fig. 10 is a view in plan of the parts represented in Fig. 9.

The invention comprises a vessel for transporting material, such as a lighter or barge, having a hatch of very nearly the length of the vessel or of that portion which carries the cargo and having mounted upon its deck or other support, upon each side of the hatch, tracks or rails upon which the material-handling devices may be moved lengthwise the vessel.

The invention further comprises a peculiar material-handling apparatus mounted upon the rails or tracks of the vessel, to be movable lengthwise the hatch and which comprises a tower or support so constructed as to carry upon each of its sides a trolley-supporting boom and also so constructed as to permit the material-handling grab, shovel, or bucket (which for brevity hereinafter will be referred to as the “grab”) to be lowered to the hold of the vessel and raised from it through or in line with the vertical center of the tower and to be moved in either direction from said center outwardly as soon as said grab has cleared the deck of the vessel and also to be moved through it from one boom to the other. The apparatus thus contains what I have termed a “well”—that is to say, an unobstructed passage from the boom-section down through the base of the tower, so that the grab may be lowered vertically through the center of the apparatus into the hold of the lighter for the purpose of loading or unloading. It has wheels or rolls, which are mounted upon said rails or tracks, and it is adapted to be locked in any desired position lengthwise the vessel, and it carries the means for moving the trolley, for operating the grab, for weighing the material, and for adjusting the booms, as will be hereinafter described. I have represented it as used in conjunction with a stationary engine carried by the vessel, preferably at the

stern; but I do not wish to be understood that this limits the invention in any way, as the engine may be mounted on the rails or tracks with the tower or support to be movable with it.

Referring to the drawings, A represents the vessel; B, the hatch; C, the engine; D, the movable tower or support; a a' , the rails or tracks upon the vessel, one upon each side of the hatch.

d represents the base of the tower or support; d' , its wheels or rolls, which bear on the rails or tracks; d^2 , the locking device for locking the tower or support in a stationary position to the vessel.

From the base d rise the two sides of the tower or support d^3 d^4 . These sides are strongly braced and are connected with each other at the base d and at the top d^5 . They support midway their height a stationary intermediate or central section E of a trolley-boom, the said section consisting of the parts e e' , which are separated from each other throughout their length and form rails or tracks upon which the trolley F is movable. Below the section E of the boom, between the sides d^3 d^4 of the tower or support, is the high wide opening F', extending from one side of the tower to the other, and in which the grab is vertically movable and from which it is horizontally movable at any point between the base d and the intermediate boom E. The base d has an opening of substantially its full width, through which the grab is moved vertically to and from the hold of the vessel. This opening forms an essential part of the well, through which the grab may be moved vertically from a position near the boom to a position under its central portion and below the base of the apparatus. The parts e e' of the boom-section E cannot be connected with each other, as the grab-ropes must play through the space e^2 , which separates them. Consequently there can be no tie uniting the two sides d^3 d^4 between the top of the tower or support, where they are joined together, and the base.

To each end of the central boom-section E there is attached a boom extension, and these boom extensions are lettered E' E², respectively. I prefer that one of them be considerably longer than the other, although this is not necessary, and in the drawings it will be seen that the boom extension E² is considerably longer than the boom extension E'. This is for the purpose of providing a sufficient length and arrangement of boom to permit the grab to take material from or deliver material to a point or position considerably removed from the side of the lighter or vessel and beyond an intermediate vessel or other object, if desired. In other words, it extends the range of usefulness of the device. Each of these boom extensions is attached to the central boom-section E to be movable out of operative position and preferably to such a position as will prevent it from interfering

with rigging or any obstruction at the side of the vessel, and I have represented them as hinged to the ends of the central section in a manner to permit their being turned upward to a vertical position. I do not intend, however, to confine myself to this disposition of the boom extensions when not in use, as they may be swung downward to a vertical position or horizontally backward or forward to a horizontal position lengthwise the vessel, if desired. Each of the boom extensions has trolley-tracks in continuation of the trolley-tracks of the central section, which are separated by a longitudinal opening in which the trolley and grab ropes move. The boom extension E' is connected by the hinge e^3 with the central section E, and it is supported in horizontal operative position by a stay e^4 , extending from the top of the tower or support D to the outer end of the boom extension. It is also supported when in a horizontal position by the topping-lift e^5 , by means of which it is also turned upward by a person on the deck to an inoperative position and held by it in a vertical position against the bar e^6 , which prevents the boom from being swung inward past its center of gravity. In other words, it so holds the boom that upon release of the topping-lift the boom will swing outward and may be lowered by the topping-lift to its horizontal position without requiring that it be first moved away from its rest or bar e^6 by hand. The boom extension E² is connected with the central section E by the hinge e^7 . It is supported in a horizontal position by the stay e^8 and topping-lift e^9 , which also serve to lift and hold it against its rest or stop e^{10} . When both booms are in a horizontal position, the trolley F may be moved from the outer end of the extension E² across the central section E to the outer end of the section E'—that is, the length of these three sections determines the extent of movement of the trolley. The three sections will be used at the same time for the purpose of transporting material from a position below the boom E² to a position below the boom E', or vice versa, or for the purpose of transferring material to the lighter or barge first over one of the boom extensions and then over the other boom extension, transferring the material from the lighter in alternate directions and to two piles, positions, or vessels. When both boom extensions are in use, the trolley-drawing rope f will run over a sheave at the outer end of each boom. (See Fig. 3, where f' represents the sheave at the outer end of the extension E', and f^2 the sheave at the outer end of the extension E².) The trolley-drawing rope passes from sheave to sheave on the upper side of the boom, the trolley itself forming a connection between the ends of the rope and upon the under side of the boom from the sheaves f' f^2 to the two sheaves f^3 f^3 at the center of the central boom-section, from whence they pass to the two sheaves f^4 f^4 , thence to the sheaves f^5 f^6 on the base d , and

from thence over the deck of the lighter to the rope-winding devices of the engine. When either of the boom extensions $E^1 E^2$ or both of them is or are not used, it or they will be turned upward, and, if preferred, the sheaves $f^1 f^2$ will then be moved inward to the outer end or ends of the central extension and the trolley-rope be correspondingly taken up or shortened at the engine in any desirable way.

I would here remark that not only may either extension be used at will, but also that the central section may be used alone.

In order that the trolley-sheaves $f^1 f^2$ may be moved from their outboard to their inboard position and may be locked in such positions, each one is mounted in a sheave block or holder, and a description of one and manner of using it and of locking it in its two positions will suffice for both. f^7 (see Figs. 6, 7, and 8) represents one of these sheave-holding blocks. It has side guiding and holding extensions $f^8 f^9$, which enter longitudinal guiding-recesses $f^{10} f^{11}$ on the inner faces of the two sides of the boom, the block f^7 being, in effect, a carriage movable lengthwise the boom extension from the outer end of the extension to the outer end of the central section. The block is locked in either position to which it may be moved by a long locking pin or bolt f^{12} , which passes through holes in the boom sides and through a hole in the block and is locked to the boom by a nut. (See Figs. 6, 7, and 8.) The sheave-block f^7 upon the removal of the bolt and the lifting of the extension will slide by gravity from the outer end of the boom to the outer end of the central section, where it is locked to the central section by the locking-bolt in the same manner in which it was locked to the boom end. (See Fig. 6, where the sheave is shown in dotted outline at the end of the central section and as locked in place.) To move it outward from the end of the central section to the outer end of the boom extension, there is used a draw-line f^{13} , which is fastened to the outer end of the block and passes over a sheave f^{14} at the end of the extension and thence back to the support. Said line f^{13} is shown in Figs. 1 and 6. It is evident that when either boom is upturned its sheave-block may be kept at its outer end, the rope running therefrom being guided to the trolley by pulleys suitably placed, or instead of moving in the sheave-block in the manner described a temporary sheave-block may be placed at the end of the central section next the upturned boom around the sheaves, in which temporary trolley the necessary ropes may be run.

In order that the lower horizontal portion of the trolley-drawing rope f which passes under the trolley may not interfere with the grab-ropes, each trolley-rope boom-sheave $f^1 f^2$ is set obliquely in its block, so that the trolley-rope passing around it will be offset in position on its under side from a central position lengthwise the boom, and thus be at

one side of the longitudinal opening of the boom. (See Fig. 8.) G represents the grab, shovel, bucket, or other material-transporting device. A grab is represented, and it has a lowering and hoisting rope g and a closing and opening rope g' . Both of these ropes pass between the rolls of the trolley F in the usual way. The ropes lead past the guiding-pulleys g^2, g^3 , and g^4 at the top of the tower or support to the pulleys $g^5 g^6$ above them and over which they run to the pulleys $g^7 g^8$ at the base of the support, from which they run over the deck of the lighter or vessel to the engine. One of the two grab-operating ropes is guided by the pulleys $g^2 g^3$ and the other by the pulleys $g^3 g^4$. It will be understood that in operation the grab-ropes may be either operated when inclined from the pulleys in the direction shown by full lines in Fig. 4 or when in the position shown in dotted lines in said figure or when they may be substantially vertical. In the first event the pulleys $g^2 g^3$ are principally operative with the ropes, while the pulley g^4 is substantially at rest. In the second case the pulleys $g^3 g^4$ become operative with the ropes, while the pulley g^2 is substantially at rest, while in the third case all pulleys assist in guiding the ropes. It will further be noticed that the pulleys $g^2 g^4$ are in horizontal line with each other and the pulley g^3 is below said line, but in the same vertical plane, and that their peripheries are deeply grooved and that the pulleys are so placed that their edges are very nearly in contact and are not separated from each other by a space sufficient to permit the escape of the ropes from the grooves. It will also be seen that the grooves of the wheels are deep and the ropes are always contained in them and that the rope g will automatically pass upon the transfer of the trolley from one side of a vertical central line to the other side on its support from the pulley g^2 to the pulley g^3 and that the rope g' will pass upon said transfer from the pulley g^3 to the pulley g^4 . The pulleys $g^5 g^6$ are represented as mounted upon a shaft or pin g^9 , supported at its ends in the arms of a yoke g^{11} , and this yoke is hung or suspended by means of the links g^{12} upon the scale-beam g^{13} , which is itself hung by the links g^{14} from the cross-beam g^{15} of the tower or support. The links $g^{12} g^{14}$ have knife-edge connections with the beam, and the links g^{14} are the trunnions or centers upon which the scale beam or lever moves. The outer end g^{16} of this beam or lever g^{13} is connected by the jointed rod g^{17} with the scale-lever g^{18} of the weighing-scales G' , which are preferably, though not necessarily, mounted upon a platform carried by the support or tower at the level of the booms or other lever. This scale-beam g^{18} is pivoted at g^{19} and connected by rod g^{20} with the weighing-beam g^{21} , which is of the common type of weighing-beams and need not further be described. It will be seen that by this construction the entire

weight of the grab, its ropes, and its contents, when it has any, are supported or are supportable by the scale, and this provides means whereby the weight of the contents of the grab may be correctly ascertained at any time during the transfer of the loaded grab from a receiving to a delivery position whether the grab is in motion or not.

The support or tower may be moved upon the lighter or vessel from one position to another by hand or by power, and in the drawings I have represented it as moved by the engine by means of a draw-rope H, which extends from a fixed post h about a sheave h' on the base of the tower or support, thence about a block h^2 , fast to the deck, and thence to a winding-drum on the engine, and a draw-rope H' , the end of which is fastened to a stationary post h^3 and from thence extends about a sheave h^4 on the base of the support or tower and to a winding-drum on the engine. It is desirable that the booms be supported at such an elevation as will permit them to overhang the decks of the highest vessels when in their highest positions sufficiently to allow the unimpeded horizontal movement of the trolley and grab. It will be noticed that the tower has a wide base of very nearly the width of the lighter or vessel and that one of the boom extensions assists when both are horizontal in counterbalancing the other and adds to maintaining the equilibrium of the tower and of the structure, the structure having what might be termed with some degree of exactness a "cantaliver" organization. It will be seen that the apparatus provides means for substantially a universal use of the grab. In the first place the lighter or boat, coal or material, and the coal-handling devices, whether usable for loading a vessel or discharging coal or material from it, are movable or transportable together from one position to another, and this enables the lighter to be loaded at any place by its own loading devices, which are also discharging devices to carry its cargo or load and loading and discharging devices to one or more vessels or points of discharge and to there immediately discharge its contents by its own discharging devices, which were before used in loading it. It will further be seen that in its own loading and its own discharging it has universal range of operation, because in the first place its position may be varied at will, as it is simply necessary to move the lighter in the water to any desired point, and in the second place that the loading or discharging devices themselves permit coal or material to be taken on or discharged at will at either side of the lighter or at both sides alternately and to or from any reasonable distance from the lighter and over an intervening vessel or obstruction, if necessary, and at any desirable height, and not only this, but the contents of one vessel or pile of material may be transported by the grab across its own lighter or vessel to another vessel or pile

without discharging into the lighter and just as readily as though the material were being loaded into or taken from its own hold. It will further be seen that by reason of the lateral openings in the tower the hoisting and traveling operation can go on at the same time. For example, when unloading from the lighter which carries the tower, as soon as the grab has been hoisted to a point where it clears the base of the tower the trolley can be moved laterally while a further hoisting operation is taking place, so that the grab from that point on will move in a curved line to its highest point without the interference of any cross-timbers. Thus the work of loading and unloading can be accomplished in much less time than where a grab has to be first hoisted to its highest point and then caused to travel laterally to a position over the point where the load is to be delivered. It will be desirable to always weigh the grab and its contents when the grab has reached a given height, because the weight of the grab and its ropes will then be known, and the weight can be definitely fixed, and this will insure an accuracy which would not otherwise be easily obtainable. I would further remark that I do not confine the use of the portion of the apparatus comprising the central or fixed boom and the movable extension or extensions and the means for making them operative in part or in whole to lighters or vessels, as they may be used on shore and in connection with fixed or movable supports.

While I have shown the grab as operated by two ropes—one for hoisting and lowering it and the other for closing and opening it—and while the rope-guides and weighing devices are represented as adapted for two ropes, I would say that it is not always necessary to use the two ropes and that when one rope only is employed to compel the operating of the grab or for hoisting and lowering it only one of the guide-ropes and one of the pulleys may be dispensed with, and where in the claims I have used the larger number I would be understood as also meaning to include the smaller number.

In order that the material-handling devices may move lengthwise the boom extensions or either of them without fouling with the stay and topping-lift of the extension upon which it may be movable, I have caused the stay, which I have lettered e^8 , to be split or made in two parts extending from a common eye at the top of the tower to each side of the boom extension at its outer end. The topping-lift e^9 is also split into the sections m m' . The section m passes upward over the sheave m^2 , then downward under the sheave m^3 , and then outward to the tackle m^4 . The section m' passes upward to the sheave m^5 , then downward under the sheave m^6 , and then over the sheave m^7 to the tackle m^4 . (See Fig. 11.) It will be seen that by this construction the parts of the topping-lift are separated or held away from the path of the grab, trolley, and

operating-ropes which are movable with the trolley between them.

It will be noted that owing to the comparative height of the boom-section above the base of the tower it is possible in this apparatus, as in no other of which I have knowledge, to start and continuously operate the hoisting of the grab and simultaneously operate the trolley, say, from one end of the boom to the other, the only restriction being that the grab shall be sufficiently high to clear the base of the tower when it reaches the base. The importance of this feature of my invention cannot be disregarded, for it is evident that this possibility will in nearly all cases save a very large amount of time in the loading or unloading of a vessel with coal or other portable material of like character, and should the structure be used upon land it will afford a similar saving of time. While this feature is due, as is stated above, primarily to the height of the boom-section of the tower above its base, it is also somewhat dependent upon the length of the projecting sections in relation to said tower-section and also upon the fact that there is a clear passage afforded below the boom of considerable height to allow the grab to move freely in either direction.

An essential part of my invention is that which relates to the height at which the boom is carried or supported by the tower and that which relates to the construction of the tower, whereby at the point where the boom crosses the tower there is provided an unobstructed space of such height that the grab may be moved vertically therein while the trolley is crossing it horizontally and without modifying the rate of movement of either and whereby the grab takes the same inclined or diagonal course across the tower that it has heretofore taken upon a boom located at one side only of a tower or support.

I am aware that structures have been patented in which a space slightly exceeding the height of a grab and trolley has been arranged beneath the boom where it passes a support in which the trolley and grab may both be moved horizontally for the purpose of transferring the grab from a boom-section on one side of the support to a boom-section on the other. Such a structure is described and claimed in my Patent No. 602,726, and I do not herein claim it, one object of my present invention being to permit the load to be lifted by the grab to a variable height of delivery at any point within the ends of a boom extending across a tower and by the joint action of a horizontally-movable trolley and vertically-movable grab simultaneously actuated to cause the grab to take an inclined or diagonal path from loading position at one side of the tower to a delivery-point on the other side and without being impeded by the tower.

Having thus fully described my invention,

I claim and desire to secure by Letters Patent of the United States—

1. An apparatus for handling portable material comprising a lighter or vessel for receiving and transporting the material, and a material-handling device mounted on said lighter or vessel to be moved therewith and comprising a tower or support, a boom carried by said tower or support, a trolley movable lengthwise said boom, a grab movable from and toward the trolley and means for closing and opening it and for moving the trolley upon the boom, said tower having an opening in one side from a point just above its base to said boom whereby said grab may be moved laterally on said boom and also having an opening through said base, as described.

2. An apparatus for handling portable material comprising a floatable or buoyant support, a tower mounted upon said support, a boom carried by said tower, a trolley movable lengthwise said boom, a grab movable vertically from and toward the trolley, means for closing and opening it and for moving the trolley upon the boom, said tower having an opening in one side from a point just above its base to said boom whereby the movement of said trolley upon said boom may begin when said grab has been moved to a point just above said support, said tower also having an opening down through its base, as and for the purposes described.

3. In an apparatus for handling portable material the combination of a lighter or vessel for receiving, holding and transporting the material, with means for loading and discharging said material mounted upon the said lighter or vessel comprising a tower or support having a well or space in line with the hatch of the said lighter or vessel, a boom extending from the tower or support near the upper end of said well or space, a trolley movable upon said boom, a grab carried by said trolley and having vertical movements, and means for opening and closing the grab.

4. An apparatus for receiving, holding, transporting and discharging coal or similar material comprising a lighter or vessel having a hatch, a tower or support mounted on the lighter or vessel having an unobstructed well or space over the hatch of the lighter or vessel or a portion thereof and also having a lateral opening from said space, a boom carried by the tower or support, extending from above the center of said space outwardly horizontally, a trolley movable on said boom, and material hoisting and lowering appliances movable horizontally by said trolley and extending through the trolley.

5. The combination of a vessel or lighter for receiving, holding, transporting and delivering coal or other material in bulk, having a long hatch extending lengthwise the vessel or lighter, with means for loading and discharging said material into and from said vessel or lighter and mounted upon the vessel or lighter

upon both sides of the hatch to be adjustable lengthwise the said hatch.

6. The combination of a vessel or lighter for receiving, holding, transporting and delivering coal or other material in bulk, having a long hatch and rails or supports upon each side of the hatch with material-handling devices mounted upon said rails or supports to be movable lengthwise the hatch and comprising a tower or support having an unobstructed central space in line with the hatch and opening laterally upon each side, a boom or track at the upper end of said space extending from both sides of the tower, and material-handling devices mounted upon said boom or track to be movable upon any portion thereof and in either direction from the central space of the tower and also, in whole or in part, to be movable vertically with respect to said boom or track.

7. The combination of a vessel for receiving, holding, transporting and delivering coal or other material, having a long hatch and rails or other supports at the sides thereof, with means for loading and discharging said material mounted upon said rails or supports to be movable thereon lengthwise the hatch and comprising a support or tower having a central well in line with the hatch and lateral opening from said well on each side thereof, a boom extending across said tower at the upper end of said well and also from each side thereof, a trolley mounted upon said boom to be movable upon any part thereof and carrying a grab vertically movable with respect to the trolley, the said grab and means for closing and opening the grab.

8. The combination of a vessel, lighter, or other buoyant supporting and transferring means, a tower or support mounted thereon having an opening extending across it, and a central opening or well extending downward therethrough, a boom or similar instrumentality above said openings and extending from each side of the tower or support, a material-handling device movable horizontally upon said boom or other similar instrumentality, and also vertically in relation thereto whereby said vertical and horizontal movements of said handling device may occur simultaneously.

9. The combination of a buoyant supporting and transferring device, a support or tower mounted upon said device having an opening extending through it, laterally and a central opening or well extending downward through it, a boom over said openings extending from both sides of the tower or support, a trolley movable upon any portion of said boom, a grab carried by said trolley, and vertically movable with relation thereto, and means for opening and closing the grab whereby said grab may be moved horizontally and operated when just clear of said supporting device, as and for the purposes described.

10. The combination of a lighter or vessel having a hatch extending for a large portion

of its length, a rail upon each side of said hatch, a truck mounted upon said rail to span the hatch and having a central opening over the hatch, a tower mounted upon the truck to be supported and movable thereby, having a central space in line with the opening in the truck, and an opening from one or both sides thereof, a horizontal boom above said space extending from one or both sides of said tower, a movable trolley mounted upon said boom, a vertically-movable grab carried by said trolley, and means for closing and opening the grab.

11. A tower or support carrying a central boom-section, said tower comprising two side sections arranged opposite one another and connected above the level of said boom-section but so separated below said boom as to form a vertical passage from said boom-section to a point below the bottom of said side sections, a trolley mounted upon said boom-section to be movable horizontally thereon, a grab carried by said trolley vertically movable with respect thereto and means for opening and closing said grab, whereby the load carried by said trolley may be moved in either direction from a point at the base of the tower, as set forth.

12. A tower carrying a stationary boom-section, said tower comprising two side sections arranged opposite one another connected above the level of the boom and separated below it, said boom being located over the passage so formed, in combination with a movable boom-section extending from said stationary section and supported thereon, a trolley movable upon either or both sections at will, and a grab carried by said trolley and movable vertically with relation to it, and means for closing and opening the grab, as described.

13. The combination of a tower or support having a central space and an opening at one side of said space, a boom over said space adapted to be moved in whole or in part into and out of an operative horizontal position, a trolley adjustable in position upon said boom and movable thereon to carry the grab, and the grab carried by the trolley and movable vertically with respect to it at any point above the level of the base of said tower.

14. The combination of the tower or support having a central well and openings from each side of said well, a boom-section over the well and extending from each side of the tower or support, a movable boom-section at each end of the said first-named section adapted to be moved into and out of operative relation therewith, a trolley adapted to be operated upon all the sections or any one or more of them, and a grab carried by said trolley and vertically movable with relation to it, said openings extending from said boom-section downward to the base of said tower and serving to allow the grab to be moved horizontally when it has cleared said base, as and for the purposes described.

15. The combination of a vessel or lighter, a tower or support mounted thereon to be movable therewith, having a central well and openings at each side thereof, a boom-section
5 over said well, movable boom-sections at each end of the first-named section, adapted to be moved into and out of operative relation therewith, a trolley movable upon said boom-sections or one or more of them, a grab carried by said trolley and vertically movable
10 with relation to it, said openings extending from said boom-section downward to the base of said tower and serving to allow the grab to be moved horizontally when it has cleared
15 said base, as and for the purposes described.

16. The combination of the tower or support having a central well and openings upon each side thereof, a boom-section at the upper end of the well, a movable boom extension at each end of said section, one of which
20 extensions is considerably longer than the other, a trolley movable upon one or more of said boom-sections, and a grab carried by said trolley and movable vertically with relation thereto, said openings extending from
25 said boom-section downward to the base of said tower and serving to allow the grab to be moved horizontally when it has cleared said base, as and for the purposes described.

30 17. A tower carrying a boom-section, said tower comprising two side sections arranged opposite one another and connected above the level of said boom-section, whereby there is formed a central well extending downward
35 from under said boom-section and open on two sides, in combination with a boom extension and means for moving it into and out of operative relation with said section and for holding it in operative relation thereto.

40 18. A tower carrying a boom-section, said tower comprising two side sections arranged opposite one another and connected above the level of said boom-section, whereby there is formed a central well extending downward
45 from under said boom-section and open on two sides, in combination with a boom extension and means for moving it into and out of operative relation with said section and for holding it in operative relation thereto, and
50 devices for holding it out of operative relation therewith, as described.

19. The combination of a tower or support having a fixed boom-section, a movable boom-section and a trolley-rope sheave or block interchangeable in position with regard to the
55 outer end of the movable extension and the end of the fixed section, as and for the purposes described.

20. The combination of a tower or support
60 having a fixed boom-section, a movable boom extension adapted to be moved into and out of operative relation with the fixed section, and a trolley-rope sheave or block attached to either the movable boom extension or to
65 the fixed portion thereof, and means for fastening it in either place.

21. The combination of a tower or support,

a fixed boom-section, a movable boom extension adapted to be moved into and out of operative relation with the fixed section, and
70 provided with guides for a carriage supporting the trolley-rope sheave with said carriage, and trolley-rope sheave movable in said guides from an operative relation at the end of the movable boom-section to an operative
75 relation at the end of the stationary boom-section, as and for the purposes described.

22. The combination of a tower or support, a fixed boom-section, a movable boom-section adapted to be moved into and out of opera-
80 tive relation with the fixed section, a carriage, a trolley-rope sheave mounted thereon, the said carriage being movable from the end of the fixed boom-section lengthwise the movable extension, and means for moving said
85 carriage from the tower.

23. The combination of the tower or support, a fixed boom-section, a movable boom-section, a trolley-rope sheave, and means for moving it lengthwise the boom, comprising a
90 line and pulley at the outer end of the extension over which the line runs, and a pulley on the tower over which the line also runs.

24. The combination of a tower or support
95 having a central well, and lateral openings extending from the top to the bottom of said well, a fixed boom-section at the upper end of the well extending from each side of the tower, a movable boom extension at each end of the
100 fixed section adapted to be independently moved into and out of operative relation thereto, a trolley movable upon the boom and its extensions, and a vertically-movable grab carried by the trolley.
105

25. The combination of a tower or support having a central well, lateral openings extending from the top to the bottom thereof, a fixed boom-section at the upper end of the
110 well, a movable boom extension at each end of said fixed section, and independent means connecting each of said extensions to the tower or support for holding the same in operative relation with each other and the fixed
115 section, and for moving one or both of them out of operative relation with each other and to the fixed section.

26. The combination of the tower or support having the central well and the lateral openings, a fixed boom-section at the upper
120 end of the well, a movable boom extension at each end of said fixed section, means for independently moving said boom extensions into and out of operative position, and a trolley-rope sheave upon each extension adapted
125 to be independently moved on said extension to the end of the fixed section, and vice versa.

27. The combination of a tower or support having a central well and an opening upon each side thereof, a fixed boom-section at the
130 upper end of the well, a movable boom extension at each end of the fixed section movable into and out of operative relation thereto independently, whereby one or both of

them may be used therewith, or it may be used without either of them, the trolley, its operating-rope of an extent sufficient to permit the trolley to be moved the full length of the entire boom, and the trolley-sheaves over which the trolley-rope extends independently movable lengthwise the boom extensions to the fixed section of the boom.

28. The combination of a vessel or lighter, a tower or support mounted thereon having a central well and lateral openings, a boom-section at the upper end of the well, a movable boom extension at each end of said boom-section, the trolley, the trolley-rope, the adjustable trolley-rope sheaves, and means for independently moving the boom extensions and for moving the trolley-rope sheaves from points on the deck of the vessel or lighter or upon the tower adjacent thereto.

29. The combination of the tower or support having a well extending through its base, a boom-section having an unobstructed longitudinal opening, a boom-section in said opening, a boom extension movable with respect to the said section and having an unobstructed longitudinal opening, a trolley movable upon the section and the extension, a grab and grab-operating ropes carried by the trolley and extending through the longitudinal opening in the boom section and extension to pass from one to the other without obstruction.

30. The combination of a tower comprising two side sections and a boom-section connected to said side sections whereby there is formed a well having two side openings in said tower, said well also extending below the base of said side sections, said boom having a longitudinal opening, in combination with a trolley mounted upon said boom, a grab and its operating rope or ropes carried by said trolley and extending through the longitudinal opening of said boom and adapted to extend through the openings in said well, one or more pulleys for said operating rope or ropes supported by said tower above the level of said boom-section and a trolley-operating rope extending to the end of the boom and having its return portion out of line with the grab rope or ropes, whereby the operation of said return-rope will not interfere with the operation of said grab rope or ropes, as described.

31. The combination of the sectional boom, the trolley, the grab, its operating rope or ropes, the trolley-rope, a trolley-rope-sheave carriage movable lengthwise the boom, and the trolley-rope sheave set obliquely in said carriage, as and for the purposes described.

32. The combination of the sectional boom, the trolley movable upon one or more of the sections of the boom, a trolley-rope, a trolley-rope-sheave carriage, a sheave, the carriage having a locking hole or recess, locking holes or recesses in the sectional boom and a locking pin or bolt to engage the said holes or re-

cesses and the locking-hole of the sheave-carriage.

33. The combination of a sectional boom having an unobstructed longitudinal opening, a guiding-recess upon each side of said opening with a sliding carriage having extensions to enter said recesses and sheave obliquely mounted in said carriage and so that its upper end shall be in line with the center of the longitudinal opening and its lower end shall be out of line with the center of said opening, and means for attaching said carriage to the sectional boom at two or more points thereof.

34. The combination of a vessel or lighter having a longitudinal hatch, a rail or support upon each side of the hatch, a truck mounted upon said rails or supports to be movable lengthwise the hatch having a central opening, a tower carried by the truck having a well in line with said opening, and also having lateral openings, a boom at the upper end of the well, a trolley movable upon the boom, a grab carried by the trolley and vertically movable with relation thereto, and means for locking the truck in a fixed or stationary position to the vessel or lighter.

35. A tower or support comprising two sides joined together at the base and at the top only and open below and through its base, having one section of a boom supported by one side and another section of the boom supported by the other side, whereby said tower is provided with a well below said boom adapted for the vertical operation of a grab, and lateral openings adapted for the movement of a grab along the length of said boom in either direction, in combination with a trolley running upon said boom and a grab carried thereby, as described.

36. The combination of a movable truck having a vertical opening through its center, a tower mounted thereon comprising two side sections united at their base by or upon said truck and at their top, whereby an unobstructed well is formed between said sections, said well having an opening at both sides, a boom mounted on said tower above said well, one section of said boom being supported by one side of said tower, the other section being supported by its other side, a movable trolley mounted upon said boom, a grab carried by the trolley, a grab-operating rope or ropes extending through the trolley to the upper end of the tower and having an unobstructed movement in both directions lengthwise the boom and from the upper end of the tower, whereby said grab may be moved vertically through said well, and laterally through the side openings thereof, said vertical and said lateral movements being simultaneous, and may be operated in any position, as and for the purposes described.

37. The combination of the tower having a well and lateral openings at each side thereof, the boom at the upper end of the well, the

movable trolley on said boom, the grab, its operating-ropes passing through the trolley and the rope-guiding rolls g^2 , g^3 , g^4 , and pulleys g^5 , g^6 , at the upper end of the tower arranged in relation to each other to operate as described.

38. In a hoisting apparatus, the combination of a grab, an operating-rope and a hoisting-rope running therefrom, two pulleys suitably mounted and located side by side, the one to receive said hoisting-rope, the other to receive said operating-rope, and three guide-rolls, two located on the same horizontal line, the third located below and between said first-named two as described and in the same plane therewith, one of said upper rolls serving as a guide for said hoisting-rope, the other for said operating-rope, and the third or lower roll serving as a guide for either of said ropes, as and for the purposes set forth.

39. The combination of a tower or support, a grab, a weighing apparatus, a pulley mounted on said weighing apparatus, and a hoisting-rope attached to said grab and passing over said pulley, as and for the purposes described.

40. The combination of a grab, its operating rope or ropes, one or more pulleys carrying said operating rope or ropes, and a weighing apparatus supporting said pulley or pulleys, whereby said grab and its contents may be weighed during the action of hoisting it, as described.

41. The combination of a tower or support composed of two sections joined together at the base and the top only, a boom carried by said tower or support, a trolley mounted to travel on said boom, said tower carrying weighing apparatus provided with one or more pulleys, a grab and a grab-operating rope or ropes passing over said pulleys, and means for operating said grab and said trolley, whereby the contents of said grab may be weighed between its loading-point and the point of delivery of its load.

42. The combination of a grab, means for hoisting and lowering it, and a weighing apparatus comprising a beam or lever supporting said hoisting means, whereby said grab is always supported by said weighing apparatus, as and for the purposes described.

43. The combination of a grab, its hoisting and operating rope, pulleys over which said ropes run, a weighing instrumentality having a movable portion adapted to be counterbalanced to perform the weighing operation, and pulleys carried by said movable portion over which said hoisting and operating ropes run, as set forth.

44. The combination of a grab, a weighing-scale having a movable section and a scale indicator or beam connected therewith, said movable section carrying one or more pulleys, and said grab having connected to it one or more ropes passing over said pulleys, as and for the purposes described.

45. The combination of the grab, its oper-

ating-ropes, the pulleys g^5 , g^6 , the support for the same, a scale beam or lever hung at the upper end of the tower connected at one end with said pulley-support, a rod connecting the other end of said scale beam or lever with the weighing devices located at a distance from said scale beam or lever.

46. The combination of a tower or support having a boom, and a trolley movable upon the boom, a grab carried by the trolley and vertically movable therewith, and a weighing instrumentality by means of which the contents of the grab is weighed in the grab between the point of loading and the point of delivery, said weighing instrumentality carrying one or more pulleys and said grab having attached thereto one or more operating-ropes passing over said pulleys, as and for the purposes described.

47. An apparatus for handling coal or other material comprising a tower or support, a boom, a trolley movable upon the boom, a grab movable vertically with regard to the trolley, and a weighing device for weighing the contents of the grab in the grab, said weighing device carrying one or more pulleys and said grab having connected to it one or more operating-ropes passing over said pulleys, whereby said grab is always supported from said weighing device, as and for the purposes set forth.

48. The combination of a vessel or lighter having a long hatch, a rail or support upon each side of the hatch, a truck mounted upon said rails or supports, having a central opening, a tower or support, a boom carried thereby, a trolley movable on the boom, a grab carried by the trolley, and vertically movable with regard to it, a stationary engine mounted upon the vessel or lighter, the trolley-operating rope and grab-operating ropes leading as described to the base of the tower and thence to the operating-engine, means for taking up or lengthening said ropes as the travel of the trolley is increased or diminished, and as the tower is moved toward and from the engine, and devices for locking the tower stationary to the vessel or lighter.

49. The combination of the vessel or lighter having a long hatch, a rail or support on each side of the hatch, a truck mounted on said rails or supports, a tower carried by said truck, a boom mounted on said tower, a trolley movable upon said boom, a grab carried by the trolley and vertically movable with respect thereto, a stationary engine upon said vessel or lighter, and means connecting the truck with the stationary engine whereby it is adapted to be moved in one direction or the other upon said rails or supports by said engine.

50. The combination of a tower or support, having a well with an opening upon one or both sides thereof, a fixed boom-section over said well, a movable boom-section at one or both ends of said fixed boom-section, a movable section or sections, means for adjusting the length

of travel of said trolley upon said fixed and said movable section or sections, an engine, a trolley-operating rope connected with the engine, means for lengthening or shortening it as the travel of the trolley is lengthened or shortened, a grab carried by the trolley and means for moving it vertically with relation thereto and for closing and opening it.

51. The combination of a tower or support having a central well open on both sides through its base, a fixed boom-section over the well, a movable boom extension at each end of the fixed section and devices for handling coal or other material movable on said boom and its extensions, whereby said coal or other material may be moved vertically, and also may be moved horizontally when raised vertically above said base.

52. The combination of a tower or support having a central well and a fixed boom-section located over said well, said well being open on one side from the level of said boom-section to its base, a movable extension at one end of said fixed boom-section, and devices for handling coal or other material movable vertically and movable horizontally at all points between said base and said boom-section, as described.

53. The combination of a movable section of a boom, coal-handling devices movable lengthwise it, and a topping-lift in two sections separated to permit the movement of the coal-handling devices between them and joined to a common operating-tackle whereby the operation of said tackle will operate the two sections of said topping-lift and apply thereto equal force to lift said boom, as and for the purposes described.

54. The combination of a movable boom-section, coal-handling devices movable thereon, a tower carrying said boom-section and also carrying two pulleys at or near its top, a topping-lift in two sections, one section passing over each of said pulleys, and one end of each section being attached to the end of said boom, the other end of said topping-lift passing downward and spreading, pulleys located to guide the lower ends of said topping-lift sections to a common tackle, and said tackle, all arranged together substantially as described.

55. The combination of a tower or support having a central well and a boom located above said well, said well being open on one side from the level of said boom to its base, and said boom comprising a fixed section and a movable section at one end thereof, located in line with the open side of said well, devices for handling coal or other material movable horizontally and movable vertically comprising a trolley adapted to run upon said boom and a grab provided with suitable hoisting-ropes passing over sheaves in said trolley, and means whereby said trolley may be moved in either direction along the horizontal portions of said boom, as and for the purposes described.

56. The combination of a tower or support having a central well and a boom located above said well, said well being open on two opposing sides from the level of said boom to its base, and said boom comprising a fixed section having at each end thereof a movable section located over one of the open sides of said well, devices for handling coal or other material movable horizontally and vertically, comprising a trolley adapted to run on said boom, and a grab provided with suitable hoisting-ropes passing over sheaves in said trolley, and means whereby said trolley may be moved in either direction along the horizontal portion of said boom, as described.

57. An apparatus for handling portable material comprising a tower, a continuous horizontal trolley-boom supported entirely by said tower and extending on both sides thereof, a grab-rope-moving trolley adapted to move along said boom, and a grab and means for moving it vertically toward and from said trolley as said trolley is being moved along said boom, said boom having a clear passage throughout its length for the movement of said grab in either direction below it, of sufficient height to permit of a diagonal or inclined path of the grab, whereby said grab may be moved simultaneously vertically and horizontally and may be caused to describe a substantially direct path from its point of loading to its point of discharge, or vice versa, as set forth.

58. An apparatus for handling portable material comprising a tower, a continuous horizontal trolley-boom supported entirely by said tower and extending on both sides thereof, one extension being longer than the other, a grab-rope-moving trolley adapted to move along said boom in either direction, and a grab and means for moving it vertically toward and from said trolley, said boom being supported at a height above the base of said tower sufficient to permit of a diagonal or inclined path of the grab within the lines of the tower and whereby said grab may be moved vertically toward and from the trolley during any and all portions of the movement of the trolley on said boom, and simultaneously with said vertical movement may be moved horizontally by said trolley a longer distance on one side of said tower from the center thereof than on the other, as set forth.

59. An apparatus for handling portable material comprising a tower, a continuous horizontal boom supported entirely by said tower and extending on both sides thereof, a grab-rope-moving trolley adapted to move along said boom or any part of it in either direction, and a grab and means for moving it vertically toward and from said trolley, said boom being supported at a height above the base of said tower sufficient to permit of a diagonal or inclined path of the grab within the lines of the tower and said trolley and grab being operatable upon either boom extension, and transferable from one extension

to the other during the operation of said grab by the connecting boom-section, the extensions of said boom-section having a movable relation to said connecting boom-section, as described.

5 60. An apparatus for handling portable material comprising a tower and a boom extending across it, and projecting at each side therefrom, a grab-rope-moving trolley adapted to
10 move along said boom or any part of it in either direction, whereby all sections of said boom are usable at will, and means for operating said trolley comprising one or more
15 ropes and means for pulling them and one or more pulleys over which said rope or ropes pass, said pulley or pulleys being located on said boom upon the section or sections of said boom in use, being adjustable at will, as described.

20 61. In a hoisting apparatus two pulleys suitably mounted and located side by side, each adapted to receive and support a rope and three guide-rolls, two located in the same horizontal line, the third located below and
25 between said first-named two as described, and in the same plane therewith, one of said upper rolls serving as a guide to one of said pulleys, the other as a guide to the other of said pulleys, and the third or lower roll serv-

ing as a guide for the rope passing over either 30 of said pulleys, as described.

62. The combination in a device for handling portable material of a tower, a trolley-boom, extending horizontally from one side of the tower across the line of the tower to a 35 point at the other side of the tower, and also elevated above the base of the tower sufficient to permit of a continuous linear diagonal path of the grab within the lines of the tower and to provide a clear operative space 40 below all parts of it in which the grab may be moved both vertically and horizontally at the same time, a trolley for moving the grab-rope lengthwise the boom mounted upon said tower, means for moving the trolley, and 45 means for moving the grab vertically with respect to the trolley, adapted to be simultaneously operated with the means for moving the trolley, whereby the grab is moved in a continuous linear diagonal path and upon the 50 portion of the boom within the line of the tower as well as upon the portion of the boom which extends from the tower.

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