

No. 717,161

Patented Dec. 30, 1902.

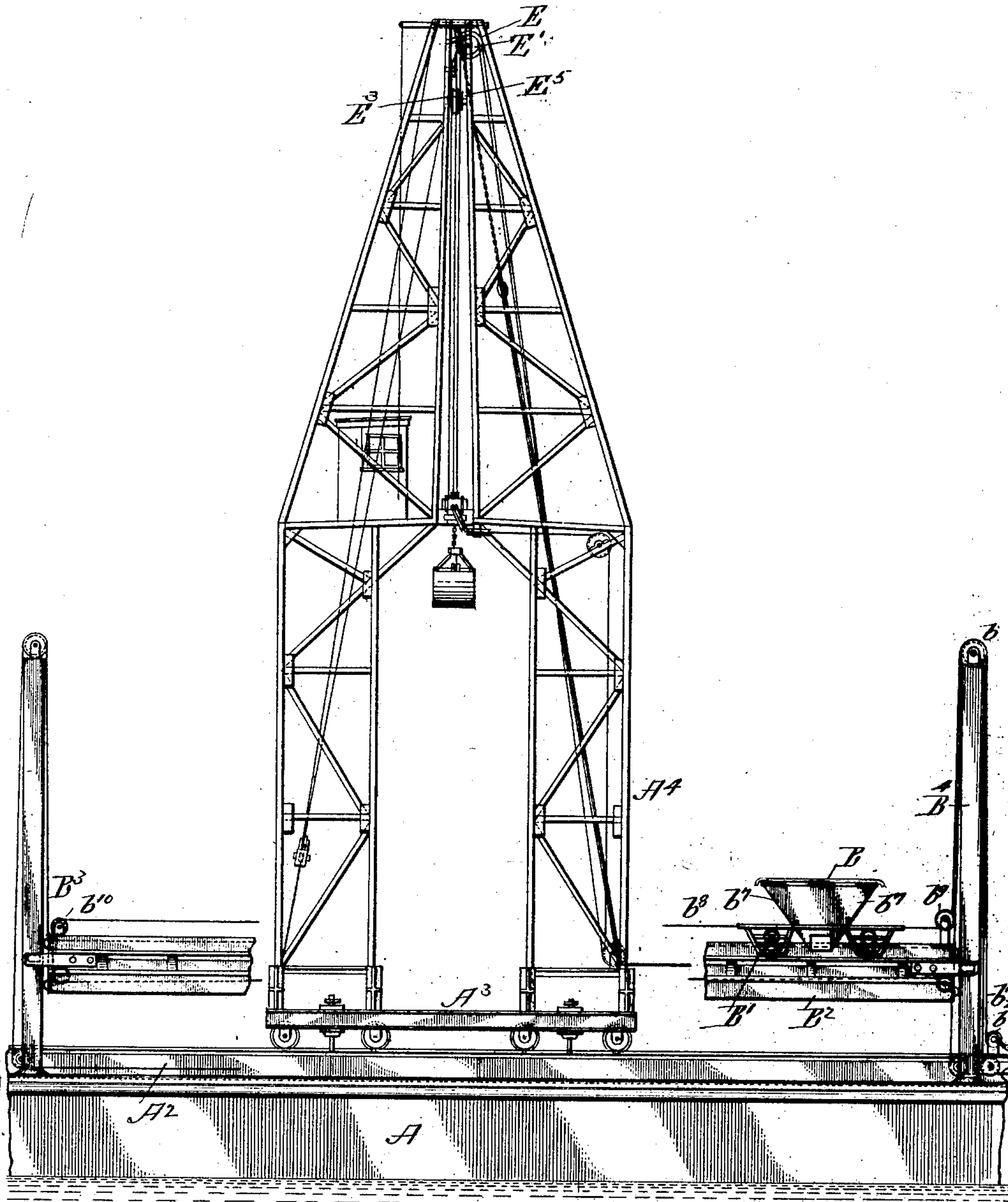
J. CAMPBELL.

APPARATUS FOR HANDLING COAL OR OTHER MATERIAL.

(Application filed July 13, 1901.)

(No Model.)

5 Sheets—Sheet 1.



WITNESSES=

J. C. R. Hayes
Saul Sippertstein

FIG. 1.

INVENTOR=

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by his atty
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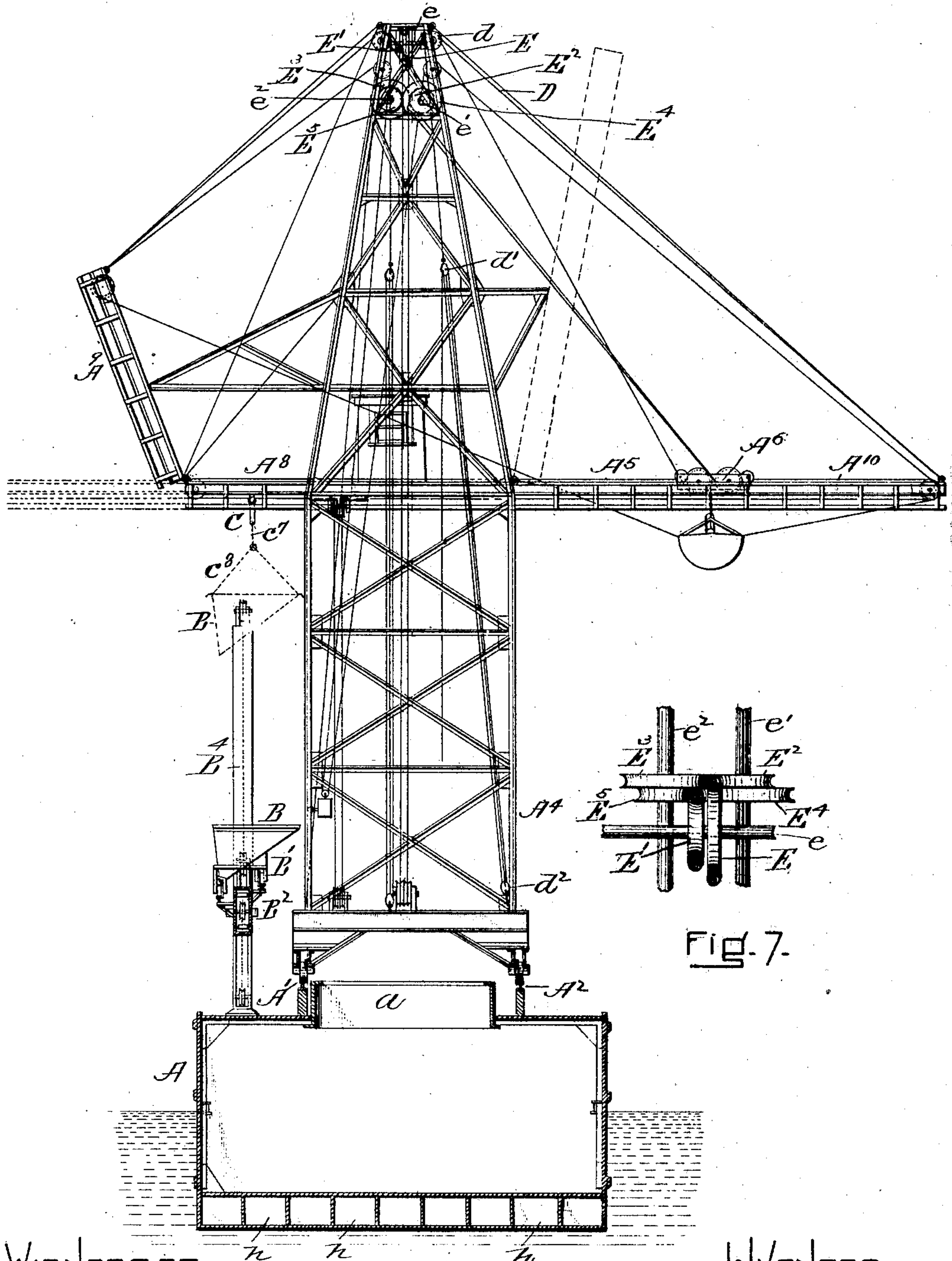


FIG. 7.

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FIG. 2.

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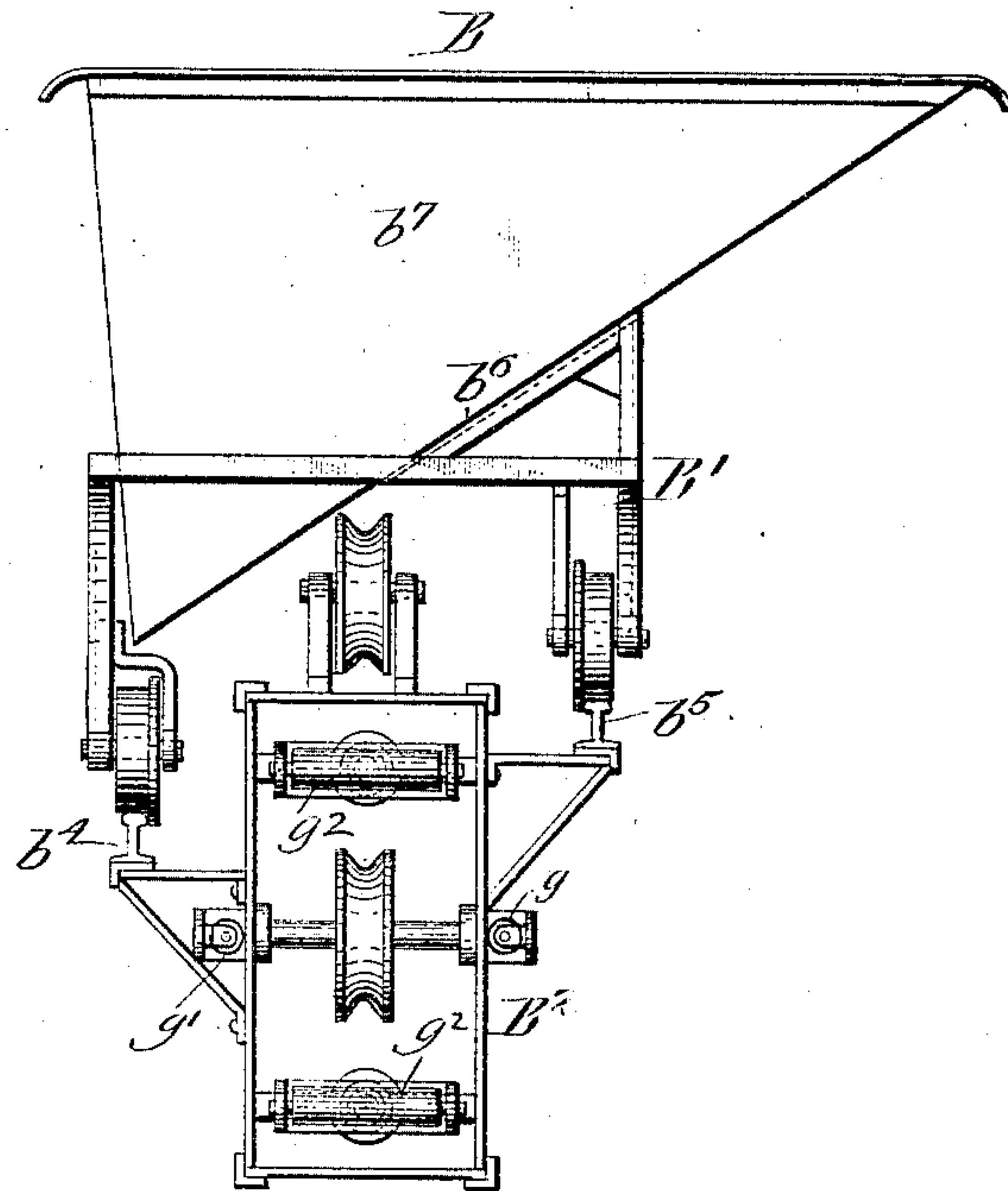


Fig. 3.

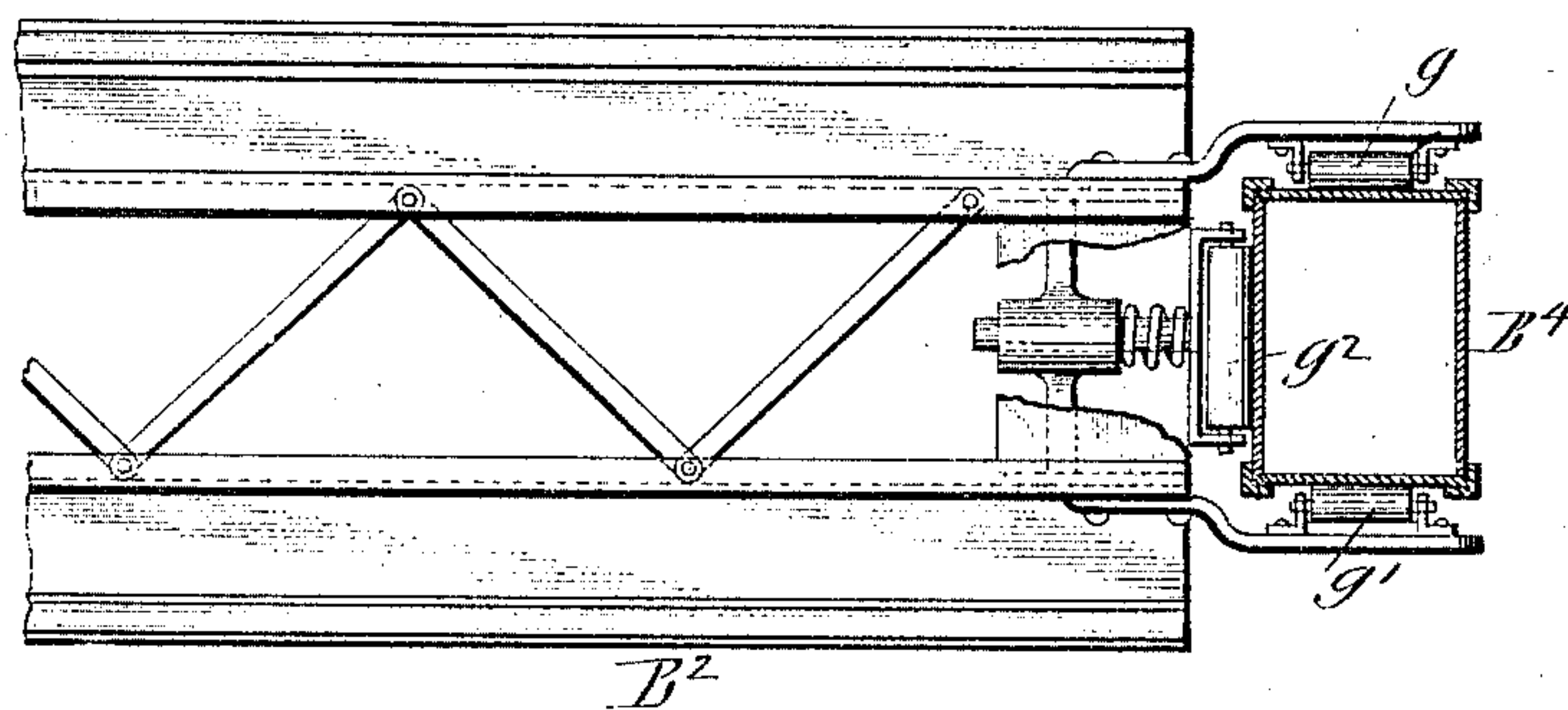


Fig. 4.

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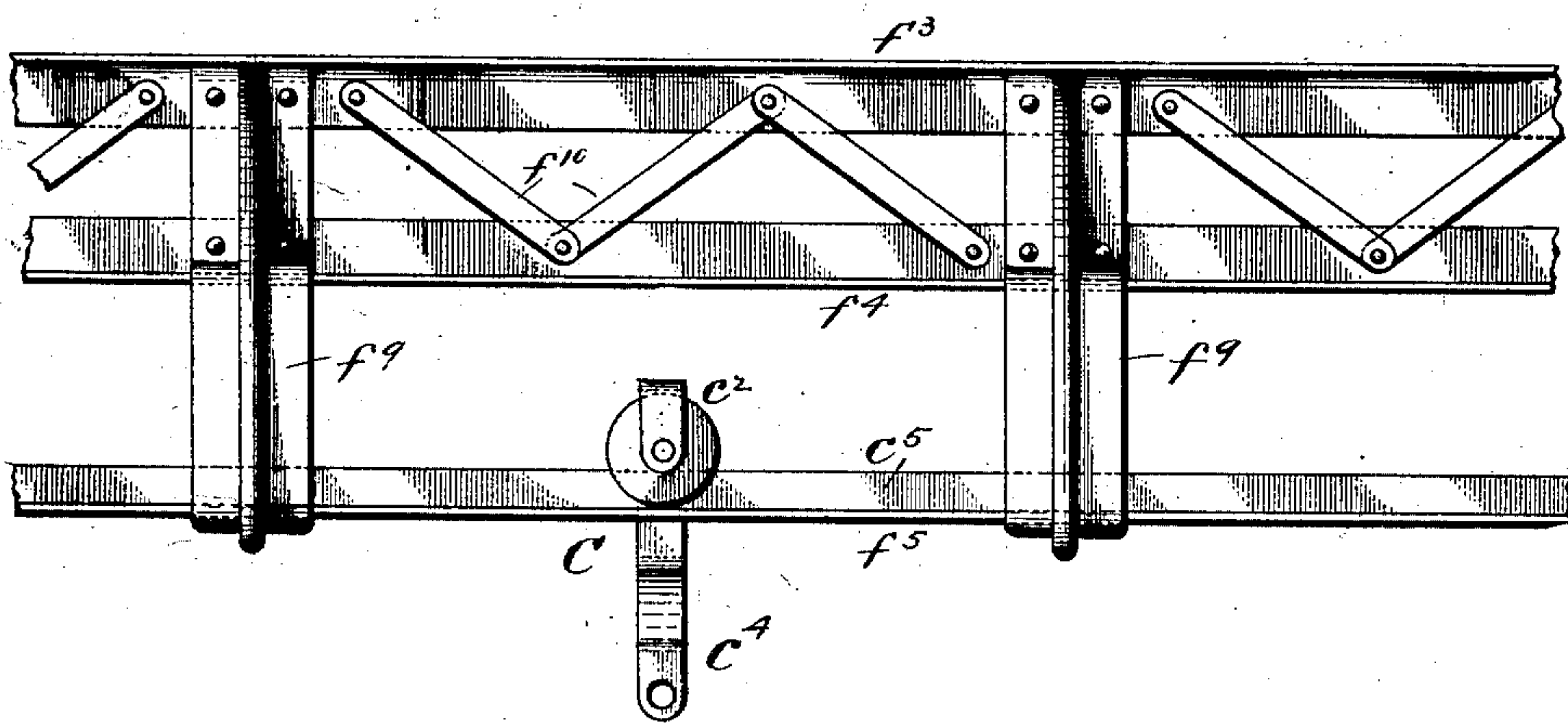
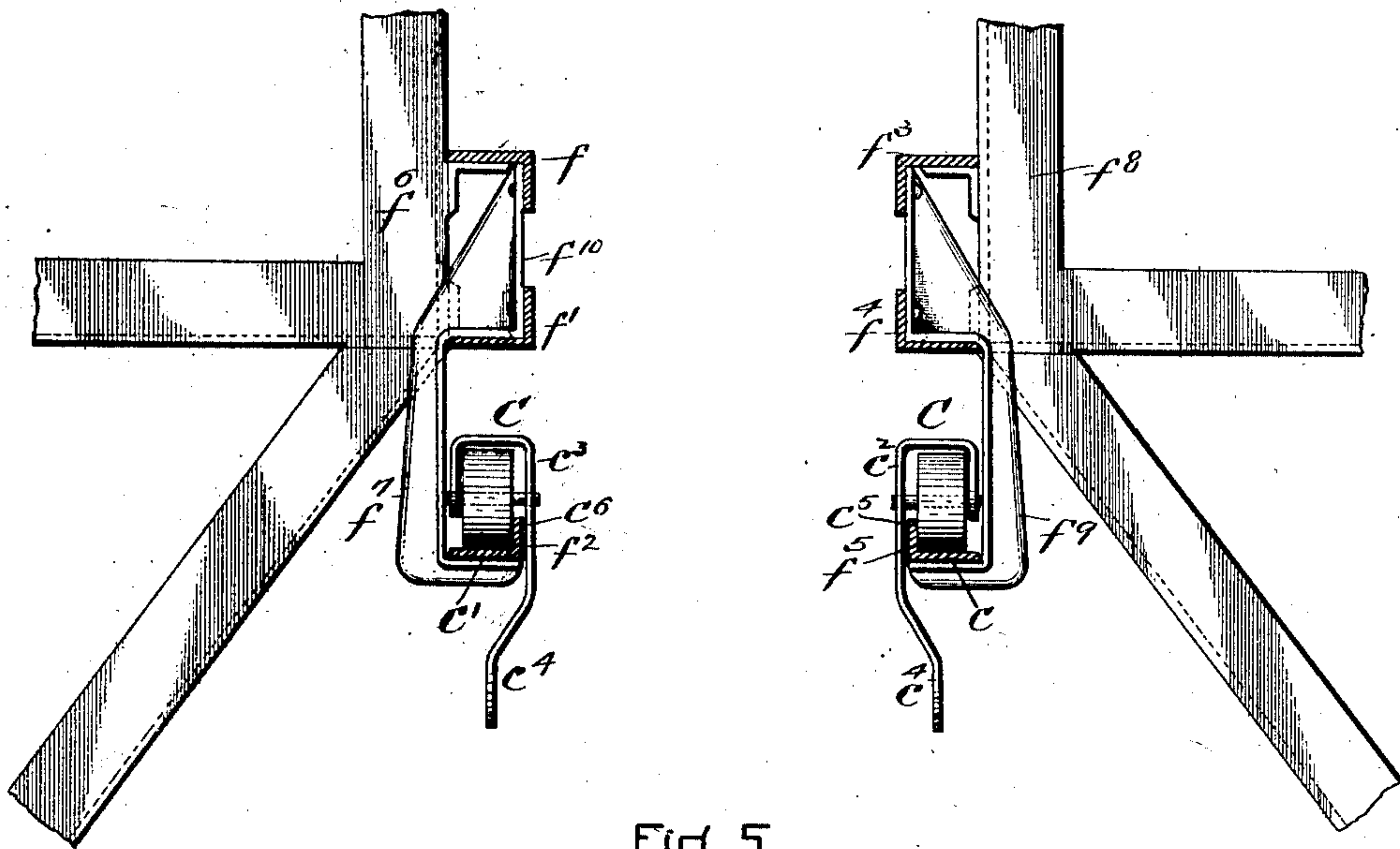
J. CAMPBELL.

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(Application filed July 13, 1901.)

(No Model.)

5 Sheets—Sheet 4.



WITNESSES:

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INVENTOR=

Jeremiah Campbell
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No. 717,161.

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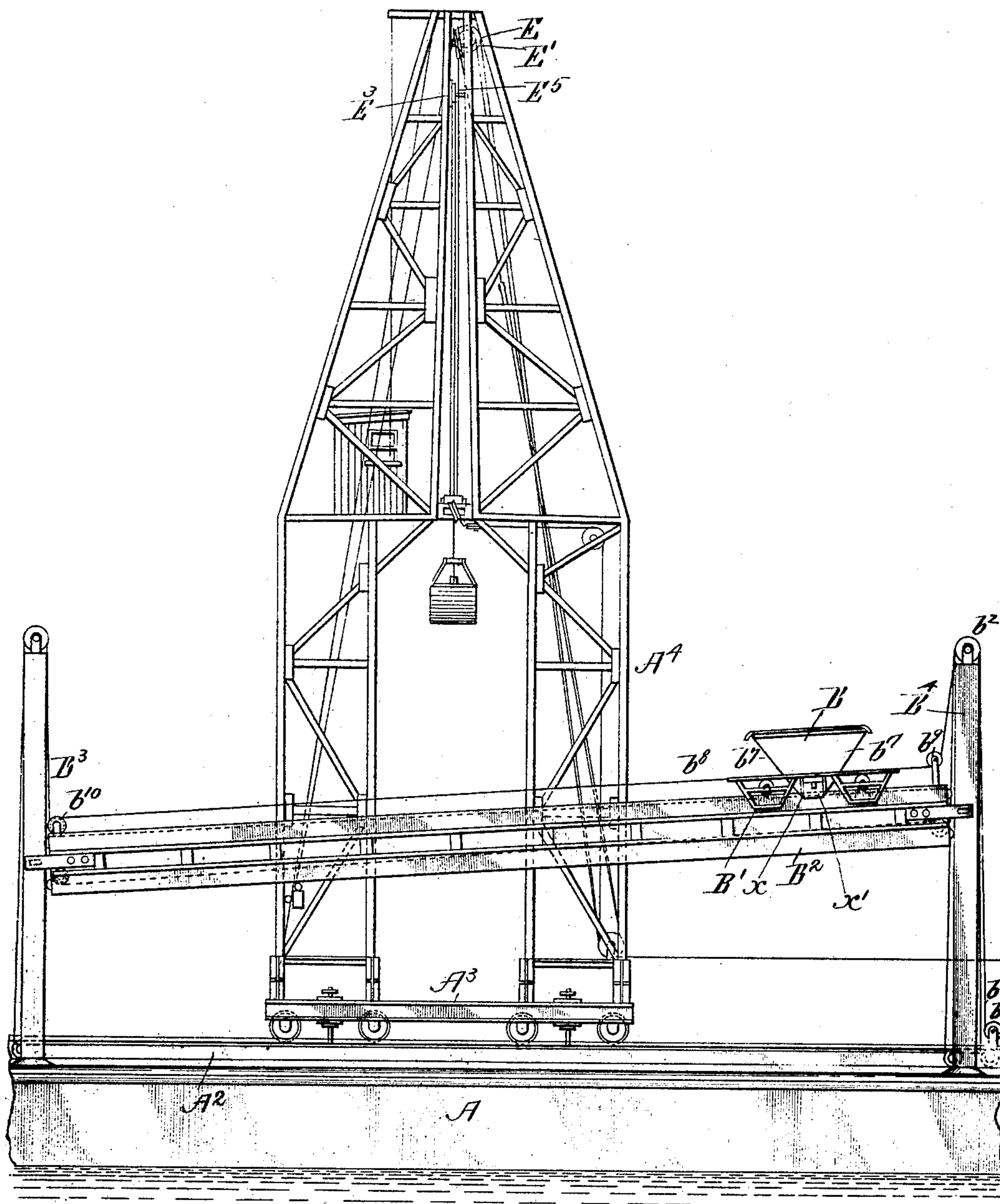
J. CAMPBELL.

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(Application filed July 13, 1901.)

(No Model.)

5 Sheets—Sheet 5.



WITNESSES.

Dr. Dolan,
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Fig. 2.

INVENTOR.

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UNITED STATES PATENT OFFICE.

JEREMIAH CAMPBELL, OF NEWTON, MASSACHUSETTS.

APPARATUS FOR HANDLING COAL OR OTHER MATERIAL.

SPECIFICATION forming part of Letters Patent No. 717,161, dated December 30, 1902.

Application filed July 13, 1901. Serial No. 68,166. (No model.)

To all whom it may concern:

Be it known that I, JEREMIAH CAMPBELL, a citizen of the United States, residing at Newton, in the county of Middlesex and State of Massachusetts, have invented a new and useful Improvement in Apparatus 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, broadly considered, comprises the combination of primary means for lifting and transferring coal or other material like a grab or shovel with secondary means for receiving the load of the grab or shovel directly from it and for transferring it laterally and at any desired height to a point or station of discharge and as consecutive operations.

To indicate one of the uses of the invention, I have illustrated my improved apparatus as mounted upon a lighter or barge adapted to receive and transport coal in bulk and also support and transport the handling machinery—viz., the grab or shovel for lifting the coal from the hold of the barge or lighter, for transferring it crosswise the barge, and the means for receiving the load of coal from the grab or shovel and transferring it lengthwise the barge or lighter. Such a barge or lighter is especially adapted for the coaling of large steamers, as it provides means whereby the coal may not only be transported in bulk to the steamer, but may also without thereafter moving the barge or lighter with respect to the steamer deliver the coal into a number of bunker-openings of the steamer in regular order or in any other order desired, so that the filling of a number of bunkers may be proceeding practically at the same time.

The capacity of the handling devices to deliver coal is much larger than the power of single bunkers to receive it, the size of the bunker-openings and the construction of the bunkers being such as to require a limited delivery and much trimming of the coal by the bunker gang as it is loaded into them. Therefore by a cross-transfer several bunkers may be supplied with coal at substantially the same time.

The capacity of the coal-handling apparatus

is also increased by its ability to deliver coal overhead to midship-bunkers while it is delivering alongside to side ship-bunkers or independently of such delivery and to take its coal from independent lighters or barges alongside the lighter or barge carrying the apparatus.

While I have illustrated the invention as mounted upon and transferred and used with a buoyant support like a lighter or barge, I would not be understood as limiting it to such use, but may employ it wherever it is desirable to handle material in the manner above described.

The invention relates to features of construction which will be described in detail in connection with the description of the drawings.

Figure 1 is a view principally in side elevation of portions of my apparatus. Fig. 2 is a view in vertical section of the lighter and a part of the auxiliary or secondary handling apparatus and in elevation of the primary handling apparatus. Figs. 3 and 4 are detail views, enlarged, showing a part of the secondary apparatus. Figs. 5 and 6 are detail views, enlarged, showing the construction of the boom and the hopper-truck mounted upon it. Fig. 7 is a detail view illustrating the sheaves and rolls in the top of the tower for leading the grab-ropes. Fig. 8 is a view illustrating the cross-transferring device in an inclined position with respect to the barge and tower.

Referring to the drawings, A represents a barge or lighter. The one shown is constructed of steel. It has any desired number of hatchways *a*. Upon its deck are longitudinal tracks $A^1 A^2$, one at each side of the hatchways. The track A^1 is nearer the hatchways than the track A^2 . This is for the purpose of providing sufficient space along one side of the barge or lighter for the erection and operation of the devices for cross-transferring the coal from the shovel or grab to the bunkers, and they preferably are on a line with the top of the hatchway-coaming.

Mounted upon the rails $A^1 A^2$ is a truck A^3 , from which rises the tower A^4 . The longitudinal center of the truck may be at one side of the longitudinal center of the barge or lighter, and the center of the tower may be at one side of the longitudinal center of the

truck. This is for the purpose above indicated of providing sufficient room for the secondary coal-handling devices at one side of the barge or lighter. The truck A^3 is represented as elevated sufficiently above the hatchway-coamings to permit the crowning of the coal in the hatchways and the operation of the shovel or grab when so crowned.

The tower A^4 carries a horizontal boom A^5 , upon which is mounted a movable trolley A^6 for transferring the rope or ropes of the grab A^7 lengthwise the boom or any part of it and while said grab and its rope or ropes are also being moved vertically with respect to the trolley.

The tower, boom, trolley, and grab, with exceptions hereinafter noted, are like the same parts described in my application for Letters Patent of the United States, filed November 16, 1900, Serial No. 36,692—that is, the boom is so supported and constructed, the tower is so arranged, and the trolley and grab so operated that the grab may take its load from a supply located anywhere beneath the boom between its ends and transfer it by a simultaneous vertical movement of the grab and horizontal movement of the trolley and for the full length of the boom or for any part of the boom and whether within the tower or at either side of it, the height at which the boom is supported by the tower and the freedom from obstructions beneath it permitting these combined movements to take place within the limits of the tower as freely as upon either side of it and the opening in the truck permitting the grab to take from a supply immediately below the tower as well as from either side of it. It will not be necessary for me to describe in detail the construction of these parts.

I have represented a tower constructed of metal instead of wood and a metal boom. The metal boom is made in three parts or sections, as described in said application—viz., the central tower or section A^8 and the outer or overboard sections A^9 and A^{10} , which sections are movable with respect to the central section A^8 to a vertical or other position and independently of each other, and I prefer that one of the sections be longer than the other. The boom not only differs in construction from that of the application referred to, but it also performs an additional function—viz., it is provided with a second set of tracks upon which a hopper is adapted to be supported and moved lengthwise the boom. The structure further varies with respect to the leading of the topping lift used in raising the boom-section and also with respect to the leading of the shovel-ropes and guiding and arrangement of sheave-rolls at the top of the tower, and these variations in the construction will be described hereinafter. The operation of this part of the mechanism, so far as taking coal and transferring it, is like that of the devices of the said application.

With the present invention the coal is adapted to be delivered by the grab to an auxiliary or secondary carrying or handling device, which has a movement lengthwise the lighter or barge below the boom and transversely to it, and which secondary carrying device is adapted to be vertically adjustable with respect to the lighter and the boom and is arranged to deliver coal through bunker-openings in the side of a vessel and in any order desired.

The secondary carrying device comprises a hopper B upon a truck B' , which is supported by tracks mounted upon a horizontal girder or beam B^2 . The girder or beam is arranged lengthwise the barge or lighter upon the side less restricted by the tower and it is mounted upon standards or posts B^3 B^4 , rising from the deck of the barge or lighter, and upon which posts or standards it is vertically movable to vary the height of the truck and hopper to any desired extent. This I have shown accomplished by means of suspending-ropes b b' , attached to the ends of the girder or support and extending over sheaves b^2 at the tops of the standards or posts and sheaves b^3 at or near the bottoms of said standards or posts, from which they preferably run to a winding-drum upon an engine on the lighter. The rails upon the girder are lettered b^4 and b^5 . They are shown in the drawings out of line, the inner one being higher than the outer one. This is for the purpose of providing the hopper-truck and hopper with a more stable support on a narrow base.

The hopper B preferably is made detachable from the truck B' and of the shape represented in Figs. 1 and 3 and preferably so as to deliver its contents outward from its lower end. It has the relatively long outward-inclined bottom b^6 , inclined sides b^7 , and a very nearly straight outer wall. It is open at the top and of any required size. The outer wall has near its lower end an outlet x , which is adapted to be closed and opened by the door x' . (See Fig. 8.) The truck B' , which supports it, is movable lengthwise the girder by any desired means. I have represented it as accomplished by means of a draft wire or rope b^8 , which extends longitudinally the girder in both directions about sheaves b^9 b^{10} . The wire or rope passes from the girder to a winding-spool of the engine. The truck-drawing rope or wire thus led will adapt itself to any height of the girder and without requiring any take-up, it being understood that the girder is lifted or lowered from time to time, as may be required to bring the discharge-outlet of the hopper into line with the line of bunker-openings. It should also be borne in mind that the truck and hopper are movable at any height of the girder lengthwise it and any distance upon it in either direction from the boom for the purpose of transferring the coal which it received from the grab to any one of a number of bunker openings or chutes, the means for

operating the hopper-truck being under the control of the engineer of the engine and of a nature to move and stop the truck at his will. This renders it possible to deliver from the barge or coal in bulk first a load at one bunker-opening, a second load at another bunker-opening, a third load at still another opening, and so on, so that with a single supplying-grab and the supplemental transferring devices it becomes possible to work the grab to its fullest capacity, which is far greater than that required to supply a single bunker, and thus feed at the same time a relatively large number of bunkers with coal as fast as they can take care of it, it being understood that each bunker has a gang of men whose duty it is to trim the coal in the bunkers as it is supplied them.

I have spoken of the hopper as removable from the track. This is for the purpose of permitting it to be used independently of the truck and in connection with the boom and the grab, and so that it may be moved horizontally upon the boom to any desired position beneath any part of it and may there receive coal from the grab which has been moved to discharge its load into it. It should be stated that coal-handling apparatus especially designed to load large steamships should have as much flexibility and adaptability as possible in order to meet the greatly varying conditions which exist in different steamships, no two ships having exactly the same arrangement of bunkers either as to height, distance apart, or location. Many of the bunker-openings are in the sides of ships, but some are overhead, and it is therefore desirable that the apparatus should have provision for overhead as well as side work. The portable hopper is useful for overhead work. It is represented as suspended from a truck C, mounted on the tracks cc' of the boom. This truck C is in two parts, one of which, the part c^2 , is mounted upon the track c , and the other, the part c^3 , is mounted upon the track c' . Each part consists of a roll from which extends downward an arm c^4 . The truck parts are kept from tipping or leaving the tracks by the angle-iron guards $c^5 c^6$. There is secured in lieu thereof to the lower ends of the arms a wire rope c^7 , which extends to a bridle c^8 , attachable at each end to the upper corners of the hopper, (see Fig. 2,) preferably by means of hooks or in any other desired way. The hopper-truck is constructed so that the hopper may be removed from it by an upward vertical movement, and when it is desired to use the hopper independently of the truck it is connected with the truck C by means of the suspending-ropes c^7 and the boom-truck then moved upon the boom to the required position. The hopper may thus be taken from its truck, attached to the boom, and transferred upon it to any position convenient for overhead or other discharge. The grab is then operated to deliver its load to whatever position the hopper may be in.

Each boom-topping lift D is constructed and led so as to take hold of a boom-section at or near its outer end by a bridle attachment, if desired, and is led to a block d on the tower, which is connected by a tackle d' with a block d^2 on the tower-truck and so that the tackle shall be at one side of the boom.

The grab-ropes extend from the grab over the trolley-rolls to the extreme top of the tower and there are led over guiding sheaves and rolls E, E', E^2, E^3, E^4 , and E^5 . The sheave E coöperates with the rolls $E^2 E^3$ and the sheave E' with the rolls $E^4 E^5$. The sheaves E, E' are mounted upon a common shaft e , the rolls $E^2 E^4$ upon the common shaft e' , and the rolls $E^3 E^5$ upon the common shaft e^2 . The sheave E is of greater diameter than the sheave E' in order that it may carry its rope to a point in line with the center between the rolls $E^2 E^3$. The sheave E' is combined with the rolls $E^4 E^5$, the said rolls being so arranged as to receive between them the rope of the sheave E' . To permit this to be accomplished, the rolls are of different diameter, as represented, to bring the centers between them out of line with each other and also to permit the mounting of the rolls and sheaves upon common shafts, as shown. It will be understood that one of the grab-ropes passes over the sheave E to between the rolls $E^2 E^3$, which alternately serve to receive it according to the direction in which the trolley is moved. The sheave E' takes the other grab-rope, and the rolls $E^4 E^5$ coöperate with it and the rope in the same way.

The metal boom is preferably constructed as represented in Figs. 2, 5, and 6 and so as to provide tracks for the rolls of the trolley and tracks for the rolls of the hopper-truck. The boom so constructed has the angle-iron stringers $f f', f^2$ and $f^3 f^4 f^5$. The stringers $f f'$ are attached by angle-cleats to the braced stud f^6 , and the angle-stringer f^2 is suspended from the angle-stringers $f f'$ by brackets f^7 . The angle-stringers $f^3 f^4$ are attached by angle-cleats to the braced stud f^8 , and the angle-stringer f^5 is suspended from the angle-stringers $f^3 f^4$ by the brackets f^9 . It will be seen that the one side of the boom is composed of the angle-stringers $f f' f^2$ and their connecting-brackets and that the other side is composed of the angle-stringers $f^3 f^4 f^5$ and their brackets and that the two sides are separated from each other throughout their length by a space in which the grab-ropes may travel with the trolley. The upper surfaces of the angle-stringers $f f^3$ form tracks for the rolls of the trolley. The angle-stringers $f^2 f^5$ form tracks for the rolls of the hopper-trucks and also guards for them. The angle-stringers $f f'$ on the one side and $f^3 f^4$ on the other may be tied and braced together by bars f^{10} . (See Fig. 6.)

I prefer that the girder forming a part of the auxiliary feed have a box construction, substantially as represented in Fig. 3, and that its ends be mounted upon the posts upon

which it is vertically movable, as shown in Fig. 4—that is, by means of guide-rolls g , g' , and g^2 —to bear against the sides and inner face of the post, the guide-roll g^2 , which bears against the said inner face, being yielding and the said rolls being supported by arms or supports attached to the end of the girder. This way of mounting the girder upon the standards or posts permits the girder to be inclined or its angle varied with respect to the level of the lighter, barge, or support, and so that it may be adjusted in level or inclination to the level of the bunker-openings of the vessel to which coal or material is delivered by the hopper movable upon the girder, the connections being of such a character that they yield or conform automatically to the standard or post, as either end of the girder may either be lifted or lowered with respect to its other end. The necessity for this adjustment of the girder is apparent when it is remembered that the barge or lighter itself may be higher at one end than at the other, and that the same is also true of the vessel, and that these relative inclinations are liable to considerable variance as the loading proceeds.

I prefer to make the central or fixed section A^8 of the boom of a length to extend from the tower beyond the girder or support of the secondary handling apparatus and to there connect the movable end A^9 to it. This provides a structure of boom in which the movable section A^{10} is connected to the central section at or near the side of the tower from which it extends, and in which the central fixed section extends from the other side of the tower, and in which the movable section A^9 is hinged to the outward extension of the fixed section at some distance from that side of the tower. This provides for a permanent or fixed relation between the fixed section A^8 of the boom and the secondary handling apparatus and so that for loading into outboard bunker-openings a movable section of the boom is not employed.

I prefer that the lighter or barge be made of steel and that it have compartments h , adapted to receive water ballast and by means of which it may be sufficiently immersed in the water to furnish a stable support for the tower when it is without other load.

I have already described somewhat in detail but not connectedly the operation of the apparatus. I will now state that the operation of the entire apparatus is under the control of a single engineer or operator stationed in an operator's house over the engine-room and at or near one end of the barge or lighter.

The engine is of any ordinary or suitable construction having appropriate wire or rope winding drums or spools and suitable levers and clutches for independently actuating and holding them and said levers, and also the levers for starting and stopping the engine are within the command of the operator. He thus has within his control not only the means for automatically loading the grab at any

point below any part of the boom and for lifting and transferring it from said loading position by a conjoint lifting movement of the grab-lifting rope and horizontal movement of the trolley which causes the shovel to take a diagonal upward and onward course toward its point of discharge, but he also controls the movement of the auxiliary or secondary carrying mechanism, which receives the load from the grab and transfers it laterally the boom to any desired place or number of places of delivery, the extent and direction of this movement being varied at will by the operator. Not only may a single operator thus govern and direct the loading of the grab, the extent and direction of its movement to the hopper, its discharge into the hopper, and the subsequent lateral feed and delivery of the load by the auxiliary feeding mechanism, but he also has within his control the means for moving the tower lengthwise the barge or lighter in either direction, for adjusting the height of the girder and auxiliary carrying devices, for lifting the hopper from its truck and moving it upon the boom, and for lifting the outboard boom-sections or either of them. In the operation of these devices he may be assisted by a man stationed on the tower.

Of course the auxiliary devices may not always be employed. The suspended hopper is used when desired. The apparatus is adapted for all the uses set forth in the said application and without employing the hopper in either of the two ways described. The coal may be taken from the hold of the lighter or barge carrying the tower and both handling devices, or from another lighter or barge, or from a stationary pile.

The invention would be practiced if the devices were mounted upon stationary supports instead of upon the lighter or barge and whether the tower is made movable the girder for the purposes of its adjustment or not.

I have spoken generally of grabs as a means for lifting the coal and transferring it, and I have referred to coal as the material to be shifted by it. I do not use these terms, however, in a limiting sense, as by "grab" I mean any of the usual devices for lifting and transferring material, and by "coal" any material which is capable of being lifted and transferred by such a lifting device.

The grab which I have shown is of the kind which is automatically or self loading and which also automatically delivers its load, and while I do not confine the invention to this form of grab, yet I prefer it for many purposes, and especially in handling coal, as by this means the transfer of the coal from the hold of the barge or lighter or from bulk is entirely automatic to the station or point of final discharge into the bunker or chute. I also prefer to use the type of transferring-trolley described in conjunction with the said grab and means for operating it specified, in that it is readily adjusted to the conditions of the work. I mean by that that the height to which the

grab is lifted is in its transfer from bulk to the auxiliary carrying device governed or controlled by the height of the said auxiliary device, and as this has quite a range the advantage of this construction in preventing unnecessary extent of movement is apparent.

I would further say that the height at which the auxiliary carrying device discharges is fixed by the height of the openings to the coal-bunkers.

I do not claim herein the hopper detachable from its truck and attachable to hopper-supporting devices movable upon the boom, as the same is the subject of a separate application.

Having thus fully described my invention, I claim and desire to secure by Letters Patent of the United States—

1. In an apparatus for handling coal and other material the combination of a barge, lighter or similar support, means mounted thereon and transported thereby for lifting coal or other material and transferring it crosswise the barge or lighter to an auxiliary cross-transferring device, said means comprising a tower, a horizontal boom carried by the tower, a trolley movable upon the boom and a grab or other conveyer movable toward and from the trolley, the said auxiliary cross-transferring device comprising a beam or girder carried by said barge or lighter to extend lengthwise it and crosswise and beneath the boom, a truck movable upon said beam or girder and a hopper or receptacle carried by said truck, adapted to receive the contents of the lifting grab or conveyer and to transfer them lengthwise said barge or lighter to a discharging position.

2. In an apparatus for handling coal and other material the combination of a barge, lighter or similar support, means mounted thereon and transported thereby for lifting coal or other material and transferring it crosswise the barge or lighter to an auxiliary cross-transferring device, said means comprising a tower, a horizontal boom carried by the tower, a trolley movable upon the boom and a grab or other conveyer movable toward and from the trolley, the said auxiliary cross-transferring device comprising a beam or girder carried by said barge or lighter to extend lengthwise it and crosswise and beneath the boom, a truck movable on said beam or girder and a hopper or receptacle carried by said truck adapted to receive the contents of the lifting grab or conveyer and to transfer them lengthwise said barge or lighter to a discharging position, and means for vertically adjusting the height of the girder or beam, truck and hopper or receptacle carried thereby with respect to said boom.

3. In an apparatus for handling coal and other material the combination of a barge, lighter or similar support, means mounted thereon and transported thereby for lifting coal or other material and transferring it crosswise the barge or lighter to an auxiliary

cross-transferring device, said means comprising a tower, a horizontal boom carried by the tower, a trolley movable upon the boom and a grab or other conveyer movable toward and from the trolley, the said auxiliary cross-transferring device comprising a beam or girder carried by said barge or lighter to extend lengthwise it and crosswise and beneath the boom, a truck movable upon said beam or girder and a hopper or receptacle carried by said truck, adapted to receive the contents of the lifting grab or conveyer and to transfer them lengthwise said barge or lighter to a discharging position, and means for moving the tower, boom, trolley and grab lengthwise the lighter or barge.

4. In an apparatus for handling coal and other material, in combination with a means for lifting it and transferring it, a supplementary or auxiliary receiving and carrying device arranged for consecutive operation with said lifting and transferring means and also having a vertical adjustment with respect thereto.

5. In an apparatus for handling coal and other material the combination of a barge, lighter or similar support, means mounted thereon and transported thereby for lifting coal or other material and transferring it crosswise the barge or lighter to an auxiliary cross-transferring device, said means comprising a tower, a horizontal boom carried by the tower, a trolley movable upon the boom and a grab or other conveyer movable toward and from the trolley, the said auxiliary cross-transferring device comprising a beam or girder carried by said barge or lighter to extend lengthwise it and crosswise and beneath the boom, a truck movable upon said beam or girder and a hopper or receptacle carried by said truck, adapted to receive the contents of the lifting grab or conveyer and to transfer them lengthwise said barge or lighter to a discharging position, and means for moving the tower, boom and trolley lengthwise the barge or lighter and for adjusting the vertical position of the beam or girder, truck and hopper or receptacle with respect to the boom.

6. In an apparatus for handling coal and other material the combination of a barge, lighter or similar support, means mounted thereon and transported thereby for lifting coal or other material and transferring it across the barge or lighter to an auxiliary cross-transferring device, said means comprising a tower, a horizontal boom carried by the tower, extending from both sides thereof and operative for a horizontal trolley and vertically-movable grab throughout its entire length or any portion thereof, said trolley movable upon the beam and said grab or other conveyer movable toward and from the trolley to the said auxiliary cross-transferring device the latter comprising a beam or girder carried by said barge or lighter to extend lengthwise and crosswise and beneath the boom, a truck movable upon said beam or

girder, and a hopper or receptacle carried by said truck adapted to receive the contents of the lifting grab or conveyer and to transfer them lengthwise said barge or lighter to a discharging position.

7. The combination in an apparatus for handling coal and other material of means for lifting it and carrying it in one direction to a point of transfer and an additional means for receiving said material at the point of transfer and transferring it to a discharging position, the said additional means being vertically adjustable to vary its height, and the said lifting and carrying means being longitudinally movable.

8. The combination in an apparatus for handling coal and other material of a tower, a horizontal boom carried by the tower, a trolley movable upon the boom and a grab or other conveyer movable toward and from the trolley to an auxiliary cross-transferring device comprising a beam or girder, a truck movable upon said beam or girder, a hopper or receptacle carried by said truck adapted to receive the contents of the lifting grab or conveyer and transfer them lengthwise said barge or lighter to a discharging position, the said boom extending beyond the said beam or girder and sufficiently elevated therefrom to permit the passage of the hopper or receptacle over it and whereby the grab or conveyer may be used either to deliver its contents to the hopper or receptacle or at a point beyond the same.

9. In an apparatus for handling coal and other material in combination with means for self-loading, lifting and transferring it, a supplementary or auxiliary receiving and carrying device arranged for consecutive operation with said self-loading, lifting and transferring means, having a movement independent thereof, vertically adjustable to the height of its discharging position and arranged to receive coal or material fed to it by said means and to be moved at will between its receiving and discharging positions.

10. In an apparatus for transferring coal or other material from bulk to the side bunkers of a vessel, means for receiving, lifting and transferring the coal to a station, variable as to height, and means for transferring the said coal or material from said station to the bunker-openings, which means are adjustable as to height and movable at will to any one of a series of bunker-openings.

11. The combination of a buoyant support, means carried thereby for lifting coal or other material and transferring it to a receiving position and other means carried by said buoyant support for transferring said coal or material from said receiving position to a discharging position, the said other means being vertically adjustable upon the buoyant support and also being adapted for consecutive or joint use with the first-named means.

12. The combination of a lighter or barge adapted to receive and transfer coal or other

material, a handling device mounted upon said barge comprising means for lifting the coal or other material from said barge and transferring it to a receiving station, and means for receiving it at said station and moving it laterally to a discharging position, the said last-named means being vertically adjustable with respect to the barge.

13. The combination of means for lifting and transferring coal or other material to a receiving-hopper, the said receiving-hopper and means for vertically adjusting it and moving it independently of the said first-named means.

14. The combination in an apparatus for handling coal or other material of a tower, a boom mounted on the tower, a trolley movable horizontally upon the boom, a vertically-movable grab combined with the trolley, a vertically-movable girder beneath the boom at one side of the tower, a hopper-truck supported on tracks mounted upon said girder, movable lengthwise the girder and a hopper carried by said truck having an operative relation to the said boom, trolley and grab.

15. The combination of the girder having tracks at different levels, the hopper-truck mounted upon said tracks, and a hopper mounted upon said truck, the rail and wheels of the truck nearest the center of the hopper's width being upon a higher level than the other wheels of the truck, and the other rail of the girder.

16. The arrangement and combination of the sheaves E, E' mounted upon a common shaft, the rolls E², E⁴ mounted upon a common shaft and the rolls E³, E⁵ mounted upon a common shaft, and the grab-operating ropes

17. The combination of the posts or supports, a girder carrying tracks mounted upon said supports to be vertically movable, a hopper-truck upon said tracks, a means for moving it horizontally thereon, a hopper carried by said trucks and having an outboard discharge-opening, and means for supplying said hopper with coal or other material.

18. The combination of a vertically-movable girder, a truck mounted thereon, a power-driven draw-rope for moving it horizontally in both directions, a hopper carried by said truck, the said draw-rope having a compensating lead for variations in the height of the girder.

19. In an apparatus for handling coal and other material, the combination of a tower, a boom having a fixed part extending from the tower over an auxiliary cross-transferring apparatus and a movable section attached to the end of said fixed section, said auxiliary cross-transferring device arranged at the side of the tower from which the fixed section of the boom extends, a trolley movable upon any part of said boom or its extension and a grab or similar device movable vertically with respect to the trolley and the auxiliary cross-transferring device.

20. In an apparatus for handling coal and

other material, a tower or support, a boom carried thereby, a fixed section of which extends from one side of the tower across it and projects from the tower upon the other side over an auxiliary cross-transferring device, movable boom extensions varying in length, attached one to each end of said fixed section, an auxiliary cross-transferring device, a trolley mounted upon the boom to be movable upon any part thereof, and a grab or similar device vertically movable with respect to the trolley and with regard to the auxiliary cross-transferring device.

21. In an apparatus for handling coal and other material, the combination of a barge, lighter or similar support, a tower carried thereby, a boom mounted upon the tower having a fixed section which extends from one side of the tower over an auxiliary cross-transferring device, a movable boom-section attached to the end of said fixed section, an auxiliary cross-transferring device mounted upon said barge or lighter at one side of the tower, a trolley movable upon the boom and a grab or similar device vertically movable with respect to the trolley and auxiliary cross-transferring device.

22. The combination of a tower or support, a boom carried thereby one part of which overhangs an auxiliary cross-transferring device, said auxiliary cross-transferring device, means for varying the inclination thereof, a trolley mounted upon the boom to be movable upon any part thereof and a grab or other device movable vertically with respect to the trolley and said auxiliary cross-transferring device.

23. In an apparatus for handling coal and other material, the combination of a tower, a boom carried by the tower one part of which is over an auxiliary cross-transferring device comprising a longitudinal girder or support, means for sustaining it, a truck mounted thereon to traverse it lengthwise, a hopper or receptacle carried by the truck, means for varying the inclination of the girder or support, a trolley mounted upon the boom to traverse any part of it and a grab or similar device movable vertically with respect to the trolley.

24. The combination in an apparatus for handling coal and other material of a tower, a boom carried thereby over an auxiliary cross-transferring device, the said auxiliary cross-transferring device comprising posts or stand-

ards, a girder mounted thereon and connected therewith in a manner to permit its inclination to be varied with respect thereto, means for lifting the girder, a truck mounted thereon, a receptacle carried by the truck, a trolley mounted upon the boom to traverse any portion of it and a grab or similar device movable vertically with respect to the trolley.

25. The combination of a tower, a boom carried thereby, a cross-transferring device beneath the boom comprising a girder, standards or posts supporting the same and automatic connections between the girder and the standards which permit the inclination of the girder to be automatically changed, a truck upon the girder, a receptacle carried by the truck, a trolley movable upon any part of the boom, and a grab or other similar device vertically movable with respect to the trolley.

26. The combination of a barge, lighter or similar support, a tower mounted thereon, a boom carried by the tower, a cross-transferring device along one side of the barge or lighter and tower and beneath a portion of the boom and means for varying its inclination to adjust it to the inclination of the bunker-openings in an alongside vessel, a movable trolley upon the boom and a grab or similar device vertically movable with respect to the trolley.

27. In an apparatus for handling coal and other material, a girder, posts or supports for the same, means connecting the girder with the posts or supports arranged to slide upon the supports and to automatically permit a change in the inclination of the girder with respect to the posts or supports and transferring devices mounted upon said girder.

28. In an apparatus for handling coal and other material, a barge or lighter, a transferring device mounted thereon comprising a track, a track-support extending lengthwise it and adjacent to one side thereof, and a car movable lengthwise it, and means for varying the inclination of the said track and support lengthwise the said barge or lighter and whereby the inclination thereof may be varied with respect to the barge or lighter or to an alongside vessel to adjust it to the height of the bunker-openings of said vessel.

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