C. W. AVELING.

HOISTING AND CONVEYING MACHINERY.

APPLICATION FILED NOV. 3, 1919.

1,395,077. **Patented Oct. 25, 1921.**

5 SHEETS—SHEET 1.

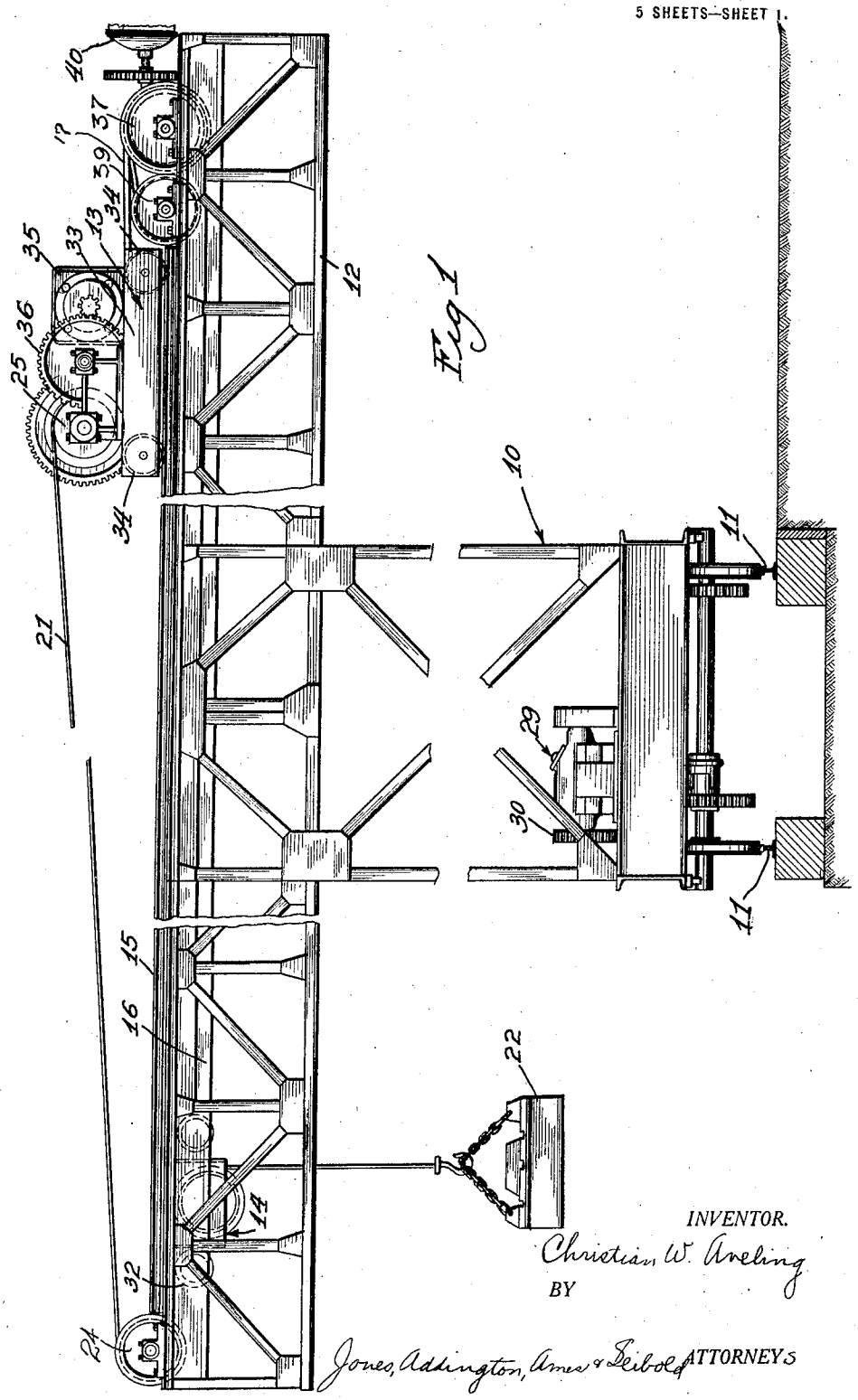

Fig 1

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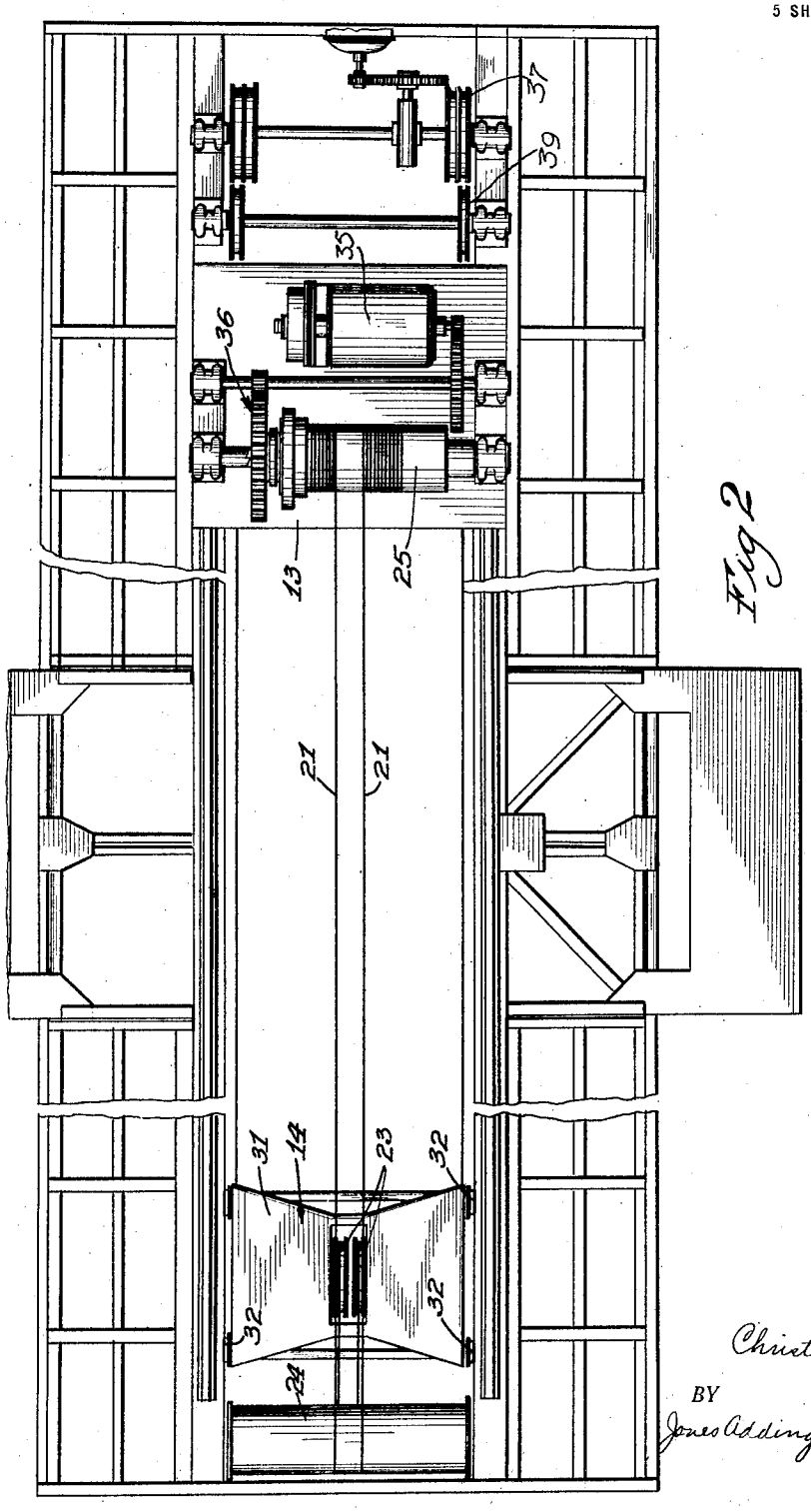

Fig 2

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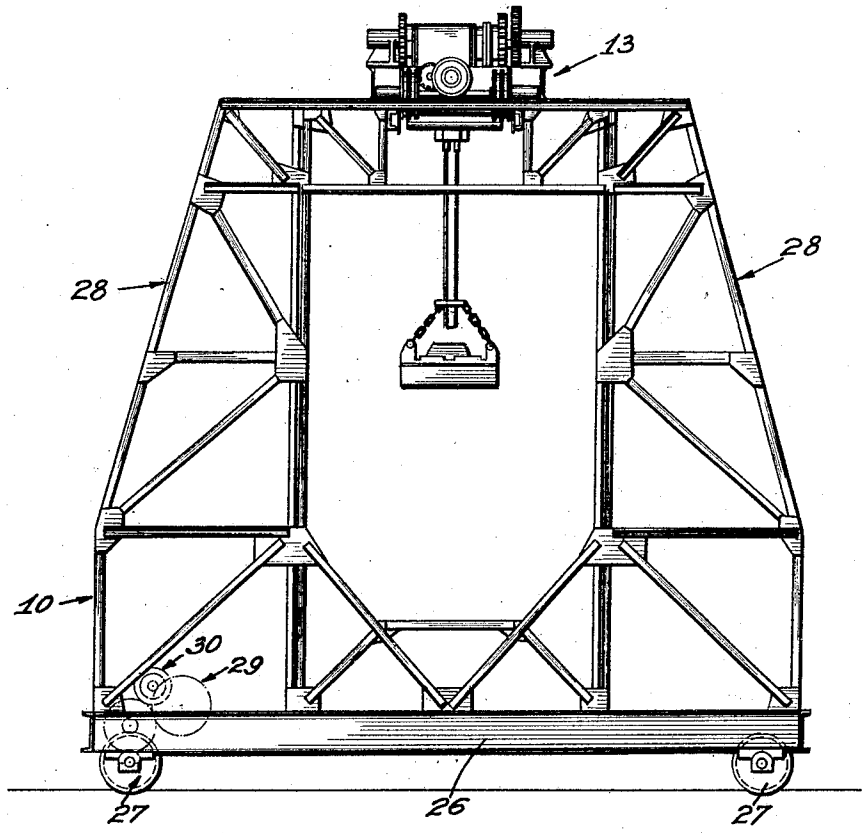

Fig 3

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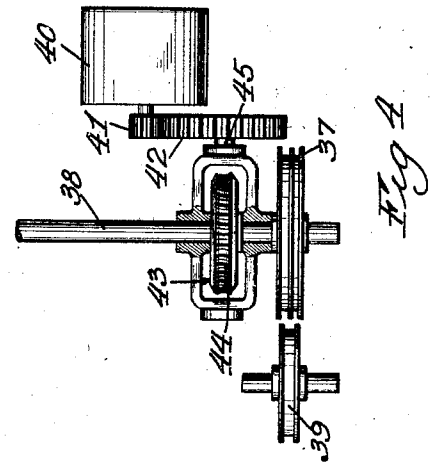

Fig 4

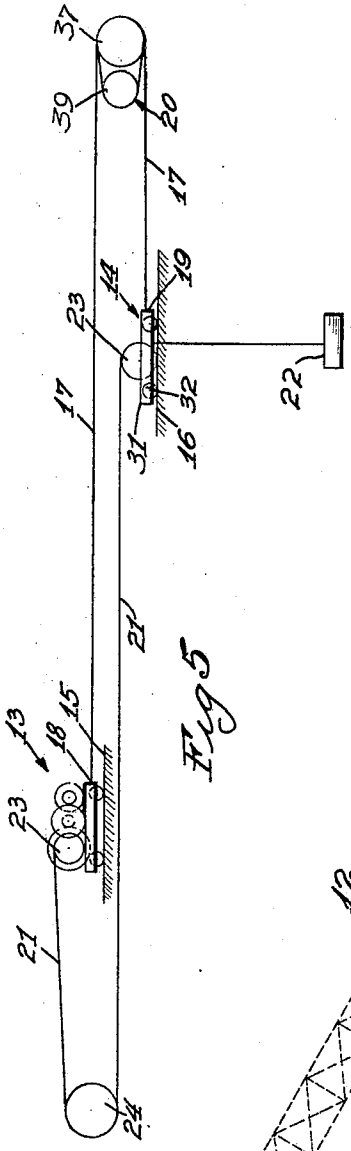

Fig 5

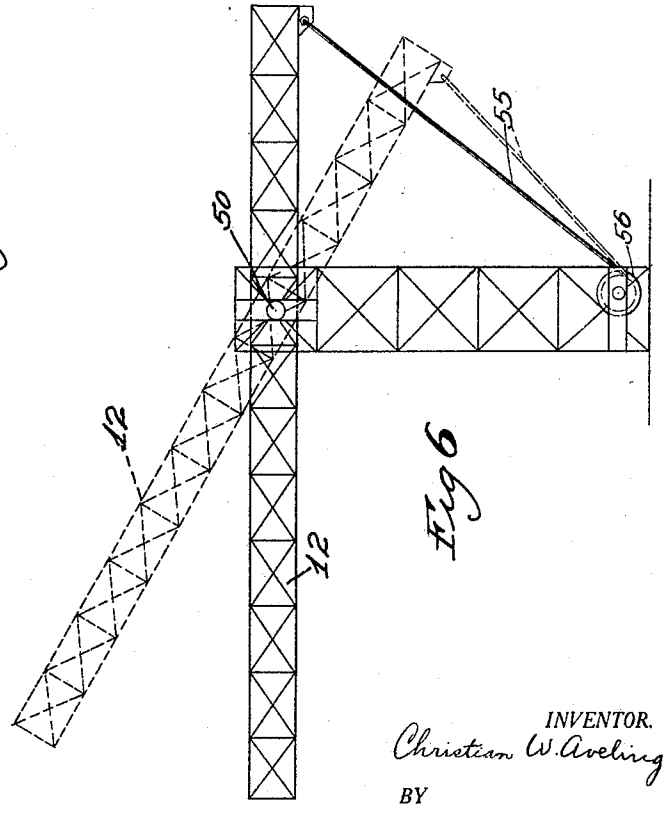

Fig 6

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5 SHEETS—SHEET 5.

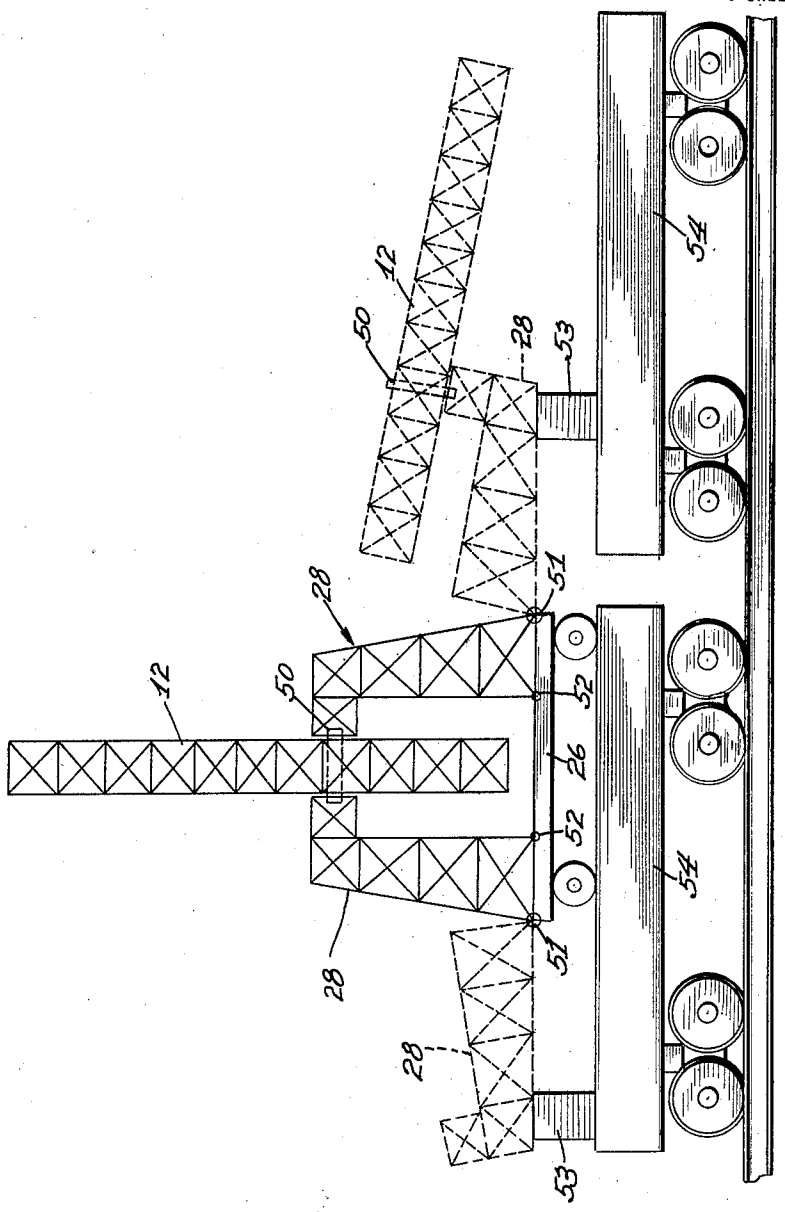

Fig 7.

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UNITED STATES PATENT OFFICE.

CHRISTIAN W. AVELING, OF ELGIN, ILLINOIS.

HOISTING AND CONVEYING MACHINERY.

1,395,077. Specification of Letters Patent. Patented Oct. 25, 1921.

Application filed November 3, 1919. Serial No. 335,431.

To all whom it may concern:

Be it known that I, CHRISTIAN W. AVELING, a citizen of the United States, residing at Elgin, in the county of Kane and State of Illinois, have invented new and useful Improvements in Hoisting and Conveying Machinery, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to hoisting and conveying machinery.

One of the objects of my invention is to provide improved means for counterbalancing the effect of the load on the bridge of a crane.

Further objects will appear from the detailed description to follow and from the appended claims.

In the drawings in which two embodiments of my invention are shown:

Figure 1 is an elevation of a double cantaliver traveling crane, parts being broken away to reduce the size of the drawing;

Fig. 2 is a plan view of the crane shown in Fig. 1, parts being broken away;

Fig. 3 is an elevation of the crane as seen from the right of Fig. 1;

Fig. 4 is a detail view of the motor and transmission for the trolley travel;

Fig. 5 is a diagrammatic view showing the arrangement of the load trolley, the hoist trolley and the drive for these trolleys;

Fig. 6 is a diagrammatic view showing a form of my invention in which the bridge and support are mounted for tilting movement, and

Fig. 7 is a diagrammatic view of the form of my invention shown in Fig. 6, showing the crane mounted for shipment and showing in dotted lines the position of the bridge and support when folded for shipment.

In order to give a general idea of the construction shown, it is here stated it comprises a motor-driven carriage 10 mounted to travel on rails 11, a double cantaliver bridge 12 extending transversely of the line of travel of the carriage 10 and supported by the carriage, and extending on both sides thereof, and two trolleys 13 and 14 traveling on upper and lower tracks 15 and 16 respectively, which tracks are supported by the double cantaliver bridge 12.

These trolleys 13 and 14 which travel on the upper and lower tracks 15 and 16 respectively are so connected together that they counterbalance each other automatically, that is to say, when one moves toward the center of the bridge, the other one also moves toward the center of the bridge, and when one moves away from the center of the bridge, the other will automatically move away from the center of the bridge. One of these trolleys 14 supports the load-lifting device and the load carried thereby, and the other trolley 13 supports the hoisting mechanism which controls the raising and lowering of the load which is carried by the other trolley.

The arrangement whereby this counterbalancing of the load-trolley and the hoist-trolley is accomplished, is shown diagrammatically in Fig. 5.

Referring particularly to Fig. 5, the hoist-trolley 13 is connected with the load-trolley 14 by means of a cable 17, one end of which is secured at 18 to the hoist-trolley, and the other end of which is secured at 19 to the load trolley, the cable 17 intermediate these ends passing over a friction-drive arrangement indicated at 20, which friction-drive is connected with a motor which is used to cause the travel of both of the trolleys 13 and 14.

To complete the connection between the trolleys 13, 14 so that they will automatically travel in opposite directions, counterbalancing each other, I take advantage of and utilize the hoisting cable 21, which is secured to the load-lifting device 22, (which may be a grab-bucket, electro-magnet or the like). In actual practice, and as shown in Fig. 2, there are two of these cables, one for each side of the construction, these cables being duplicate in arrangement and function, two being provided in order to avoid side pull when the cable gets over toward the end of the winding drum. Each cable 21 passes over a pulley 23, mounted on the lower trolley 14, and thence over a drum 24, rotatably mounted at the end of the bridge 12, the end of the cable being secured to the winding drum 25 on the hoist-trolley 13.

The winding cable 21 thus serves not only to hoist the load-lifting device 22, but also serves together with the cable 17, to connect the two trolleys 13 and 14 so that they automatically move in opposite directions. The weight of the load-lifting device (together with the load itself if it is loaded)

will serve to keep the cable 21 tight between the two trolleys, no matter what position of vertical adjustment the load-lifter is in. The weight of the load-lifter 22 also keeps the cable 17 tight enough so that there is tension enough in this cable to make the friction-drive 20 effective. If desired, an additional cable may be provided between the trolleys 13 and 14, passing over the drum 24, the ends of this additional cable being firmly secured to the trolleys 13 and 14 respectively. This additional cable could be made tight enough to prevent any slight jumping of the trolleys along the track which might be occasioned when the load is suddenly released from the load-lifter 22, which would result in a slight slacking of the cable 21.

Coming now to a more detailed description of the construction, the carriage 10 may be of structural steel comprising a base portion 26 mounted on the flanged track-engaging wheels 27, and a pair of structural steel towers 28 extending upwardly from the base 26 and spaced from each other, which between them support the bridge 12, and between which the load-lifter 22 may pass when the load trolley 14 is shifted from one side to the other of the bridge. The carriage 10 is driven from the motor 29 through any suitable transmission 30, which need not be described in detail.

The bridge 12 may be of structural steel, and the upper and lower tracks 15 and 16 for the trolleys 13 and 14 respectively, may be secured to and supported on the bridge 12 in any suitable manner, not necessary to be shown or described in detail.

The load-trolley 14 may comprise a frame 31 supported by four track-engaging wheels 32, that travel on the track 16, the frame 31 serves to support the pulleys or sheaves 23 over which the hoist cables 21 pass.

The hoist-trolley 13 may comprise a base 33 supported on four track-engaging wheels 34, which engage the upper track 15, and a suitable motor 35 supported by the base 33, which motor controls the winding drum 25 through any suitable transmission 36, not necessary to be described in detail.

In practice I may provide two of the cables 17 in order that the two sides of the trolley may be driven evenly. The drive for each cable 17 comprises a double sheave or pulley 37 (Fig. 4) firmly secured on a shaft 38, and a single sheave or pulley 39, the pulley 39 being located so that the cable 17 may pass from the load-trolley 14 up and over one side of the double sheave 37, down and over the single sheave 39, and up and over the other side of the double sheave 37 to the hoist-trolley 13. The contact obtained between the cables and the double sheave 37 is ample for driving the trolleys. The double sheave 37 may be driven from a suitable motor 40 supported on the end of the bridge 12. The transmission from the motor 40 to the friction sheave 37 is through the motor pinion 41, the spur gear 42, which meshes with the motor pinion, and the worm gearing 43, which is driven from the gear 42. The worm wheel 44 of the worm gearing is firmly secured to the shaft 38 on which the double sheave 37 is mounted, and this worm wheel is driven by a worm (not shown) secured on the shaft 45 on which the spur gear 42 is secured.

The motors 29, 35 and 40 may be controlled from any suitable locality convenient for the operator, probably from a position adjacent the motor 29.

The operation has been indicated in connection with the description of the construction. Assuming that it is desired to pick up a load, and to transfer it to some other place within the range of the machine, and assuming that the parts are in the position shown in Fig. 1, the motors 40 and 29 are put in operation to bring the load-lifter 22 in position above the load which is to be lifted, the motor 40 acting to shift the trolleys 13 and 14 along their tracks, and the motor 29 acting to move the carriage 10 along the track.

During the shifting of the trolleys 13 and 14 the cables 21 and 17 together, act in effect, as an endless-belt, to shift the trolleys 13 and 14 in opposite direction, so that these trolleys will counterbalance each other, the trolley 13 passing over the trolley 14 in its travel, if it is necessary to shift the load-lifter from one side to the other of the bridge 12. As previously stated the weight of the load-lifter 22 is sufficient to keep the cable 21 tight, and keep the cable 17 tight enough to make sufficient traction between this cable 17 and the friction-drive 20. When the load-lifter is above the load to be lifted, the hoist-motor 35 is put in operation to lower the load by paying out the cables 21. When the load-lifter has secured its load, the motor 35 is put in operation to raise the load, and the motors 29 are put in operation to move the load above the point where it is to be deposited.

The counterbalancing of the trolleys avoids the necessity of weighting the carriage to keep it from upsetting, and it also enables the bridge 12 and the carriage 10 to be of much lighter construction than would be the case if the hoist mechanism and load-lifting device traveled together. The reason that a lighter construction can be employed, is that with the old construction the bridge 12 had to support, as a cantaliver beam, a weight equal to the weight of the hoisting mechanism plus the weight of the load-lifter and load, whereas with the present construction the weight is divided so

that the greatest load which is ever supported at the outer part of the cantaliver is the load-lifter and load, or the hoisting mechanism, not the sum of these two as in the construction in which the hoisting mechanism, load-lifting device and load all travel together. This lightening of the cantaliver bridge enables the supporting carriage 10 to be made of lighter construction. This, of course, cuts down the cost of construction, also cuts down the cost of operation, as it does not require as much power of the motor 29 which moves the carriage along the track.

In Figs. 6 and 7 are shown certain additional features of construction, whereby the bridge can be tilted to enable the load-trolley to be lowered into a gravel pit for instance, and whereby the bridge and towers may be straightened and folded down flat for shipment on flat cars.

In this construction the bridge 12 is pivotally mounted on a pin or shaft 50, which shaft is pivotally mounted in the towers 28. This enables the bridge to be tilted as indicated by the dotted line position in Fig. 6 to enable the load-trolley to run down into the gravel pit, or to run up to a greater elevation than could be obtained with a horizontal bridge. The counter-balancing feature previously described in detail enables this tilting of the bridge to be accomplished without any great tendency for the load-trolley to run down hill, as the hoist-trolley counterbalances this tendency. There is thus a real combination between the tilting bridge and the counterbalancing of the trolleys.

The construction is also such that the towers 28 can be folded down flat, for convenience in shipment, the towers 28 being pivotally mounted at 51 on the base 26, detachable connections being provided at 52 whereby the towers can be firmly secured in vertical position when the device is used. This construction enables the towers to be folded down flat to the dotted line position indicated, in which they rest on supports 53 on the flat cars 54. One end of the pin 50 remains secured to the right hand tower 28, the other end of the pin 50 being detached from the other tower 28. The bridge 12, when the crane is to be shipped, is brought around so that it lines up with the right hand tower 28, which can be easily accomplished because of the pivotal connection between the bridge and this tower. Suitable means may be provided for controlling the tilting movement of the bridge on the towers. The construction shown for this purpose comprising a cable 55, one end of which is secured to the end of the bridge, and the other end of which is secured to a winding drum 56.

It will be noted, that the greater the load carried by the load-lifting device, the greater will be the tension in the cable 17, and hence the greater will be the friction of the friction-drive arrangement 20, and the greater will be the tractive force which can be exerted, so that this tractive force automatically increases with the work required of it.

The counterbalancing feature enables the gage of the carriage to be made very narrow, in fact so narrow that the wheels may be brought close enough together to be used on a standard gage railroad track without danger of the crane upsetting.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A hoisting and conveying mechanism comprising a bridge, a load-supporting trolley mounted to travel along said bridge, a second trolley also mounted to travel along said bridge, a hoisting mechanism supported by said second trolley for controlling the load supported by said first trolley, and means whereby said trolleys travel in opposite directions along said bridge to counterbalance each other.

2. A hoisting and conveying mechanism comprising a bridge, a load-supporting trolley mounted to travel along said bridge, a second trolley also mounted to travel along said bridge, a hoisting mechanism supported by said second trolley for controlling the load supported by said first trolley, and means whereby said trolleys automatically travel in opposite directions along said bridge to counterbalance each other.

3. A hoisting and conveying mechanism comprising a double cantaliver bridge, a load-supporting trolley mounted to travel along said bridge, a second trolley also mounted to travel along said bridge, a hoisting mechanism supported by said second trolley for controlling the load supported by said first trolley, and means whereby said trolleys travel in opposite directions along said bridge to counterbalance each other.

4. A hoisting and conveying mechanism comprising a double cantaliver bridge, a load-supporting trolley mounted to travel along said bridge, a second trolley also mounted to travel along said bridge, a hoisting mechanism supported by said second trolley, for controlling the load supported by said first trolley, and means whereby said trolleys automatically travel in opposite directions along said bridge to counterbalance each other.

5. A hoisting and conveying mechanism comprising a bridge, a load-supporting trolley mounted to travel along said bridge, a second trolley also mounted to travel along said bridge, a hoisting mechanism supported by said second trolley, a winding drum supported by said second trolley and driven by

said hoisting mechanism, a rotatable member supported by said bridge, a rotatable member supported by said load-supporting trolley and a flexible member secured to said winding drum and passing over both of said rotatable members for supporting the load.

6. A hoisting and conveying mechanism comprising a bridge, a load-supporting trolley mounted to travel along said bridge, a second trolley also mounted to move along said bridge, a hoisting mechanism supported by said second trolley, a winding drum also supported by said second trolley and driven from said hoisting mechanism, a rotatable member supported by said bridge, a rotatable member supported by said load-supporting trolley, a flexible member secured to said winding drum and passing over both of said rotatable members for supporting the load, a third rotatable member supported by said bridge and a second flexible element secured to both of said trolleys and passing over said third rotatable member.

7. A hoisting and conveying mechanism comprising a bridge, a load-supporting trolley mounted to travel along said bridge, a second trolley also mounted to move along said bridge, a hoisting mechanism supported by said second trolley, a winding drum also supported by said second trolley and driven from said hoisting mechanism, a rotatable member supported by said bridge, a rotatable member supported by said load-supporting trolley, a flexible member secured to said winding drum and passing over both of said rotatable members for supporting the load, a third rotatable member supported by said bridge, a second flexible element secured to both of said trolleys and passing over said third rotatable member, and means for driving said third rotatable member to cause the trolleys to travel in opposite directions along the bridge.

8. A hoisting and conveying mechanism comprising a support, a bridge tiltably mounted on said support, a load-supporting trolley mounted to travel along said bridge, a second trolley also mounted to move along said bridge, a hoisting mechanism supported by said second trolley for controlling the load supported by said first trolley, and means whereby said second trolley acts to counterbalance said first trolley to hinder said first trolley from running down grade when the bridge is inclined.

9. A hoisting and conveying mechanism comprising an elongated base, a tower hinged to said base to swing from a substantially vertical position to a position in substantial alinement with said base, and a bridge supported by said tower.

10. A hoisting and conveying mechanism comprising an elongated base, a tower pivoted to said base to swing from a substantially vertical position to a position in substantial alinement with said base, and a bridge pivotally supported by said tower.

11. A hoisting and conveying mechanism comprising an elongated base, two towers pivotally mounted on said base, to swing from a position in which the towers are substantially vertical to a position in which they are in substantial alinement with the base, and a bridge supported by said towers.

12. A hoisting and conveying mechanism comprising an elongated base, two towers pivotally mounted on said base, to swing from a position in which the towers are substantially vertical to a position in which they are in substantial alinement with the base, and a bridge pivotally supported by said towers.

13. A hoisting and conveying mechanism comprising a bridge, a load-supporting trolley mounted to travel along said bridge, a second trolley also mounted to travel along said bridge, and means for causing said trolleys to travel in opposite directions along said bridge, comprising a flexible element connected to said trolleys, and a rotatable tractive member over which said flexible member passes, and means whereby the friction between said flexible element and said rotatable element varies with the load supported by said load-supporting trolley.

In witness whereof, I have hereunto subscribed my name.

C. W. AVELING.