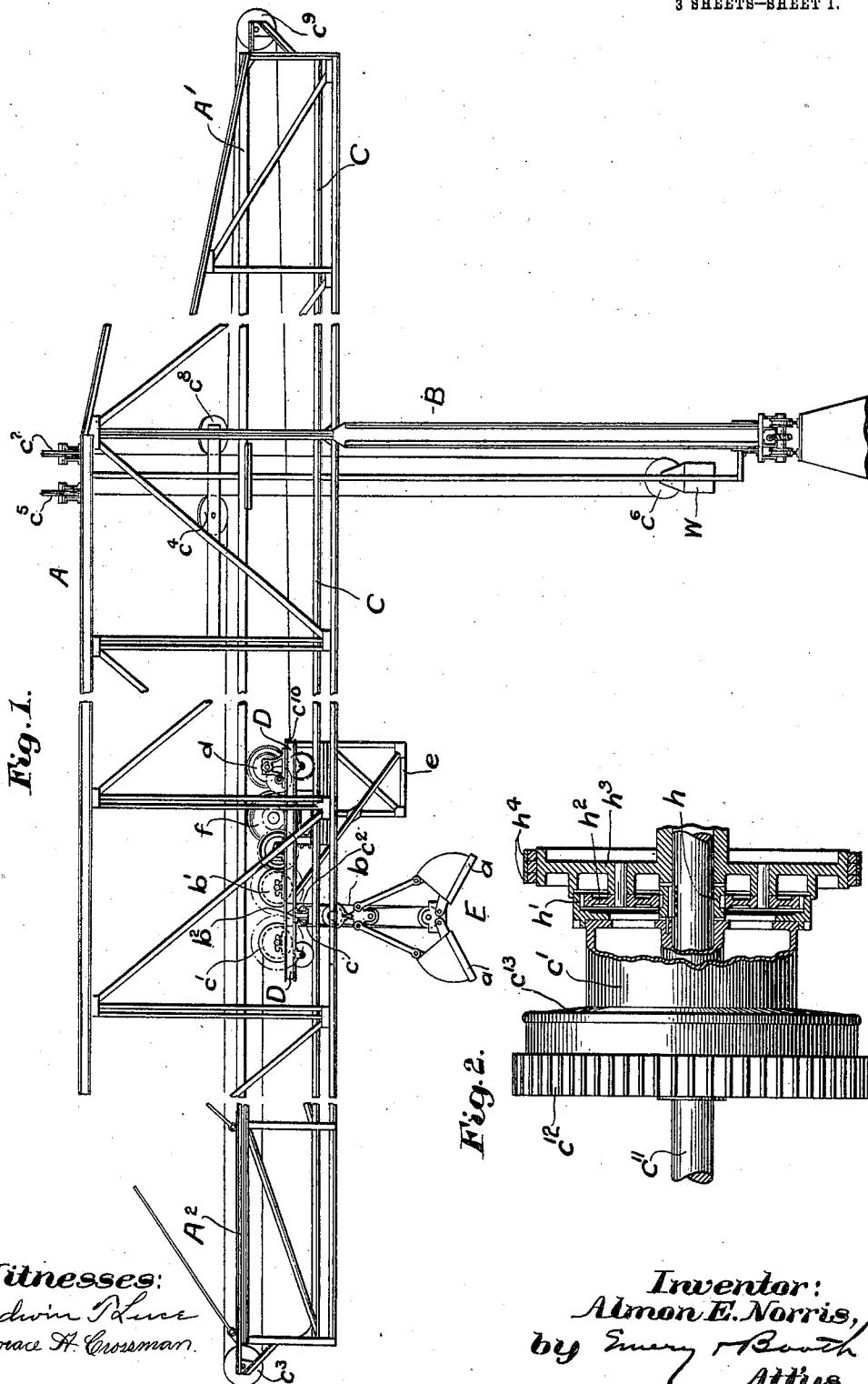


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HOISTING AND CONVEYING APPARATUS.
APPLICATION FILED JULY 8, 1907.

995,707.

Patented June 20, 1911.

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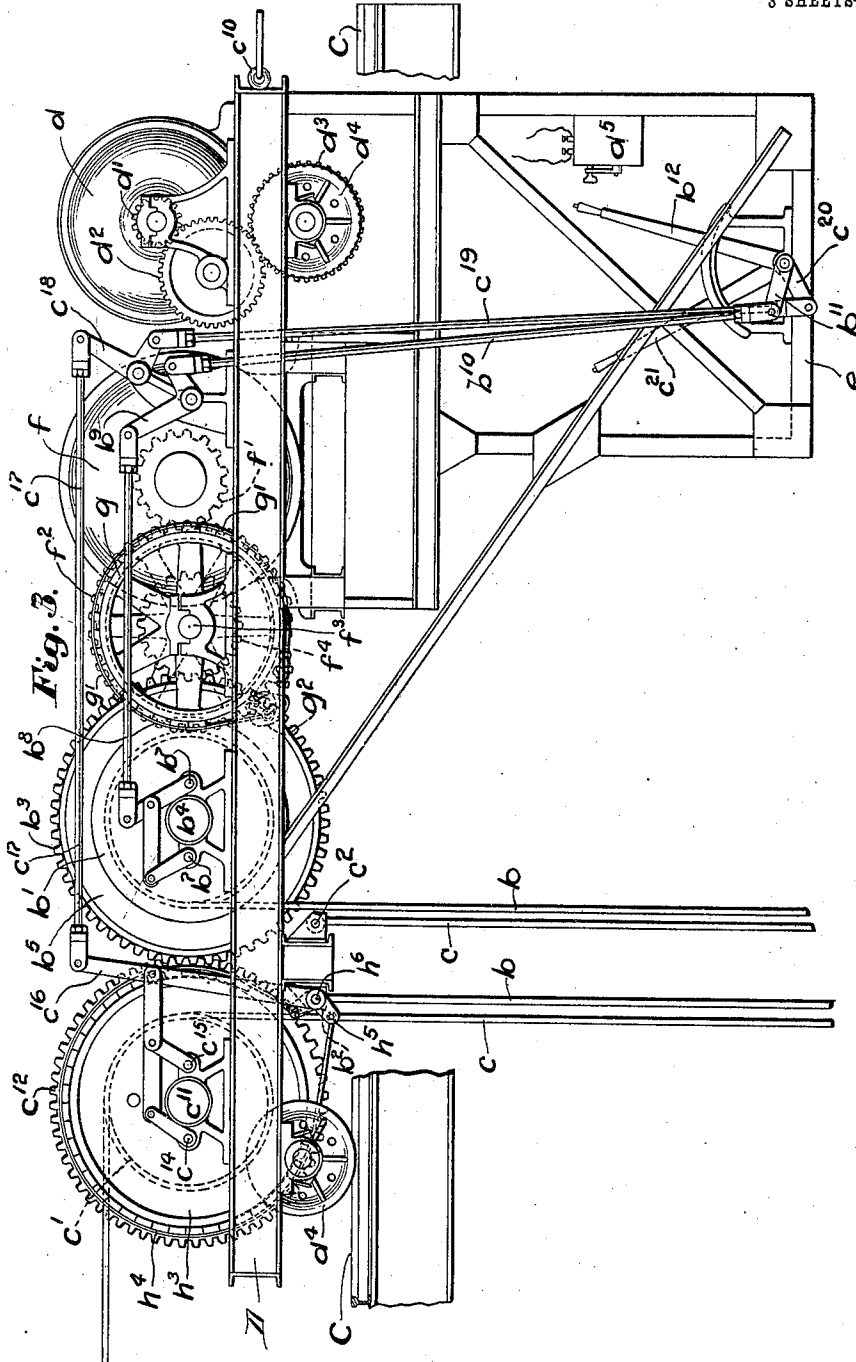


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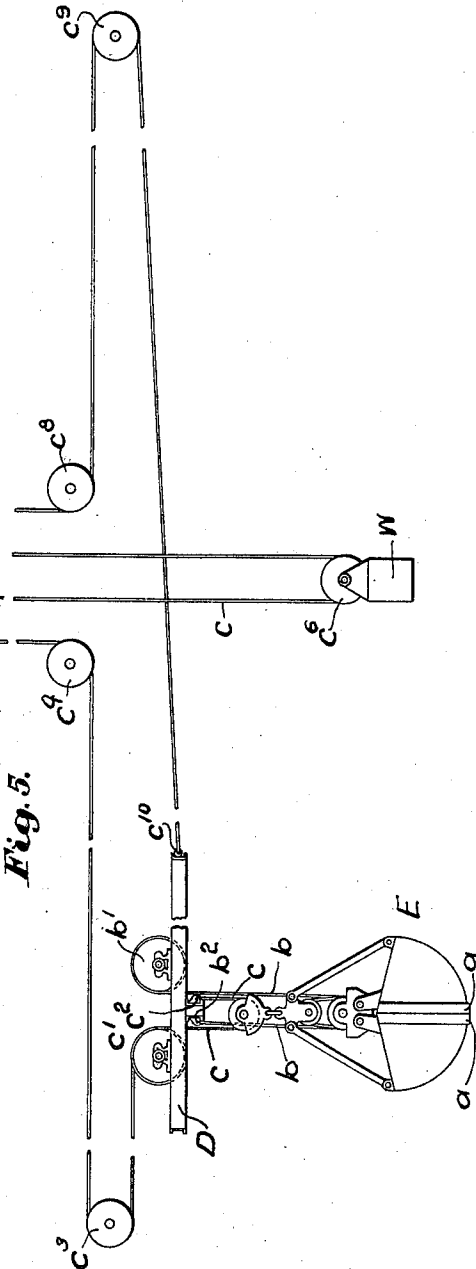
3 SHEETS--SHEET 2.



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3 SHEETS--SHEET 3.



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UNITED STATES PATENT OFFICE

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HOISTING AND CONVEYING APPARATUS.

995,707.

Specification of Letters Patent. Patented June 20, 1911.

Application filed July 8, 1907. Serial No. 382,584.

To all whom it may concern:

Be it known that I, ALMON E. NORRIS, a resident of Cambridge, county of Middlesex, and State of Massachusetts, have invented an Improvement in Hoisting and Conveying Apparatus, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

My invention relates to hoisting and conveying apparatus and consists more particularly in improvements which add to the efficient and economical operation, as well as facilitating the control of such apparatus.

My invention will be best understood by reference to the following description when taken in connection with the accompanying illustration of one specific embodiment thereof, while its scope will be more particularly pointed out in the appended claims.

Referring to the drawings: Figure 1 shows in side elevation several detached portions of a coal handling bridge with its trolley carriage and grab, all embodying, by way of illustration, one form of my invention; Fig. 2 shows in partial section the hoisting drum employed upon the trolley carriage; Fig. 3 shows in enlarged side elevation the details of the trolley carriage and its associated operating parts; Fig. 4 is a plan view, with certain parts in section, of the trolley carriage and parts shown in Fig. 3; and Fig. 5 is a view of diagrammatic nature showing more clearly the plan or arrangement of the operating ropes or cables.

Referring to the drawings I have there illustrated my invention as applied to a coal handling bridge A, comprising a framework sustained upon traveling supports B, (one of which only is shown) providing an elevated track-way C for the trolley carriage D, which latter sustains the hoisting device E. The hoisting device in this case consists of a grab or bucket of usual form, which is caused at will to be raised or lowered, opened or closed and traversed from one end of the track-way to the other by means of operating parts and mechanism to be described. In the particular embodiment of my invention illustrated, *i. e.* the coal handling bridge referred to, the framework is fixedly carried between the supports B and to this is added an over-hanging, track-sustaining portion A' of the frame-work at one end and a second over-hanging portion A² at the opposite end, the

latter being constructed in the form of a boom and adapted to be raised from a horizontal position to an upright position, or again lowered through means of suitable connections which it is unnecessary herein to show.

It is to be understood that while I have selected for illustration an embodiment of my invention in the form of the bridge referred to, it is susceptible of useful embodiment in many other installations and arrangements employing traveling carriages but quite different in appearance and construction from the illustrated bridge, and that the latter is submitted as an illustration only of the broad principles of my invention.

In the drawings I have shown an ordinary form of grab E provided with the usual jaws *a*, which may be opened or closed in the ordinary manner by letting out or taking in slack in the opening and closing rope *b*, which latter is secured to the opening and closing rope-winding drum *b'* on the overhead trolley carriage, thence passing downward over the opening and closing sheaves on the grab and thence upward where its end is fixedly attached to the carriage at *b²* (Fig. 5).

While my invention may be applicable in certain of its features to hoisting devices other than those of the grab type (and, therefore, is not to be limited thereto) it has, as will appear, particular utility in this connection.

To effect the raising and lowering of the grab at the desired time there is provided in association therewith the hoisting rope *e* which leads to suitable mechanism to be described whereby the rope may be taken in or let out and the grab accordingly raised or lowered. Obviously, the hoisting rope may be connected to the grab by a direct connection or in various other ways; but this connection, the nature of which is quite immaterial, in the illustrated form is obtained by leading the hoisting rope downward over and about one or more fixed sheaves upon the grab and thence upward to a fixed point *e²* upon the overhead carriage. The winding in of the hoisting rope, therefore, shortens the loop in which the grab is suspended and causes the elevation of the latter. While the hoisting rope might, through appropriate connections, be associated with rope winding mechanism located at some fixed point along the track-

way, or the entire run of the hoisting rope might be carried wholly upon the carriage, in the illustrated form of my invention, in order to provide for the control of the hoisting of the bucket from the carriage itself, while, at the same time, providing means for counter-weighting the bucket at a fixed position so as to relieve the carriage from the burden of the counter-weight, I have shown the hoisting rope as of endless form, while wrapped for several turns about a hoisting drum c' carried above on the overhead carriage. That is to say, the hoisting rope leads upward over and about the drum thence to the opposite or boom end of the track-way (Figs. 1 and 5) where it passes over the guide sheave c^3 and thence in a reverse or return direction to a point where it is desired to introduce the counter-weight. Here the rope passes obliquely upward over the inclined sheave c^4 to the guiding sheave c^5 thence downward to the counter-weight sheave c^6 , which latter carries suspended the counter-weight W , thence upward to the guiding sheave c^7 , downward to the inclined sheave c^8 , thence to the farther end of the track-way over the guide sheave c^9 and back again to the carriage, where it is fastened in any suitable manner as by the eye bolt c^{10} .

It will be observed that the traverse of the carriage causes the hoisting rope to travel with it without any necessary effect upon the movements of the grab, the rope, as the carriage travels, running through the counter-weight sheave without effect upon the raising or lowering of the weight. If the hoisting drum c' , however, is turned to wind up the depending portion of the hoisting rope the grab is necessarily raised and the counter-weight lowered. If the rope unwinds the counter-weight is raised. The counter-weight in effect, is in a depending loop of the hoisting rope, which merely lengthens or shortens as the depending grab supporting portion of the hoisting rope is wound in or out upon the drum c' . While the counter-weight may be of any desired or selected mass it is preferably somewhat less than sufficient to overcome the unloaded bucket,—that is to say, still leaving the empty bucket, when unchecked, with a tendency to fall and the counter-weight to rise.

While the carriage may be traversed, or controlled, or both, from some stationary position along the bridge, in the present instance it is provided with its own propelling motor d (Figs. 3 and 4) and suitable controlling appliances associated with the carriage itself so that it may be started, stopped or reversed by an attendant upon the carriage. The propelling motor d has the driving pinion d' meshing with intermediate gear d^2 which drives the axle gear d^3 , the latter mounted upon one of the axles

of the carriage and connected, therefore, to drive the latter through its wheels or trucks d^4 , which latter engage the track-way C . Current may be taken by the carriage from a stationary feeding wire or rail by means of a shoe or trolley, not shown.

Depending from the carriage frame-work is a man-supporting platform e suitably arranged to carry the attendant or operator and provided with necessary controlling devices conveniently arranged. For controlling the traversing motor d any suitable form of electrical controlling appliances may be employed, the usual starting switch and rheostat being conventionally represented at d^5 . For operating the two rope-winding drums c' and b' the carriage is also provided with a second operating motor f , which also may be started or stopped from the operator's platform by means of electrical controlling devices, the latter not shown in detail. The hoisting or winding motor f is provided with a driving pinion f' which meshes with the driven gear f^2 upon an intermediate or counter-shaft f^3 . The counter-shaft may be and preferably is provided with an automatic brake or load-holding device of any suitable construction, the one illustrated consisting of a drum g secured to the shaft f^3 and encircled by a brake band g' , the opposite ends of which are attached to the oscillating actuator block g^2 . The block is turned (Fig. 4) by the spiral spring g^3 to cause the band constantly to contact with the periphery of the brake drum. The connection of the oscillating block to one end of the band is nearer the oscillating center of the block than its connections to the opposite end of the band, so that when driven by the motor in the direction of hoisting, the drum pulls upon the longer radius of the band attachment to the block, tending more or less to loosen the band when power is shut off, however, any reverse movement of the drum, if the load tends to settle or drop, pulls upon the attachment of the shorter radius, causing the band to be drawn tightly about the drum and preventing further movement thereof. The counter-shaft or intermediate shaft f^3 in turn is provided with a driving pinion f^4 which meshes with the gear b^3 fast upon the driving shaft b^4 for the opening and closing drum b' . The opening and closing drum shaft b^4 is driven in one direction by the motor while the driving shaft c^{11} for the hoisting drum is at the same time driven in the opposite direction by means of the driving gear c^{12} fast thereon and meshing with the gear b^3 .

In order to clutch the rope-winding drums to, or unclutch them from, their respective driving shafts upon which they are normally free to rotate, they are each provided with suitable clutching devices. The drum b' is axially movable to cause en-

gagement of the attached clutching member b^5 with a cooperating clutch member secured to the gear b^3 and shaft b^4 . The drum c' may be similarly moved to engage its clutch member c^{13} with the gear c^{12} .

Any suitable clutch operating devices may be employed and I have herein indicated for the opening and closing drum a sliding collar b^6 and clutch operating screws b^7 , of the type described in my prior patent Re-issue No. 12,085, for forcing the drum into clutching engagement with the shaft. For this purpose, the clutching screws for the drum are connected (Fig. 3) to be turned by means of the operating rod b^8 , connected through the bell-crank lever b^9 to the link b^{10} , the latter secured to the laterally extending arm b^{11} connected to the upright pivoted hand lever b^{12} on the operating platform. In a similar fashion the drum c' is provided with clutch operating screws c^{14} and c^{15} connected to be operated by the upright pivoted lever c^{16} , which, in turn, is connected through the link c^{17} , bell-crank lever c^{18} , and link c^{19} , to the arm c^{20} of the controlling lever c^{21} on the operating platform. The operator, therefore, by throwing the controlling levers b^{12} and c^{21} , can throw in or out either of the clutches at will. It will be observed that the counter-weight W acts to counter-balance the major portion of the weight of the empty bucket so that in raising the loaded bucket the motor f is required to lift but a little more than the load itself, and, since the weight of the empty bucket is often greater than the load which it is designed to carry, this results in the saving of a large amount of power. In order that the counter-weight may not act to prevent the open-jawed, empty bucket from sinking effectively into the coal when dropped thereon, provision is made permitting the counter-weight to be positively raised at that time and the hoisting rope to be positively paid out to the bucket, so that its full weight may be effective for this purpose. To this end there is provided means whereby at the requisite time the hoisting drum may be turned positively in a direction reverse to its direction of hoist and preferably at a slower speed, so that under these conditions the depending hoisting rope is slackened and relieved from the strain of the counter-weight. In the described form of my invention, for this purpose, I have provided an additional connection between the hoisting drum and its driving shaft, the same consisting of an arrangement of planetary gearing which may be thrown into engagement at will to give a slow turning movement reverse to that imparted by the clutch. Referring more particularly to Fig. 2 it will be seen that this consists of a driving pinion h keyed or otherwise secured to the hoisting drum shaft

c^{11} , an internal gear h' attached to or comprising a part of the hoisting drum c' and the intermediate pinion h^2 carried by and journaled upon the rotatable member h^3 , the latter mounted for free rotation about the shaft c^{11} except when held or opposed by the three-part brake band h^4 . Thus, when it is desired to reverse the movement of the hoisting drum, the same is unclutched and the band h^4 tightened to hold fast the rotatable member h^3 , whereupon the drum is reversely driven at a slower rate of speed through the pinion h , intermediate gear h^2 and internal gear h' . The brake band h^4 is connected to a two-arm lever h^5 secured to the transverse rock-shaft h^6 , to which is attached also the clutch lever c^{16} , so that the lever may be moved in one direction to throw in the clutch, or in the opposite direction to release or partially release the clutch, and still farther in the latter direction to apply the brake band h^4 .

The operation of the apparatus will be readily understood from the preceding description. The traversing motor d may be started, stopped or reversed at will by the attendant on the platform independently of and without disturbing the position of suspension of the grab, which latter is caused to travel with the carriage. Starting with the carriage above the coal or other material to be conveyed, and with the bucket empty and elevated and the jaws open, the clutch for the opening and closing drum is released, the hoisting drum clutched to its shaft, the motor at rest and the bucket held against descent by the automatic brake on the counter-shaft f^3 . The grab may then be allowed to drop upon the coal with open jaws by throwing the clutch lever c^{21} far enough to unclutch or partly unclutch the drum, the movement of said lever, however, being insufficient to apply the brake band h^4 for the planetary gearing. When the grab strikes the coal, the motor may be started and the opening and closing drum clutched to its shaft by movement of the clutch lever b^{12} , and at the same time, the clutch lever c^{21} thrown still farther so as to tighten the brake band h^4 and throw in the reverse speed of the hoisting drum, this acting to raise the counter-weight and positively to let out slack to the grab permitting the grab to settle in the coal, while, at the same time, taking in slack more rapidly in the opening and closing rope and causing the jaws to close about the coal as the grab settles. When the jaws are closed the clutch lever c^{21} for the hoist is moved to its reverse position throwing out the slow reverse speed, and clutching the drum to its shaft, the motor continuing to drive both drums and thereby wind in both the hoisting and opening and closing ropes at the same speed, lifting the closed and loaded grab. As soon as the motor is stopped the closed grab is held

by the automatic brake, while, on the other hand, both clutches may be partly released to drop or lower the grab in this condition. When the carriage, with the loaded, raised grab, has been traversed to the desired point, the load may be dumped by releasing the opening and closing drum, while still holding the hoisting drum clutched.

It will be seen that not only may the hoisting and conveying apparatus described be operated with a small consumption of power in virtue of the relation of the counter-weight and controlling parts to the grab, but that the control thereof may be effected with the greatest simplicity by a single operator upon the carriage who is enabled to effect the entire control of the hoisting and traversing operation through the employment of the two clutch members shown, and the motor controlling devices referred to.

It will be obvious, of course, that I have employed the term "rope" in this specification in its broad sense and inclusive of cables, chains or other like connecting or transmitting members, which are, or may be, used as equivalents for the purpose herein referred to.

While the endless form of hoisting rope which I have described contemplates the formation of the grab supporting loop in the rope itself, which latter is frictionally held to the drum by its several convolutions thereabout, I, nevertheless, include within this term and as a full equivalent thereof, a construction contemplating a supporting loop or strand for the grab and a separate counter-weighted hoisting rope each of which has an end fixedly secured to the hoisting drum, one being wound in as the other is unwound.

While the described mode of operation and control represents a simplified and preferred procedure, it will be readily understood that other modes of operating the apparatus and other instrumentalities may be used without departing from the spirit of the invention. It will also be understood that while I have herein described one form and embodiment of my invention for the purpose of illustrating the same, the same is susceptible of numerous modifications both as to form, construction and relative arrangement of parts, as well as to the application here made of the broad and general principles set forth.

Claims:

1. The combination with a bridge structure having an elevated track-way, of a carriage adapted to travel along the same, an electric motor upon said carriage and provided with connections for propelling the latter along the track, a depending platform for an attendant supported by the carriage, controlling mechanism for the motor arranged conveniently thereon, a grab for said

carriage, a hoisting drum on said carriage, a hoisting rope having one end connected to said carriage and forming a depending loop in which said grab is suspended, said rope passing thence upward for one or more turns over said hoisting drum, guiding sheaves at opposite ends of the track-way, said rope leading from the hoisting drum to one of said end sheaves and thence to the sheave at the opposite end thereof and thence back to the carriage to which it is fastened, fixed guiding sheaves permitting the formation of a depending loop in said rope at some point in its length, a counter-weight suspended in said loop and adapted to somewhat less than counter-balance the weight of the grab, an opening and closing rope connected to the grab, an opening and closing rope-winding drum on said carriage for taking the same in or out, a driving part and clutch for each drum, clutch operating levers on the attendant's platform and connected to the clutches, gearing connecting the two driving parts, an operating motor, an intermediate shaft geared to said driving parts, an automatic brake to oppose the movement of the intermediate shaft in a direction the reverse of the hoisting direction, controlling means located at the platform for starting and stopping the motors, planetary gearing between the hoisting drum and its driving part for obtaining a reverse turning movement of the drum at a slower speed, said gearing comprising a driven member upon the drum, a driving member upon the driving part and a rotatable member carrying a third gearing member, a band brake to hold the rotatable member against rotation and an operating lever for the band brake connected to the operating lever of the hoisting drum clutch, said lever acting when thrown in one direction to tighten the band, and when thrown to an opposite position to cause engagement of the clutch.

2. The combination with an elevated track-way of a carriage adapted to travel along the same, means for carrying an attendant upon said carriage, self-propelling means therefor under the control of said attendant, a grab associated with said carriage, a hoisting rope connected to said grab, a hoisting drum on said carriage about which said rope is wrapped for one or more turns, said rope having an endless connection with said carriage to one end of the track-way, thence to the opposite end and back to the carriage, a counter-weight suspended in a loop of said rope at a fixed point in its length, an opening and closing rope associated with the grab, an opening and closing drum upon said carriage connected to said opening and closing rope, driving means for each rope-winding drum adapted to be clutched to or unclutched

from the same, means accessible to said operator for controlling the clutching means, driving mechanism geared to said clutch driving means and adapted to be thrown into or out of operation at will, means automatically to prevent the reverse movement of the drum driving members, planetary gearing between the hoisting drum and its driving member for giving a reverse movement to the drum, and means available to the operator for throwing in said planetary gearing when said drum is unclutched from its driving member.

3. The combination with a track-way of a traversing carriage therefor, self-propelling means for said carriage, means for carrying an attendant thereon, a grab, a rope-winding drum on said carriage, a hoisting rope connected to said grab and said drum, a rope leading to suitable guiding devices at opposite ends of the track-way and connected, one end to said carriage and the other end to the drum thereon, a counterweight suspended on a loop in said rope and acting to assist the winding in of the grab, an opening and closing rope and its winding drum on the carriage, driving means for said drums adapted to be clutched to or unclutched from the same, means automatically to prevent retrograde movement of said driving means, means for driving said hoisting drum in a reverse direction at will and controlling means available to the operator for controlling the traverse of the carriage, the clutching of the drums and the said drum driving means.

4. The combination with a track-way of a traversing carriage, self-propelling means thereon, a grab, a hoisting drum connected to raise or lower said grab, an endless rope connected with the hoisting drum upon said carriage, while permitting the traversing of the carriage along the track-way, a counterweight associated with said rope and tending to assist the said drum in the raising of said grab, an opening and closing rope, a rope-winding drum upon said carriage, driving means for said drums also thereon and adapted to be clutched to or unclutched from the same and means for reversely turning said hoisting drum to relieve the grab of the said counter-weight.

5. The combination with a traversing carriage, of a grab suspended therefrom, an opening and closing rope for said grab, a hoisting rope therefor, a rope-winding drum for said hoisting rope upon said carriage, means for counterweighting the grab, and means for positively relieving the grab of the full effect of said counterweight, while moving said opening and closing rope to close the jaws of the grab.

6. In a hoisting and conveying apparatus the combination with a traversing carriage, of a hoisting device, a hoisting drum

therefor upon said carriage, means to turn said drum to elevate said hoisting device, means for counterweighting said hoisting device and planetary gearing for said drum whereby the latter may be reversed positively to elevate the said counterweighted means.

7. In a hoisting and conveying apparatus the combination with a self-propelling traversing carriage, of a counterweighted hoisting device thereon, a hoisting drum and planetary gearing between said drum and its driving shaft, whereby the said drum may be reversed to positively relieve the hoisting device of the counterweighting effect.

8. In a hoisting and conveying apparatus the combination with a traversing carriage, of a hoisting device, an endless controlling rope for elevating said hoisting device, a counterweight for said rope, a hoisting drum controlling said rope, and planetary gearing for said drum whereby said counterweight may be positively raised.

9. A hoisting and conveying apparatus having a traversing carriage, a grab suspended thereon, a hoisting drum on the carriage, an opening and closing drum also on the carriage, each with its controlling rope or ropes connected to the grab, counterweighting means for the grab located at a fixed position relatively to the carriage and means permitting reversal of the hoisting drum to positively lift said counterweight.

10. A hoisting and conveying apparatus having a self-propelling traversing carriage, a grab suspended thereon, a hoisting drum, an opening and closing drum, suitable controlling ropes connecting said drums and the grab, a counterweight associated with the hoisting drum, and means for reversing the movement of the latter to elevate said counterweight.

11. A hoisting and conveying apparatus having a traversing carriage, a grab suspended thereon, a hoisting drum on said carriage, an opening and closing drum also thereon, and arranged to be driven with said hoisting drum, means for positively driving the said drums in the same direction, a counterweight associated with said hoisting drum, and means for reversing the movement of the hoisting drum to positively raise said counterweight, while continuing the movement of the opening and closing drum in the same direction.

12. A hoisting and conveying apparatus having a self-propelling traversing carriage, a grab suspended thereon, a hoisting drum, an opening and closing drum, suitable controlling ropes connecting said drums and said grab, means for driving said drums together in a given direction, a counterweight operatively associated with said opening and closing drum, and means for reversing the movement of the hoisting drum to positively

raise said counterweight, while continuing the movement of the opening and closing drum.

13. In a hoisting and conveying apparatus the combination with a self-propelling traversing carriage, of a grab thereon, means for counterweighting the same, an opening and closing rope, a hoisting rope, means for simultaneously paying out or taking in said ropes, and means for paying out the hoisting rope to the unbalanced grab, while taking in the opening and closing rope.

14. In a hoisting and conveying apparatus the combination with a traversing carriage, of a grab, counterweighting means therefor, an opening and closing rope, a hoisting rope, means upon said carriage for simultaneously paying out or taking in said ropes, and means also on said carriage for paying out the hoisting rope to the unbalanced grab, while taking in the opening and closing rope.

15. In an apparatus of the class described, the combination with a traversing carriage, of a hoisting device, an operating rope leading thereto, a hoisting rope, means for counterweighting said device, and means upon the carriage for relieving the counterweighting effect thereof, while taking in said operating rope.

16. In an apparatus of the class described, the combination with a self-propelling traversing carriage, of a hoisting device suspended thereon, an operating rope leading thereto, a hoisting rope, means for counterweighting said device and means for relieving the counterweighting effect thereof, while taking in said operating rope.

17. The combination of a trackway, a traversing carriage, self-propelling means thereon, a grab, a hoisting drum connected to raise or lower said grab, an endless rope connected with the hoisting drum upon said carriage while permitting the traversing of the carriage along the trackway, a counter-

weight associated with said rope and tending to assist the said drum in the raising of said grab, an opening and closing rope, a rope winding drum upon said carriage, driving means for said drums also thereon and adapted to become operative or inoperative, and means for reversely turning said hoisting drum to relieve the grab of the said counterweight.

18. In a hoisting and conveying apparatus the combination with a traversing carriage, of a grab, a hoisting drum for said grab upon said carriage, means for counterweighting said grab, means to open and close the jaws thereof, and means to relieve the grab of the effect of the counterweighting means during the closing movement of the jaws.

19. In a hoisting and conveying apparatus the combination with a trackway, of a traversing carriage therefor, a grab carried by said carriage, a counterweight arranged at some fixed position lengthwise the trackway, a rope extending longitudinally said trackway and operatively connected to said counterweight and said grab, means for opening and closing the jaws of the grab, and means for relieving the grab of the effect of the counterweight during the closing of the jaws.

20. The combination of a trackway with a carriage thereon, a grab sustained by the carriage, a motor on the carriage, a counterweight for the grab, connections for raising the grab through the turning of the motor and means for positively raising the counterweight through movement of the motor in the same direction.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

ALMON E. NORRIS.

Witnesses:

THOMAS B. BOOTH,
EVERETT S. EMERY.