No. 832,744. PATENTED OCT. 9, 1906.

A. E. NORRIS.

HOISTING APPARATUS.

APPLICATION FILED JAN. 14, 1905.

2 SHEETS—SHEET 1.

Fig. 1

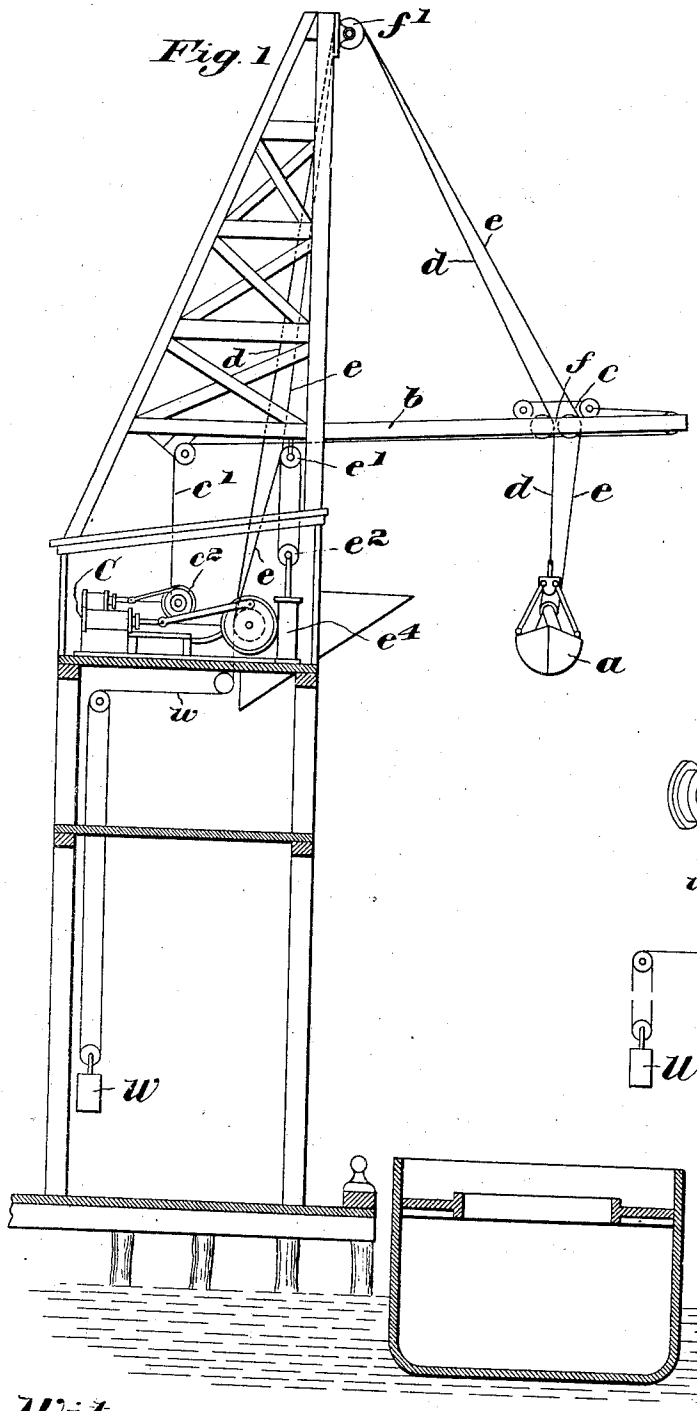
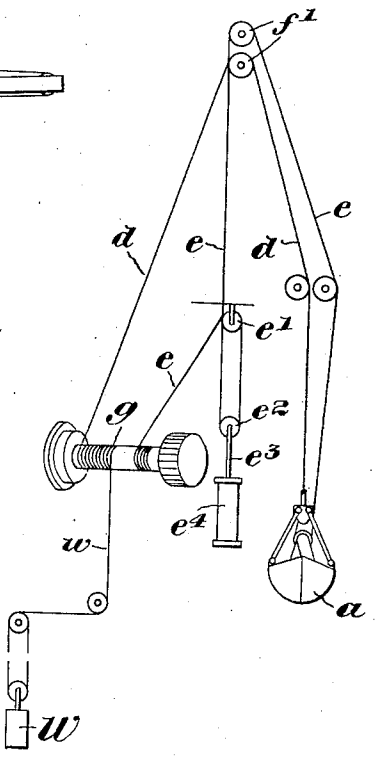


Fig. 2



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THE NORRIS PETERS CO., WASHINGTON, D. C.

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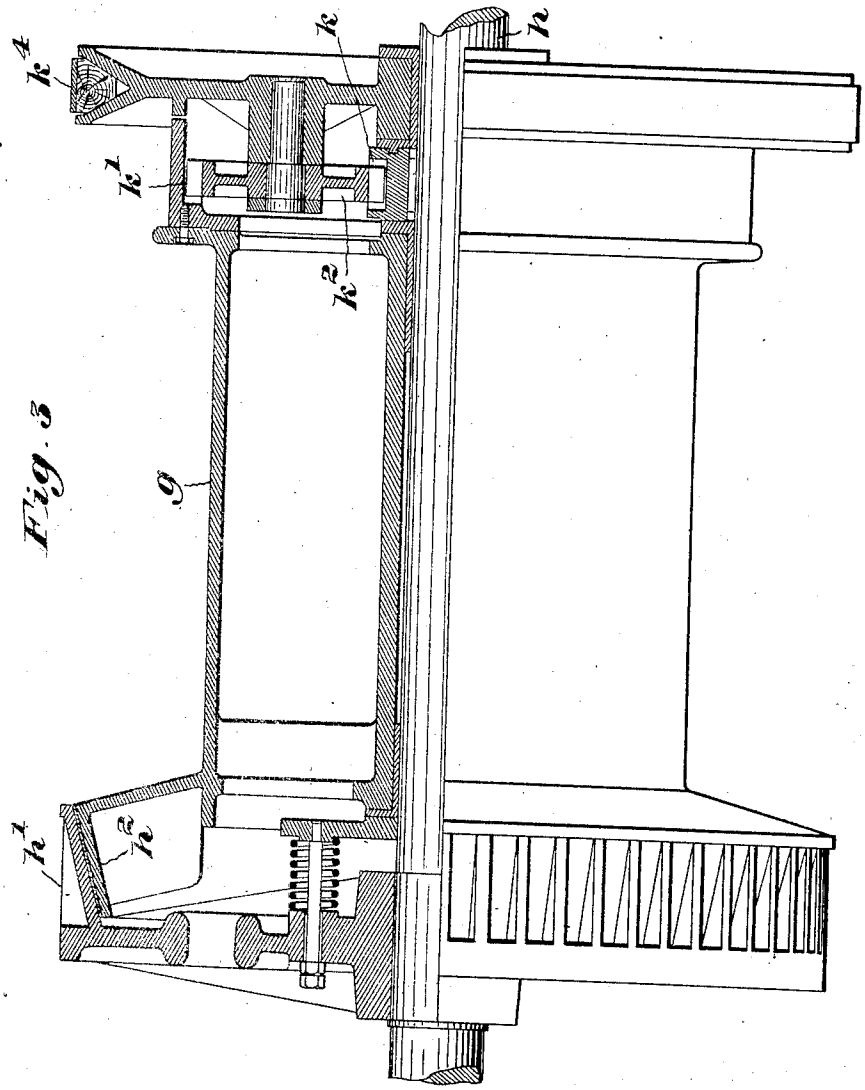
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2 SHEETS—SHEET 2.

Fig. 3



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UNITED STATES PATENT OFFICE.

ALMON E. NORRIS, OF CAMBRIDGE, MASSACHUSETTS.

HOISTING APPARATUS.

No. 832,744. Specification of Letters Patent. Patented Oct. 9, 1906.

Application filed January 14, 1905. Serial No. 241,074.

To all whom it may concern:

Be it known that I, ALMON E. NORRIS, a citizen of the United States, residing at Cambridge, in the county of Middlesex and State of Massachusetts, have invented an Improvement in Hoisting 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 consists in improvements in load-hoisting devices, and particularly in the means for controlling the operating ropes or cables thereof.

In my copending application, Serial No. 241,073, of even date herewith I have disclosed and broadly claimed a system employing a counterweighted hoisting element—therein a bucket or grab of the clam-shell type—and having means for relieving the bucket of the counterweight at times in order to render effective the full bucket-weight. This is accomplished specifically by providing two independently-operable winding-drums, one of which positively raises the counterweight and unwinds the slack of the hoisting-rope, while the other takes in the slack of the opening and closing rope. By this means while the weight of the bucket is counterbalanced during lifting its weight nevertheless is effective when required to sink the bucket into the material to be lifted.

My present invention comprehends a slack-take-up device, which in the illustrative embodiment submitted I have shown placed in the opening and closing rope of a bucket-hoist and may be operated at any time to take in or let out slack for the closing or opening of the bucket-jaws independently of the control of the rope-winding apparatus, the latter herein comprising merely a single rope-winding drum common to both the opening and closing rope and the hoisting-rope.

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

In the drawings, Figure 1 is an elevation showing in outline the bucket-hoist to which is applied one form of my invention. Fig. 2 is a diagram showing the relations between the opening and closing, the hoisting, and counterweight ropes in the hoisting apparatus shown in Fig. 1; and Fig. 3 is an elevation, partially in section, showing the clutch and gearing employed in the rope-winding drum in the system illustrated in Figs. 1 and 2.

Referring particularly to Fig. 1, I have therein shown my invention as applied to an ordinary bucket-hoisting system employing a grab or bucket *a* of the usual form, herein of the well-known Rawson type. The bucket is casued to travel along the boom *b* by means of the trolley-carriage *c*, attached to the trolley-rope *c'*, the latter passing about and controlled by a suitable trolley-drum c^2 upon the hoisting-engine C. The bucket is raised or lowered by the hoisting-rope *d*, and its jaws are opened and closed in the usual manner by the opening and closing rope *e*. These two operating-ropes pass upward over suitable sheaves upon the trolley-carriage, over sheaves *f'* upon the tower, and thence downward to and about the rope-winding apparatus. The system illustrated is of the ordinary and usual type. The usual mode of operation is to raise the bucket when loaded by winding in simultaneously on both the hoisting and the opening and closing ropes. When hoisted, the load is dumped by holding the hoisting-rope and letting out slack in the opening and closing rope to cause the jaws of the bucket to open outward. The bucket is then dropped by paying out both ropes until it strikes the coal or other material to be hoisted with its open jaws. With the hoisting-rope slack the bucket will sink into the coal from its own weight and the opening and closing rope is then wound in to take up the slack previously let out and to close the jaws, after which both ropes are wound in simultaneously to hoist the closed bucket with its load, as before.

In the described embodiment of my invention I have provided a slack-take-up device for the opening and closing rope, so that the latter may be taken in or paid out independently of the rope-winding apparatus. I have also provided means for counterweighting the bucket, so that the force required to lift the latter will be little more than that required to lift its contained load; but the arrangement is such that the effect of the counterweighting means upon the bucket may be positively relieved when desired. The full weight of the bucket may therefore be made effective when the latter strikes the coal and at the same time, or at any other time, inde-

pendently of the position of the bucket, the jaws of the latter may be made to open or close by the movement of the slack-take-up device.

Referring more particularly to Fig. 3, a single rope-winding drum g is employed for both the opening and closing and the hoisting rope. This drum is journaled upon the main driving-shaft h and is adapted to have a slight endwise movement thereof to bring it into or out of engagement with a suitable friction-clutch h', which is fixedly secured to the driving-shaft at one side of the drum. The drum is provided with clutch-surfaces h^2 to operate with corresponding surfaces upon the clutch device with which it may be engaged through any suitable clutch-operating means (not shown)—such, for example, as a sliding collar and clutch-operating screws of the type described in my prior patent, Reissue No. 12,085, dated February 24, 1903.

In addition to the direct driving connection described the hoisting-drum g when unclutched may be driven in a reverse direction and at a slower rate of speed by means of planetary gearing, herein comprising the driving-pinion k, keyed or otherwise secured to the shaft h, the internal gear k', attached to or comprising a part of said hoisting-drum g, and the intermediate pinion k^2, carried by and journaled upon the rotatable member k^3, the latter mounted for free rotation about the shaft h, except when held or opposed by the adjustable brake-band k^4. Thus when it is desired to reverse the movement of the drum g the same is unclutched and the band k^4 tightened to hold fast the rotatable member k^3, whereupon the drum is reversely driven at a slower rate of speed through the pinion k, intermediate gear k^2, and internal gear k'.

Any suitable means may be employed for counterweighting the bucket. In Fig. 2 I have shown the counterweight W, carried by a counterweight-rope w, which latter after passing over suitable sheaves is wound about the hoisting-drum and secured to the latter or to the hoisting-rope d, so that as the hoisting-rope winds on or off the counterweight-rope winds respectively off or on. The opening and closing rope e is also secured to the drum g so that a turning movement of the latter winds or unwinds similarly both the hoisting and the opening and closing ropes. Between the winding-drum g and the hoisting-bucket a the opening and closing rope passes about a suitable slack-take-up device. The latter herein comprises a pair of sheaves e' and e^2, about which the rope is looped, preferably with several turns. The sheave e' is stationary, but the sheave e^2 is attached to a rod e^3, the opposite end of which is secured to a piston movable within the cylinder e^4 and having its position therein controlled by the admission thereto of steam or other pressure fluid by means of suitable controlling-valves. (Not herein shown.) It will thus be seen that the rope e in passing about the sheaves e' and e^2 forms one or more loops which may be lengthened or shortened by the controlled movement of the piston-rod e^3 and that thereby not only is the opening and closing rope controlled independently of the winding apparatus, and therefore independently of the position of the bucket, but by adjusting the loop the opening and closing rope may be lengthened or shortened relatively to the hoisting-rope and maintained in that relation without further attention on the part of the operator.

The mode of operation is as follows: The bucket having been filled and its jaws closed, the clutch is thrown in and the engine started to wind in both the hoisting and the opening and closing ropes simultaneously, this action serving to pay out the counterweight, which latter is preferably of a weight approximately, but not quite, to balance the weight of the unloaded bucket. When the load has been hoisted and the trolley-carriage properly positioned, the hoisting-drum g is held and the pressure in the piston e^4 adjusted to shorten the loop in the opening and closing rope. This lets out the slack therein and permits the bucket to open its jaws and dump its load. It is usual to provide the drum-shaft with a friction-brake to prevent reverse movement of the shaft; but when the open bucket is ready to be dropped the drum is released from the shaft to allow both ropes to pay out until the open jaws of the bucket touch the coal. At this point the drum is unclutched, the reverse-gearing thrown in by tightening the brake-band, and the engine started, thereby causing the hoisting-drum to positively raise the counterweight and pay out the slack hoisting-rope at a relatively slow speed. The opening and closing rope, of course, is also paid out from the drum; but simultaneously with the reversal of the latter steam is admitted to the cylinder e^4 to take in the slack of the opening and closing rope, so that the latter is thereby gradually shortened and the jaws of the bucket gradually closed, the bucket at the same time sinking into the coal under the effect of its own weight, which is now no longer offset by the counterweight W. By the time the jaws are closed the slack previously let out in the opening and closing rope has been taken in. The hoisting-drum is then again clutched to the shaft, which continues to rotate to take in both ropes similarly and simultaneously with the hoisting of the load, as before. It will thus be seen that while the rope-winding means may act as a unit to take in or pay out the two ropes simultaneously there is provided a separately-controlled device which makes possible a differential rope movement at any

time during the operation of the rope-winding means and which furnishes means for taking in or letting out the slack of the operating-rope, as desired.

In bucket-hoist systems of this character as heretofore employed the differential rope movement which is required at certain times has necessitated the employment of separate drums for the two ropes, and this in turn has resulted in a multiplication of the controlling-levers required therefor. The number of controlling-levers necessary for controlling the bucket required the constant and entire attention of one operator and an additional operator has been necessary to control the trolley. In the system which I have herein described the piston-rod e^3 may be controlled by movement of a valve and maintained in position without further attention on the part of the operator, and a single operator without assistance is therefore enabled to control both the bucket and the trolley.

Although I prefer the arrangement herein described, if desired the planetary gearing may be dispensed with and the reverse movement of the drum *g* be attained by employing a reversible engine.

It is to be understood that my invention is in no wise limited to the specific illustrative embodiment thereof herein described, but that the same may be employed for other purposes and varied within wide limits without departing from the spirit thereof.

I claim—

1. In an apparatus of the class described, the combination with a rope-winding drum of a rope secured thereto, and having a loop formed in the outgoing strand thereof, and means for controlling the length of said loop independently of the operation of said winding-drum.

2. In an apparatus of the class described, the combination with a clam-shell bucket of an opening and closing rope, a hoisting-rope, rope-winding means for said ropes, means for counterweighting said bucket, and means controlled independently of said rope-winding means for taking in or paying out said opening and closing rope.

3. In an apparatus of the class described, the combination with a clam-shell bucket, of a rope-winding drum, a hoisting-rope and an opening and closing rope secured to said drum, a counterweight also secured thereto, and means separate from the winding-drum for causing differential movement between said hoisting and said opening and closing ropes.

4. In an apparatus of the class described the combination with an operating-rope having a loop formed in the outgoing strand thereof, of rope-controlling means for taking in and paying out said rope, and fluid-pressure means for taking in and letting out said loop.

5. In an apparatus of the class described the combination with a clam-shell bucket of an opening or closing rope therefor, a hoisting-rope, a drum upon which said ropes are adapted to be simultaneously wound, a counter-weight connected to said drum to approximately counterbalance the unloaded bucket, means for reversing the winding-drum to positively raise the counterweight and pay out the said ropes at a relatively slow speed and additional means for taking in or paying out the opening and closing rope.

6. In an apparatus of the class described the combination with a clam-shell bucket of an opening or closing rope therefor, a hoisting-rope, a drum upon which said ropes are adapted to be simultaneously wound, a counterweight connected to said drum to approximately counterbalance the unloaded bucket, means for reversing the winding-drum to positively raise the counterweight and pay out the said ropes at a relatively slow speed and fluid-pressure means separate from said winding-drum for taking in or paying out the said opening or closing rope.

7. In an apparatus of the class described, the combination with a hoisting device of an operating-rope, a counterweight for said device, rope-controlling means for taking in and paying out said rope, and fluid-pressure means additional to said rope-controlling means also for taking in and paying out said rope.

8. In an apparatus of the class described, the combination with a hoisting device of means for counterweighting the same, rope-winding means for taking in and paying out a plurality of operating-ropes and means for taking in or paying out one of said ropes independently of the operation of said rope-winding means.

9. In an apparatus of the class described, the combination with a clam-shell bucket of counterweighting means therefor, an opening and closing rope, a hoisting-rope, rope-winding means therefor and means for taking in and paying out one of said ropes independently of said rope-winding means.

10. In an apparatus of the class described the combination with a clam-shell bucket of an opening and closing rope therefor, a hoisting-rope, means for counterweighting said bucket, means to relieve the same of the effect of said counterweighting means, and fluid-pressure means for slacking or tightening said opening and closing rope.

11. In an apparatus of the class described the combination with a hoisting device of a counterweight connected therewith, rope-winding means positively to raise said counterweight, and additional fluid-pressure means to control said hoisting device.

12. In an apparatus of the class described the combination with a counterweighted hoisting-rope, of an operating-rope, and fluid-

pressure means for letting out slack in said hoisting-rope while taking in said operating-rope.

13. In an apparatus of the class described the combination with a hoisting device of a hoisting-rope, an operating-rope, a winding-drum for said ropes, a counterweight also attached to said drum, means for turning said drum in either direction, and additional means for taking in or letting out slack in said operating-rope.

14. In an apparatus of the class described the combination with a hoisting device of a hoisting-rope, an operating-rope, a winding-drum for said ropes, a counterweight also attached to said drum, means for turning said drum in either direction at different rates of speed, and additional means for taking in or letting out slack in said operating-rope.

15. The combination with a clam-shell bucket of means for raising and lowering the same, means for neutralizing the bucket weight or a part thereof during its elevation, while permitting the bucket weight to be effective when lowered into or against the material to be lifted, and fluid-pressure means for controlling the opening or closing of the jaws.

16. The combination with a clam-shell bucket of rope-winding means, means for neutralizing the bucket weight or a part thereof during its elevation, while permitting the bucket weight to be effective when lowered into or against the material to be lifted, and fluid-pressure means for controlling the opening or closing of the jaws.

17. The combination with a clam-shell bucket of rope-winding means, means for neutralizing the bucket weight or a part thereof during its elevation, while permitting the bucket weight to be effective when lowered into or against the material to be lifted, and means additional to said rope-winding means for opening and closing the jaws.

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

ALMON E. NORRIS.

Witnesses:
DAISY C. GWINN,
THOMAS B. BOOTH.