No. 872,524. PATENTED DEC. 3, 1907.

S. H. LIBBY & I. F. BAKER.

HOIST CONTROLLER.

APPLICATION FILED MAR. 7, 1906.

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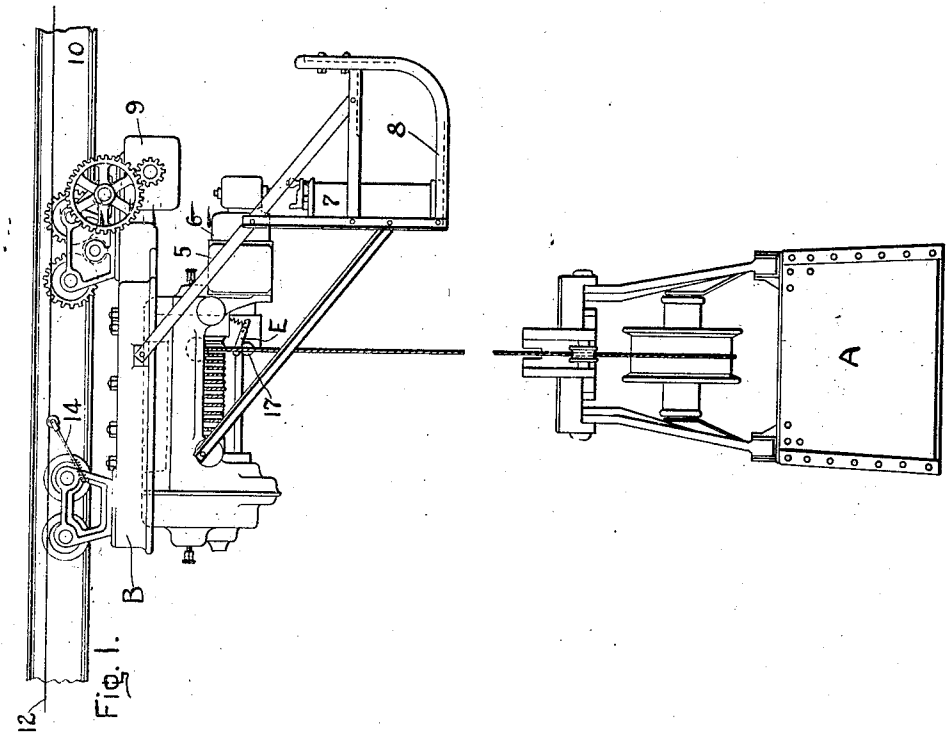


Fig. 1.

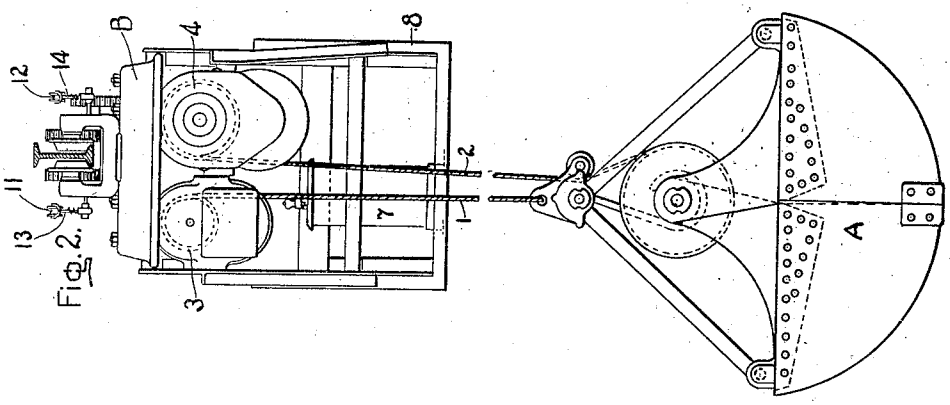


Fig. 2.

Witnesses:
J. Ellis Glen
Helen Alford

Inventors:
Sam H. Libby
Isaac F. Baker,
by Albert G. Davis
Atty

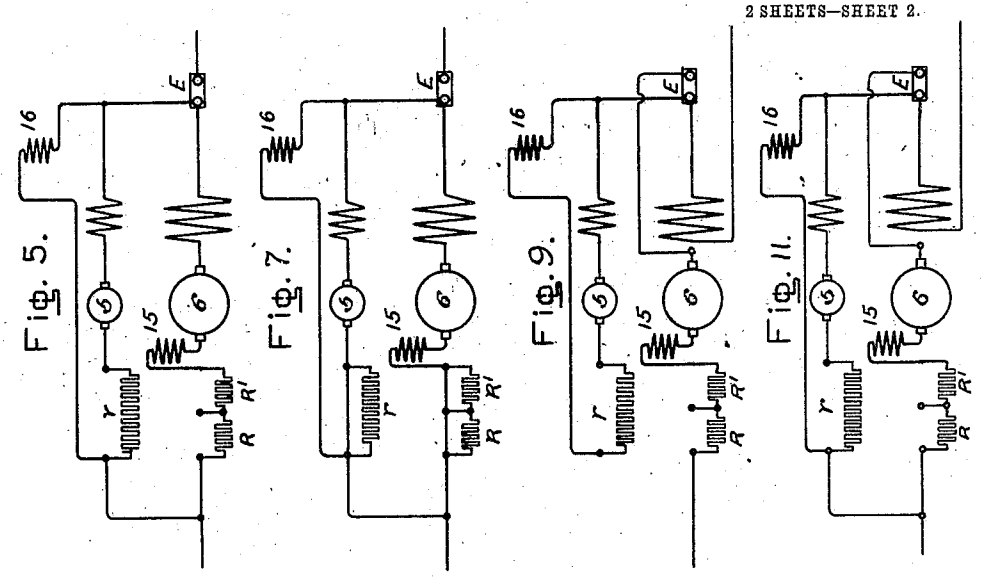
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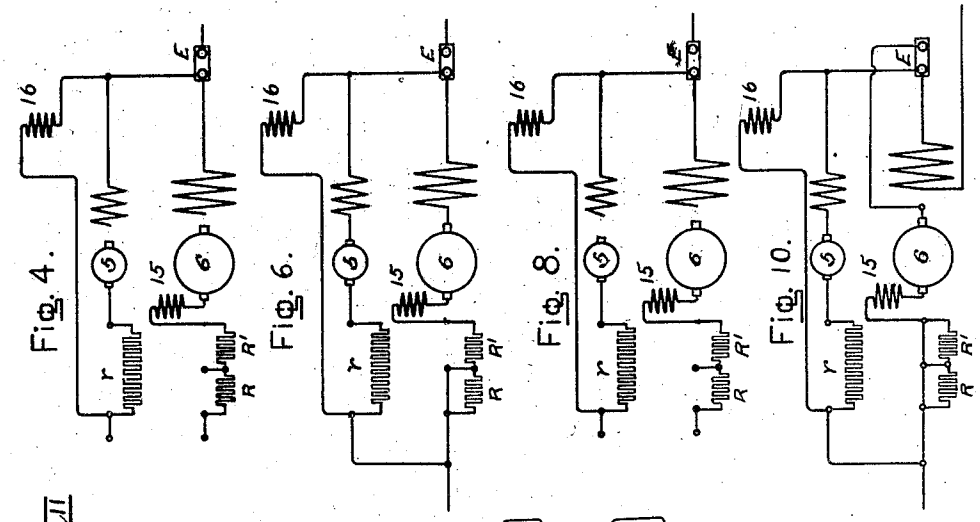
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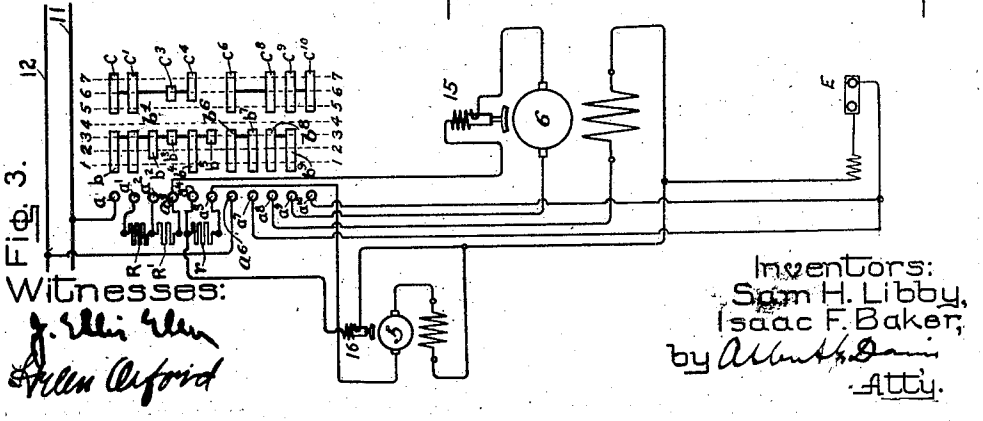
HOIST CONTROLLER.

APPLICATION FILED MAR. 7, 1906.

2 SHEETS—SHEET 2.







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Helen Alford

Inventors:
Sam H. Libby,
Isaac F. Baker,
by Albert G. Davis
Atty.

UNITED STATES PATENT OFFICE.

SAM H. LIBBY AND ISAAC F. BAKER, OF EAST ORANGE, NEW JERSEY, ASSIGNORS TO SPRAGUE ELECTRIC COMPANY, A CORPORATION OF NEW JERSEY.

HOIST-CONTROLLER.

No. 872,524. Specification of Letters Patent. Patented Dec. 3, 1907.

Application filed March 7, 1906. Serial No. 304,657.

To all whom it may concern:

Be it known that we, SAM H. LIBBY and ISAAC F. BAKER, citizens of the United States, residing at East Orange, county of Essex, State of New Jersey, have invented certain new and useful Improvements in Hoist-Controllers, of which the following is a specification.

The present invention relates to grab-bucket hoist apparatus and has for its object to improve the controlling means for operating ropes so as to render the operation of the hoist convenient and certain.

In an application filed by Sam H. Libby, March 7, 1906, Serial No. 304,656, for grab-bucket hoist apparatus, there is disclosed a novel system of control for grab-bucket hoists for simplifying and improving the operation of such hoists. In said system the holding rope is maintained taut at all times; but during the lowering of the bucket this is effected by an auxiliary load-brake.

The present invention contemplates a novel construction and arrangement of parts for accomplishing the same purpose without the use of auxiliary apparatus, the holding motor itself performing the function of a load-brake during the descent of the bucket. In this aspect the present invention may be regarded as comprising an improvement on the apparatus disclosed in said application.

The above end is attained by so constructing the controller that whenever the holding motor is energized it is in a direction tending to wind up the holding rope, and by either making the holding motor small so that it will at all times have only sufficient power to maintain the holding rope taut, or else cutting down its power by means of resistance when the bucket is closing and when it is descending under its own weight. Further, the closing and the holding motors are energized simultaneously when it is desired to either close the bucket, raise it or lower it. Thus, when the bucket is being lowered upon the material, both ropes are being paid out, but the holding rope unwinds only so long as the pull of the bucket is greater than that of the holding motor; therefore when the bucket comes to rest upon the material to be moved, the unwinding of the holding rope immediately ceases and the rope is held taut; while, as soon as the closing motor is set in operation to close the bucket, the holding motor begins to pull upon the holding rope and takes up any slack which might otherwise be formed.

The present invention will be more fully understood and its objects and advantages will be more apparent from the following detailed description.

In the accompanying drawings we have illustrated a preferred form of the present invention, Figure 1 showing in side elevation a carrier adapted to move along an elevated track and provided with the improved hoisting mechanism; Fig. 2 showing an end elevation of the same apparatus; Fig. 3 being a diagram showing the holding and the closing motors, together with the controller and circuits therefor; and Figs. 4 to 11, inclusive, showing the various motor connections in the several positions of the controller.

Referring to Figs. 1 and 2, A represents a grab-bucket of the usual "clam-shell" type suspended from a traveling carriage B by holding and closing ropes 1 and 2, respectively; these ropes being wound upon drums 3 and 4 operated by electric motors 5 and 6. 7 is a controller for the motors 5 and 6; this controller being located on the operator's platform 8. 9 is a traverse motor whereby the carriage may be moved along the track 10 to convey the bucket from one point to another. Current for the several motors is obtained from trolley wires 11 and 12 which are engaged by current-collecting devices 13 and 14, respectively, mounted on the carriage. These parts, with the exception of the controller, may all take any usual or preferred forms, the particular forms shown being simply illustrative of general types of apparatus to which the present invention may be applied.

In Fig. 3 the controller 7 is shown in developed form and is illustrated as having eight different positions, including the "off" position. The controller comprises a series of fixed contact fingers a to a^{10}, and two series of movable contact fingers b to b^9 and c to c^{10}. Assuming that the carriage has been brought above and the bucket has been

dropped upon the material to be moved, then in order to close the bucket and elevate the load, the controller is moved into its first running position wherein the movable contacts engage with the fixed contacts along line 1—1. A circuit may now be traced from trolley wire 11, to contacts a, b, b^1, a^1, resistance sections R and R^1, brake coil 15, armature of motor 6, contacts a^9, b^9, b^8, a^8, field of the motor 6, switch E, contacts a^7, b^7, b^6, a^6, trolley 12. A branch circuit passes from contacts a and b, through contacts b^4 and a^4, resistance r, armature and field of motor 5, and thence through switch E back to trolley 12, as before. At a^4 the branch circuit divides and a portion of the current passes through the coil of brake 16 before reaching switch E. The circuit conditions are shown in Fig. 5. The brakes controlled by the coils 15 and 16 are released and both motors tend to wind up their respective cables. The motor 5, with the resistance r in circuit, is, however, too weak to lift the bucket and therefore simply maintains the holding rope taut. The motor 6, however, begins to wind up cable 2 and the bucket is closed. As soon as the bucket has been completely closed, the controller is moved to its second position and the motor circuits remain unchanged except that resistance section R is cut out by reason of contacts a^2 and b^2 coming into engagement. The closing motor now has sufficient power to slowly lift the bucket with its contents, but the holding motor still does little more than keep the holding rope taut. The motor circuits in this position of the controller are indicated in Fig. 6. Upon moving the controller to its third position, resistance section R^1 is cut out and the bucket is lifted more rapidly.

It is clear that the holding motor may either be a small motor of sufficient capacity only to maintain the holding rope taut, or it may be made larger so as to assist the closing motor in raising the load, in which latter case the resistance r is provided for cutting down the power of this motor when it is operating simply as a holding motor. Therefore, when the controller is moved to its third running position, whereby all external resistance is removed from the circuit of the closing motor, the resistance section r is also cut out of the circuit of the holding motor by reason of the engagement of contacts a^5 and b^5, so that the holding motor may assist the closing motor in raising the load. Fig. 7 illustrates the circuit conditions for this position of the controller. When the bucket has reached the proper height, the controller may either be turned to the "off" position or to the fourth running position wherein all the circuits are interrupted, just as in the "off" position, (see Figs. 4 and 8), and the motors are held stationary through the operations of the brakes controlled by the coils 15 and 16. The carrier may now be operated to convey the bucket to the point at which it is to be dumped, and when this point is reached and the controller is turned in the fifth running position, current is supplied to motor 6 as in the first running position, namely, with all resistance in circuit, the relative connections of the field and armature being reversed, however, as indicated in Fig. 9. In this position the holding motor 5 remains deënergized, since contact c^4 is out of engagement with contact a^4; consequently the holding rope is held stationary through the action of the brake controlled by coil 16 and the closing rope is unwound. As soon as the closing rope becomes slack, the bucket of course opens and drops its contents. The bucket, now being open, may be lowered again upon the material to be moved by turning the controller to the sixth running position, when it will be seen the circuit of motor 6 will remain unchanged except that the resistance is all removed, but current will be supplied to the motor 5 in the same direction as is the case when the controller is in the first to the third positions. Where the motor 5 is larger than necessary to simply maintain the holding rope taut, the resistance r is again inserted in the sixth position of the controller so that the empty bucket overhauls the holding motor and descends due to its own weight. When the bucket reaches the material, the controller is returned to its "off" position, preferably by moving it through the seventh position. The motor circuits are now all interrupted and the holding rope, which cannot become slack while the holding motor is energized, is held taut through the action of brake 16. The seventh position of the controller is provided so that the loaded bucket may be lowered before it is dumped. Thus, after the bucket has been lifted by turning the controller through its first three running positions, the controller may be returned to the "off" position and its motion continued in that direction until the seventh position is reached. In this position of the controller the motor circuits are those indicated in Fig. 11, being exactly the same as those produced in the sixth running position, except that all the resistance is included in the circuit of the closing motor; this being for the purpose of preventing the closing motor from running so fast that its rope becomes slack and allows the material to be dumped. After the bucket has been lowered the desired extent it may be dumped as previously described, by turning the controller to the fifth running position.

The switch E is a limit switch arranged to open the motor circuits at the extreme upper

limit of the bucket and comes into operation only when the operator fails to operate the controller at the proper time. It may be operated in any suitable manner, as by means of a stop 17 on the closing rope. Obviously any type of limit switch, both for upper and lower limits, may be employed; this feature, however, constituting no part of the present invention.

What we claim as new and desire to secure by Letters Patent of the United States, is,—

1. In a grab-bucket hoist, a bucket, a holding rope, a closing rope, motors connected to said ropes, and means for causing the motor for the closing rope to pay out the closing rope to lower the bucket and for causing the motor for the holding rope to place the holding rope under tension in lowering the bucket.

2. In a grab-bucket hoist, a bucket, a holding rope and a closing rope, motors connected to said ropes, and means for causing said motors to wind up said ropes to raise the bucket and for causing the motor for the closing rope to unwind the closing rope and the motor for the holding rope to exert a pull upon the holding rope to lower the bucket.

3. In a grab-bucket hoist, a bucket, a holding rope and a closing rope, motors connected to said ropes, and means for causing the motor for the closing rope to wind up the closing rope in raising the bucket and unwind the closing rope in lowering the bucket and for causing the motor for the holding rope to exert a winding effort on the holding rope both in raising and lowering the bucket.

4. In a grab-bucket hoist, a holding rope, a closing rope, motors connected to said ropes, and a controller having contacts and connections arranged to energize the motor for the closing rope so as to either wind up or unwind the closing rope and to energize the motor for the holding rope only so as to tend to wind up the holding rope.

5. In a grab-bucket hoist, a bucket, a holding rope and a closing rope connected to said bucket, motors connected to said ropes for operating the same, and a controller having contacts and connections arranged to energize both motors so as to wind up the said ropes to raise the bucket and to energize the motor for the closing rope so as to unwind the closing rope and the motor for the holding rope so as to tend to wind up the holding rope in order to lower the bucket.

6. In a grab-bucket hoist, a bucket, a holding rope and a closing rope connected to said bucket, a motor connected to the closing rope, and a motor connected to the holding rope, the said latter motor being adapted to exert power sufficient only to maintain the holding rope taut both when the bucket is being closed and when it is being lowered.

7. In a grab-bucket hoist, a bucket, a holding rope and a closing rope connected to said bucket, a motor connected to the closing rope, and a motor connected to the holding rope, the said latter motor being adapted to exert power sufficient only to maintain the holding rope taut when the bucket is being lowered.

8. In a grab-bucket hoist, a bucket, a holding rope and a closing rope connected to said bucket, electric motors connected to said ropes for operating the same, each of the said motors being provided with brakes arranged to be released when the motor-circuit is closed, and an electric controller for the said motors, the system being so constructed and arranged that both motors will be energized simultaneously and the motor connected to the holding rope will exert power sufficient to maintain the holding rope taut both when the bucket is being closed and when it is being lowered.

9. In a grab-bucket hoist, a bucket, a holding and a closing rope, motors connected to said ropes for operating the same, and a controller having contacts and connections arranged to energize both motors simultaneously in a direction to wind up the ropes in order to close the bucket and to energize the motor for the closing rope in a direction to unwind the closing rope and the motor for the holding rope in a direction tending to wind up the holding rope in order to lower the bucket.

10. In a grab-bucket hoist, a bucket, a holding rope and a closing rope connected to said bucket, motors connected to said ropes for operating the same, and control apparatus arranged to simultaneously energize the motor connected to the closing rope and supply the motor connected to the holding rope with only sufficient current to maintain the holding rope taut in order to close the bucket, to increase the current supply to both motors in order to raise the bucket and to reverse the direction of rotation of the motor for the closing rope and supply the motor connected to the holding rope with current in the same direction sufficient to maintain the holding rope taut in order to lower the bucket.

11. In a grab-bucket hoist, a bucket, a holding rope and a closing rope connected to said bucket, motors for operating said ropes, resistances, and a controller for said motors, said controller having contacts and connections arranged to simultaneously complete the circuits of said motors through said resistances to cause the motor for the holding rope to maintain the holding rope taut and the motor for the closing rope to close the bucket, and to remove said resistances from the motor circuit in order to cause both mo-

tors to operate to raise the bucket, said controller also having contacts and connections constructed and arranged to energize the holding motor in a direction to wind up the holding rope and the closing motor in a direction to unwind the closing rope in order to lower the bucket.

In witness whereof, we have hereunto set our hands this fifth day of March, 1906.

SAM H. LIBBY.
ISAAC F. BAKER.

Witnesses:
ROGER H. BUTTERWORTH,
ANNA M. GILLIN.