(No Model.) 2 Sheets—Sheet 1.

# G. H. REYNOLDS.

## ELECTRIC HOISTING MACHINE.

No. 456,908. Patented July 28, 1891.

Fig. 1.

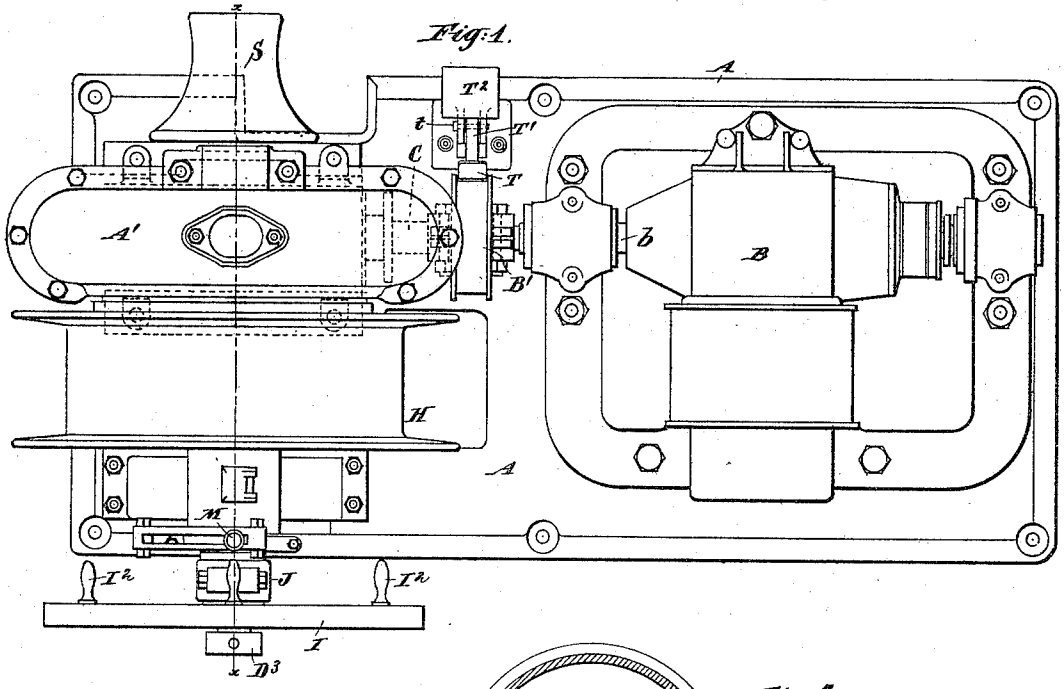
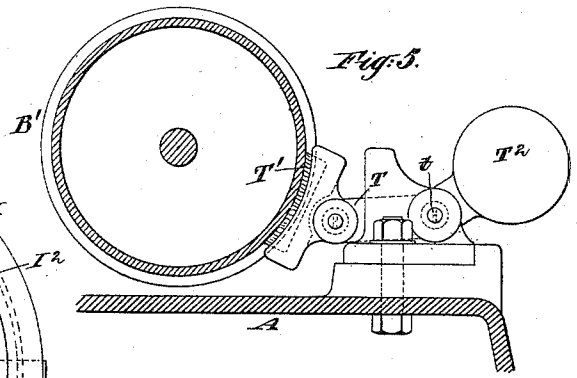



Fig. 5.



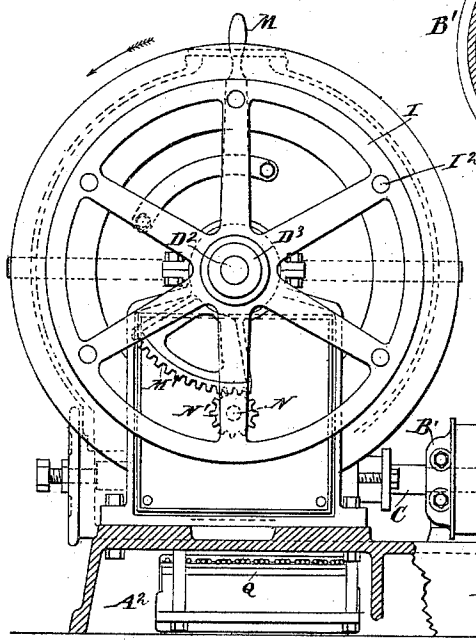




Fig. 2.




Witnesses
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Charles R. Searle.

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By his Attorney
Thomas Drew Sletson

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(No Model.) 2 Sheets—Sheet 2.

# G. H. REYNOLDS.

## ELECTRIC HOISTING MACHINE.

No. 456,908. Patented July 28, 1891.

Fig. 3.

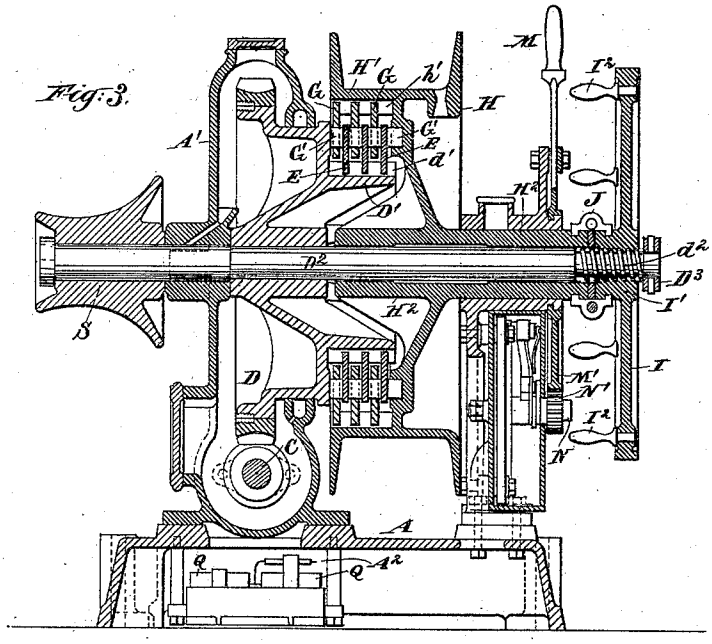
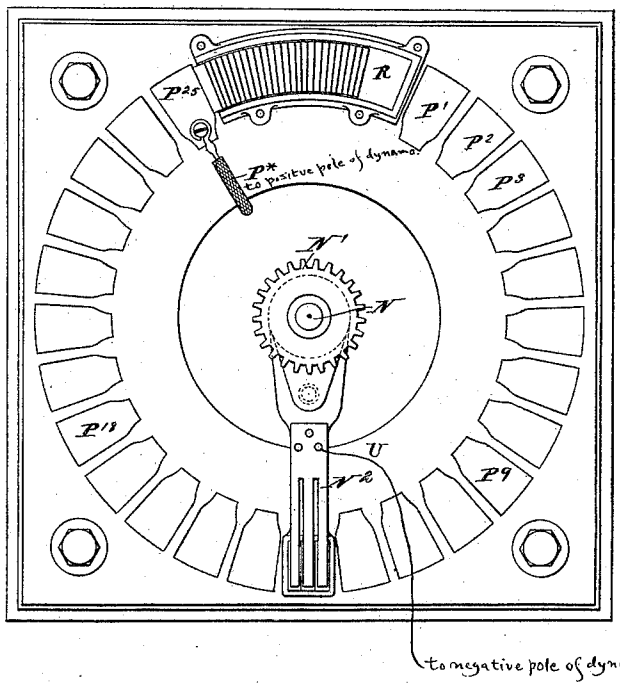



Fig. 4.




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# UNITED STATES PATENT OFFICE.

GEORGE H. REYNOLDS, OF NEW YORK, N. Y., ASSIGNOR TO THE AMERICAN ELECTRIC ELEVATOR COMPANY, OF SAME PLACE.

## ELECTRIC HOISTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 456,908, dated July 28, 1891.

Application filed December 27, 1890. Serial No. 375,947. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE H. REYNOLDS, a citizen of the United States, residing in the city and county of New York, in the State of New York, have invented a certain new and useful Improvement in Hoisting-Machines, of which the following is a specification.

The improved machine is adapted for operating by an electrical motor and is controlled by introducing a greater or less resistance in the electric current which drives the motor. I provide convenient means for varying the amount of resistance at will between wide limits. An efficient friction-clutch connects the drum on which the rope is wound with a shaft which is driven by the motor. These parts may be engaged together to wind up the hoist-rope to raise the load. The engagement may be freed to allow the rope to be unwound lightly, or the parts may be partly disengaged to allow the load to be lowered or hoisted slowly, as the exigencies may require.

The accompanying drawings form a part of this specification and represent what I consider the best means of carrying out the invention.

Figure 1 is a plan view showing the hoisting-machine and also an ordinary reversed dynamo from which the power is received. Fig. 2 is a side elevation of the same, partly in section. Fig. 3 is a vertical section on the line $x\,x$ in Fig. 1. Figs. 4 and 5 represent portions on a larger scale. Fig. 4 is an elevation seen from the right in Fig. 3. It shows the circular series of contact-plates and the arm which can be traversed around on them, which serve in varying the resistance, shown as about midway of its traverse. Fig. 5 is a view looking longitudinally of the machine, showing the brake which prevents the electric motor employed from ever turning backward when the current is shut off.

Similar letters of reference indicate corresponding parts in all the figures where they appear.

A is the fixed frame-work, certain portions being designated, when necessary, by numerals appended. A′ is a nearly circular casing, which incloses a worm-wheel and worm, the shaft of the latter extending out through a stuffing-box and is to be rotated by a reversed dynamo or other quick-working electric motor B, which by the aid of a shaft $b$ and a suitable coupling B′ connects to the worm-shaft C, which is properly threaded to impart by its rapid revolutions the required slow and strong revolution of the wheel D, keyed on the shaft $D^2$ of the hoisting-machine. The periphery of the wheel D is toothed to engage with the worm C, and is also equipped to make a tolerably oil-tight contact with the casing A′. Oil is supplied liberally to the mechanism within this casing. A hollow cylinder D′ on one face of the wheel D is provided with four or any other convenient number of wings $d'$, extending radially on the periphery of this cylinder.

E E E are annular friction plates or rings of cast-iron or other suitable material applying on the cylinder D′ and notched to receive the wings $d'$ with freedom to slip endwise or axially thereon, as required. The faces of these rings E are smoothly and truly finished.

G G G are annular friction plates or rings of a little greater diameter, so that the inner edges of the plates G can revolve freely outside of the wings $d'$. Each plate G is recessed at a number of points, and receives blocks G′ of maple or other fine-grained and durable wood adapted to exert a strong friction against the plates E when the parts are compressed together, and to allow the plates to run easily when the axial compression is relaxed. The outer edges of the plates G are notched, and the notches receive wings $h'$, cast on the inner face of a cylindrical portion H′ on the drum H, which is carried on a sleeve $H^2$, supported in a stationary bearing in the framing. The shaft $D^2$ revolves freely in the hollow interior of this sleeve except when the parts are locked together by the friction of the plates E and G, which constitute a friction-clutch. The end of the shaft $D^2$ is screw-threaded, as indicated by $d^2$, and receives the corresponding internally-threaded boss or hub I′ of a large hand-wheel I, provided with handles $I^2$, by which it may be conveniently turned.

J is a coupling-ring provided with internal flanges, which engage in grooves in the boss I′ and sleeve $H^2$ and lock them together with liberty to move endwise, both moving alike, to the small extent required to vary the friction between the blocks G′ and the plates E.

$D^3$ is a stop fitted on the end of the shaft

$D^2$, which projects beyond the wheel I, and serves to prevent this wheel from ever being unscrewed too far. When the wheel I is turned in one direction, it draws the friction-blocks G′ and plates E into tight contact and compels the drum H to revolve with the wheel D. Under these conditions the rope (not represented) is taken up by being coiled in the ample space provided in the periphery of the drum H. When the hand-wheel I is turned in the opposite direction, it relaxes the compression, and consequently the friction, to a sufficient degree to allow the load to overcome the friction and the rope to be unwound. By relaxing it still more the rope will descend even with no load on it except the hook or other provisions (not shown) for engaging with the next article to be hoisted.

The electric current revolves the shaft *b*, and consequently the worm C, with a force properly modified to overcome the resistance and to effect the hoisting at a proper rate. This requires adjustment as the loads vary.

M is a hand-lever turning on a suitable bearing concentric to the shaft $D^2$ and carrying a segment of gear M′, which engages in a spur gear-wheel N′ on a shaft N, which is free to revolve in fixed bearings below, and carries an arm $N^2$, which, as the shaft N is rotated in one direction and the other by the turning of the lever M, is traversed around on a circular series of contact-pieces P′ $P^2$, &c. These contact-pieces are connected by wires (not shown) extending, one from each contact-piece, to a corresponding section of the resistance-plates Q, mounted in a box $A^2$ in the base of the machine. When the lever M, and consequently the arm $N^2$, is thrown to one extreme position, all the resistance-plates are in circuit, and the motion is nearly or quite stopped.

R is an insulated surface. When the arm $N^2$ is brought around to approach this surface, the resistance is greatest, and when it is brought quite onto that surface the current is entirely switched off and the machine stops. The starting is effected by moving the handle M in the reverse direction, and as the arm $N^2$ is moved around on the series of contact-pieces P′ $P^2$ the current is thrown on. The electric current is at first subjected to the entire resistance of all the plates P′ $P^2$, &c.; but as the arm $N^2$ is moved farther and farther around the resistance is lessened until when the circuit is nearly completed all the resistance is off and the current is allowed to work with the greatest possible effect.

P* is a properly-covered wire leading from the last of the contact-pieces $P^{25}$ to any sufficient source of electricity, as one pole of a dynamo. (Not represented.) Another wire U connects to the arm $N^2$. The current will flow from the end of this arm to the several contact-pieces P′ $P^2$, &c., by direct contact when the arm is swung around into that position. As the arm $N^2$ is moved successively over two or any other number of contact-pieces, the current is required to traverse through the resistance-plates, moving in each instance out from the contact-piece through the corresponding resistance-plate and back to the next contact-piece, and so on.

A considerable portion of the insulated surface R is roughened. Such rough surface performs a useful service in insuring that the brush or contact surface on the arm $N^2$ shall be kept bright and clean by reason of its frequent traverses on and off this roughened surface.

B′ is a coupling which connects the motor-shaft *b* with the worm-shaft C. Its periphery is nicely finished and receives a bearing-block T′, carried by a lever T, which turns on the center *t* on the fixed work A, and is more than balanced by a counter-weight $T^2$. So long as the motor turns in the proper direction the friction due to this brake-block is insignificant; but when under any circumstances there is a tendency to turn the motor backward, the friction causes the brake-block T′ to lift slightly, and this, causing the lever T to act togglewise, induces a very great pressure between the brake-block T′ and the coupling B′, and the backward motion is promptly arrested. The casing A′, in which the worm C and the worm-wheel D are inclosed, is tight and may be partly filled with oil to insure their efficient lubrication. Any ordinary or suitable means may be employed for lubricating the frictional surfaces of the blocks G′ and plates E.

When the machine is out of use the hand-wheel I is turned backward upon its shaft sufficient to relieve the parts of the friction-clutch from contact.

If I now wish to operate the machine, I proceed as follows: Standing at the side of the machine and in front of the hand-wheel I, one hand is placed upon the wheel and the other upon the handle M. I now move the handle from its vertical position in the direction of the arrow, (see Fig. 2,) and through its connection with the pinion N′ turn the contact-arm $N^2$. This turns the electric current upon the motor, which immediately starts revolving the worm-shaft C, and through its connection with the worm-wheel D the shaft $D^2$ is slowly rotated, and were it not for my hand being upon the hand-wheel I it, too, would revolve with the shaft; but only a light pressure of the hand upon this wheel is necessary to prevent its turning with the shaft. The result is that the shaft $D^2$ is screwed into the wheel I and brings the same to press the drum H, moving its clutch contact-plates G and bearing-blocks G′ against the clutch contact-plates E, which are carried by the worm-wheel D. The moment that sufficient friction is produced in this clutch to lift the load which is on the rope (not shown) wound on the drum the hand-wheel I may be released by my hand, and the load is lifted to any desired height. It will thus be seen that the amount of friction which I put onto the clutch will al-

ways be just and only sufficient to lift the load. If now I wish to stop hoisting, I move the lever M back to the vertical position. The current is cut off and the motor stops. If I wish to lower the load, I have only to turn the hand-wheel I backward, or in the direction opposite from which it has been turning while the load was being lifted. This operation relieves the friction-plates in the clutch and the load will overhaul the drum, fast or slow, just in proportion as I release the pressure on the friction-plates. In order to provide for releasing these friction-plates of the clutch sufficiently when a very light load is lifted or when only the lifting-cable with its hook is attached, I provide a clamp J, which unites the hand-wheel I and drum H with liberty for each to turn independently of the other, but so that I cannot turn the hand-wheel backward without drawing endwise on the drum, and thus compelling the release of the friction-clutch.

Modifications may be made without departing from the principle or sacrificing the advantages of the invention. I can employ a greater number of the plates E and G. I can vary the number and area of the bearing-blocks G′.

I have shown the periphery of the worm-wheel D as made of steel in a separate piece from the wheel and held by screws serving as keys. This is a convenient construction and allows the rim to be removed as often as may be required; but this precise mode of constructing the wheel is not essential to success.

S is a winch-head fixed upon the extreme end of the main shaft $D^2$ outside of the casing A′. I intend this for use with one or more extra ropes whenever the drum H is filled with the main hoisting-cables or out of gear with the driving mechanism from any other cause. A rope is turned a few times around this winch-head or otherwise connected therewith, and the latter can be rotated by the motor acting through the worm C and worm-wheel D without regard to the frictional contacts or drum H, so long as the latter is drawn free along the shaft by the hand-wheel I and clamp J.

I claim as my invention—

1. In a hoisting apparatus, the combination, with a series of contacts and a rheostat in an electrical circuit, a switch arranged to traverse said contacts, and an electric motor adapted to receive a greater or less electromotive force therethrough, of a worm driven from the shaft of said motor, a worm-wheel meshing with said worm and carrying frictional contact-surfaces, a central shaft upon which the worm-wheel is fixed, having one end threaded, a winding-drum having frictional surfaces to correspond with those on the worm-wheel, and a sleeve carried loosely upon the central shaft, a hand-wheel working upon the screw of the shaft, and a clamp for joining said hand-wheel to said sleeve, so that they may move together laterally and revolve together or independently, all arranged substantially as and for the purpose set forth.

2. In a hoisting-machine, the combination, with the framing A, electric motor B, winding-drum H, and means for imparting motion from the motor to the drum, of the rheostat Q, switch composed of arm $N^2$, contact-pieces P′ $P^2$, &c., and insulator R, and said rheostat and switch being incased within the framing and electrically connected to the motor, hand-lever M, and proper gears for operating said switch, all substantially as and for the purpose specified.

3. In a hoisting-machine, the combination, with the central shaft $D^2$, of the worm-wheel D, fixed thereupon so as to rotate therewith, a series of frictional contact-pieces E, carried by said worm-wheel, winding-drum H, mounted loosely upon the central shaft, a series of annular friction-plates G, carried by the drum, and means for throwing said frictional pieces E and G in and out of contact with each other, substantially as and for the purposes set forth.

4. The combination, with the central shaft $D^2$, having screw-threads $d^2$ and end stop $D^3$, and with the drum H and its sleeve $H^2$, of the hand-wheel I, having hub I′ and handles $I^2$, and clamp J, joining said sleeve and hub, substantially as and for the purpose specified.

5. The combination, with the worm-wheel and its annular friction-plates E E, of the winding-drum H and its annular frictional plates G G, having wooden blocks G′ G′ recessed therein and adapted to bear upon the plates E, substantially as and for the purpose specified.

6. The combination, with the rheostat-switch composed of the movable arm $N^2$ and series of contacts P′ $P^2$, &c., of the roughened insulated surface R, for the purpose described.

7. The combination, with the main framing A, central shaft $D^2$, worm C, and worm-wheel D, of the separate casing A′, affording a bearing for the shaft and surrounding the worm and worm-wheel, so as to form an efficient oil-receptacle, substantially as shown and described.

8. The combination, with an electric motor, worm, and worm-wheel, and with the central shaft $D^2$ and friction-clutch E G, of the winch-head S, fixed upon the outer end of said shaft and adapted to be used for independent winding, substantially as specified.

In testimony that I claim the invention above set forth I affix my signature in presence of two witnesses.

GEO. H. REYNOLDS.

Witnesses:
DORA REINERS,
FRANK CREELMAN.