No. 816,879. PATENTED APR. 3, 1906.

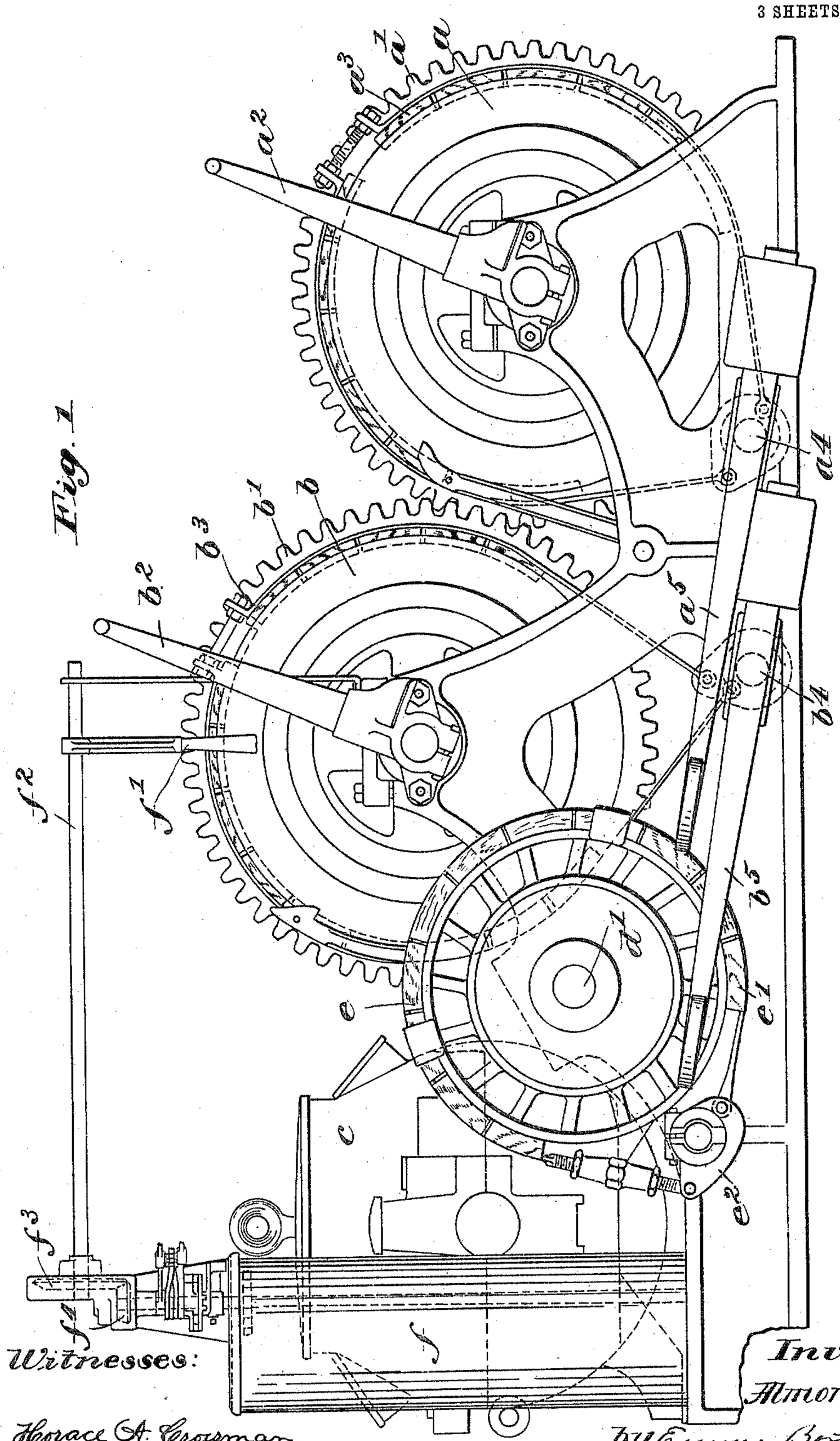
A. E. NORRIS.

ELECTRICAL HOISTING APPARATUS.

APPLICATION FILED SEPT. 23, 1904.

3 SHEETS—SHEET 1.

Fig. 1



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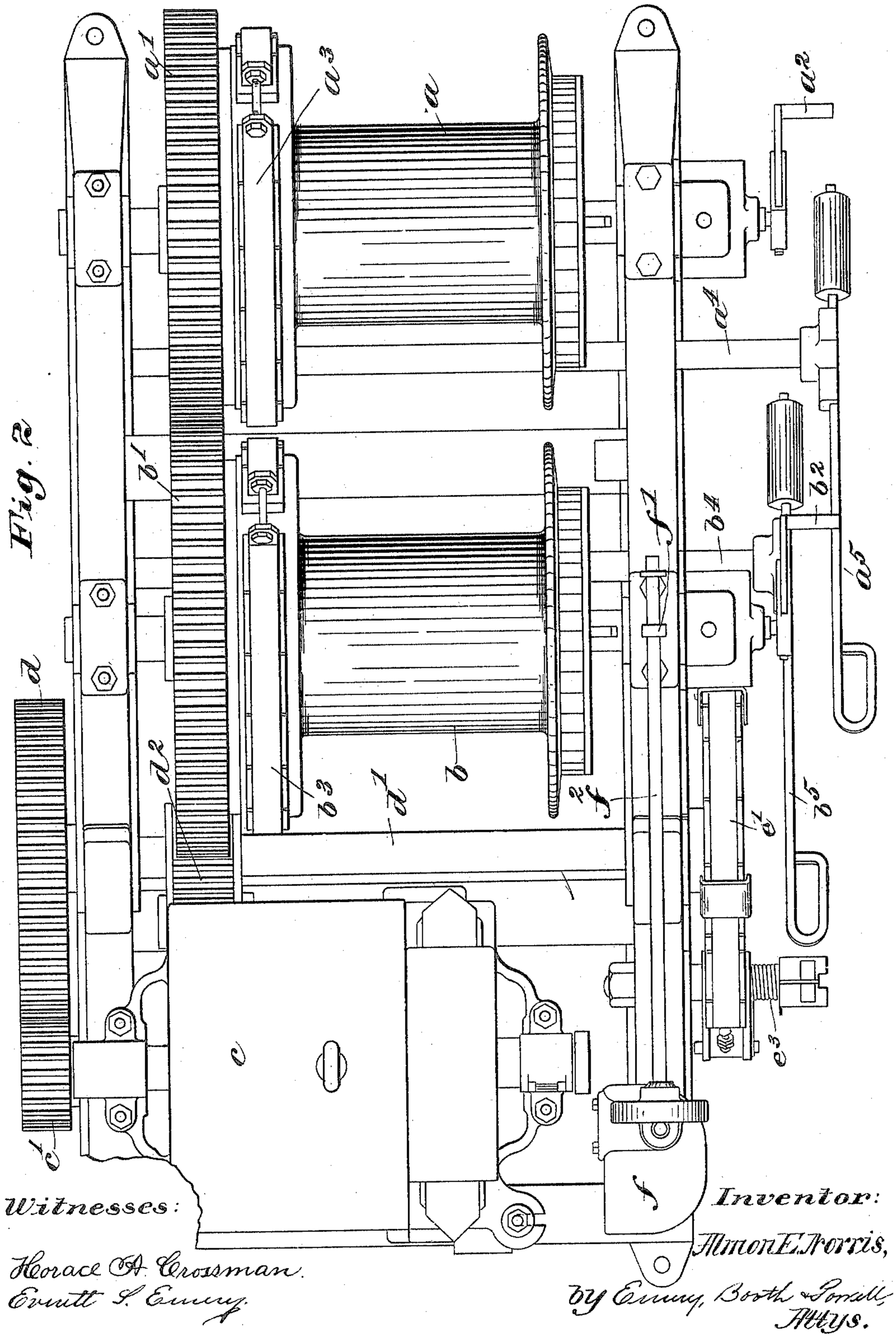
3 SHEETS—SHEET 2.

Fig. 2



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3 SHEETS—SHEET 3.

Fig. 3:

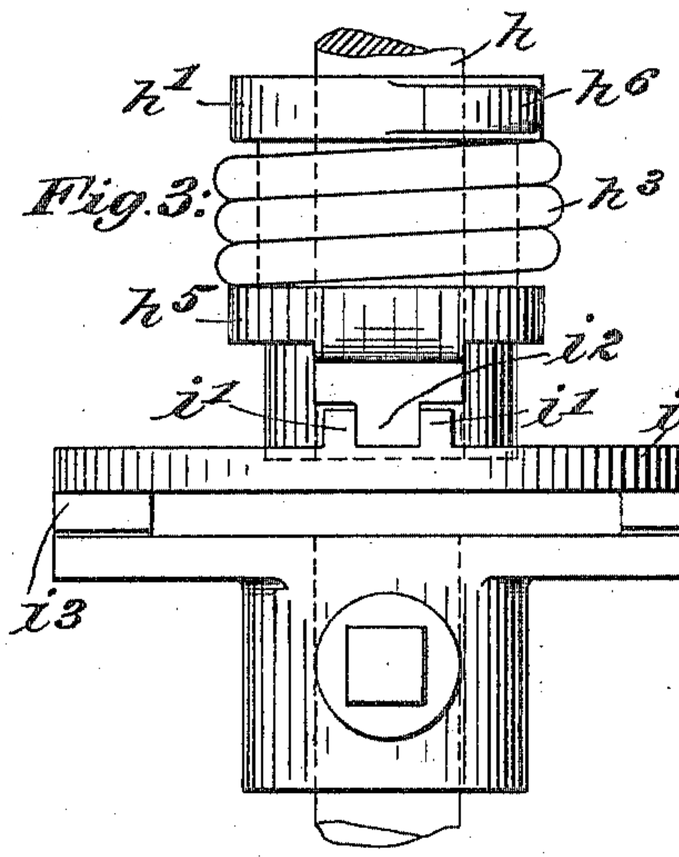
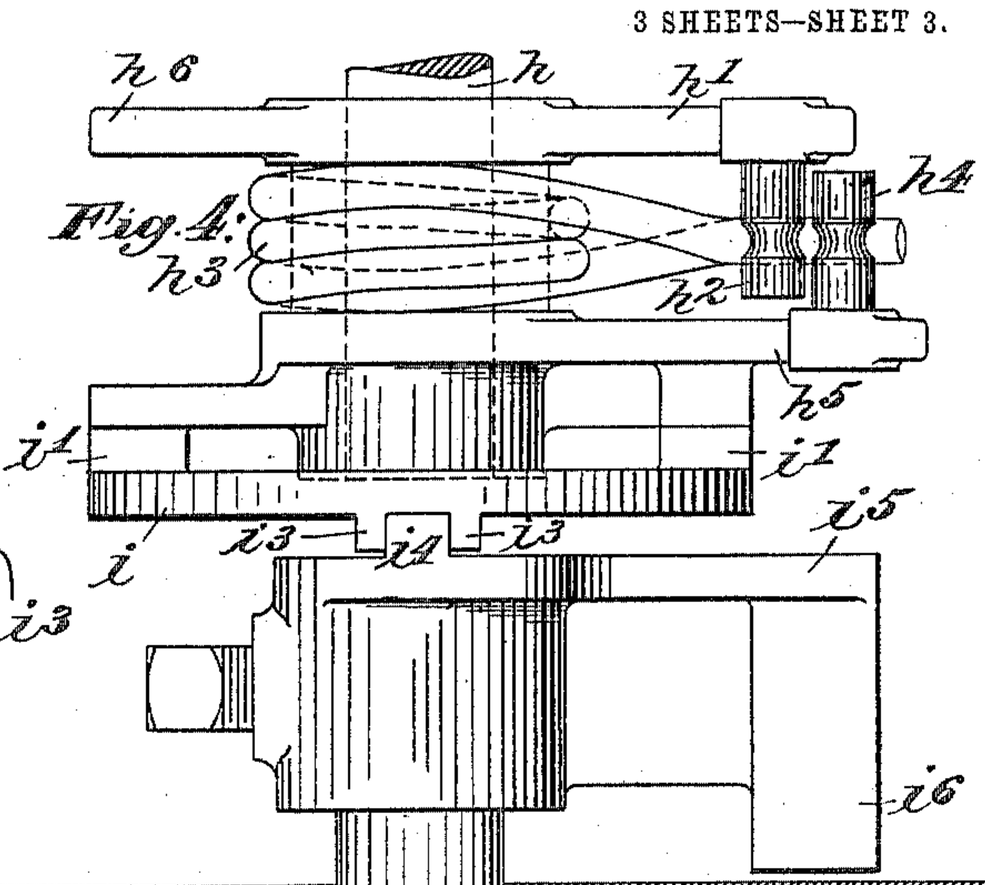


Fig. 4:



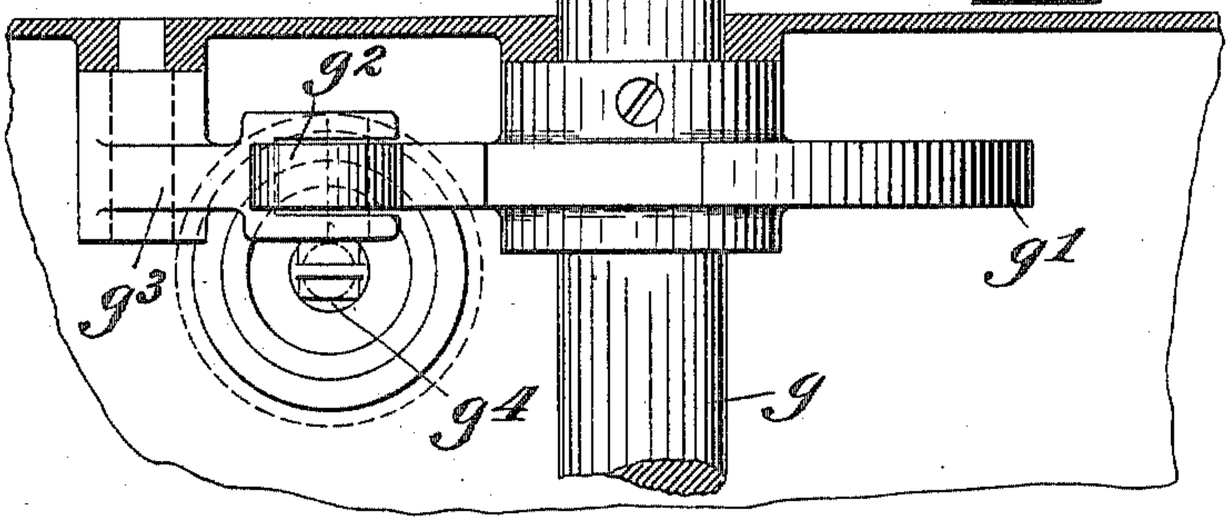
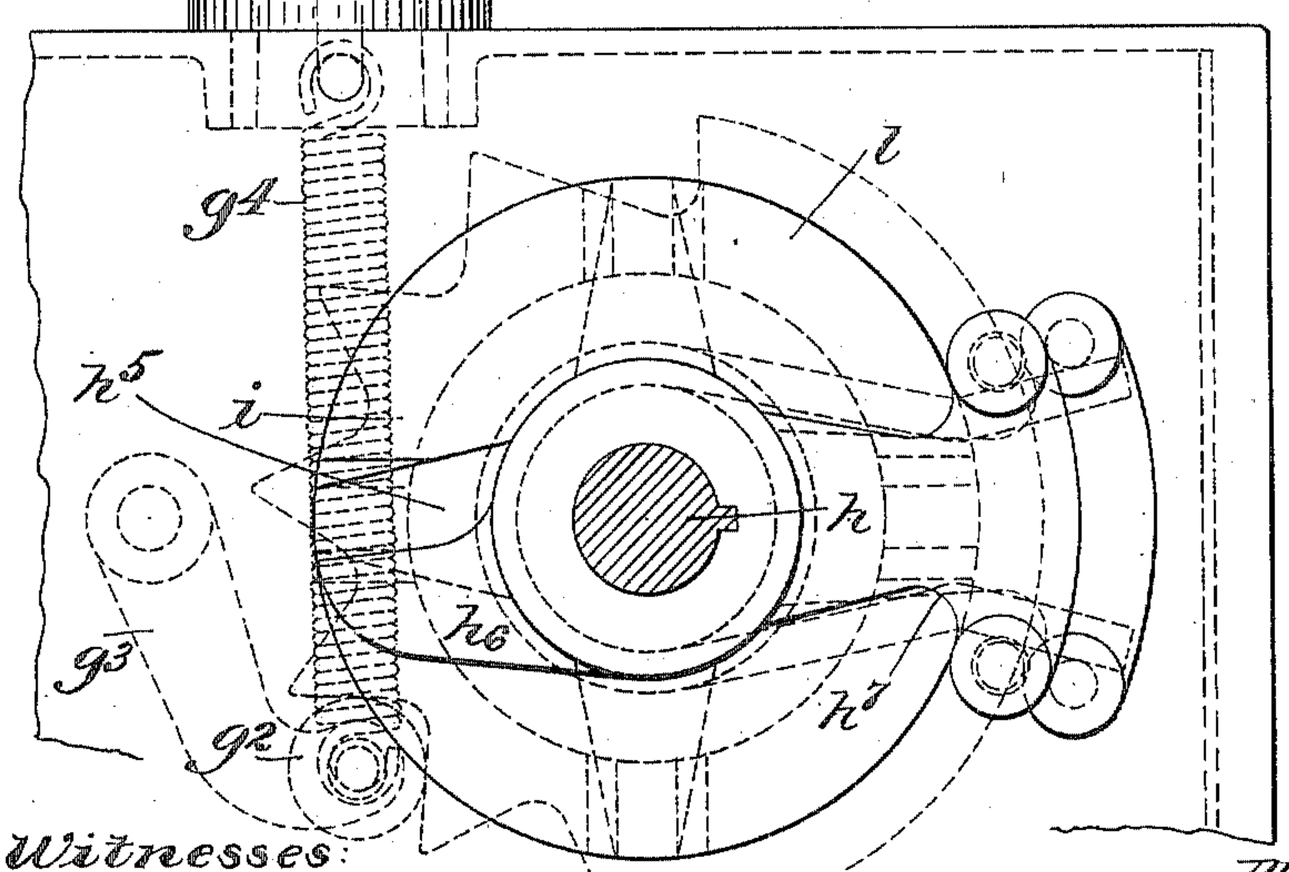


Fig. 5:



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UNITED STATES PATENT OFFICE.

ALMON E. NORRIS, OF CAMBRIDGE, MASSACHUSETTS.

ELECTRICAL HOISTING APPARATUS.

No. 816,879. Specification of Letters Patent. Patented April 3, 1906.

Application filed September 23, 1904. Serial No. 225,610.

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 Electrical 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 relates to hoisting machinery, and particularly to hoisting machinery employing electricity as a motive power, although in certain respects it may have application to other uses.

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.

In the drawings, Figure 1 is a side elevation showing for illustrative purposes one embodiment of my invention. Fig. 2 is a plan view of the same, and Figs. 3, 4, and 5 are details of the controller connections.

In the drawings is illustrated the application of my invention to an ordinary form of double-drum hoisting-engine employing the two drums *a* and *b*, adapted to be clutched to their respective driving-gears *a'* and *b'* through clutch-operating mechanism controlled by the clutch-levers a^2 and b^2. The clutch-operating mechanism may be and preferably is of any well-known type, and it is not therefore necessary to show or describe the same in detail. Brake-bands a^3 and b^3 embrace the suitably-shaped surfaces of parts attached, respectively, to the said drums *a* and *b* and are adapted to be operated independently or together by means of the rock-shafts a^4 and b^4, to which are secured, respectively, the counterbalanced adjacent foot-brake-operating levers a^5 and b^5. The gears *a'* and *b'* are intermeshing and are driven in opposite directions through intermediate gearing by the electric motor *c*, which is mounted upon the same bed-plate with the drums *a* and *b*. The drums are driven by the motor through the motor-pinion *c'*, gearing with the gear *d* upon the counter-shaft *d'*, the latter having also fixedly secured thereto the counter-shaft pinion d^2 in mesh with the drum-driving gear *b'*.

In the operation of a hoisting apparatus employing a steam-engine as a motor the pressure of the steam caught in the cylinders will serve to catch or hold the load temporarily if the power is suddenly shut off. With an electric hoist, however, if it is desired to shut off power with the load still on the motor there is ordinarily nothing to hold the load without movement of the foot-operated brake-levers or such other manually or foot operated means as may be provided. I have therefore provided upon the counter-shaft *d'* automatic means for holding the load in case the occasion arises for shutting off the power from the motor. This automatic brake or load-holding device may be of any suitable construction; but I preferably employ one similar to that shown in reissued Letters Patent No. 12,040, granted to me September 30, 1902. This consists of a drum *e*, secured to the shaft *d* and encircled by a brake-band *e'*, the opposite ends of which are attached to an oscillating actuator-block e^2 at different radial distances from its center. The block e^2 is turned, Fig. 2, through the influence of the spiral spring e^3 to cause the band to constantly 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 connection to the opposite end of the band. When driven by the motor in the direction of hoisting, the drum pulls upon the longer radius of band attachment to the block, tending more or less to loosen the band and requiring the drum merely to overcome the friction of the band induced by the spiral spring e^3. Should the power be shut off, however, any reverse movement of the drum resulting from a tendency for the load to settle or drop pulls upon the attachment of shorter radius, causing the band to be drawn tightly about the drum and prevent further movement thereof.

In constructing and using electrical hoists I have found it highly desirable to preserve substantially the same location of operating-levers as exists upon steam-hoists and substantially the same conditions of operation, so that an operator accustomed to the control of a steam-operated hoist can work with an electrical hoist without the necessity of further practice or instruction and can use interchangeably an electrical hoist with equal facility, having the assurance that the movement of his hand or foot which usually follows the unconscious direction of his eye as he watches the progress of the work will result in precisely the same effect in the one case as in the other. The controller *f* is lo-

cated at the end of the bed-plate and by the side of the motor *c* relatively remote from the clutch and brake operating levers; but the controller hand-lever *f'* is arranged adjacent to the remaining operating-levers and in such a position that the operator can grasp it and move it under substantially the same conditions as he would grasp and move the throttle of a steam hoisting-engine. The controlling-lever *f'* is secured to the rock-shaft f^2, journaled in suitable brackets upon the frame of the apparatus and extending lengthwise the latter to and immediately above the controller, with the drum of which it is connected by the bevel-gears f^3 and f^4.

Referring more particularly to Figs. 4 and 5, the shaft *g*, which carries the controller-drum, (not shown,) is provided with a notched wheel or star-wheel *g'*, arranged, as is usual, with a series of notches about its periphery with which the roll g^2, carried by the arm g^3, is adapted to engage to cause the drum to snap positively and decisively from one position to another. The roll g^2 is held seated in one of the notches of the star-wheel by the tension-spring g^4, secured to the adjustable rod g^5, the latter entering and passing through the walls of a pocket or cap g^6, attached to the side of the controller-casing. It is usual to arrange the spring relatively to the roll and the arm upon which it is mounted in such a way that as the roll moves outward toward the apex of the star-wheel points the resistance to movement is increased. I have so arranged the tension-spring that as the roll moves outward the tension upon the spring is but slightly increased, while the leverage thereof upon the roll is diminished, with the result that the effective moment which opposes further outward movement of the roll remains substantially constant or, if varying at all, slightly diminishes. As a result of this any movement of the controller-shaft and its star-wheel which is sufficient to displace the roll and start it on its outward movement is sufficient to complete the movement and cause it to snap by the apex of the point and into the next notch, thus insuring the movement of the controller through at least one notch under an effort which is sufficient to start it. The controller movement, which involves snapping from one notch to another and which must be maintained in order to prevent burning and mutilation of the controller-contacts, is essentially different from movement of an engine-throttle, which of course may be gradual or jerky, slight or extensive, as the operator may desire. In order that the operator while moving the controller may continue to move it exactly as he would an engine-throttle without conscious care or thought on his part and that the handle may offer the same resistance and have the same feeling and effect, I have interposed between the controller-handle and the controller-shaft an elastic torsion device which permits the operator to move the handle in any way which he desires, the controller responding to such movement when the amplitude of the handle movement is sufficient to store up the necessary torsion in the torsion device.

Referring to Figs. 1, 3, and 4, the beveled gear f^4, which is moved by the controller-handle, is connected to turn the shaft *h* and the driving-arm *h'*, the latter being fast on the shaft *h*. The said arm is provided with a pair of depending grooved studs h^2, against the inner grooved sides of which press the ends of a coiled spring h^3, which is wound about the hub of the driving-arm *h'*. Arranged radially outward beyond the driving-arm studs and adjacent thereto is a pair of similar studs h^4, contacting also with the ends of the coiled spring h^3 and projecting upward from a driven arm or member h^5 immediately beneath the driving-arm and spring, but loose upon the shaft *h*. The driven member is connected to the controller-shaft through a flexible coupling, hereinafter described, and is turned by movement of the driving member when the resultant torsion in the coiled spring is sufficient to overcome the tension of the spring acting upon the star-wheel roll. Thus movement of the controller-handle is transmitted, through the driving-arm *h'*, to one or the other of the two studs h^2, causing such stud to move in a direction to wind up the coiled spring and to press through its opposite spring end against the oppositely-located driven stud h^4. When the ampiltude of the handle movement is sufficient and the spring-pressure great enough to overcome the tension-spring g^4, the controller-drum is caused to snap to its next notch, and this without conscious effort on the part of the operator.

If the controller-shaft tends to bind either through inaccurate constructional alinement or through misuse, to which this class of apparatus is liable, it may require an abnormal torsion of the spring h^3 to move the star-wheel and the movement of the controller-handle may not act to operate the controller just as is desired or expected. I have therefore connected the driven member h^5 and controller-shaft by a flexible coupling, so that haste in setting up the apparatus or such misuse of the same as will result in throwing the parts out of alinement cannot affect the operation. This coupling comprises a torsion-ring *i*, having two pairs of upturned oppositely-arranged lugs *i'*, between which fit, respectively, oppositely-arranged single lugs i^2, depending from the driven member h^5. On a diametrical line at right angles to the lugs *i'* are similar pairs of depending lugs i^3, adapted to engage and receive between them two upturned single lugs i^4 upon the controller stop-lever i^5, which is fixedly secured to the controller-

shaft g. The latter carries the stop-piece i^6, adapted to coöperate with a stationary stop (not shown) upon the controller-casing to limit the movement of the controller-drum. A spur or lug h^6 is carried by the driving-arm h' and is adapted to engage with a pin (not shown) attached to the beveled gear-housing to limit movement of the driving-arm in one direction, movement in the opposite direction being limited by contact between said pin and the concave portion h^7 (see Fig. 5) of said arm. Since the plate i may be rocked relatively either to the driven member h^5 or the stop-lever i^6 without affecting transmission of movement, the alinement of the several parts need be only approximate and variation in alinement will not affect the freedom of operation.

It will be understood that my invention is not limited to the particular details and arrangement of parts herein shown, but that extensive modifications of the same may be made without departing from the spirit thereof; also, that while I have shown the same as applied to a particular form of hoisting-engine such embodiment is by way of illustration only and not because the particular type of engine is concerned with the essential features of my invention.

I claim—

1. In a hoisting apparatus, the combination with hoisting-drums of brake-levers and clutch-levers arranged adjacent the usual position of the operator, an electric driving-motor, a controlling-lever therefor, also arranged adjacent the position of the operator, and a step-by-step electric controller relatively remote from its controlling-lever.

2. In a hoisting apparatus, the combination with a bed-plate of hoisting means mounted thereon, electric driving means arranged adjacent one end of the bed-plate, a step-by-step electric controller also arranged adjacent the end of the bed-plate, and a controlling-lever arranged relatively remote from its controller.

3. In a hoisting apparatus, the combination of hoisting means, driving means therefor, a step-by-step controller, a controlling-lever therefor and a yielding connection between said controller and said lever.

4. In a hoisting apparatus, the combination of hoisting means, driving means therefor, a step-by-step controller, a controlling-lever therefor and a flexible coupling between said controller and said lever.

5. In a hoisting apparatus, the combination of hoisting means, driving means therefor, a step-by-step controller having a controlling-lever arranged in simulation of a steam-engine throttling-lever, and means for causing said controller to snap from one position to another in response to a movement of its lever in simulation of an engine-throttle movement.

6. In a hoisting apparatus, the combination of hoisting means, driving means therefor, a controller-shaft, a star-wheel for said controller-shaft, a controlling-lever arranged in simulation of a steam-engine-throttle lever, and an elastic connection between said lever and said controller-shaft.

7. In a hoisting apparatus the combination with hoisting means, driving means therefor, a step-by-step controller, a controller-lever, an elastic connection between said lever and said controller tending to turn the controller-shaft with increased force as the controller-lever is moved, and means for retarding movement of the controller-shaft, said means acting with a non-increasing force on movement of said shaft.

8. In an apparatus of the class described, the combination with a bed-plate, of a plurality of hoisting-drums mounted thereon at one end of the bed-plate and an electric driving-motor mounted at the other end thereof, an intermediate counter-shaft geared to the motor and also geared to said drums, and load-holding means upon said counter-shaft.

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.