No. 747,463. PATENTED DEC. 22, 1903.

E. Y. MOORE.

HOIST.

APPLICATION FILED APR. 3, 1902.

NO MODEL. 4 SHEETS—SHEET 1.

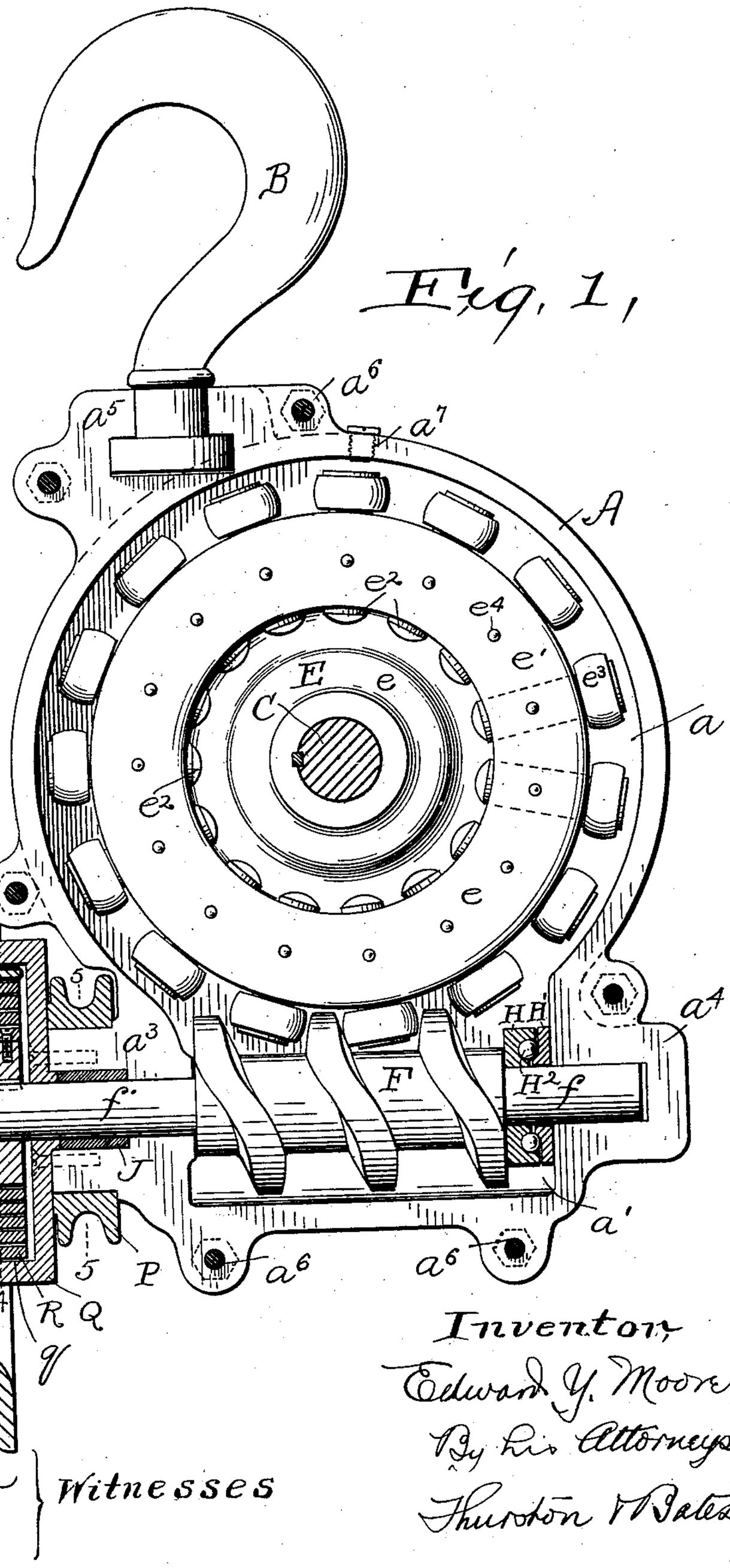

Fig. 1.

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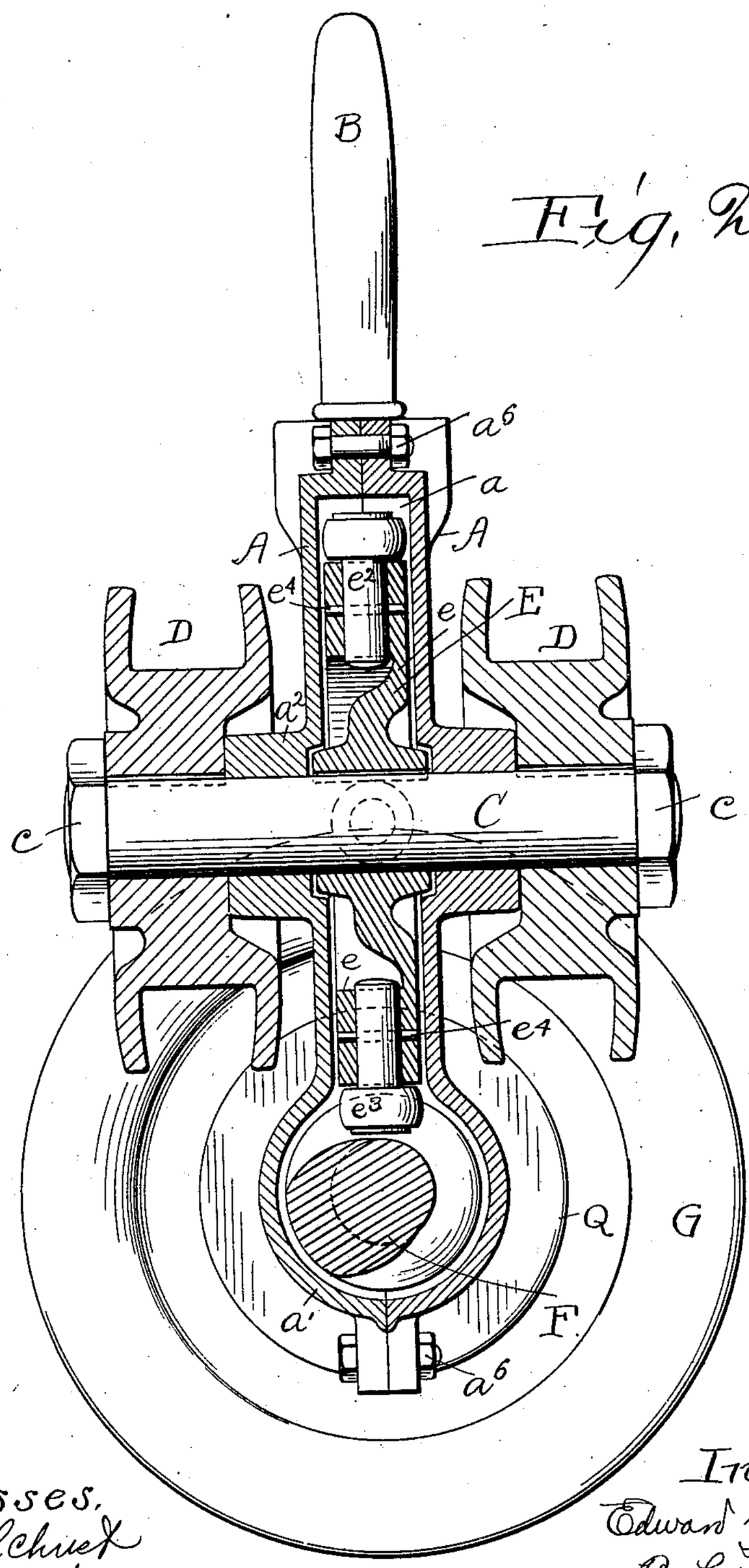
NO MODEL. 4 SHEETS—SHEET 2.

Fig. 2.



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NO MODEL. 4 SHEETS—SHEET 3.

Fig. 3,

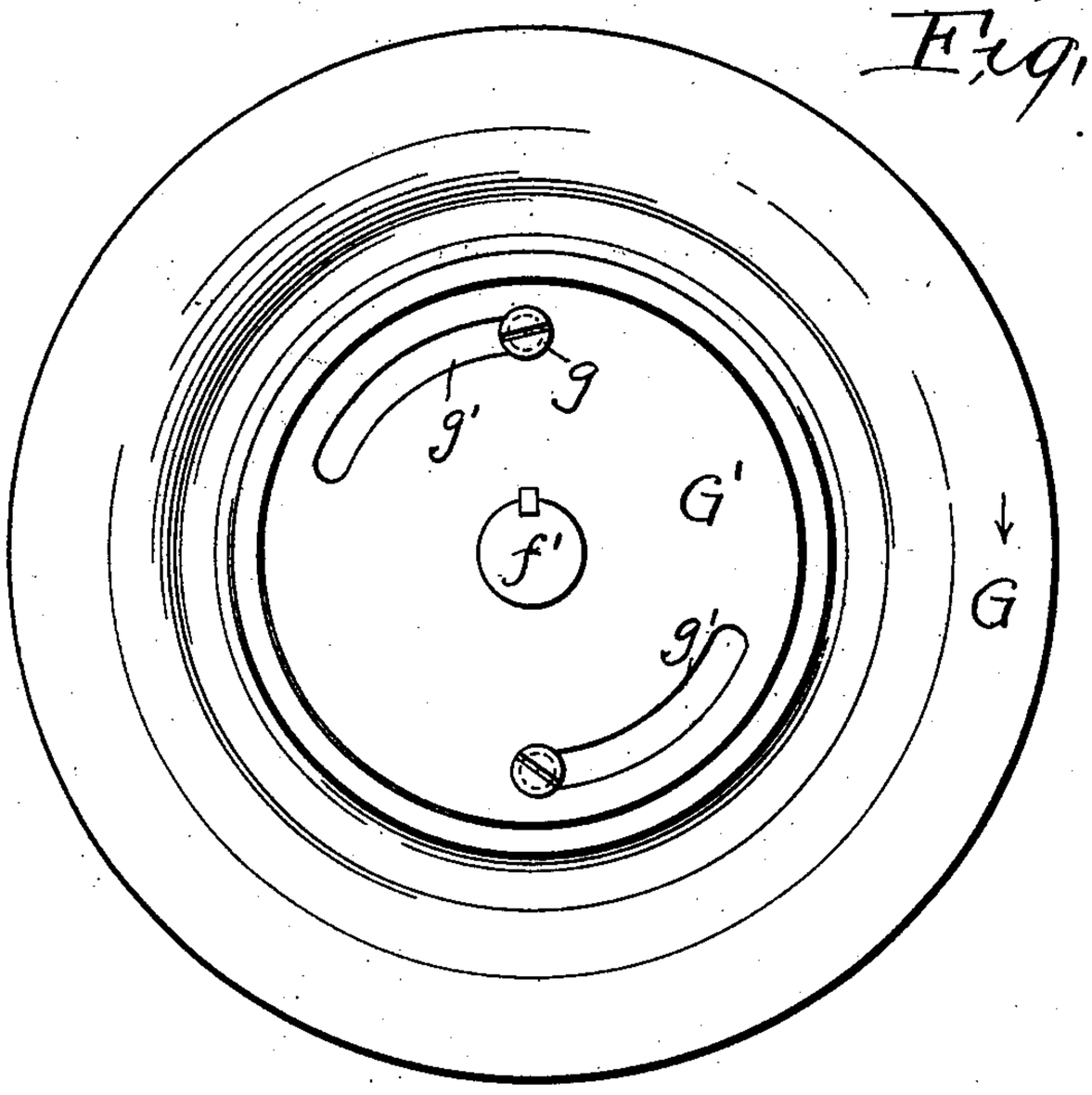
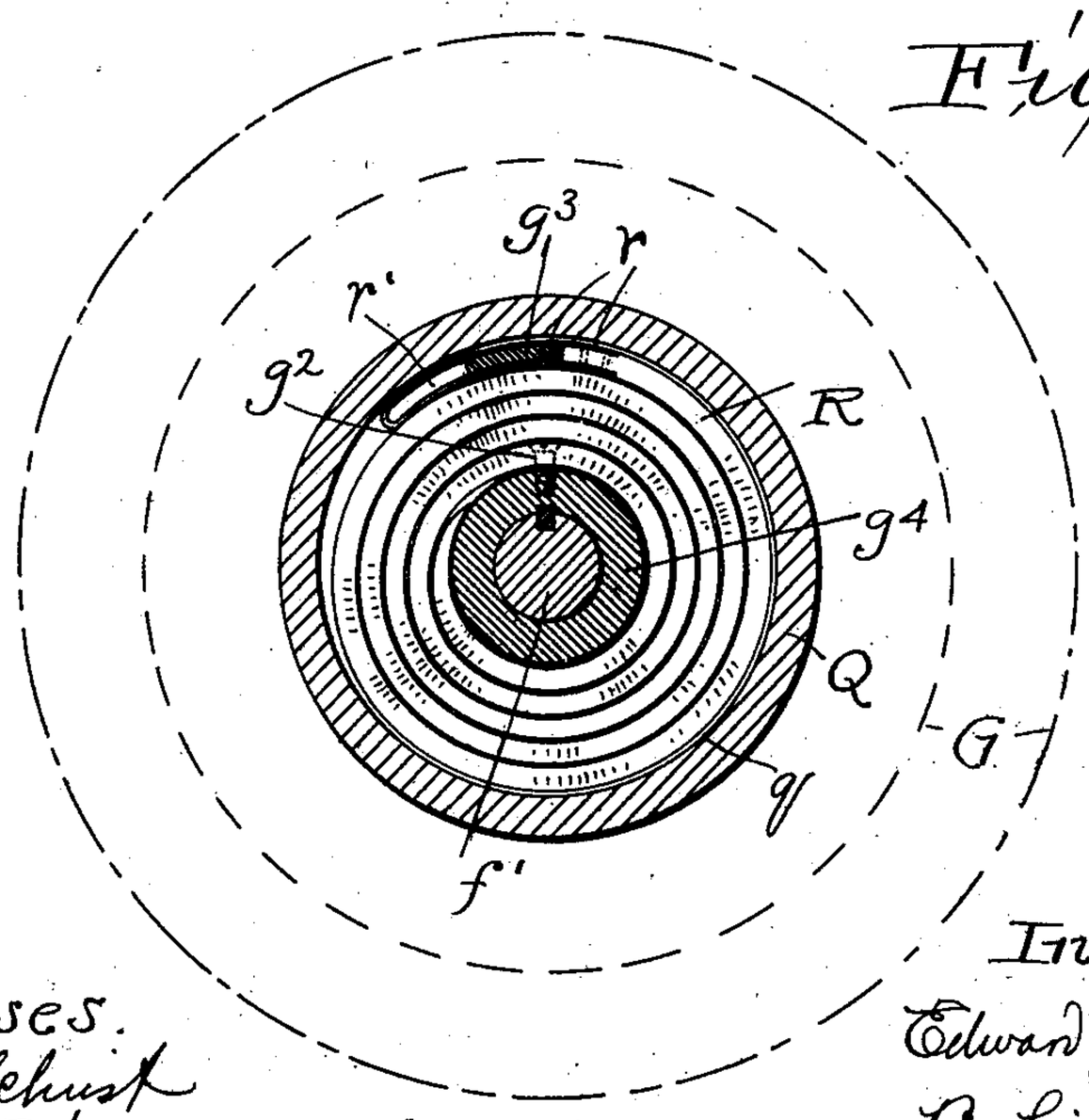


Fig. 4,



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NO MODEL. 4 SHEETS—SHEET 4.

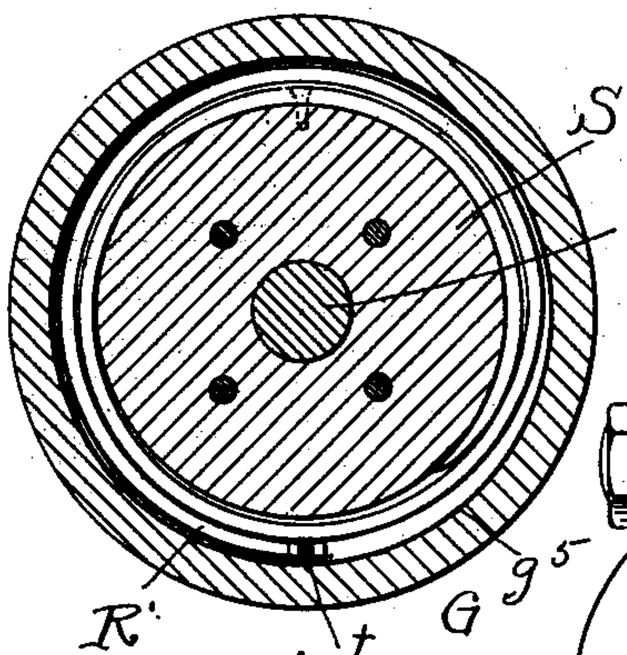

Fig. 8.

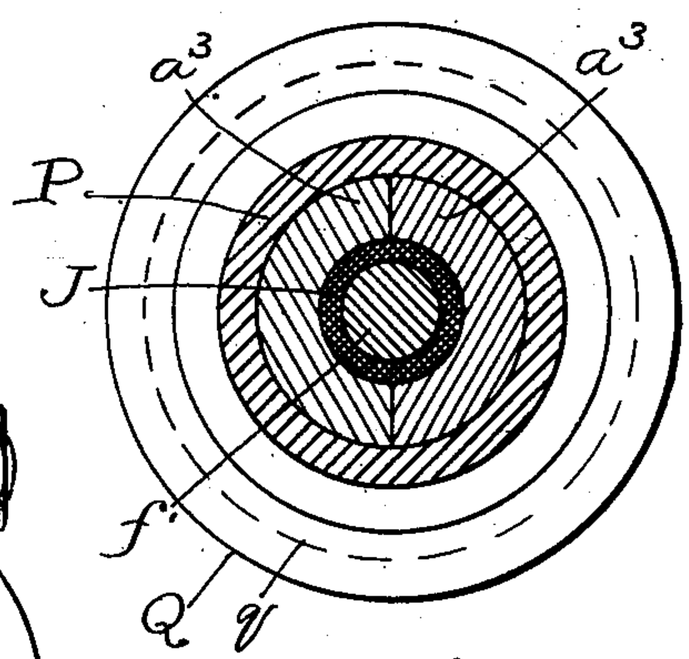

Fig. 5.

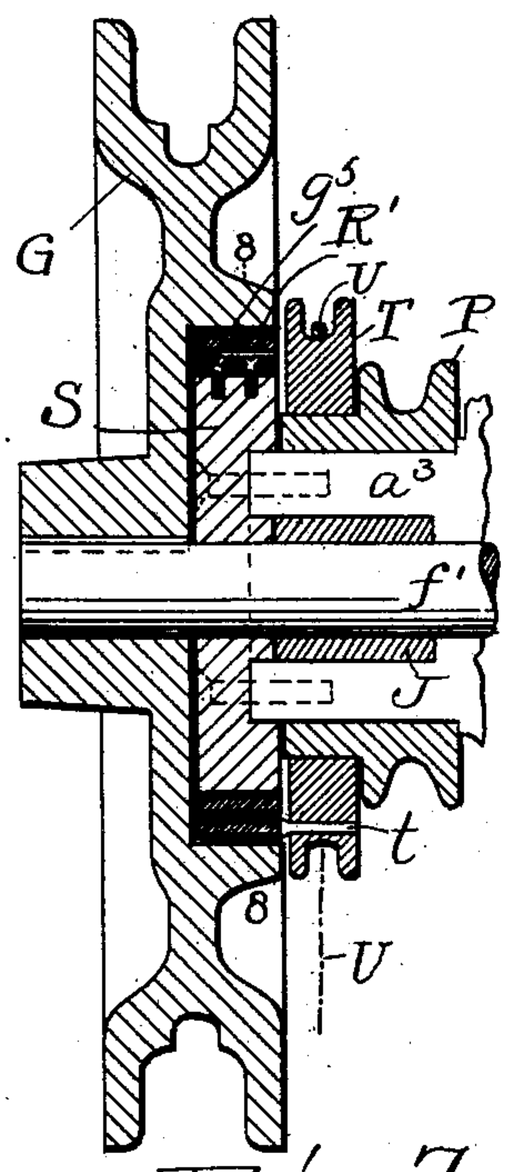

Fig. 7.

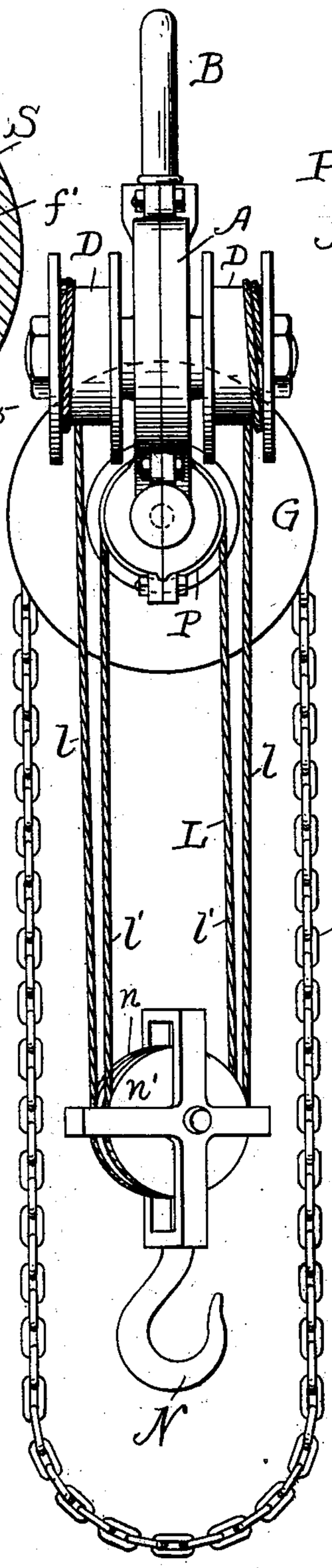

Fig. 6.

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No. 747,463. Patented December 22, 1903.

UNITED STATES PATENT OFFICE.

EDWARD Y. MOORE, OF CLEVELAND, OHIO.

HOIST.

SPECIFICATION forming part of Letters Patent No. 747,463, dated December 22, 1903.

Application filed April 3, 1902. Serial No. 101,156. (No model.)

To all whom it may concern:

Be it known that I, EDWARD Y. MOORE, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Hoists, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

The object of this invention is to provide a hoist which while being capable of automatically sustaining a load shall have a high efficiency in operation. In carrying out this object I provide a worm-geared hoist so arranged and constructed that the internal friction is very much reduced, very much more than half of the driving power being thus effective in raising the load. To sustain the load, I provide an automatic brake, which sets itself whenever the application of the power ceases.

The invention may be best summarized as consisting in the construction and combination of parts hereinafter described, reference being had to the accompanying drawings, description, and claims.

In the drawings, Figure 1 is a sectional side elevation of the hoist. Fig. 2 is a transverse and approximately vertical section thereof through the shaft of the worm-wheel. Fig. 3 is a front elevation of the hand-chain wheel. Fig. 4 is a transverse section on the line 4 4 of Fig. 1 looking in the same direction as Fig. 3. Fig. 5 is a transverse section on the line 5 5 of Fig. 1 looking toward the hand-chain wheel. Fig. 6 is a rear elevation of the complete hoist with its cable, load-hook, and hand-chain. Fig. 7 is a central section along the worm-shaft, showing a modified form of brake. Fig. 8 is a section on the line 8 8 of Fig. 7 looking toward the hand-chain wheel.

My hoist includes a casing made in two parts A A, a supporting-hook B, a rotating shaft C, intersecting the casing, wire-rope sheaves D D, keyed to the shaft C, a special form of worm-wheel E within the casing and keyed to the shaft C, a worm F, journaled in the casing, and a hand-chain wheel G for driving the worm F. These various parts will all be more particularly described.

The two parts of the casing A are pairs, each half having a cylindrical chamber a for the reception of the worm-wheel and at the base thereof a communicating partial chamber a' for the reception of the worm. The worm-wheel shaft is journaled in bosses a^2 on the outer sides of the casing and the worm-shaft in split bosses a^3 a^4, arranged to receive it. The hook B is swiveled within a recess provided in a split boss a^5 at the upper end of the casing. The two parts of the casing are held together by numerous bolts a^6.

The two raising-pulleys D D are rigid on the shaft C outside of the two bosses a^2 a^2, being held by suitable keys and also by the nuts c, screwing onto the ends of the shafts.

In order to reduce the friction, I provide a special form of worm-wheel E. This consists of the central spider or frame e, keyed to the shaft and having a broad peripheral flange e', which has radial holes through it occupied by studs e^2, on which are journaled rollers e^3. The rollers are held in place between the heads of the studs and the periphery of the spider, but are free to rotate, while the studs themselves are prevented from movement by the pins e^4 passing through them and the flange e'. The rollers e^3 are suitably curved across their peripheries and constitute the teeth of the worm-wheel.

The worm F is rigid with its shafts f f'. It is of a steep pitch, engaging the rollers e^3 to rotate the worm-wheel unusually rapidly. The weight of the load acting downward on the front side of the pulleys D (substantially in line with the shank of the hook B) tends to drive the worm-wheel in the left-hand direction, as shown in Fig. 1, and hence to shift the worm toward the right. This thrust of the worm is taken by a very simple and efficient ball-bearing which I have provided consisting of a pair of hardened-steel bearing plates or rings H H', loosely surrounding the shaft f of the worm and being between the end of the worm and the inner face of the casing and having between them a set of balls H^2.

The chamber which the worm occupies is adapted to be partially filled with oil, and this keeps the ball-bearing oiled, also the engagement of the worm and worm-wheel, the journals of the rollers of the worm-wheel, and finally the bearing for the shaft C, the oil for these various parts being gradually carried

up by the moving members. An oil-hole may be provided at any convenient point, as at a^7, for the insertion of the proper quantity of oil, and a suitable packing J is provided within a recess in the boss a^3 around the shaft f' of the worm to prevent the leakage of such oil.

The worm is rotated by a suitable hand-chain wheel G, as stated. In the modification shown in Fig. 8 this wheel is keyed directly to the shaft f' of the worm. In the form shown in Fig. 1 it is journaled on the hub g^4 of an intermediate wheel G' and has stops in the form of screws g, taking through curved slots g' in the wheel G'. This connection allows a limited movement between the wheels G and G' for the purpose of applying or releasing a brake, as hereinafter explained; but after the play allowed by the slots has been taken up the two wheels rotate in unison.

Fig. 6 shows the usual hand-chain K passing over the wheel G and lying in pockets therein, whereby a pull on the hand-chain rotates the worm in one direction or the other. L represents the raising-cable. This cable has its ends secured to the sheaves D D and wraps around them, passing downward on the front side thereof. The two sides or plies $l\,l$ of the cable then pass downward through a suitably-sheaved load-hook N. As shown, there are two independent sheaves $n\,n'$ carried by the load-hook, and from opposite sides of these sheaves the plies $l'\,l'$ of the cable pass upward and meet, occupying a groove in the equalizer-sheave P, which is journaled on the boss a^3 of the casing. These sheaves allow the cable to play back and forth, so that when in the raising of the load if the cable on one pulley rises upon the previously-wound portion before it does on the other pulley the load is not thereby disturbed nor is one cable given more than its share of the strain. This is an important feature, as without it it is extremely difficult to operate a double raising-pulley with a cable in place of the usual chain. The cable has many usages, including saving in wear and steadiness in elevation.

From what has been described it will be seen that when the hand-chain is pulled in the proper direction the hand-chain wheel is rotated, and thereby the worm F, and hence the worm-wheel raises or lowers the load. The particular kind of an antifriction worm-wheel which I use, the steep thread of the worm, and the ball-bearing for it, as well as the arrangement for thorough lubrication, very largely reduce the internal friction, so that the hoist would not thereby support its load. To make it support its load, I provide an automatic brake, which is caused to engage when the raising power ceases by reason of the tendency of the worm to rotate backward. I have shown this brake in two forms, one form appearing in Figs. 1 and 5 and the other form in Figs. 7 and 8. These I will now proceed to describe.

In the first form of braking I provide a cup Q, rigidly secured to the casing of the hoist and having a smooth cylindrical inner surface q, and I provide around the hub g^4 of the wheel G' a leather band R, wound into a spiral, substantially filling the space between the hub and such inner surface q. This leather band is secured to the hub g^4 at or near one end, and at the other end it has a strap r taking loosely around a lug g^3, rigidly carried by the wheel G. Now to raise the load the hand-chain is pulled to turn the wheel G in the right-hand direction in Figs. 3 and 4, thereby causing the stops g to travel to the ends of the slots g' into the position shown in Fig. 3. The slots g' are each longer than the loose play r' between the strap r and the lug g^3, wherefore this movement slightly unwinds the spiral leather band, causing it to frictionally rub the surface q; but in continuing the movement the lug g^3 and the hub g^4 rotate in unison, and this direction of rotation being such as to cause the spiral to trail over the surface q the leather easily slides over that surface without materially binding the same. When the load has been elevated to the proper point and the power on the hand-chain ceases, the tendency of the worm to rotate backward turns the hub g^4 in the left-hand direction in Fig. 4, unwinding the spiral leather for the center, the outer end being held by its friction with the surface q and the loose play between the lug g^3 and the strap r allowing the friction to hold it. This unwinding of the leather causes it to jam within the cup Q sufficiently to hold the load against descension. Thereafter when it is desired to lower the load, the hand-chain is pulled in the opposite direction, rotating the wheel G independently of the wheel G' for the length of the slots g'. This more than takes up the loose play at the outer end of the band, and thus winds up the band sufficiently to relieve the friction, and thereafter the wheels G and G' rotate in unison in lowering the load, the wheel G being always kept by the hand-chain with the pins g at the ends of the slots g' to drive the wheel G' in the left-hand direction. When the load has been lowered the proper amount, the cessation of the lowering pull allows the load to turn the worm-shafts f' and the wheel G' through the distance of the slot g' to again set the brake.

In the form of brake shown in Figs. 7 and 8 there is rigidly secured to the casing of the hoist a disk S. On the outer periphery of this is wound a leather band R', the inner portion being secured to the disk S and the outer portion more or less closely engaging the cylindrical surface of a recess g^5 in the wheel G. The leather band substantially fills the space between the surface g^5 and the periphery of the disk S, though for convenience of illustration considerable play is shown in Fig. 8. The outer end of the band is secured to a pin t, which projects from a suitable operative member, preferably a sheave T, which is

shown as journaled on the hub of the sheave P. The sheave T has very little travel, its movement being simply sufficient to wind up the band R′, which movement may be given it by a cord U, attached to some portion of the upper periphery of the sheave and depending therefrom on the front side of Fig. 7, which corresponds to the left-hand side of Fig. 8, the latter figure looking away from the sheave T. Now when the load is being elevated by a right-hand rotation of the hand-chain wheel G this wheel travels in the direction in which the spiral leather is wound, and hence the latter though engaging offers no material impedance. When the raising power is removed, the tendency of the hand-chain wheel to rotate backward by reason of the backward rotation of the worm carries the leather band back on itself by friction, causing it to snugly jam into the space between the surface g^5 and the periphery of the disk S, locking the hoist to sustain the load. To release the load, the cord U is pulled downward, rotating the sheave T to wind up the leather R′ sufficiently to release the hand-wheel G, whereupon the load descends. The load continues to descend as long as the pull is maintained on the cord U. As soon as it is released the hoist stops.

I claim—

1. In a hoist, in combination, a split casing, a worm-wheel within the casing, a worm within the casing journaled on the line of the split, a ball-bearing for receiving the thrust of the worm, said ball-bearing including a ring loosely surrounding the worm-shaft and extending across the split of the casing, and a set of balls rolling between said ring and a coöperating surface mounted on the worm-shaft, substantially as described.

2. The combination of a hoist, a driving-shaft therefor, a coiled flexible band idle for the raising rotation of said shaft, and surfaces between which said band is clamped by the lowering rotation whereby it acts as a brake, substantially as described.

3. The combination of a hoist, a driving-shaft therefor, a coiled band substantially filling the space between two surfaces between which there is relative rotative movement, the band being secured to one of said surfaces and coiling in the direction to trail over the coöperating surface during the raising of the load, substantially as described.

4. In a hoist, in combination, a driving-shaft, a member rotating therewith, a stationary member, a spiral band secured to one of said members and coiled in the direction to trail over the other when the shaft is rotated to raise the load, and to jam between the two when the shaft is rotated in the opposite direction, and mechanism for drawing such jammed band tauter to relieve the frictional engagement, substantially as described.

5. In a hoist, in combination, a driving-shaft, a cup rigidly carried by the hoist axially with the driving-shaft, a wheel for rotating said shaft, and a spiral band secured to the hub of said wheel and winding around it in the direction to trail over the surface of the cup when raising the load, substantially as described.

6. In a hoist, in combination, a two-part casing, a worm journaled within said casing, a worm-wheel journaled within said casing and consisting of a central frame or spider, studs carried thereby, and rollers on the studs, said rollers engaging the teeth of the worm, a hand-wheel for rotating the worm, and a brake consisting of a coiled band automatically expanded by the backward rotation of the worm, substantially as described.

7. In a hoist, in combination, a worm-wheel, a worm adapted to drive the worm-wheel or be driven by it, a hand-chain wheel for operating the worm and comprising two parts between which there is limited rotative movement, and a brake thrown off by the backward movement of the hand-chain wheel when moving through such allowed limited movement, substantially as described.

8. In a hoist, the combination of a driving-shaft, a hand-wheel therefor composed of two parts between which there is limited rotative movement, a stationary cup carried by the hoist, a flexible band having one end connected with one member of the hand-wheel and the other end with the other member, whereby the limited movement of the hand-wheel may expand said coil, said expanded coil engaging the surface of said cup, substantially as described.

9. In a hoist, in combination, a casing, a worm-wheel therein, a worm journaled within the casing and engaging the worm-wheel, a cup surrounding the shaft of the worm and secured to the casing, a hand-chain wheel having two parts, the first of which is secured to said shaft and the second of which is mounted on the first, one of said parts having a slot and the other a projection operating between the same, and a spiral band having its inner end rigid with the shaft and coiled around the same within said cup, its outer surface substantially engaging with the inner surface of the cup and its outer end loosely secured to the second member of the hand-chain wheel, substantially as described.

10. In a hoist, the combination of a casing, a hook for supporting the same, a worm-wheel within the casing, a shaft for the worm-wheel journaled in the casing, a pair of pulleys on said shaft, a worm journaled in said casing and meshing with said worm-wheel, ball-bearings between said worm and said casing, a hand-chain wheel on said worm, an equalizer-sheave journaled on said casing, a load-hook carrying independent sheaves, and a cable secured at its end to said pulleys and passing under the sheaves of the load-hook intermediately over the equalizer-sheave.

11. In a hoist, the combination of a casing, a hook for supporting the same, a worm-wheel within the casing, a shaft for the worm-wheel

journaled in the casing, a pair of pulleys on said shaft, a worm journaled in said casing and meshing with the worm-wheel, a hand-chain wheel on said worm, an equalizer-sheave journaled on said casing, a load-hook carrying independent sheaves, and a cable secured at its ends to said pulleys and passing under the sheaves of the load-hook and intermediately over the equalizer-sheave, substantially as described.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

EDWARD Y. MOORE.

Witnesses:

ALBERT H. BATES,

N. L. BRESNAN.