No. 849,625. PATENTED APR. 9, 1907.

G. W. KING.

HOISTING MECHANISM.

APPLICATION FILED MAY 29, 1905.

4 SHEETS—SHEET 1.

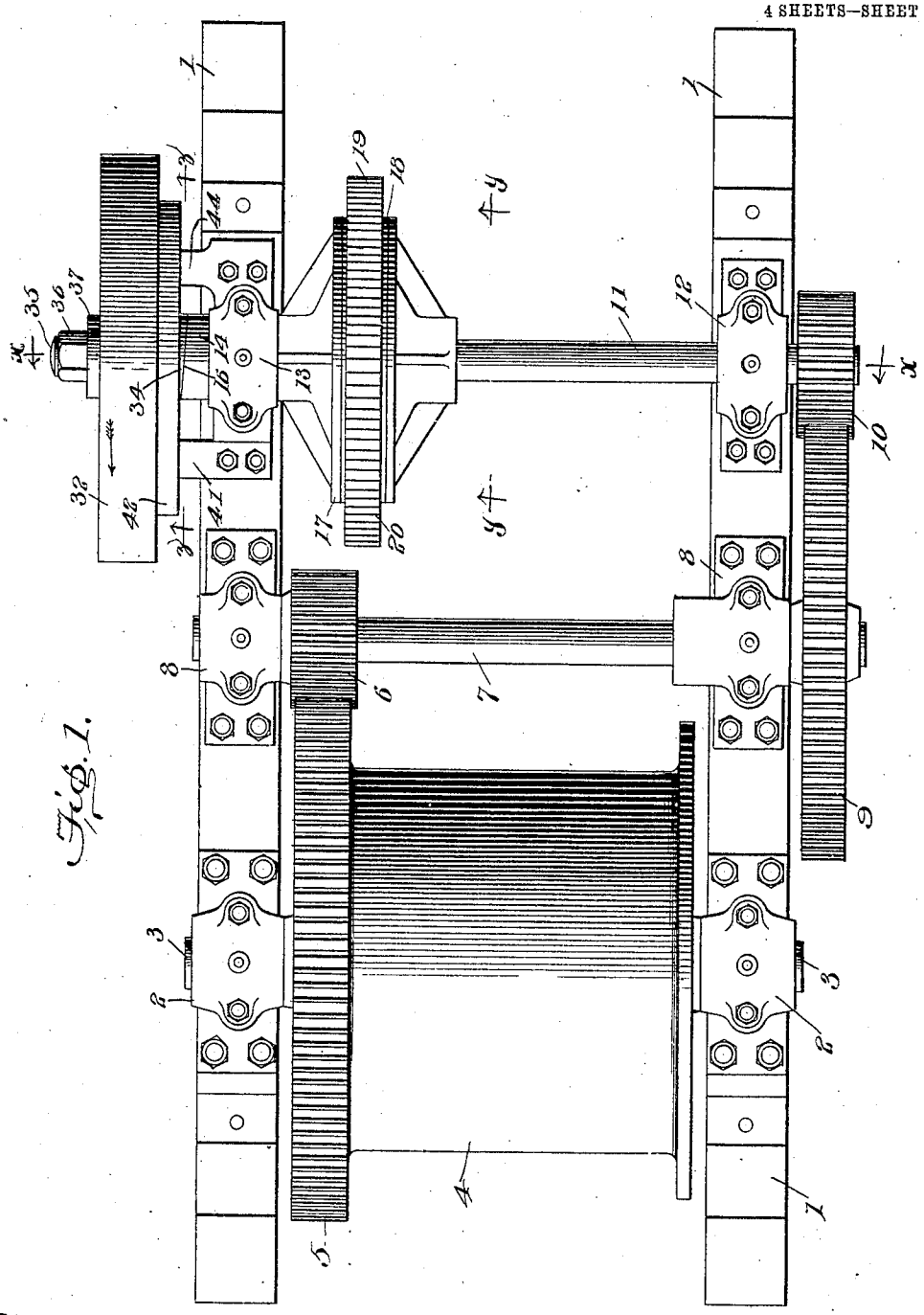

Fig. 1.

Witnesses

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4 SHEETS—SHEET 2.

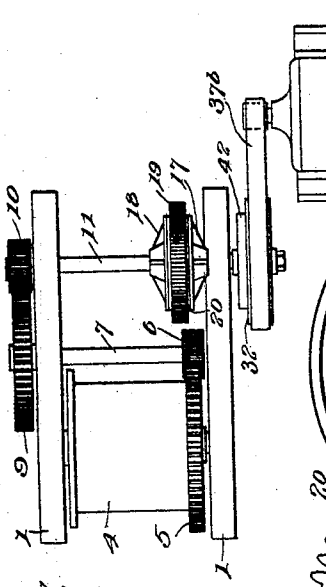

Fig. 7.

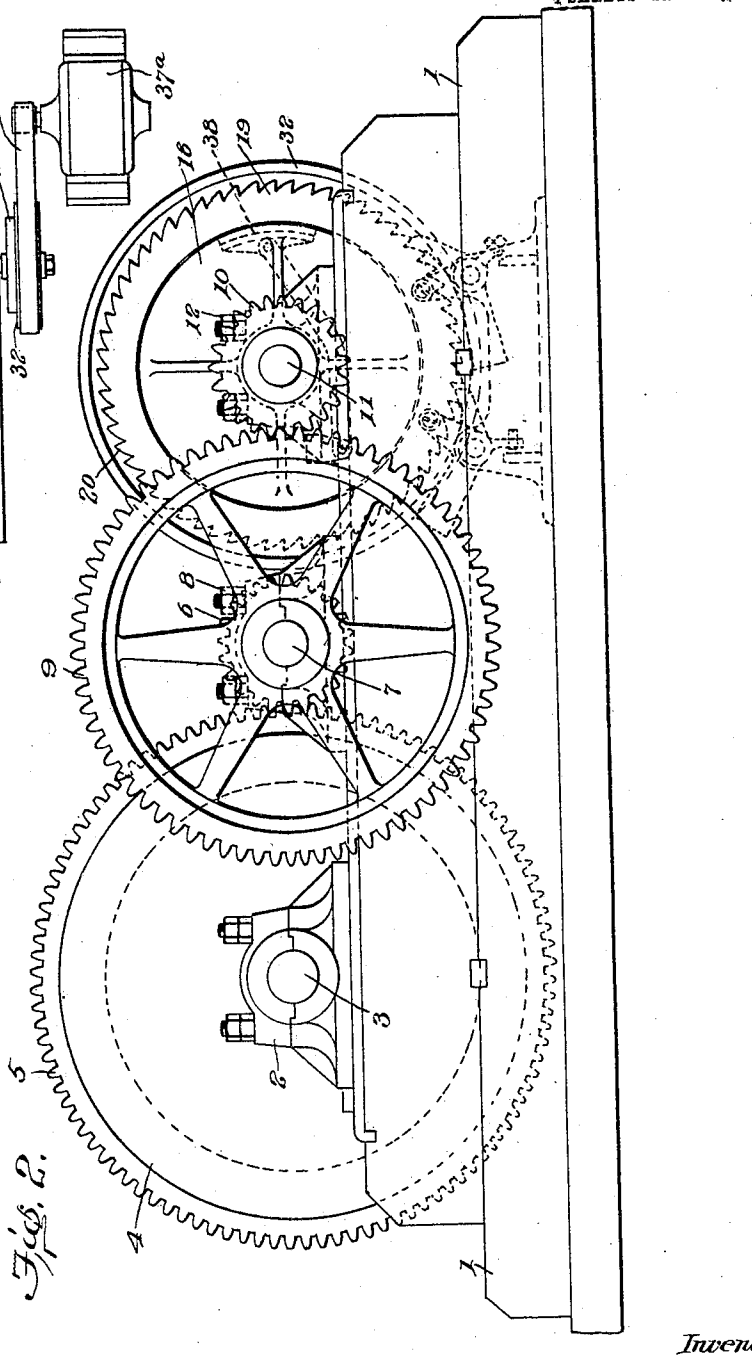

Fig. 2.

Witnesses

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4 SHEETS—SHEET 3.

Fig. 3.

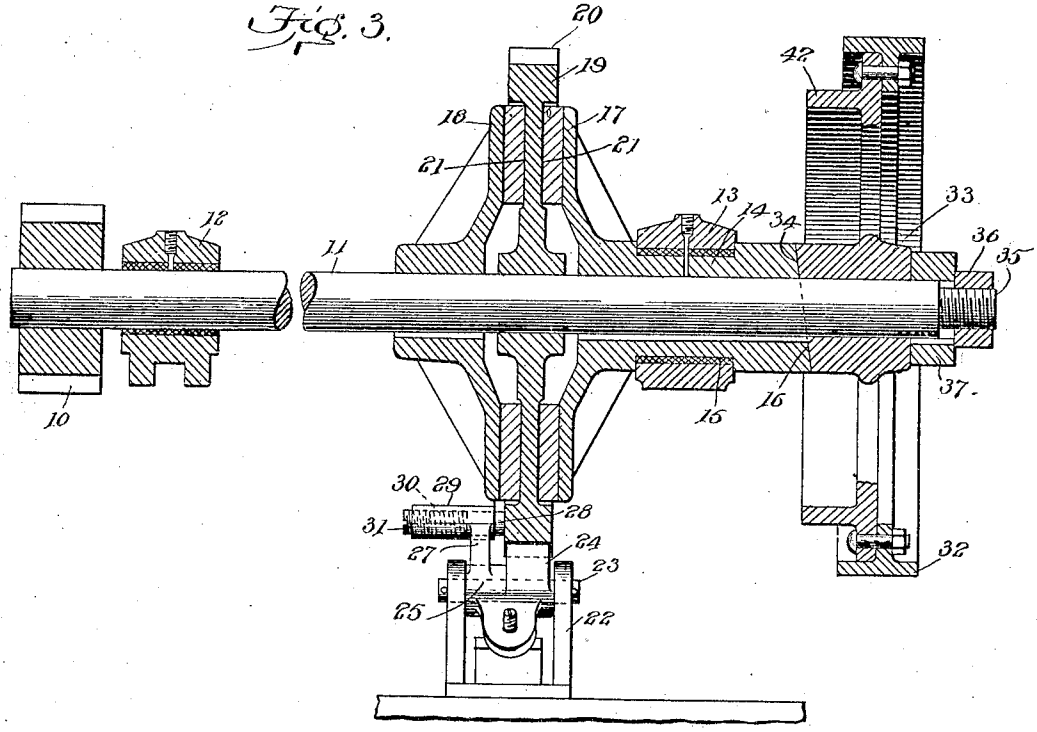
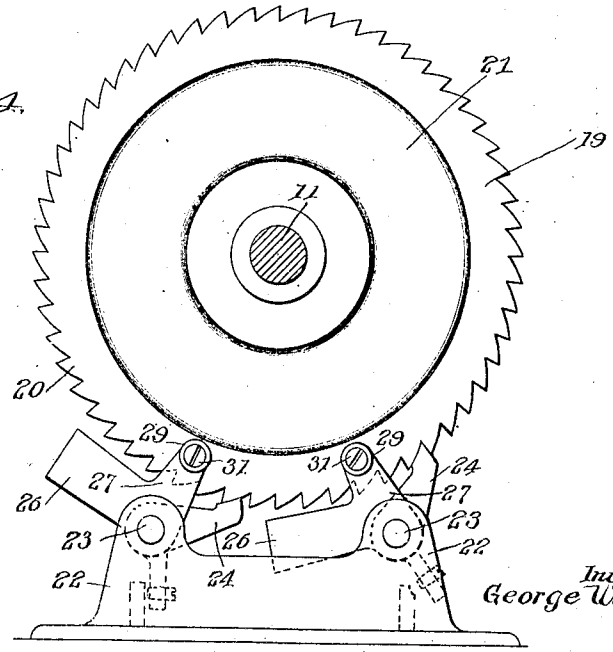


Fig. 4.



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4 SHEETS—SHEET 4.

Fig. 6.

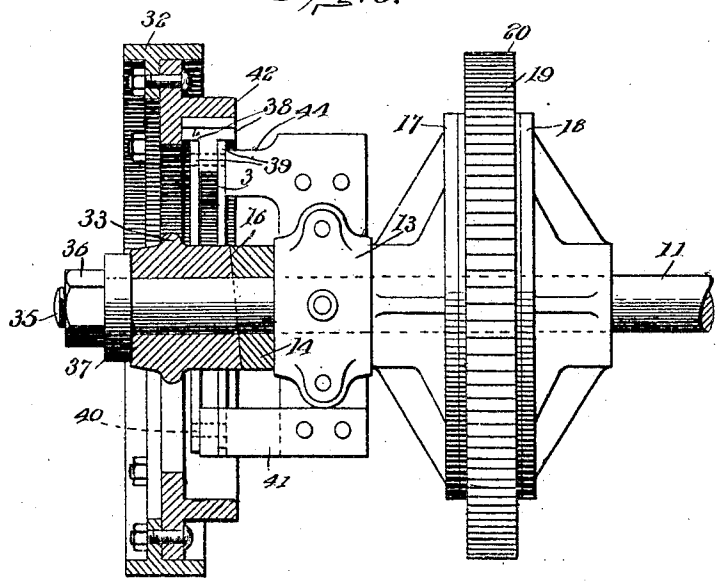
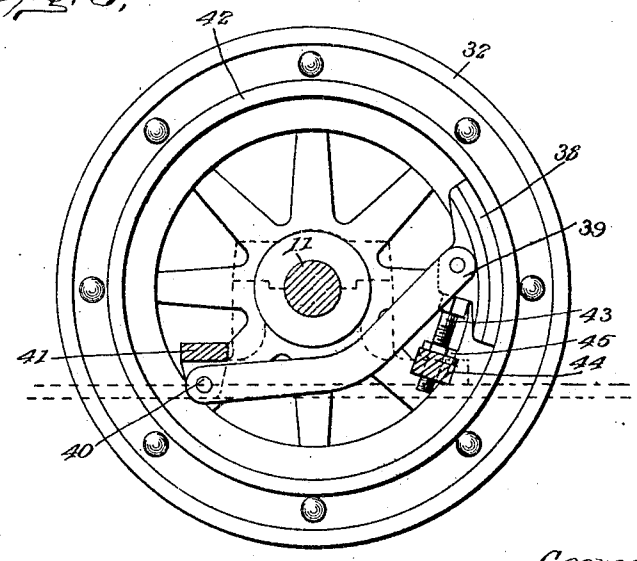


Fig. 5.



Witnesses

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UNITED STATES PATENT OFFICE.

GEORGE W. KING, OF MARION, OHIO, ASSIGNOR TO THE MARION STEAM SHOVEL COMPANY, OF MARION, OHIO, A CORPORATION OF OHIO.

HOISTING MECHANISM.

No. 849,625. Specification of Letters Patent. Patented April 9, 1907.

Application filed May 29, 1905. Serial No. 262,735.

To all whom it may concern:

Be it known that I, GEORGE W. KING, a citizen of the United States, residing at Marion, in the county of Marion and State of Ohio, have invented certain new and useful Improvements in Hoisting Mechanism, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to hoisting mechanism or to mechanism whereby a rope, cable, or the like supporting a load or otherwise under strain may be wound upon or unwound from a suitable drum.

Although the invention is of general application, the particular embodiment thereof chosen for purposes of illustration is designed more particularly for use as a ladder-hoist for gold-mining dredges, being employed to raise and lower the ladder or supporting-frame around which the endless chain of excavating-buckets passes.

The object of the invention is to provide a structure which will automatically and securely hold a heavy load in any desired position, the same comprising an automatic brake or holding device, which comes into play the moment the motor stops, holding the load stationary, and requiring a reversal of the direction of movement of the driving part or motor to effect the lowering of the load.

To these and other ends my invention consists in certain novel features, which I will now proceed to describe and will then particularly point out in the claims.

In the accompanying drawings, Figure 1 is a plan view of a structure embodying my invention in one form. Fig. 2 is a side elevation of the same. Fig. 3 is a transverse sectional view taken on the line x x of Fig. 1 and looking in the direction of the arrows. Fig. 4 is a detail sectional view taken on the line y y of Fig. 1 and looking in the direction of the arrows. Fig. 5 is a side elevation of the driving-wheel, showing the friction-brake in elevation and the bearing partly in section and partly in dotted lines. Fig. 6 is a detail plan view, partly in section, through the driving-wheel and its friction-ring and showing the friction-shoe; and Fig. 7 is a view showing the hoist and its operating-motor connected thereto.

In the said drawings, 1 indicates a suitable supporting frame or base, on which are mounted bearing-boxes 2 to receive a shaft 3, which carries the drum 4, on which the cable or rope is wound. This drum is provided with a gear 5, which meshes with a pinion 6 on a counter-shaft 7, mounted in bearings 8 on the frame 1. The counter-shaft 7 carries a gear 9, which meshes with a pinion 10 on a shaft 11, which I will term the "driving-shaft," since to it the power is applied for actuating the drum 4. The shaft 11 is mounted in bearings 12 and 13 on the frame 1 and is capable of a slight longitudinal movement in said bearings. Said shaft bears directly in the bearing 12, but indirectly in the bearing 13, there being interposed between the bearing and shaft a sleeve 14, splined to the shaft so that the two rotate in unison, while the shaft is free to move longitudinally with respect to the sleeve, the latter being prevented from longitudinal motion by its engagement with the bearing 13, which fits a reduced or grooved portion 15 of the sleeve. The outer end of the sleeve is provided with a helical or inclined cam-surface 16, while the inner end of said sleeve is provided with a friction-surface, preferably in the form of a friction-ring 17. 18 indicates a similar friction-ring, which is keyed or otherwise secured to the shaft 11, so as to partake of all its movements. Between the two friction-rings there is mounted loosely on the shaft 11 a ratchet-wheel 19, the periphery of which is provided with ratchet-teeth 20, while its lateral surfaces 21 constitute friction-surfaces which cooperate with the corresponding friction-surfaces of the rings 17 and 18. In connection with the ratchet-wheel 20 one or more pawls are employed, and I have shown two pawls as employed in the present instance, deeming this number more desirable, for the reason that in the case of breakage of one of them the other will still hold the load. These pawls are so arranged that when one of them is in locking engagement with a tooth of the ratchet-wheel or in position to so engage the other is half-way between two teeth. By this arrangement the distance which the wheel can turn backward is reduced to one-half of the pitch of its teeth, and the shock or blow to the ratchet-wheel and pawl is correspondingly diminished.

The two pawls being alike, I will describe only one of them, the same description being applicable to the other also.

Each pawl is supported in a suitable base or bracket 22 on a pivot 23, the body or tooth of the pawl 24 being carried by a sleeve 25, which fits on said pivot, said sleeve also carrying a counterweight 26, which constantly tends to move the pawl into engagement with the ratchet-wheel. The sleeve 25 also carries an arm 27, which extends alongside of the ratchet-wheel 19 and carries a friction plug or pin 28, which bears against the side of the ratchet-wheel. Said pin is preferably of wood and is mounted to slide in a sleeve 29 on the end of the arm 27, said sleeve also inclosing a spring 30, which bears at one end against the pin 28 and at the other end against a screw-plug 31, threaded into the outer end of the sleeve. This spring tends to keep the friction-pin in contact with the ratchet-wheel, and its pressure may be adjusted by the screw-plug in an obvious manner. The arrangement of these parts is such that when the hoist is winding in the rope or cable the ratchet-wheel 19 turns in a direction such that by its engagement with the friction-pins 28 it so moves said pins as to turn the sleeves 25 upon their pivots and throw the pawl-teeth out of engagement with the ratchet-teeth, thus preventing clicking and wear of these parts while winding in or hoisting. Movement of the drum and ratchet-wheel in the opposite direction will, by its engagement with the friction-pins, instantly throw the pawls inward toward the ratchet-teeth, and thus insure their prompt engagement therewith.

The shaft 11 projects some distance beyond the end of the sleeve 14 with the helix or cam incline 16. On said projecting end there is loosely mounted a driving-wheel 32, to which power is applied from the motor in any suitable manner. The hub 33 of this driving-wheel is provided with a helical cam or incline 34, which is a reverse counterpart of and coöperates with the cam 16 on the sleeve 14. The end of shaft 11 projects beyond the hub 33 of the driving-wheel and is reduced and threaded, as shown at 35, to receive a nut 36, which connects and adjusts the parts, said nut being prevented from rotating with respect to the shaft, and thus becoming loose, by means of a collar 37, interposed between the nut and the end of the hub 33 of the driving-wheel, said collar being splined on the shaft 11, so as to rotate therewith and be capable of longitudinal movement thereon.

The machine is designed for use in connection with a reversible motor 37^a of any kind, preferably an electric motor which is geared or otherwise connected to the driving-wheel 32, as by means of a belt 37^b, as shown. When this driving-wheel is turned in the direction indicated by the arrow, the rope or cable is wound upon the drum, lifting the load. This is effected by reason of the fact that the driving-wheel 32 first turns upon the shaft 11, its helix or cam 34 traveling over the helix or cam 16 of the sleeve 14. Said sleeve 14 being fixed against longitudinal motion, the action of the cam-surfaces moves the shaft 11 longitudinally in a direction toward the right in Fig. 3 of the drawings. This brings the friction-ring 18, which moves along with the shaft, against the ratchet-wheel 19, pressing this latter in turn against the friction-ring 17, which forms an abutment to support said thrust, so that the ratchet-wheel is firmly gripped and rotates in unison with the shaft, all of the parts then rotating together. As already noted, when the ratchet-wheel 19 is rotating in this direction the pawls 24 are thrust out of engagement with the ratchet. As soon, however, as the desired amount of winding has been accomplished or the load has been raised to the desired height the motor is stopped, whereupon the pawls are immediately thrown into engagement with the ratchet-wheel and prevent this latter from rotating. It will be understood that the load acts upon the shaft 11 in such a way that the engagement of the helices or cams 16 and 34 continue to exert an end thrust on the shaft 11 in the same direction, the cam-surface 16 receiving the moving impulse from the load and transmitting it to the cam-surface 34 and thence through hub 33 and collar 37 to the nut 36. This keeps the ratchet-wheel 19 gripped between the friction-rings 17 and 18, and therefore fast on the shaft 11, which cannot rotate, since the pawls prevent the ratchet-wheel from rotating. Thus the load may be held stationary at the point which it has reached when the motor stops. In order to lower the load, the motor is reversed, so as to turn the driving-wheel 32 in the opposite direction. This causes the cam-surface 34 to move away from the cam-surface 16, thereby removing the end thrust from the shaft 11 and loosening the grip of the friction-rings 17 and 18 upon the ratchet-wheel 20. The shaft 11 is therefore free to turn in the proper direction to allow the load to lower itself by its own weight, said shaft turning in the ratchet-wheel, which is still held stationary by the pawls; but this lowering of the load by gravity only occurs as long as the motor is running in the reverse direction referred to, and as soon as the motor stops the cam-surface 16 again engages the cam-surface 34, which latter is now stationary, and the shaft 11 is again thrust endwise so as to cause the friction-rings to grip the ratchet-wheel, thereby connecting the shaft to said ratchet-wheel and stopping the rotation of the shaft, since the ratchet-wheel is held stationary by the pawl.

It will be seen from the foregoing descrip-

tion that the load is automatically locked at any point at which it may be when the motor is stopped and can only be lowered by reversing the motor. In consequence of this the motor exerts its power to lift the load, but has no load to hold, and in lowering the load the motor must be run in the opposite direction, exerting only a very small amount of power, sufficient to keep the cam-surfaces disengaged. The structure comprises, in effect, an automatic brake which is always applied except when the motor is running either in one direction or the other.

When lowering the load, it may occur where the parts work very easily that the momentum of the motor and other parts positively connected to it may be sufficient to keep the cam 34 from engagement with the cam 16 for some little time after the power has been shut off. Where this occurs, there will be a lowering of the load beyond the point where it is desired to stop it by the stopping of the motor. To prevent this, I employ a friction device or automatic brake which will arrest the movement of the motor as soon as the power is shut off, bringing it to a quick stop. This device in its preferred form is shown more particularly in Figs. 1 and 5. It comprises a friction-shoe 38, which is pivoted to the free ends of a pair of supporting arms or links 39, the other ends of which are pivoted at 40 to an arm 41, extending out from the bearing 13, said pivot being eccentric to the axis of the wheel. Coöperating with this friction-shoe is a friction-ring 42, formed or secured on the driving-wheel 32. The shoe is so located as to tend to engage with the friction-ring and to have its engagement therewith increased when the driving-wheel is turning in the direction necessary to lower the load. The extent of this engagement is, however, limited by means of a suitable stop, so that while the friction-shoe engages the friction-ring with a pressure sufficient to stop the momentum of the motor when the power is off and bring the motor to a quick stop said pressure is not sufficient to prevent the motor from turning the driving-wheel in the proper direction to lower the load when the power is turned on. The stop which limits the engagement of the shoe with the ring is preferably an adjustable one, and in practice I prefer the specific form of stop shown, which comprises a screw or bolt 43, located in the path of the shoe and threaded into an arm 44, extending from the bearing 13 below the shoe. The screw can be readily turned in its threaded seat so as to cause it to project up more or less, and thus decrease or increase the frictional engagement of the shoe and ring, and is secured in position after adjustment by a lock-nut 45, threaded onto it and bearing against the top of the arm 44.

I do not wish to be understood as limiting myself to the precise details of construction hereinbefore described, and shown in the accompanying drawings, as it is obvious that these details may be varied without departing from the principle of my invention.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a mechanism of the character described, the combination, with a shaft acting against a resistance or load tending to turn said shaft in one direction, of a friction member mounted on said shaft and having a rotary and longitudinal movement, a load-supporting wheel loosely mounted on said shaft adjacent thereto, a drive-wheel mounted on said shaft, means operated by said drive-wheel for bringing said friction member into engagement with said load-supporting wheel, an abutment engaging said load-supporting wheel on the side opposite said friction member to support the same against the thrust of said friction member, and means for locking said load-supporting wheel against movement in the direction in which the load tends to turn the shaft, substantially as described.

2. In a mechanism of the character described, the combination, with a shaft acting against a resistance or load tending to turn said shaft in one direction, said shaft being longitudinally movable, of a friction member rotating and moving longitudinally with said shaft, a load-supporting wheel loosely mounted on said shaft adjacent thereto, a drive-wheel mounted on said shaft, means operated by said drive-wheel for moving said shaft to bring said friction member into engagement with said load-supporting wheel, an abutment engaging with said load-supporting wheel on the side opposite said friction member to support the same against the thrust of said friction member, and means for locking said load-supporting wheel against movement in the direction in which the load tends to turn said shaft, substantially as described.

3. In a mechanism of the character described, the combination, with a shaft acting against a resistance or load tending to turn said shaft in one direction, said shaft being longitudinally movable, of a sleeve rotating with said shaft and held against longitudinal movement, said sleeve being provided with a friction member, a driving-wheel loosely mounted on said shaft, means operated by said driving-wheel for moving said shaft longitudinally, a friction member secured on said shaft, a wheel loosely mounted on said shaft between the friction members carried by the shaft and sleeve respectively, and means for locking said wheel against movement in the direction in which the load tends to turn the shaft, substantially as described.

4. In a mechanism of the character described, the combination, with a shaft acting against a resistance or load tending to turn said shaft in one direction, said shaft being

provided with a part rotating in unison therewith and having a helical or spiral cam-surface, of a driving-wheel loosely mounted on said shaft and having a complementary cam-surface coöperating with the first-mentioned cam-surface, a load-supporting wheel loosely mounted on said shaft, means for preventing rotation of said wheel in the direction in which the load tends to turn the shaft, and a friction member having a rotatory motion derived from the driving-wheel and movable in the direction of its axis of rotation toward and from the load-holding wheel, said axial movement being caused by the movement of the cam-surfaces on each other, substantially as described.

5. In a mechanism of the character described, the combination, with a shaft acting against a resistance or load tending to turn said shaft in one direction, said shaft being longitudinally movable, of a sleeve rotating with said shaft and held against longitudinal movement, said sleeve being provided with a helical or spiral cam-surface, a driving-wheel loosely mounted on said shaft and having a complementary cam-surface coöperating with that of the sleeve, said driving-wheel engaging said shaft to move it longitudinally, a wheel free to rotate relatively to said shaft, means for locking said wheel against movement in the direction in which the load tends to turn the shaft, and means for connecting said wheel and shaft to cause said parts to rotate in unison, said connecting means being operated to connect said parts by the longitudinal movement of the shaft in one direction, and being operated to disconnect said parts by the longitudinal movement of the shaft in the other direction, substantially as described.

6. In a mechanism of the character described, the combination, with a shaft acting against a resistance or load tending to turn said shaft in one direction, said shaft being longitudinally movable, of a sleeve rotating with said shaft and held against longitudinal movement, said sleeve being provided with a helical or spiral cam-surface, a driving-wheel loosely mounted on said shaft and having a complementary cam-surface coöperating with that of the sleeve, said driving-wheel engaging said shaft to move it longitudinally, a friction member rotating and moving longitudinally with said shaft, a load-supporting wheel loosely mounted on said shaft adjacent thereto, an abutment to support said load-supporting wheel against the thrust of the first friction member, and means for locking said load-supporting wheel against movement in the direction in which the load tends to turn the shaft, substantially as described.

7. In a mechanism of the character described, the combination, with a shaft acting against a resistance or load tending to turn said shaft in one direction, said shaft being longitudinally movable, of a sleeve rotating with said shaft and held against longitudinal movement, said sleeve being provided at one end with a helical or spiral cam-surface, and at the other end with a friction member, a driving-wheel loosely mounted on said shaft and having a complementary cam-surface coöperating with that of the sleeve, said driving-wheel engaging said shaft to move it longitudinally, a friction member secured on said shaft, a wheel loosely mounted on said shaft between the friction members carried by the shaft and sleeve respectively, and means for locking said wheel against movement in the direction in which the load tends to turn the shaft, substantially as described.

8. In a mechanism of the character described, the combination, with a shaft acting against a resistance or load tending to turn said shaft in one direction, said shaft being provided with a part rotating in unison therewith and having a helical or spiral cam-surface, of a driving-wheel loosely mounted on said shaft and having a complementary cam-surface coöperating with the first-mentioned cam-surface, a load-supporting ratchet-wheel loosely mounted on said shaft, a pawl for preventing rotation of said wheel in the direction in which the load tends to turn the shaft, and a friction member having a rotatory motion derived from the driving-wheel and movable in the direction of its axis of rotation toward and from the ratchet-wheel to engage and disengage the same, said axial movement being caused by the movement of the cam-surfaces on each other, substantially as described.

9. In a mechanism of the character described, the combination, with a shaft acting against a resistance or load tending to turn said shaft in one direction, said shaft being longitudinally movable, of a sleeve rotating with said shaft and held against longitudinal movement, said sleeve being provided with a helical or spiral cam-surface, a driving-wheel loosely mounted on said shaft and having a complementary cam-surface coöperating with that of the sleeve, said driving-wheel engaging said shaft to move it longitudinally, a friction member rotating and movable longitudinally with said shaft, a ratchet-wheel loosely mounted on said shaft adjacent to said friction member and having a friction-surface to coöperate therewith, an abutment to support said ratchet-wheel against the thrust of the friction member, and a pawl for locking said ratchet-wheel against movement in the direction in which the load tends to turn the shaft, substantially as described.

10. In a mechanism of the character described, the combination, with a shaft acting against a resistance or load tending to turn said shaft in one direction, said shaft being longitudinally movable, of a sleeve rotating

with said shaft and held against longitudinal movement, said sleeve being provided at one end with a helical or spiral cam-surface, and at the other end with a friction member, a driving-wheel loosely mounted on said shaft and having a complementary cam-surface coöperating with that of the sleeve, said driving-wheel engaging said shaft to move it longitudinally, a friction member secured on said shaft, a ratchet-wheel loosely mounted on said shaft between the friction members carried by the shaft and sleeve respectively, said ratchet-wheel being provided with friction-surfaces to coöperate with said friction members, and a pawl for locking said ratchet-wheel against movement in the direction in which the load tends to turn the shaft, substantially as described.

11. In a mechanism of the character described, the combination, with a drum, a shaft operatively connected therewith, and a driving-wheel, connected to said shaft, adapted to be connected with a motor and having a friction-ring with an inwardly-facing friction-surface, of a friction-shoe bearing on said friction-surface, an arm pivotally supported at one end eccentrically to the driving-wheel axis and connected to the friction-shoe at its other or free end, and a stop for limiting the engaging movement of the shoe, substantially as described.

12. In a mechanism of the character described, the combination, with a drum, a shaft operatively connected therewith, and a driving-wheel, connected to said shaft, adapted to be connected with a motor and having a friction-ring with an inwardly-facing friction-surface, of a friction-shoe bearing on said friction-surface, an arm pivotally supported at one end eccentrically to the driving-wheel axis and connected to the friction-shoe at its other or free end, and an adjustable stop for controlling the engaging movement of the shoe, substantially as described.

13. In a mechanism of the character described, the combination, with a shaft acting against a resistance or load tending to turn said shaft in one direction, said shaft being provided with a part rotating in unison therewith and having a helical or spiral cam-surface, of a driving-wheel loosely mounted on said shaft and having a complementary cam-surface coöperating with the first-mentioned cam-surface, a load-supporting wheel loosely mounted on said shaft, means for preventing rotation of said wheel in the direction in which the load tends to turn the shaft, a friction member having a rotatory motion derived from the driving-wheel and movable in the direction of its axis of rotation toward and from the load-holding wheel by the movement of the cam-surfaces on each other, a reversible motor operatively connected with said driving-wheel, and an automatic brake acting on said driving-wheel with a pressure regulated to overcome the momentum of the wheel and motor when power is shut off after the motor has been running in the direction in which the load tends to move the parts, substantially as described.

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

GEORGE W. KING.

Witnesses:
WILLIAM R. SHISLER,
ROBERT G. LUCAS.