4 Sheets—Sheet 1.

T. A. WESTON.

Hoisting-Machine.

No. 212,339. Patented Feb. 18, 1879.

Fig 1.

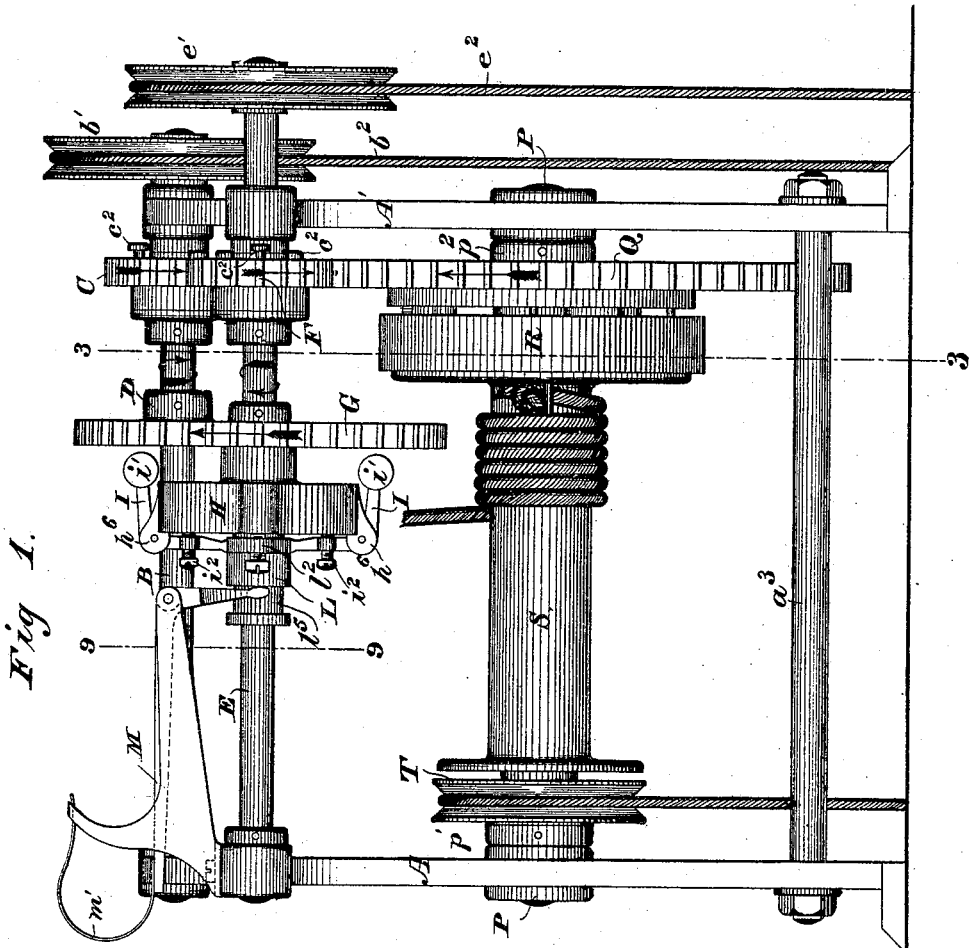
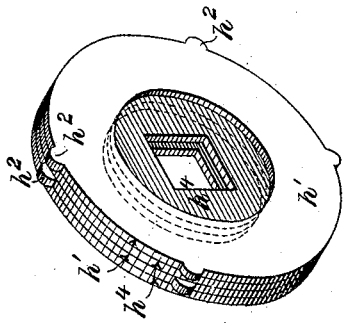


Fig 13.



WITNESSES.

Wm A Skinkle

Geo W. Breck

INVENTOR

Thomas A Weston

BY HIS ATTORNEYS.

Baldwin, Hopkins & Peyton

4 Sheets—Sheet 2.

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Fig 3.

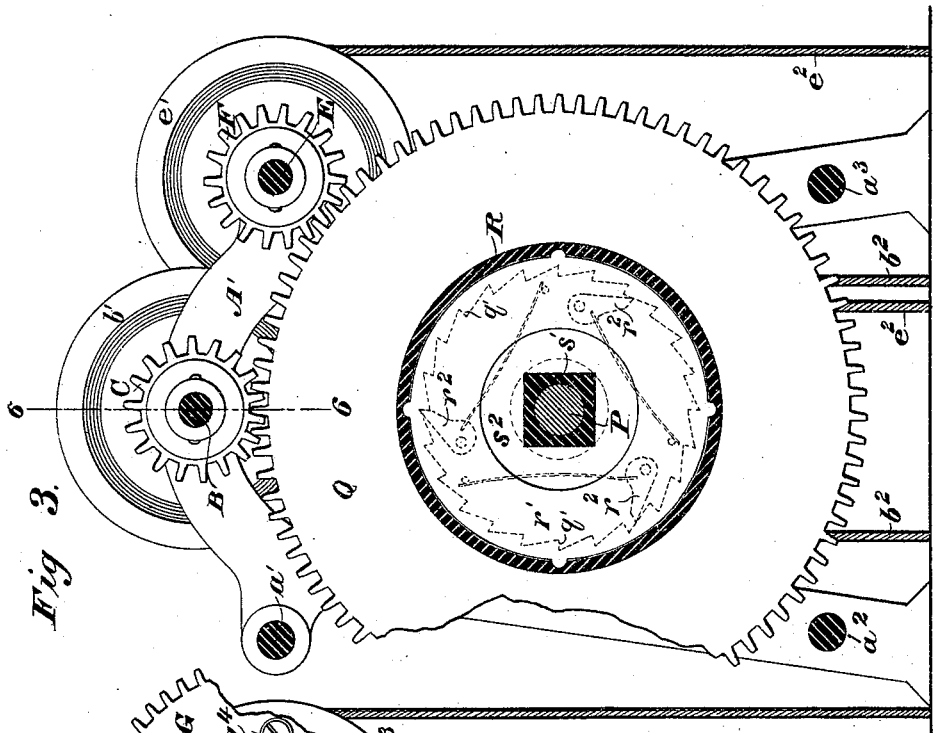

Fig 2.

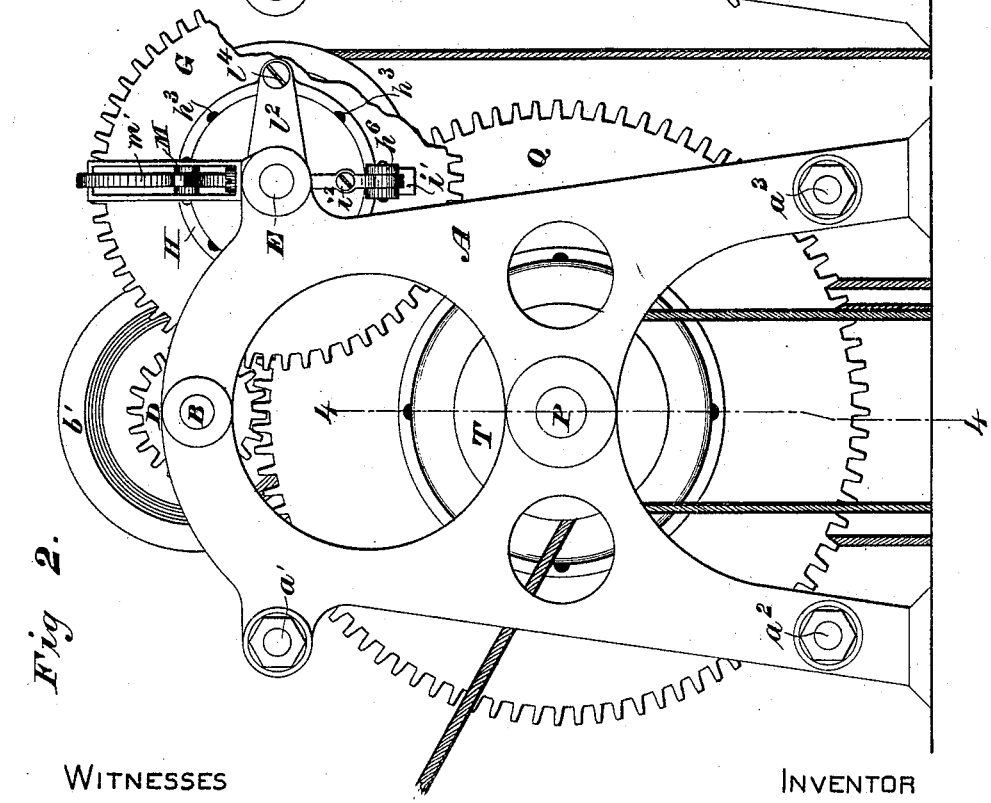

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Fig 4.

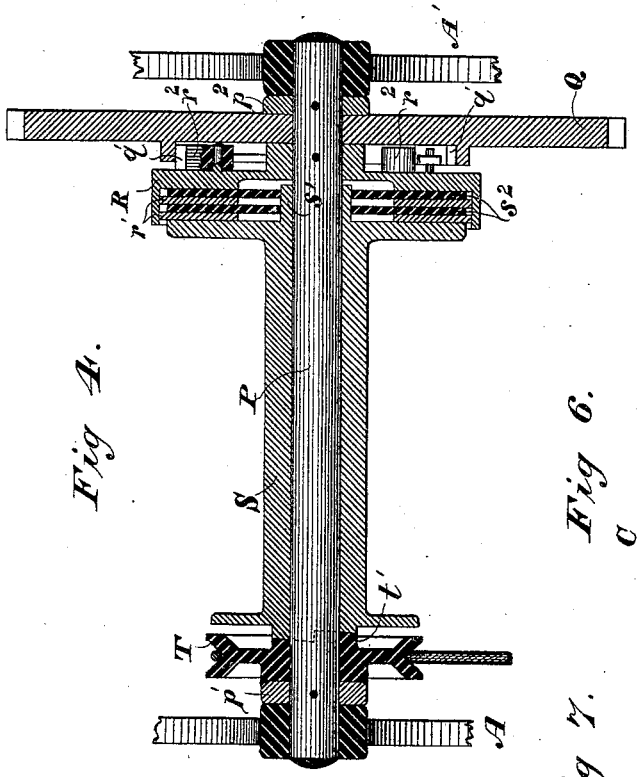

Fig 6.

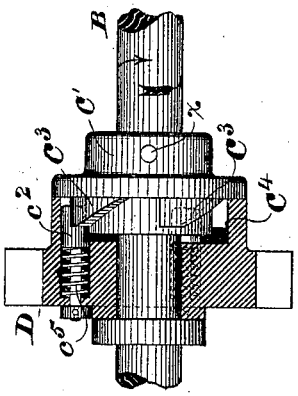

Fig 7.

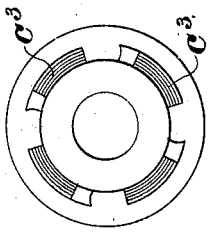

Fig 5.

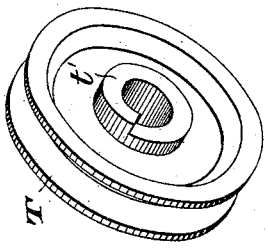

Fig 8.

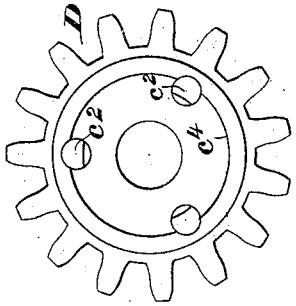

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Fig 10.

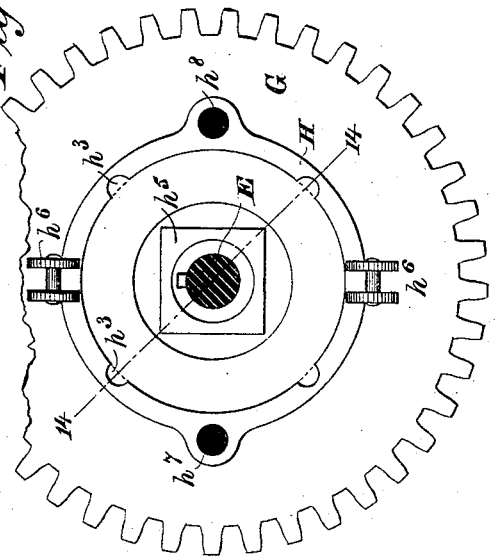


Fig 14.

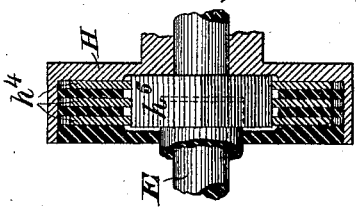


Fig 12.

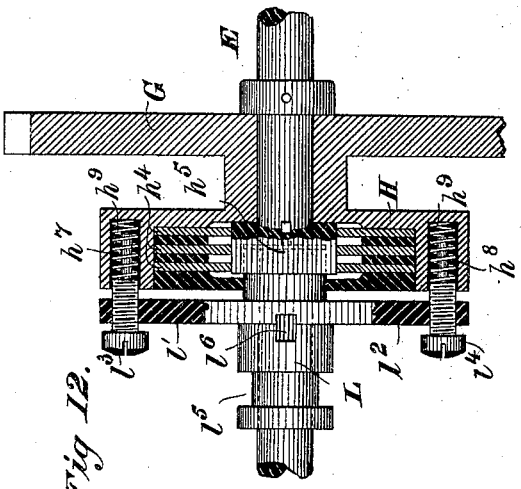


Fig 9

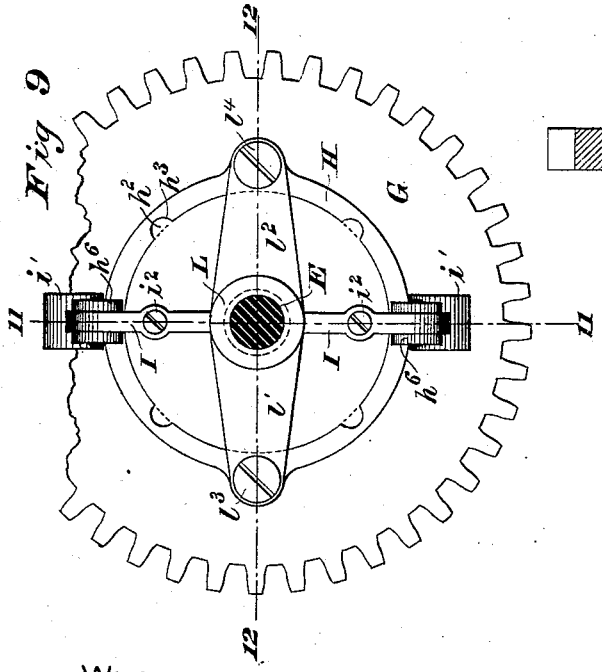
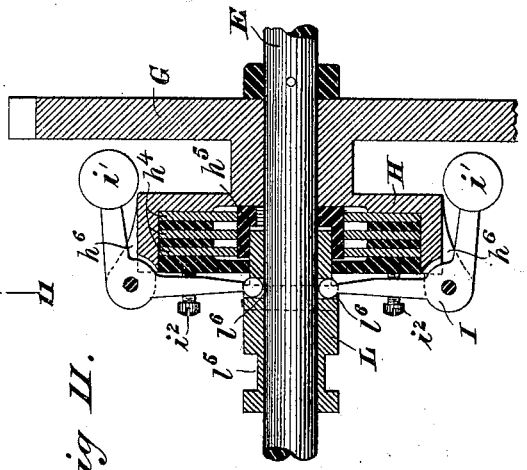


Fig 11.



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Thomas. A. Weston.

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Baldwin, Hopkins, & Peyton.

UNITED STATES PATENT OFFICE.

THOMAS A. WESTON, OF STAMFORD, CONNECTICUT, ASSIGNOR TO THE YALE LOCK MANUFACTURING COMPANY, OF SAME PLACE.

IMPROVEMENT IN HOISTING-MACHINES.

Specification forming part of Letters Patent No. **212,339**, dated February 18, 1879; application filed May 16, 1878.

To all whom it may concern:

Be it known that I, THOMAS A. WESTON, of Stamford, in the county of Fairfield and State of Connecticut, have invented certain Improvements in Hoisting Machinery, of which the following is a specification:

My invention relates to that class of hoisting-machines to which the motive power is applied through the medium of rotating shafts and gearing, portions of it being applicable to other purposes, as explained hereinafter.

The objects of my invention are, first, to provide improved means for obtaining a variety of speeds for hoisting and other purposes, which may be quickly and safely alternated during the act of hoisting to suit varying degrees of applied force or varying weight in the load; secondly, to provide improved means for obtaining a direct and independent hoisting and lowering motion of the winding-drum, whereby the hoisting-chain can be rapidly coiled upon or uncoiled from the said drum, regardless of whether the driving-shaft and gearing be in motion or at rest; thirdly, to provide, in combination with the foregoing, an improved automatic centrifugal governor of a general applicability, whereby the lowering of the load may be self-controlled, but at any desired speed, which may be varied or arrested by the operator during the act of lowering.

In the accompanying drawings, Figure 1 is a side elevation of a hoist containing my improvements. Fig. 2 is an end elevation. Fig. 3 is a sectional elevation through the line 3 3, Fig. 1. Fig. 4 is a longitudinal section of the parts carried upon the main shaft, taken through the line 4 4, Fig. 2. Fig. 5 is a perspective view of the sprocket-wheel upon the main shaft, whereby the direct and independent hoisting and lowering motions are imparted to the winding-drum. Fig. 6 is a longitudinal section of one of the ratchet-pinions, both pinions being alike, through the line 6 6, Fig. 3, and of the differential ratchet-clutch connecting each with its shaft. Fig. 7 is a face view of one of the pinion ratchet-wheels. Fig. 8 is a side elevation of one of the ratchet-pinions, showing the engaging ends of the differential pawls. Fig. 9 is an elevation of the governor and attached wheel, taken in the line 9 9, Fig. 1. Fig. 10 is a similar view to Fig. 9, but with the centrifugal arms, connected sleeve, and outside disk removed. Fig. 11 is a sectional view of the governor and attached parts, taken through the line 11 11, Fig. 9. Fig. 12 is a section of the latter, taken through the line 12 12, Fig. 9. Fig. 13 is a perspective view of the two series of friction-disks in their relative alternated position which they occupy within the drum containing them upon the governor-shaft. Fig. 14 is a sectional view of the governor-brake, drum, and contained parts through the line 14 14, Fig. 10.

The drawings represent my improvements in connection with a geared hoisting-machine having a rope-barrel or winding-drum, and operated by sprocket-wheels with endless hand-ropes; but these improvements may be applied to various other hoisting-machines operated by these or other means.

The frame-work is of the ordinary kind, consisting of two side frames, A A′, united by stay-bars a^1 a^2 a^3.

B is the first pinion-shaft, carrying a sprocket-wheel, b^1, hand-rope b^2, and pinions C D.

The second pinion-shaft, E, carries a sprocket-wheel, e^1, a pinion, F, a wheel, G, with governor attachments consisting of a brake and a drum, H, with centrifugal arms or cranked levers I.

The main shaft P carries loose upon it the main spur-wheel Q, the brake-drum R, fixed to the said shaft, the winding-barrel S, loose thereon, and the sprocket-wheel T, also loose.

p^1 p^2 are collars fixed to the said shaft P, to retain the loose parts in position.

The pinions C and F are both at all times in gear with the main wheel Q, and they are constructed alike, each pinion being loose upon its shaft, and provided with sliding pawls or bolts c^2, which engage with the teeth c^3 of the ratchet-wheel c^1, the latter being keyed to its shaft by the key or pin x, and capable of driving the pinion in one direction only.

The teeth c^3 of the ratchet c^1 slope in the direction of a right-hand screw-thread, so as to slip in the direction of the arrow in Fig. 6.

The pawls c^2 slide longitudinally in lines parallel with the shaft, and are pressed up to the ratchet-teeth by spiral springs c^5.

A cylindrical recess, c^4, is bored in the pinion end to receive easily the outer periphery of the teeth c^3, which rotate therein freely in one direction, pushing back and slipping over the pawl ends, but driving the pinion, when rotated in the contrary direction, by engagement of the vertical faces or ends of the teeth c^3 with the said pawls c^2.

The circumferential line of the recess c^4 intersects the holes bored for the pawls to slide in, so that the engaging sections of the pawls against which the teeth c^3 abut are shrouded or backed to their extreme ends upon one side in the solid metal of the pinion, the other side or section of the pawl end being projected into the recess c^4 and exposed to the action of the teeth c^3.

The pawls are, therefore, when driven, subject to a shearing or crushing strain like that upon a key in the hub of a pulley, so that with small dimensions the pawls possess proportionate strength to the shaft and to the teeth of the ratchet.

The differential arrangement of the pawls and ratchet-teeth, which is fully set forth in my patent for improved pawl and ratchet of even date herewith, furnishes numerous engagements by means of a few large coarse teeth only, and therefore with ample strength and but little lost motion in reversing.

The general capacities and further applicability of my improved ratchet and pawls are more fully set forth in my patent for improved ratchet mechanism of even date herewith.

The pinion D is securely fixed to its shaft and engages with the wheel G. The latter is provided with a drum, H, containing the frictional disk-coupling described in the specification of my Letters Patent of the United States, dated March 3, 1868, No. 75,227.

The drum H has arms I, which may be operated automatically by centrifugal force and otherwise by means of a sliding sleeve, L, lever M, and spring m', the whole constituting my improved speed-governor.

The friction-disks are shown separately in Fig. 13, and are of two kinds, placed alternately.

The series h^1 has lugs h^2, to engage with and slide in corresponding slots h^3 in the drum H. The series h^4 is fitted to slide upon the hub h^5, fixed to the shaft E.

When the disks are not pressed together each series is free to revolve independently of the other, the drum H and shaft E being then disconnected; but when the disks are pressed together the drum and shaft E are thereby frictionally connected, as will be hereinafter explained.

The centrifugal arms or crank-levers I are pivoted between lugs h^6 upon the drum H, and have weights i^1 at their outer ends. Their inner ends are fitted into and embraced by mortises l^6 in the sliding sleeve L, as shown in Figs. 11 and 12. This mutual connection of the arms in the sleeve L places them in equilibrium, as effected by gravity, in all positions of rotation around their axis.

Set-screws i^2 in the said arms serve to adjust them to press equally and simultaneously upon the friction-disks h^1 h^4, whether the said initial pressure be derived from the centrifugal force of the arms I or from the sleeve L, operated by the lever M. The sleeve L has two arms, l^1 l^2, the ends of which carry guide-pins l^3 l^4, sliding into holes h^7 h^8 in the drum H to engage the same. Within the said holes are spiral springs h^9 to push back the armed sleeve L, and so aid in freeing the disks from pressure.

The sleeve L is grooved at l^5 to receive the forked end of the lever M, the groove being wider than the said forked-lever end, to allow independent motion to the sleeve and governor-arms I, under centrifugal action, when the lever M is withdrawn.

To couple the friction-drum H and wheel G to the shaft for hoisting, pressure is applied to the disks through the arms I, sleeve L, and lever M by a spring, m', by an equivalent weight, by hand, or in any convenient manner of operating the lever M; and such pressure is similarly withdrawn to allow the automatic governor-action to take place, the descending load then controlling the brake-action and regulating its own speed.

The automatic brake-action may be varied by using the lever M to pull backward the sleeve L, thus opposing the centrifugal force to any extent desired, with a corresponding increase of speed in the descent of the load.

The automatic brake-action and its speed may also be varied by screwing in the guide-pins l^3 l^4, to compress further the spiral springs h^9, and so offer a higher resistance to the inward pressure of the centrifugal arms.

The general capacities and further applicability of my improved governor are more fully set forth in my patent for an improved speed-governor of even date herewith.

The object and purpose of the aforesaid shafts B and E, with their spur-gear, governor, and attachments, are to transmit to the main wheel Q power and rotary hoisting motion at different speeds in the same direction, and to regulate automatically and otherwise by hand the backward or lowering motion.

These several operations are effected as follows: The lever M being depressed with due force, and held in that position, as shown in Fig. 1, the wheel G becomes frictionally coupled to its shaft, and the hoist is thereby put in readiness for lifting.

Now, if the near side of the endless rope b^2 in Fig. 1 be pulled, the pinion C will be driven by its ratchet-clutch, and will drive the main wheel Q, so that its teeth, facing the observer in Fig. 1, will move upward, winding upon the barrel the hoisting-rope, as shown in Fig. 1.

This operation gives the medium speed of the first three of the hoisting-speeds of which the machine, as illustrated, is capable. During such hoisting action the pinion D drives the governor-wheel G and shaft E, as shown by the arrows in Fig. 1. The wheel G being larger than D, the shaft E turns slower than B, while the pinion F must move at the same angular velocity as C, (being, as illustrated, of equal size to it, and always geared to the same main wheel Q,) the ratchet-clutch of F permitting it to run in reverse direction to that of its own shaft. Upon ceasing thus to hoist, the main wheel Q tends to drive backward both the pinions C and D, and, through their ratchet-clutches, also the shafts in one and the same direction; but this is impossible so long as the wheels D and G are connected with their shafts. This mutual blocking action of the gearing against backward motion then serves to sustain the load in suspension. Now, if the endless hand-rope b^2 be pulled on its side farthest from the observer in Fig. 1, the slowest and most powerful of the said three speeds is obtained. In this operation the ratchet-clutch of the pinion C slips freely, as its pinion turns the contrary way in gear with the wheel Q. The shaft B, pinion D, and wheel G are then moving in contrary directions to the arrows in Fig. 1, and so drive the ratchet-pinion F and main wheel Q in the direction for hoisting, as shown by the arrows upon F and Q, Fig. 1. Upon ceasing to hoist, the ratchet-clutches and gears C D F G prevent backward motion, and safely sustain the load. Thus, by simply reversing the rotation of the sprocket-wheel b^1, either of two of the said speeds may be used while the load is suspended.

A third and still quicker speed is obtained by pulling the rope e^2 on its distant side in Fig. 1. The pinion F then slips, as its shaft E turns the contrary way, driving the wheel G and pinions D and C, with the wheel Q, as shown by the arrows, Fig. 1, in the direction for hoisting. Assuming the pinions C and F to be of equal diameter, the three speeds thus obtained may have any desired relative rate, determined by the difference of diameters between the wheels G and D. Obviously, should these two latter gears be equal in size, the three speeds or motions already described would be alike.

In the drawings the ratchet or slipping pinions C and F are shown of equal diameter; but by making F either larger or smaller than C, the pinion F would then give an additional or fourth speed, when used to drive direct the main wheel Q, by pulling downward the near side of the endless rope e^2 in Fig. 1, whereas, when F is of equal diameter to C, its direct driving-speed is necessarily the same. The blocking action which prevents the gearing from being driven backward is found in the contrary tendency of the wheels G and D which each receives through its shaft from the wheel Q. By relaxing the frictional hold of the brake-disks in the drum H, so as to allow the wheel G to slip on its shaft, the blocking action is released, so that the gearing can run backward and the load be lowered under control of the brake. This relaxing is effected by withdrawing the lever M from its pressure upon the sleeve L and brake-disks, permitting backward motion of the wheel G, under automatic control of the governor-arms and weight I, which, by their centrifugal force, restore sufficiently the pressure upon the disks to insure a safe speed to the descending load. The speed, however, can be accelerated to any desired degree, as follows: The lever M may not only be withdrawn from its forward pressure upon the sleeve L and disks, but it may be moved farther, so as by its forked end to pull backward the sleeve L and levers I away from the disks, and thus resist the centrifugal force more or less, when a proportionate increase of speed in the descending load will follow; but at any moment the governor may be permitted to resume its automatic action and check the load simply by restoring the lever M to its neutral position, where it does not press the sleeve L in either direction.

The arrangement of gearing with slipping pinions, hereinbefore described, whereby a variety of speeds is obtained, may be applied advantageously to other uses than hoisting—as, for example, in driving presses, or in any case where it is desirable to drive a spur-wheel, such as the main wheel Q, with varying speed or force.

The direct hoisting and lowering motions of the winding-barrel S, independent of the shafts B E and their gearing, are thus effected: The barrel S, placed loosely upon the shaft P, has at one end a hub or square boss, S^1, to carry the friction-disks S^2. The other series of disks, r^1, is contained in a drum, R, keyed to the shaft. The two series of disks together form the improved friction coupling and brake described in the specification of the Letters Patent hereinbefore referred to in connection with the brake-drum H.

T is a sprocket-wheel, loose upon the shaft, and it has a screw-faced or helical boss, t', on its side, in contact with a corresponding boss upon the end of the barrel S. The action of these helical bosses in connection with other parts carried upon the shaft is fully set forth in my Letters Patent of the United States, dated December 14, 1869, No. 98,000.

A slight turning of the barrel S upon its shaft, under the pull of a load, causes the inclines to ascend each other, and thus, by screw-action, urge the barrel bodily along the shaft against the friction-disks S^2 r^1, coupling them frictionally, and likewise the barrel S, drum R, and shaft. The said coupling, by friction, can also be effected by turning the sprocket-wheel T in a direction to make the incline bosses mount each other—that is by pulling the endless hand-rope upon the wheel T at its side far-

thest from the observer in Fig. 1. By continuing to pull the rope and rotate the wheel T in this same direction the barrel may be driven in the direction for hoisting, carrying with it the frictionally-connected drum R and shaft P, which in this direction turns freely within the spur-wheel Q, leaving the latter and all the other gearing and shafts at rest, unless they be at such time driven in the direction for hoisting by one of the sprocket-wheels b^1 b^2, as might occur. The reverse or backward motion of the barrel S is arrested by the pawls r^2, engaging with the ratchet-teeth q', formed upon the wheel Q.

The same ratchet-teeth and pawls serve to drive the barrel S, and thus hoist when the motive force is applied through the shafts B and E and attached gearing. The independent safety lowering motion of the barrel S is obtained by driving the sprocket-wheel T in a contrary direction, so that the incline or helical boss t' is continually retired or unscrewed from the corresponding boss upon the barrel end. The barrel thus released follows continually, leaving the shaft P, drum R, wheel Q, and all other gearing unaffected. This unscrewing action of the boss t' continually removes the coupling pressure from the disks S^2 r^1, which the backward motion of the barrel S as continually restores. The lowering of the load direct is, therefore, self-checked, and continues only so long as the sprocket-wheel T is rotated backward, as fully explained in the aforesaid Letters Patent No. 98,000. This independent motion of the barrel both ways permits the rapid and noiseless coiling and uncoiling of the rope from the barrel, so as to reach a load at any point quickly and attach it for hoisting or lowering, and it affords a fifth and direct quick speed for hoisting light weights, always ready without disconnecting the other shafts and gear.

As now explained, I obtain by my aforesaid improvements five distinct rates of speed in hoisting and three separate modes of lowering—viz., first, a direct lowering motion by the sprocket-wheel T; second, an automatic lowering motion, controlled by the governor; third, a rapid and variable lowering motion by resisting the governor with the lever M. These several modes or speeds of hoisting and lowering are respectively available at any instant, and in any order succeeding each other, even when the load is in suspension, and whether it is being lowered or raised.

All the loss of time and risk in shifting the clutches and shafts out of gear and in transferring the strain of the load from the gearing to the brake, or vice versa, which are characteristic of the old-fashioned hoists, are avoided by my improvements, whereby the mechanical relationship of all the parts of my improved hoist is made automatically adaptable to its various functions or uses.

Although I have described my improved method of changing the speeds of driving in a hoisting-machine as being effected in part by means of my improved ratchet-clutch, it is obvious that, with more or less efficiency, an ordinary ratchet-wheel and pawls or other slipping devices could be used in lieu thereof—as, for instance, the helical inclines and frictional surfaces of my aforesaid Letters Patent No. 98,000, which in like manner permit free rotation in one direction and engage or drive in the other.

The plain winding-barrel S may also be replaced by a spirally-grooved drum or toothed chain-wheel, each being specially suited to working a chain, as the plain barrel is suited to a rope or cable.

The friction-brake and governor described as being placed upon the shaft E, may be placed upon the shaft B and connected with the pinion D, in which case the wheel G would be a plain one keyed to its shaft. The efficiency of the brake would then be largely increased from the one series of disks carried by the drum H being in this case driven along with the pinion D at an increased velocity by the wheel G, whereas when the said disks are attached to the wheel G they are, with it, driven at a reduced velocity by the pinion D.

The friction-brake and clutch described as being operated by the lever M, sleeve L, and arms I may be operated by a hand-lever alone pressing directly upon the disks, in such case dispensing with the automatic governing action obtained when the sleeve L and centrifugal arms I are employed.

What I claim as my improvements in hoisting machinery, portions of which are capable of other applications, are—

1. The automatically-slipping pinions C and F, gears D and G, with their shafts, in combination with the main wheel Q, as and for the purposes set forth.

2. The automatically-slipping pinions C and F, gears D and G, with their shafts, the main wheel Q, and a frictional brake-clutch, whereby disengaging may be effected and the backward motion of the said gears controlled, as and for the purposes set forth.

3. The automatically-slipping pinions C and F, gears D and G, and main wheel Q, with their shafts, in combination with the winding-drum or its equivalent, substantially as and for the purposes set forth.

4. The automatically-slipping pinions C and F, gears D and G, and main wheel Q, with their shafts, in combination with the winding-drum, or its equivalent, and a frictional brake-clutch, whereby coupling for hoisting may be effected, and backward motion may be controlled and arrested, as and for the purposes set forth.

5. The automatically-slipping pinions C and F, gears D and G, and main wheel Q, with their shafts, in combination with the winding-drum, or its equivalent, a frictional brake-clutch, and an automatic centrifugal governor,

whereby backward motion may be automatically controlled and regulated, as and for the purposes set forth.

6. The combination of the main shaft, the loose sprocket or driving wheel T, the loose winding-drum, the friction-drum R, the pawls and ratchet-wheel, and the spur-wheel Q, as and for the purposes set forth.

In testimony whereof I have hereunto subscribed my name.

THOS. A. WESTON.

Witnesses:
MARCUS S. HOPKINS,
G. M. MAYNADIER.