(No Model.)

2 Sheets—Sheet 1.

W. M. FRISBIE.

ELEVATOR.

No. 576,568. Patented Feb. 9, 1897.

Fig. 1.

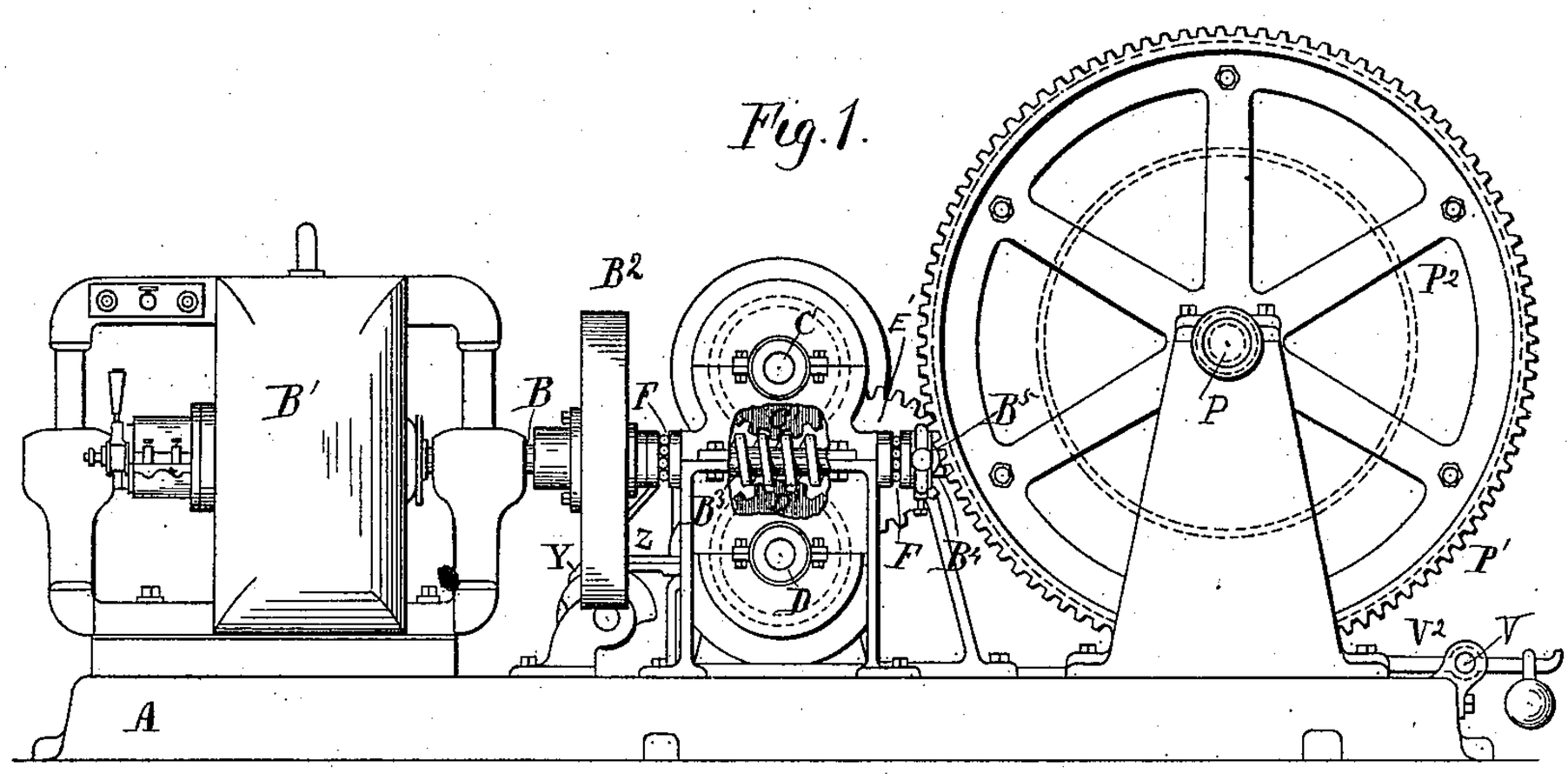
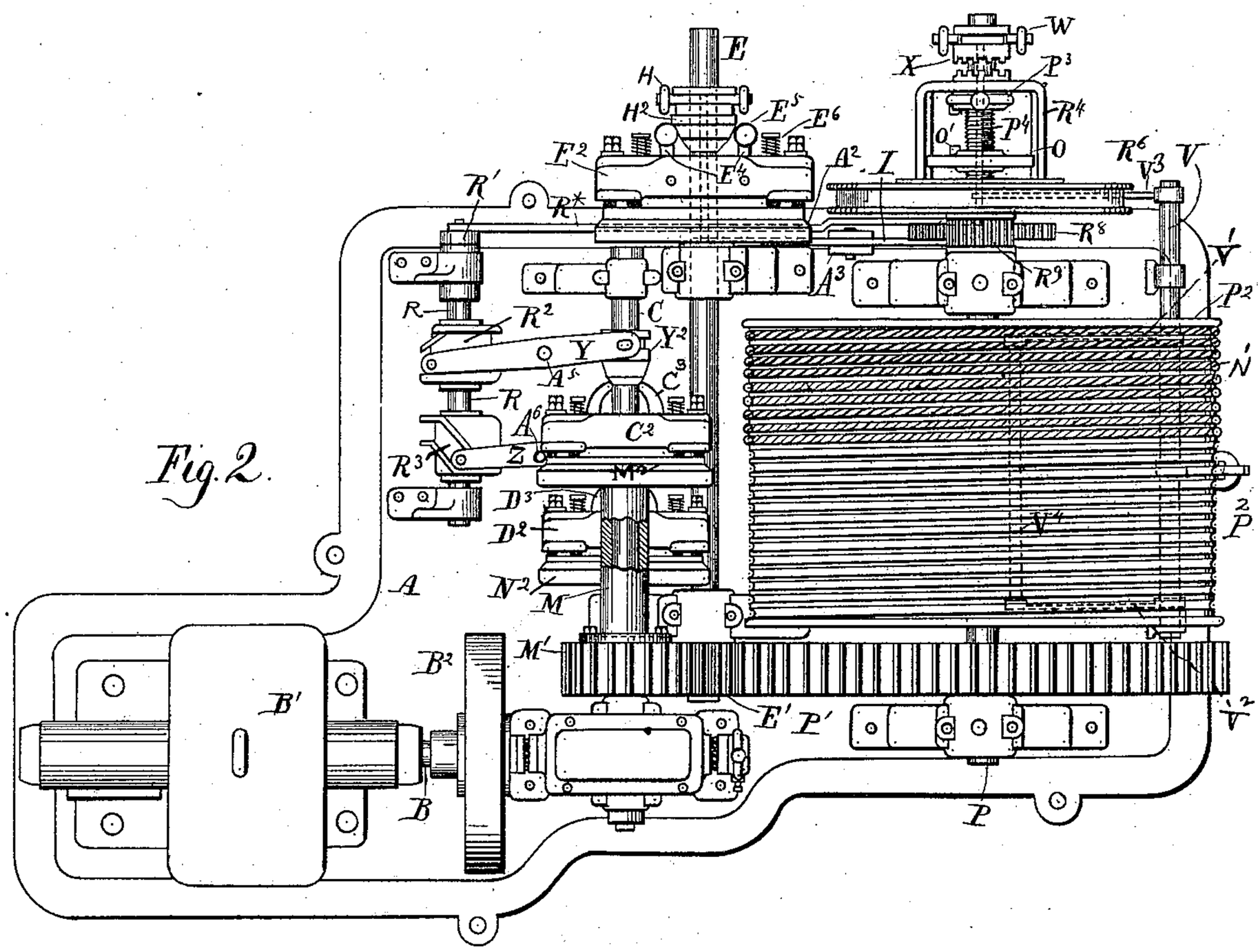


Fig. 2.



WITNESSES:

M. B. Harris

M. F. Boyle

INVENTOR

Wm M Frisbie

BY

Thomas Drew Stetson

ATTORNEY.

(No Model.) 2 Sheets—Sheet 2.

W. M. FRISBIE.

ELEVATOR.

No. 576,568. Patented Feb. 9, 1897.

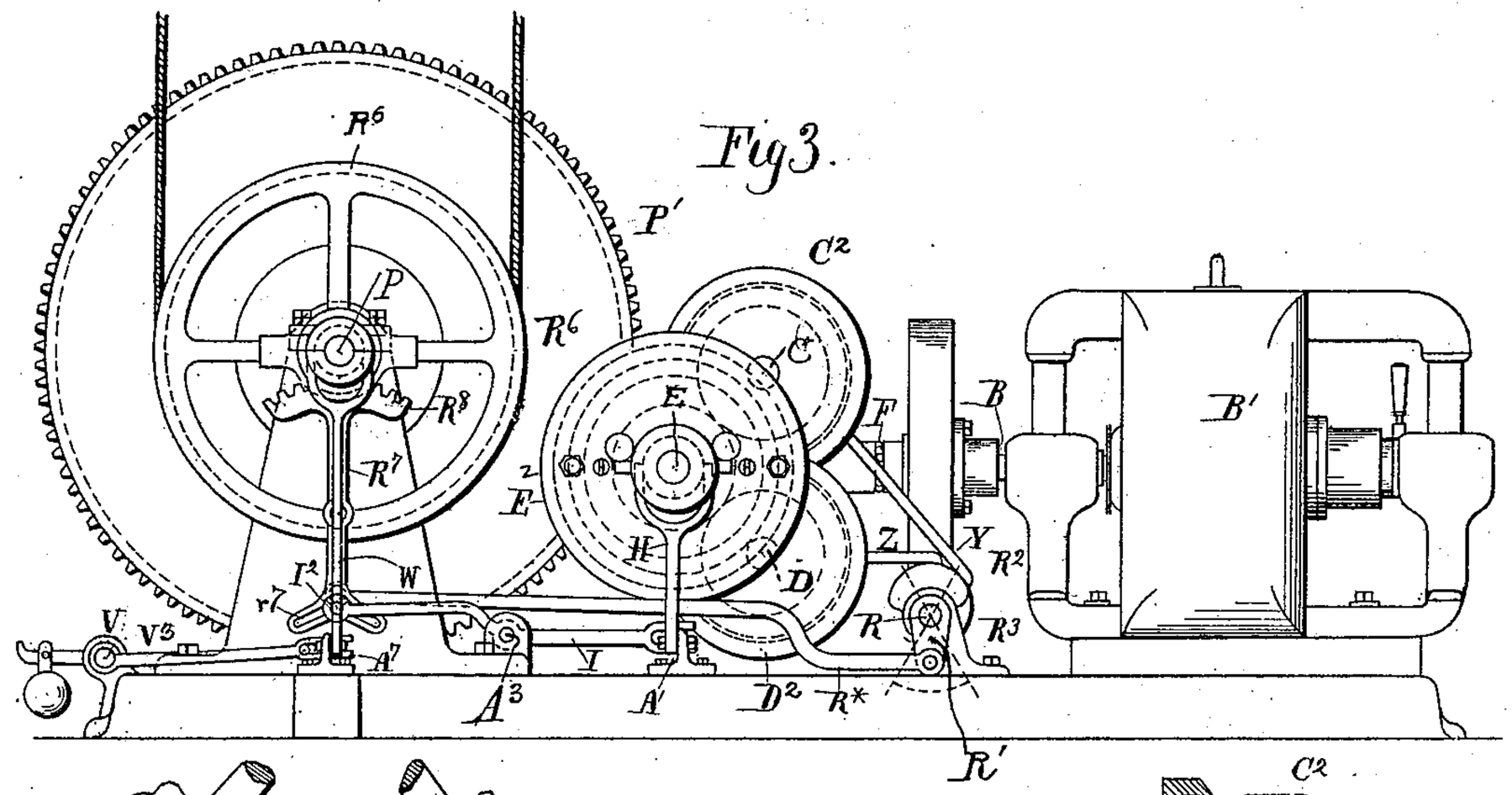


Fig. 3.

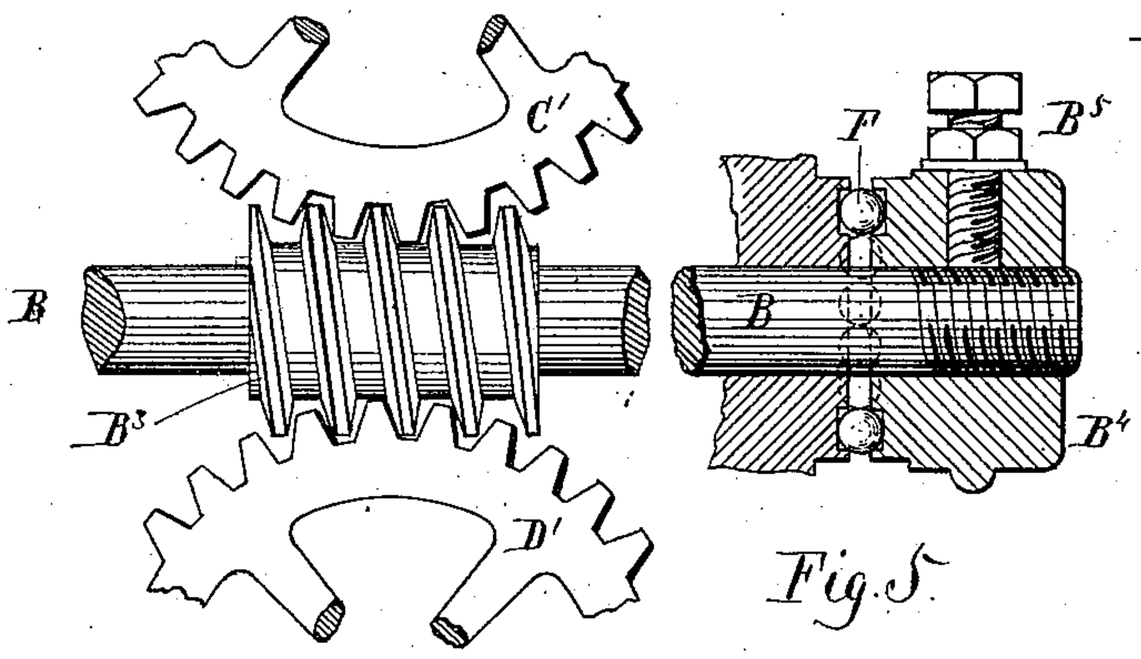


Fig. 5.

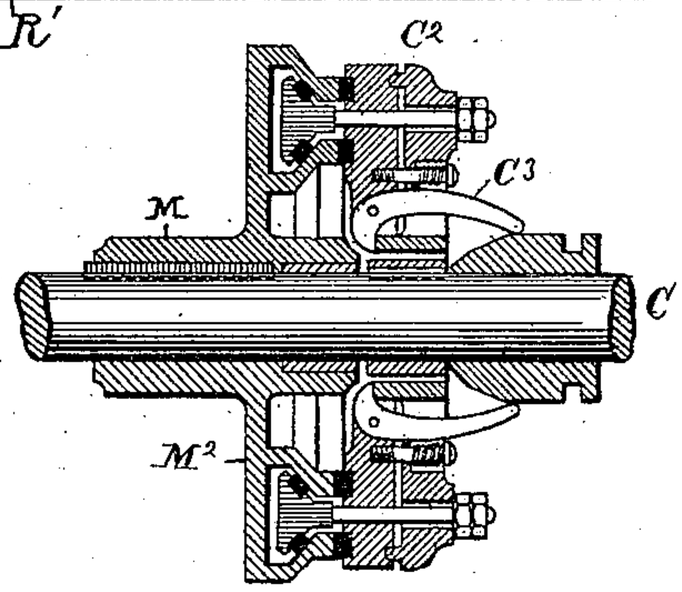


Fig. 4.

WITNESSES:

W. B. Harris

M. F. Boyle

INVENTOR

Wm. M. Frisbie

BY

Thomas Drew Stetson

ATTORNEY.

UNITED STATES PATENT OFFICE.

WILLIAM M. FRISBIE, OF NEW HAVEN, CONNECTICUT.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 576,568, dated February 9, 1897.

Application filed May 23, 1895. Serial No. 550,430. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM M. FRISBIE, a citizen of the United States, residing in the city and county of New Haven, in the State of Connecticut, have invented a certain new and useful Improvement in Elevators, of which the following is a specification.

The invention may apply to all of the ordinary styles of elevators to raise and lower passengers and freight in buildings. I have wrought out the invention in connection with the improvement in elevators set forth in the patent to me dated March 20, 1894, No. 516,987, and I will describe it as thus applied.

The invention includes important improvements in the means for communicating motion from the quick-running electrical motor to the slowly-revolving drum for effecting the hoisting and lowering, which improvements, among other advantages, reduce the friction and wear due to the end thrust on the quick shaft, provide for taking up any end play by operating from the outside, and provide increased momentum of the parts and thereby contribute greatly to the rapidity and force with which the power can be brought into action to raise or lower, and provide an intermediate wheel to receive and communicate to the drum the motion from either of two worm-wheels arranged on opposite sides of the motor-shaft and each engaging with the endless screw-threads thereon.

It also includes improvements in the provisions for holding the drum stationary when the mechanism is neither raising nor lowering, improvements in the means for receiving the initiatory movement to stop the machinery when the hoisting-rope is slackened, so as to be affected equally by such a slackening in different portions of the drum, and improved means for actuating a stop-motion by the aid of a governor when the required speed is exceeded.

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 an elevation showing the machinery seen endwise of the drum, partly broken away. Fig. 2 is a plan view, partly in horizontal section. Fig. 3 is an elevation showing an opposite side to that in Fig. 1. The remaining figures are on a larger scale. Fig. 4 is a section showing one of the friction-clutches. Fig. 5 represents the worm-gearing and the antifriction-bearing therefor, with the shaft contracted in length.

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

A is the stationary framework, of cast-iron or other suitable material, certain portions being designated, when necessary, by supernumerals.

A′ is the center for a lever.

B′ is an electric motor; B, the rapidly-revolving shaft thereof, carrying a fly-wheel B^2 and an endless screw-thread or worm B^3, which engages with two worm-wheels C′ and D′, carrying shafts C and D, extending parallel to each other and to the drum P^2.

The considerable end thrust to which the quick-running motor-shaft B is subjected is received on a circular series of antifriction-balls F. A nut B^4, secured by the pinching-screw B^5, allows all end play to be conveniently taken up. The fly-wheel B^2 is strong, adapted to resist the great centrifugal force to which it will be subjected, and contributes largely to the ability of the elevator to start promptly when a heavy load is suddenly imposed upon it.

Each shaft C and D carries, firmly fixed thereon, clutch-wheels C^2 and D^2, which may be a little larger than the corresponding worm-wheels C′ and D′, being mounted one considerably out of the plane of the other, so as to afford room both for those wheels and for the accompanying wheel which matches with each, the parts being fitted to serve as Frisbie friction-clutches, the wheel C^2, rigidly fixed on the upper shaft C, being engaged frictionally with a corresponding wheel M^2, which is fixed on the sleeve M, mounted on the shaft C, with liberty to move a little endwise and carrying a nicely-cut spur gear-wheel M′. The wheel D^2 correspondingly engages and disengages frictionally with a wheel N^2, mounted on a sleeve which is concentric to the shaft D and which carries a corresponding spur gear-wheel. The means for controlling these friction-clutches, engaging one and disengaging the other as required to cause the elevator-car to rise and lower, will be de-

scribed farther on. These two spur gear-wheels, the wheel M′ and a corresponding wheel (not shown) directly below it, each engage with a nicely-cut spur gear-wheel E′, which I term the "intermediate" wheel, which also gears with the large spur gear-wheel P′ on the shaft P of the drum P^2. This important member of the mechanism, the drum, may be of any ordinary or suitable construction. I have shown it as cast-iron, grooved spirally and receiving in its grooves a wire rope N′, which, it will be understood, extends upward over a suitable sheave and by the winding and unwinding of which on this drum the car (not shown) is raised and lowered.

R is a horizontal shaft lying parallel to the shafts C and D and performing the important function of controlling the motion of the drum. It is rocked in its bearings by means of a crank-arm R′, which is engaged by a link R^*, which latter may be moved to the proper extent to and fro by a rocking lever R^7, which turns on a fixed center and is provided at its upper end with a segment of gear R^8, which engages a pinion R^9, keyed on the hub of the large wheel or sheave R^6, which latter turns loosely on the shaft P as a center and receives the ordinary operating-cord, which, it will be understood, extends up in the ordinary manner through the car. (Not shown.) There are other means of rocking the shaft R, which I will presently describe.

The shaft R carries two devices which may be termed "cams" R^2 R^3, which are provided with nicely-finished deep grooves, each oblique to the circumference at the middle portion, the obliquity of the two cams being in opposite directions. The groove in the cam R^2 operates a lever Y, turning on a fixed center A^5 and engaging a cone Y^2, mounted on the shaft C and free to slide endwise thereon, properly arranged to actuate the levers C^3 of the friction-clutch C^2 M^2 thereon. The groove in the cam R^3 operates a lever Z, turning on a fixed center A^6 and engaging a cone mounted on the shaft D and free to slide endwise thereon, properly arranged to actuate the levers D^3 of the friction-clutch D^2 N^2 thereon.

The grooves in the cams R^2 and R^3 are so formed and arranged that a rocking of the shaft R to the full extent in one direction will liberate or relax the grip of the friction-clutch C^3 M^2 and tighten the grip of the friction-clutch D^2 N^2, while a rocking of the shaft R to the full extent in the opposite direction will induce the opposite conditions, the tightening of the grip of the clutch C^2 M^2 and the relaxing of the hold of the clutch D^2 N^2. It follows that the turning of the shaft R in one direction to its extreme position will cause the drum to wind up the rope N′ and hoist the car, and the turning of the shaft R in the extreme opposite position will cause the drum to revolve in the opposite direction and unwind the rope N′ and allow the car to descend.

There is an intermediate position of the shaft R and its attachments in which both the friction-clutch C^2 M^2 and the friction-clutch D^2 N^2 relax their holds and are of no effect.

The intermediate shaft E extends out beyond the framing and carries on its overhung end a wheel E^2, which serves relatively to a corresponding stationary disk A^2 as the members of a Frisbie friction-clutch. The disk A^2, instead of either giving or receiving motion, is a portion of the fixed framework of the machine, so that the engagement of this clutch serves as a brake to prevent the motion of the mechanism. E^4 E^5 are the levers of this friction-clutch. They are subject to the action of a cone H^2, which is movable endwise on the shaft E, being operated by a forked bell-crank lever H, which turns on a fixed center A′, and the horizontal arm of which is engaged by an always nearly-horizontal lever I, which turns on a fixed center A^3 and is operated by a pin I^2, which is received in an A-shaped slot i^7, formed on the widened lower end of the upright lever R^7. With each change of the position of the lever R^7 to stop or reverse the motion of the drum the action of the slot i^7 on the pin I^2 operates the levers I and H. The parts are so proportioned and arranged that when the lever R^7 is in the upright position the pin I^2 is in the mid-length of the slot i^7, and the levers I and H are so held that the cone H^2 is inward and the friction-clutch E^2 A^2 is engaged, holding the drum stationary. This condition may remain for any period while the machine is at rest. The construction insures that this condition will always obtain for a short period during each reversion of the motion of the drum. This follows from the fact that the lever R^7 in changing its position from one extreme to the other must go through the middle position, in which latter it is certain to hold the clutch E^2 A^2 engaged. Under ordinary conditions of rapid reversion this period of engagement and consequent holding of the drum at rest is very brief. During this period, whether long or short, the friction-clutch E^2 A^2 is firmly gripped, holding the shaft E locked to the stationary frame of the machine, so that the drum P^2 and the connected rope N′ are held stationary. The result corresponds with that attained in my patent of 1894, referred to, but the mechanism whereby this is attained is preferable in simplicity, strength, and reliability.

Of the three other means for controlling the machinery two operate the shaft R by acting through the same lever R^7 and connections, and operate under certain conditions to turn the shaft R into the intermediate position, which will arrest the drum P^2 and hold it stationary.

While the drum P^2 is being revolved in the direction to wind up the rope N′, and consequently to hoist the car, the screw-threads P^4 on the shaft P are causing the nut O to move

outward. This is so adjusted that the nut O is certain to reach its outermost limit and engage with the dog P^3, which is fast on the shaft P, at the same time that the car approaches the top of its traverse. At this period a projection O′ on the nut O is struck by the revolving dog P^3 and is caused to effect a partial revolution. The nut O being engaged with the yoke R^4 and the latter being fixed to the pulley R^6 causes the latter to perform a partial revolution. The effect is to turn the pinion R^9 and operate the lever R^7, and thus to turn the shaft R in the same manner and with the same effect as if the operation had been performed by the attendant pulling on the cord. This mechanism to avoid overwinding is substantially the same as the corresponding parts in my patent of 1894, referred to.

When a car is descending and its descent is obstructed through any cause, there is a liability to accident from the slackening of the hoist-rope. In the machine described in my patent of 1894, referred to, a bar extended across under the drum just out of contact with the rope so long as the rope was under proper tension. A slackening of the rope, allowing it to hang below the drum at any point, would, by causing the rope to touch such bar and depress it, effect the stopping of the machine. But in that device the bar turned leverwise, one end sinking more than the other, and it followed that a slackening of the rope and a contact thereof with the bar near one end of the drum would be more effective in operating this stop-motion than a corresponding slackening and contact of the rope with the bar at or near the other end of the drum.

My present mechanism for operating in this manner is analogous to that in the previous patent of 1894, but is superior in the important point that the bar descends uniformly, moving bodily and uniformly downward throughout its whole length whenever it is depressed at any point. This makes the slackening of the rope on one end of the drum equally effective with a similar slackening on the other end or on the mid-length of the drum to induce a prompt operating of the stop-motion.

V is a shaft supported in bearings near the level of the lower part of the drum, but sufficiently removed therefrom laterally, and V′ V^2 are arms extending horizontally from such shaft, each to a point under the shaft P. V^3 is a third arm keyed rigidly on such shaft, the free end of which engages with the lower arm of the bell-crank lever W, as shown in dotted lines in Fig. 2.

A horizontal bar V^4 connects the free ends of the levers V′ and V^2 and lies close to, but out of contact with, the lower side of the drum and with the rope N′ so long as the latter is tightly wound on the drum. It serves to receive the action of the rope N′ when it is slackened and effect the prompt stopping of the drum, so as to avoid accident from such cause. Its motion is very simple.

W is a bell-crank lever turning on a fixed center A^7 and taking hold by its upper arm of a clutch-piece X, feathered on the shaft P, so that it must turn therewith, but is free to be moved endwise thereon. Its lower arm engages with the arm V^3, so as to be raised and lowered therewith. So soon as the rope is slackened, it will, by hanging below the drum, touch the bar V^4, and acting through the shaft V and its rigidly-connected arms V′ V^2 V^3 turn the connected lever W and engage the clutch-piece X and cause the yoke R^4 and its connections to be partially revolved, with the effect to operate the lever R^7 and partially rotate the shaft R and stop the drum. The arrangement insures that the slackening of the rope shall be equally effective in turning the shaft V whether the bar V^4 be acted on near one end of the drum or near the other.

There is still another mode of controlling the mechanism. This acts independently. Each of the levers E^4 of the clutch E^2 A^2 carries near its free end a considerable mass of iron or lead E^5, which enables the mechanism, in addition to its other duties, to act automatically by the centrifugal force of these weights whenever the speed of the drum exceeds a certain required degree, thus serving as an automatic stop to arrest the mechanism whenever any accident occurs which would cause the rope to unwind too rapidly, and consequently endanger the passengers or freight on the elevator.

When from any cause the car commences to descend too rapidly, and consequently to induce an excessively-rapid turning motion of the drum P^2, it induces a correspondingly-excessive rapid rotation of the quicker intermediate shaft E. The levers E^4 of the friction-clutch on this shaft E are drawn inward by the usual springs E^6, which are of sufficient tension to hold the levers inward in contact with the shaft, and consequently to hold the clutch in the loose condition and allow the shaft E to revolve freely, so long as the velocity of the rotation is small, but when through any accident or other cause the rate of rotation becomes excessive the centrifugal force of the weights E^5 induces them to fly apart in opposition to the tension of the spring E^6. When this occurs, the grip of the friction-clutch E^2 A^2 is effected and the rotation of the drum is arrested. When the velocity is sufficiently reduced to allow the weights E^5 to be drawn inward by the spring E^6, the car may again descend, but at a proper slow rate, the loaded levers and the spring serving as a governor to operate the clutch engaging with the stationary frame to keep the velocity down.

While the details of construction shown in the drawings are the ones I prefer, they are

subject to modifications which would not depart from the principle of the invention and are intended to be included by the claims.

Parts of the invention can be used without the whole. Additions may be made.

It is expedient in most situations to cover the friction-clutches and gearing with shields adapted to protect them from blows and from dust.

I do not in this patent claim anything that may be inferred in regard to the method of operating, such being claimed in another application for United States patent filed or to be filed by me of nearly even date herewith.

Some of the advantages due to certain features of the invention may be separately enumerated as follows:

First. By reason of the electric motor and the worm carried directly on the shaft thereof running continuously in one direction at a high speed, making any required addition to the momentum by a fly-wheel on such shaft, and of the two worm-wheels engaged on opposite sides of said worm with independent friction-clutch connections from each to the drum, I am able to operate efficiently with a slow motion of the intermediate mechanism between the motor and the clutches, so that there is little inertia to be overcome at the several changes of direction of the motion.

Second. By reason of my lever R^7, with its angular slot r^7, vibrated at each change of direction of the rotation of the drum and of the lever I and its connections operated by such slot, I am able to hold the car locked motionless between each rising and sinking movement and to attain this by simple and reliable mechanism.

Third. By reason of the weights E^5 on the friction-clutch levers E^4, arranged to be operated by the cone H^2 and the provisions for moving the latter endwise when required, I am able to retard the motion by means of the centrifugal force due to a high speed or to do so by moving the cone H^2 and to attain both modes of working at the same time or at different times by acting through the same mechanism.

Fourth. By reason of my intermediate shaft E, I am able to connect the friction-clutches to the drum and also to conveniently mount the additional friction-clutch for slowing or arresting the-motion.

Fifth. By reason of a bar V^4, which is touched by the hoist-rope N′ when it is slackened, being arranged to work always parallel to its supporting-shaft V, I am able to insure that the slackening of the hoist-rope at any point in the descent of the car will have full effect in operating the stop-motion.

Sixth. By reason of the fly-wheel B^2 and the series of antifriction-balls F and of the nut B^4 and pinching-screw B^5 on the quick-running motor-shaft R, I am able to realize great force when suddenly required to start the car with little friction and to adjust the parts to take up slack without removing any part of the machine, but simply operating on the pinching-screw and nut from the outside.

I claim as my invention—

1. In an elevator, an electric motor running in one direction, and a worm revolved thereby, in combination with two worm-wheels engaged on opposite sides, two corresponding friction-clutches, and provisions for engaging them alternately each with its proper worm-wheel, and an elevator-drum connected to both, all arranged for joint operation substantially as herein specified.

2. In an elevator the lever R^7 having the angular slot r^7 turned in one direction or the other at each change of direction of the rotation, in combination with the drum P^2 and clutch E^2, A^2, and with the lever I engaged in such slot and connected to the brake, all arranged to serve substantially as herein specified.

3. In an elevator having friction-clutch mechanism serving as a brake for the winding-drum, the combination therewith of weighted levers E^4, E^5, the cone H^2 and connections extending to and actuated by the power-controlling devices to intermediately effect the movement of the cone, the arrangement being such that the weighted levers will also operate the clutch to apply the brake when the speed of the winding-drum becomes excessive, substantially as herein specified.

4. In an elevater, the combination with a driving-motor and slower-driven speed-shaft E, geared with the drum, of friction-clutch mechanism mounted on the shaft and serving as a brake for the winding-drum, weighted levers E^4, E^5, the cone H^2 and connections extending to and actuated by the power-controlling devices to intermediately effect the movement of the cone, the arrangement being such that the weighted levers will also operate the clutch to apply the brake when the speed of the winding-drum becomes excessive, substantially as herein specified.

5. In an elevator an electric motor running in one direction, and a worm revolved thereby, in combination with two worm-wheels engaged on opposite sides, and two corresponding friction-clutches and an additional friction-clutch serving as a brake, and with a drum and an intermediate gear-wheel E′, the latter arranged to perform the double function of a connection between the two friction-clutches and the drum, and a means of carrying the brake-clutch, all arranged for joint operation substantially as herein specified.

6. In an elevator having a stop-motion for arresting the drum when the hoisting-rope is slackened, the bar V^4 extending longitudinally of the drum, connections as the shaft V and arms V′, V^2, arranged to induce a parallel and uniform motion of such bar throughout its length, and connections therefrom to the stop mechanism, arranged to serve substantially as herein specified.

7. In an elevator an electric motor running in one direction and having a worm B^3 on a

quick-running shaft B, the fly-wheel B^2, anti-friction-bearings F, and means as the nut B^5 for taking up the slack and wear by operating outside, in combination with friction-clutches C^2, M^2, and D^2, N^2, engaged alternately, and with the elevator-drum and suitable connecting mechanism, all arranged for joint operation substantially as herein specified.

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

WILLIAM M. FRISBIE.

Witnesses:
THOMAS DREW STETSON,
M. F. BOYLE.