No. 703,127. Patented June 24, 1902.

M. HANFORD.

ELEVATOR.

(Application filed Aug. 29, 1901.)

(No Model.) 4 Sheets—Sheet 1.

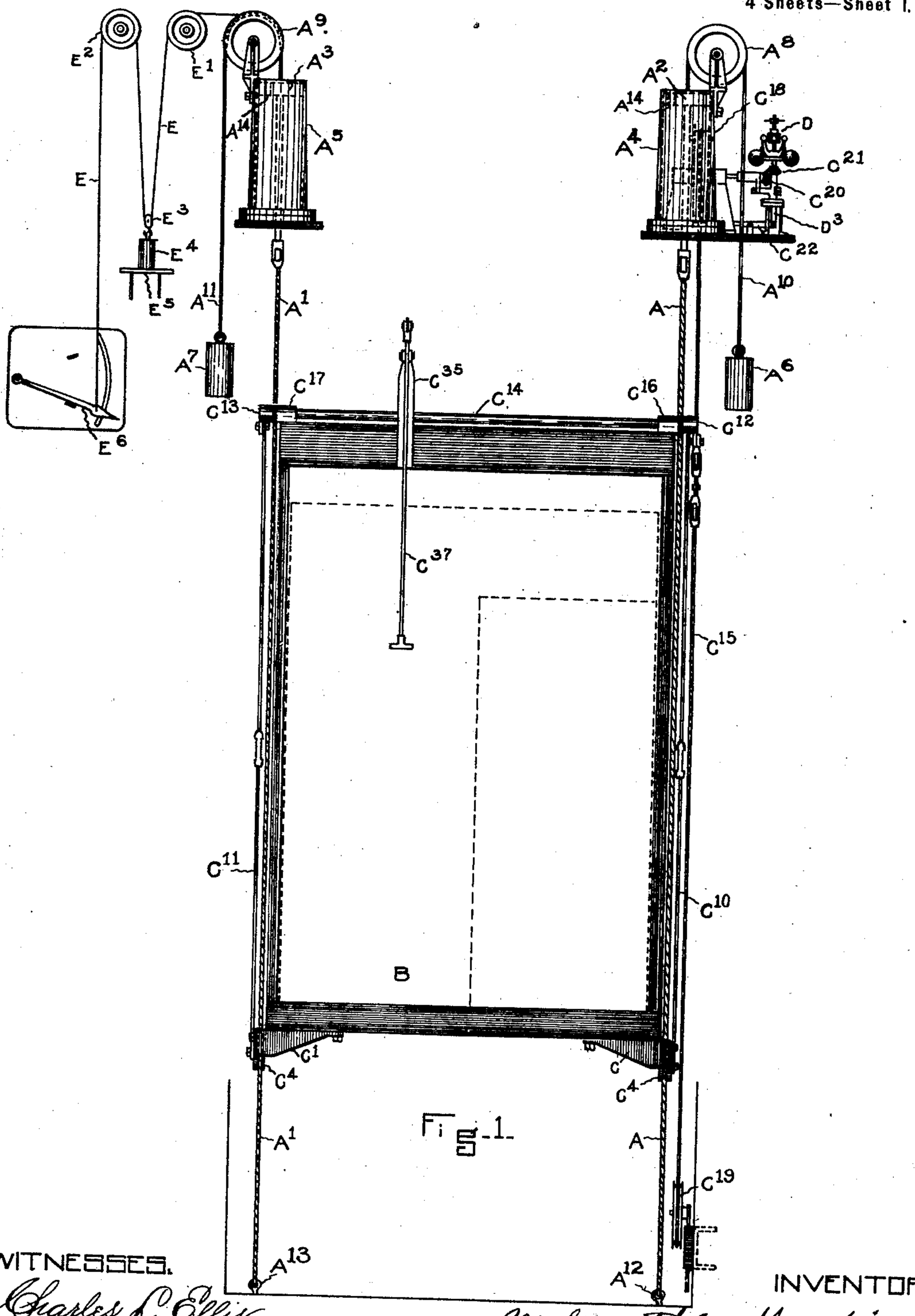

Fig. 1.

WITNESSES.

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(No Model.) 4 Sheets—Sheet 2.

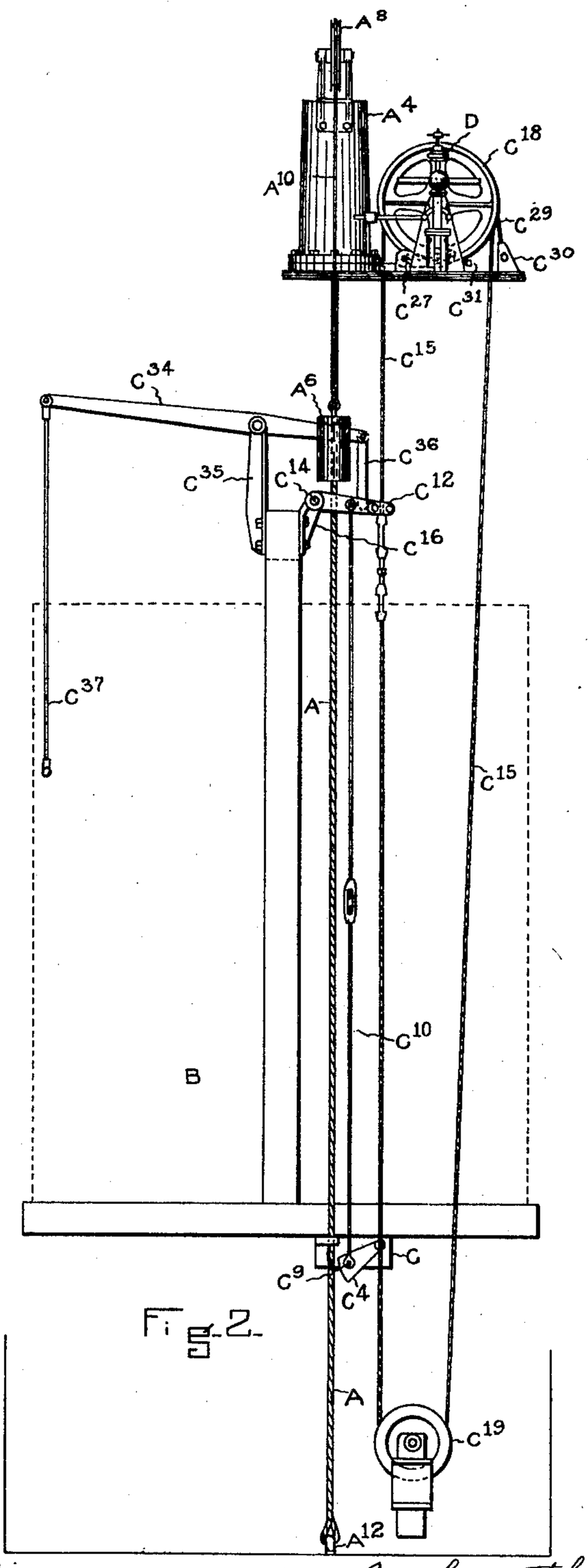

Fig. 2.

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(No Model.)

4 Sheets—Sheet 3.

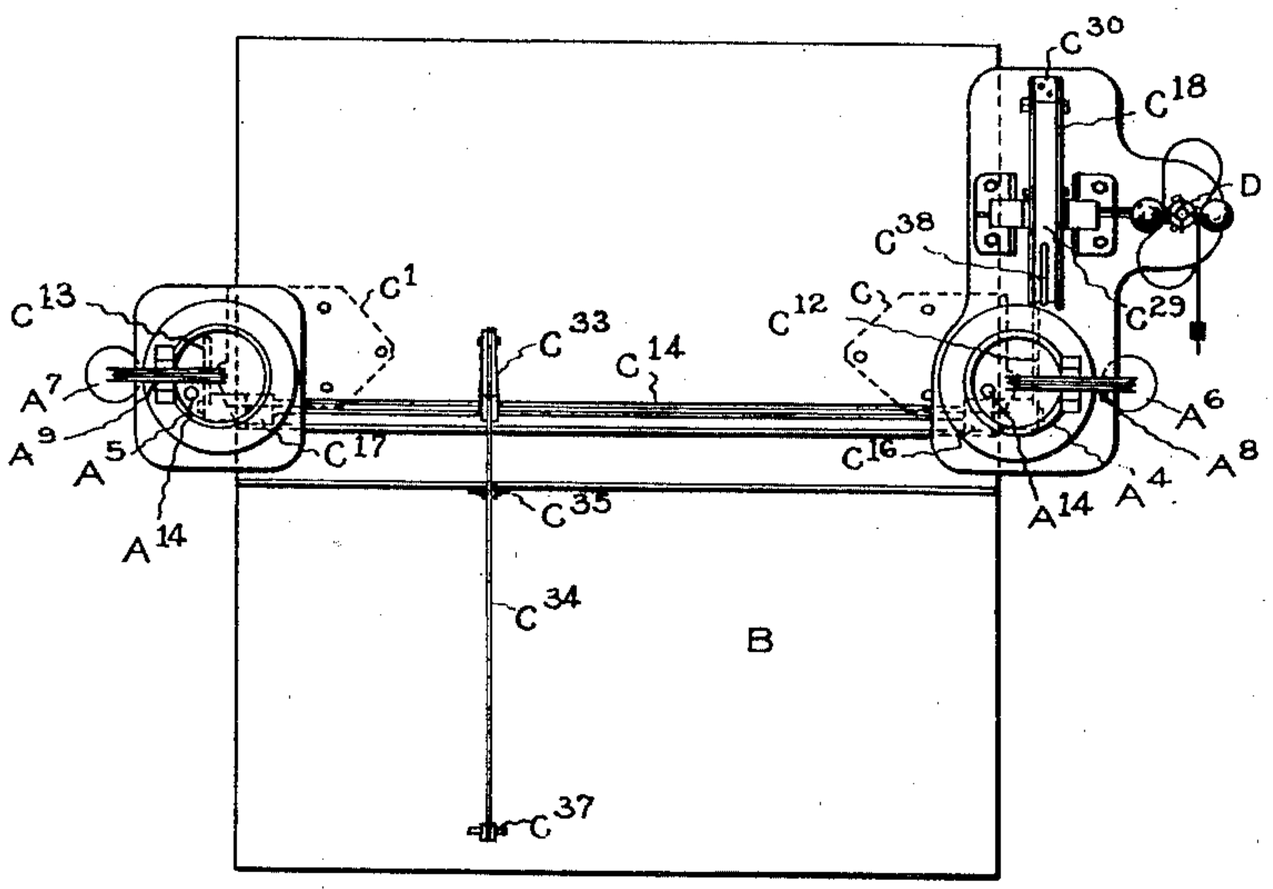

Fig. 3.

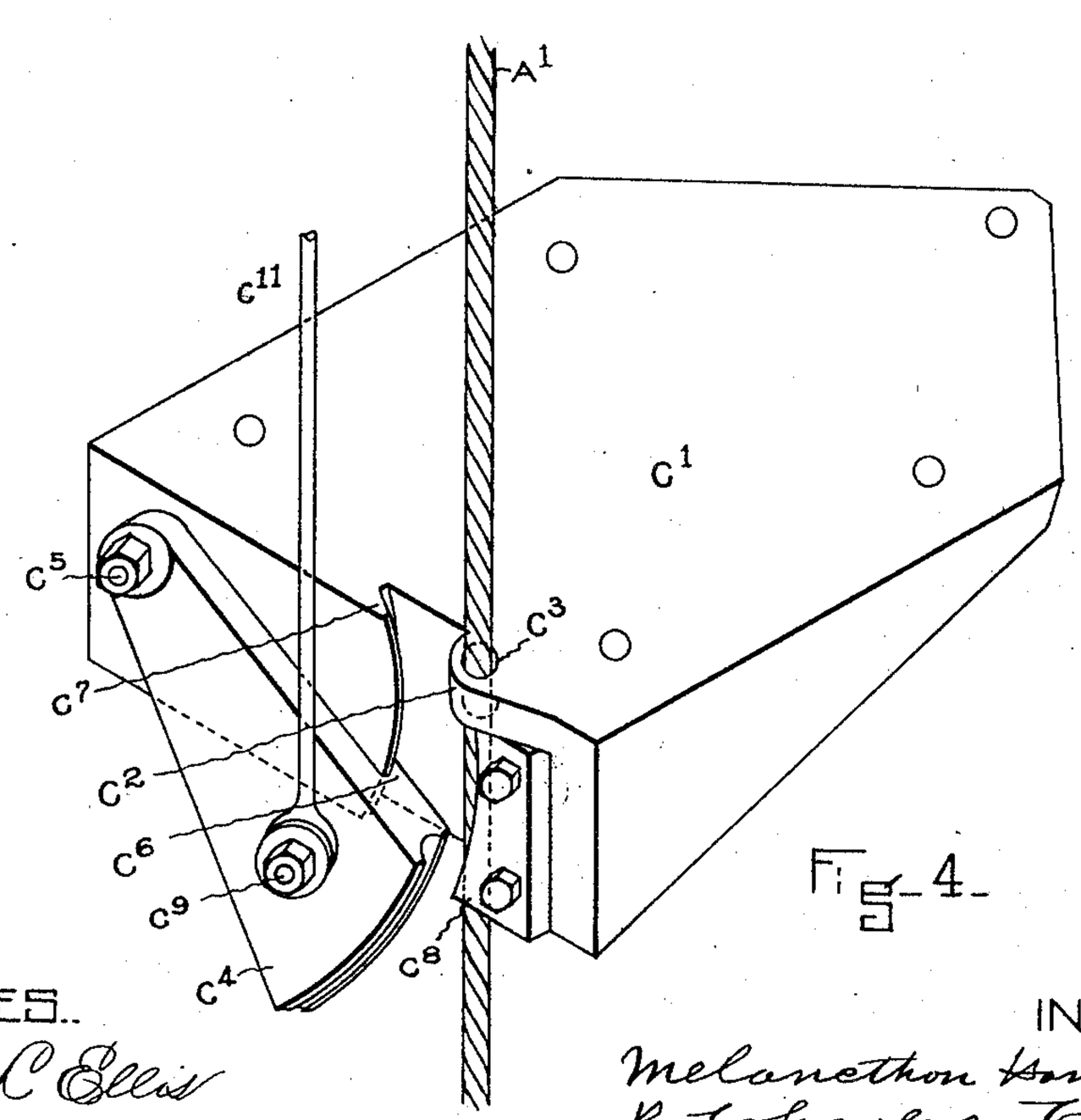

Fig. 4.

WITNESSES..

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(Application filed Aug. 29, 1901.)

(No Model.) 4 Sheets—Sheet 4.

Fig. 5.

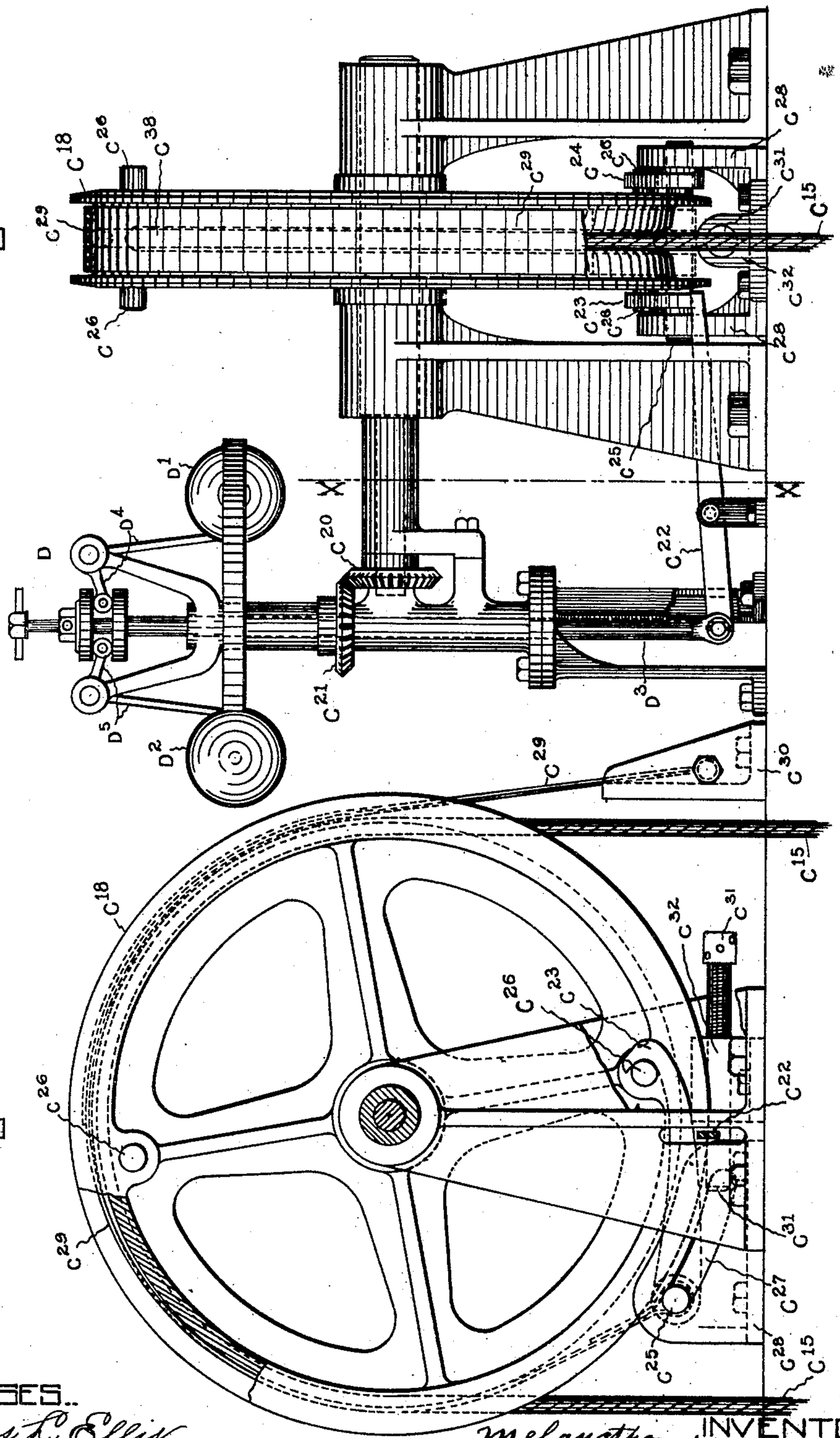

Fig. 6.

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UNITED STATES PATENT OFFICE.

MELANCTHON HANFORD, OF MALDEN, MASSACHUSETTS.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 703,127, dated June 24, 1902.

Application filed August 29, 1901. Serial No. 73,743. (No model.)

To all whom it may concern:

Be it known that I, MELANCTHON HANFORD, of Malden, county of Middlesex, State of Massachusetts, have invented new and useful Improvements in Elevators, of which the following description, in connection with the accompanying drawings, is a specification.

The same parts in all the drawings bear the same designating letters and figures.

My invention has for its object an effective and unfailing means for stopping and sustaining an elevator-car in the event of a failure of the usual ropes or hoisting machinery or the usual safeties to hold the car or when its downward speed is accelerated beyond a predetermined limit.

My device is designed to operate either automatically or manually, is entirely independent of the ropes, machinery, and supporting-framework of the hoisting mechanism, and is an improvement upon a similar invention for which Letters Patent No. 397,912 were granted to me February 19, 1889, and which improvements consist in an additional safety-rope, with its piston, cylinder, &c., and an additional clutch for the purpose of distributing the weight of the car evenly on each clutch and each side of the car when the safety device is in operation, a connection between the clutches for the purpose of simultaneous action, an improved brake device, and a means for instantly stopping the hoisting machinery of the car by the safety device when it operates.

The following is a general description of the construction and operation of the safety device, including the improvements above referred to.

In the elevator-well at opposite sides two safety-cables of great sustaining power are suspended from pistons which operate in cylinders at the top of the well. These cylinders contain air or other fluid and are of sufficient superficial area to produce a force capable of sustaining the car when the fluid is put under moderate pressure by the lowering of the pistons. These pistons are provided with suitable vents A^{14}, which are controlled by valves. These cables hang one on either side of the elevator-car and at their lower end are preferably secured to bolts in the bottom of the elevator-well. The car carries on the under side of floor two clutches opposite each other and provided with lugs through which the safety-cables pass. The clutches operate simultaneously through a shaft and arms by which they are connected. In case of an accident to the hoisting machinery, which leaves the car free to speed downward at a dangerous rate, these safety-cables are instantly and automatically attached to the car by means of the clutches operated through an endless rope secured thereto and which rope is brought into action by a speed-governor when the downward speed of the car is too great. When the weight of the car is thrown upon the safety-cables by means of the clutches, its speed is gradually checked by the resisting force in the cylinders, and the car is brought to a stop without shock or injury.

In the drawings Figure 1 shows the safety device as viewed from the front of an elevator-car. The outline of the car is shown by dotted lines with a door on the right, and the car is assumed to be operated by the usual hoisting machinery, which it is unnecessary to show in these drawings. The arrangement for automatically stopping the hoisting machinery is shown only in this-view. Fig. 2 is a side elevation of Fig. 1, view point at the right. Fig. 3 is a plan of Fig. 1. Fig. 4 is an isometric drawing, on larger scale, of the clutch for engaging the safety-cable. Fig. 5 shows the brake-wheel over which the rope for actuating the clutches travels, the hooks for engaging the brake-wheel pins, the lever by which the hooks are raised, the governor which operates the hook-raising lever, and the brake-band. The fixed end of the brake-band is omitted for the purpose of more clearly showing other parts. Fig. 6 is a section on line $x\ x$ of Fig. 5.

Detailed description of the construction and operation of the safety devices.—Cables A and A′ (see Figs. 1 and 2) hang on either side of the car in the elevator-well parallel to the path of travel of the car B and are strong enough to support many times the weight of the car and a maximum load. These cables are suspended from the pistons A^2 and A^3, which operate in the cylinders A^4 and A^5, which latter are of sufficient area to contain enough air at atmospheric pressure or other

fluid to form an effective and gradually-yielding resistance to the downward movement of the pistons and car. The pistons A^2 and A^3 are held in their normal position at the tops of the cylinders A^4 and A^5 by means of the counterweights A^6 and A^7, which hang on the ropes A^{10} and A^{11}, the ropes passing over the sheaves A^8 and A^9. The lower end of the safety-cables A and A′ are secured to eye-bolts A^{12} and A^{13} in the bottom of the elevator-well.

To connect the car B to the safety-cables A and A′ when the hoisting mechanism fails to support the car, two clutches C and C′, which are made right and left, are so connected as to operate simultaneously, are permanently attached to the car, one on either side, (see Figs. 1, 2, 3, and 4,) and are constructed and operated as follows: A projecting lug C^2 (see Fig. 4) on clutch C is provided with a hole C^3, through which the safety-cable A passes and by which it is held in position to be gripped by the clutch at any time. The arm C^4 of the clutch swings on the stud C^5 and is guided by its dovetailed lug C^6, which bears on the correspondingly-dovetailed shoulder C^7. The stud C^5 takes none of the thrust of the arm C^4 when it is gripping the safety-rope, the whole being taken by the dovetailed shoulder C^7. A bearing-piece C^8, directly beneath the projecting lug C^2 and opposite the arm C^4, takes the pressure of the swinging arm when it swings up, and it is between this swinging arm C^4 and the piece C^8 that the safety-rope is gripped and held. The faces of the swinging arms C^4, which bear on the safety-cables A and A′, are slightly grooved, as are the corresponding faces of the bearing-pieces C^3, and the swinging arms C^4 are hung eccentric to the faces of the bearing-pieces C^8, so that when the cables are clutched it is with increasing force, preventing any slip of the car.

The clutches are connected for the purpose of operating simultaneously in the following manner: The swinging arms C^4, Figs. 1, 2, 3, 4, are provided with studs C^9, on which the connecting-rods C^{10} and C^{11} (see Figs. 1 and 2) are secured at their lower ends. The upper ends are similarly attached to the arms C^{12} and C^{13}, (see Figs. 2, 3,) which are keyed on the shaft C^{14}. Arm C^{12}, which is longer than arm C^{13}, has attached at its outer end an endless rope C^{15}. As the shaft C^{14} is carried in bearings C^{16} and C^{17} bolted to the car-framing, it will be seen that the rope C^{15} travels upwardly and downwardly with the car independently of the gripping action of the clutch and in its travel passes over and rotates the sheaves C^{18} and C^{19} at a speed equal to that of the car. It is not necessary to place the shaft C^{14} at the top of the car, as the clutches may be directly cross-connected below the car. I prefer the previously-described method.

Brake mechanism.—The shaft of the sheave C^{18} has at its outer end the miter-gear C^{20}, (see Fig. 1,) engaging the miter-gear C^{21}, through which the speed-governor D receives its motion. In Figs. 5, 6 the governor D, the brake-sheave C^{18}, and their parts are shown on larger scale. When the downward speed of the car becomes too great for safety, the balls D′ and D^2 of the governor D are thrown outward by centrifugal force and acting on the vertical rod D^3 through their arms D^4 and D^5 depress the rod D^3, which at its lower end is connected to one end of a lever C^{22}. The opposite or right-hand end of this lever bears on the under side of a hook C^{23}, secured to a shaft C^{25}, which carries at its opposite end a similar hook C^{24}, the hooks having a corresponding movement. The sheave C^{18} is provided with pins C^{26}, which serve as stops when the hooks C^{23} and C^{24}, raised by the lever C^{22} into their path, are engaged by them. On the hook-shaft C^{25}, which is free to slide in the radial slots C^{27} (partly shown in full and partly in dotted lines in Fig. 6) of the hook guide-lugs C^{28} is secured the brake-band C^{29}, the hook-shaft being free to turn. The other end of the brake-band is permanently secured to the fixed piece C^{30}. The brake-band on the side with the hook-shaft has a longitudinal slot C^{38} extending from the hook-shaft to a point above the horizontal center line of the brake-sheave, through which slot the rope C^{15} passes. When the stop-pins C^{26} of the sheave C^{18} are engaged by the hooks C^{23} and C^{24}, the momentum of the sheave C^{18} causes the hook-shaft C^{25} to travel in the radial slots C^{27}, thereby putting a pressure on the clutch-operating rope C^{15} through the agency of the brake-band C^{29}. This pressure or friction retards the rope C^{15}, which, as before stated, is secured to and travels with the car, and this retarding action causes the arms C^{12} and C^{13}, connected together by shaft C^{14}, to rise and by means of their connecting-rods C^{10} and C^{11} to raise the swinging arms C^4 of the clutches C and C′ to grip and hold the safety-cables A and A′, which instantly take the weight of the car, and the pistons A^2 and A^3, to which the cables A and A′ are attached, gradually descend in the cylinders A^4 and A^5, checking the momentum of the car and bringing it to rest through the action of the cushioning device, which exerts an increasing upward force as the pistons and car descend. The brake C^{29} in its normal position does not touch the rope C^{15}, and not until the centrifugal governor has attained a maximum speed is the brake applied, and then it is applied with maximum effect, and the subsequent decrease in the speed of the governor does not alter or affect its action.

The retarding action through pressure or friction of the brake-band C^{29} on the rope C^{15} is regulated by means of screw-bolt C^{31} and nut C^{32}, placed in front of the hook-shaft C^{25}, which strikes against the end of the bolt C^{31}.

The safety-cables A and A′ are gripped and held by manual connections to the clutches in the following manner: The shaft C^{14}, which

through arms C^{12} and C^{13} and connecting-rods C^{10} and C^{11} is connected to the clutches C and C′, has secured to it an arm C^{33}. This arm is connected to a lever C^{34}, supported by upright bearing C^{35} by the link C^{36}. When the elevator-operator wishes to throw the clutches in operation, he pulls down on the lever C^{34} by means of the depending handle C^{37}, thereby turning the shaft C^{14} and raising the arms C^{12} and C^{13} and likewise the clutches C and C′, attached to them.

Automatic stops.—It is obvious that if the clutch is thrown into action and the car brought to rest by means of my device, which is entirely independent of the hoisting machinery of the car, the machinery will continue to run until stopped in the usual manner. This often damages the hoisting-ropes and causes trouble, delay, and expense to readjust. To prevent this occurrence, I provide a means for automatically stopping the hoisting machinery at the instant the clutching device commences to operate. A rope E, connected to the pistons A^3 at one end, is secured to the starting-lever (in this case represented by E^6) of the hoisting machinery.

When the piston A^3 in cylinder A^5 drops, it pulls on the rope E, which in turn operates the starting-lever E^6. As the drop of the piston may be longer than the throw of starting-lever, I have adopted the following method, which is one of the many simple equivalent devices for overcoming this inequality.

The rope E, secured to piston A^3, passes over the sheaves E′ and E^2, between which the rope E loops downward and passes through a pulley E^3, attached to a weight E^4, resting on the shelf E^5. When the piston A^3 drops in the cylinder A^5, it pulls on the rope E, swinging the starting-lever E^6 to the opposite position, which having attained its full throw stops, the descending piston A^3 then raising the weight E^4 from the shelf E^5.

In the event of the operation of this safety device from any cause, the car will remain suspended on the safety-cables A and A′, until the car is again hoisted by its operating mechanism. When the car is again hoisted, the cables A and A′ being secured below in the well, the clutches C and C′ release their grip on the cables A and A′ the clutch swinging arms C drop back to their normal positions, the brake-sheave revolving in the opposite direction releases the hooks C^{23} and C^{24}, which drop back to their normal positions. The pistons A^2 and A^3 through the action of the counterweights ascend to the tops of the cylinders A^4 and A^5. The weight E^4 on rope E drops to its former position on the shelf E^5, and the starting device E^6 returns to its former position, the whole mechanism being then ready to again perform its functions.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is as follows:

1. In combination with an elevator-car, air-cylinders secured in the upper part of the wellway, free elastically-moving pistons in said air-cylinders, suspended depending safety-ropes attached to said free moving pistons, a clutching device secured to the car for the purpose of grasping the elastically-suspended safety-ropes; an endless rope attached to the clutching device which travels with the car and revolves a speed-governor, the said governor, a brake-wheel, stop-pins in brake-wheel, a brake-wheel friction-band, and hooks connected to the brake-wheel band, said brake-wheel friction-band operated by the governor for the purpose of throwing the clutches into action by arresting the movement of the traveling endless rope; all arranged substantially as shown and for the purposes set forth.

2. In an elevator safety device in combination with an elevator-car, an air-cushioning device consisting of cylinders and pistons; safety-ropes elastically suspended from the pistons, clutches for grasping the said elastically-depending safety-ropes, an endless traveling rope secured to the said clutches, a friction brake-wheel band, hooks attached to the said brake-wheel band, a brake-wheel, stop-pins in the brake-wheel adapted to be engaged by the hooks on the brake-band, a tension-adjusting screw for regulating the tension or pressure of the brake-wheel band on the endless rope attached to the clutches, and a speed-governor revolved by the endless rope; all arranged substantially as shown and for the purpose set forth.

3. The combination of a car, clutches including swinging arms on the car, an endless rope adapted to operate said arms, a brake-wheel driven by said rope, a friction brake-band around said wheel, stop-pins in said wheel and hooks and hook-shaft slidable in slots, said hooks being adapted to engage said pins, substantially as shown and described.

4. The combination of an elevator-car, the depending air-supported movable safety-ropes on each side, the clutches arranged to grasp the safety-ropes, an endless rope attached to the clutches through cross-shaft and arms, a hand-operated lever also attached to the cross-shaft, vertical rods connecting the overhead cross-shaft and the swinging clutch-arms, a brake-wheel, stop-pins on said wheel, a brake-band rigidly secured at one end, for retarding the movement of said endless rope, the other end arranged slidably in slots, hooks attached to said brake-band, and a governor for elevating said hooks till they engage with the stop-pins of the brake-wheel; substantially as shown and described.

5. The combination of an elevator-car, the cylinders overhead, the pistons within said cylinders, the depending ropes on each side secured to the pistons of the air-cylinders at the top of the wellway and to the floor at the bottom of the elevator-well, simultaneously-acting clutches on each side of the car, an

endless rope arranged to operate said clutches, a brake-wheel, a friction brake-band around the brake-wheel, an adjusting-screw for regulating the tension of the brake-band, stop-pins in the brake-wheel, and hooks on hook-shaft slidably mounted in slots for engaging the said stop-pins; substantially as shown and described.

6. In combination with a safety device herein described having air-cylinders and movable pistons, an automatically hoisting machinery stop mechanism, consisting, in proper relation, of a rope, a shelf, a weight on said rope resting on said shelf, the starting device, the said rope being attached to the piston within one of said cylinders and to the starting device of the hoisting machinery, the said rope being looped downward and passed through a pulley attached to said weight; substantially as shown and described.

MELANCTHON HANFORD.

Witnesses:
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CHARLES CARR.