(No Model.) 6 Sheets—Sheet 1.

J. PARKINSON.

COMBINED ELECTRIC HYDRAULIC ELEVATOR.

No. 571,730. Patented Nov. 17, 1896.

Fig. 1.

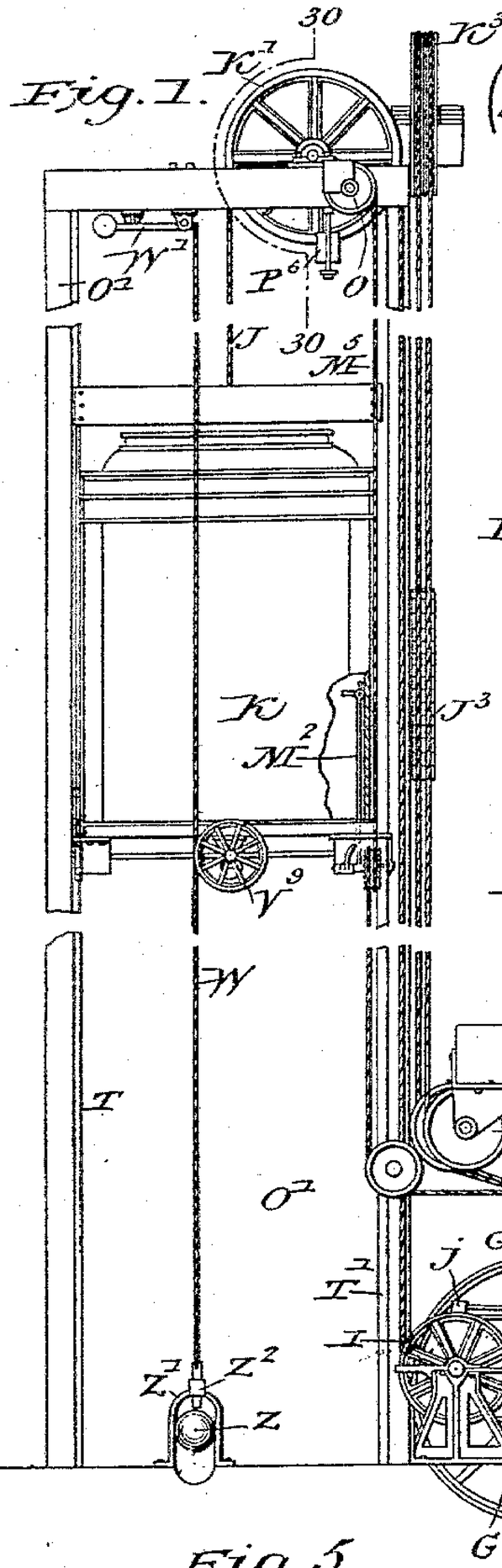


Fig. 2. (Line 2-2 Fig. 9.)

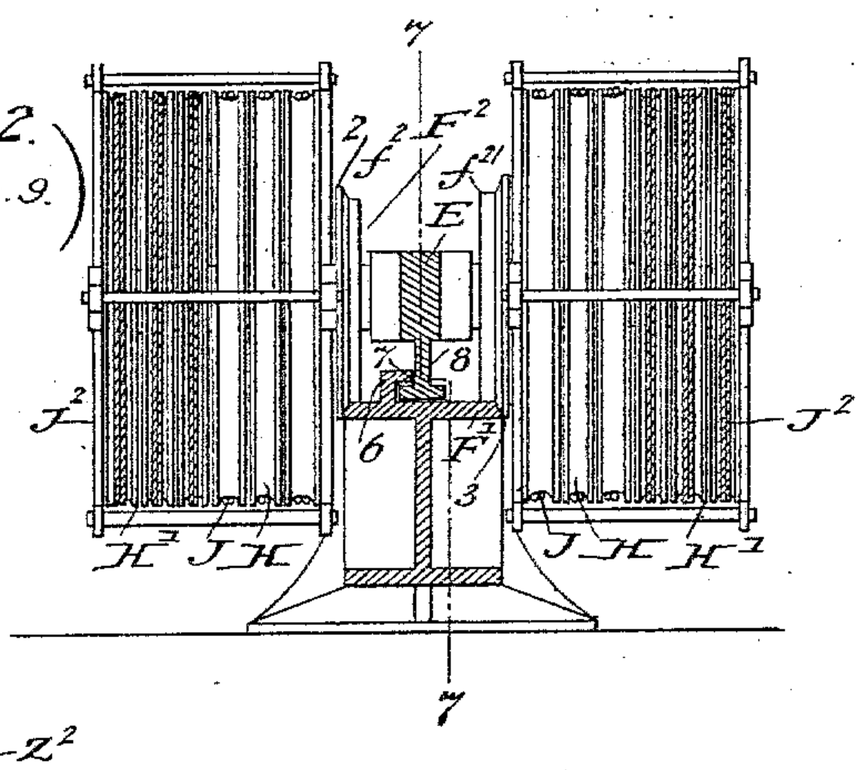


Fig. 3.

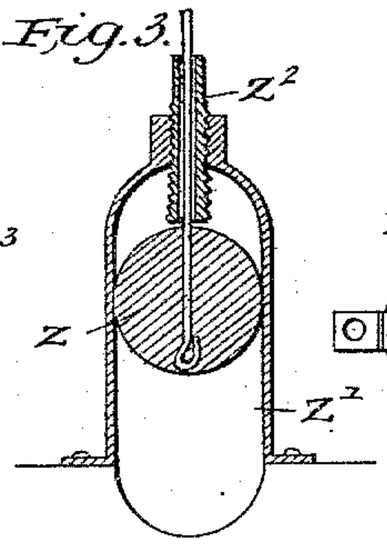


Fig. 4.

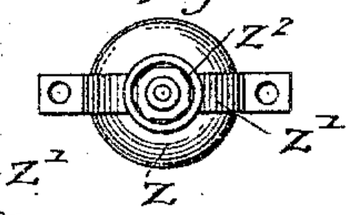


Fig. 5.

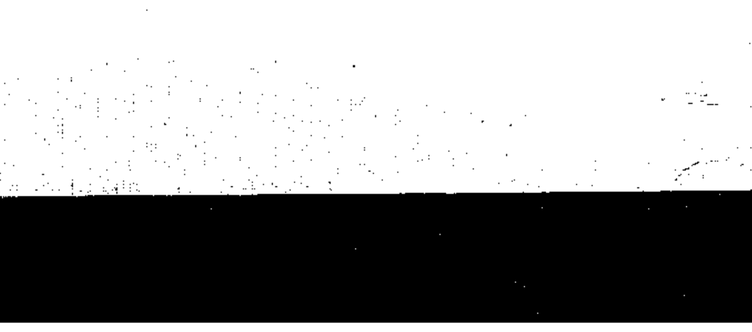
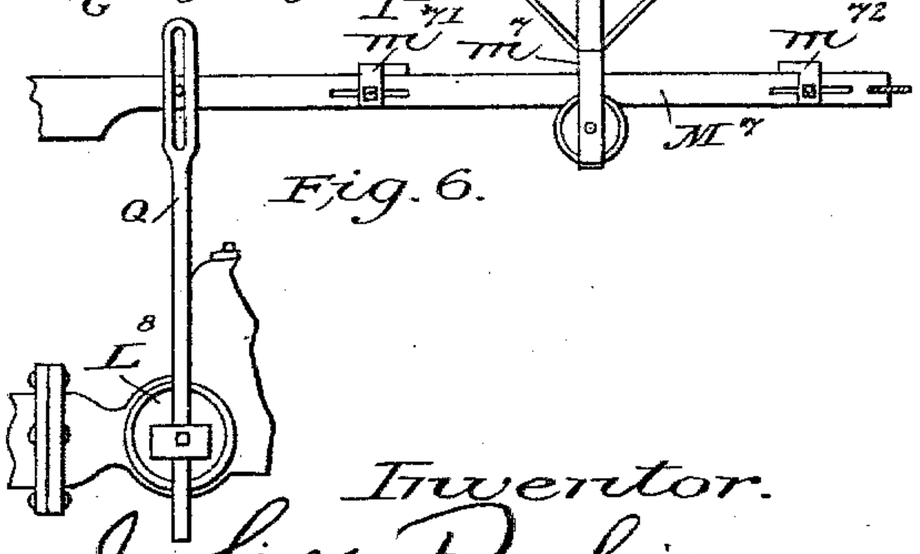


Fig. 6.



Witnesses.
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Inventor.
John Parkinson
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(No Model.) 6 Sheets—Sheet 2.

J. PARKINSON.

COMBINED ELECTRIC HYDRAULIC ELEVATOR.

No. 571,730. Patented Nov. 17, 1896.

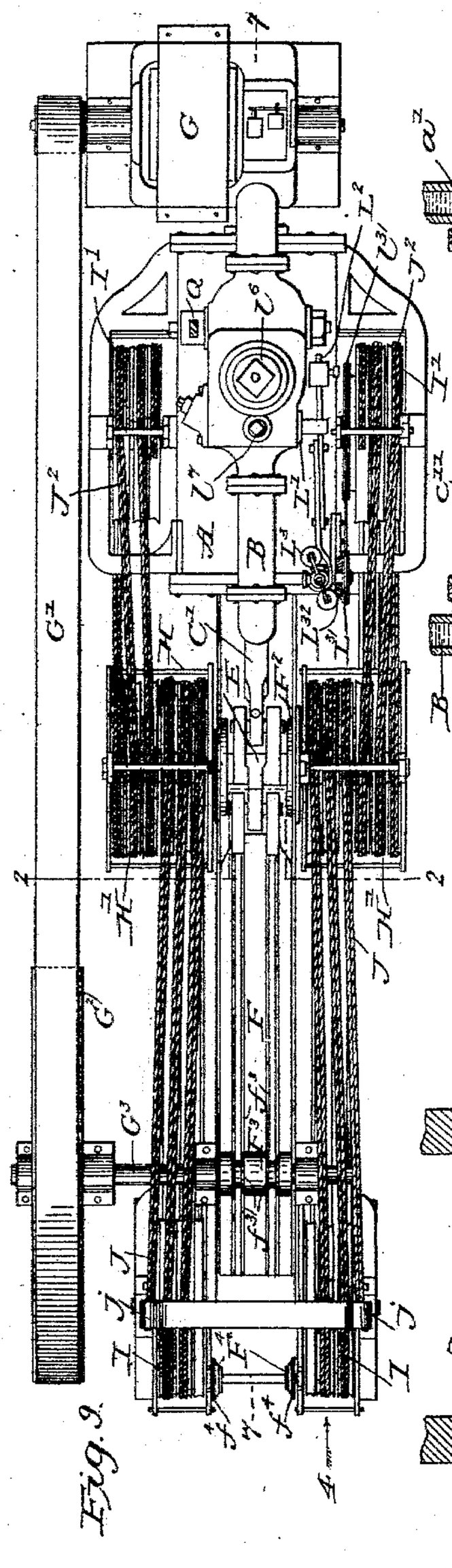

Fig. 9.

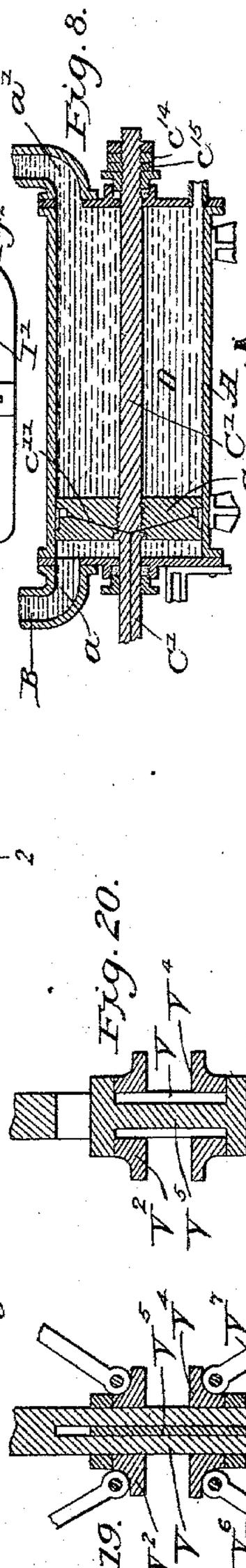

Fig. 8.

Fig. 20.

Fig. 19.

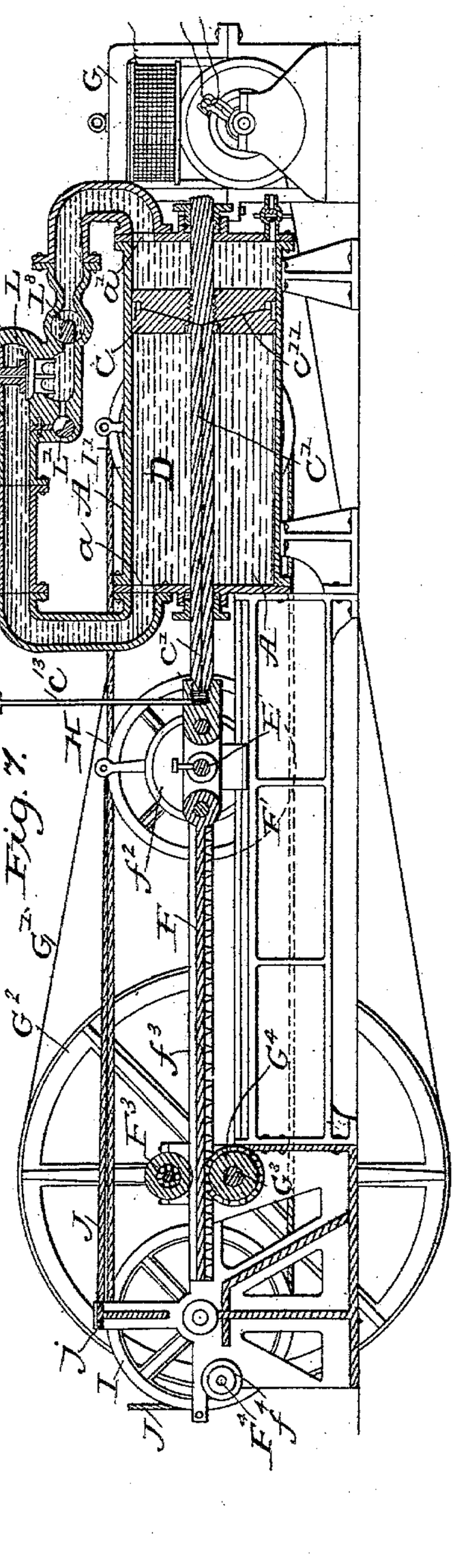

Fig. 7.

Witnesses.
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(No Model.) 6 Sheets—Sheet 3.

J. PARKINSON.

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No. 571,730. Patented Nov. 17, 1896.

Fig. 10.

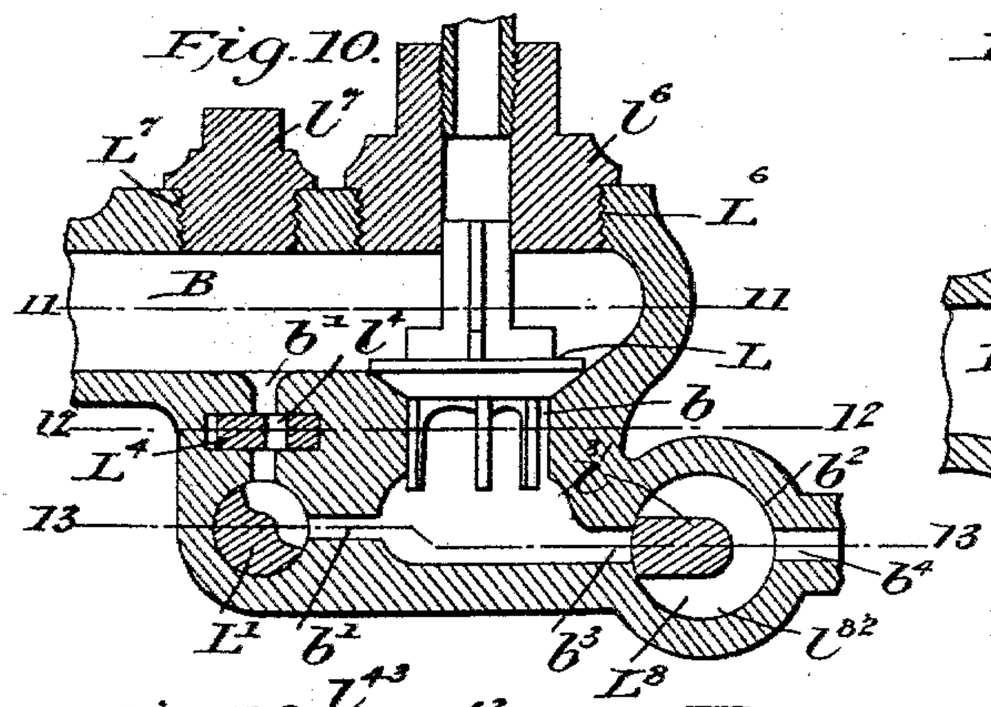


Fig. 11.

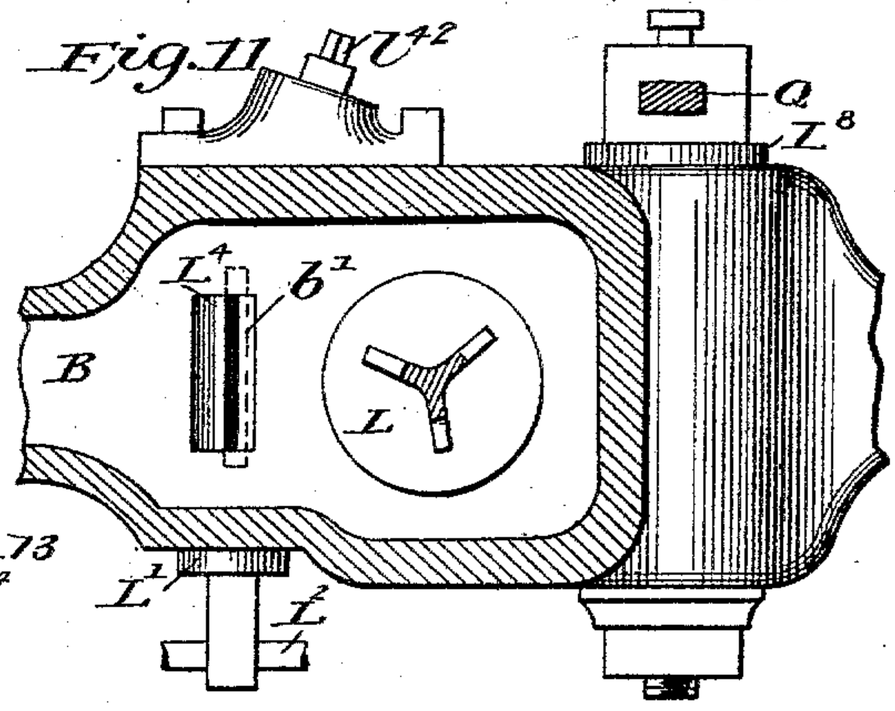


Fig. 12.

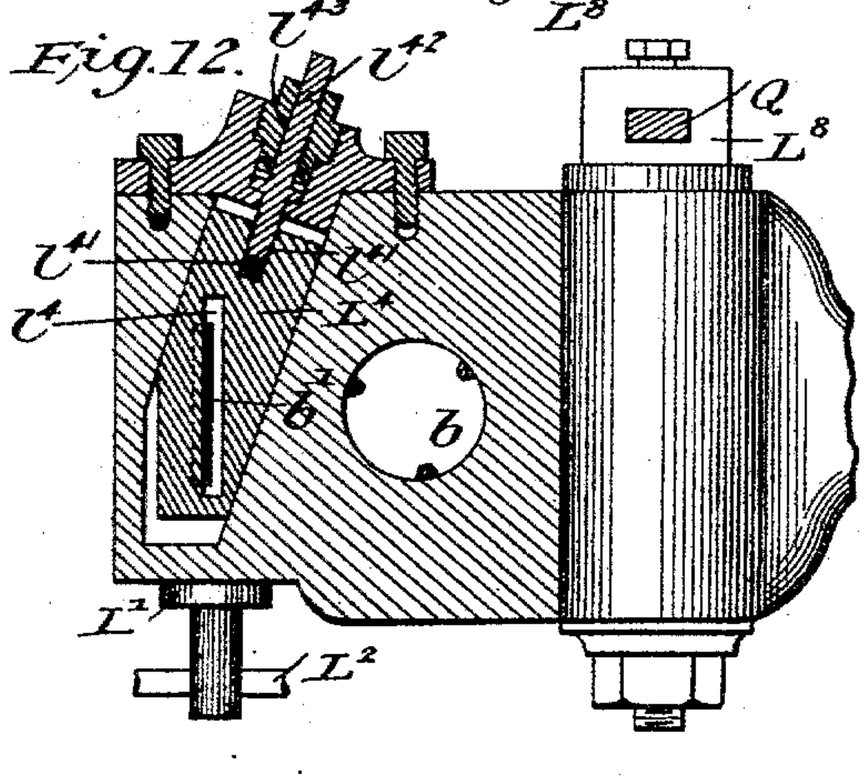


Fig. 13.

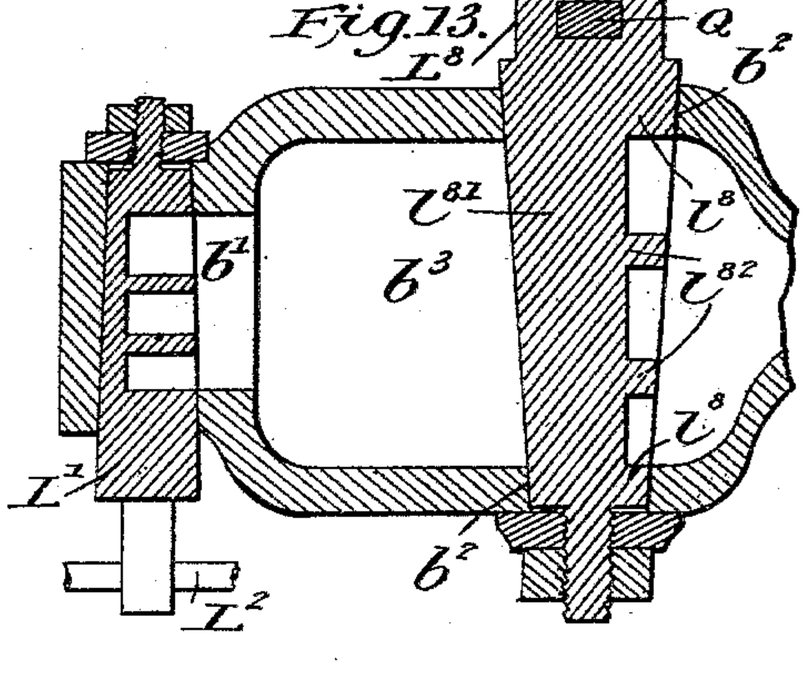


Fig. 14.

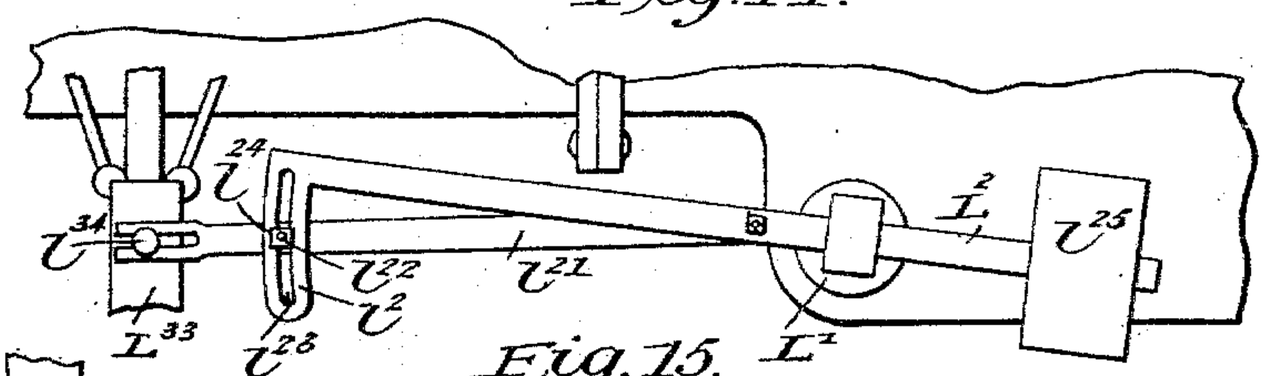
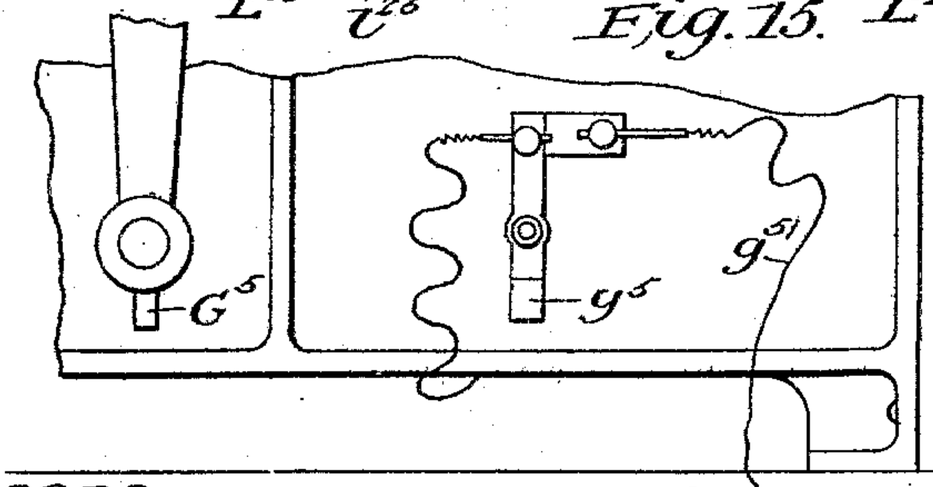


Fig. 15.



Witnesses.
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(No Model.) 6 Sheets—Sheet 4.

J. PARKINSON.

COMBINED ELECTRIC HYDRAULIC ELEVATOR.

No. 571,730. Patented Nov. 17, 1896.

Fig. 17.

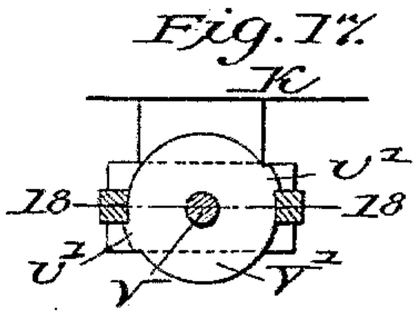
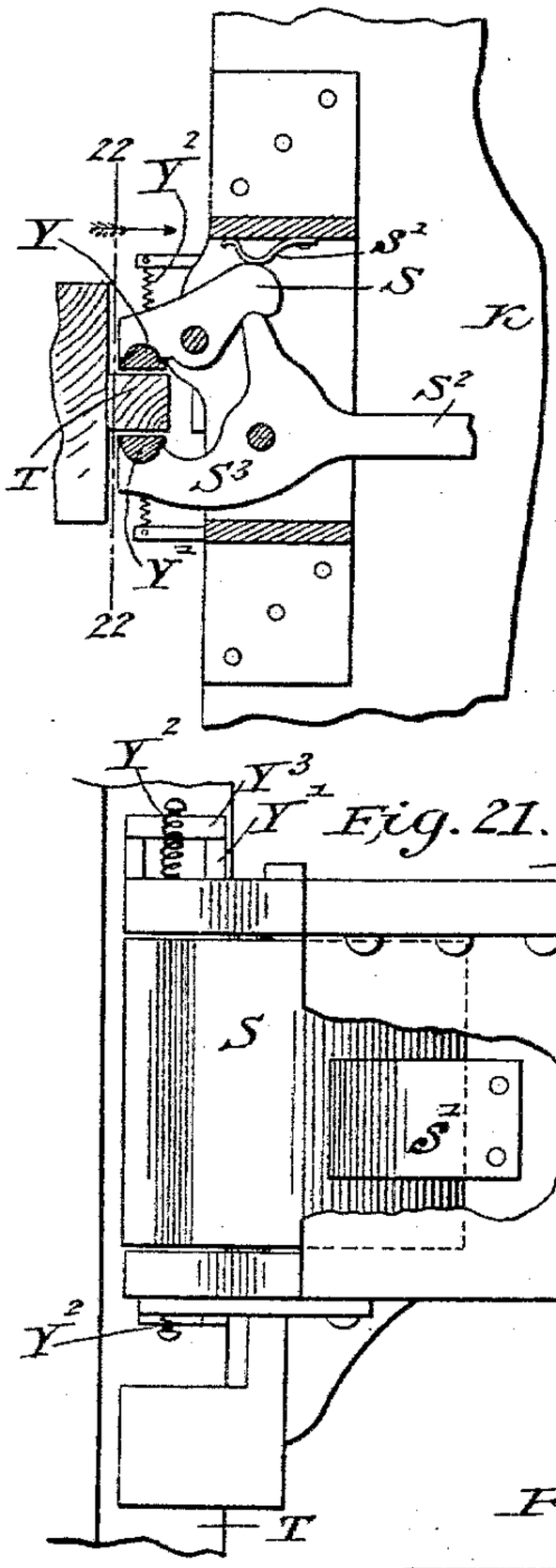


Fig. 16.



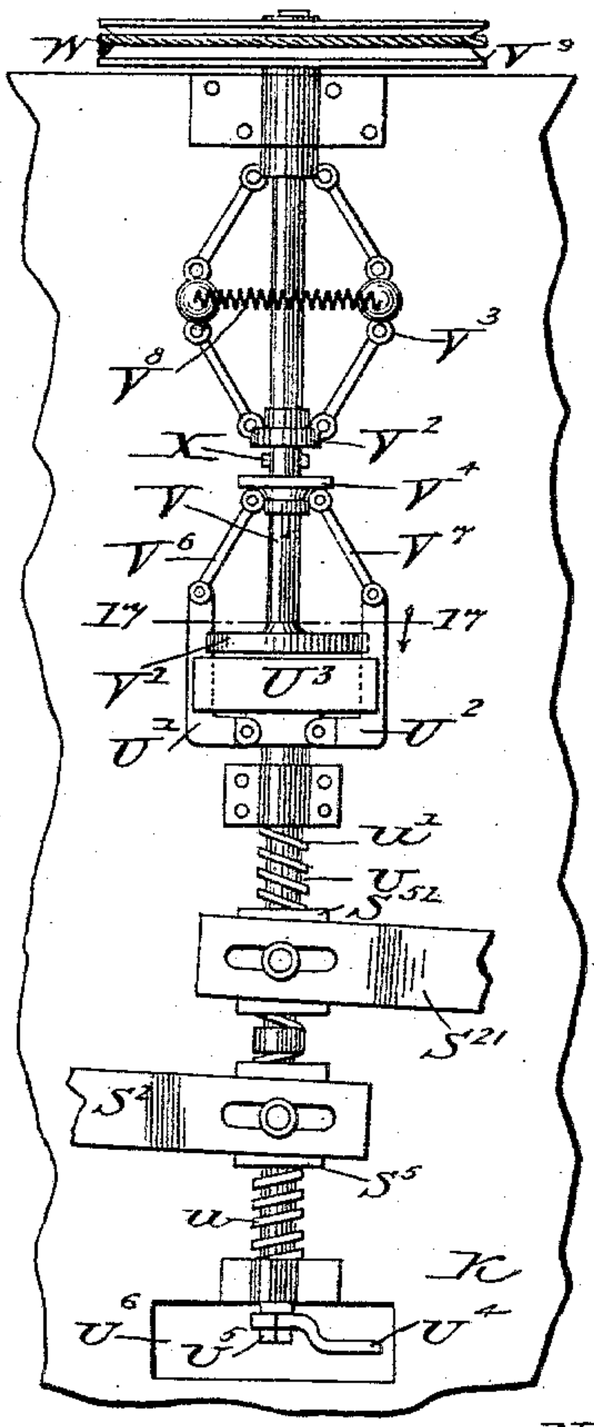
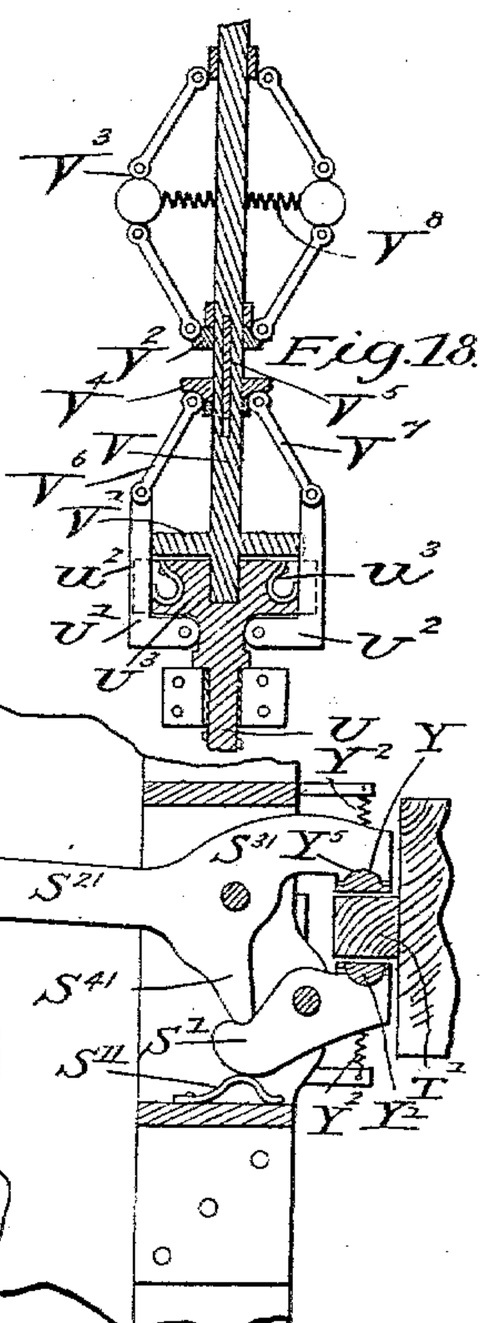


Fig. 18.



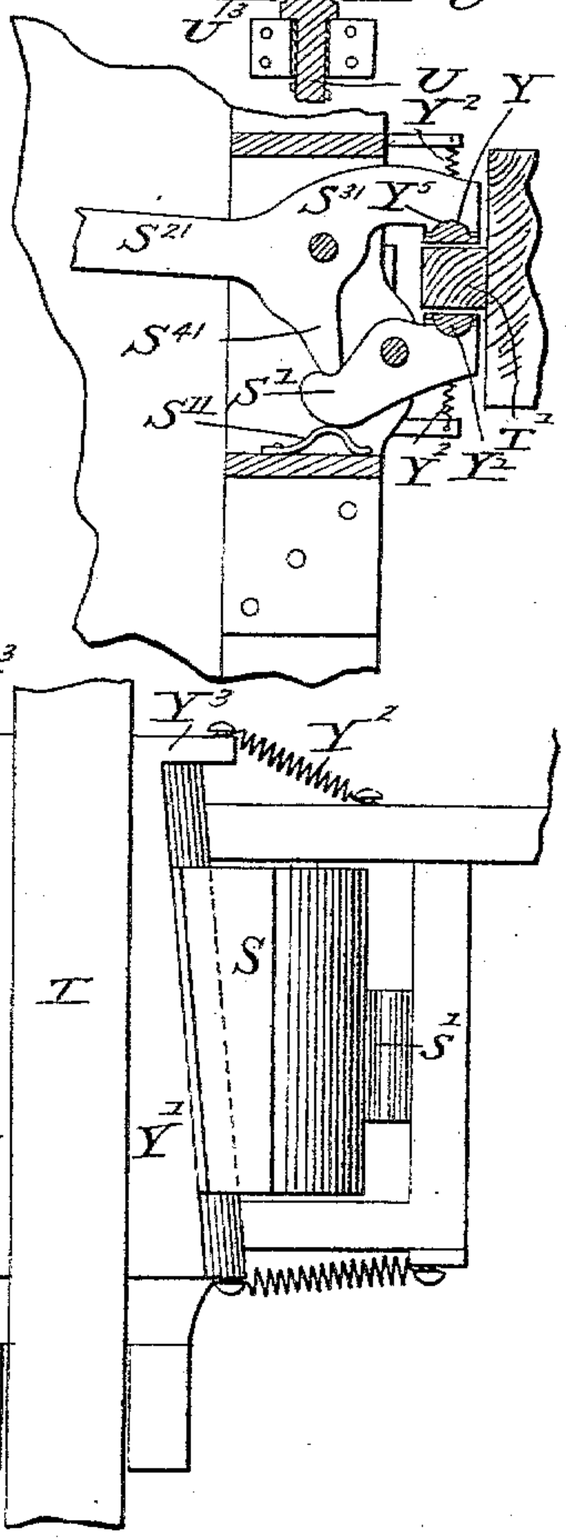
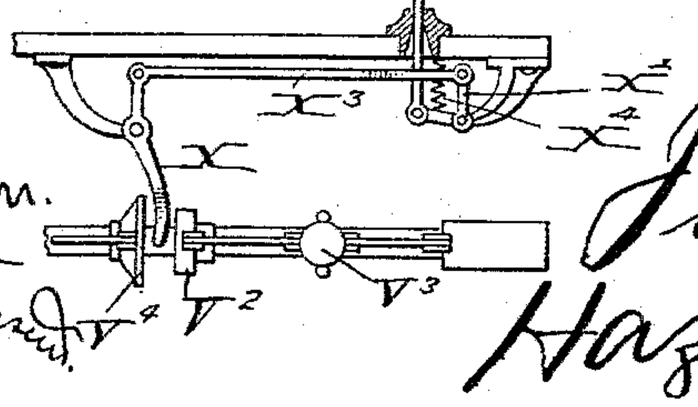


Fig. 21.

Fig. 22.

Fig. 23.



Witnesses.
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(No Model.) 6 Sheets—Sheet 5.

J. PARKINSON.

COMBINED ELECTRIC HYDRAULIC ELEVATOR.

No. 571,730. Patented Nov. 17, 1896.

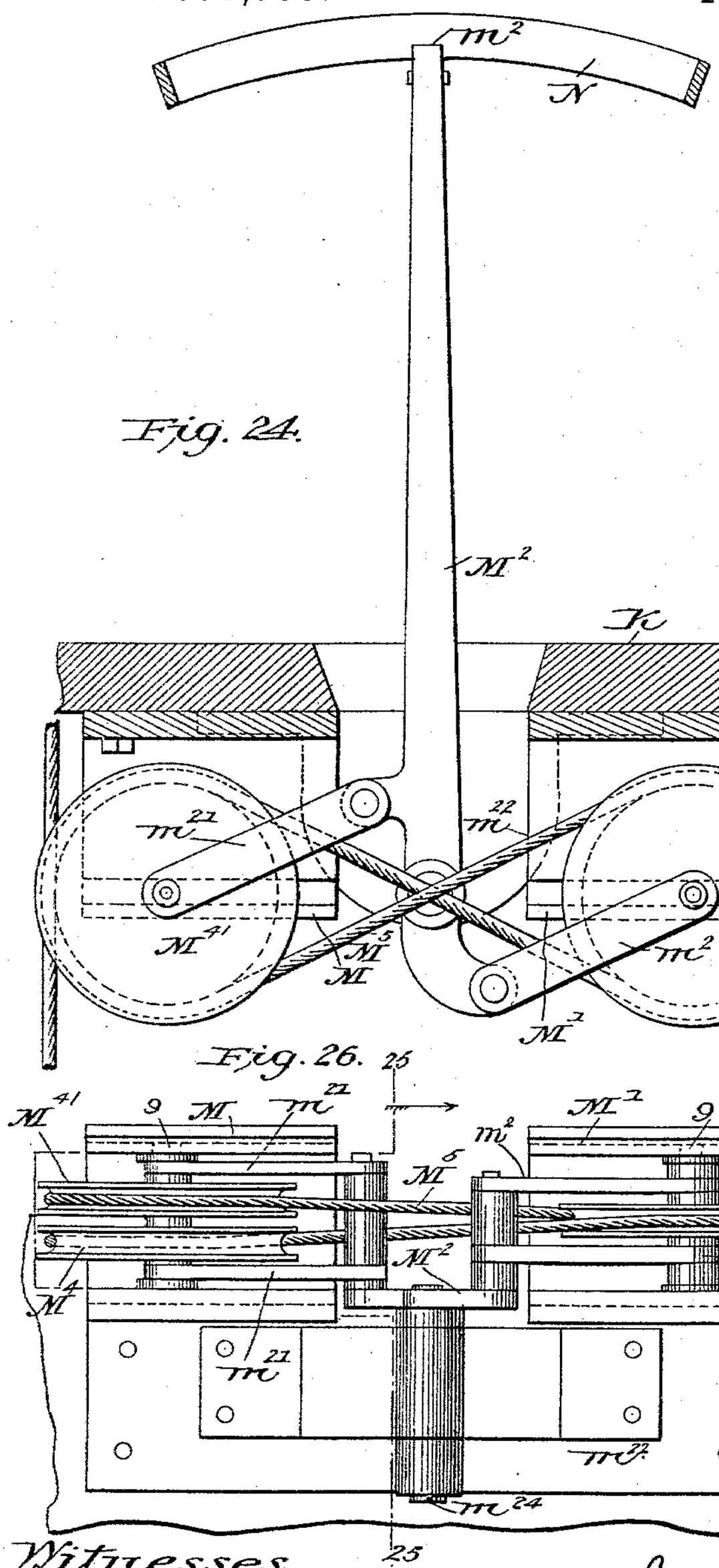

Fig. 24.

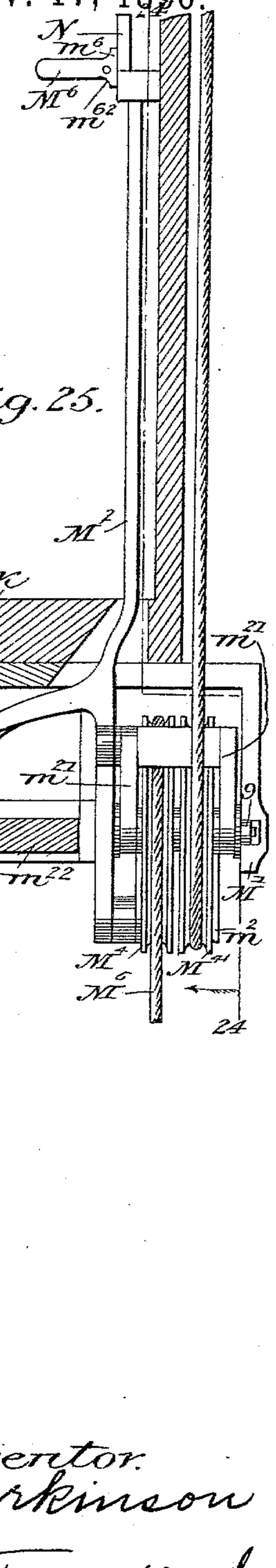

Fig. 25.

Fig. 26.

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(No Model.) 6 Sheets—Sheet 6.

J. PARKINSON.

COMBINED ELECTRIC HYDRAULIC ELEVATOR.

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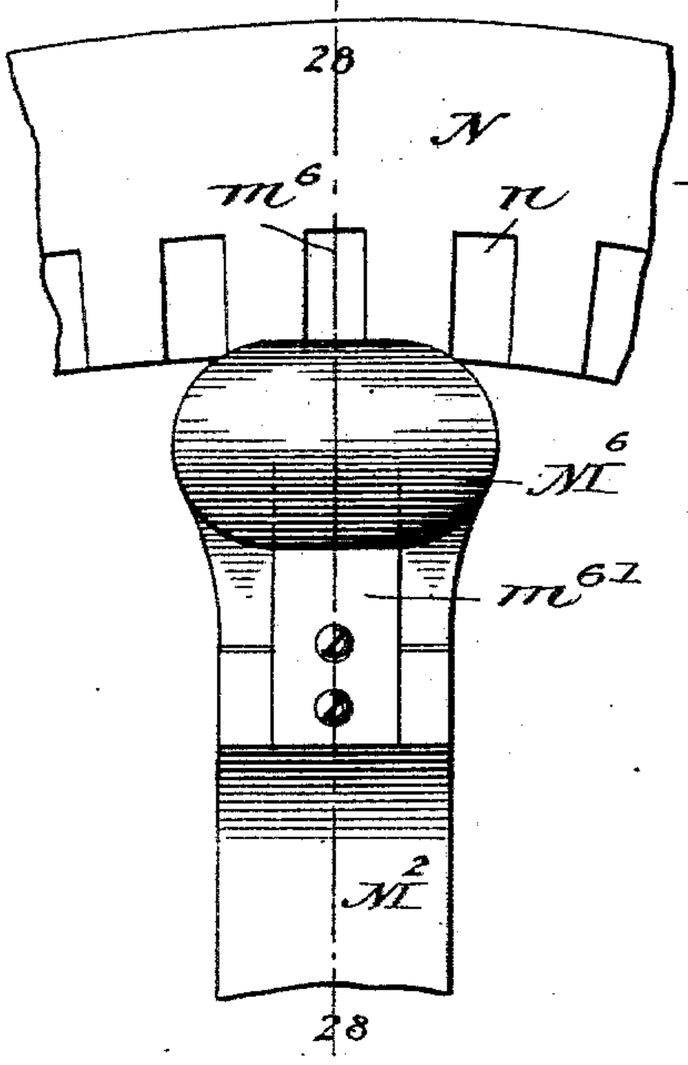

Fig. 27.

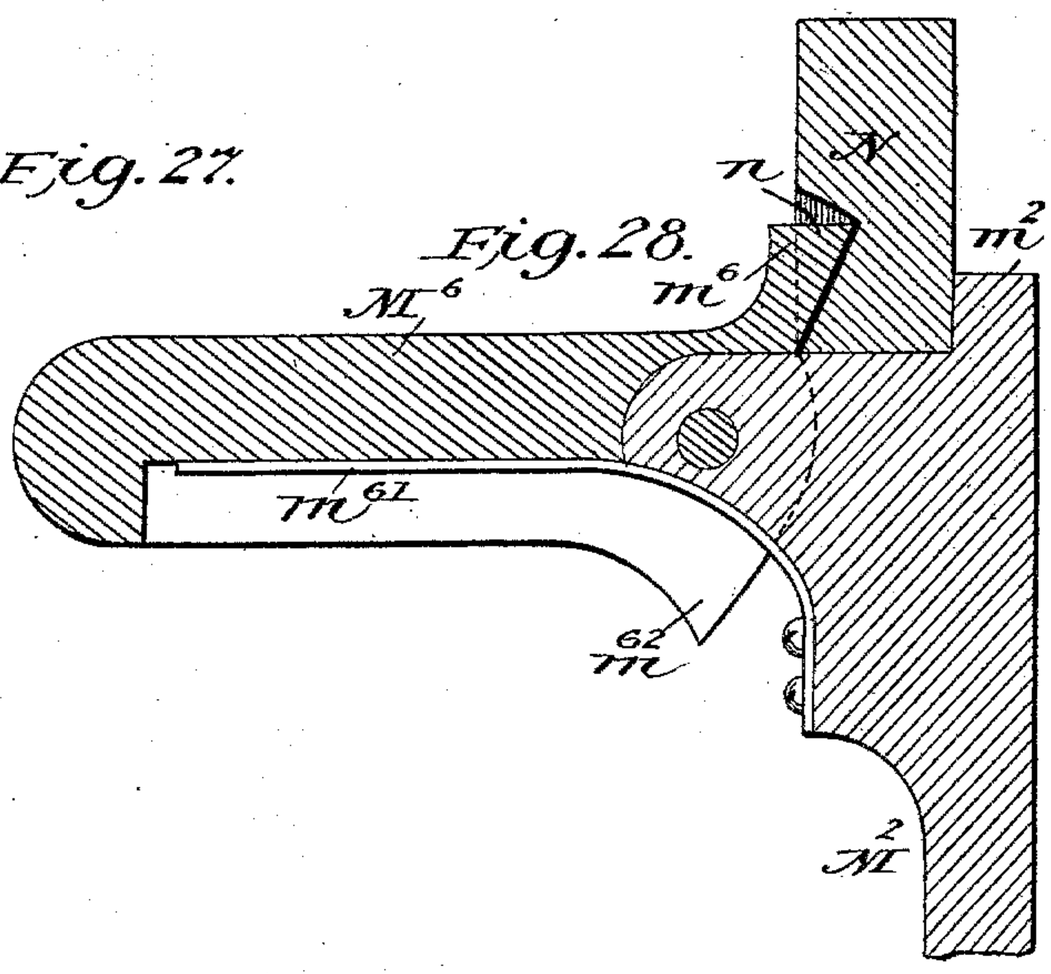

Fig. 28.

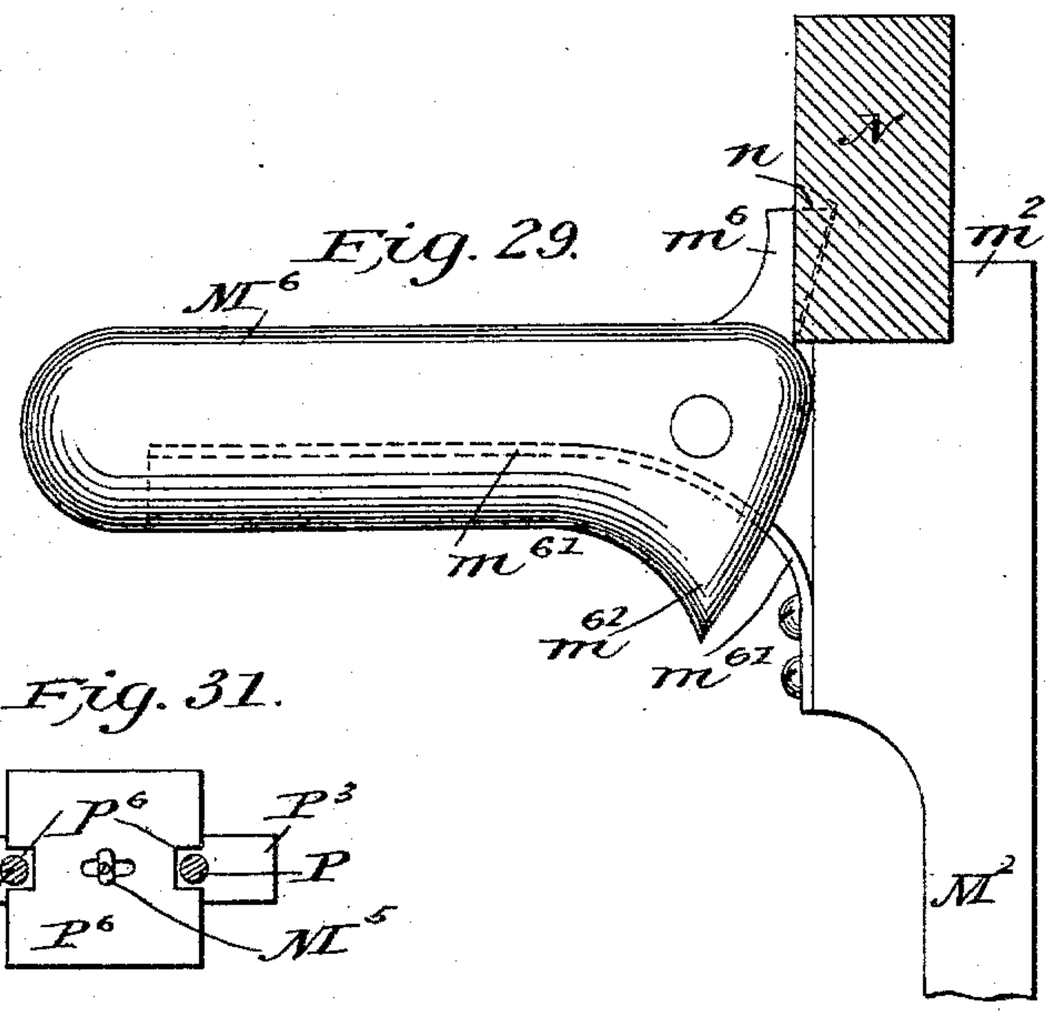

Fig. 29.

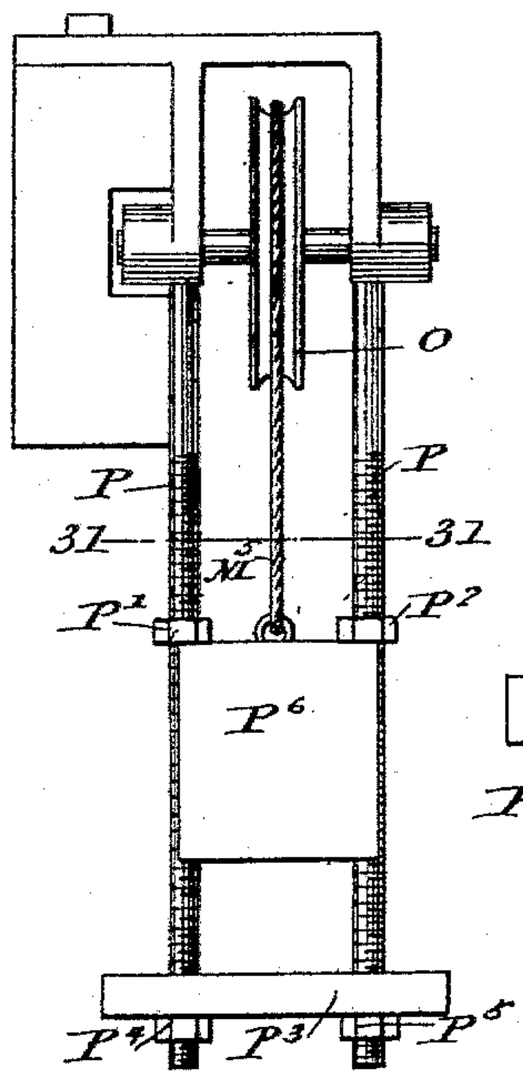

Fig. 30.

Fig. 31.

Witnesses.
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UNITED STATES PATENT OFFICE.

JOHN PARKINSON, OF LOS ANGELES, CALIFORNIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE PARKINSON ELEVATOR COMPANY, OF SAME PLACE AND PHŒNIX, ARIZONA TERRITORY.

COMBINED ELECTRIC HYDRAULIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 571,730, dated November 17, 1896.

Application filed April 10, 1895. Serial No. 545,175. (No model.)

To all whom it may concern:

Be it known that I, JOHN PARKINSON, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented new and useful Improvements in Combined Electric Hydraulic Elevators, of which the following is a specification.

My invention relates to the new class of elevators set forth in my former application for Letters Patent, Serial No. 536,198, filed January 25, 1895, in which the piston of a hydraulic safety appliance is connected with a rack which is operatively connected with the car hoisting or driving mechanism of the elevator and in which the elevator-car is supported by the hydraulic safety appliance at all times when the car is not moving upward.

By my present invention I am enabled, with very simple means, to use a piston having only one head, which plays in a cylinder and divides the cylinder into two compartments, and I return the water from side to side of the piston-head through a valved conduit which connects the two compartments through the heads of the cylinder. The valved conduit is not broadly new, but is an improvement over former constructions. In my present device I have also added a new valve to this conduit, by which I am enabled to readily set the machine to a desired limit of speed of descent.

One object of my invention is to simplify my safety appliance by using a piston having but one head; also, to make the valves of such appliance more accessible.

Another object is to make a machine by which to successfully apply the said invention, embracing said hydraulic piston and rack, to horizontal multiple-sheave elevators, so that such machines can be converted from hydraulic machines to electric machines; that is to say, to machines driven by electric power applied directly and not through the medium of water under pressure. By my present invention I am able to use a large portion of the machinery of the hydraulic multiple-sheave machines and thereby make a great saving in space in buildings now using hydraulic machines by doing away with the furnace, boilers, pumps, cisterns, and pressure-cylinders. I also dispense with all connections with pressure from the mains and dispense with all connections with and waste of water into sewers consequent upon direct connection of hydraulic elevators with city water-mains.

Another object is to so arrange the multiple sheaves that the counterweight will exert a power on the multiple sheaves equal to the power required to raise the car under normal conditions; also, to allow a construction by which the travel of the counterweight can be less than that of the car.

Another object is to provide in the horizontal multiple-sheave type of elevator a valve controlled by the governor and which will control the speed of descent of the car.

Another object is to provide adjustable means for accurately setting the descent-speed-controlling valve to operate at any desired limit of speed.

Another object is to provide an automatically-operated switch which will cut off the electric current when the car reaches a limit of upward travel.

Another object is to provide more simple means for operating the valves and rheostat in conjunction and with relation to each other.

Another object is to devise a machine of the multiple-sheave horizontal elevator type in which the power can be applied by a belt or by a cog-gear with and without the interposition of an electric motor.

Another object is to provide a new safety device to be carried by the car, and which is very simple in its mechanism and powerful in its operation, to hold the car in case of accident and to stop it with but little jar, and yet make the stop absolutely certain.

Another object of this invention is to provide for convenient means for lubricating the piston-head from the exterior without having to take off the head of the cylinder.

Another object is to provide a new and very simple device for holding and operating the single controlling-rope and by which a large movement of the rope is produced by a slight movement of the lever.

Another object is to provide a new adjustable take-up for the controlling-rope; also, to provide a new take-up for the safety-device rope.

Another object of my invention is to provide a new and improved connection between the hydraulic piston and the power-pinion.

Another object is to provide an improved construction of the wide-way valve in which a large discharge is required with small movement of the valve.

Another object is to provide means for readily and accurately setting a limit to the speed of descent.

Another object is to provide a convenient means for throwing the safety device into operation from within the car.

Another object is to provide a traveling truck for carrying the movable sheaves and to hold the same in position.

My invention embraces the various parts, improvements, and combinations hereinafter described and claimed.

In my application for Letters Patent of the United States, Serial No. 568,898, filed November 14, 1895, I have broadly and generically claimed the invention underlying this appliance, and which invention consists, essentially, of controlling the downward movement of the elevator-car by a body of liquid arranged to flow from one liquid-containing compartment to another through passages provided with valves which regulate the obstruction which the liquid may present to the operation of the piston.

The new type of elevator which I have invented and which is claimed in said application includes, broadly, the combination, with an electric motor, of a piston operated thereby and operatively connected with the car to drive the same, and suitable means or appliances arranged to allow the free movement of the piston when the car ascends and to afford perfect control of the movement of the piston at the descent of the car. The said invention comprises an electric lifting apparatus and a hydraulic supporting and lowering apparatus so arranged in combination that the strain is taken off of the electric motor at all times except when the motor is in operation to raise a load. It comprises a cylinder, a piston arranged in such cylinder, means connected with the piston to move it in one direction, a receptacle or reservoir, a body of liquid in the cylinder and receptacle, a passage being provided between the receptacle and cylinder, a valve arranged to allow the liquid to flow freely through such passage from the receptacle into the cylinder and prevent its return, a passage being provided to allow liquid to flow from the cylinder into the receptacle, a valve arranged to control and to prevent the flow of liquid through such passage, and means for operating such valve.

No claim is herein made, broadly and generically, to said invention, because the same is broadly claimed in said application, Serial No. 568,898.

The accompanying drawings illustrate my invention.

Figure 1 is a fragmental elevation of an elevator embodying my invention, a part of the car being broken away for clearness of illustration. Fig. 2 is a vertical cross-section on line 2 2, Fig. 9. The traveling sheaves are shown in elevation. Fig. 3 is a sectional detail of the adjustable take-up and tension for the rope which operates the safety device. Fig. 4 is a plan of the same. Fig. 5 is a fragmental detail showing the under side of the piston-rack and its pinion. Fig. 6 is a fragmental detail showing the connection between the controlling mechanism and the operating-valve. This view is taken looking from rear to front in Fig. 1. Fig. 7 is a fragmental vertical longitudinal section of the car hoisting and supporting apparatus. Line 7 7, Figs. 2 and 9, indicate the line of section. Fig. 8 is a fragmental mid-section on same line, showing the piston at the lower limit of its stroke. Fig. 9 is a plan of the hoisting and supporting apparatus. Fig. 10 is a fragmental vertical sectional detail of the valves shown in Fig. 7. This view is taken on the same line of section as Fig. 7 in a larger scale. Fig. 11 is a horizontal section on line 11 11, Fig. 10. Fig. 12 is a horizontal section on line 12 12, Fig. 10. Fig. 13 is a horizontal section on line 13 13, Fig. 10. Fig. 14 is an elevation of the governor mechanism for controlling the speed-descent governor-valve. Fig. 15 is a fragmental elevation of the electric switch and trip for cutting off the current when the car reaches its upper limit of travel. Fig. 16 is an inverted fragmental plan of the car, partly in section. This view is taken looking at the under side of the car and illustrating the safety device which is attached to the car. The governor and the operative parts connected therewith and the gripping devices are shown in full. The floor of the car and the levers which connect the gripping devices with the governor appliance are broken to contract the view. The governor and clutch are shown in operative position to rotate the screw-shaft, and the grip-operating levers are shown just started to operate the grips. Fig. 17 is a sectional elevation on line 17 17, Fig. 16, showing the governor-operated clutches partly in section. In this view the parts are shown upright. Fig. 18 is a fragmental longitudinal plan section on line 18 18, Fig. 17, to illustrate the governor and operative parts which operate the gripping-levers. Fig. 19, Sheet 2, is a larger detail of a part of the structure shown in Fig. 18. Fig. 20, Sheet 2, is a fragmental plan view at right angles to Fig. 19. Fig. 21 is a fragmental elevation of one side of one of the gripping devices. In this detail the short jaw shown at the left in Fig. 16 is in sight and a portion of the hanger is broken away to expose the spring which retracts such jaw. Fig. 22 is a fragmental elevation of one guide and the gripping device gripped thereon. This view is taken on line 22 22, Fig. 16, looking toward the car. In comparing Figs. 21 and 22 with Fig. 16 it must be ob-

served that Fig. 16 shows the parts inverted. Fig. 23 is a detail of the mechanism to enable the operator within the car to throw the safety device into operation. Fig. 24 is a fragmental elevation, partly in section, showing the operating or control rope lever and pulleys and connections which are carried by the car. Line 24 24, Fig. 25, shows the line of section. Fig. 25 is a fragmental sectional elevation of the same mechanism, looking toward the right in Fig. 24. Line 25 25, Fig. 26, shows the line of section. Fig. 26 is an inverted plan looking at the under side of the control rope, lever, pulleys, and connections which are carried by the car. Fig. 27 is a fragmental detail of the rack and handle for holding and moving the control rope and lever. Fig. 28 is a section of the same on line 28 28, Fig. 27. Fig. 29 is a fragmental elevation showing the handle and fragments of the rack and lever shown in Fig. 27. Fig. 30 is an elevation of the rope take-up and tension device, looking toward the right on line 30 30 at the top of Fig. 1. Fig. 31 is a plan on line 31 31, Fig. 30.

In constructing my machine two sets of sheaves for operating the car and two sets of sheaves for operating the counterweights are employed and are arranged with one set of each on opposite sides of the rack and piston which operate and control the traveling sheaves. This balances the machine. The double sets of sheaves are shown in the plan view, Fig. 9, and are there indicated in a general way by the reference-characters 4 and 5. In the particular description hereinafter given reference is made to the parts as though there were but one set of sheaves for the car and but one set for the counterweight.

I will first proceed to describe my improved hydraulic supporting device. This comprises the combination of a hydraulic cylinder A, having a port a a' at each end, a valve-controlled conduit B connecting the ports, the car-supporting piston arranged with its head C within the cylinder between the ports and its rod C′ extending through both ends of the cylinder, and a body of liquid D in the cylinder and conduit. By this simple contrivance I am enabled to use a single head within a straight cylinder, dividing the cylinder into two compartments, and the valves which control the conduit are made very accessible, the conduit being preferably arranged above the top of the cylinder. It is important in a hydraulic supporting device of this character that the piston-rod should play through both ends of the cylinder in which the piston-head mounted on such rod plays, for by this means when the piston moves the consequent contraction of space on one side of the head is exactly compensated by the increased space on the other side of the head within the cylinder, thus allowing the piston to play freely, subject only to the friction of the liquid through the conduit and the controlling operation of the valves.

E indicates a cross-head fastened to one end of the piston-rod C′.

F indicates a rack connected with the cross-head and connected with the driving mechanism of the elevator. This driving mechanism includes the motor G, the belt G′, the belt-pulley G^2, the power-shaft G^3, and the pinion G^4. The belt-pulley or power-wheel G^2 and the pinion G^4 are fixed upon the power-shaft G^3, and the pinion meshes with the rack, so that when the motor is driven in one direction the rack will be driven in one direction, together with the piston-rod and its piston-head, and vice versa.

H is a car-operating traveling sheave mounted on the cross-head E, and I is the car-operating fixed sheave, and J is the car-operating cable fixed to a suitable support j at one end, passed thence around the traveling sheave H and the fixed sheave I, and operatively connected with the car K at the other or free end in the ordinary manner, being passed over the supporting-pulley K′ and down to the car, as is common in the usual mode of construction.

In order to cause the counterweight to exert a power on the multiple sheaves equal to the power required to raise the car under normal conditions, I provide a counterweight fixed sheave I′ and a counterweight traveling sheave H′. Both of the traveling sheaves H H′ are mounted upon the cross-head E, which is connected with the rack F, and the two fixed sheaves are arranged upon opposite sides of the traveling sheaves and in one plane therewith, so that the two traveling sheaves are arranged to travel together between the fixed sheaves.

J^2 indicates a counterweight-cable fixed at one end to a suitable support j^2, passed thence around the counterweight operating traveling and fixed sheaves, and operatively connected with the counterweight J^3. The connection with the counterweight is made in the ordinary manner, the cable being passed under the depression-pulley K^2 and over supporting-pulley K^3, and thence down and fastened at its free end to the counterweight. This construction is applicable to ordinary hydraulic-driven multiple-sheave elevators, and by its means it is possible to so gear the tackle that the counterweight will move only through a short distance, say through only one story, while the car moves the whole length of the well. This will be done by using a larger number of pulleys on the car-operating sheaves than are used on the counterweight-sheaves. This modification will be easily understood without further illustration and can be applied by any competent mechanic.

By means of my improvement as above outlined I am enabled to apply the driving power in a practical manner from the motor to the power-shaft through the power-shaft pulley by a belt leading directly from the motor to such pulley. I believe my invention

to be an improvement over all other elevators in the extreme simplicity of the machinery by which I apply the power from the motor, and I regard this simple combination of elements as a very important invention in elevators.

The valves which control the flow of liquid through the conduit are operatively connected with the car through suitable mechanism, which I will hereinafter describe, and by means of this the flow of liquid will not afford any obstruction while the car is rising, but will control the speed of descent and will support the car at all times when the car is not rising.

I provide suitable guides for the rack to hold the same constantly and truly in mesh with the power-pinion G^4. The guide for one end of the rack is essentially composed of the track F′, upon which runs the truck F^2, which carries the cross-head E to which the rack, piston, and sheaves are fastened. The truck is provided with two carrying-wheels f^2 f^{21}, each having a beveled flange 2. (See Fig. 2.) The track F′ for such carrying-wheels is provided at its edges with beveled faces 3 to fit the flanges, and it has a retaining-web 6, projecting from its upper side between the beveled faces and provided with a retaining-flange 7.

The truck F^2 is provided with a hooked arm 8, depending from the truck and hooking into the retaining-web underneath the retaining-flange 7. Thus the truck is kept constantly in exact line between the cylinder A and the pinion G^4. The guide for the other end of the rack comprises a guide-roller F^3, which is mounted above the rack opposite the pinion and engages the back of the rack. It is grooved to fit ribs f^3 on the back of the rack. I prefer to use a rack and pinion having several distinct spur-gears. The teeth instead of being in line are arranged in steps to give a continuous bearing. (See Fig. 5.) This construction, however, is not claimed to be new, although I do not know that it has been applied to elevators. The ribs of the ribbed rack are beveled at their sides, and the grooves f^{31} in the roller are beveled to fit such ribs, and this construction, in combination with the guide for the other end of the rack, holds the rack constantly in proper mesh with the pinion and in line with the piston-rod. The traveling sheave-carrying truck is fastened to the rack through the medium of the cross-head, and the flanged web 6 and the depending hooked arm 8 afford suitable means for holding the truck down upon the track and thus holding the rear end of the rack in proper line with the piston-rod. The rack and the piston-rod are pivoted to opposite sides of the cross-head and play back and forth in a horizontal line.

F^4 is a supporting-roller arranged beneath the path of the rack beyond the pinion G^4 to engage the under side of the end of the rack after it has passed the pinion, and thus support the end of the rack at the latter part of its downward stroke; that is, the close of the stroke when the car is descending. The roller F^4 is provided at its sides with flanges f^4, which engage with plain faces f^{41} at the sides of the teeth on the under face of the rack. (See Figs. 5, 7, and 9.)

While at present I deem it preferable to use in the cylinder and conduit glycerine or some other oil, or a mixture of oil and water as the liquid for the hydraulic safety-support, yet in order to provide for lubricating the piston-head, if it should at any time be found desirable to do so, I have invented means for conveniently accomplishing this lubrication. The piston-rod C′ is provided with a longitudinal oil-duct c', and the piston-head C, mounted on the rod, is provided with oil-ducts c^{11}, extending from its rim and communicating with the piston-rod duct, and an oil-reservoir c^{12} is arranged above the plane of the piston-head, and an oil-tube c^{13} is arranged connecting said reservoir with the piston-rod duct outside of the cylinder. By this construction the oil in the oil cup or reservoir c^{12} flows through the tube and ducts to the rim of the piston-head and constantly lubricates the bearing between such head and the cylinder.

In order to accurately limit the movement of the piston-rod to the point of descent desired and also to prevent the piston-head from jamming against the ends of the cylinder at the close of the descent of the car, I mount upon the projecting free end of the piston-rod a suitable stop-nut c^{14}, arranged to screw back and forth upon the end of the piston-rod and to be set at such a point thereon that it will engage the rear head of the cylinder when the car has reached the downward limit of its travel. It is preferably fastened by a lock-nut.

c^{15} indicates a rubber cushion to receive the impact of the stop-nut.

In order to absolutely cut off the electric current from the motor when the car has reached the upward limit of its travel, I provide a switch-trip G^5, carried by the car-operating machinery and arranged to operate the switch g^5, which controls the electric-supply conductor g^{51}, which is connected with the electric motor G. The switch-trip G^5, as I have shown it, is fastened to and carried by the cross-head E, and it is arranged to operate the switch to cut off the current when the car has reached the upward limit of travel. The switch g^5 is to be set at the proper position in the path of the switch-trip, so as to be engaged by such trip when the car has reached the point above which it is not to ascend.

My present elevator, like the one described in my said former application, is provided with a valve-controlled conduit B, which connects the end ports of the cylinder A. This valved conduit is provided with a check-valve L, arranged to allow the liquid to flow freely

from one compartment of the cylinder to the other when the piston moves during the ascent of the car and to wholly cut off the flow of liquid through its passage *b* when the piston returns in the opposite direction during the descent of the car.

A speed-descent governor-passage *b'* is arranged to connect the conduit around the check-valve and independent of the check-valve passage, so that when the check-valve has cut off the flow the liquid is still allowed to flow through the speed-descent governor-passage of the conduit.

L' indicates the speed-descent governor-valve, and L^2 indicates a valve-lever connected therewith to partially rotate the same.

L^3 indicates the speed-descent governor operatively connected with the car K through suitable intermediate connections, which, as shown in the drawings, consist of the car hoisting or driving mechanism and suitable means connecting the governor with such mechanism. I will now describe such connecting means.

L^{31} is a pulley connected by beveled gear L^{32} with the governor-shaft L^{33}, and this pulley is driven by a pulley l^{31}, which is secured to rotate with one of the fixed counterweight-sheaves, which is operated by the car-driving mechanism through the cables. The valve-lever is connected with the speed-descent governor by suitable adjustable connections which I will now describe. The valve-lever L^2 is provided between the lever and the governor with an arc l^2, having the axis of the valve for center. (See Fig. 14.)

l^{21} is a connecting-rod pivoted to the valve-lever between the valve and the arc and adjustably fastened to the arc by suitable means, such as the set l^{22}, fastened to the connecting-rod and passed through a slot l^{23} in the arc, and there secured by a nut l^{24}. The governor is operatively connected with the connecting-rod l^{21} by the pin l^{34}, working in a slot in the end of the connecting-rod l^{21}.

l^{25} indicates an adjustable weight on the end of the valve-lever opposite the arc. The purpose of these adjustable devices is to enable the engineer to accurately set the descent-speed governor-valve is such relation to the governor and the various operative parts that when the speed of the car shall exceed the desired limit the governor will operate the valve. A greater or less spread of the governor-balls is allowed at pleasure by these adjustable means. If it is desired to allow an increased speed of descent before the valve operates, the arc will be lowered on the connecting-rod and there secured so that the connecting-rod will have to be raised a greater distance before the valve operates, and vice versa. The purpose of the adjustable weight l^{25} is to so counterbalance the lever and connecting-rod and the governor-balls as to give greater or less sensitiveness to the governor mechanism.

In order to cause the descent-speed governor-valve to have a larger capacity for controlling the flow with very slight movement of such valve, I use a wide-way form of valve, and the descent-speed governor-passage *b'* is oblong in cross-section. This construction is common to the elevator described in my said former application. It is desirable to be able to adjust this passage so that its normal capacity of flow when open will allow a certain speed of descent. The speed of descent with a given size of passage will necessarily vary under different loads, and I have provided means for varying the size of this passage to adjust the same for cars of different weight, so that in setting up the machine the engineer can accurately set the speed-descent for a given speed for the particular weight of unloaded car in use in that elevator.

L^4 is an auxiliary slide-valve arranged to close such descent-speed governor-passage and to slide diagonally across such passage, and provided with a slot l^4, arranged parallel with such passage to register therewith during a portion of the movement of the slide. This slot is of equal width with the passage, but of greater length, the length being sufficient to allow for the longitudinal movement of the slide, so that the passage will always be open from end to end a greater or less width until finally closed by the slide. Owing to the diagonal path of the slide the edges of the slot in the slide move transverse to the descent-speed governor-passage and will slide across such passage, and the slide is adapted to entirely close the same. During the movement of the slide the passage is increased or diminished in width throughout its entire length, so that the liquid is fed to the wide-way speed-descent governor-valve throughout the entire length of its port. The slide is provided with a screw-socket l^{41}. (See Fig. 12.)

l^{42} is a valve-rod screwed into the socket in such valve.

l^{43} indicates the bearing, arranged to allow the valve-rod to rotate and to prevent it from moving axially. The end of the rod is angular, to allow it to be turned by a wrench.

When the elevator has been set up, the descent-speed governor-passage is regulated as to width by turning the valve-rod.

There is from various causes a liability of air being inclosed within the cylinder and the valved conduit, and I provide for the removal of the same. In this relation my invention comprises a hydraulic speed-regulator composed of a cylinder having its ends connected by a valve-controlled conduit, a piston within such cylinder arranged to return liquid from compartment to compartment of the cylinder through the conduit, a body of liquid in the cylinder and conduit, and having an air-collecting chamber L^5, provided with a valved outlet l^5, and arranged above and connected with the highest point of the valved passage. By this arrangement

when the liquid passes back and forth through the conduit by reason of the operation of the piston it carries with it the contained air until it reaches the highest point in the conduit, and there the air escapes upward to the air-collecting chamber and may be expelled by the introduction of additional liquid, the valved outlet being opened for this purpose while the liquid is being introduced.

L^6 indicates a screw-threaded hand-hole in the top of the conduit, and l^6 is a screw-threaded plug screwed into such opening. The air-collecting chamber L^5 is mounted upon such plug and connects therethrough with the interior of the conduit. This plug is arranged above the check-valve L and admits of its insertion and removal and also allows access to and inspection of the interior of the conduit. L^7 is a like hand-hole over the descent-speed governor-passage, and the same is closed by plug l^7.

The check-valve is arranged on that side of the descent-speed governor-valve toward which the liquid flows during the descent of the car, and the conduit B on the side of the check-valve opposite the speed-descent governor-valve is controlled by the main control-valve L^8, which is operated from the car by the control-rope. The conduit at this point has a valve-seat b^2, circular in cross-section, with a narrow inlet b^3 on one side of the valve-seat and an outlet b^4 on the other. The valve is composed of the journals l^8, journaled in the valve-seat on the opposite sides of the conduit, a valve-web l^{81}, having an arc face fitting the valve-seat and slightly wider than the inlet-port b^3, and arranged to fit the valve-seat and close the port and to open the port when the valve is slightly rotated, and the web-braces l^{82}, forming, with the valve-web, bearings circular in cross-section to fit the valve-seat. This construction provides a valve having a very slight extent of motion to open both ways and having great strength, so as to resist the pressure, and also has excellent wearing qualities and is very simple in construction for a valve which is to open when turned in two directions and is to be closed when in its intermediate position.

I will now describe the mechanism for controlling this valve to wholly shut off the flow of liquid through the conduit and prevent the movement of the car. I will first describe the mechanism in the car for operating the control-rope.

M M′ are pulley-guides carried by the car. M^2 is a pivoted lever pivoted to the car and arranged to play between said guides. M^3 is a single traveling pulley arranged in said guides on one side of the lever to travel toward and from the lever.

m^2 are connecting-rods connecting the single pulley with one arm of the lever.

M^4 M^{41} indicate a pair of traveling pulleys arranged in the pulley-guides on the other side of the lever to travel toward and from the lever. m^{21} indicate connecting-rods connecting the pair of pulleys with the other arm of the lever.

M^5 is the control-rope, fastened at one end at the top of the well and passed under one of the pair of traveling pulleys, thence over and around the single traveling pulley, thence up and over the other pulley of the pair, and thence down and connecting with the control-valve-operating mechanism.

m^{22} indicates the hanger which supports the lever, guides, and pulleys. It is carried by the car. The lever has a brace m^{23}, which projects from the side of the lever and straddles the hanger and is journaled on the fulcrum m^{24}, upon which the lever turns.

9 indicates antifriction-rollers, which carry the control-rope traveling pulleys.

N is an arc fixed to the car and notched on one face. The pivoted operating-lever M^2 is arranged with its free end engaged with and arranged to slide along the other face of the arc.

M^6 is a handle pivoted to the front side of the lever M^2, and provided on one side with a tooth m^6 to enter the notches n of the rack. Suitable means are provided for moving the handle in one direction to insert the tooth into the notches. These means, as shown, consist of the spring m^{61}, fastened to the lever M^2, and arranged to press against the handle to force the tooth against the notched face. The handle is recessed to receive the spring, and is provided with a stop m^{62}, arranged opposite the tooth to limit the movement of the handle in the other direction. The pivoted lever M^2 is provided at its free end with a stop m^2, engaging with and sliding along the plain face of the arc. Normally the spring m^{61} holds the handle up, with its tooth inserted into a notch of the arc. When it is desired to operate the lever, the handle is first moved against the action of the spring to withdraw the tooth from the notch, and then the lever is moved to operate the control-rope-operating pulleys and can be set in any position by simply releasing the handle and allowing the spring to again insert the tooth in one of the notches.

O indicates a stationary control-rope support-pulley fastened to the frame of the well O′. P indicates fixed threaded weight-guide rods fastened to such frame and arranged beneath such pulley.

P′ P^2 indicate upper stop-nuts on the intermediate threaded portions of the rods.

P^3 indicates a weight-retaining cross-head.

P^4 P^5 indicate the lower stop-nuts on the lower ends of the rods to sustain the weight-retaining cross-head and to adjust it on the guide-rods.

P^6 indicates the control-rope weight having guideways p^6 at its sides fitting the guide-rods.

The control-rope M^5 is connected with the control mechanism of the elevator and passes over the pulley and is fastened to the weight. This combination provides a suitable adjust-

able tension device for holding the control-rope taut and also limiting the movement of the control-rope weight. When the machine is set, the upper stop-nuts are screwed down against the weight to bring the rope to the right position to be taut when the control mechanism at the bottom of the well is in its intermediate position with the electric current cut off and the valved conduit closed, and the lower stop-nuts P^4 P^5 are adjusted to hold the cross-head P^3 a short distance below the weight to allow a limited movement of the weight downward and to prevent the weight from falling.

The control-valve L^8 is arranged to close at its intermediate position and to open when turned to either side of such position. Q is a valve-lever connected with such valve to partially rotate it. M^7 is the rheostat and control-valve-lever operating slide operatively connected with such valve-lever and connected with the control-rope M^5.

M^8 is suitable means to operate the slide against the action of the control-rope. This means, as shown, consists of a weight connected with the slide by a rope hung over the pulley m^7. The slide can be operated by a spring if desired.

R indicates the rheostat for turning on, regulating, and cutting off the current for driving the elevator. This rheostat is operated by the slide M^7, and the several parts are so arranged that the slide will operate to cut off the current when the valve is closed and when the lever is turned to one side to open the valve, and will turn on the current when the lever is turned to the other side of its intermediate position to open the valve.

m^7 m^{71} m^{72} indicate adjustable stops to limit the movement of the slide in both directions.

When the control-rope-operating lever is operated in the car, it operates the pulleys and thereby operates the control-rope, which pulls the slide in opposition to the slide-retaining weight and thereby operates the control-valve. If it is desired to drive the car upward, the lever will be turned to spread the pulleys M^3 and M^4 M^{41} and raise the rope to pull the slide in opposition to the slide-retaining weight M^8, thus opening the control-valve and turning on the current through the rheostat. The electric motor is then operated by the electric current, thus driving the power-pulley and the power shaft and pinion and driving the rack to operate the traveling sheaves to operate the car-operating cable and raise the car. At the same time the counterweight J^8 acts through its cable to pull upon the the traveling sheaves to draw them in the direction in which they are forced by the rack, and at the same time the piston is forced to the right in the cylinder, thus driving the liquid through the conduit and returning it to the opposite end of the cylinder. The check-valve rises to allow it to freely pass through the conduit.

To stop the car, the lever M^2 is turned to its intermediate position, thus returning the control-valve to its intermediate position and also cutting off the current at the rheostat, so that the piston is prevented by the liquid and the control-valve from moving in the cylinder and at the same time the power ceases to act to drive the rack. To cause the car to descend, the lever M^2 is thrown to the reverse position. The slide-retracting weight operates to pull the slide M^7 into a reverse position to reverse the control-valve lever and open the control-valve in the opposite direction. The rheostat remains with the current cut off, and the weight of the car is allowed to act through the car-operating cable, the traveling sheaves, and the piston upon the liquid. This immediately tends to force the liquid from the left compartment of the cylinder to the right compartment. The check-valve prevents any flow through the check-valve passage *b* of the conduit, and the liquid is therefore forced to find passage through the speed-descent governor-valve L′. In case the speed of descent exceeds the limit for which the speed-descent governor is set the speed-descent governor will operate to close the speed-descent governor-valve L′, and thus prevent the liquid from passing so rapidly through the conduit, and thus the speed of descent is controlled by governor.

The control-operating mechanism is connected with the car to control the same through intermediate means comprising the car-hoisting apparatus, and I wish my claims to cover the car-controlling device when applied to other engines of different type from that which I have shown herein, as such application can be made by an ordinary workman. The car-hoisting apparatus in this instance comprises the electric motor and its connections, the sheaves and the machinery between the sheaves and the motor, the car-hoisting rope and the pulleys pertaining thereto.

I have provided a suitable safety device which is carried by the car and is arranged to be brought into operation by a safety-device-operating rope, which is fastened at the top and bottom of the well. This safety device is designed to be brought into operation in case the car-operating cable should break or in case of any other emergency which might be considered of sufficient importance, and is arranged to be operated both by a safety-governor and also by the person in charge of the elevator within the car, and my invention includes a form of construction and combination of parts whereby I am enabled to release the safety device with but little inconvenience after it has been thrown into operation and has caught the fallen car. I will now describe this safety device.

S indicates a pivoted guide-gripping jaw, and S′ the retracting-spring arranged to hold such jaw open.

S^2 indicates a pivoted guide-gripping operating-lever provided on one side of its fulcrum with a guide-gripping jaw S^3, and with

an arm S^4, arranged to operate the other jaw S. I provide suitable means for operating the long arm of the grip-operating lever, and the operating of such arm causes the gripping-jaws to close toward each other. These jaws are arranged with the car-guide T between them, so that when the jaws close they will grip the guide. Each elevator-well is provided with two guides T T', and the gripping-jaws for one guide is of like construction with that for the other guide. My invention in this regard is so arranged that the two gripping devices will balance at the middle of the car, the operating-lever for one of the gripping devices being arranged on one side of the vertical mid-plane of the car which cuts the guides, and the other grip-operating lever being arranged on the other side of such plane, and I provide means for operating the two operating-levers simultaneously in such a manner as to hold the two constantly in corresponding positions in relation to such plane. To operate these levers, I provide an axially stationary screw U, journaled to the car, a nut S^5, swiveled to the end of the long arm of the lever S^2 and arranged to slide therealong and screwed upon the screw.

I provide suitable screw-rotating means arranged to be driven by the movement of the car, and I provide suitable means for connecting the screw with and disconnecting it from such screw-rotating means. My invention comprises the combination of this screw and the means for operating the same and the gripping device, and it also comprises the combination of the two gripping devices, the screw, and the means connecting them with the screw. The two pairs of gripping-jaws, which are indicated in the drawings by the same respective characters, except that the characters in one pair is marked with an additional indice 1.

The safety device as applied to the car comprises the two pairs of gripping-jaws arranged to grip the guides, respectively, jaw-retracting springs arranged, respectively, to normally hold one jaw of each pair away from the guide, two levers arranged, respectively, to operate the pairs of gripping-jaws, the right-hand nut S^5, swiveled to one of the levers and arranged to slide thereon, the left-hand nut S^{51}, swiveled to the other lever and arranged to slide thereon, the right and left compound screw U, journaled to the car and having its right threads *u* screwed into the right-hand nut and its left threads *u'* screwed into the left-hand nut, the screw-rotating means arranged to be driven by the movement of the car, and means for connecting the screw-rotating means with and disconnecting such screw-rotating means from the screw.

I will now describe the means for connecting the screw-rotating means with and disconnecting the same from the screw.

V indicates the screw-rotating shaft provided with a clutch-head V'.

V^2 indicates the governor-sleeve, mounted on the shaft to slide thereon.

V^3 indicates the safety-governor, mounted on the shaft to rotate therewith and arranged to operate the governor-sleeve.

U' U^2 indicate clutch-arms pivoted to the screw and arranged to rotate therewith and adapted to engage the clutch-head.

u^2 u^3 indicate suitable means, such as springs, to normally hold the clutch-arms out of engagement with the clutch-head.

V^4 indicates the clutch-operating sliding sleeve journaled upon the shaft V.

V^5 indicates a link connecting the governor-sleeve with the clutch-operating sleeve to operate the same when the governor-sleeve is slid by the spreading action of the governor-balls.

V^6 V^7 indicate connecting-rods connecting the clutch-sleeve with the clutch-arms to draw them into engagement with the clutch-head when the governor-balls are spread apart by the rapid rotation of the rotating shaft. The springs V^8 are arranged to draw the governor-balls together when the rotation decreases. The screw-shaft U is provided at its clutch end with a grooved head U^3, and the clutch-arms are arranged to play back and forth in its grooves. The purpose of the grooved head is to hold the arms rigid and support them when acted upon by the clutch-head V', which operates upon the arms by means of the peripheral projections *v'*.

V^9 indicates the safety-rope pulley fixed upon the end of the rotating shaft V and connected with the safety-rope W, which is wound once around the safety-pulley and extends from top to bottom of the well and is fastened at the top and bottom. I provide a suitable tension device for holding this rope taut.

W' at the top of the well is a weighted lever to which the safety-rope is attached. I provide the lower end of the rope also with a suitable tension device and take-up, which I will hereinafter describe.

The governor V^3 is set for such a speed of descent that if the car should exceed the speed of descent for which the descent-speed control-governor is set the safety-governor V^3 will operate to slide the sleeve, to draw the clutch-arms into engagement with the clutch-head and thereby connect the screw so that it will be rotated by the rotating shaft and drive the nuts S^5 S^{51} apart, thus operating the levers S^2 S^{21} and the pairs of gripping-jaws so that the gripping-jaws grip upon the guides. When this is done, the car must stop. In order to increase the gripping action, I have provided a certain wedge arrangement, which I will hereinafter describe, and this causes the grips to take hold with very great force. In order to release the grip when it has thus been brought into operation, I make one end of the screw-shaft angular in cross-section, and I provide a wrench U^4 to fit upon the angular end U^5 of the screw, and a suit-

able hole U^6 is provided in the bottom of the car to give access to the angular portion of the screw-shaft to enable it to be turned by the removable wrench.

I will now describe the mechanism by which the operator within the car can throw the safety device into operation independent of the action of the safety-governor. (See Fig. 23.)

X indicates a vertical lever pivoted to the car and arranged to throw the safety device into operation. The lower end of the lever extends into the space between the sleeves V^2 V^4, so as to operate upon the sleeve V^2, throwing it to the right.

X' indicates a bent lever pivoted to the car; X^2, a vertical foot-rod pivoted to the horizontal arm of such bent lever; X^3, the connecting-rod connecting the vertical arm of such bent lever with the upper end of the vertical lever, so that when the foot-rod is pushed down it will operate through the intermediate means described to push the governor-sleeve V^2 to the right, thus to draw the clutch-arms against the clutch-head and cause the screw to rotate to operate the gripping device.

I provide suitable means for returning and normally holding the several operative parts in position to be eperated to throw the safety device into operation. X^4 indicates a spring which accomplishes this object. The connecting-rod X^3 is bifurcated at the end to straddle the rod X^2 and the spring X^4, so that the bent lever, the connecting-rod, and the foot-rod and spring can all operate in the same vertical plane. This bifurcation is indicated by shading on the rod X^3 in Fig. 23.

I will now describe the construction of the guide-gripping jaws whereby I increase the grip of such jaws and cause the downward movement of the car to complete the gripping of the guides by the jaws after the jaws have once been set into operation to grip the guides. Each pair of jaws is provided with two vertically-arranged wedges Y Y', arranged, respectively, between the jaws and the guide embraced by the jaws to play along the guide and also alorg the faces of their respective jaws. These wedges are arranged with the small ends up, and the faces of the jaws where they fit upon the wedges respectively are beveled in the same angle as the side of the wedge, so that when the wedge slides vertically along its jaw its guide-engaging face will remain parallel with the guide.

Y^2 indicates springs arranged to hold the wedges normally in place against their respective jaws.

Y^3 indicates shoulders at the top of the wedges to prevent the wedges from falling below their jaws. In order to allow the wedges of the gripping-jaws to fit flat against the guide without digging into it, each gripping-jaw is provided with a concave groove Y^5, which extends from top to bottom of the jaw, and each sliding wedge has one side flat fitted to the guide and its other side convex and fitted to the groove to slide vertically therein.

When the lever S^2 is operated to cause the jaws to grip the guide, the wedges are pressed against the guide, and the friction of the wedge upon the guide causes the wedge to slide with relation to the jaw, thus wedging the jaws firmly to grip the guide. It is designed by this contrivance to cause the safety device to stop the car with a gradual movement, the gripping not being instantaneous, but by a slight sliding motion upon the guide before the wedging and gripping has been sufficient to stop the car. The stop, however, will be made within the space of about a foot.

I will now describe the take-up and tension for the safety-device-operating rope.

Z indicates a weight fastened at the lower end of the safety-device-operating rope.

Z' is a sleeve-support fixed at the bottom of the well.

Z^2 is a screw-threaded sleeve surrounding the rope and screwed through the sleeve-support into the path of the weight and adapted to be screwed up and down thereon. The upper end of the sleeve is angular in cross-section to admit of the use of a wrench to turn it to screw it up and down. The purpose of the weight is to keep the safety-rope always taut, and the purpose of the sleeve is to prevent its rising when the car is traveling upward. In setting the machine the sleeve is screwed down firmly against the weight, and the weight will take up any stretch or slack that may occur and which is not brought to the notice of the operator. The operator may from time to time screw the sleeve down to keep it in engagement with the weight so that there will be no play of the rope.

Now, having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a multiple-sheave elevator, the combination of a hydraulic cylinder; a valve-controlled conduit connecting the ends of the cylinder; the car-supporting piston-rod within said cylinder passing through both ends of the cylinder; a piston-head mounted on the piston-rod within the cylinder; a body of liquid in the cylinder and conduit; a cross-head fastened to one end of the piston-rod; a rack connected with the cross-head and connected with the driving mechanism; the traveling sheave mounted on such cross-head; the fixed sheave; the car-operating cable fixed at one end, passed thence around the sheaves and operatively connected with the car at the other end; and the driving mechanism operatively connected with the cross-head.

2. In an elevator, the combination of a hydraulic cylinder; a valve-controlled conduit connecting the ends of the cylinder; the car-supporting piston-rod provided with a piston-head and arranged to reciprocate in the cylinder; a body of liquid in the cylinder

and conduit; a traveling sheave operatively connected with the piston-rod to move therewith; the fixed sheave; the car-operating cable fixed at one end, passed thence around the sheaves and operatively connected with the car at the other end; and the driving mechanism operatively connected to the piston-rod.

3. In an elevator, the combination of the power-shaft provided with the pinion; the two fixed sheaves; the rack meshing with such pinion; two traveling sheaves fastened to such rack and arranged to travel back and forth between the fixed sheaves; the car; the car-operating cable fixed at one end, passed thence around one of the traveling sheaves and one of the fixed sheaves and operatively connected with the car at the other end; the counterweight; the counterweight-cable fixed at one end, passed thence around the other traveling sheave and the other fixed sheave and operatively connected with the counterweight; the cylinder; the conduit connecting the opposite ends of the cylinder; the piston-rod connected with the rack and extending through both ends of the cylinder; the piston-head mounted on the piston-rod and arranged to reciprocate within the cylinder; a body of liquid in the cylinder and conduit; valves to control the flow of liquid through the conduit, and mechanism operatively connecting the valves with the car.

4. In an elevator, the combination of the power-shaft provided with the pinion; the rack meshing with such pinion; the traveling sheave fastened to such rack; suitable guides for said rack; the fixed sheave; the car; the car-operating cable fixed at one end, and passed thence around the sheaves and operatively connected with the car; and car-supporting means connected with the rack.

5. In an elevator, the combination of the power-shaft provided with the pulley and with the pinion; a rack meshing with such pinion; a traveling sheave fastened to such rack; suitable guides for such rack; the fixed sheave; the car-operating cable fixed at one end, passed thence around the sheaves and operatively connected with the car; the motor; the belt connecting the motor with the power-shaft pulley; and car-supporting means connected with the rack.

6. In an elevator, the combination of the power-shaft provided with a pinion; a rack meshing with such pinion; the traveling sheave fastened to such rack; suitable guides for said rack; the fixed sheave; the car; the car-operating cable fixed at one end, passed thence around the sheaves and operatively connected with the car at the other end; the cylinder; the conduit connecting the opposite ends of the cylinder; the piston-rod connected with the rack and extending through both ends of the cylinder; the piston-head mounted on the piston-rod and arranged to reciprocate within the cylinder; a body of liquid in the cylinder and conduit; valves to control the flow of liquid through the conduit, and mechanism operatively connecting the valves with the car.

7. The combination of the power-shaft provided with the pinion; the rack meshing with the pinion; the traveling sheave connected with the rack; the truck provided with the two wheels each having a beveled flange; a track for such wheels provided with beveled faces to fit the beveled flanges and having a retaining-web projecting from its upper side between the beveled faces and provided with a retaining-flange; and a hooked arm depending from the truck and hooking into the retaining-web.

8. The combination of the power-shaft provided with the pinion; the rack meshing with such pinion; the roller engaging the back of the rack opposite the pinion; the truck fastened to one end of the rack; the track for such truck arranged on one side of the pinion, and the rack-supporting wheels arranged on the other side of the pinion to engage with the under side of the rack to support it.

9. In an elevator, the combination of the car; the cylinder; the valve-controlled conduit connecting the ends of the cylinder; the car-supporting piston-rod operatively connected with the car and extending through both ends of the cylinder; the piston-head mounted on the piston-rod and arranged within the cylinder; the adjusting stop-nut screwed upon the end of the piston-rod to engage one head of the cylinder when the car has reached the downward limit of its travel.

10. In an elevator, the combination of the speed-descent governor-valve; a valve-lever secured thereto to partially rotate the same and provided at one end with an arc having the axis of the valve for center; a connecting-rod pivoted to the valve-lever between the valve and the arc and adjustably fastened to the arc; the car; the governor operatively connected with the car and also operatively connected with the connecting-rod.

11. In an elevator, the combination of the governor; the car operatively connected with the governor; the speed-descent governor-valve; a valve-operating lever connected with such valve and provided at one end with an adjustable weight and at the other end with an arc with the axis of the valve for center; a connecting-rod pivoted to the valve-lever between the arc and the valve; adjustable connections connecting the arc with the connecting-rod and means connecting the free end of the connecting-rod with the governor.

12. The combination of the conduit having a passage oblong in cross-section; a valve arranged to close such passage and to slide diagonally across such passage and provided with a screw-socket and with an oblong slot arranged parallel with such passage to register therewith during a portion of the movement of the valve; a valve-rod screwed into

such valve; and the bearing arranged to allow the valve-rod to rotate and to prevent it from moving axially.

13. In an elevator, the combination of the cylinder having two compartments communicating with each other through a conduit; the car-supporting piston arranged in the cylinder; mechanism connecting such piston with the car to support the same during its descent; the descent-speed governor operatively connected with the car; the descent-speed governor-valve operatively connected with such governor and arranged to control the flow through the conduit, and an auxiliary valve arranged to adjust the size of the passage leading to such governor-valve.

14. In an elevator a hydraulic speed-regulator composed of a cylinder having its ends connected by a valve-controlled conduit; a piston within such cylinder arranged to return the liquid from compartment to compartment of the cylinder through such conduit; a body of liquid in the cylinder and conduit; and an air-collecting chamber having a valved outlet and arranged above and connecting with the highest point of the valved passage.

15. In an elevator, the combination of the car; the pulley-guides carried by the car; a pivoted lever; a single traveling pulley arranged in said guides on one side of the lever to travel toward and from the lever; the connecting-rods connecting the single pulley with one arm of the lever; the pair of traveling pulleys arranged in the pulley-guides on the other side of the lever to travel toward and from the lever; connecting-rods connecting the pair of pulleys with the other arm of the lever; the rope fastened at one end, passed under one of the pair of traveling pulleys, thence over and around the single traveling pulley, thence over the other pulley of the pair and thence down and connecting with the control-operating mechanism; such mechanism, and intermediate means connecting such mechanism with the car to control the same.

16. The combination of the pulley-guides carried by the car; the pivoted lever; a single traveling pulley arranged in the pulley-guides on one side of the lever to travel toward and from the lever; the connecting-rods connecting the single pulley with one arm of the lever; the pair of traveling pulleys arranged in the pulley-guides on the other side of the lever to travel toward and from the lever; and connecting-rods connecting the pair of pulleys with the other arm of the lever.

17. The combination of the arc, plain on one face and notched on the opposite face; the pivoted lever provided at its free end with a stop engaging with and sliding along the plain face of the arc; the handle pivoted to the lever and provided with the stop to limit its downward movement, and with the tooth arranged to enter the notches of the arc; and the spring arranged to move the handle to insert its tooth into the notches.

18. In an elevator, the combination of the well-frame; the stationary control-rope-supporting pulley; the fixed threaded weight-guide rods arranged beneath such pulley; the upper stop-nuts on the intermediate threaded portions of the rods; weight-retaining cross-head connecting the rods below the weight; the lower stop-nuts on the lower ends of the rods; the weight having guideways at its sides fitting the guide-rods; and the control-rope connected with the controlling mechanism of the elevator and passing over the pulley and fastened to the weight.

19. In an elevator, the combination of the control-valve arranged to close at its intermediate position and to open when turned to either side of such position; a valve-lever connected with such valve; the rheostat for turning on, regulating and cutting off the current for driving the elevator; the rheostat and control-valve-lever operating slide arranged to cut off the current when the valve is closed and when the lever is turned to one side to open the valve, and to turn on the current when the lever is turned to the other side to open the valve; the control-rope; means for operating the control-rope to operate the slide; and means for operating the slide in opposition to such rope.

20. In an elevator, the combination of the control-valve arranged to close at its intermediate position and to open when turned to either side of such position; a valve-lever connected with such valve; the rheostat for turning on, regulating and cutting off the current for driving the elevator; the rheostat and valve-lever operating slide connected with the control-valve and with the rheostat and arranged to cut off the current when the valve is closed and when the lever is turned to one side to open the valve, and to turn on the current when the lever is turned to the other side to open the valve; the control-rope; means for operating the control-rope to operate the slide; means for operating the slide in opposition to such rope; and adjustable stops to limit the movement of the slide in both directions.

21. The combination of the rotating shaft provided with a clutch-head; the governor-sleeve mounted on the shaft to slide thereon; the governor mounted on the shaft to rotate therewith to operate the governor-sleeve; the rotating screw; the angle-levers pivoted to the screw to rotate therewith and adapted to engage the clutch-head; means to normally hold the levers out of engagement with the clutch-head; a lever-operating sliding sleeve journaled upon the shaft; a link connecting the governor-sleeve with the lever-operating sleeve to operate the same, and connecting-rods connecting the lever-sleeve with the angle-levers to draw them into engagement with the clutch-head.

22. In an elevator, the combination of the

car; a safety device connected with the car; the governor-sleeve mounted on a shaft to slide therealong and connected with the safety device; such shaft; the governor mounted on the shaft to rotate therewith to operate the governor-sleeve and provided with springs arranged for normally holding the governor in position to be operated to operate the sleeve to throw the safety device into operation; a vertical lever pivoted to the car and connected with the sleeve to operate the same; a bent lever pivoted to the car; a vertical foot-rod pivoted to the horizontal arm of such bent lever; and the connecting-rod connecting the vertical arm of such bent lever with the upper arm of the vertical lever.

23. The combination of the safety-device-operating rope fastened at the top; a weight fastened to the lower end of such rope; a sleeve-support; a screw-threaded sleeve surrounding the rope and screwed through the sleeve-support into the path of the weight and adapted to be screwed up and down therein.

JOHN PARKINSON.

Witnesses:
JAMES R. TOWNSEND,
ALFRED I. TOWNSEND.