No. 855,074. PATENTED MAY 28, 1907.

DE WITT C. SUPLEE.

ELEVATOR.

APPLICATION FILED MAY 8, 1906.

3 SHEETS—SHEET 1.

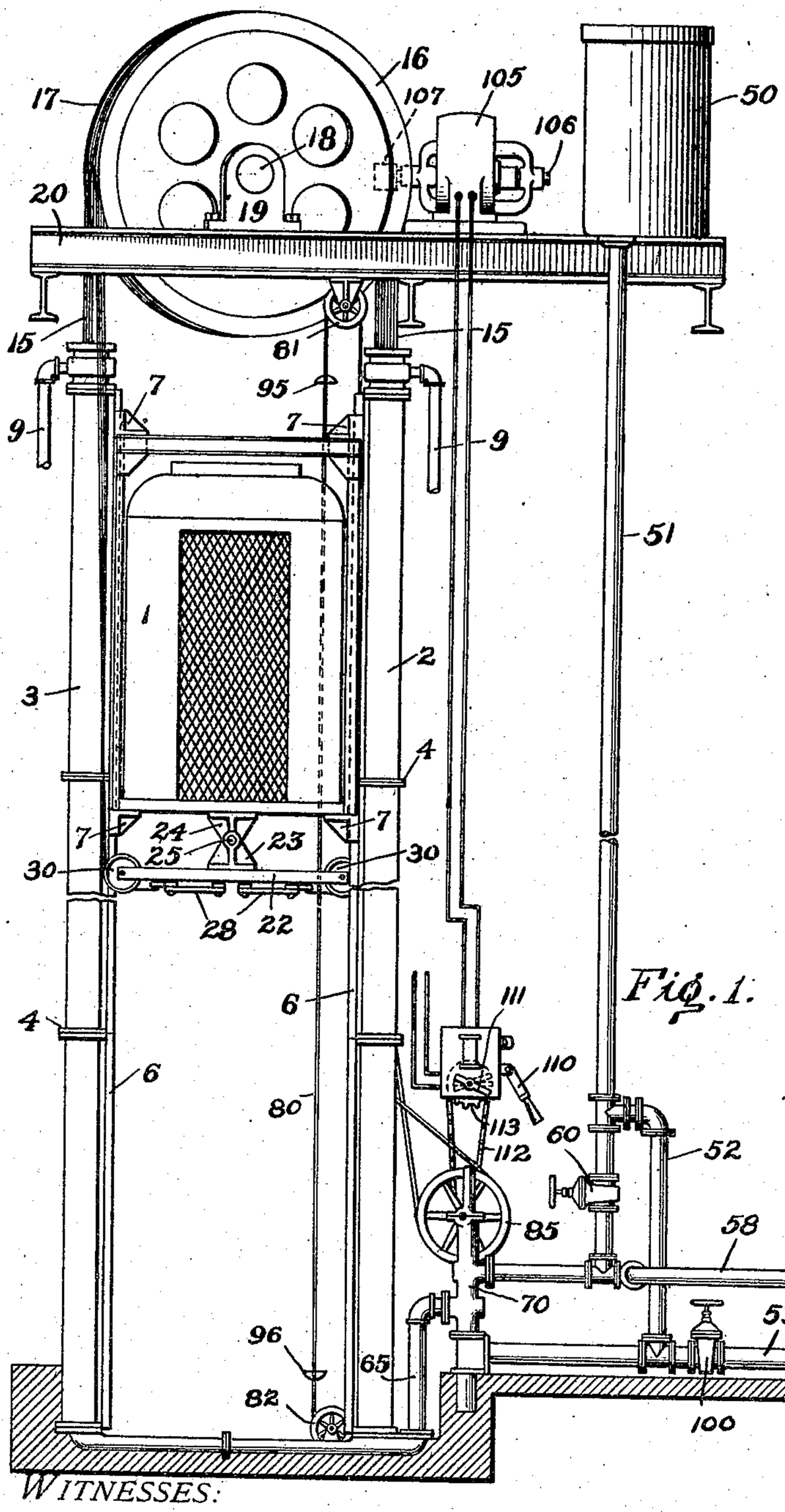

Fig. 1.

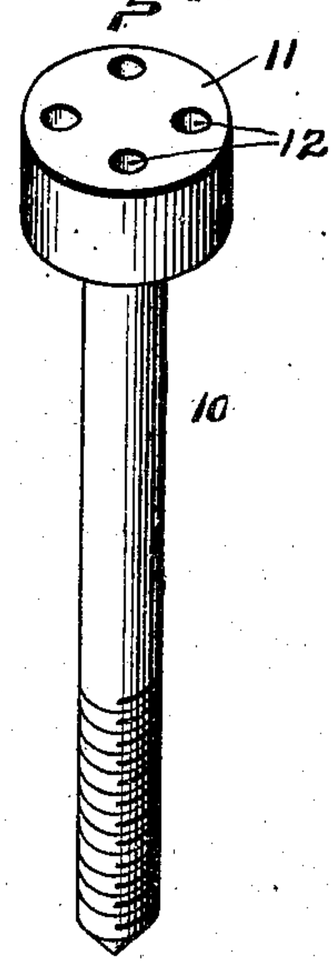

Fig. 7.

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3 SHEETS—SHEET 2.

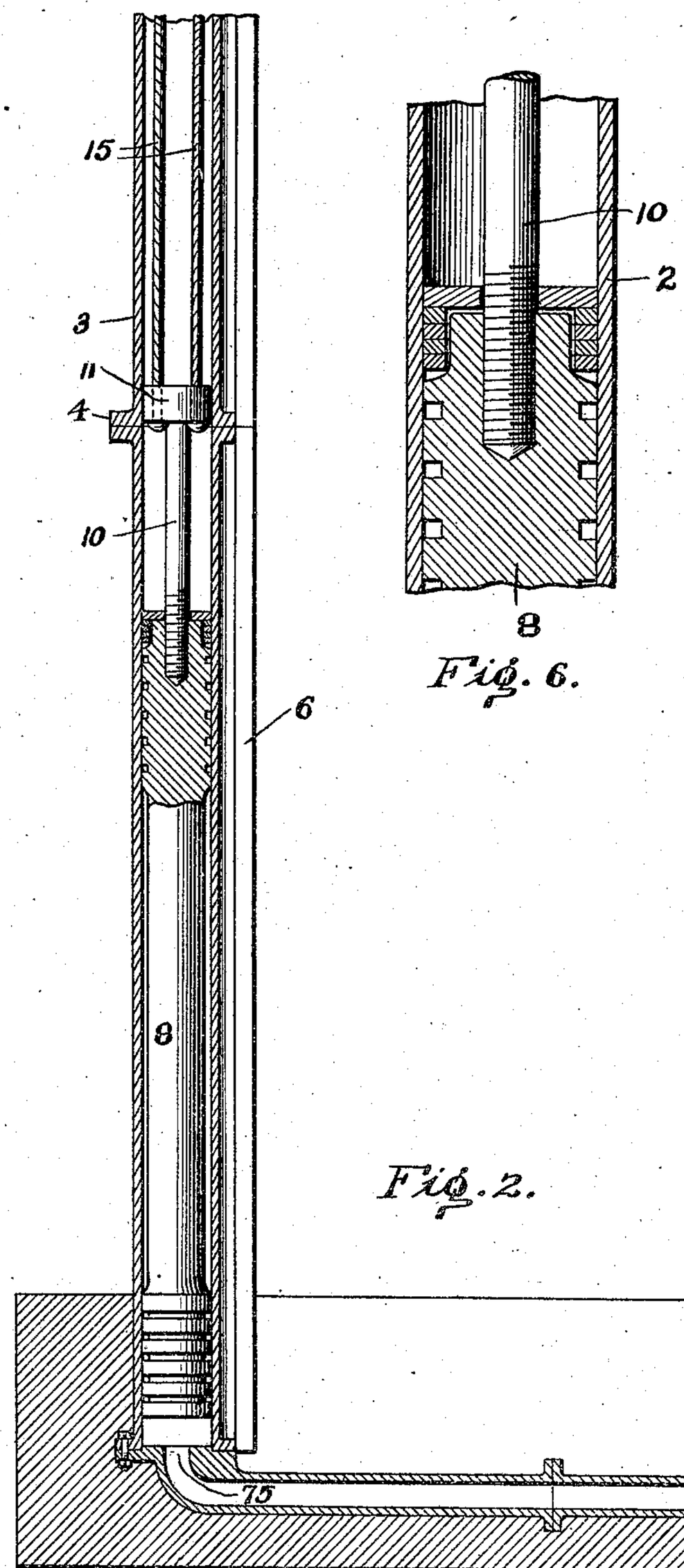
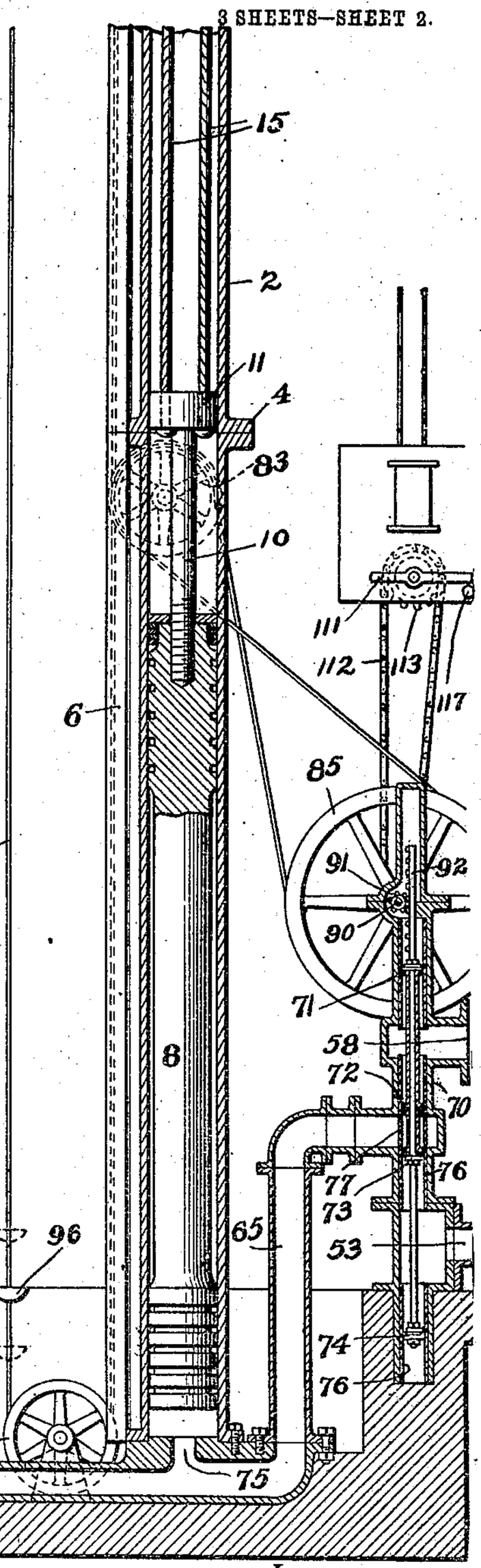


Fig. 2.

Fig. 6.



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3 SHEETS—SHEET 3.

Fig. 3.

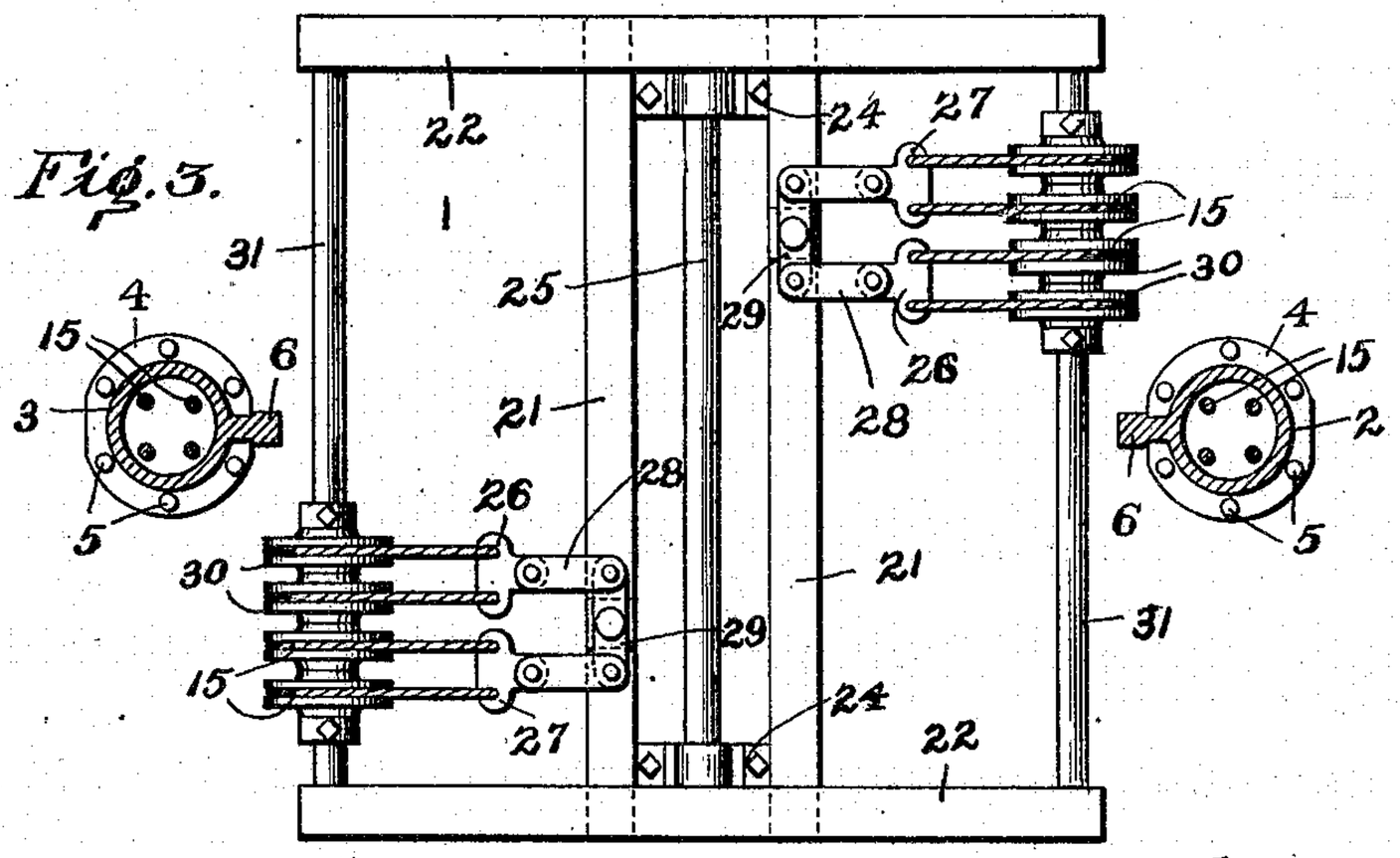


Fig. 4.

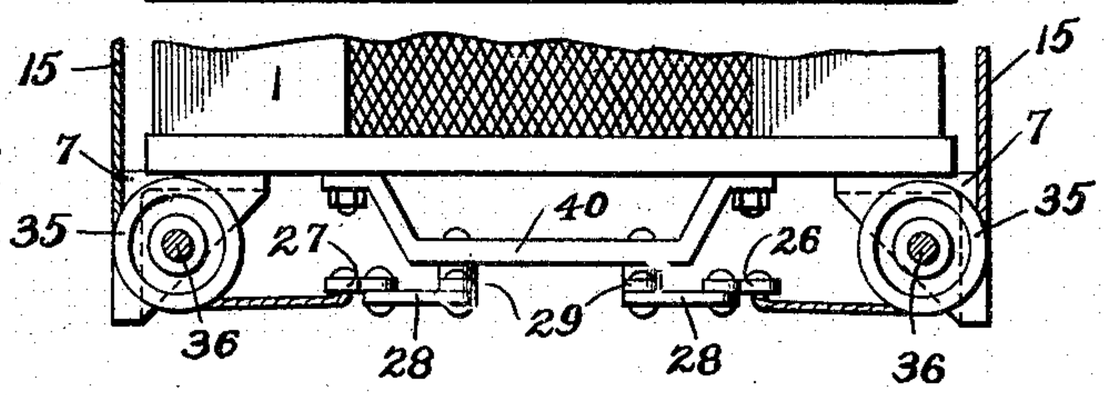
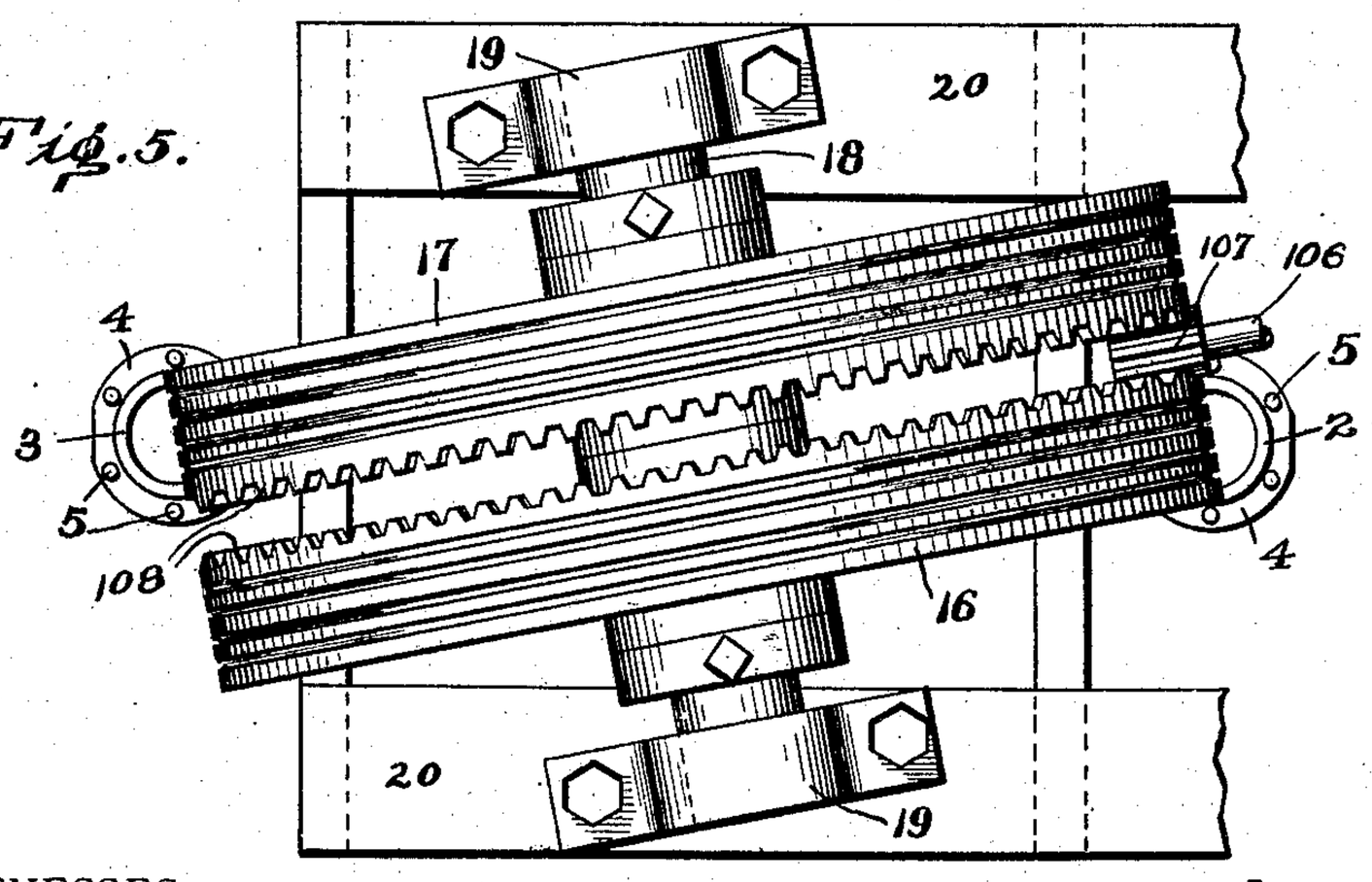


Fig. 5.



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UNITED STATES PATENT OFFICE.

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ELEVATOR.

No. 855,074. Specification of Letters Patent. Patented May 28, 1907.

Application filed May 8, 1906. Serial No. 315,723.

To all whom it may concern:

Be it known that I, DE WITT C. SUPLEE, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, (and whose post-office address is No. 427 North Thirty-third street, in said city,) have invented certain new and useful Improvements in Elevators, of which the following is a specification.

My invention relates to improvements in elevators, and it has for its object to provide an elevator in which primarily water is employed as a means to occasion the upward and downward movement of the elevator car, and in which electric power may be employed, either to supplement the action of the water or to be used alone and exclusive of such hydraulic power.

My invention resides in the combination and arrangement of parts as hereinafter described in detail, set forth in the claims, and as shown in the accompanying drawings forming a part of this specification, and to which reference is to be had for a clearer understanding of my invention, and in which

Figure 1 is a side elevation of the elevator and its operating mechanism; Fig. 2 is a sectional elevation of the lower portion of the elevator mechanism or apparatus; Fig. 3 is a bottom plan view of the elevator car with certain cylinders and guideways on opposite sides of the same shown in section; Fig. 4 is a side elevation of the lower portion of the elevator car; Fig. 5 is a view looking down upon the elevator well and the mechanism at the top of the same; and Figs. 6 and 7 are views showing details of construction.

In the drawings,—1 designates the elevator car, and 2 and 3 designate upright cylinders located upon opposite sides thereof. These cylinders may be constructed in any desirable manner, but preferably each cylinder consists of a greater or less number of sections, each of which is provided with flanges 4 at its opposite ends and the said sections are placed end to end and are secured together by bolts 5 passing through the said flanges. Each of the cylinders is provided also with a guide 6, the said guides being located upon the insides of the said cylinders and facing each other, as clearly shown in Figs. 1, 2 and 3. The elevator car is provided with shoes 7 at the top and bottom of each of its sides, which are adapted to engage the guides 6 and travel up and down thereon and guide the car in its vertical movements in the elevator well.

The cylinders 2 and 3 are provided with pistons 8 which are adapted to act as weights. The pistons are provided with packing or other suitable means at one or both of their respective ends for the purpose of preventing the passage of the water between such pistons and the sides of the cylinders. In case any water should pass the pistons, it is disposed of through pipes 9 communicating with the top portions of the cylinders. In the upper ends of each of the pistons, I have secured a bolt 10. I have shown these bolts 10 as having screw-threaded connection with the pistons, but it is to be understood that they may be connected to the pistons in any other suitable or desired manner. The upper ends of these bolts are provided with heads 11, preferably circular, through which holes 12 are passed for the purpose of securing cables to the said bolts and by means of the latter to the said pistons. I have shown each of these heads provided with four holes 12, but this number may be increased or diminished so as to increase or diminish the number of cables by means of which the elevator car is supported and connected to the said pistons. The cables 15 extend from the heads of the said bolts, that is, from the pistons, upwardly therefrom, through the cylinders and out of the upper ends of the latter, as shown in Fig. 1 of the drawings. The cables after passing from the said cylinders extend over wheels or pulleys 16 and 17, revolubly journaled upon a shaft 18, supported upon brackets 19, at the top of the building or rather at the top of the well or path in which the elevator car is adapted to travel. These brackets 19 are secured to the tops of joists or supports 20, as shown in Fig. 1. It will be noted that these wheels or pulleys are located in planes, which planes are angularly related to planes passing longitudinally through the cylinders 2 and 3. Each of these wheels is, however, located in a plane with one or the other of the cylinders 2 and 3. The wheel 16 is located in a plane with the cylinder 2 and in consequence of the fact that this plane is at an angle to a plane passing through the cylinders, the edge or portion of the wheel farthest away from the cylinder 2 is located to one side of the cylinder 3. What has been said

in connection with the cylinder 2 and the wheel 16 is also true with respect to the cylinder 3 and the wheel 17.

The cables which extend from the piston in the cylinder 2 pass over the wheel 16 and downwardly to points underneath the elevator car. The cables are not connected directly to the bottom of the car but are connected to cross pieces 21 forming a part of a frame 22 which is pivotally connected to the bottom of the elevator car, as shown in Figs. 1 and 3 of the drawings. The frame 22 is connected to the bottom of the car by means of brackets 23 and 24, the first being connected or secured to the frame 22 and the latter being secured to the bottom of the elevator car. There are two of these brackets 23 connected to the frame 22 at opposite sides thereof and two of the brackets 24 connected to the opposite sides of the bottom of the elevator car.

25 designates a rod passing through holes in the outer ends of the said brackets and by means of which the said brackets are pivotally connected together. The pivotal framework 22 constitutes in effect an equalizing device by means of which the strain or load sustained by the series of cables or ropes upon opposite sides of the elevator is at all times equal. In order that each of the ropes or cables upon either side of the elevator may be subjected to equal strains or loads, I have connected them in couples to levers 26 and 27, which levers are connected respectively by means of links 28 to the opposite ends of levers 29, which are respectively pivoted upon the cross pieces 21. The lever 29 acts as an equalizing bar by means of which the load or strain to which each couple of cables upon either side of the elevator is subjected is the same and each lever 26 acts as an equalizing bar or member, by reason of which each cable of any couple is subjected to equal loads or strains. Thus it follows that the load or strain to which each of the cables upon either side of the elevator is subjected is the same. It is very desirable that this should be so in order to reduce the liability to breakage or rupture of any one or more of the cables or of any other portion of the supporting means for the car of the elevator to a minimum.

The cables in passing to their points of connection underneath the frame 22, being also underneath the body of the elevator car, pass or travel over wheels 30 rotatably mounted on the side members 31 of the frame 22.

In Fig. 4, I have shown a modified construction in which the cables in passing to points underneath the elevator car travel over wheels or pulleys 35 which are revolubly mounted upon shafts or supports 36, the latter being supported upon or secured to the guiding shoes 7 at the lower end of the elevator car. In this construction, the levers 26, 27 and 29 and the links 28 are connected to yokes 40 which are secured directly to the bottom of the car.

My invention comprehends the idea that the vertical movements of the elevator car shall be occasioned by the action of gravity upon the car and upon the pistons 8 in the cylinders 2 and 3 to which pistons the said car is connected. In view of the fact that the car is connected to the pistons, it is obvious that movement of the car in either direction is accompanied by a movement of the pistons in an opposite direction and that any means which may control or occasion a movement of the pistons will also control and occasion movement of the car. The upward movement of the elevator is occasioned by the action of gravity upon the pistons, the combined weight of which is greater than the weight of the elevator plus its live load. The control and movement of the pistons 8 in their cylinders are occasioned by hydraulic power, that is, by water action, which may be supplemented, if desired, by an electric motor as will be fully pointed out hereinafter.

The water employed by me in the carrying out of my invention is contained in a tank 50 supported at the top of the building in which the elevator is located, or at least, if not at the top of the building, at a point either as high as or higher than the top of the elevator well or shaft. This tank is connected by means of pipes 51 and 52 to a pipe 53, which is normally in communication with a force or power pump 55. The force due to the weight of the water is exerted through the pump and supplements the force or power adapted to be exerted by the pump in forcing water through the pipes 57 and 58.

It may be stated here that the pipe 51 is connected directly to the pipe 58, but ordinarily direct communication between the two pipes is closed by means of a valve 60. The valve 60 is opened under certain circumstances, which will be set forth subsequently in detail.

61 designates a pressure tank having the usual construction and function which need not be set forth here. The pipes 53 and 58 are each adapted to be placed or brought into communication with a pipe 65 through or by means of the valve casing 70 to which all of the said pipes 53, 58 and 65 are connected. The communication between the several pipes last mentioned is controlled by means of a number of valves located in the valve casing 70.

As illustrated in Fig. 2 of the drawings, the valves occupy what may be termed intermediate positions, and as will be seen upon examination of the said figure, the communication between the pipes 53 and 58 through the casing 70 with the pipe 65 is closed. At this time the car is stationary and may be located

at the top or bottom of the well or elevator shaft, or at some intermediate point.

It is obvious that if the cylinders underneath the pistons are filled with water and the communication from the pipe 65 to the pipes 53 and 58 is closed, the said pistons must remain stationary for the reason that the presence of water in the cylinders prevents downward movement of the said pistons; and by reason of the fact that the weight of the pistons is greater than the weight of the elevator the action of gravity upon the elevator cannot occasion upward movement of the said pistons. Furthermore, it is to be noted that even though the elevator with its live load should be heavier than the pistons, such pistons would be prevented from moving upwardly and becoming separated from the water in the cylinders because in doing so a vacuum would be created between the bottoms of the pistons and the tops of the columns of water in the cylinders 2 and 3.

The valves in the valve casing 70 are designated by 71, 72, 73 and 74. It will be seen upon examination of this figure that if these valves are moved downwardly, as they may be, communication from the pipe 58 through the casing 70 to the pipe 65 is opened and when the pump 55 is operating, the water may pass from the tank 50 through the pumps to the pipe 58 and valve casing 70 into the said pipe 65. The latter pipe communicates with what may be termed a coupling pipe connected to the lower ends of each of the cylinders 2 and 3, the interior of the said coupling pipe being in communication with the interior of the said cylinders through openings or ports 75. If, on the other hand, the valves 71 to 74 are moved upwardly from the position shown in Fig. 2, communication from the pipe 58 to the pipe 65 remains closed and communication between the latter pipe 65 and the pipe 53 is opened.

In order that the flow of water either into or out of the pipe 65 may begin more or less gradually, I have provided an interior pipe or lining 76 within the casing 70, which is perforated in line with the upper end of the pipe 65, as indicated at 77.

The position of the valves within the casing 70 is controlled from the elevator car by means of a rope or cable 80, one portion of which extends through the car, as indicated in Fig. 1. The cable is supported at its upper and lower ends upon the wheels 81 and 82. From the wheel 82 the rope or cable 80 extends upwardly and passes over a wheel or roller 83, shown in dotted lines, thence over a valve controlling wheel or roller 85, and upwardly around a wheel, not shown, located adjacent to the wheel 83 and thence over the wheel 81.

The shaft 90 of the wheel 85 is provided with a gear wheel 91, which is in engagement with a rack bar 92, which is formed upon an extension of the stem, which supports the valves 71 to 74. It will thus be seen that as the wheel 85 and its rotatable shaft are rotated, movement of the valves is occasioned either up or down, depending upon the direction of rotation of the wheel 85, and its connected shaft.

At the top and bottom of the rope or cable 80, I have provided stop buttons 95 and 96, with which the elevator in its upward and downward movements is adapted to contact. These buttons are so located that when they are moved upward by the elevator or downwardly by the elevator, movement of the rope or cable 80 is occasioned, which in turn occasions rotation of the wheel 85 and its shaft 91, to carry the valves into intermediate closed position, as indicated in Fig. 2.

Assuming that the elevator is at the bottom of its well or shaft, and that the stops 95 and 96 and the valves 71 to 74 are in the position indicated in Fig. 2, and it is desired to occasion upward movement of the elevator, the conductor pulls upon the rope or cable 80 to move the same downwardly, which movement through the wheel 85 and gear wheel 91 occasions upward movement of the valves to open communication between the pipe 53 and the bottoms of the cylinders 2 and 3. The pistons act as weights to raise the elevator and its load and also to drive the water from the cylinders 2 and 3 through the connecting pipes to the tank 50. On the other hand, assuming that the elevator is at the top of the elevator well or shaft, and that it is desired to lower the same, the conductor pulls the rope or cable 80 upwardly and occasions rotation of the wheel 85 and shaft 90 connected thereto to the right, and a consequent downward movement of the valves, so that the valve 71 is moved to a position just above the opening of the pipe 58 into the casing 70 and the valve 72 is moved to a position just below the opening of the pipe 65 into the pipe 70, the consequence being that communication between the lower ends of the cylinders 2 and 3 and the pipe 58 is opened, so that the water which is being forced through the pipe 58 by the action of gravity from the tank 50 and the supplemental force of the pump 55 exerts its pressure upon the bottoms of the pistons 8 to occasion their upward movement to permit the downward travel or lowering of the car.

The amount of force necessary to apply to the bottom of the pistons must be sufficient to overcome the excess of weight of the pistons combined with the weight of the cables within the cylinders over the weight of the elevator car and of the portions of the cables extending from the wheels at the top of the elevator shaft downwardly in the shaft to their points of connection to the elevator car.

When the car reaches the bottom of the elevator shaft, it strikes the stop 96 and moves it from its uppermost dotted line position to the full line position which occasions the movement of the valves to the position indicated in Fig. 2. If it is now desired to occasion upward movement of the elevator car, the conductor pulls the rope or cable downwardly and thus occasions upward movement of the valves 71 to 74 so that the valve 72 is moved to a position just underneath the connection between the pipe 58 and casing 70, while the valves 73 and 74 are moved to positions to open the communication between the pipes 65 and 53, so that the water may pass from the cylinders 2 and 3 outwardly and upwardly through the pipe 51 to the tank 50. The water is forced out of the cylinders by the weight of the pistons 8.

It will be understood that when the elevator is at the bottom of the shaft, the columns of water in the two cylinders and in the pipe 51 substantially balance each other. Although as the top of the pipe 51 extends to a point somewhat higher than the points to which the water in the cylinders 2 and 3 may rise, it will, of course, be understood that the columns of water are not entirely balanced. The weight of the pistons within the cylinders must be sufficient to overcome the excess of pressure exerted by the column of water in the pipe 51 and also to raise the elevator car and the load carried thereby As the pistons descend, the weight of the cables are sufficient to compensate for the increased excess of pressure exerted by the column of water in the pipe 51 over the downward pressure exerted by the water in the cylinders 2 and 3, in consequence of which the effectiveness of the pistons in lifting power or force as exerted upon the elevator car remains substantially the same at all points of their downward movement.

I have provided what may be termed an emergency valve 100 in the pipe 53 which is closed only when it is found to be necessary or desirable to cut the water from the tank 50 entirely off from the pump 55 for the purpose of cleaning the latter or repairing it in some manner.

In Fig. 1, I have shown an electric motor 105 having a shaft 106 which is provided with a gear wheel 107 located between the wheels or rollers 16 and 17, the latter being provided with gear teeth 108 upon their adjacent sides, which are adapted to be engaged by the gear wheel 107. The wheels 16 and 17 are journaled upon the shaft 18 and are adapted to and do rotate, when in operation, in opposite directions. Ordinarily and generally, the current is cut off and does not pass through the motor 105, in which case it does not aid in any manner in the lifting of the elevator. If, however, it is desired to bring the said motor into operation, the switch 110 is closed and the contact or circuit closing member 111 is adapted to be moved by means of a sprocket chain 112 passing over a sprocket wheel 113 and a sprocket wheel (not shown) on the shaft 90, into position to contact with a button 117 to close the circuit through the motor when the valves are moved into position to permit the access of water from the tank 50 to the cylinders 2 and 3. At this time, the upward movement of the pistons 8 to permit the downward movement or travel of the elevator car is assisted or occasioned by the motor 105.

In addition to the arrangement of the circuit whereby the motor 105 is adapted either to elevate or assist in elevating the pistons, as described, such circuit may also be arranged in such manner that the said motor may be brought into action to assist in the elevation of the elevator car and thus decrease the weight which must be overcome by the weight of the pistons in the cylinders.

When the valves 71 to 74, inclusive, occupy the closed position shown in Fig. 2, the contact member 111 occupies the intermediate position indicated in Fig. 2.

It may be found desirable and necessary to disconnect the pump 55 and depend upon the motor 105 to assist in raising the pistons. In this case, the valve 60 is opened so that the water may travel directly from the pipe 51 into the pipe 58 and from the latter into the pipe 65. In returning the water passes from the pipe 65 and through the pipes 53 and 52 to the pipe 51. In other words, the water travels up and down the pipe 51 in a contrary direction to that in which the pistons are moving but is not permitted to pass through the pump 55 which, as stated, is entirely out of action.

It thus appears that the motor 105 may be used to supplement the force or power of the pump 55 so that the load carried in or by the elevator may be increased to substantially double that which may be carried without the use or assistance of the motor. Also, as will be seen, the motor 105 may be employed alone and exclusive of the pump 55, if for any reason this is found necessary or desirable.

Although I have shown only one cylinder upon either side of the elevator well or shaft, I may note that, if desired, two or more cylinders, such as are shown, may be employed on each or either side, in which case a greater number of cables may be employed for supporting the car and lifting the same than if a single cylinder were employed upon each side of the elevator shaft or well.

Preferably, the guides 6 are formed integral with the cylinders 2 and 3, but, if desired and found to be practicable, these guides may be supported in any other suitable manner, either upon the cylinders or independently thereof.

Having thus described my invention, I claim:—

1. In an elevator, in combination, cylinders located upon the sides of an elevator well or shaft, pistons located in the said cylinders and adapted to travel therein, an elevator car, cables connected to the said pistons and to the said car, wheels located above and intermediate the said cylinders and adapted to support the said cables, and means for occasioning revolution of the said wheels in opposite directions.

2. In an apparatus of the character described, the combination of an elevator car, rotatable wheels located above said car, cylinders located on opposite sides of said car, the said wheels being located in planes angularly related to a plane passing through the said cylinders, one wheel being in a plane passing longitudinally through one of the said cylinders, and the other wheel being in a plane passing longitudinally through the other of said cylinders, pistons located in the said cylinders, cables connected to the said pistons and to the said car, the said cables extending over the said wheels.

3. In an apparatus of the character described, the combination of an elevator car, rotatable wheels located above the said car, the said wheels being arranged in parallel relation with respect to each other, cables extending over the said wheels, one end of one of the cables being extended down on one side of and connected to the elevator car and one end of the other cable being extended down on the other side of and connected to the elevator car, and means for occasioning movement of the said cables, and the said wheels being adapted to rotate in opposite directions as the car is raised or lowered.

4. In an apparatus of the character described, the combination of an elevator car, rotatable wheels located above said car, weights, cables passing over the said wheels and being connected to the said car and to said weights, and means located intermediate the said wheels and engaging the same to occasion rotation thereof.

5. In an apparatus of the character described, the combination of an elevator car, rotatable wheels located above the car, weights located on opposite sides of the said car, a cable passing over each of the said wheels, the cable passing over one wheel being connected at one end to the car and at its other end to one of the weights, and the cable passing over the other wheel being connected at one end to the car and at its other end to the other one of said weights, and means independent of the said cables to occasion simultaneous rotation of the said wheels in opposite directions.

6. In a device of the character described, the combination of an elevator car, rotatable wheels located above the said car, the said wheels being arranged in parallel relation with respect to each other, weights, cables extending on opposite sides of and connected to the said car, and the said cables extending over the said wheels and being connected to the said weights, a power device located intermediate the said wheels and being in engagement with each of them and adapted to occasion rotation in opposite directions of the said wheels for the purpose of occasioning the raising and the lowering of the said car.

7. In an apparatus of the character described, the combination of an elevator car, rotatable wheels located above the said car, cylinders upon opposite sides of the said car, pistons located and operating in the said cylinders, cables connected at one end to the said car, and extending over the said wheels, and being connected at their other ends to the said pistons, a rotatable device located intermediate the said wheels and adapted to occasion rotation thereof in opposite directions.

8. In a device of the character described, the combination of an elevator car, rotatable wheels located above the said car, cylinders located upon the opposite sides of the said car, the said wheels being located in planes angularly related to a plane passing through the said cylinder, and one of the said wheels being in a plane passing longitudinally through one of the said cylinders, and the other of the said wheels being in a plane passing longitudinally through the other of the said cylinders, cables connected to the said elevator car and extending over the said wheels, and being connected to the said pistons, the weight of the pistons being sufficient to overcome the weight of the elevator car and the load carried thereby, and a power device located intermediate the said wheels and adapted to occasion rotation thereof in opposite directions for the purpose of assisting in the elevation of the said pistons.

9. In an apparatus of the character described, the combination of an elevator car, rotatable wheels located above the said car, cylinders located upon the opposite sides of the said car, pistons located and operating in the said piston cylinders, cables connected to the said car and to the said pistons, the said cables extending over the said rotatable wheels, means for supplying hydraulic power for the purpose of occasioning the raising of the said pistons, and a power device located intermediate the said wheels and being adapted to occasion rotation of the same in opposite directions.

10. In an apparatus of the character described, the combination of an elevator car, cylinders located upon opposite sides of the said car, the said cylinders being adapted to receive a suitable operating fluid and being in communication with each other, pistons in said cylinders, rotatable wheels located above

the said elevator car, cables connected to the said car and to the said pistons, a tank for holding a supply of said fluid, the said tank being in communication with the said cylinders, the height of the said tank with relation to the said cylinders being such that the downward pressure of the column of fluid from the said tank is in excess of the downward pressure of the fluid in the said cylinders, and the said excess of fluid pressure from the said tank being counterbalanced by the weight of the portions of the cables between the said pistons and the said wheels, a pump for forcing the said fluid into the said cylinders to occasion the elevating of the pistons, and a power device located intermediate the said wheels and being in engagement with each of them and adapted to occasion rotation of the said wheels in opposite directions to assist in raising the said cylinders and also to assist in raising the said elevator car.

11. In an apparatus of the character described, the combination of an elevator car, cylinders located on opposite sides of the said car, the said cylinders being adapted to receive a suitable operating fluid and being in communication with each other, pistons in said cylinders, rotatable wheels supported above the said elevator car, the said wheels being located respectively in different planes extending longitudinally through the respective cylinders, cables connected to the said car and to the said pistons, a tank for holding a supply of said fluid, the said tank being in communication with the said cylinders, and the height of the said tank with relation to the said cylinders being such that the downward pressure of the column of fluid from the said tank is in excess of the downward pressure of the fluid in the said cylinders, and the said excess of fluid pressure from the said tank being counterbalanced at all positions of the pistons by the weight of the portions of the cables between the said pistons and the said wheels.

In testimony whereof, I have hereunto signed my name this seventh day of May, A. D. 1906.

DE WITT C. SUPLEE.

In the presence of:
D. SOLOME BROOKE,
CYRUS N. ANDERSON.