E. CARLSON.

ELEVATOR OPERATING MECHANISM.

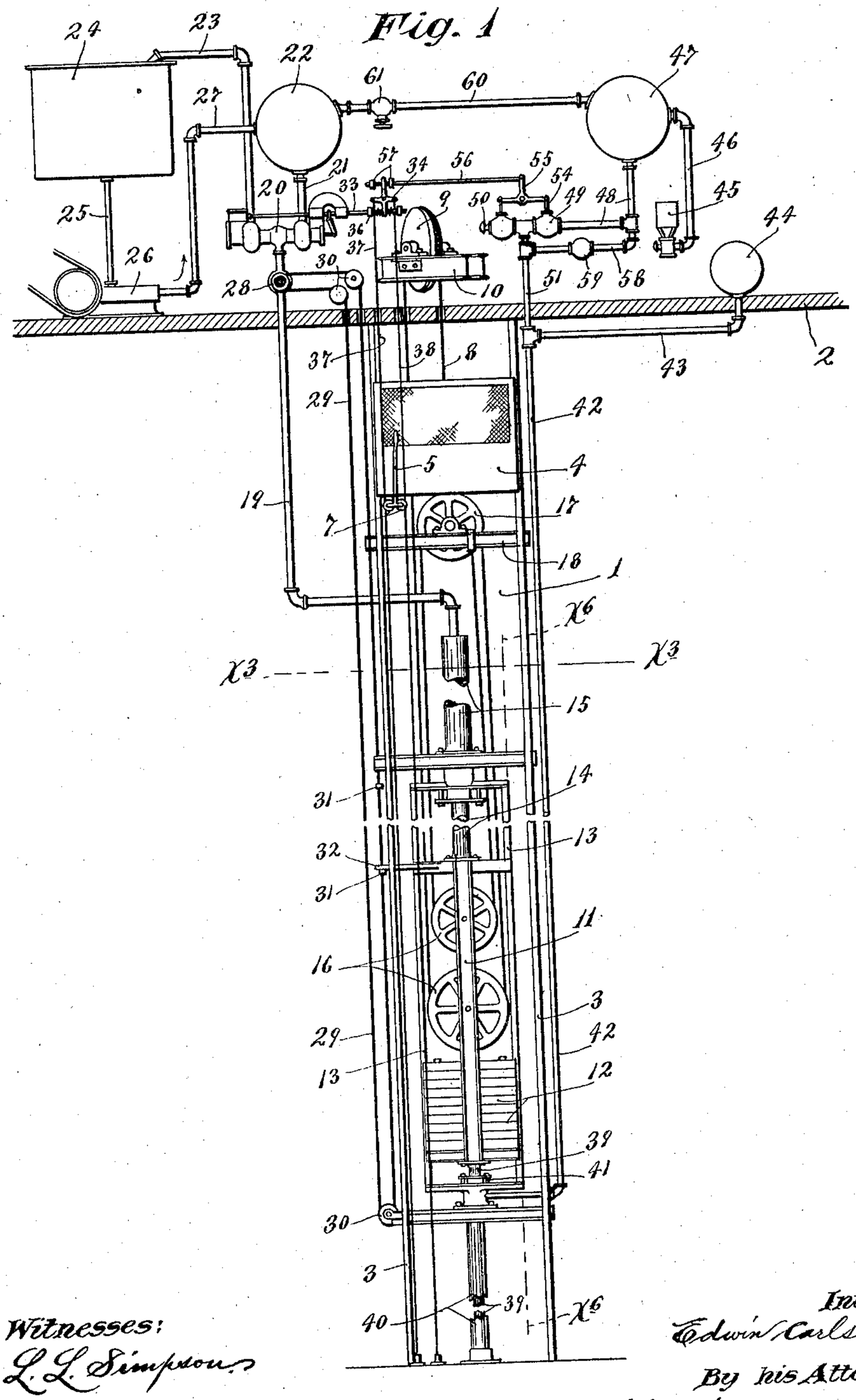
APPLICATION FILED FEB. 21, 1910.

983,426.

Patented Feb. 7, 1911.

3 SHEETS—SHEET 1.

Fig. 1



Witnesses:

L. L. Simpson.

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3 SHEETS—SHEET 2.

Fig. 2.

Fig 6.

Fig. 3.

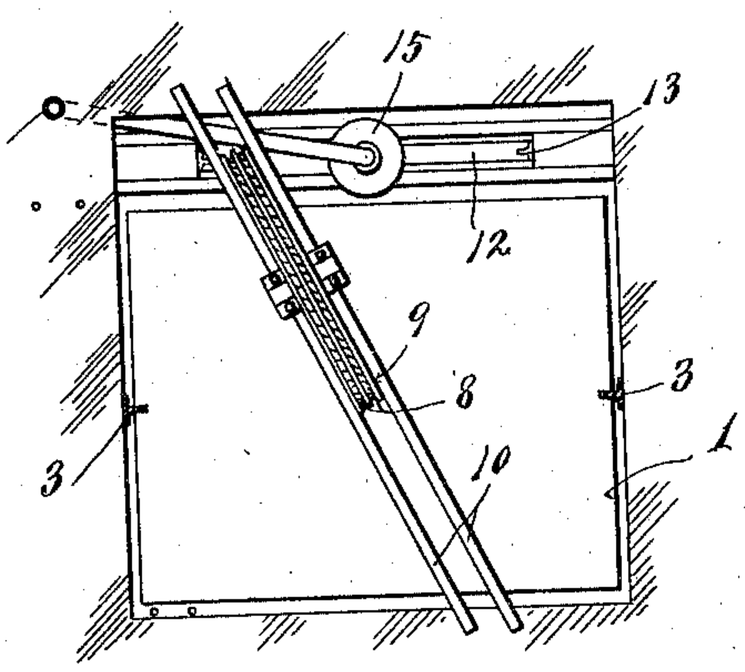


Fig. 4.

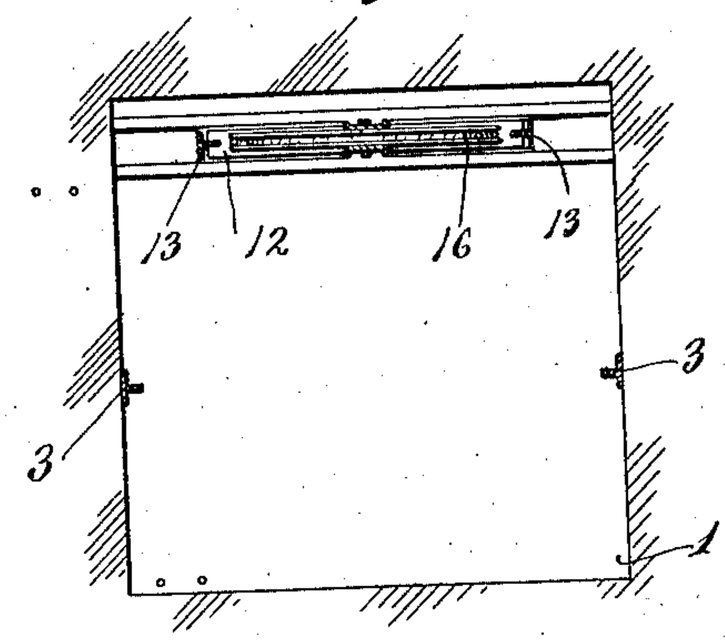
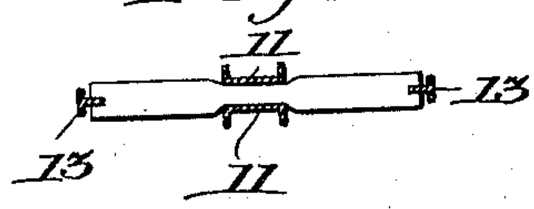


Fig. 7



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3 SHEETS—SHEET 3.

Fig. 4

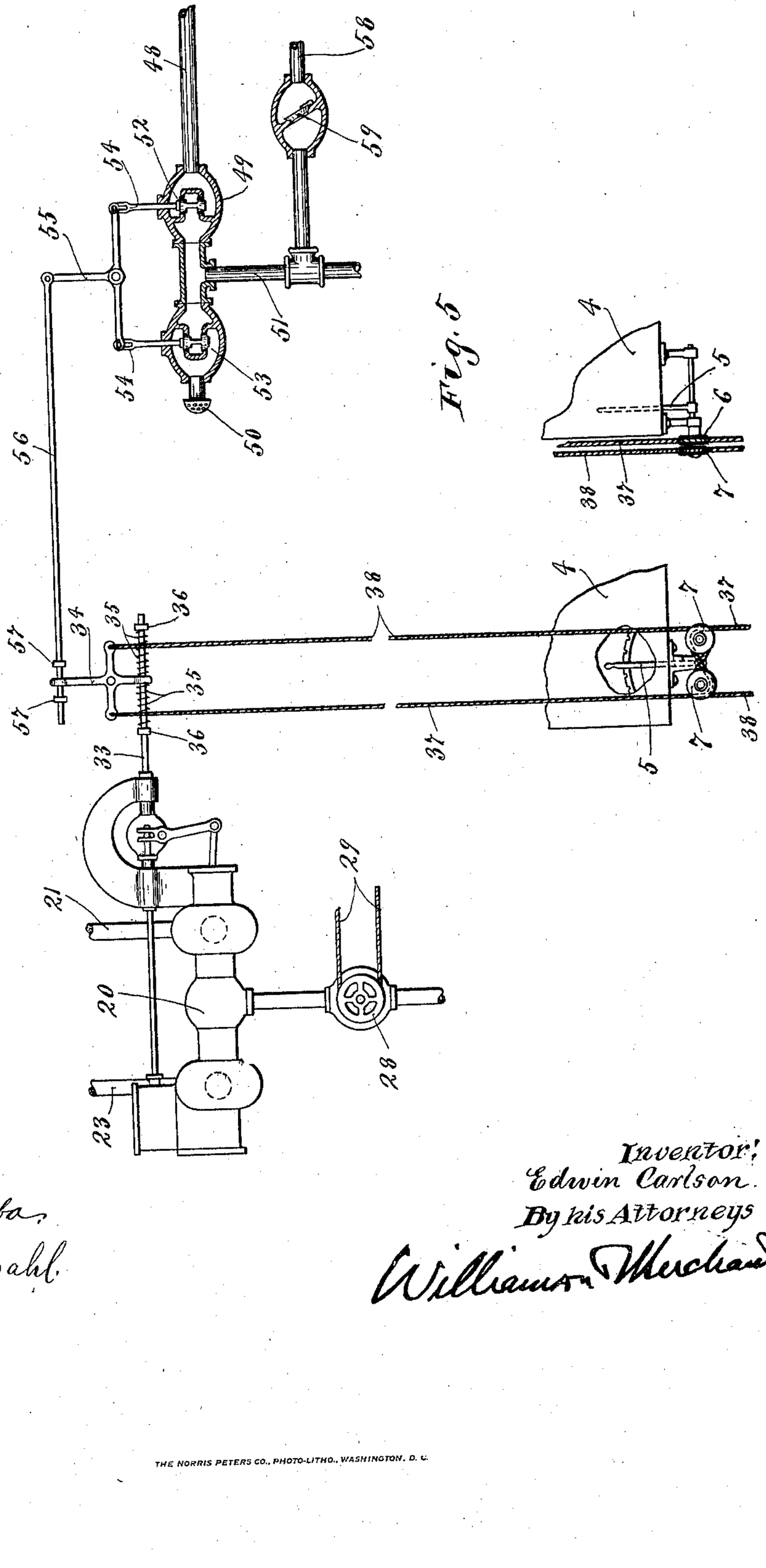

Fig. 5

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UNITED STATES PATENT OFFICE.

EDWIN CARLSON, OF MINNEAPOLIS, MINNESOTA.

ELEVATOR-OPERATING MECHANISM.

983,426. Specification of Letters Patent. Patented Feb. 7, 1911.

Application filed February 21, 1910. Serial No. 544,995.

To all whom it may concern:

Be it known that I, EDWIN CARLSON, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Elevator-Operating Mechanism; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates generally to the improvement of the construction of hydraulic elevators, but more particularly to those of the passenger type, and has for its object, first, to provide an improved counter-balancing device and, second, to provide an auxiliary power mechanism for use in case of an emergency.

To the above ends, the invention consists of the novel devices and combinations of devices hereinafter described and defined in the claims.

In the accompanying drawings which illustrate the invention, like characters indicate like parts throughout the several views.

Referring to the drawings, Figure 1 is a view, partly in vertical section and partly in diagram, illustrating the several features of my invention applied to, or incorporated in, a hydraulic elevator, some parts being broken away; Fig. 2 is a diagrammatic plan view showing a car and the immediate associated parts; Fig. 3 is a horizontal section taken approximately on the line x^3 x^3 of Fig. 1; Fig. 4 is a diagrammatic view in side elevation, showing a portion of an elevator car, the controlling cables, the controlling lever and certain valve mechanism, some parts being shown in section and some parts being broken away; Fig. 5 is a fragmentary view in rear elevation of certain of the parts shown in Fig. 4; Fig. 6 is a vertical section taken approximately on the line x^6 x^6 of Fig. 1, some parts being broken away; and Fig. 7 is a detail in horizontal section taken on the line x^7 x^7 of Fig. 6.

As illustrated in the drawings, the tanks and controlling valve mechanism are located near the roof or above the upper extremity of the elevator shaft. The elevator shaft 1 is indicated diagrammatically in Figs. 2 and 3, and the attic floor is indicated by the numeral 2 in Fig. 1. Customary vertical car guides or rails 3 are located at opposite sides of the elevator shaft and extend from the top to the bottom thereof. The elevator car is indicated as an entirety by the numeral 4 and it is provided with the usual operating lever 5, which, at its pivoted end, carries two pairs of idle cable-tightening rollers 6 and 7.

The car is suspended by a lifting cable 8, the upper portion of which runs over a guide wheel 9, journaled in suitable bearings on a supporting beam 10 that crosses the elevator shaft 1 at a point above the floor 2. Located in the elevator shaft, back of the line of travel of the car, is a cross head frame 11, which carries a multiplicity of counter-weights 12 and is guided for vertical movements by a fixed rectangular cross head guide 13. To the upper end of the cross head frame 11 is rigidly secured a long piston or plunger 14, that works in a long cylinder 15 secured to, and extending upward from, the upper portion of the fixed cross head guide 13. Cable-guiding wheels 16 are journaled to the intermediate portion of the cross head 11, and another cable-guiding wheel 17 is journaled to a suitable anchoring frame 18 rigidly secured at a point not far from the upper extremity of the elevator shaft and at a point back of the line of travel of the car. The car hoisting cable 8 is passed over the guide wheels 16 and 17 and, at its lower end, is anchored to the said frame 18. The above described arrangement of the hoisting cable and guides multiplies the movement of the car in respect to the cross head 11, preferably, about four to one.

The upper extremity of the cylinder 15 is connected by a pipe 19 to the intermediate portion of the main operating valve 20, one side of which is connected by a pipe 21 to a compression tank 22, and the other side of which is connected by a pipe 23 to the upper portion of a water supply tank 24. The water tank 24 is also connected by a pipe 25 to a power-driven pump 26, which, in turn, is connected by a pipe 27 to the compression tank 22. Located in the pipe 19 is a normally open cut-off valve 28, which is adapted to be operated in the customary way by an endless cable 29 mounted to run over guide sheaves 30 provided with stops 31 and sub-

ject to an arm 32 carried by the cross head 11. The main operating valve 20 has the customary operating valve rod 33, which is subject to the lower extremity of a four-armed lever 34; customary opposing coiled springs 35 are interposed between said lever and stops 36 fixed on the said valve rod. The usual elevator controlling cables 37 and 38 are attached, at their upper ends, to the upwardly projecting arms of the lever 34, and at their lower ends, they are anchored in the customary way to the bottom of the elevator shaft. The cable 37 is passed under one and over the other of the lever actuated guide sheaves 6, while the cable 38 is passed over one and under the other of the coöperating guide sheaves 7.

The construction so far described in detail is standard or well-known hydraulic elevator mechanism, and the operation thereof will be briefly stated later on in connection with the description of the coöperating mechanisms which embody my invention.

As is well known, an elevator lifted by a cable requires a variable counterpoising device to offset the increasing cable weight added to the car under downward movement and decreasing cable weight on the car under upward movement of the car. Various devices have been provided for this purpose and the most certain of such devices hitherto devised is probably found in the extensively used counterpoising chain.

One of the principal features of my invention is directed to the provision of an improved variable or compensating elevator counterpoising device, and this device preferably involves the use of both hydraulic and pneumatic power. This improved compensating counterpoise may now be described.

To the lower end of the cross head 11, is secured a depending plunger or long piston 39, that works in a long cylinder 40, the lower end of which is secured to the bottom of the elevator shaft. The plunger 39 is of considerable less diameter than the interior of the cylinder 40, and it works through a stuffing box 41 at the extreme upper portion of the said cylinder. The numeral 42 indicates a long pipe which extends from the cylinder 40 upward to a point above the floor 2, or above the upper extremity of the elevator shaft, and, as shown, is connected by a branch pipe 43 to an air storage compression tank 44. The cylinder 40 and the pipe 42 contain water in such a quantity that, when the car is moved to its uppermost position (at which time, the cross head 11 is moved to its lowermost position), the water will be forced upward in the said pipe 42 and, preferably, through the branch pipe 43 nearly or quite into the lower portion of the compressed air tank 44. When, however, the car is at its lowermost position (at which time, the cross head 11 is at its uppermost position), the water will fall very greatly within the pipe 42. It will thus be seen that the varying altitude of the column of water in the pipe 42 will, to a considerable extent, compensate for the varying counter-weighting action of the cable 8 on the car. To give the required pressure of this counter-balancing column by the altitude of the counter-balancing column alone would require a stand pipe 42 of too great a height for practical purposes and, hence, the said pipe is connected to the air storage or compression tank 44 and air, under high pressure, is maintained in the said tank. When the elevator car 4 is at its lowermost position and the cross head 11 is at its uppermost position, the column of water in the stand pipe 42 will be at its lowest altitude, and, at this time, the pressure exerted on the top of the water column by the air from the tank 44 will be, say, approximately one hundred fifty pounds, while, when the car is raised and the cross head 11 is lowered, the column of water in the stand pipe 42 will be at its greatest height and the pressure on the upper portion thereof by the air from the tank 44 will then be, say, approximately two hundred pounds. The variation of the pressure of the column of water on the piston 39 within the cylinder 40 is then due, both to the variation of the altitude of the column of water and to the increased compression put upon the air in the tank 44 when the column of water is raised in the stand pipe 42. This variation may be so regulated that it will properly counter-balance the varying weight or the varying counter-weighting action of the lifting cable under vertical movements of the elevator car.

The auxiliary power device preferably utilizes the stand pipe 42 and, furthermore, serves to maintain the proper compression of air in the tank 44. This device, as shown, comprises an air pump 45 of any suitable construction and driven in any suitable way and is connected by a pipe 46 to an air supply reservoir 47. This air reservoir is connected by a pipe 48 to one extremity of a valve casing 49, the other extremity of which casing opens to the atmosphere through a nozzle 50, and the intermediate portion of which casing is connected to a pipe 51 which, as shown, constitutes the upper end extension of the stand pipe 42. A valve 52 normally closes a passage in the casing 49 between the pipe 48 and the intermediate section of said casing; and a similar valve 53 normally closes a passage in the said casing 49 between the intermediate section of said casing and the discharge nozzle 50. The upwardly projecting stems of these valves 52 and 53 are connected by slot pin joints 54 to the opposite arms of a three-armed lever 55, the upper arm of

which is connected to one end of a rod 56, and the other end of the rod 56 is passed loosely through a perforation in the upwardly extending arm of the heretofore described four-armed lever 34, and, on opposite sides of the lever arm, said rod is provided with stop collars or nuts 57, which latter are so spaced that the upper arm of the lever 34 will engage the same only when the said lever is given an extreme movement, but will not engage the same under such movements of said lever 34 as required to properly actuate the main operating valve stem 33. The pipe 48 is preferably connected by a branch pipe 58 to the upper portion of the pipe 51, and this pipe 58 is provided with a check valve 59 which will permit air to be forced upward from the stand pipe into the air supply tank 47, but will check or prevent a reverse flow of the air.

A pipe 60 connects the air supply tank 47 to the compression tank 22, and this pipe 60 is provided with a normally closed valve 61. Whenever an additional supply of air is desired in the compression tank 22, it may be afforded by opening up the valve 61, thereby letting in air from the air supply tank 47. It will thus be seen that the common or single air pump 45 supplies air either directly or indirectly to the air supply tank 47, to the main air compression chamber 22 and to the compression tank 44. For the purpose of illustration, we will assume that a pressure of two hundred pounds is maintained in the reservoirs or tanks 22 and 47.

The manner, in which the elevator car is variably counterpoised by the column of water in the stand pipe 42 and by the air pressure in the reservoir or tank 44, which counter-poising action compensates for the varying counter-weighting action of the hoisting cable 8 of the car, has already been noted.

At times during the day, when the service is heavy, the car will sometimes be overloaded or loaded to such an extent that the primary power, as applied to the cylinder 15 and to the piston 14, will not be sufficient to lift the heavily loaded car, and, at such a time, the auxiliary power device, afforded by the air stored in the reservoir 47, may be rendered temporarily effective to raise the loaded car. When such a loaded car is at the bottom of the shaft, the cross head 11 will be in its uppermost position and the column of water in the stand pipe 42 will be in its minimum altitude, but the pressure of the air on this column of water, supplied from the reservoir 44, will be at minimum, or, as assumed, will exert approximately one hundred fifty pounds per square inch, under upward pressure on the cross head piston or plunger 39. This upward pressure on the said piston 39 then acts as a counter-force resisting upward movement of the elevator car. The auxiliary power device, when thrown into action at this time, temporarily releases this one hundred fifty pounds pressure on the piston 39 and correspondingly increases the lifting power of the cylinder 15 and the piston 14. The above noted release of the air pressure is effected by an extreme movement of the car-controlling lever 5 in a direction from left toward the right in respect to Fig. 4, which movement of the said lever tightens the controlling cable 38 and imparts an extreme oscillatory movement to the four-armed lever 34, thereby, with an approximately simultaneous action, opens the valve 53 of the auxiliary power device and imparts to the main controlling valve stem 33 a movement required to admit the water under pressure, through the controlling valve 20 and the pipe 19, into the upper end of the main cylinder 15. As is evident, the above noted opening of the valve 53 permits the escape of the air pressure from the stand pipe 42 to the atmosphere with the result above noted.

When the car is raised and it is desired to move the same downward, the controlling lever 5 is given an extreme movement from the right toward the left in respect to Fig. 4, thereby imparting to the main controlling valve stem 33 a movement required to connect the pipe 19 to the discharge pipe 23 and, approximately simultaneously therewith, closing the valve 53 and opening the valve 52 of the said auxiliary power device. When the valve 52 is thus opened, the pressure from the charging tank 47 restores the normal pressure within the stand pipe 42 and the compression tank 44. This auxiliary power device is intended only for occasional use and is especially to keep the car in service, even when overloaded, thereby making it unnecessary, as is frequently the case in elevator service, to stop the car and request one or more persons to step out of the car in order that the car may be moved upward.

What I claim is:

1. The combination with an elevator car and means for raising and lowering the same, of a counter-balancing device for said car, comprising a cylinder and a piston, a stand pipe extending upward from said cylinder, and an air compression chamber connected to the upper end portion of said stand pipe, substantially as described.

2. The combination with an elevator car and means for raising and lowering the same, of a counter-balancing device for said car, comprising a cylinder and a piston, one of which is fixed and the other of which is subject to movement of said car, a stand pipe extending upward from said cylinder, said cylinder and stand pipe containing a liquid,

and an air compression reservoir connected to the upper portion of said stand pipe and containing air under pressure.

3. The combination with an elevator car and means for raising and lowering the same, of a counter-poising device for said car, comprising a cylinder and a piston, one of which is subject to movement of said car, and an air storage reservoir connected to said cylinder and affording a variable pressure on said piston.

4. The combination with an elevator car and means for raising and lowering the same, of a cylinder and a piston adapted to resist upward movement of said car, an air reservoir, a pipe connecting said reservoir to said cylinder, a valve mechanism in said pipe, arranged to open communication between said reservoir and cylinder to admit air which will resist upward movements of said car, and movable to open said pipe to exhaust and thereby decrease the normal resistance against upward movement of said elevator car, substantially as described.

5. The combination with an elevator car and means for raising and lowering the same, of an auxiliary mechanism including means for supplying pneumatic power, adapted to be manipulated to increase the elevating capacity of the coöperating mechanism, substantially as described.

6. The combination with an elevator car and means for raising and lowering the same, said means being subject to a common controller carried by said car, of an auxiliary mechanism including means for supplying pneumatic force, operative to increase the lifting capacity of the elevator mechanism and subject to movements of the said common controller on the car, substantially as described.

7. The combination with an elevator car and means for raising and lowering the same, of a car counter-balancing mechanism, comprising a cylinder and a piston, one of which is subject to movements of the car, two air storage reservoirs connected to said cylinder, one thereof serving as a supply reservoir and the other as a compression reservoir, and valve mechanism arranged to be manipulated by the part carried on the car and operative in one position to connect said supply reservoir to said cylinder, and in another position to open said cylinder to exhaust, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

EDWIN CARLSON.

Witnesses:
HARRY D. KILGORE,
F. D. MERCHANT.