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ELEVATOR CONTROLLING MECHANISM.

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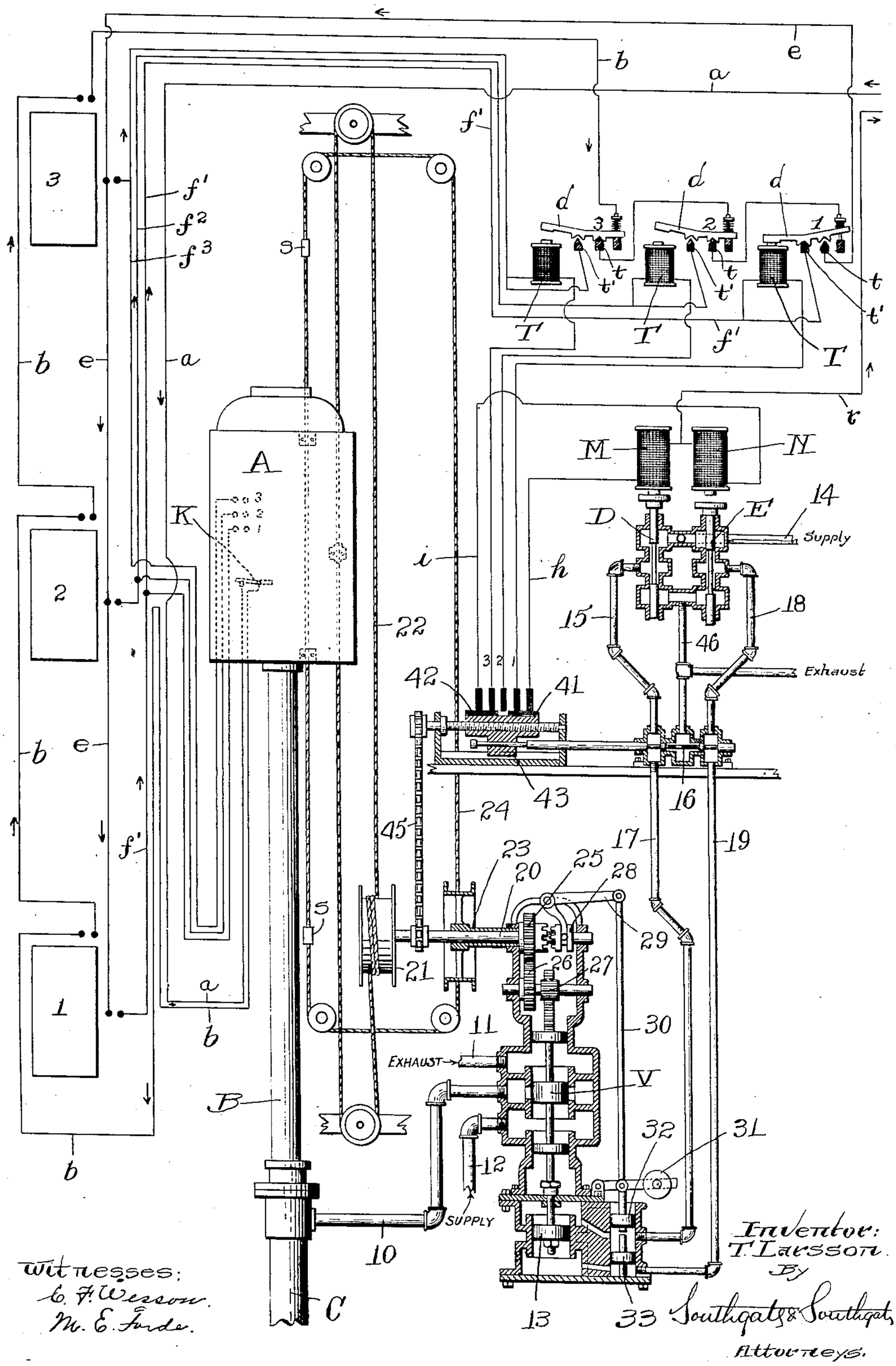

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UNITED STATES PATENT OFFICE.

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ELEVATOR-CONTROLLING MECHANISM.

No. 911,888. Specification of Letters Patent. Patented Feb. 9, 1909.

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To all whom it may concern:

Be it known that I, THURE LARSSON, a subject of the King of Sweden, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented a new and useful Elevator-Controlling Mechanism, of which the following is a specification.

This invention relates to an improved construction for controlling a hydraulic elevator.

The especial object of this invention is to provide a form of elevator controlling mechanism in which the travel of the elevator car or other moving element is employed for closing the main valve when the elevator is to be stopped; to provide connections for normally locking the main valve with parts controlled from the motion of the elevator car or other moving part, so that the elevator can not be started until after the main valve is first automatically unlocked; to provide for shifting the main valve from its closed position by means of pressure admitted through electrically operated valves; to provide means for automatically breaking the circuit when the elevator has reached any desired landing, permitting the valve restoring mechanism operated by the travel of the elevator to come into operation; to provide automatic circuit switching devices which will automatically short-circuit the push buttons, so as to maintain a circuit until the car reaches the desired landing so that when a push button has been operated the car will not stop until it reaches a landing corresponding thereto, and after a push button has been operated, no succeeding push button can be operated until after this travel of the elevator is completed; to provide cut-out devices for preventing any operation from taking place while any of the elevator doors are open; to provide hand-controlled connections for operating the main valve whenever the valve restoring connections are unclutched, which hand-controlled connections are provided with automatic end-stops for stopping the car at the end of its run; to provide an emergency cut-out switch in the elevator car for stopping the travel of the elevator car in unusual cases; and to provide pressure controlling end-stops so as to furnish additional assurance of bringing the car to rest at the ends of its run.

To these and other ends, this invention consists of the parts and combinations of parts as hereinafter described and more particularly pointed out in the claims at the end of this specification.

The accompanying drawing illustrates diagrammatically the application of this invention to a direct plunger hydraulic elevator. It is understood, however, that a controlling mechanism constructed according to this invention is also applicable to other types of hydraulic elevators.

Referring to the drawing for a detail description of one form of construction embodying this invention, A designates an elevator car which is connected to and directly operated by a plunger B, which runs down into a plunger casing C. These parts may be of the ordinary or approved construction and need not be herein described at length. Opening into the plunger casing C is a to and from pipe 10, which is connected with a valve casing containing the main valve V. Also connected to the casing of the main valve V is a supply pipe 12 and an exhaust pipe 11. These parts are arranged substantially in the ordinary manner so that when the main valve V is moved down, a connection will be opened between the exhaust pipe 11 and the to and from pipe 10 to permit the elevator car to descend, and when the main valve V is lifted, a connection will be opened between the to and from pipe 10 and the supply pipe 12, to raise the elevator car. When the main valve V is in central position, the elevator is stopped. The main valve is shifted from normal position by pressure admitted through electrically controlled valves. To accomplish this purpose, an operatiing piston 13 is secured on the lower end of the main valve stem. The admission of pressure above the piston 13 to open the main valve V is controlled by a small electrically actuated valve D. The valve D is arranged to be lifted by a magnet M to admit pressure from a supply pipe 14 to a pipe 15, which pipe 15 is normally connected to the exhaust through a pipe 46. The pipe 15 is connected through the casing of an emergency stopping valve to a pipe 17 to admit pressure to the central part of a controlling chamber and thence through a port above the piston 13.

The electrically actuated valve E for admitting pressure to shift the main valve V to connect the elevator plunger casing with the supply is similar in construc-

tion to the valve D and is arranged to be lifted by a magnet N to admit pressure from the supply pipe 14 to a pipe 18, which is also normally connected to the exhaust through pipe 46. The pipe 18 connects through the casing of the emergency stopping valve to a pipe 19 admitting pressure to the lower end of the controlling cylinder and thence through a port below the piston 13 to raise the main valve. When the main valve is shifted from its normal or closed position, it is moved or shifted back to normal position by means of connections operated from the travel of the elevator car or other moving element just before the car is to come to rest. These valve restoring connections are normally coupled together to form an operative train between the elevator car or other moving part and the main valve so that the main valve can not be shifted from its normal central position until this train has been unlocked or uncoupled. As herein illustrated, the train of connections comprising this automatic valve restoring mechanism comprises a shaft 20 journaled in brackets extending up from the casing of the main valve V.

Secured on the outer end of the shaft 20 is a capstan or drum 21 having an endless rope 22 wrapped thereon, which rope 22 passes around suitable sheaves and is connected to be operated by the elevator car A, although it might be operated by other moving parts which travel with or at a fixed speed ratio with the elevator car.

Journaled on the shaft 20 is a sleeve 23 having on its inner end a gear 25 which drives a gear 26 through a pinion. Turning with the gear 26 is a pinion 27, which meshes with a rack carried by the valve stem of the main valve V.

On its inner face the sleeve 23 is provided with clutch teeth coöperating with a clutch section 28, which is splined on the shaft 20 but is moved longitudinally thereon. The clutch section 28 is normally locked into engagement with the sleeve 23 to form a valve restoring connection, by means of which the travel of the elevator car will restore the main valve to its central position. The means normally tending to hold the clutch sections into engagement with each other comprise a bell-crank lever 29 having a rod 30 extending down therefrom which rod 30 is normally drawn down by a weight 31.

To provide for unlocking the valve restoring connections when the elevator car is to be started, the rod 30 extends down into the controlling chamber and is provided with a piston 32, which is lifted when pressure is admitted through the pipe 17. Below the piston 32 is a separate piston 33, which is lifted when pressure is admitted to the pipe 19. By means of this construction whenever pressure is admitted through either of the pipes 17 or 19, the valve restoring connections will be first unlocked or uncoupled to permit the main valve to be shifted, which connection will remain unlocked until just before the car is to come to rest and the elevator will continue to travel so long as pressure is maintained in either of the pipes 17 or 19. Whenever it happens, however, that pressure is cut off through the pipes 17 and 19, the connections normally tending to hold the clutch sections into engagement with each other will connect the valve restoring train so that the further travel of the car will automatically close the main valve, bringing the car to rest opposite the desired landing. I consider this a particularly important feature of my invention. That is to say, it provides a more advantageous means for automatically closing the main valve than any of the other constructions with which I am familiar.

In the older forms of hydraulic elevators, the main valves have usually been operated by hand. In the larger and more modern hydraulic elevators, especially for high speed elevators, the main valves are necessarily so large that they cannot be readily actuated by hand-controlled connections. To overcome this difficulty, it has been proposed to operate the main valve by pressure so that a comparatively small pilot-valve could be used for admitting and exhausting the pressure which shifts the controlling valve, while in other cases electric connections or other supplemental power has been used to operate the main valve. In none of these constructions, however, so far as I am familiar with the same, has the elevator car been coupled to a valve restoring mechanism by means of which the travel of the car itself will be utilized to close the main valve, which valve restoring connections are normally coupled together so that the car cannot again be started until the clutch or other coupling connection has first been thrown out of engagement.

In connection with the valve restoring mechanism, I also preferably provide hand-controlled connections which may be employed for shifting the main valve by hand and which will also provide for automatically stopping the car at the ends of its run when the clutch sections are out of engagement. To accomplish this purpose, the sleeve 23 is provided with a drum or capstan, wound on which is a controlling rope 24, which passes through the elevator car in the ordinary manner and is provided with stops S arranged to be engaged by the elevator car as the same approaches the ends of its run.

Any desired electrical connections may be employed for closing the circuits which admit pressure to shift the main valve. In the present instance I have illustrated an

arrangement of electrical connection in which buttons are arranged at the several landings, or in the elevator car, and operated from said push buttons are automatic switches arranged to short-circuit the push buttons so that when the elevator car has been started, no other circuit can be completed until after the car has been brought to rest opposite the desired landing.

To provide for stopping the car when it reaches the landing, a circuit breaking device is employed, which is connected to be operated by the travel of the car, and in practice also the several electric circuits are preferably arranged so that no circuit can be completed or closed while any one of the elevator doors are open.

The electrical connections which are herein shown are described simply to illustrate one manner in which the electrically controlled valves may be operated.

Referring to the drawings for a detail description of the electrical connections herein illustrated, *a* designates a wire from any suitable source of electrical energy. A current passing along the wire *a* passes through a wire which may be contained in a flexible pipe in the ordinary manner, so as to be connected to a cut-out knife switch K, or emergency cut-out, which is located in the elevator car and may be actuated whenever it is desired to break the circuit to stop the car before it reaches the landing towards which it is traveling. From the knife-switch K the current passes through wire *b*, through a number of circuit breaking devices of ordinary construction, which are normally closed by the elevator doors, as illustrated diagrammatically. From the wire *b* the current passes through a number of automatic switches. In the present instance, three automatic switches are illustrated corresponding with the three floors or landings. Each of these automatic switches comprises a pair of terminals t—t^1 and a spring controlled switch-blade *d*. When the switch-blade is in normal position, it makes a connection with the terminal *t*. Each of the switch blades is arranged to be tipped by an electro-magnet T so as to break connection with the terminal *t* and close a circuit through the terminal t^1, as illustrated in connection with the automatic switch No. 1, corresponding to landing No. 1. Considering now automatic switch No. 1 as being in its normal position, the current will travel from its terminal *t* through wire *e*, which wire is connected to the several push buttons at the different floors or which may also be connected to push buttons in the car. The push buttons will make connection with the several return wires f^1—f^2—f^3 corresponding with the several landings. Suppose that push button at floor No. 1 be operated, the current will return through wire f^1, through the magnet T, to one brush of an automatic circuit breaking device, which automatically breaks the circuit when the car approaches the desired landing. As hereinafter described, the circuit breaking device comprises contact strips 41 and 42. In the present instance, the current from contact strip 41 passes through magnet M to the outgoing wire *r*, which returns to the source of electric energy completing the circuit. As soon, however, as the circuit is completed through one of the magnets T, it will pull down its pivoted switch blade *d* breaking circuit with terminal *t*, so that the current from wire *b* will pass directly through terminal t^1, thence through the magnet to the circuit breaker, thus creating a short-circuit to the magnet T of the automatic switch corresponding with the button which is operated. Throwing in a short-circuit in this manner will cut out all of the push buttons, so that no other circuit can be established while the car is in motion, and the car will continue to run until the circuit is broken opposite the desired landing by means of the automatic circuit breaker.

As herein illustrated, the sliding contact strips 41 and 42 are carried by a movable piece 43 threaded into which is a lead-screw, which is connected by a sprocket chain 45 to the shaft 20. The piece 43 is mounted on its lead screw so as to be moved back and forth thereby substantially in the same manner that the carriage of a screw-cutting lathe or other reciprocating part is controlled by such lead-screw. A suitable gap or circuit breaking space is left between the contact strips 41 and 42, so that when any terminal or brush corresponding with the several landings is opposite this gap or space, the circuit will be broken, while, as before explained, the contact strip 41 is connected by a wire *h* to the magnet M and the contact strip 42 is connected by a wire *i* to complete a circuit through the magnet N, which controls the valve E for shifting the main valve to cause the elevator to ascend.

To provide additional means for stopping the elevator at the ends of its run, I preferably provide a stop-valve 16, which has a lost motion connection with the movable piece 43, as by means of a lever (not shown). By means of this construction when the elevator reaches the end of its run in one direction the pipe 19 will be connected to the exhaust, and when the elevator reaches the other end of its run, the pipe 17 will be connected with the exhaust. This construction provides for additional assurance that the elevator will not run past the desired limits, although this mechanism is preferably only brought into operation as an emergency stop for automatically stopping the car.

I am aware that numerous changes may be made in practicing my invention by those

who are skilled in the art. For example, the specific electrical constructions may be widely varied or may be entirely dispensed with when it is desired to operate small controlling valves by direct connections from the elevator-car. In vew of this, I do not desire to be limited to the particular constructions I have herein shown and described, nor to the use of the entire combinations, as it is obvious that different features of the construction may be used in different combinations and in different locations or applied to different types of elevators, without departing from the scope of the invention as expressed in the claims.

Having thus fully described my invention, what I do claim and desire to secure by Letters-Patent of the United States is:—

1. In a hydraulic elevator plant, the combination of a main valve, valve restoring connections operated by a moving part of said plant and normally connected to move the valve to its closed position, and means for uncoupling the valve-restoring connections during the desired travel of the car.

2. In a hydraulic elevator plant, the combination of a main valve, valve-restoring connections operated from a moving part of the plant, comprising a clutch normally connected to move the valve to its closed position, and means for uncoupling the clutch during the desired travel of the car.

3. In a hydraulic elevator plant, the combination of a main valve, a shaft, means for turning the shaft from a moving part of the plant, a clutch normally connected to move the valve to its closed position, and means for uncoupling the clutch during the desired travel of the car.

4. In a hydraulic elevator plant, the combination of a main valve, a shaft, a drum secured on the shaft, an endless rope wound on said drum, and connecting to a movable part of the plant, a clutch normally connected to move the valve to its closed position, and means for uncoupling the clutch during the desired travel of the car.

5. In a hydraulic elevator plant, the combination of a main valve, an operating piston for the main valve, means for supplying pressure to act on said piston to shift the main valve, a valve restoring mechanism operated from a moving part of the plant and normally connected to move the valve to its closed position, and means for uncoupling the valve restoring mechanism during the desired motion of the car.

6. In a hydraulic elevator plant, the combination of a main valve, an operating piston therefor, a controlling valve for admitting pressure to act on the piston to shift the main valve and start the elevator, and a valve-restoring mechanism operated from a moving part of the plant and normally connected to restore the main valve to its closed position.

7. In a hydraulic elevator plant, the combination of a main valve, an operating piston therefor, an electrically controlled valve for admitting pressure to act on the piston to shift the main valve and start the elevator, and a valve restoring mechanism operated from a moving part of the plant and normally connected to restore the main valve to closed position.

8. In a hydraulic elevator plant, the combination of a main valve, an operating piston therefor, two electrically controlled valves, one for admitting pressure above the piston to start the elevator in one direction, and the other for admitting pressure below the piston to start the elevator in the opposite direction, and a valve-restoring mechanism operated from a moving part of the plant and normally connected to restore the main valve to closed position.

9. In a hydraulic elevator plant, the combination of a main valve, a valve-restoring mechanism operated from a moving part of the plant and normally connected to move the main valve to closed position, and an elevator starting device controlled from the car for first disconnecting the valve-restoring mechanism, and then opening the main valve to start the car in either direction.

10. In a hydraulic elevator plant, the combination of a main valve, a valve restoring mechanism operated from a moving part of the plant and comprising a clutch normally connected to move the valve to closed position, and starting devices controlled from the elevator-car for first uncoupling the clutch and then moving the main valve to start the car up or down.

11. In a hydraulic elevator, the combination of a main valve, a valve restoring mechanism operated from the travel of the car and normally connected to move the valve to its closed position, and means for applying pressure to first uncouple the valve restoring mechanism and then shift the main valve.

12. In a hydraulic elevator, the combination of a main valve, a valve restoring mechanism operated by the travel of the car normally connected to move the main valve to its closed position, an operating piston for the main valve, and a controlling valve for first admitting pressure to uncouple the valve restoring mechanism and to then act on the piston to shift the main valve.

13. In a hydraulic elevator, the combination of a main valve, a valve restoring mechanism operated by the travel of the car and normally connected to move the main valve to its closed position, an operating piston for the main valve, a piston connected to uncouple the valve restoring mechanism,

and a controlling valve for first admitting pressure to uncouple the valve restoring mechanism and to then act on the piston for shifting the main valve.

14. In a hydraulic elevator, the combination of a main valve, a valve restoring mechanism operated by the travel of the car, a clutch for the valve restoring mechanism, an operating piston for the main valve, a piston for uncoupling the clutch, a controlling valve for admitting pressure to act on said pistons, whereby the valve restoring mechanism will first be unlocked and the main valve then shifted, and a weight for moving the parts of the clutch back into engagement when the controlling pressure is shut off, whereby the continued travel of the car will move the main valve to closed position.

15. In a hydraulic elevator, the combination of a main valve, a valve restoring mechanism operated by the travel of the car, a clutch for the valve restoring mechanism, an operating piston for the main valve, two pistons connected to uncouple the clutch, and two electrically operated controlling valves, one for admitting pressure to uncouple the clutch and shift the main valve in one direction, the other connected to admit pressure to uncouple the clutch and move the main valve in the opposite direction.

16. In a hydraulic elevator, the combination of a main valve, hand-operated valve shifting gearing for operating the main valve from the elevator-car, a shaft, connections for turning said shaft from the travel of the elevator-car, and a clutch normally connecting the shaft with the valve shifting mechanism.

17. In a hydraulic elevator, the combination of a main valve, an electrically operated valve for admitting pressure to shift the main valve, means for establishing a circuit to open the controlling valve, a circuit breaker operated by the travel of the car for releasing the controlling valve when the elevator reaches the desired landing, a valve restoring mechanism actuated by the travel of the car, comprising a clutch, and connections operated by the pressure admitted by the electrically operated controlling valve for holding the clutch uncoupled.

18. In a hydraulic elevator, the combination of a main valve, an electrically controlled valve for admitting pressure to shift the main valve in one direction, an electrically controlled valve for admitting pressure to shift the main valve in the opposite direction, means for establishing circuits to operate said valves, a circuit breaking device for opening the circuit when the elevator is opposite the desired landing, a clutch normally connected to close the elevator valve from the travel of the car, and means for uncoupling the clutch when pressure is admitted through either of the electrically operated controlling valves.

19. In a hydraulic elevator, the combination of a main valve, an electrically operated controlling valve for admitting pressure to shift the main valve, push buttons corresponding to the several landings, automatic switches for short-circuiting the push buttons and maintaining circuits for the controlling valve until the car reaches the desired landing, a circuit breaker operated from the travel of the car for automatically breaking the circuits when the car reaches the desired landing, a clutch normally connected to restore the main valve to closed position from the travel of the car, and means for uncoupling the clutch when pressure is admitted through the controlling valve.

20. In a hydraulic elevator, the combination of a main valve, an electrically operated valve for admitting pressure to shift the main valve, and a moving piece operated by the travel of the car arranged to act as a circuit breaker and also connected to exhaust the pressure admitted by the electrically operated valve to insure the stopping of the elevator at the end of its run.

In testimony whereof I have hereunto set my hand, in the presence of two subscribing witnesses.

THURE LARSSON.

Witnesses:

PHILIP W. SOUTHGATE,

LOUIS W. SOUTHGATE.