

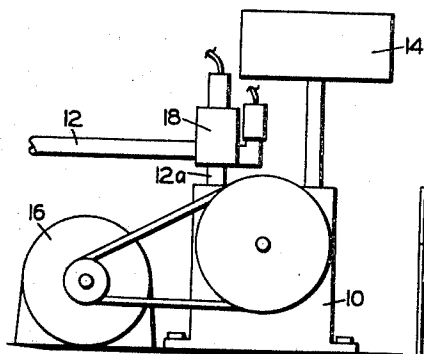
Nov. 11, 1969

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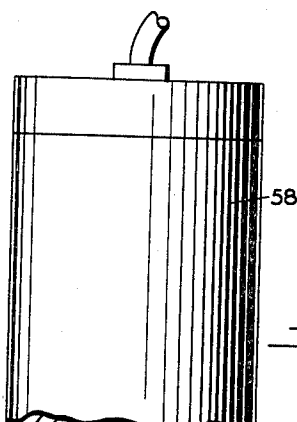
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ELEVATOR FLUID CONTROL VALVE MECHANISM

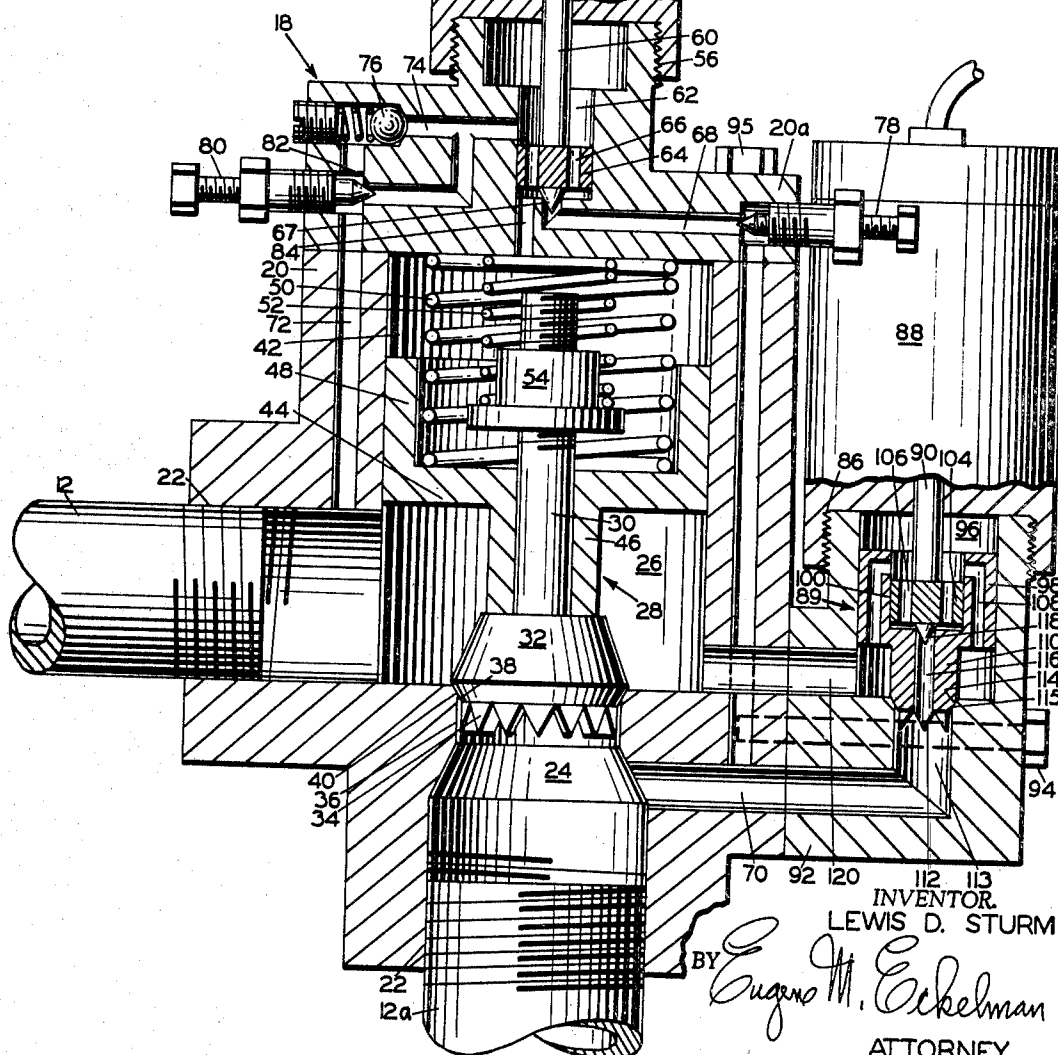
Filed April 3, 1967



*Fig. 1*



*Fig. 2*



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## ELEVATOR FLUID CONTROL VALVE MECHANISM

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Filed Apr. 3, 1967, Ser. No. 627,708

Int. Cl. F16k 11/00, 31/12; F15b 13/04

U.S. Cl. 137-599

13 Claims

### ABSTRACT OF THE DISCLOSURE

Valve mechanism that is connected between a conventional pump and a fluid operated piston of the type which operates an elevator in up and down and stop functions. The mechanism includes a housing in which is incorporated several individual valves for controlling the flow of fluid through the housing. Some of the valves are operated in part by solenoids controlled by conventional elevator selector means.

### BACKGROUND OF THE INVENTION

This invention relates to an elevator fluid control valve mechanism and more particularly is concerned with mechanism arrangement to be controlled by conventional electric elevator selector circuits for up and down and stop functions of the elevator.

Conventional piston operated elevators utilize the necessary components of a pump, a piston for lifting the elevator, a reservoir, and necessary valving mechanism and conduits. The valving mechanism existing between the pump and the elevator piston in prior devices has been complex and expensive, utilizing multiple valves and connecting conduits. In addition to comprising an expensive structure to manufacture, such prior devices require a great amount of time for installation and maintenance and furthermore utilize outside conduits which are subject to accidental damage.

### SUMMARY OF THE INVENTION

Briefly stated, the invention employs a housing in which is incorporated a series of valves and passageways and a pair of solenoids for operating some of the valves. The solenoids are controlled in their operation by elevator selector means in functions of rapid up movement, level movement, rapid down movement, level down movement, and emergency stop. The primary objective of the present invention is to provide control mechanism of the type described arranged to be mounted between the pump and an elevator operating piston and having a novel valve arrangement which is compact and utilizes all inside passage in lieu of conduits, thus providing control mechanism which is simplified in structure, easy to install and maintain, and safe from accidental damage.

Another object is to provide an elevator fluid control valve mechanism of the type described which has a novel arrangement of valves and passageways providing smooth operation of an elevator as well as smooth leveling thereof.

Another object is to provide an elevator fluid control valve mechanism of the type described employing a first valve which has free movement between open and closed positions and which is controlled in such movements by second and third solenoid operated valves.

Additional objects and advantages will become apparent from the following description taken in connection with the accompanying drawings which illustrate a preferred form of the mechanism.

### BRIEF DESCRIPTION OF THE DRAWING

In the drawings:

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FIGURE 1 is a side elevational view of the present elevator control mechanism as associated with a pump; and

FIGURE 2 is a cross sectional view of the present control mechanism enlarged relative to FIGURE 1.

### DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now in particular to the drawings and first to FIGURE 1, the numeral 10 designates a pump for supplying fluid under pressure to a conduit 12 leading to a piston and cylinder assembly, not shown, capable of operating an elevator vertically. The pump 10 is of conventional construction as is the piston and cylinder. Pump 10 has the usual fluid reservoir 14 and drive motor 16 and includes an externally threaded outlet conduit 12a.

The present control mechanism is designated generally by the numeral 18 and comprises a housing or body member 20 having tapped bores 22 leading into two adjacent sides for threaded connection with conduits 12 and 12a. The bore 22 associated with the conduit 12a leads into a chamber 24 and the other bore 22 leads into a chamber 26, these two chambers having a controlled communication therebetween by means of a main valve 28.

Valve 28 has a stem 30 terminating at its lower end in an enlarged head 32 provided with bottom saw tooth projections 34. The lower toothed end of valve head 32 is arranged to move freely into a port 36 which establishes communication between chambers 24 and 26, and the said head has a beveled portion 38 arranged to seat on the upper defining wall edge of port 36 for providing a positive seal against backflow of fluid from chamber 26 to chamber 24. The defining wall edge of the port 36 also has a bevel 40 to provide a good seal with the beveled portion 38 on the head 32. As is well understood in the art, the saw tooth projections 34 accomplish a gradual flow through the valve as the latter is opened, as well as a gradual stoppage as the valve is closed, to provide smooth operation of the elevator.

Valve stem 30 projects upwardly into an enlarged chamber 42 in axial alignment with the port 36, and slidably mounted on the stem 30 is a valve operating member or cup 44 having a downwardly projecting boss or hollow stem 46 slidably supported on the stem 30. Valve operating member 44 also has an upwardly projecting flange 48 forming an open top, cup-like structure. Valve operating member 44 is slidably engaged in the chamber 42 with the outer surface thereof in sealing relationship with the defining side walls of said chamber.

Boss 46 of the valve operating member 44 is adapted for abutting engagement with the upper end of head 32, and the entire assembly is urged toward a closed valve position by a first compression spring 50 having abutting engagement between the upper defining wall of chamber 42 and the bottom wall of member 44 and also by a second compression spring 52 having abutting engagement between the upper defining wall of chamber 42 and a collar 54 threadedly mounted on the stem 30. Collar 54 is adjustable on the threaded stem 30 to control the spring force acting on the stem 30. Since the valve operating member 44 is slidably associated with the valve stem 30, relative axial movement of these parts may occur in functions of operation to be described hereinafter.

Mounted on the upper end of housing 20, as by means of a threaded support 56 is a solenoid 58 forming a part of an electric circuit which includes elevator selector means. Such selector means are of conventional construction and are not shown herein.

Solenoid 58 has a plunger 60 which is projected downwardly in a de-energized condition of the solenoid, such as by a spring return in the solenoid, and which is pulled upwardly by the electrical force of the solenoid when the

latter is energized. The lower end of plunger 60 projects into a chamber 62 and integrally carries adjacent its lower end a valve 64 slidably engaged in the chamber 62 for sealing engagement with the side walls of the latter and having vertical ports 66 therein which permit the flow of fluid through the head in an axial direction. The bottom end of plunger 60 is pointed at 67 and has sealing engagement with the outlet of a passageway 68 leading into another passageway 70 which has direct communication with the chamber 24. Thus, when the solenoid 58 is deenergized, the plunger 60 seals the one end of the passageway 68 and when deenergized fluid can flow through such passageway.

Leading from chamber 26 to chamber 62 is another passageway 72, such passageway opening into the chamber 62 at an upper portion thereof and more particularly above the valve 64 in the lower position of the latter, the parts being arranged such that when the solenoid 58 is energized the valve 64 will cover the outlet of passageway 72 and prevent fluid flow from said passageway to chamber 64. Associated with the passageway 72 is a bypass passageway 74 in which is included a spring pressed, ball check valve 76 the purpose of which will be described hereinafter. The housing 20 has needle control valves 78 and 80 mounted thereon which project into respective passageways 68 and 72. These valves are adjustable to regulate the rate of flow of fluid through such passageways. An area 82 of passageway 74 adjacent the working end of needle valve 80 is enlarged in order that fluid flow in the passageway 74 can freely by-pass such needle valve.

Chamber 42 is in communication with chamber 62 by means of a port 84.

Further mounted on the housing 20, as by means of a threaded support 86 is a solenoid 88 also in circuit with the elevator selector means. This solenoid forms a part of a valve designated generally by the numeral 89, and has a plunger 90 which similar to the plunger 60 is projected downwardly in a de-energized condition of the solenoid but is forcefully pulled upwardly when the solenoid is energized. The plunger 90 is extended in FIGURE 2, comprising the de-energized condition of the solenoid. The threaded support 86 may comprise an integral cast portion of the housing 20 or as shown it may form a part of a mounted extension 92 secured to the housing 20 by stud screws 94.

Housing extension 92 has a chamber 96 in which is slidably mounted in sealing engagement with its defining walls a valve head 98, forming a part of the valve 89. This valve head has a chamber or bore 100 leading downwardly from its upper end and terminating above the bottom thereof. Chamber 100 slidably receives an auxiliary head 104 secured to the lower portion of the plunger 90. This auxiliary valve head has vertical ports 106, and valve head 98 has ports 108 which extend vertically from the lower end thereof and terminate at their upper ends in the chamber 100 such that when the auxiliary valve head 104 is in a lowered position the ports 108 open into the chamber 100 above the head 104 and when the latter is moved to an upper position by the solenoid 88 it seals off the upper ends of the ports 108. Valve head 98 has a bottom projection 110 terminating at its lower end in saw tooth type projections 112. The lower end of projection 110 moves freely in a port 113 which establishes communication between passageway 70 and chamber 96. Similar to the structure of valve 28, projection 110 has a beveled portion 114 engageable with a beveled portion 115. Valve projection 110 has an axial port 116 which is always open to the passageway 70 but which is adapted to be closed at its upper end by a bottom pointed end 118 on the plunger 90. Thus, with the solenoid 88 deenergized, fluid cannot flow through port 116. Chamber 96 is in communication with the chamber 26 by means of a passageway 120, the latter passageway leading into the lower portion of the chamber 96 in order to open thereinto

below the valve head 98. Passageway 120 by-passes passageway 68, as indicated in dotted lines, in order that there will be no direct communication therebetween.

#### OPERATION

For describing the operation of the present control mechanism, it is to be understood that FIGURE 2 illustrates the position of all the valves when the elevator is stopped. In such a position, solenoids 58 and 88 are deenergized, with the result that the upper end of passageway 68 is closed by the plunger 60, the upper end of port 116 in the valve head 98 is closed by the plunger 90, and communication between passageways 70 and 120 is closed by the valve projection 110. The pump at this time is not operating and the back pressure of fluid existing in conduit 12 from the weight of the elevator is sealed off from the conduit 12a by the valve 28. Fluid under pressure exists in passageway 72 and on top of valve operating member 44, the communication between the passageway 72 and chamber 42 being established by ports 66 in the valve 64 and by port 84. Such fluid pressure on top of member 44 and head 32 holds the valve 28 shut, assisted by the springs 50 and 52.

When the pump is started and solenoids 58 and 88 remain deenergized, as when the "up" button of the elevator selector means is pushed, the output pressure from the pump forces the valve 28 upwardly and fluid flows through port 36 into conduit 12, the fluid pressure from the pump overcoming the back pressure of the elevator to raise the latter. Fluid under pressure from the pump will also flow through passageway 70, raise the valve assembly 89 against the spring action of the solenoid 88, and pass into the conduit 12 through passageway 120. The entire valve assembly 89 is raised at this time with the bottom end of plunger 90 remaining in sealed engagement with port 116. Thus, any fluid which may exist above this valve assembly can escape into passageway 120 through ports 108 in the valve head 98 to prevent fluid lock on top of the valve. Although fluid exists above the valve 28 at the time that the pump raises such valve, the area above the valve is at this time a lower pressure area than below the valve due to the outflow of fluid through conduit 12. Thus, the valve can open freely. The check valve 76 opens at this time to allow a fast escape of fluid from the upper portion of the valve 28 and be discharged into conduit 12 through passageway 72, the fluid above the valve 28 escaping to passageway 72 through port 84, ports 66, and auxiliary passageway 74. Since the solenoid 58 is not energized at this time, its lower plunger end seals off passageway 68. In the position of the parts just described, the elevator is moving up rapidly at least in relationship to a leveling function now to be described.

When the solenoid 58 is energized and the pump is still providing pressured flow to the conduit 12a, such as when the elevator selector means requires a reduced speed, level-up condition, plunger 60 is raised by the solenoid 58 to open the upper end of passageway 68 and allow fluid to flow from passageway 68 to port 84 and into chamber 42. The upward movement of plunger 60 causes the valve head 64 to close off the upper end of passageway 72 and fluid pressure in chamber 42 becomes greater than in chamber 26 so as to close the valve 28 slowly. The springs 50 and 52 assist in closing. Such closing of the valve 28 is not instantaneous but more or less gradual to provide a smooth conversion of movement of the elevator between the full up movement and the level up. The speed at which the valve 28 closes is controlled by a selective setting of the valve 78 since it is the rate of flow through passageway 68 that determines the time period for closing the valve 28. The speed at which the valve closes is also determined by the compression force of springs 50 and 52 and the threaded setting of collar 54.

In the level-up condition of the present mechanism, as in the full speed up, fluid pressure holds the valve 89

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open and fluid flows through passageway 120 to conduit 12. Since the passageways 70 and 120 are of restricted size the elevator will now move upwardly at a substantially slow speed.

When the solenoid 58 is de-energized and the pump simultaneously shut-off by the elevator selector means, as when the elevator has reached the floor level after leveling up, the valve 89 will drop immediately under the action of the spring pressure from the solenoid as well as from fluid pressure which exists on top of the valve head 98 and head 104, as a result of fluid flow through ports 108. Valve 89 thus acts as a check valve in this function of operation. In this stage of operation, the plunger 60 still seals off the upper end of passageway 68 and the plunger 90 still closes off the upper end of port 116, and since the valve 28 is closed, backward flow of fluid is prevented and the elevator is held at floor level.

When the solenoid 58 is energized while the solenoid 88 remains de-energized and the pump is started, as when the elevator has sagged slightly below floor level and the elevator selector means requires a leveling up, valve 28 remains closed by fluid pressure which once again exists in chamber 42 due to the flow of fluid from the pump through passageway 68 and port 84 and the leveling up fluid movement to conduit 12 moves through passageway 70, valve 89, and passageway 120. When the solenoid 58 is de-energized and the pump simultaneously shut off, the valve 89 will drop down as described hereinbefore and the plunger 60 will again close off the upper end of passageway 68.

When the solenoid 58 is energized while the pump is shut off, and the solenoid 88 remains de-energized such as when the elevator selector means is in a condition requiring rapid down movement of the elevator, fluid in chamber 42 bleeds off through port 84 and passageway 68 and down into the pump conduit 12a through passageway 70. Since no appreciable pressure now exists above the valve operating member 44 and since a high pressure exists in chamber 26 from the back flow of fluid from the elevator, valve 28 opens immediately and allows fluid to return through the pump to the reservoir. The elevator will travel down rapidly until such time that a level down is desired. To start the level down the solenoid 58 is de-energized and the solenoid 88 is energized. When the solenoid 58 is de-energized and solenoid 88 is simultaneously energized fluid flows to chamber 42 by means of passageway 72 and achieves a balanced pressure above and below the valve 28. The backflow force of fluid as well as the springs 50 and 52 close the valve 28. The closing movement of the valve 28 at this time is not instantaneous but at a speed to stop the elevator smoothly for its conversion into leveling down, to be described next. The closing speed of valve 28 can be varied according to the setting of needle valve 80 since it is the rate of flow of fluid through passageway 72 to chamber 42 that determines the time it takes to establish a balanced pressure above and below such valve to allow the springs to close it. The force of springs 50 and 52 also determine the speed at which the valve 28 closes.

In a condition of the valve of the present mechanism wherein the solenoid 58 is de-energized and the solenoid 88 is energized, such as in the leveling down function, valve 89 opens and fluid moves in a restricted flow through passageways 120 and 70 to return to the reservoir. The restricted flow of fluid to these passageways provides a smooth level down of the elevator.

When the solenoid 88 is de-energized with the solenoid 58 remaining de-energized, such as when the elevator selector means calls for a stop of the level down, valve 89 immediately closes by the spring pressure of the solenoid as well as the fluid pressure existing on the upper surface of the heads 98 and 104. In this stage of operation, plunger 60 seals off passageway 68 and the valve 89 seals off backflow to passageway 70. The elevator thus stops.

When the solenoid 88 is energized just temporarily and the solenoid 58 remains de-energized while the pump is still off, as when the elevator selector means requires a slight leveling down of the elevator, the valve 89 opens, due to the fluid pressure on the lower surfaces thereof and the lack of fluid pressure on the upper end thereof because of the sealing of the upper end of the ports 108 by the head 104. Fluid flows through passageways 120 and 70. As soon as the solenoid 88 is de-energized, the valve closes instantaneously by the spring pressure on the plunger 90 and by fluid pressure which now exists on the top surface of the valve heads 98 and 104 because of the uncovering of the upper portion ports 108 by head 104. It is to be understood that when the solenoid 88 is energized and the plunger moved upwardly with the upper ends of ports 108 being sealed by the head 104, fluid existing in the chamber 96 can escape downwardly through ports 106 and 116.

During all functions of the elevator it can be made to come to a rapid stop, such as an emergency stop, when the two solenoids are de-energized simultaneously with the shutting off of the pump. In this condition, the stem 30 of valve 28 falls rapidly relatively unaffected by fluid resistance and the quick stop is accomplished.

In the functions of the present mechanism above described, it is apparent that the three valves and passageways are arranged so as to provide a compact structure wherein such valves and passageways perform multiple functions as determined by the operation of the solenoids 58 and 88 as well as by the pump. For example, passageway 68 serves to produce a balance of fluid pressure on the valve 28 in the initiation of a level up function in order that said valve can close and also serves as a bleed-off passageway when the parts are in a position providing for a rapid down movement of the elevator. Furthermore, valve 89 serves to permit a restricted flow to the elevator pistons, such as in a level-up function of the elevator, and also controls the level-down function of the elevator. By the novel co-operation of the valves and the selective disposition of the passageway and ports, a minimum of parts is used to reduce the cost of manufacture and the cost of maintenance. All of the passageways are disposed within the housing 20 itself to prevent any accidental damage to conduits.

It is to be understood that the form of my invention herein shown and described is to be taken as a preferred example of the same and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of my invention.

Having thus described my invention, I claim:

1. An elevator fluid control valve mechanism comprising a housing, inlet means in said housing arranged to communicate with a pump, outlet means in said housing arranged to communicate with elevator drive means, means defining a port in said housing establishing communication between said inlet and outlet means, a main valve slidable in said housing arranged to open and close said port, means defining a chamber in said housing, said main valve having a first portion associated with said port to open and close the same and having a second portion slidably mounted in said chamber, said second valve portion being slidably supported on said first valve portion and being arranged to move said first valve portion toward closed position when said second valve portion is subjected to fluid pressure on its far side with relation to said first valve portion, a pair of springs independently biasing said first and second valve portions toward closed position, said housing having passageway means controlled by first valve means and communicating with said inlet and said outlet means, said passageway means leading into said chamber at a point on the far side of said second portion of said main valve with relation to said first portion.

2. The control valve mechanism of claim 1 wherein said passageway means includes a first passageway ex-

tending between said inlet means and said chamber and a second passageway extending between said outlet means and said chamber, said first valve means being power operated and located in said housing, said first valve means having a pair of positions, one of which closes off said first passageway and opens said second passageway and the other of which closes off said second passageway and opens said first passageway.

3. The control valve mechanism of claim 1 wherein said passageway means includes a first passageway extending between said inlet means and said chamber and a second passageway extending between said outlet means and said chamber, said first valve means being power operated and located in said housing, said first valve means having a stem movable between two positions, said movable stem having a pair of valve members one of which closes off said first passageway and opens said second passageway and the other of which closes off said second passageway and opens said first passageway.

4. The control valve mechanism of claim 1 wherein said passageway means includes a first passageway extending between said inlet means and said chamber and a second passageway extending between said outlet means and said chamber, said first valve means being power operated and located in said housing, said first valve means having a stem movable between two positions, said movable stem having a pair of valve members, one of said valve members comprising a pointed end on said stem arranged to engage and close off said first passageway in one position of said stem and said other of said valve members comprising a head on said stem arranged to close off said second passageway in the other position of said stem.

5. The control valve mechanism of claim 4 wherein said first power operated valve comprises a solenoid operated valve and said stem comprises the plunger of the solenoid.

6. The control valve mechanism of claim 1 wherein said passageway means includes a by-pass passageway around a portion thereof arranged to permit faster flow from said chamber to said outlet means than normal flow through said passageway and a check valve in said by-pass passageway permitting one way flow of fluid from said chamber to said outlet means.

7. The control valve mechanism of claim 1 including a by-pass passageway communicating between said inlet and outlet means, said by-pass passageway being of smaller cross dimension than said inlet and outlet means to restrict the rate of fluid flow to and from the elevator drive means when the said main valve is closed, and a second power operated valve in said by-pass passageway controlling the flow of fluid therethrough.

8. The control valve mechanism of claim 7 wherein said second power operated valve comprises a solenoid operated valve.

9. The control valve mechanism of claim 7 wherein said second power operated valve has a pair of valve members, one of the members of said second valve being movable and being arranged to open and close said by-pass passageway, the other of said valve members also being movable and being engageable with the said one member of said second valve and controlling the operation thereof.

10. The control valve mechanism of claim 7 wherein said second power operated valve has a pair of valve members, one of the members of said second valve being movable and being arranged to open and close said by-pass passageway, the other of said valve members also being movable and being engageable with the said one member of said second valve and controlling the operation thereof, and solenoid means connected with the other of said valve members for controlling the movement of the same.

11. The control valve mechanism of claim 7 wherein said second power operated valve is operable in a chamber communicating with said by-pass passageway, said second valve having a pair of valve members, one of said valve members being slidably mounted in said chamber and having a longitudinal port therethrough, the other of said valve members being slidably mounted in the said one valve member and being arranged upon movement thereof to open and close the said port in said one valve member, and power drive means connected with the other of said valve members for controlling certain operating movements thereof.

12. The control valve mechanism of claim 1 wherein said passageway means includes a first passageway extending between said inlet means and said chamber and a second passageway extending between said outlet means and said chamber, said first valve means being power operated and located in said housing, said first valve means having a pair of positions one of which closes off said first passageway and opens said second passageway and the other of which closes off said second passageway and opens said first passageway, means defining a by-pass passageway communicating between said inlet and outlet means to restrict the rate of fluid flow to and from the elevator drive means when the said main valve is closed, and a second power operated valve in said by-pass passageway controlling the flow of fluid therethrough.

13. The control valve mechanism of claim 1 wherein said passageway means includes a first passageway extending between said inlet means and said chamber and a second passageway extending between said outlet means and said chamber, said first valve means being power operated and located in said housing, said first valve means having a pair of positions one of which closes off said first passageway and opens said second passageway and the other of which closes off said second passageway and opens said first passageway, means defining a by-pass passageway communicating between said inlet and outlet means, said by-pass passageway being of smaller cross dimension than said inlet and outlet means to restrict the rate of fluid flow to and from the elevator drive means when the said main valve is closed, and a second power operated valve in said by-pass passageway, said second valve having a pair of valve members, one of the members of said second valve being movable and being arranged to open and close said by-pass passageway, the other of said valve members also being movable and being engageable with the said one member of said second valve and controlling the operation thereof.

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U.S. Cl. X.R.

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