(No Model.)

4 Sheets—Sheet 1.

C. E. ONGLEY.

ELEVATOR.

No. 446,137. Patented Feb. 10, 1891.

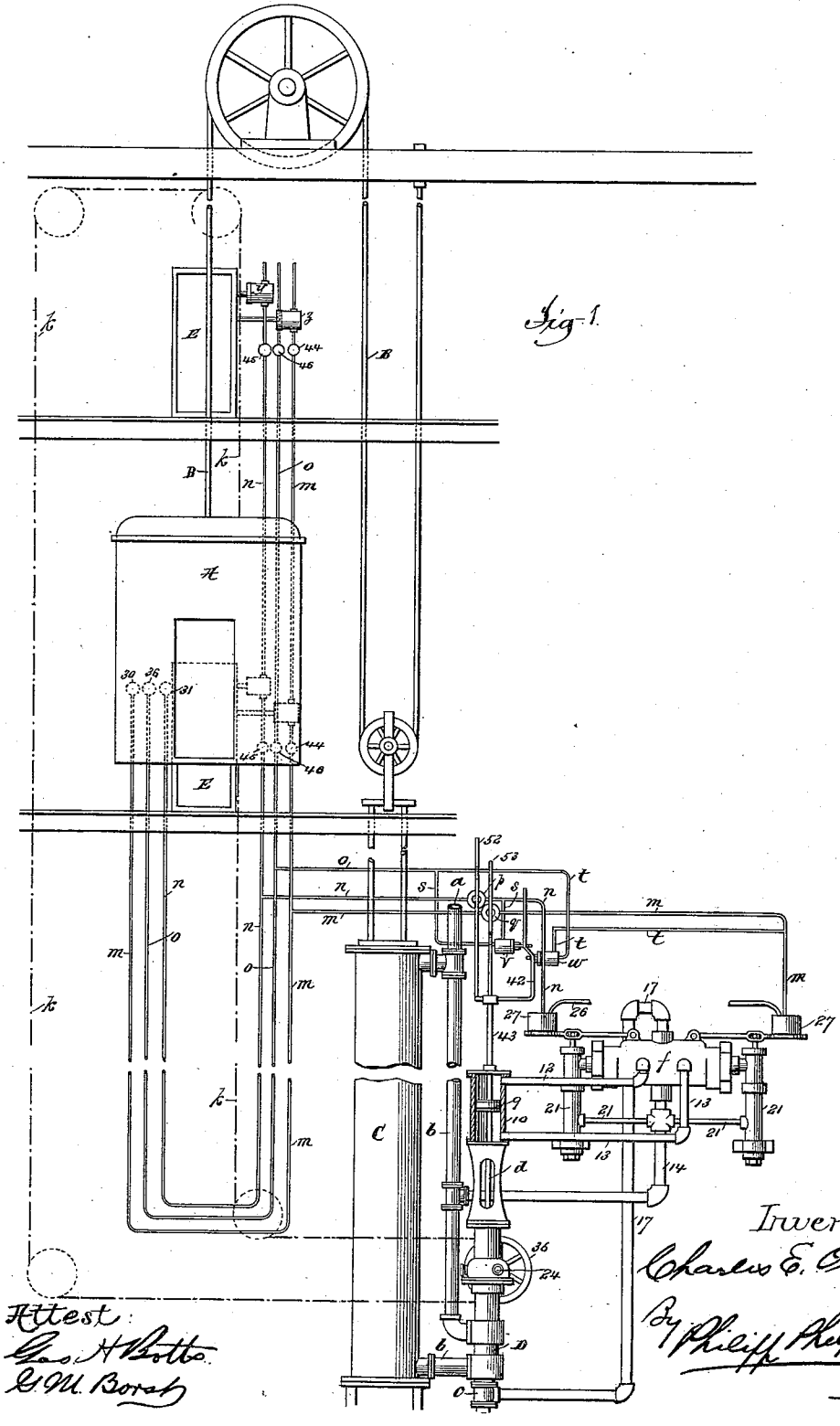

Fig. 1.

Witnesses:
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G. M. Borst.

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By Philip Phillips & Moore
Attys

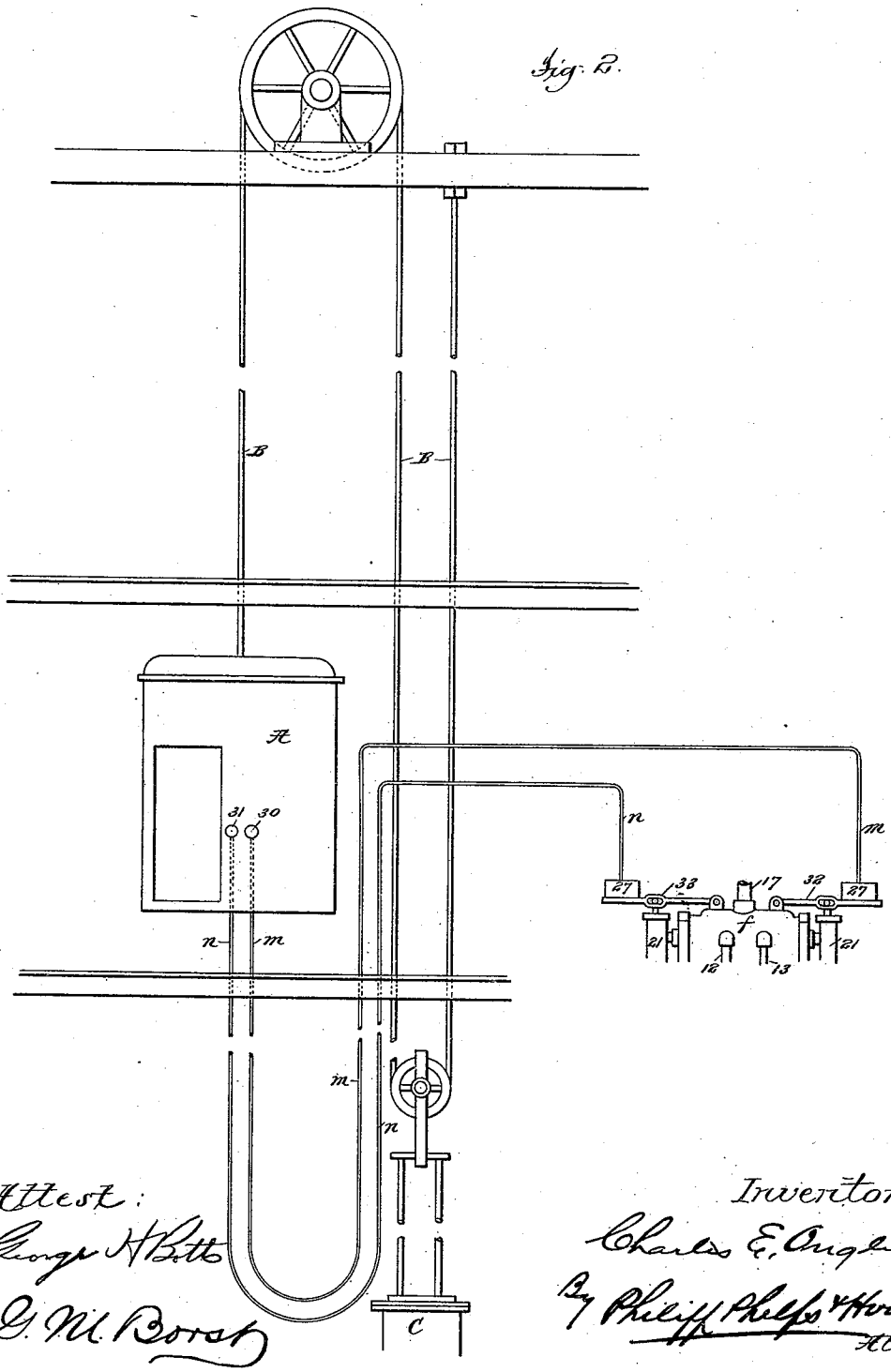
(No Model.) 4 Sheets—Sheet 2.

C. E. ONGLEY.

ELEVATOR.

No. 446,137. Patented Feb. 10, 1891.

Fig. 2.



Attest:
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(No Model.) 4 Sheets—Sheet 3.

C. E. ONGLEY.

ELEVATOR.

No. 446,137. Patented Feb. 10, 1891.

Fig. 3

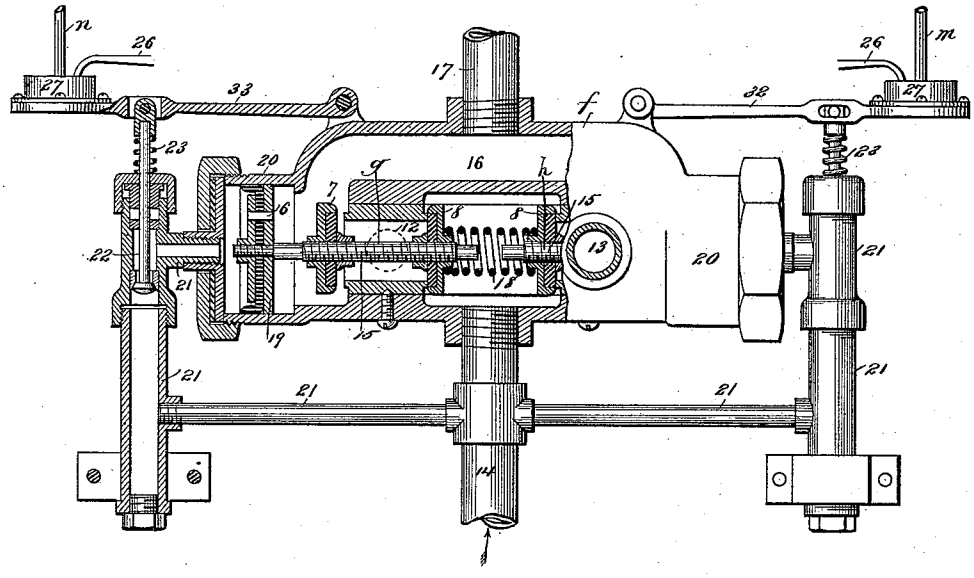


Fig. 5.

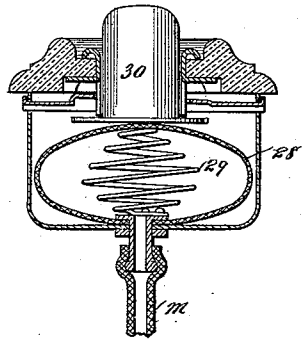


Fig. 6.

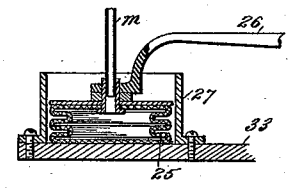
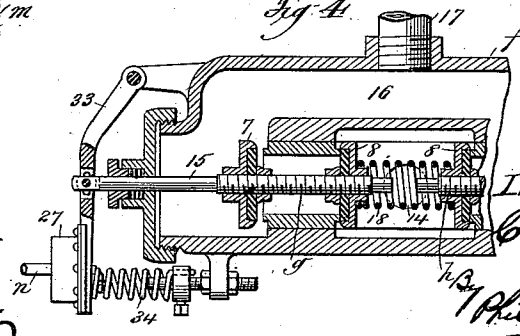


Fig. 4.



Attest
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(No Model.)

4 Sheets—Sheet 4.

C. E. ONGLEY.

ELEVATOR.

No. 446,137. Patented Feb. 10, 1891.

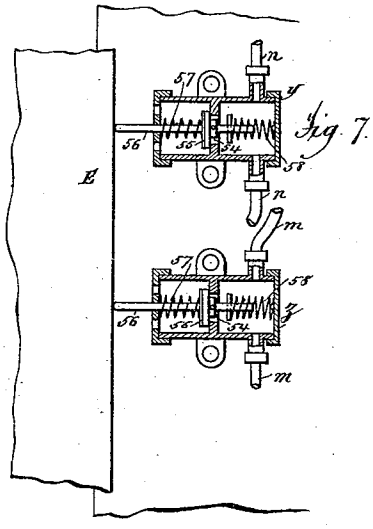

Fig. 7.

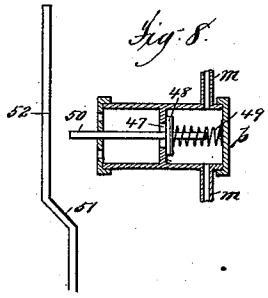

Fig. 8.

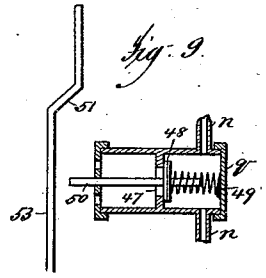

Fig. 9.

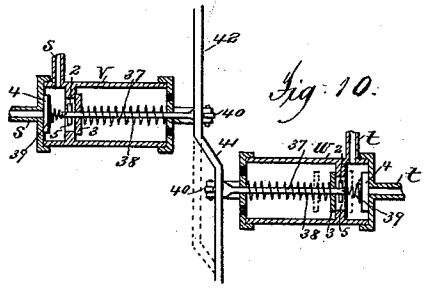

Fig. 10.

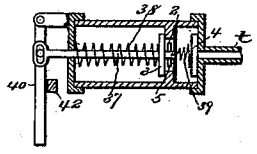

Fig. 11.

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Geo. H. Bobo.
G. M. Borst

Inventor:
Charles E. Ongley
By Phelps Phelps & Henry
Attys

UNITED STATES PATENT OFFICE.

CHARLES E. ONGLEY, OF NEW YORK, N. Y., ASSIGNOR TO THE HYDRAULIC ELEVATOR COMPANY, OF ILLINOIS.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 446,137, dated February 10, 1891.

Application filed August 24, 1888. Serial No. 283,606. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. ONGLEY, a citizen of the United States, residing at New York, county of New York, and State of New York, have invented certain new and useful Improvements in Elevators, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to a means for operating the valve or other mechanism which controls the movements of an elevator by means of pneumatic pressure derived from the car or from the landings or other points from which it is desired to control the movements of the elevator.

The improvement relates particularly to means for operating the auxiliary valves shown in my patent, No. 410,181, dated September 3, 1889, and similar valves, by pneumatic pressure.

One feature of the invention consists in the combination, with the elevator proper consisting of the car, its motor, and the main valve or other mechanism for controlling the movements of the motor, of an auxiliary piston and cylinder for operating the main valve, an auxiliary valve for controlling the movements of the auxiliary piston, a primary cylinder, piston and valve for actuating the auxiliary piston and valve, and pneumatic connections for operating the primary valve from the car or landing.

Another feature of the invention relates to a pneumatic system whereby the main valve is automatically arrested at the middle of its stroke when it is desired to stop the car, whereby it is rendered impossible to start the car until all the doors leading to the elevator-shaft are properly closed, and whereby the main valve is arrested at the proper point at the end of its stroke in each direction, so as to prevent the slamming of the valve.

In order to convey a full understanding of the various features of the invention, the system will now be described in detail, reference being had to the accompanying drawings, in which—

Figure 1 is a diagrammatic view illustrating the system in its most complete form. Fig. 2 is a similar view illustrating the system in its simplest form. Fig. 3 is an enlarged view, partly in section, showing the auxiliary valves and the primary cylinders, pistons, and valves. Fig. 4 is a similar view illustrating an organization in which the primary pistons, cylinders, and valves are omitted. Figs. 5 to 11 illustrate details which will be hereinafter referred to.

Referring to said drawings, it is to be understood that A represents the elevator-car, B the hoisting-cable, and C the motor, consisting of a hydraulic cylinder, these parts being organized in the common and well-known manner. The cylinder C, as herein shown, is arranged vertically; but it may be arranged horizontally, if preferred, as is well understood in the art. The cylinder C is provided with the usual supply-pipe *a*, through which water is admitted to the cylinder under suitable pressure to drive the piston therein, and with the usual circulating and discharge pipes *b c*, by which the water is circulated from the upper to the lower end of the cylinder as the car descends and by which the water is discharged from the bottom of the cylinder as the car ascends. This form of motor is herein shown merely for the purpose of illustrating the application of the present invention. It is to be understood, however, that the invention is not limited in its application to a motor of this form, but may be used in connection with other forms of hoisting apparatus.

The movements of the motor are controlled by means of the main-valve apparatus D, which controls the circulation and discharge of the water in and from the cylinder C. This apparatus will therefore, for convenience, be herein termed the "main valve;" but it is to be understood that this term is herein used in a broad sense and is intended to include any suitable form of mechanism for controlling the motor, which mechanism will of course be modified in different cases to conform to the character of the motor employed. The rod *d* of the main valve D is extended beyond the casing of the valve, and is provided with a piston 9, called, for convenience, an "auxiliary piston," which works in an auxiliary cylinder 10. The cylinder 10 communicates at its opposite ends with two pipes 12 13, which enter a valve-chamber *f*, which also communicates by a pipe 14 with the circulat-

ing-pipe *b*, or with some other source from which water is supplied under a suitable pressure to operate the piston 9 and the main valve. The induction and exhaust of the water to and from the cylinder 10 are controlled by means of two auxiliary valves *g h*, which are located in the casing *f*. Each of these valves consists of two disks 7 8, which are connected to a common rod 15, and are arranged to seat against the ends of chambers into which the pipes 12 13 open between the disks of the respective valves, the disks of the respective valves being so arranged that when the valves are in one position communication is established between the pipe 14 and the pipes 12 13, and that when the valves are in the reverse position communication is cut off between the pipe 14 and the pipes 12 13 and is established between the pipes 12 13 and a duct 16, which communicates with a discharge-pipe 17. The valves *g h* are provided with a spring or springs 18, which is or are so arranged as to normally hold the valves in position to cut off communication between the pipe 14 and the pipes 12 13, and to keep the communication open between the said pipes 12 13 and the pipe 17. In other words, the auxiliary valves are so arranged that they are normally held in such position as to equalize the pressure upon the opposite sides of the piston, and at the same time allow the water to pass out of both ends of the cylinder 10, the purpose being to permit the piston 9 to be moved in either direction. The rods 15 of the respective valves *g h* are extended beyond the disks 7, and are provided with pistons 19, termed, for convenience, "primary pistons," which work in primary cylinders 12. The cylinders 20 are provided with induction-pipes 21, which communicate with the pipe 14, or with some other source through which water is supplied under suitable pressure to operate the pistons 19. The pipes 21 are controlled by primary valves 22, by which the water is allowed to enter the cylinders 20 at the proper times to operate the pistons 19, and through them the valves *g h* to move the piston 9. The valves 22 are normally held in position to close the pipes 21 and prevent the entrance of water to the cylinder 20 by means of springs 23, arranged to act upon the valve stems.

The operation of the system as thus far described is as follows: Assuming that it is desired to cause the car to descend, it is only necessary to depress the primary valve 22, which controls the auxiliary valve *g*, so as to allow water under pressure to pass through the pipe 21 and enter the primary cylinder 20. The water entering the cylinder 20 will act upon the pistons 19 and move the valve *g* against the tension of the spring 18, so as to cause the disks 7 to cut off communication between the pipes 12 17 and the disk 8 open communication between the pipes 12 14. The water will then pass from the pipe 14 into the pipe 12 and enter the cylinder 10 above the piston 9, thus putting greater pressure upon the upper side of the piston and moving it and the connected main valve downward, so as to permit the water to circulate from the upper to the lower end of the cylinder C, and thus permit the car to descend. During this operation the valve *h* will remain in its normal position, so as to maintain communication between the pipes 13 17, so that as the piston 9 is driven downward by the water entering the cylinder 10 through the pipe 12 the water contained in the cylinder below the piston will pass out through the pipe 13 and past the valve *h* to the pipe 17. When the main valve has been shifted to the proper extent, depending upon the speed at which it is desired the car shall move, the valve 22 will be closed, and as soon as the valve is thus closed the spring 18 will restore the valve *g* to its normal position. To permit this the pistons 19 are provided with permanently-open exhaust-ports 6, through which the water contained in the cylinders 20 is allowed to escape as the valves are restored to their normal position by the spring 18. These ports are, however, so small that the water entering through the pipes 21 will not escape with sufficient rapidity to prevent the pressure upon the pistons 19 from moving the valves. To stop the car in its descent or cause it to ascend it is only necessary to depress the other primary valve 22. The auxiliary valve *h* will then operate in the same manner as just described to allow the water to pass from the pipe 14 through the pipe 13 to the lower end of the cylinder 10, and thus drive the piston 9 upward. If it is desired to simply stop the car, the primary valve will be closed as soon as the main valve has arrived at its mid-position, so as to cut off both the circulation and discharge of the water in and from the cylinder C. If it is desired to cause the car to ascend, the primary and auxiliary valves will be kept open until the main valve has been moved upward past its mid-position, so as to allow the water to escape from the lower end of the cylinder C and permit its piston to descend, and thus cause the car to ascend. To stop the car in its ascent the operation is reversed. From this it will be seen that in order to control the movements of the car either from the car itself or from any other point—as, for example, from the landings—it is only necessary to provide means by which the primary valves 22 can be opened at the proper times either from the car or from such other desired point. For this purpose the rods of the primary valves 22 are connected to levers 32 33, which are fulcrumed upon the casing *f*, and are arranged with their free ends in close proximity to an expansible bulb or sack 25, (see Fig. 6,) which is supported upon a rigid arm 26, extending from some stationary part of the machinery or frame-work. The sacks 25 are normally maintained in a collapsed condition; but they are so arranged that when

inflated they press upon the levers 32 33, so as to depress the levers and open the valves 22. The sacks 25 will preferably be arranged to lie within cylindrical cups or casings 27, mounted upon the ends of the levers, as shown; but they may of course be arranged in any other suitable manner. The sacks 25 communicate with small pipes *m n*, which lead from the respective sacks to collapsible bulbs 28, (see Fig. 5,) carried upon the car. The portions of the pipes *m n* which are connected to the bulbs 28 upon the car will be flexible for a sufficient length, as indicated by the depending loops, to allow the car to have the required up-and-down movement in the elevator-shaft. The bulbs 28 are normally held in an inflated condition by means of springs 29, inclosed within the bulbs or by other suitable means. Each of the bulbs is located in a suitable casing or receptacle, and the bulbs are provided with push-buttons 30 31, similar to electrical push-buttons, but having a more extended movement, by which the bulb can be collapsed when desired. The bulbs 28, pipes *m n*, and sacks 25 being filled with air and being so constructed that the air can find no escape, it becomes possible to operate the valves 22 by simply pressing upon the buttons 30 31 upon the car. To illustrate, if the conductor wishes the car to ascend, he will press the buttom 30, and thereby collapse the bulb 28 beneath that button. The air confined in the bulb will thus be forced into the pipe *m* and will force the air out of the pipe into the sack 25, which is arranged above the lever 32, thereby inflating the sack and causing it to press against the lever, so as to depress the same and open the valve 22, which controls the auxiliary valve *h*, and thus cause the car to ascend, as before explained. To cause the car to descend the conductor will press upon the button 31, thereby depressing the lever 33 and operating the valve *g* in the same manner. To stop the car the conductor will press upon the proper button to reverse the main valve, and will release the button in time to arrest the main valve in its mid-position. As soon as pressure is removed from either one of the buttons 30 31 the spring 29 will at once restore the bulb 28 to its inflated condition, thereby allowing the air to pass out of the sack 25, so that the sack will collapse and allow the spring 23 to close the primary valve, which has been opened.

The system as thus far described embodies my invention in its simplest form—that is to say, it provides means by which the car can be caused to move in either direction at any desired speed and can be stopped in any position when moving in either direction, the movements of the car being under the control of the conductor. This is sufficient to meet the requirements in a great number of cases.

I have thus far described the main valve as being operated by an auxiliary piston which is controlled by auxiliary valves, which auxiliary valves are in turn operated by primary pistons controlled by primary valves, which latter are operated by pneumatic pressure from the car. This is the preferred organization, as by this means the power required to be exerted by the pneumatic pressure is reduced to such an extent that a comparatively light pressure and small amount of movement of the push-buttons is all that is required. In some cases, however, it may be preferred to dispense with the primary pistons, cylinders, and valves and operate the auxiliary valves directly. This is perfectly feasible and may be accomplished without wholly departing from my invention by the organization shown in Fig. 4, in which the rods 15 of the auxiliary valves are connected to the levers 32 33, so that the auxiliary instead of the primary valves are operated by the inflation of the sacks 25. In this case the pressure required to operate the levers 32 33 may be reduced by providing the levers with springs 34, which act in opposition to the spring 18, and are provided with means by which their tension can be adjusted, so as to nearly, but not quite, overcome the tension of the spring 18. By this means the valves *g h* can be nearly balanced, so that a comparatively light pressure will be sufficient to move them. The speed of the car cannot, however, be so easily controlled by this organization as by that first described.

In addition to the system for controlling the movements of the main valve D by means of pneumatic connections from the car, it may in some cases be desirable to provide the elevator with means by which the main valve can be operated mechanically from the car, so as to give the conductor positive control of that valve and of the movements of the elevator in case for any reasons the pneumatic connections become disordered or fail to operate properly. The organization of the auxiliary-valve apparatus which has been described, by allowing the water to pass freely out of both ends of the cylinder 10, permits this, and for this purpose the rod *d* of the main valve is provided with the usual rack, which engages with a pinion mounted upon a shaft 24, having a pulley 35, around which passes an ordinary hand-rope *k*, which passes around pulleys arranged in the usual manner and extends up and down the wall and through the car in position to be grasped by the conductor. In the usual working of the elevator this hand-rope will simply remain idle and be moved around its pulleys by the rack and pinion as the main valve is moved by the piston 9. If, however, the pneumatic system becomes disordered or fails to operate, the conductor can by using the hand-rope have positive control of the valve and of the movements of the car.

It has been explained how by operating the buttons 30 31 the conductor can cause the car to ascend or descend or be stopped in any position. In order to stop the car in any po-

sition, it is necessary, however, in the system as thus far described, that the conductor should release the button 30 or 31, as the case may be, as soon as the main valve has arrived at its mid-position and stopped the car, as if the pressure is not removed from the button immediately upon the main valve arriving at its mid-position the valve will continue to move and pass its mid-position, and thus reverse the movement of the car. If the conductor is skillful and attentive, this need not occur, as he will be able to release the button at the proper time to arrest the valve in the proper position. If, however, the conductor is unskillful or inattentive, this may occasion some annoyance, and to avoid this the system, as illustrated in Fig. 1, is provided with means by which, when it is desired to arrest the car at any point, the main valve will be automatically stopped in its mid-position. For this purpose the car is provided with a third push-button 36 and bulb 28, which is connected with a pipe *o*, similar to the pipes *m n* and having branches *s t*, which connect, respectively, with the pipes *n m*.

The branches *s t* are controlled by valve apparatuses *v w*, which are arranged as follows: Each of the valve apparatuses *v w* (see Figs. 10 and 11) consists, primarily, of a small chamber, which is included in the respective branches *s t*. Each of these chambers is provided with a port 5 and with two valves 3 4, the former of which controls the port 5, while the latter controls the pipe *s* or *t*, as the case may be, when the valve is in one position and the port 5 when it is reversed. The valve 3 is arranged to move freely on its stem 37 and is pressed to its seat by a spring 38, it being moved away from its seat by a pin 2 inserted in the stem. The valve 4 is pressed to its seat when in either position by a spring 39 secured to the end of the stem 37. By this means it will be seen that a certain amount of lost motion is permitted between the valves and their stems 37, which permits the stem to be moved slightly in either direction after either or both of the valves have been carried to their seats. The stems 37 are connected to levers 40, which are arranged to be acted upon by reversely-arranged shoulders 41, formed upon a rod 42, which is carried by an extension 43 of the valve-rod *d*, or by any other moving part of the elevator which moves in harmony with the main valve. The shoulders 41 are so arranged with relation to the levers 40 that when the main valve is in its mid-position the levers 40 will be allowed to move to such position as to permit the valves 3 4 to close the ports 5 and branches *s t*, as shown in Fig. 10, and thus cut off communication between the pipe *o* and both the pipes *m n*. The shoulders 41 are, however, so arranged that when the main valve is moved downward from its mid-position, so as to cause the car to descend, the shoulder 41, acting upon the lever 40 of the apparatus *w*, will move the valve-stem 37 so as to move the valve 3 away from the port 5 and at the same time move the valve 4 so as to open the branch *t* and into position to close the port 5, as indicated by dotted lines in Fig. 10. It will readily be seen, therefore, that when the parts are in this position communication is established through the branch *t* between the pipes *o m*, the branch *s* remaining closed, so as to shut off communication between the pipes *o n*. When the main valve is moved upward from its mid-position, the operation is reversed, and the other shoulder 41, acting upon the lever 40 of the apparatus *v*, operates similarly to shift the valves 3 4 of that apparatus, so as to establish communication through the branch *s* between the pipes *o n*, while the branch *t* remains closed, so as to cut off communication between the pipes *o m*.

The operation of this part of the system is as follows: Assuming the car to be descending and that it is desired to stop the car at a given landing, the conductor will, when the car arrives at the proper distance from the landing, press the button 36. This will press the bulb 28 beneath that button and force the air out of the bulb into the pipe *o*. The car being, as assumed, descending, the valve D will be below its mid-position, and as a consequence the rod 42 will be moved downward, so that the shoulder 41, acting upon the lever 40, will have moved the valves 3 4 of the apparatus *w* to the position shown by dotted lines in Fig. 10, so as to establish communication between the pipes *o m* through the branch *t*, while the valves of the apparatus *v* will remain in the position indicated in Fig. 10, so as to cut off communication through the branch *s*. The air forced into the pipe *o* cannot therefore find an escape through the branch *s*, and will be forced through the branch *t* to the pipe *m*, and will therefore operate to inflate the sack 25 and operate the lever 32, and through it the primary and auxiliary valves, so as to reverse the main valve and cause it to ascend. As soon, however, as the main valve arrives at its mid-position upon its ascent the shoulder 41 will pass out of engagement with the lever 40 of the apparatus *w*, thereby allowing the valves 3 4 to move to the position shown by full lines in Fig. 10, so as to cut off communication through the branch *t*. As the valves thus move from the position shown by dotted lines in Fig. 10 to the position shown by full lines, there will be a short time in which the port 5 will be open to the atmosphere, and during this period the pressure in the pipes *o t m* will be relieved, so as to allow the sack 25 to collapse and the primary and auxiliary valves to close, and thus arrest the main valve in its mid-position, no matter whether the conductor releases the button 36 at the proper time or not. When the car is ascending and it is desired to arrest it at any point, the operation will be exactly the same, except that in such case the main valve being above its mid-position communication will be shut off

through the branch *s*, so that upon pressure being applied to the button 36 the air will be forced into the pipe *n*, so as to operate the lever 33 and cause the main valve to move downward to its mid-position.

It is in many cases desirable to provide means by which the movements of the car can also be controlled from any one of the several landings, so that where no conductor is employed a person at any landing can bring the car to that landing and stop it in proper position for ingress or egress. When this is desired, it can readily be accomplished in the manner indicated in Fig. 1. For this purpose the pipes *m n o* are extended to the several landings and are provided at each landing with push-buttons 44 45 46, corresponding to the buttons 30 31 36, which act upon bulbs which communicate with the respective pipes the same as the bulbs upon the car.

The operation of controlling the movements of the car from any one of the several landings is exactly the same as already described.

In operating elevators of this class it is desirable to provide means by which the main valve will be arrested before it reaches the extreme limit of its movement, so as to avoid the effects which would result from the slamming of the valve. Where the valve is operated by the ordinary hand-rope, this is usually accomplished by causing the rope to pass through a stationary guide and providing the rope with stops located at a suitable distance upon either side of the guide, which by coming into contact with the guide will arrest the rope before it has been moved sufficiently to slam the main valve. For the purpose of accomplishing the same result in the present system, the pipes *m n* are provided with automatic escape-valves, which operate to automatically relieve the pressure in the respective pipes just before the main valve reaches the limit of its movement in either direction, and thus arrest the valve. These valves are contained in small chambers *p* and *q*, (see Figs. 8 and 9,) with which the pipes *m n* respectively communicate. These chambers are provided with ports 47, which are controlled by valves 48, which are normally held in position to close the ports by means of springs 49, and thus prevent the escape of the air from the pipes. The valves 48 are provided with stems 50, which are acted upon by reversely-arranged shoulders 51, formed upon rods 52 53, which are carried by the extension 43 of the valve-rod *d*, or by any other part of the elevator which moves in harmony with the main valve. The shoulders 51 are so arranged that so long as the main valve is in any position intermediate of the desired limit of its movement in each direction the valves 48 will remain closed to prevent the escape of the air from the pipes *m n*, and thus permit the valve to be operated. The shoulder 51 of the rod 53 is, however, so arranged that as the main valve arrives at the desired limit of its downward movement it will come into engagement with the stem 50 of the lower valve and move the valve 48 so as to open the port 47, and thus allow sufficient air to escape from the pipe *n* to relieve the pressure in the pipe and permit the sack 25 to collapse and the lever 33 to rise, so as to close the primary and auxiliary valves and arrest the main valve. The shoulder 51 of the rod 52 is so arranged that as the main valve reaches the desired limit of its upward movement it will act upon the stem 50 of the upper valve and allow the air to escape from the pipe *m* with the same result. When either of the valves 48 is thus opened to automatically arrest the main valve at the limit of its movement in one direction, the other valve remains closed, so that the primary and auxiliary valves which act to reverse the movement of the main valve are in condition to be operated. It is also desirable in elevators of this class, and particularly in the case of those that are used for carrying passengers, to provide means by which it will be impossible to start the car from any landing until the door opening from the landing to the elevator-shaft has been closed, thereby providing a safeguard against accidents, caused by persons entering the door when the car is not present in front of it. For this purpose the pipes *m n* are provided with valves (see Fig. 7) located at each landing, and so arranged that whenever any one of the doors E leading to the elevator-shaft is not properly closed the valves will be open, so as to allow the escape of the air from the pipes *m n*, and thus prevent the operation of either one of the levers 32 33 and the starting of the car in either direction until the door has been properly closed. These valves are located in chambers *y z*, which communicate with the respective pipes *m n*, and are provided with ports 54, which are controlled by valves 55, the stems 56 of which are in position to be engaged by the door E, so as to cause the valves 55 to close the ports 54 when the door is closed, as shown in Fig. 7. The valves are provided with springs 58, which act whenever the door is moved away from the stems 56 to open the valves, and thus afford free communication between the atmosphere and the pipes *m n*. The valves 55 are made to slide freely in one direction upon their stems, and are provided with springs 57, by which they are pressed against their seats, so as to close the ports 54 whenever the stems are moved inward by the door. This allows the stems 56 to have a limited amount of movement after the valves have been forced against their seats, and thus compensate for slight variations in the position of the door when closed.

The term "bulb" as applied to the collapsible and expansible devices which are operated upon by the push-button upon the car and at the landings is herein used in a broad sense, and is to be understood as in-

cluding not only the specific form of expansible device shown, but any other form of apparatus which will perform an equivalent function—that is to say, any apparatus which will operate through the pressure upon the button to exert a pressure upon the column of air contained in the pipe. So, also, the term "sack" as applied to the expansible and collapsible devices 25, which act through the medium of the levers 32 33 to operate the primary or auxiliary valves, is used in a similar sense, and is to be understood as including not only the specific form shown, which is the preferred form, but also any other form which will perform the same function—that is to say, will expand so as to exert a pressure to be transmitted to the valves when the air-pressure in the pipe is raised above its normal point.

What I claim is—

1. The combination, with an elevator-car, its motor, and the main valve for controlling the movements of the motor, of an auxiliary cylinder, piston, and valve for operating the main valve, a primary cylinder, piston, and valve for operating the auxiliary valve, an expansible sack for operating the primary valve, and a pneumatic pipe connecting said sack with a bulb, substantially as described.

2. The combination, with an elevator-car, its motor, and the main valve for controlling the movements of the motor, of an auxiliary cylinder, piston, and valves for operating the main valve, primary cylinders, pistons, and valves for operating the auxiliary valves, expansible sacks for operating the primary valves, and pneumatic pipes connecting said sacks with bulbs, substantially as described.

3. The combination, with an elevator-car, its motor, and the main valve for controlling the movements of the motor, of pneumatic pipes through which the movement of the main valve in opposite directions is controlled by air-pressure, and valves 48, controlling said pipes and operated by a moving part of the elevator mechanism to allow the air to escape from the respective pipes as the main valve reaches the limit of its working movement in opposite directions, substantially as described.

4. The combination, with an elevator-car, its motor, and the main valve for controlling the movements of the motor, of a pneumatic pipe having branches for controlling the movements of the main valve in opposite directions by air-pressure, valves controlling said branches and operated by a part of the mechanism moving in harmony with the main valve, and said valves opening communication through one of said branches when the main valve is near the end of its stroke and closing communication through both of said branches when the main valve is at the middle of its stroke, as described.

5. The combination, with an elevator-car, its motor, and the main valve for controlling the movements of the motor, of a pneumatic pipe through which the movement of the main valve is controlled by air-pressure, valves 55, controlling said pipes and having an escape-opening, and doors of the elevator-shaft in operative connection with said valves 55 to open said escapes by the opening of the doors and close said escapes by the closing of the doors, as described.

6. The combination, with an elevator-car, its motor, and the main valve for controlling the movement of the motor, of an auxiliary cylinder and piston for operating the main valve, an auxiliary valve for controlling the same and having an open exhaust in free communication at all times with an end of the auxiliary cylinder, an expansible sack for actuating the auxiliary valve, a pneumatic pipe connecting the said sack with a collapsible bulb, and a rope *k*, connected to operate the main valve from the car, as described.

7. The combination, with an elevator-car, its motor, and the main valve for controlling the movements of the motor, of an auxiliary cylinder and piston for operating the main valve, auxiliary valves for controlling the same so set that the exhaust-passages from the auxiliary cylinder are open in all positions of the valve, in order to allow the water to pass out of the auxiliary cylinder and permit the auxiliary piston to be moved in either direction, expansible sacks for actuating the respective auxiliary valves, pneumatic pipes connecting said sacks with collapsible bulbs, and a rope *k*, connected to operate the main valve from the car, substantially as described.

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

CHARLES E. ONGLEY. [L. S.]

Witnesses:
OSMAR D. BALLERT,
W. F. MOODY.