T. E. BROWN.

LIMIT STOP FOR HYDRAULIC ELEVATORS.

APPLICATION FILED NOV. 23, 1905.

952,097.

Patented Mar. 15, 1910.

Fig. 1.

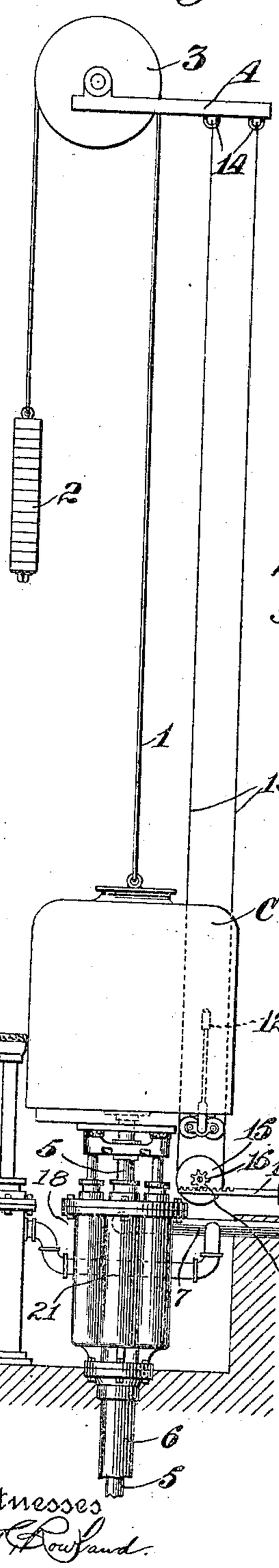

Fig. 2.

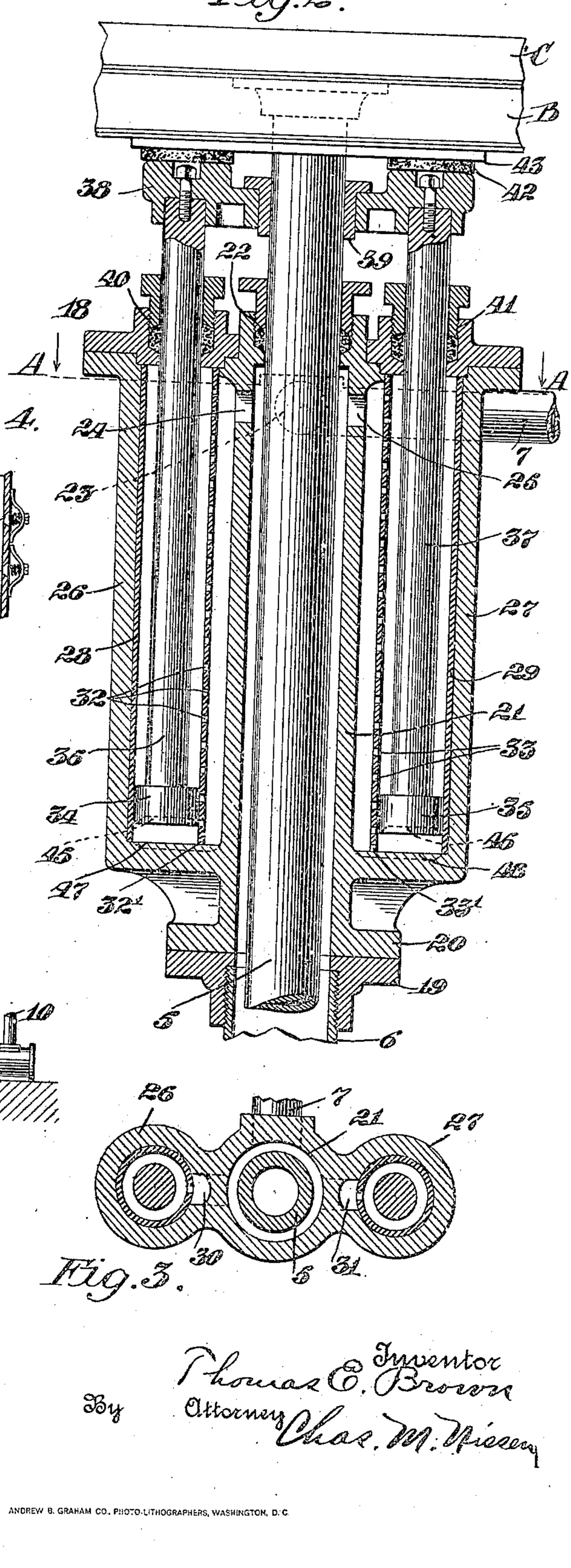

Fig. 4.

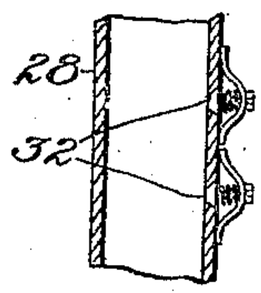

Fig. 3.

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UNITED STATES PATENT OFFICE.

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LIMIT-STOP FOR HYDRAULIC ELEVATORS.

952,097. Specification of Letters Patent. Patented Mar. 15, 1910.

Application filed November 23, 1905. Serial No. 288,636.

To all whom it may concern:

Be it known that I, THOMAS E. BROWN, a citizen of the United States, residing in the city of New York, in the county of New York and State of New York, have invented a new and useful Improvement in Limit-Stops for Hydraulic Elevators, of which the following is a specification.

My invention relates to safety buffers for elevators and one of its objects is the provision of simple and efficient means for gradually retarding an elevator car so as to bring the same to rest gradually and stopping the car with minimum shock or jar.

A further object of the present invention is the provision of a buffer device for hydraulic elevator cars that will also act to assist in starting the car from rest and accelerating same to substantially full speed.

Other objects of the invention will appear hereinafter, the novel combination of parts being pointed out in the claims.

In the accompanying drawings Figure 1 represents a plunger elevator system with my invention applied thereto; Fig. 2 is a sectional elevation illustrating the details of the invention; Fig. 3 is a section taken at right angles to Fig. 2 on the line A—A looking in the direction of the arrows; and Fig. 4 shows a fragmentary view of the inner tube 28 with check valves applied to the openings 32.

In Fig. 1, C designates an elevator car which is connected by the cable 1 to the counterweight 2, said cable passing over the sheave 3 which is mounted on the overhead beam 4. Rigidly attached to the bottom of the car is the plunger 5, which is received by the hydraulic cylinder 6. The flow of water to and from this cylinder through the pipe 7 may be controlled by a change valve 8 having a supply pipe 9 and an exhaust pipe 10. Merely to illustrate some means for operating the change valve, I have shown a manually actuated lever 12 in the car C which is suitably connected to the operating rope 13. This rope has its upper ends secured to some overhead structure, as the beam 4, at 14 and its middle portion is passed one or more times around the drum 15 which carries a pinion 16 in mesh with the rack 17 extending from the valve piston rod 11 of the change valve 8.

The construction thus far alluded to is well known in the art and therefore does not require detailed description.

18 designates my improved buffer which in this instance is shown at the lower limit of travel of the car. One may be placed also at the lower limit of the counterweight 2 so that the buffer which I am about to describe may take the place of the ordinary limit stops and be more efficient and positive in gradually stopping the car at both limits of its travel without shock.

To the upper end of the standard plunger cylinder 6 I have shown connected an annular flange 19 to which is secured the corresponding flange 20 at the lower end of the cylinder 21 which is in alinement with the main cylinder. The cylinder 21 is in reality an extension of the standard cylinder 6. A stuffing box 22 for the plunger 5 is provided at the upper end of the cylinder 21.

23 designates the main pressure inlet and discharge port to which the pipe 7 is connected. Preferably this port 23 is adjacent the upper end of the cylinder 21 and in circumferential alinement therewith. I have shown the ports 24 and 25 in the said cylinder although the position of the latter parts may be changed as found desirable. The ports 24 and 25 establish communication between the cylinder 21 and the additional auxiliary cylinders 26 and 27, all of said cylinders being arranged parallel to each other. There are as many ports, 24, 25, as there are auxiliary cylinders 26, 27, and although I have herein shown only two such auxiliary or side cylinders three or more may be used and in any event these cylinders are preferably symmetrically arranged. It should be noted that the cylinders 26 and 27 are shown in this instance lined with additional cylinders 28 and 29 respectively, composed of such material as brass, bronze, or the like, but these linings may be omitted and the casting itself perforated. Longitudinal grooves are provided between the cylinder 21 and the cylinders 26, 27, respectively. The longitudinal passages 30 and 31 formed by these grooves communicate with the cylinder 21 through the ports 24 and 25, respectively, and with the interior of the cylindrical linings through the rows of graduated or restricted openings or perforations 32 and 33. Adapted to move to and fro in the cylindrical linings are differential pis-

tons 34, 35 which are preferably rigidly connected by the buffer rods 36, 37 to the striking block or frame 38 outside and above the cylinders. The buffer or piston rods 36, 37 extend upwardly through the stuffing boxes 40, 41, respectively, and the frame 38 is provided with a central cylindrical bushing 39 surrounding the plunger 5 to prevent any lateral vibration of said buffer rods. Pieces of resilient material, such as rubber 42, or resilient devices such as springs, are placed on the upper side of the frame 38 or on the under side of the car. This frame serves therefore not only as a guide for the buffers comprising the pistons, piston rods, and parts coacting therewith but also as a striking block, the resilient devices being adapted to be struck by the platen 43 which is preferably secured to the under side of the channel beams B on the bottom of the car.

The operation of my invention is as follows. Assuming that the car is at the lowermost landing or in the position shown in Fig. 1 with the buffer mechanism in the pit 44, let the change valve 8 be operated from the car to admit the motor fluid under pressure to the inlet 23. The plunger 5 will begin to rise, but it will be noticed that fluid pressure extends also through the ports 24, 25 and the graduated openings 32, 33 to the pistons 34, 35. The unbalanced pressure on the bottom of these pistons will force the same upwardly but only one, or a few perforations as 32′, 33′, being below these pistons the rate of movement of the same just after starting will be a minimum because the flow of fluid is restricted. As the pistons rise the comparatively large number of perforations above them allow substantially free flow of the liquid from the cylinders above the pistons. Furthermore, as the pistons rise the number of perforations establishing communication between the longitudinal passages and the auxiliary chambers below the pistons gradually increases. This allows of a gradually increased flow of fluid to the space beneath the pistons which has the effect of accelerating the upward movement of the block 38 as the same rises with the car. The construction may be such that the upward movement of the buffer mechanism as just described will assist in accelerating the car, but it is obvious that the operation just set forth will also reset the buffer mechanism at the upper limit of its travel, the upward movement of the frame 38 being limited by the pistons 34 and 35 striking against suitable stops such as the cap plates of the stuffing boxes 40 and 41, or the confined liquid beneath said plates. Or suitable stops may be provided for the frame 38 or any other approved means may be employed for limiting the upward travel of the pistons, piston rods, and striking block. It should be noted that when the pistons rise the perforations above the same are gradually cut off so that the resistance to flow of liquid from above the pistons is gradually increased. This will have the effect of retarding the upward motion of the block 38 near its upper limit of travel so that although started slowly and accelerated to a higher speed, it will again be retarded and gradually brought to a stop. This may be desirable as a cushioning device to prevent a too sudden stop of the pistons 34, 35 against the stuffing boxes or the confined fluid just beneath the same, or to prevent too sudden stopping of the frame 38 against its stops. If desired, however, check valves may be placed where necessary, as for example, one at the upper end of each of the cylindrical linings 28 and 29 so as to open into the longitudinal passages 30 and 31, respectively. Obviously this construction would allow a free movement of the blocks 38 and permit the same to be accelerated from its lowermost position to its uppermost position. When the pistons 34, 35 descend these check valves would automatically close, of course. When the car is ascending, the pressure applied to the plunger is also transmitted to the pistons 34 and 35 and when the change valve 8 is closed the unbalanced weight of the car and its load will exert a pressure on the fluid to maintain the block 38 raised. When the car descends, the discharge back pressure and the friction of the stuffing boxes will hold up the pistons 34, 35 and consequently the frame 38 connected thereto. When the car or counterweight strikes its safety buffer at slow speed, the pistons 34, 35 settle down until the car comes to its lowermost landing or lower limit of travel. If the car or counterweight strikes its buffer while traveling at high speed a retarding pressure is produced by the graduated holes in the linings bringing the car to rest positively, gradually and without shock. As the buffer rods descend, however, the relative positions of the holes and pistons are gradually changed so that the flow of fluid is gradually retarded. That is, when the pistons are at their upper limits of travel and the car strikes the block 38 while descending the fluid beneath the pistons is forced out through the holes 32, 33, which are at this time beneath the pistons, and thence along the longitudinal passages 30, 31 and through the ports 24, 25, and 23 to the exhaust port of the change valve. Now as the pistons descend, the number of holes beneath the pistons gradually diminishes and while this occurs the rate of flow of fluid from beneath the pistons is gradually decreased until finally there is only one opening 32′ or 33′ to allow the escape of the fluid. This last opening is not closed, however, although the pistons may strike the bottoms of the cylinders 26 and 27, there being recesses or grooves

on the lower sides of the pistons 34 and 35, respectively, as indicated by dotted lines 45 and 46. So also grooves or recesses 47 and 48 may be placed at the bottom of the cylinders 26 and 27. If desired, suitable stops may be provided for the block 38 so that the pistons will assume the positions shown when the car comes to rest. Preferably, however the pistons 34, 35 rest on the bottoms of their cylinders when the car is at rest at its lower limit of travel. In any event the buffer rods may again be forced upwardly to reset the buffer device for the reason that the lowermost perforations always establish communication between the passages 30, 31 and the space beneath the pistons.

Instead of a perforated lining for the buffer pistons, linings which are longitudinally slotted may be used. This slot may be tapered toward the bottom so as to be V-shaped in form with its widest portion at the top. I prefer to use the perforated lining as shown, however. Furthermore, the buffer pistons are preferably smooth fitting in the cylindrical linings but are not provided with any packing. These pistons may even be loose fitting, if desired. Instead of placing check valves at the upper portions of the linings one or more may be placed in the pistons themselves and so arranged that they open downwardly to allow free upward movement of the pistons. The pistons may also be provided with graduated or restricted perforations. In place of the longitudinal grooves forming the passages 30, 31 the linings may form central cylinders concentrically arranged with respect to the outer cylinders 26, 27 which will then form jackets for the inner cylinders.

Obviously various changes in the details and arrangement of parts may be made by those skilled in the art without departing from the spirit and scope of my invention. I, therefore do not desire to be limited to the precise construction herein shown and described, nor do I wish to limit my invention to plunger elevator systems as it may be applied to other types of hydraulic elevators.

I claim—

1. In an elevator, the combination of a car, means for operating said car, and a buffer device arranged to be struck by some moving part of the elevator, said buffer device comprising a differential piston subjected to fluid pressure to automatically reset the same.

2. In an elevator, the combination with a car, of moving means therefor, appliances mechanically separate from any moving part of said moving means for positively and automatically retarding the motion of the car at the limit of its travel, and apparatus for controlling the moving means and the pressure acting on said retarding appliances to re-set the latter or hold the same in normal position.

3. In an elevator, the combination with a car, of means for moving the same, appliances for gradually stopping the car, and apparatus for controlling said stopping appliances to cause the same to assist in starting and accelerating the car to full speed.

4. In a hydraulic elevator, the combination with a car and its plunger, of a buffer apparatus for gradually stopping the car at the limit of its travel, and means for controlling the operation of the car and the re-setting of said buffer apparatus to cause the latter to accelerate the motion of the car from start to substantially full speed.

5. In a hydraulic elevator, the combination with a car, of a hydraulic cylinder, an actuating member movable in said cylinder and connected to the car, an automatic stop device comprising one or more cylinders in communication with the fluid circulation and one or more differential pistons, and means for controlling the admission of fluid under pressure to said hydraulic cylinder for effecting the operation of the car and to said cylinders for causing the said stop device to assist in the acceleration of the car from rest and to re-set said pistons.

6. In an elevator, the combination of a movable body, and non-elastic fluid means comprising a member having a limited movement compared to the movement of said body, said means being so constructed and arranged as to be automatically re-set by fluid pressure when released by said body.

7. In an elevator, the combination with a car and moving means therefor, of appliances for gradually stopping the car, and apparatus for controlling both the moving means and said stopping appliances, the latter being constructed and arranged to assist in starting and accelerating the car to full speed and then remaining stationary while the car moves between its limits of travel.

8. In an elevator, the combination of a car, a plunger, a receiving cylinder, and controlling apparatus, and means separate from the plunger for gradually retarding the car at a predetermined point in its travel, said means being constructed and arranged to be automatically re-set by fluid pressure.

9. The combination with a movable body, of an inclosed receptacle, a single piston therein having a limited degree of movement as compared to the movement of said body, and means for gradually retarding the movement of said piston and to permit the automatic resetting of the same by fluid pressure acting directly thereon.

10. In an elevator, the combination with a movable body, of a receptacle for fluid, and means co-acting with said body to change the restriction to the flow of fluid in said recep-

tacle to effect a gradual stopping of said body, the latter being constructed and arranged to be automatically re-set by differential fluid pressure acting directly thereon.

11. The combination with a movable body, of an inclosed receptacle, a single permanently closed differential piston in said receptacle and having a limited degree of movement as compared to the movement of said body, means for increasing the restriction of flow of fluid in or from said receptacle, and an actuating device connected to the piston and extending outside the receptacle, said piston being re-set by fluid pressure.

12. The combination with a movable body, of a receptacle, a single permanently closed differential piston in said receptacle and having a limited degree of movement with respect to said body, an actuating device connected to the piston, means for increasing the restriction of the flow of fluid in or from said receptacle as said actuating device moves the piston, and apparatus permitting the automatic resetting of said piston to initial position by fluid pressure acting directly thereon.

13. In an elevator, the combination with a movable body, of one or more receptacles for fluid, and means for causing the fluid to change its rate of flow from said receptacle to effect a gradual stopping of said movable body, said means comprising a moving member permitting differential fluid pressure to act directly thereon to re-set the same.

14. In an elevator, the combination with a car, of means for actuating said car, and a safety buffer device comprising a receptacle, a differential piston and an actuating device, said safety buffer device co-acting with said operating means to gradually stop the car and being itself automatically re-set by fluid pressure independently of the operating means when released by the car.

15. In an elevator, the combination with a car, of means for moving the same, and a fluid-buffer device co-acting with said moving means to stop the car, said buffer device comprising one or more differential pistons to permit fluid pressure to re-set the same, when released by the car, separately from the moving parts of said moving means.

16. In an elevator, the combination with a car, of moving means for said car, a buffer device for absorbing inertia of the car when stopping at the limit of its travel, and means co-acting with said buffer device but mechanically independent of any moving part of said moving means for automatically resetting the buffer device by fluid pressure common to the latter and the moving means.

17. In a hydraulic elevator, the combination with a car and its plunger, of hydraulic means independent of the plunger for gradually stopping the car at the limit of its travel, and means for controlling the flow of fluid to said plunger and the pressure acting upon said stopping means.

18. In a hydraulic elevator, the combination with a car and hydraulic operating means therefor, of a buffer device for gradually stopping the car at the limit of its travel, apparatus for controlling both the said hydraulic-operating-means and the said buffer device, said buffer device being constructed and arranged to be actuated and held in normal position by fluid pressure independently of said hydraulic-operating-means.

19. In a hydraulic elevator, the combination with a car and its plunger, of a cylinder for said plunger, a buffer device for gradually stopping the car at the limit of its travel, said buffer device being constructed and arranged to be automatically re-set by fluid pressure independently of the plunger when released by the car, and apparatus for controlling the operation of the car and the re-setting of said buffer device.

20. In an elevator, the combination with a car and moving means therefor, of a buffer device co-acting with said moving means to gradually stop the car, said buffer device being constructed and arranged to be re-set automatically when released by the car, and the moving means being constructed and arranged to be operated independently of said buffer device between limits of travel, and apparatus operated from the car for controlling both the re-setting of the buffer device and the operation of said moving means.

21. In an elevator, the combination with a car, of moving means therefor, one or more cylinders containing fluid, appliances comprising differential pistons co-acting with the car for moving the fluid in said cylinders, and apparatus for regulating the flow of fluid to effect the gradual stopping of the car, said fluid-moving appliances being automatically re-set by fluid pressure acting directly upon said differential pistons.

22. The combination with a movable body, of a receptacle, a source of fluid pressure supply connected to said receptacle, an actuating device, and a single differential piston connected to said actuating device to have a limited degree of movement with respect to said movable body, said piston being located in said receptacle to permit fluid pressure acting on said piston to automatically reset the same.

23. In a multiple buffer device, the combination with a plurality of cylinders, of a source of fluid pressure connected to said cylinders, a plurality of differential pistons one in each of said cylinders, and a plurality of actuating devices one connected to each of said pistons and arranged to be struck by a body to be retarded.

24. In an elevator, the combination with a car, of moving means therefor, a plurality

of cylinders for containing fluid, differential pistons movable in said cylinders, a buffer block connected to said pistons and arranged to be struck by the car to actuate the fluid in said cylinders, and mechanism for regulating the flow of fluid to effect the gradual stopping of the car.

25. In an elevator, the combination with a car and its plunger, of moving means therefor, one or more auxiliary fluid cylinders, differential pistons in said cylinders, a buffer block connected to said pistons to cause the actuation of the fluid in said cylinders when struck by the car, and apparatus for regulating the flow of fluid in said cylinders to effect a gradual stopping of the car.

26. In an elevator, the combination with a car, of a plunger, a cylinder for said plunger, means for controlling the flow of motor fluid to and from said cylinder, auxiliary cylinders in communication with said plunger cylinder, pistons in said auxiliary cylinders, a striking block, buffer rods connecting said pistons to said striking block, means for variably restricting the flow of fluid to gradually stop the car, provisions for establishing communication between the plunger cylinder and the buffer device to effect a re-setting of the latter.

27. In a hydraulic elevator, the combination with a car, of a plunger connected to said car, a plunger cylinder, a buffer device comprising auxiliary cylinders and differential pistons, and means for controlling the flow of fluid from one side of said pistons to the other.

28. In an elevator, the combination with a car, of moving means therefor, a buffer device dependent upon a non-elastic medium to effect a gradual stopping of the car, and resilient means co-acting with said buffer device to prevent sudden shock in thus stopping the car, said buffer device comprising appliances separate from and independent of any moving part of said moving means but dependent upon fluid pressure to re-set the same.

29. In an elevator, the combination with a car, of moving means therefor, a fluid buffer device, and resilient means co-acting with said buffer device to effect a gradual stopping of the car, said fluid buffer device comprising one or more differential pistons to effect an automatic re-setting of the buffer device by fluid pressure acting directly upon said pistons.

30. In an elevator, the combination with a car, a plunger, a cylinder and apparatus for controlling the admission of fluid under pressure thereto, and an automatic stop device comprising one or more cylinders communicating by a series of openings with the fluid circulation and one or more pistons coöperating therewith and in the path of the moving part of the elevator.

31. In an elevator, the combination with a car, a plunger connected thereto, a cylinder, and apparatus for controlling the admission under pressure to said cylinder, of one or more comparatively short cylinders in communication with the source of fluid pressure and having a series of apertures, and one or more pistons, one moving in each of said short cylinders and thus forming dash-pots, but detached from the car and in the path of a moving part of the elevator as the car approaches the limit of its travel.

32. In a hydraulic elevator, the combination with a car, of a hydraulic cylinder, a motor member movable in said cylinder and connected to the car to operate the same, one or more auxiliary cylinders in communication with said hydraulic cylinder, differential pistons movable in said auxiliary cylinders, a striking block, buffer rods connecting said pistons to said striking block, means for variably restricting the flow of fluid in said buffer device to gradually stop the car, and means establishing communication between the hydraulic cylinder and the buffer device to effect an acceleration of the car upon starting the same from rest, and to effect also the re-setting of the buffer device to normal position.

33. In a hydraulic elevator, the combination with a car, of hydraulic apparatus for moving said car, one or more differential pistons, receptacles for containing said fluid and said pistons, a striking block connected to said pistons and in the path of movement of the car near the limit of its travel, and means for controlling the application of fluid pressure to said hydraulic car-moving apparatus and said pistons at the same time.

34. In a hydraulic elevator, the combination with a car, of hydraulic apparatus for operating said car, means for controlling said operating apparatus, one or more cylinders connected to said apparatus, differentially-acting pistons movable in said cylinders, a piston rod for each piston, a buffer block connected to the exposed ends of said piston rods, and means for controlling the application of fluid pressure to said pistons to assist in accelerating the car and to re-set the buffer block, rods and pistons.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

THOMAS E. BROWN.

Witnesses:
CHARLES M. NISSEN,
PAUL DE MONTCALM.