T. E. BROWN.

HYDRAULIC ELEVATOR SAFETY DEVICE.

APPLICATION FILED NOV. 23, 1905.

1,028,807.

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Fig. 1.

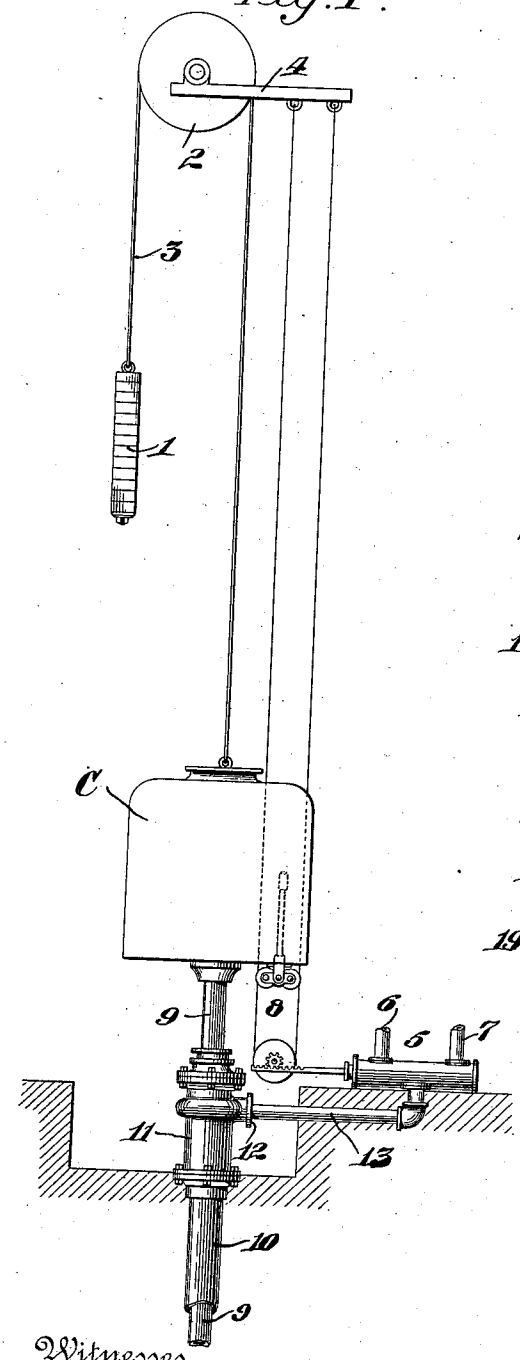
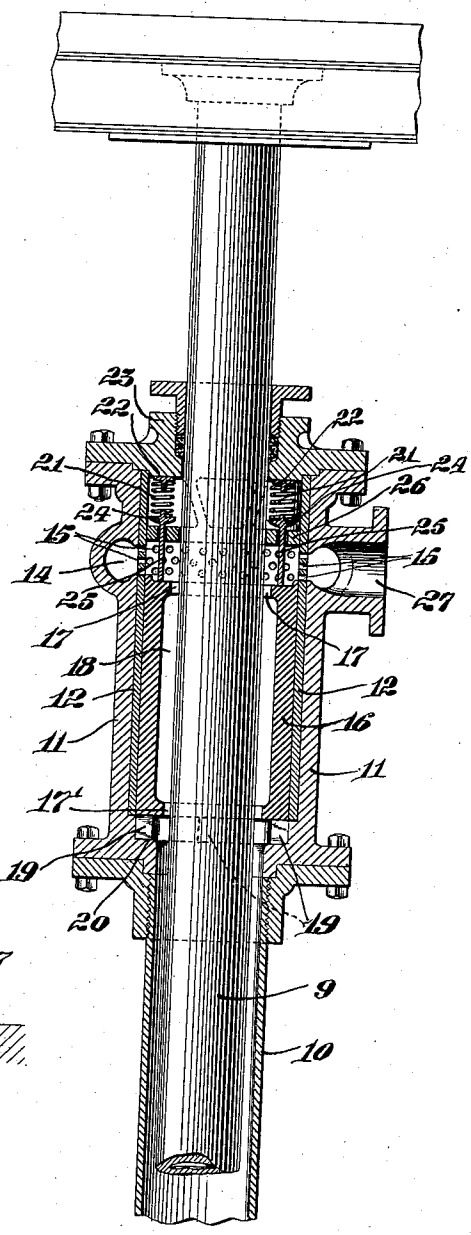


Fig. 2.



Witnesses

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UNITED STATES PATENT OFFICE.

THOMAS E. BROWN, OF NEW YORK, N. Y., ASSIGNOR TO OTIS ELEVATOR COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

HYDRAULIC-ELEVATOR SAFETY DEVICE.

1,028,807. Specification of Letters Patent. Patented June 4, 1912.

Application filed November 23, 1905. Serial No. 288,637.

To all whom it may concern:

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

My invention relates to safety devices for elevators of the plunger type.

One of the objects of my invention is the provision of simple and efficient means for retarding the speed of a plunger elevator car when the same moves too rapidly.

More particularly it is the object of the present invention to provide a device which will prevent the descent of the elevator car at a speed beyond that which may be predetermined under any conditions whatsoever, other than the bursting of the cylinder itself, or the collapsing of the plunger.

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

In the accompanying drawings, Figure 1 represents a plunger elevator system in elevation with my invention applied thereto; and Fig. 2 is an enlarged sectional elevation of my invention showing the details thereof.

In Fig. 1 is shown a plunger elevator system of usual construction comprising a car C, counterweight 1, counterweight sheave 2, on the overhead beam 4, counterweight cable 3, change valve 5 with its supply port 6 and exhaust port 7, means 8 for operating the change valve, a plunger 9 and a cylinder 10.

The upper section 11 of the plunger cylinder is enlarged in diameter and is preferably, though not necessarily, provided with a brass or bronze liner 12, the inlet and outlet port 27 is at one side of this section and is connected by the pipe 13 to the change valve 5. The port 27 may communicate with the plunger cylinder directly, but I prefer to carry an annular port 14 around the cylinder section and connect with the interior by the graduated or restricted perforations or openings in the liner 12. In this instance I have shown the inlet and outlet port 27, the annular port 14 and the perforations 15 in the liner 12 in alinement with each other and near the upper portion of the cylinder section 11.

16 designates a heavy ring or cylinder of metal which fits loosely within the liner 12 so as to be free to move up and down. Each end of the ring is provided with an inwardly extending flange but annular spaces 17, 17' are left between said flanges and the plunger, and an annular space 18 is left between the body of the ring and the plunger. If desired the flanges may be omitted.

Under normal conditions of operation the ring 16 rests on a plurality of lugs 19 which extend upwardly from the flange 20. When the car and its plunger are ascending the ring 16 rests on the lugs 19, and the motor fluid passes from the inlet port 27 through the perforations 15 in the liner 12 and thence down through the annular space between the ring 16 and the plunger to the underside of the plunger. Since in this case the pressure on top of the ring is always as great or slightly greater than the pressure on the bottom of the ring, the ring will remain at rest on the lugs 19.

When the car and its plunger descend the motor fluid will pass from the cylinder 10 up through the annular space between the ring 16 and the plunger and out to the change valve exhaust-port through the perforations 15 in the liner 12. Now it is evident that when the water ascends through the annular space 18, the pressure on the bottom of the ring 16 will be greater than the pressure on the top of the ring 16 by an amount equal to the loss of head, due to the velocity of water in the annular space. Hence the conditions of equilibrium require that since the top and bottom areas of the ring are substantially the same, the pressure on the bottom of the ring must be equal to the pressure on the top of the ring, plus the weight of the ring itself. Any excess, therefore, of the pressure on the bottom of the ring over the pressure on the top of the ring greater than the weight of the ring, must cause the ring to move upwardly, until, by throttling the holes 15 in the liner 12, the equilibrium is again established by raising the pressure above the ring until it is equal to the pressure under the ring less an amount equal to the weight of the ring. It will thus be seen that the difference of pressure above and below the ring must be that due to the weight of the ring itself, or a constant quantity. Now, as the annular

space is fixed, and the difference of pressure at the top and bottom of the ring must be the hydraulic loss in the annular space, and as above demonstrated, this must be a constant, and correspond to the weight of the ring, it is evident that the velocity through the annular space cannot exceed that due to the hydraulic head corresponding to the weight of the ring. Therefore, no matter what the conditions may be, such as the breaking of the discharge pipe, or loss of control of the apparatus in any way, the descending speed of the plunger being directly proportional to the velocity of the water through the annular space, cannot exceed the velocity due to the difference of hydraulic head corresponding to the weight of the ring 16.

I prefer, for the sake of accuracy, to rely entirely upon the weight of the annular ring 16 for this difference of head, but there may be cases where it would be inconvenient or undesirable to make the ring 16 of sufficient weight to account for the full difference of pressure desired. In such cases one or more springs, such as indicated at 21, may be inserted and retained in position in any suitable manner. In this instance, I have shown a holder 22 secured to the under side of the cylinder head 23, and a corresponding movable holder 24 for the lower end of the spring. The lower holder is provided with a stem 25 which extends downwardly and engages the upper annular surface of the ring 16. The stem 25 is guided by a perforation in the partition 26. The effect of such springs is equivalent to an increased weight of the ring 16, so long as the springs are of such length that the change of strain due to their compression by the rising of the weight, is not material. If, however, the springs are not made of such length, then the action of the apparatus will be only approximate. Other equivalents of a spring may be used if desired, such as weights acting on levers connected to the ring 16 through stuffing boxes.

It will be evident that the ring 16 may be made to fit the plunger, and that the equivalent of the annular space may be obtained by holes through the ring, but I prefer the method of construction shown. Also, the apparatus may be made adjustable by providing means of changing the size of the annular space, or the equivalent holes through the ring, but I prefer to construct the apparatus without such adjustment, as I consider it better to determine the hydraulic coefficient of the annular space and give it a proper size to begin with. It will also be evident that with a given size of the annular space, and a given coefficient of hydraulic friction, the greater the weight 16, the greater the speed, and vice versa. Hence where springs or other equivalents are used, the speed may be varied by adjusting such springs, or their equivalents.

In the remote contingency of the cylinder head blowing off, the apparatus described would not operate to retard the speed of the descending car but on the contrary would allow the same to lower itself very rapidly. I therefore secure to the lining 12 above the perforations, a stop which in this instance I have shown in the form of a ring 26. The ring will then perform the same function whether the cylinder head 23 is on or not. The ring 26 serves also as a partition to form a chamber for the springs, such as that designated 21. When the cylinder head is off, the springs cannot of course, act to increase in effect the weight of the ring, but the release of the springs will cause the perforations 15 to be throttled more quickly and completely and therefore all the more retard the downward travel of the car.

Many variations and changes in the details of construction and arrangement of parts would readily suggest themselves to those skilled in the art, and still be within the spirit and scope of my invention. I desire, therefore, not to be limited or restricted to the particular form of construction and arrangement of devices herein shown and described. It is also obvious that the associated operating parts may be varied, altered, and changed in the details of their construction and arrangement without affecting the principles of my invention.

Having thus set forth the object and nature of my invention, and an operative embodiment of the principles thereof, what I claim and desire to have protected by Letters Patent of the United States is:—

1. In a hydraulic elevator; the combination with a car and plunger, or a cylinder for said plunger, and a throttling device within said cylinder arranged to leave an annular space between the plunger and said throttling device, the operation of the latter to regulate the outflow of fluid being dependent upon the difference of pressure of the motor fluid exerted on its ends and also upon the weight of its movable part.

2. In a hydraulic elevator, the combination with a car, plunger and cylinder, a throttling device for regulating the outflow of motor fluid, and a partition within the cylinder above the throttling device.

3. In a hydraulic elevator, the combination with a car, plunger and cylinder, of means for controlling the flow of motor fluid to and from said cylinder, means within said cylinder for limiting the speed of descent of said car, and means for assisting gravity in holding the movable part of said speed-limiting means normally in its lowermost position.

4. In a hydraulic elevator, the combination with a car, plunger and cylinder, of a throttling device including a movable part carried within said cylinder and acting to regulate the speed of outflow of the motor fluid, and one or more resilient devices for assisting gravity in holding the movable part of said throttling device normally in its lowermost position.

5. In a hydraulic elevator, the combination with a car, plunger and cylinder, of a supply pipe connected to the cylinder, a throttling device carried by said cylinder independently of the supply pipe and acting to regulate the speed of outflow of the fluid, and one or more resilient devices for assisting gravity in holding the movable part of said throttling device normally in its lowermost position.

6. In a hydraulic elevator, the combination with a car, of a plunger and a cylinder, and a freely movable cylinder within the hydraulic cylinder for throttling the outflow of fluid from said hydraulic cylinder through a series of perforations.

7. In a hydraulic elevator, the combination with a car, plunger and cylinder, and a throttling device within said cylinder, said throttling device being constructed and arranged to be dependent upon the weight of its movable part, and difference of hydraulic head for its operation to regulate the speed of the motor fluid in said cylinder.

8. In a hydraulic elevator, the combination with a car, plunger and cylinder, of a lining in an enlarged portion of said cylinder said lining having a plurality of perforations establishing communication between said cylinder and an inlet and outlet port, a cylinder movable in said enlarged portion to close one or more of said perforations, a partition above said perforations, and springs between said partition and the cylinder head, and means acted upon by said springs to exert a pressure on the upper end of said movable cylinder.

9. In a plunger elevator system, the combination of the casing, a plunger vertically movable therein, a car on the upper end of the plunger, and a governor device for regulating the motion of the car controlled by the pressure to the casing, said governor device being mounted within the plunger casing, the latter being constructed and arranged to receive the same.

10. In a plunger elevator system the combination of the plunger casing, a plunger vertically movable therein, a car on the upper end of the plunger, a to-and-from pipe opening into the plunger casing, and a throttling device located inside the plunger casing, and actuated by fluctuations of pressure thereto for throttling the passage of the to-and-from pipe.

11. In a hydraulic elevator, the combination with a car and its plunger, of a receiving cylinder for said plunger, and an interior cylinder freely movable for throttling the outflow of fluid from said cylinder.

12. The combination with a main elevator cylinder, of a plunger in said cylinder, a valve in said cylinder for controlling the outflow of fluid through a port in said cylinder, and pressure-controlled means for operating said valve.

13. In an elevator, the combination with a car and its plunger, of a cylinder, means for controlling the flow of motor-fluid to and from said cylinder, means within said cylinder for limiting the speed of descent of the car, and means dependent upon gravity for holding the movable part of said speed-limiting means normally in its lowermost position.

14. In a hydraulic elevator, the combination with a car and a plunger, of a cylinder for said plunger, and a cylindrical throttling device loosely surrounding the plunger for regulating the outflow of motor-fluid to limit the speed of descent of the car.

15. In a hydraulic elevator, the combination with a car and a plunger, of a cylinder for said plunger, means for controlling the flow of fluid to and from said cylinder, and a throttling device within said cylinder arranged to leave an annular space between the plunger and said throttling device, the operation of the latter to regulate the outflow of fluid being dependent upon difference of pressure of the motor-fluid exerted on its ends and also upon the weight of its movable part.

16. In a hydraulic elevator, the combination with a car, plunger and cylinder, of a throttling device, including a movable part within said cylinder and acting to regulate the speed of outflow of the motor-fluid, and means for assisting the weight of the movable part of said throttling device in holding the said part normally in its lowermost position.

17. In a hydraulic elevator, the combination with a car, plunger and cylinder, of a supply pipe connected to the cylinder, a throttling device carried by said cylinder independently of the supply pipe and acting to regulate the speed of outflow of the fluid, and one or more devices for assisting the weight of the movable part of said throttling device in holding said part in its lowermost position.

18. In a hydraulic elevator, the combination with a car, of a plunger and a cylinder, a freely movable cylindrical device within the hydraulic cylinder, and means co-acting with said cylindrical device for throttling the outflow of fluid from said hydraulic cylinder.

19. In a hydraulic elevator, the combination of a car, plunger and cylinder, and a

throttling device within said cylinder, said throttling device being constructed and arranged to be dependent upon the weight of its movable part and the rate of outflow of the motor-fluid from said cylinder to regulate the speed of such outflow.

20. In an elevator, the combination with a main cylinder, of a plunger movable in said cylinder, a car connected to the upper end of said plunger, and a throttling device wholly inclosed by said cylinder for regulating the flow of fluid from said cylinder.

21. In an elevator, the combination of a main cylinder, fluid-flow controlling means, and a throttling device within said cylinder and dependent upon gravity and the friction of the outflowing fluid with a part of said throttling device to control the flow of fluid in said cylinder.

22. In an elevator, the combination of a main cylinder, fluid-flow controlling means, and a throttling device wholly within said cylinder for controlling the outflow of fluid therefrom, the operation of said throttling device being dependent upon gravity, fluid friction, and pressure.

23. In an elevator, the combination of a main cylinder, means wholly within said cylinder automatically actuated by the flow of the fluid for regulating the speed of such flow, and means for holding said regulating means in normal position.

24. In a plunger elevator system, the combination of the casing, a plunger vertically movable therein, a car on the upper end of the plunger, and a governor device for regulating the motion of the car controlled by the pressure in the casing, said governor device being mounted within the plunger casing, the latter being constructed and arranged to receive the same.

25. In a plunger elevator system, the combination of the plunger casing, a plunger vertically movable therein, a car on the upper end of the plunger, a to-and-from pipe opening into the plunger casing, and a throttling device located inside of the plunger casing and actuated by fluctuations of pressure therein for throttling the passage of fluid through the to-and-from pipe.

26. In a plunger elevator system, the combination with a casing, of a plunger movable therein, a car on the upper end of the plunger, means for controlling the flow of fluid to and from said casing, and a governor device within said casing for regulating the motion of the car by fluctuations of velocity of flow of fluid in the said casing.

27. In a hydraulic elevator, the combination with a main cylinder, of fluid-flow controlling means, and means within said cylinder and dependent upon gravity, fluid friction and pressure to limit the speed of outflow of fluid from said cylinder.

28. In a hydraulic elevator, the combination with a car and a plunger, of a cylinder for said plunger, and means within said cylinder automatically actuated by the exhaust flow to regulate the speed of movement of said plunger.

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.