F. C. FURLOW.

SPEED REGULATOR AND STOP MOTION DEVICE FOR PLUNGER ELEVATORS.

APPLICATION FILED APR. 25, 1908.

1,005,190.

Patented Oct. 10, 1911.

2 SHEETS—SHEET 1.

Fig. 1.

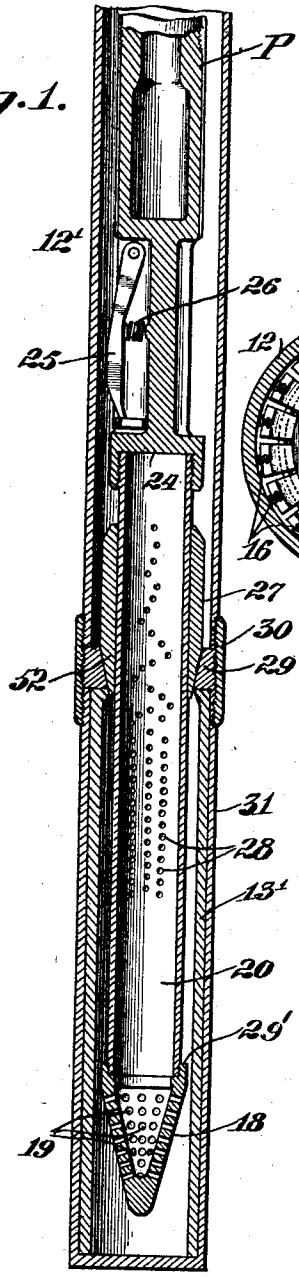


Fig. 3.

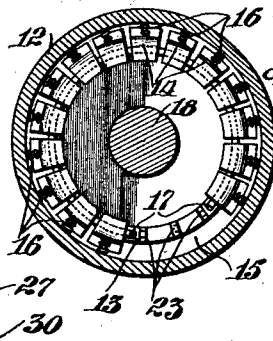


Fig. 4.

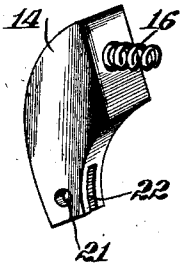
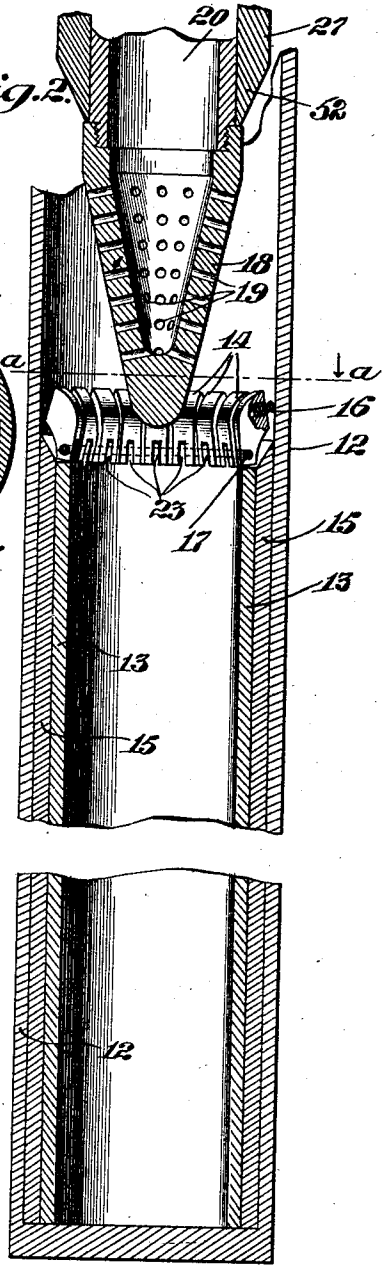


Fig. 2.



Attest:

C. Mitchell
Walter C. Strang

by

Inventor:

Floyd C. Furlow
C. M. Nissen
Atty

F. C. FURLOW.

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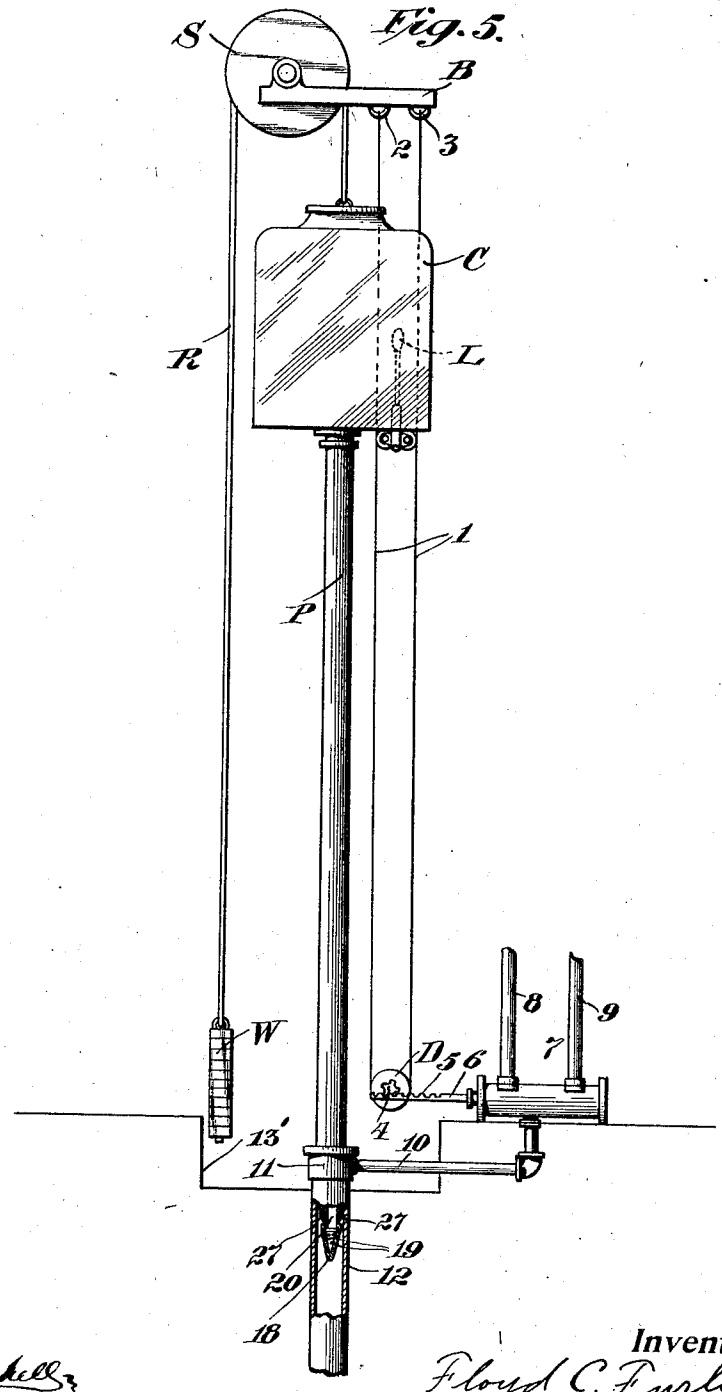
2 SHEETS—SHEET 2.

Fig. 5.



Attest:

Walter C. Strang

by

Inventor:

Floyd C. Furlow

C. M. Nissen

Atty

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

FLOYD C. FURLOW, OF MONTCLAIR, NEW JERSEY, ASSIGNOR TO OTIS ELEVATOR COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

SPEED-REGULATOR AND STOP-MOTION DEVICE FOR PLUNGER-ELEVATORS.

1,005,190. Specification of Letters Patent. **Patented Oct. 10, 1911.**

Application filed April 25, 1906. Serial No. 313,606.

To all whom it may concern:

Be it known that I, FLOYD C. FURLOW, a citizen of the United States, residing at Montclair, in the county of Essex and State of New Jersey, have invented a new and useful Improvement in Speed-Regulator and Stop-Motion Devices for Plunger-Elevators, of which the following is a specification.

This invention relates to plunger elevators and is an improvement of the invention disclosed in my co-pending application, Serial No. 290,716, filed December 7, 1905.

One of the objects of the present invention is the provision of simple and efficient means for gradually and automatically stopping an elevator car at the lower limit of its travel.

A further object of my invention is to provide a resilient flaring mouth for the lower portion of a plunger cylinder and means co-acting therewith to produce a gradual stopping of the elevator car.

Another object of this invention is the provision of valve mechanism carried on the outside of the lower portion of the plunger to effect a gradual stopping of the car at the lower limit of its travel.

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

In the accompanying drawings, Figure 1 is an elevational sectional view of the lower portions of an elevator cylinder and plunger; Fig. 2 is a similar but enlarged view of a modification; Fig. 3 is a plan sectional view taken on the line *a*—*a*, Fig. 2; Fig. 4 is a detail view; and Fig. 5 illustrates a plunger elevator system to which my invention may be applied.

It has been discovered that with plunger elevators operating at high speeds, it is necessary to introduce a positive limit stop at the bottom of the run to prevent the elevator from striking the pit sufficiently hard to cause injury to the passengers, or to any part of the elevator apparatus. A stop of this kind is particularly desirable as the car approaches the bottom of the run, for in addition to the unbalanced live load in the car, the inertia of the moving parts must be overcome, so as to bring the car gradually to rest.

I have herein disclosed one embodiment of the principles of my invention, but I do not desire to be limited or restricted to the precise construction shown. Obviously, various changes in the details and arrangement of parts could be made by persons skilled in the art without departing from the spirit and scope of this invention.

Although my invention is particularly adapted to plunger elevators as illustrated in Fig. 5, it may, with slight modifications in the form and proportions of parts, if necessary, be used to retard or stop the movement of bodies, such for example, as are placed on hydraulic presses or other apparatus operated by fluid pressure. In this instance, a car C is shown connected by means of the counter-weight rope R to the counter-weight W. The rope R passes around the sheave S mounted on the overhead beam B. Connected to the bottom of the car is a plunger P which is adapted to be received by the standard cylinder 12 sunk into the earth and having only its upper portion or head 11 exposed in the pit 13′.

For controlling the flow of motor-fluid to and from the cylinder 12, a change valve 7 may be employed which is provided with supply and exhaust pipes 8 and 9, and connected to the cylinder head 11 by means of the pipe 10. Any desirable means for operating the change valve may be used; that here shown comprises an operating lever L in the car for actuating the operating rope 1, the upper ends of which are attached to the over-head beam B at 2 and 3, and the lower end of which is passed one or more times around the drum D. This drum when rotated actuates the pinion 4 carried thereby, thus causing the valve stem 6 to be moved in the desired direction, since the latter is connected to the rack 5 which is in mesh with said pinion 4.

Referring now to Fig. 2, it will be seen that at the extreme lower end of the plunger cylinder 12 is inserted a sleeve 13 composed of suitable material, such as brass. The cylinder 12 is preferably made of iron or steel and between the same and said sleeve 13 is interposed the sleeve 15 of material which is different from that of the sleeve 13 and the cylinder 12, as for example, Babbitt metal. This is for the reason that by the electrolytic action due to the metals differing in their composition, any rusting of the cylinder is eliminated or greatly reduced.

The sleeves 13 and 15 may be cup-shaped

or open at their lower ends, as shown. The Babbitt metal may be cast into a cup or cylinder before being put in place, or directed when in a molten state between the sleeve 13 and the lower portion of the cylinder 12 and allowed to harden. Any other desired method of securing the Babbitt metal in proper position may be employed, however, if desired.

The upper portions of the sleeves 13 and 15 may be cut away so as to form a flaring mouth for the lower portion of the cylinder which is now in effect of reduced diameter. The sleeve 13 may be of any desired thickness and so also may the interposed sleeve 15, but the internal diameter of the innermost sleeve should be somewhat larger than the external diameter of the plunger P. In this instance, I have shown a resiliently flared sleeve 13 in that to the upper portion thereof are pivoted the movable dogs 14, spring-pressed inwardly by the springs 16. As shown in Fig. 4, the lower end of each dog 14 is bifurcated at 22 and provided with a hole 21. The bifurcated portion fits over one of the vertical extensions or lugs 23 at the upper end of the sleeve 13 and a wire 17 may pass through holes in such lugs as well as through the holes 21 to form bearings for the dogs 14. Any other suitable pivotal connection may be used, that here shown being merely by way of illustration.

The plunger P may be hollow, as shown, or it may be solid. In any event it should have a hollow extended portion 20 and a bottom at some intermediate portion as at 24, Fig. 1. In this instance I have shown a lever 25 between the plunger proper and the extended portion 20. This lever is held outwardly by means of a spring 26 to constitute a buffer device for the plunger when the same swings against the inner wall of the cylinder.

A conical cap 18 is shown screw-threaded to the extreme lower end of the tube 20 and is preferably provided with a series of holes 19. It should be noted that my invention contemplates the use of a plunger closed at its lower end so that when the resiliently flared sleeve co-acts with such lower end, the car will be gradually stopped at its lower limit of travel. I prefer, however, in order to make the stop more gradual, to make the lowermost end of the entire plunger conical and perforate the conical portion. Furthermore, if desired, the hollow extension 20 may be provided with openings 28 arranged in any suitable manner. Also the valve 27 may be added so that when the same is held by the dogs 14, it will have the same effect on the valve 27 as in the construction shown in Fig. 1, and about to be explained.

Referring to Fig. 1, it will be seen that the plunger cylinder 12′ is divided into two parts connected by the nut 30. Between the upper portion of the cylinder and the lower portion 31 is clamped the inwardly extending ring 29. This lower portion may be of increased thickness or an inner sleeve 13′ provided so that such lower portion of the plunger cylinder will be of reduced diameter. If desired, the ring 29 may be integral with the cylinder, or in the form of a plurality of inwardly extending lugs. In this instance I have shown the ring 29 beveled on its inner side and the lower end 52 of the slide valve 27 beveled correspondingly. Any suitable slide valve carried by the extension 20 may be used, but I prefer to use a cylindrical valve 27 by reason of its simplicity. When the plunger P moves upwardly from the lowermost position a predetermined distance, the cylindrical shoulder 29′ of the cap 18 will strike the valve 27 and thereafter carry the latter upwardly. In other words, so long as the parts are in the positions indicated in Fig. 1, the valve 27 rests on the ring 29, but when the plunger moves upwardly a certain distance, the shoulder 29′ strikes the valve 27 and carries the latter upwardly with the plunger.

The operation of the invention is as follows: Assuming that the controller lever in the car has been moved so as to effect a downward movement of the car, it is evident that the motor fluid will be exhausted from the plunger cylinder. As the plunger approaches the lower limit of its travel, or arrives at the lower end of the cylinder of reduced diameter, the fluid will be gradually throttled in its flow from beneath the plunger. This is obvious because the space between the plunger and cylinder is lessened. The back pressure on the plunger thus produced effects a gradual stopping of the plunger and car. The resilient flaring mouth of the lower portion of the cylinder of reduced diameter not only acts as a guide and buffer device for the plunger, but also varies the rate of flow of the fluid from beneath the plunger, and thus prevents shocks or jars and tends to make the stopping of the car gradual within a wide range of speed. For instance, if the speed of descent of the plunger is comparatively great, the pressure acting on the spring-pressed dogs will be greater and hence there will not be so much throttling at the beginning as when the car descends more slowly.

As hereinbefore stated, the construction illustrated in Fig. 2 as to the cylinder and the parts attached to it may be used with an ordinary plunger, but I prefer to make the lower end thereof conical so that the throttling will be more gradual. Obviously, a closed conical cap may be used at the lower end of the plunger, but I prefer to perforate the same as indicated in Figs. 1 and 2 in which case the motor fluid will be forced

into the extension 20 and thence through the openings 28 as the plunger enters the lower end of the cylinder of reduced diameter.

When the construction shown in Fig. 1 is employed, the outflow of the motor fluid from beneath the plunger will be throttled as soon as the conical cap 18 comes into proximity with the ring 29. Fluid will at first be forced upwardly between the cap 18 and the ring 29, or sleeve 13′, and also upwardly within the hollow extension 20 and out through the holes 28. But when the valve 27 strikes the ring 29, the motor fluid in the lower portion of the cylinder must flow through the tube 20 and thence through the holes 28, unless the descent is very quick and the consequent back pressure very great when the valve 27 will be lifted from its seat to allow flow of fluid between the ring 29 and the tube 20 even after the cap 18 has entered the cylinder 31. This action prevents too sudden stopping if the speed of descent is very great, and in high speed elevators it may be advantageous to have the tube 20 longer than in low speed elevators. It will now be seen that although the ring 29 may be substituted by any means for arresting the valve 27, such means should close or nearly close the passage between the upper and lower portions of the cylinder when the valve 27 is arrested in its downward movement. As the plunger continues in its downward movement after it has been partially retarded in the manner explained, the openings 28 in the tube 20 are closed one after another or in groups until finally they are all closed when the fluid can no longer flow from within the tube 20 through the openings 28 to the cylinder above the ring 29. If at this time there is still sufficient momentum of the unbalanced weight of the car and plunger to continue the movement of the latter, the valve 27 will be lifted by the increased pressure of the fluid within the cylinder 31. The valve 27 will thus not only act as a throttling device, but also as a safety device. The weight of the valve 27 may be predetermined to effectually prevent too sudden stopping of the car when traveling at high speed with a heavy load; also to prevent the car in any event from striking the cylinder head or the bottom of the plunger from striking the bottom of the cylinder. It should also be noted that by varying the weight of the valve 27, and rearranging or changing the sizes of the openings 28, the stopping may be made as gradual as desired. Furthermore, the openings 28 may be closed or omitted and the action of the valve 27, with the addition of the conical cap 18, if desired, be depended upon to govern or regulate the stopping of the car at its lower limit of travel. When the lower end of the cylinder, or the sleeve 13 as shown in Fig. 2, has a flaring mouth, resilient if desired, the valve 27 will be arrested by such mouth and the retarding operation thereafter would be like that heretofore explained.

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

1. The combination with a car and a plunger, of a cylinder for receiving said plunger, means for controlling the flow of motor-fluid to and from said plunger, and means comprising a movable device on the outside of the lower portion of the plunger to effect a gradual stopping of said car at the lower limit of its travel.

2. The combination with a car and its plunger, of a cylinder for receiving said plunger, and a resiliently flared sleeve at or near the lower end of said cylinder for effecting a gradual retardation of said car to stop the same at the lower limit of its travel with minimum shock or jar.

3. The combination with a car and its plunger, of a cylinder for receiving said plunger and having its lower portion of reduced diameter, a resiliently flared mouth for the portion of reduced diameter, and means co-acting with said mouth and the said portion of reduced diameter for effecting a gradual stopping of the car at the lower limit of its travel.

4. In a plunger elevator, the combination with a car and its plunger, of a perforated hollow extension of said plunger, a sliding device carried by said extension, and means for limiting the downward movement of said sliding device to effect a gradual stopping of the car.

5. In a plunger elevator, the combination with a car and its plunger, of a cylinder for receiving said plunger, a hollow extension of said plunger having its bottom and walls perforated, a slidable sleeve carried by said extension, and means secured to the cylinder for limiting the downward movement of said sleeve and causing the same to throttle the flow of motor fluid from beneath the plunger by closing the openings in the walls of said hollow extension.

6. In a plunger elevator, the combination with a plunger and a cylinder therefor, a hollow extension of said plunger provided with a plurality of openings, a slide valve, and means for operating said slide valve for closing one or more of said openings.

7. In a plunger elevator, the combination with a plunger and a cylinder therefor, a sliding valve, and means co-acting with the lower portion of the cylinder and the lower end of the plunger for operating said valve.

8. In a plunger elevator, the combination with a plunger and a hollow perforated extension thereof, of a conical perforated cap

for the lower end of such extension, a cylinder for the plunger, a sliding valve carried by said extension, and annular means for limiting the movement of said valve to effect a gradual throttling of the flow of fluid from beneath the plunger when the car approaches the lower limit of its travel.

9. In a plunger elevator, the combination with a plunger, of a cylinder, inwardly extending obstructing means inside of said cylinder, and throttling mechanism operated by said obstructing means to effect a gradual stopping of the car as it approaches its lower limit of travel.

10. As an article of manufacture, a hydraulic, laterally perforated plunger carrying a sliding valve at its lower end.

11. As an article of manufacture, a plunger provided with a hollow laterally perforated extension at its lower end, and a slide valve carried by said hollow extension.

12. As an article of manufacture, a hydraulic plunger having an extended portion at its lower end provided with one or more openings, and a valve carried by said extended portion and adapted to slide over the same to cover said opening or openings.

13. As an article of manufacture, a hydraulic plunger having a hollow perforated extension at its lower end, a perforated conical cap for the lower end of said extension, and a slide valve carried by said extension.

14. As an article of manufacture, the combination with a hydraulic plunger, a tube provided with one or more openings and secured to the lower end of said plunger, and a sleeve carried by said tube and adapted to slide over the same to act as a valve to close said opening or openings.

15. The combination of a cylinder and plunger of a hydraulic elevator, of a guiding means yieldingly attached to the cylinder.

16. The combination of a cylinder and plunger of a hydraulic elevator, of a guiding mechanism with a spring tension attached to the cylinder.

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

FLOYD C. FURLOW.

Witnesses:
W. W. LIGHTHIPE,
W. H. BRADY.