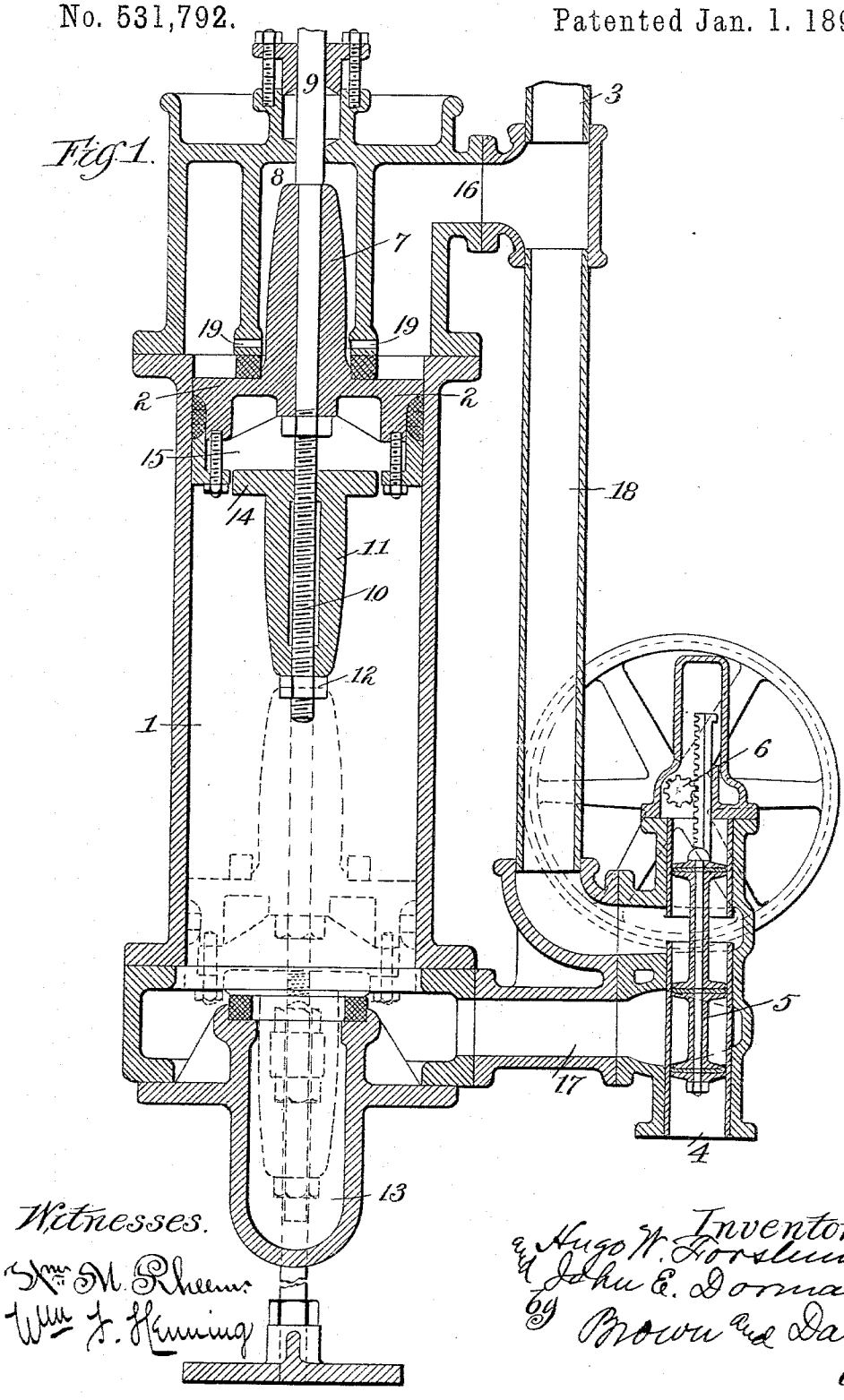
(No Model.) 2 Sheets—Sheet 1.

H. W. FORSLUND & J. E. DORMAN.

ELEVATOR APPARATUS.

No. 531,792. Patented Jan. 1, 1895.

Fig. 1.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

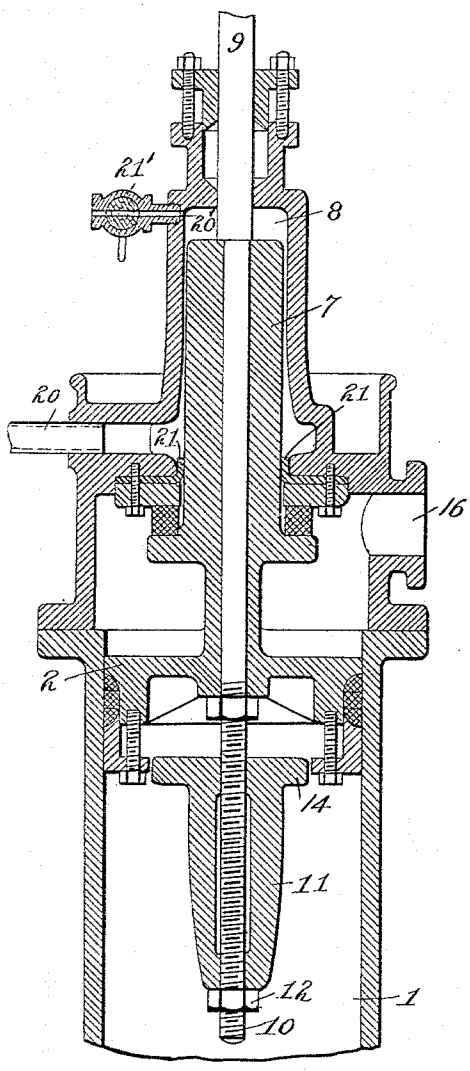
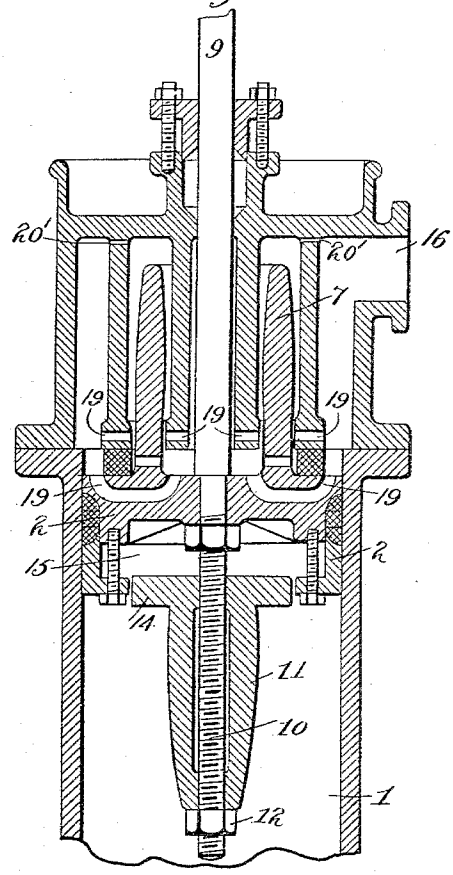


Fig. 3.



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UNITED STATES PATENT OFFICE.

HUGO W. FORSLUND AND JOHN E. DORMAN, OF CHICAGO, ILLINOIS.

ELEVATOR APPARATUS.

SPECIFICATION forming part of Letters Patent No. 531,792, dated January 1, 1895.

Application filed April 19, 1894. Serial No. 508,076. (No model.)

To all whom it may concern:

Be it known that we, HUGO W. FORSLUND and JOHN E. DORMAN, the former a citizen of the United States and the latter a subject of the Queen of Great Britain, both residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Elevator Apparatus, of which the following is a specification.

This invention relates to hydraulic elevators, and its objects are to remedy difficulties and avoid defects found to exist in elevator apparatus, as heretofore constructed, to increase the efficiency of the same and to effect a more reliable and positive operation of the same.

With these objects in view the invention consists in the construction, combinations, location and relative arrangements of parts as will be more fully hereinafter described, as shown in the accompanying drawings, and finally pointed out in the appended claims.

In the drawings, Figure 1 illustrates in central longitudinal section, parts being broken away, a hydraulic elevator motor embodying one form of apparatus for carrying out the principles of our invention. Fig. 2 is a similar view embodying another form. Fig. 3 is a similar view embodying still another form.

To enable others skilled in the art to make and use our invention, we will now explain fully the principle thereof and the forms of apparatus shown for applying that principle.

Reference is had to the accompanying drawings, forming a part hereof and to the various views and reference signs appearing thereon, and wherein—

Reference sign 1, designates a fluid motor cylinder which may be of any suitable or well known form. In the drawings a well known type of upright or vertical fluid motor cylinder is shown, as such type is particularly well adapted for hydraulic elevator constructions, but it will be readily seen and understood that our invention may be applied to any other type of motor to which it is adapted. The piston is represented generally by the numeral 2. The fluid supply and outlet pipes 3, 4, valve 5, and valve controlling mechanism 6, may be of any well known and suitable construction. Carried by, or cast solidly with the piston, and projecting centrally from one face thereof, is a plunger 7, adapted to be received in a chamber 8, formed in the head of the cylinder, when the piston reaches the limit of its stroke in one direction. The plunger 7, is bored longitudinally and receives therethrough the piston rod 9, which also passes through the piston and its end is screw-threaded, as shown at 10, and mounted on the screw threaded end thereof, on the opposite side of the piston, is a centrally bored, elongated, cuneiform block or plunger 11, capable of adjustment on said rod by means of the set nut 12. This block is adapted to be received in a cylindrical chamber 13, formed in the cylinder head, at the opposite end thereof from the end above described, where chamber 8, is located. The end of plunger block 11, adjacent to the piston may be flanged, as shown at 14, to adapt it to enter a chamber 15, formed in the face of the piston, sufficient space being allowed for the free passage of the fluid around the flange, as clearly shown. The cylinder ports 16, 17, are of the usual construction and any suitable pipe connection 18, may be employed to afford communication between the two. Suitable passages 19, are provided, see Figs. 1 and 3, which open constant and free communication between chamber 8, and the source of fluid supply, or, as in Fig. 2, the chamber 8, may be supplied with fluid from the tank or other source by means of a connection 20, disconnected from and independent of the main supply pipe 3.

In the form of apparatus shown in Fig. 1, for carrying out the principles of our invention, plunger 7, is shown as a solid, centrally bored, cuneiform block, and may be, if desired cast solidly with the piston. Chamber 8, is shown cylindrical in shape. When the piston approaches its limit of stroke, that is when the elevator car reaches one limit of its travel, say the bottom of the shaft, cuneiform plunger block 7, enters the chamber 8, which, being in constant communication with the main fluid supply pipe, is filled with fluid. As plunger 7, advances in chamber 8, the fluid contained therein is displaced, forced out, escaping therefrom through the space between the outer surface of said plunger and the inner wall of said chamber. By reason of the tapering or cuneiform shape of the plun-

ger, the farther it advances into the chamber the smaller becomes the space through which the fluid can pass out from the chamber, and hence more resistance is offered to the displacement, thus forming a hydraulic buffer, effectually arresting the motion or travel of the piston, and hence of the car, rapidly, without jar or jerk, and without in any manner interfering with or cutting off, either wholly or partially, the supply of fluid to the cylinder, as the arrangement is such that the chamber 8, while receiving its supply of fluid from the main fluid supply to the cylinder, is, in action removed from and independent of the main fluid supply, and this we consider a most important feature of our invention. An action similar to that above described takes place at the other limit of stroke of the piston by plunger block 11, entering chamber 13, thus in like manner arresting without bump or jar the motion of the piston, and hence of the car, when it reaches the top of the shaft.

In order to avoid the possibility of forcing the fluid contained in chamber 8, through the box or perforation in the cylinder head through which piston 9, passes, in case said chamber immediately surrounds the piston, as shown Fig. 1, by the pressure due to the entrance of plunger block 7, in said chamber, we may, in some cases construct plunger 7, in the form of a beveled sided shell, and chamber 8, may be in the form of a ring-shaped circular chamber, as shown in Fig. 3, and when piston 2, reaches its limit of stroke and the shell-shaped plunger enters the chamber, the same action as that above described takes place, and the car is arrested without jar.

In the form shown in Fig. 2, the plunger block 7, is made cylindrical in shape, and chamber 8, is made tapering. In this construction said chamber is isolated from the main fluid supply of the cylinder, and receives its supply of fluid from the tank or other source through supply pipe 20. A suitable packing 21, serves to isolate said chamber from the main cylinder fluid supply.

By adjustably mounting plunger block 11, on the end 10, of piston rod 9, the limit of stroke of the piston may be adjusted.

In order to avoid the objection usually present in constructions of this kind of having the car start off slowly at the beginning of its ascent or descent due to the fact that only a small or limited surface area of the piston is presented to the action of the fluid at the moment of starting the car, we provide passages 19, through which the fluid may freely pass and thus reach a large area of piston.

It will be observed that by the action of our hydraulic buffer, depending as it does on displacement, instead of compression, and not affecting the supply of fluid to the cylinder, as by wholly or partially cutting off said supply, as is usually the case, the objection is avoided of increasing the resistance to the discharge of the fluid from the main cylinder at that end thereof toward which the piston is traveling, as is the case where the supply and exhaust ports are partially contracted or closed. This we consider an important feature of our invention, for thereby we reduce friction and wear on the piston, by relieving it of excessive strain during part of its stroke, and hence secure a perfect balance for the piston on all sides throughout its entire stroke.

In order to provide a means of escape for any air that may accumulate in the upper part of chamber 8, we provide air ducts or passages 20'. In the form shown in Fig. 2, this duct may be provided with a stop cock 21', of any ordinary or suitable construction, but in most cases simply a very small air passage is sufficient, and in practice it has been found that a small passage does not cause any material escape of fluid therethrough.

Many variations and changes may be made in the forms of apparatus for carrying out the principles of our invention without departing from the spirit and scope thereof. We do not desire to be limited or restricted, therefore, to the exact details shown and described; but

Having now fully described our invention and its method of operation, what we claim as new, and desire to secure by Letters Patent of the United States, is—

1. In an elevator apparatus, a fluid motor cylinder provided with supply and exhaust ports, a piston, a buffer therefor comprising a chamber removed from and independent of said supply and exhaust ports, and in constant communication with a source of fluid supply, a plunger carried by said piston, and adapted to enter said chamber at the limit of stroke of said piston, the interior walls of said chamber and the exterior surface of said plunger being inclined relative to each other, whereby said plunger effects a displacement of the fluid contained in said chamber against a gradually increasing resistance without affecting the supply or exhaust of fluid to or from the motor cylinder; as and for the purpose set forth.

2. In an apparatus of the class described a fluid motor cylinder, having supply and exhaust ports, a piston, a plunger carried thereby, a chamber adapted to receive said plunger, said chamber being in constant communication with a source of fluid supply, but removed from and independent of said supply and exhaust ports, the inner walls of said chamber and said plunger being conical with respect to each other; as and for the purpose set forth.

3. In an elevator apparatus a motor cylinder, provided with the usual supply and exhaust ports, a piston, a plunger carried on each side of said piston, a chamber arranged adjacent to each end of the motor cylinder, said chambers being in constant communication with a source of fluid supply but removed from and independent of said supply and exhaust ports, one of said chambers adapted to

receive a plunger at each limit of stroke of said piston, whereby the movement of the piston is arrested without jar, and without affecting the supply or exhaust of the fluid to or from the motor cylinder; as and for the purpose set forth.

4. In an elevator apparatus a cylinder provided with the usual supply and exhaust ports, a piston an adjustable plunger carried by said piston, a chamber arranged adjacent to the cylinder head removed from and independent of the supply and exhaust ports, said chamber being in constant communication with a source of fluid supply, said plunger arranged to enter said chamber at the limit of stroke of said piston, said chamber and piston being conical with relation to each other, whereby said plunger effects a displacement of the fluid contained in said chamber, as it advances therein, against a gradually increasing resistance without affecting the supply or exhaust of fluid to or from the motor cylinder; as and for the purpose set forth.

5. In a hydraulic elevator apparatus, a fluid motor cylinder provided with supply and exhaust ports, a piston, a plunger carried by said piston, a chamber arranged adjacent to the end of the cylinder removed from and independent of the exhaust or supply ports, but adapted to receive a constant fluid supply and having air passages or ducts, as described, said plunger adapted to be received in said chamber when the piston approaches the limit of its stroke; as and for the purpose set forth.

6. In a hydraulic elevator a fluid motor cylinder provided with supply and exhaust ports, a piston, a cone-shaped plunger carried by said piston, a cylindrical chamber arranged adjacent to the end of the cylinder, removed from and independent of the exhaust or supply ports and in constant communication with a source of fluid supply, said plunger adapted to be received in said chamber as the piston approaches its limit of stroke, whereby the fluid contained therein is displaced against a constantly increasing resistance, and without interfering with or throttling the fluid supply to the motor cylinder; as and for the purpose set forth.

7. In a hydraulic elevator apparatus, a fluid motor cylinder provided with the usual supply and exhaust ports, a piston, a tapering plunger carried thereby, a cylindrical chamber arranged at the end of said cylinder, removed from and independent of the supply or exhaust ports, and in free communication with a constant source of fluid supply, said chamber provided with air passages at the outer extremity thereof, said plunger adapted to enter said chamber as the piston approaches the limit of its stroke, whereby the fluid contained in said chamber is displaced against a gradually increasing resistance without affecting or interfering with the supply or exhaust of the fluid to or from the motor cylinder; as and for the purpose set forth.

In testimony whereof we have hereunto set our hands, this the 14th day of April, 1894, in the presence of two subscribing witnesses.

HUGO W. FORSLUND.
JOHN E. DORMAN.

Witnesses:
G. T. FRANCIS,
B. F. RUSS.