

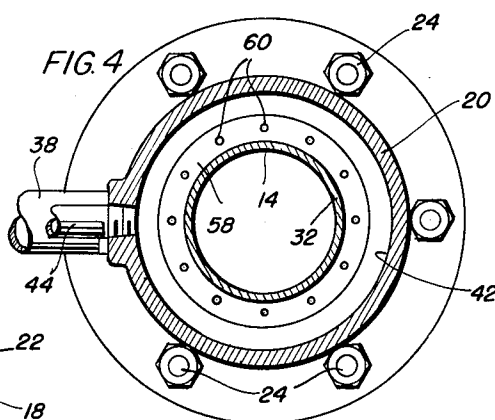
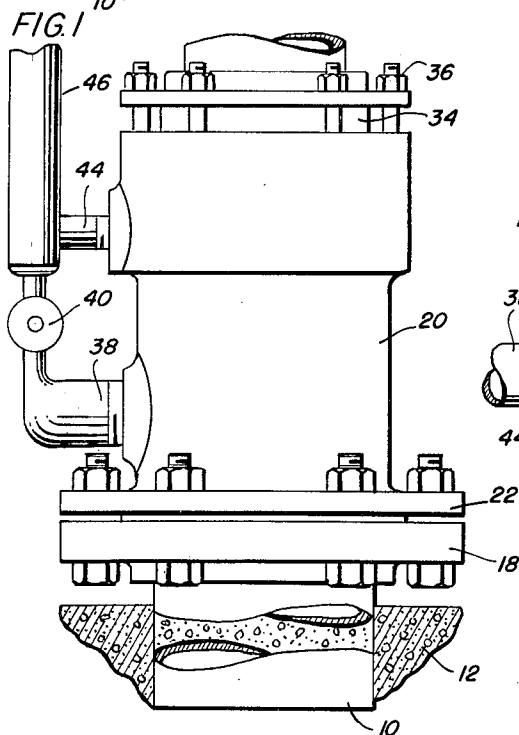
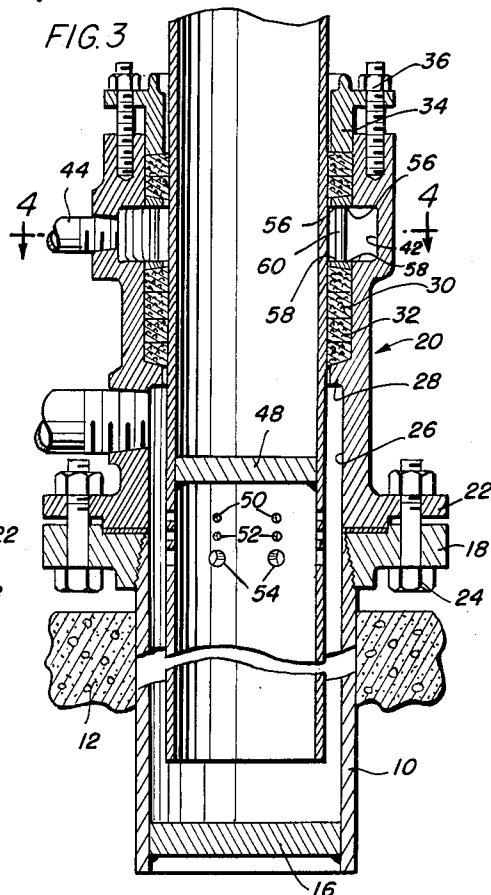
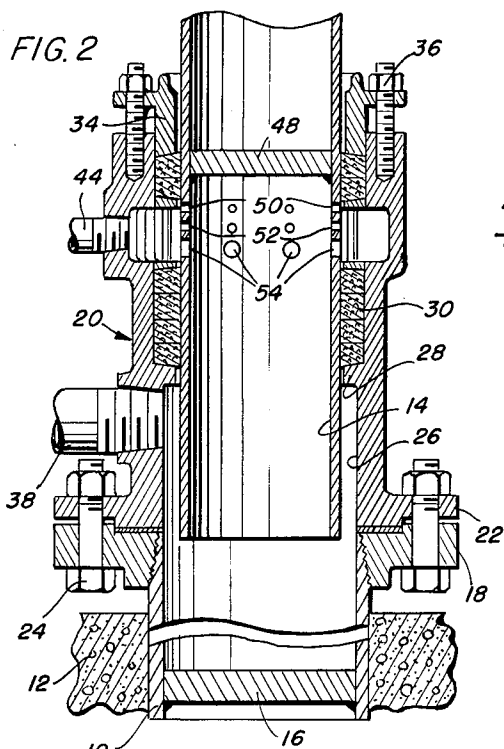
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HYDRAULIC ELEVATORS

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HYDRAULIC ELEVATORS

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This invention relates in general to hydraulic elevators and is more particularly described as a stuffing box and by-pass valve for special use with such elevators but having a more general use wherever applicable.

In hydraulic elevator practice, it is customary to support the elevator car upon a plunger or piston which passes through a stuffing box for maintaining fluid tight connections, the piston being driven by a pump and controlled by a valve for starting, running and sometimes also for stopping the elevator. If the valve should remain closed and the pump continues to run, driving the car beyond the normal upper limit of travel of the elevator, the piston may run out of the stuffing box or if a mechanical stop is provided, the stuffing box may be greatly damaged if the elevator does not stop at normal upper limit of travel and continues to travel until a mechanical stop is engaged.

If a stop ring or other projection is provided in connection with the piston to limit the movement in one direction, stopping at the top is so abrupt that it severely jars the elevator and passengers, causing fright, and also the stuffing box may be severely damaged or disrupted so that from a replacement or repair standpoint, breaking the elevator pit and removing the connections may be necessary in repairing the damage done. This also can cause the elevator to travel downward in an uncontrolled manner until it reaches the extreme bottom limit of travel in the elevator pit.

The present invention overcomes these objections by providing for the automatic deceleration of the piston or plunger near the extreme upper end of its stroke so as to slow the elevator and car before stopping at the end of its travel. This is effected by deceleration openings varied in accordance with the speed of travel, the size, capacity and piston diameter of the particular installation having a return communication for the oil or other liquid used in the elevator so that if the pump should keep running when the car approaches the top limit of travel, the oil will automatically return to the oil supply tank, thereby preventing the piston from being forced through the stuffing box and out of the cylinder.

An important object of the invention is therefore in the provision of means for automatically insuring the slowing and stoppage of an elevator car and construction as it approaches the extreme upper end of its travel.

A further object of the invention is to provide a safety connection for progressively diverting an increasing amount of hydraulic liquid to a tank through the by-pass for preventing an abrupt stop of the hydraulic piston of an elevator and for thereby preventing the piston from leaving the cylinder.

A still further object of the invention is to provide the stuffing box of an elevator construction with a fluid return or by-pass which acts in conjunction with a plurality of openings spaced longitudinally in the piston for discharging pressure liquid from within the piston through the by-pass and thereby progressively reducing the speed of the piston as it approaches a particular position so that an actual and positive stopping point is reached smoothly and without shock.

Other objects of the invention will appear in the specification and will be apparent from the accompanying drawings in which,

FIG. 1 is an elevational view of a stuffing box for a

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hydraulic elevator in accordance with this invention with parts of the piston and cylinder omitted.

FIG. 2 is a sectional view of the construction shown in FIG. 1 at the upper end of the piston travel showing the deceleration holes in relative operating position.

FIG. 3 is a sectional view similar to FIG. 2 showing the piston in another position; and

FIG. 4 is a sectional view taken on the line 4-4 of FIG. 3.

In the operation of hydraulic elevators and other hydraulic equipment, it is customary to provide a valve for controlling the fluid pressure to the cylinder and thereby operating a piston which carries an elevator car or is connected to other operating mechanism. Usually the cylinder construction contains safety obstructions at the top and bottom for automatically stopping the piston, but even with this safeguard, the piston is sometimes stopped too abruptly near or at the end of its travel.

The present invention provides a simple and effective means for further controlling the deceleration of the piston and other operating means particularly at or near the end or limit of travel which is the most dangerous point.

Referring now more particularly to the drawings, a cylinder 10 for an ordinary type of hydraulic elevator is represented as fixed in a concrete cap 12 which may be the ground or any other suitable mounting, and the cylinder which is shown broken intermediate its ends may have considerable length depending upon the extent or travel of a plunger or piston 14 therein. At the bottom of the cylinder is a sealed end piece 16 and secured to the upper end of the cylinder by threading or otherwise is an attachment flange 18.

Secured to the flange 18 is a stuffing box 20 having a flange 22 at its lower end connected to the flange 18 by bolts 24. At the inside of the stuffing box adjacent the end of the cylinder, it is preferably formed with a portion 26 having an internal diameter substantially the same as the internal diameter of the cylinder 10 and with an inner rib 28 extending completely around the inside of the stuffing box to separate the portion 26 from a gland portion 30 in which packing 32 is seated tightly around the piston 14 with a gland packing device 34 at the upper end of the stuffing box having an inner flange pressed against the packing by fastening bolts 36 to maintain a fluid-tight connection around the piston, in a well known manner.

Extending from the portion 26 of larger diameter is a fluid pressure supply pipe 38 connected to a pump 40 by means of which pressure is applied to the cylinder to act upon the plunger or piston 14 in raising an elevator car positioned at the top thereof, or operating other mechanism secured to the top. In the upper gland portion of the stuffing box is a continuous groove or recess 42 larger in diameter than the gland portion 30 and usually necessitating a portion of enlarged diameter at the outside of the stuffing box to accommodate it. Communicating with this recess is a relief or discharge pipe 44 which is represented as leading to a liquid supply tank 46 to which an inlet from the pump 40 is also connected.

In the piston 14 near its lower end is a transverse wall or partition 48 and the piston is open at its lower end so that the piston forms an abutment against which fluid pressure in the cylinder operates in a well known manner. Adjacent the partition and extending through the outer wall of the piston are series of openings 50, 52 and 54 which may be graduated in diameter smaller near the partition and progressively larger along the partition therefrom. These openings are designed and intended to register in succession with the recess 42 in the stuffing box as the piston is raised or moved upwardly in the

cylinder and toward the upper limit of its travel as determined by the length of the piston.

In order to keep the space occupied by the gland packing 34 from projecting into the recess 42 at either the upper or lower edge thereof, a spacer is provided which comprises opposite rings 56 and 58 located at the upper and lower edges of the recess 42 respectively, the rings being held and spaced apart substantially the width of the groove or recess by spacing bars 60. The width of the recess and likewise the width of the spacer may be substantially of a length along the piston to span the location of the openings 50, 52 and 54 thereon so that as the piston is moved in the cylinder and in the stuffing box, the openings will reach and register with the recess in succession and together their capacity will be substantially the same as that of the inlet pipe 38.

With this construction, the operation of the by-pass will constitute a gradual reduction of the amount of fluid applied to the plunger or piston 14 when it reaches any particular point where the openings are located and thus a deceleration of the movement of the piston will be caused by an increase of fluid flow through discharge pipe 44 and if openings 50, 52, and 54 are located near the end of travel of the piston, it will cause a gradual deceleration and an actual stoppage of the movement of the piston when the volume of the discharge equals that of the inlet. Thus the continued action of the pump 40 will produce no further movement of the piston in its cylinder, the piston and the elevator car carried thereby will go gradually to rest at the upper end of the piston travel and the connections above described will act as a continuous by-pass even though the operation of the pump is continued.

The location and spacing apart of the holes along the piston may be determined and varied with the speed capacity and size of the elevator car to slow it more or less before stopping. Freight elevators, for example, are usually operated at a much lower speed than passenger elevators, but the present invention may be applied to any type of hydraulic elevators or hydraulic mechanisms.

While we have described a preferred construction in some detail, it should be regarded by way of an illustration and example rather than a restriction or limitation thereof, as many changes in the construction, combination and arrangement of the parts may be made without departing from the spirit and scope of the invention.

We claim:

1. In a hydraulic elevator, a cylinder closed near one end and having a stuffing box near the other end, a piston having a hollow wall movable loosely in the cylinder and tightly through the stuffing box, means to apply fluid under pressure to the stuffing box end to move the piston in the cylinder, means in the piston and stuffing box to progressively relieve and by-pass said fluid under pressure for decelerating the piston at a predetermined rate and location independent of the applied pressure, the piston having openings through its wall and the stuffing box having a recess extending at right angles around it to register at the outside of the piston with said openings when the piston is correspondingly moved and a discharge connection from said recess to the outside of the stuffing box.

2. In an elevator according to claim 1, the pressure fluid applying means comprising a pump and a fluid supply tank connected to the pump inlet and to the stuffing box, and said relief means comprising a fluid connection through the piston and stuffing box for discharging fluid to said supply tank.

3. In a hydraulic elevator in accordance with claim 1, the piston having a partition near its lower end and series of graduated openings extending longitudinally of the piston adjacent the partition to gradually decelerate and stop the elevator by discharging liquid into the recess near the upper end of its travel.

4. A hydraulic power apparatus, a cylinder closed at one end and having a stuffing box at the other end, a piston movable loosely in the cylinder and partially but tightly through the stuffing box, means to apply a pressure fluid through the said other end of the cylinder to move the piston, cooperating means in the piston and stuffing box to by-pass such fluid from the piston when it reaches a certain position to decelerate it at a predetermined rate and stop it at a predetermined position, the piston having openings in the wall thereof, and the stuffing box having a recess closed by the wall of the piston with an outlet to register with the openings and by-pass fluid from within the cylinder through the piston.

5. Hydraulic power apparatus according to claim 4, in which the stuffing box has its packing therein on both sides of the recess and outlet therefor to receive and confine deceleration liquid through the openings from the inside of the piston and direct it to the outlet when it reaches a particular point.

6. Hydraulic power apparatus according to claim 5, in which the packing at both sides of the recess surrounding the piston is held apart by a spacer extending entirely around the piston to maintain a free and open space around the piston for the discharge of the decelerating liquid.

7. In a hydraulic elevator, a cylinder open at the top and having a closed bottom located below the surface of the ground where the open top is located so that the bottom is relatively inaccessible, in combination with a stuffing box fitting attached at the upper open end of the cylinder, a piston of a size to move freely in the cylinder but extending in a fluid tight connection through the stuffing box, the piston having a hollow portion at its lower end with a partition adjacent the lower end, a plurality of series of openings in the piston wall below the said partition graduated in size in accordance with the speed and desired movement of the piston, an inlet pipe and pressure connection at the lower end of the fitting below the stuffing box portion thereof communicating with the cylinder surrounding the piston, a packing gland in the stuffing box fitting above the pipe opening with means forming a discharge opening surrounding the piston and fluid discharge pipe in the stuffing box leading therefrom to decelerate the piston through said series of openings near the upper end of its stroke and for equalizing the inlet and discharge pressure for bringing the piston to a stop.

8. In a hydraulic elevator in accordance with claim 7, the stuffing box fitting being in the form of an attachment which may be applied to the upper end of an elevator cylinder in which the lower end of the cylinder is inaccessible under ground and at a distance from the upper exposed edge of the cylinder, the connection of the fitting being such that it is readily applicable at the top of the cylinder after the cylinder has been installed in place and the fluid inlet and fluid discharge pipe connections being in the stuffing box fitting and accessible for attachment at the top of an existing hydraulic elevator cylinder.

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