

Hydraulic Buffer for Elevators

This invention concerns hydraulic buffers,
5 in particular hydraulic buffers for elevators.

Hydraulic buffers are used in elevators to decelerate the elevator car or the counterweight under certain conditions. The typical hydraulic buffer has a heavy fluid container and a piston
10 that extends into this container to force fluid through ports. This flow produces progressive deceleration, and the deceleration pattern is determined by the location of the ports along the direction in which the piston moves.

15 All current hydraulic elevator buffers of this type use piston seals to close off the space around the piston rod and the container to prevent entry of contaminating material, such as dust (which can abrade the piston and seal surfaces during
20 buffer operations, e.g., during performance service checks) and to prevent the air/fluid mixture that results from a buffer operation from escaping. Moreover, the external seals deteriorate over time; sometimes becoming brittle. Buffer service life
25 is highly dependent on the effectiveness of those piston seals in blocking contaminants and preventing fluid from escaping.

Mainly because of the seals, currently available buffers are comparatively expensive to construct
30 and expensive and difficult to maintain, and require routine maintenance to check the seals.

A principal object of the invention is to provide an inexpensive hydraulic buffer than requires no seal inspection or service.

35 According to a first aspect of the present invention there is provided a hydraulic buffer including

14

- 2 -

a fluid container;

a piston which extends through the top of the container;

a piston cylinder within the container, said
5 piston extending into said cylinder, the top of said cylinder being in close proximity to the top of the container to provide a small annular nozzle around the piston; and

there being a space between the piston and
10 the container about said nozzle for allowing air to flow from said container under pressure therein.

According to another aspect of the present invention there is provided a hydraulic buffer including:

15 a fluid container;

a piston cylinder within said container, said cylinder defining two fluid chambers within the container, one within the cylinder, the second around the cylinder, said cylinder also containing
20 one or more fluid ports between the two chambers;

a piston extending through a sleeve in the top of the container into said piston cylinder, said sleeve being above the top of said piston cylinder, there being space between the piston
25 and the sleeve for flow of air under pressure from within the container;

nozzle means for allowing fluid/air mixture to pass from said second chamber to the top of said piston cylinder, whereby fluid is separated
30 out from said mixture through said nozzle means and directed to the piston, air being forced out of the container through the space between piston and sleeve.

Thus in operation as the fluid/air mixture
35 passes through the nozzle means the fluid drops out and is directed (e.g., funneled) to the piston, lubricating the piston as it travels down. The

air is forced out of the container through the sleeve, removing contaminants, such as dust, from the space between the piston and the sleeve. As a result of this configuration, no seals are needed
5 for the purpose of cleaning the piston or preventing fluid from escaping from the container.

The present invention thus provides a buffer with a number of features. The buffer has no seals of any kind; all parts can be metallic. It requires
10 no maintenance. Buffer test operation removes contaminants from the space around the piston.

In a preferred construction the container is provided with an angled filler hole such that lower surfaces of the innermost and outermost portions
15 of the hole respectively define the minimum and maximum fluid levels within the container.

Thus the fluid level can be checked easily, without a dipstick, simply by opening the filler hole and looking in. If the fluid is not visible, it is below the minimum; if it is visible, it is at least at the minimum and no greater than the maximum (i.e., in a safe range).

5 A feature of the invention is that the buffer may be easily and economically constructed as a single assembly, with all parts permanently attached (i.e., welded together) because no fasteners of
10 any kind need to be used.

The invention thus enables an exceptionally simple, inexpensive and virtually maintenance-free buffer to be provided.

15 A preferred embodiment of the invention will now be described by way of example only with reference to the accompanying drawings wherein

Fig.1 is an elevation view of an hydraulic buffer according to the present invention, showing
20 the buffer partially cut away along section line 1-1 in Fig.2, exposing its internal components and the fluid;

Fig.2 is a top plan view of Fig.1; and

Fig.3 is a magnified view of a portion of
25 Fig.1.

Referring to Fig.1, a buffer 10 according to the present invention includes a piston 12 (i.e., a plunger or rod) which extends through a sleeve 16c in the lid 16a of a container 16 into the container
30 16. Within this container 16 is an internal cylinder 18, which receives the piston and guides it as it moves in and out of the container 16. The piston has a slightly elevated chamfered portion 12a which acts as a stop when it engages the lowermost portion
35 of the sleeve. The sleeve 16c extends comparatively tightly around the piston to provide a good metal-to-metal seal, yet provides a space 16b therebetween for the passage of air under pressure from within

- 4 -

the container as is explained hereafter. The piston 12 also slides tightly within the internal cylinder 18. The cylinder 18 defines a first chamber 19a, a second chamber 19b outside it, and at the top a collection area 19c. Both chambers are partially filled with fluid (oil). There is a small annular passage 19d around the piston at the uppermost part of the cylinder 18 which separates chambers 19b and 19c, and it acts as a nozzle to separate oil and air (this is explained below). The ratio between the height of the passage (from the top outer corner of cylinder 18 and the wall of lid 16a) and its width (along the circumference of the cylinder 18) is 0.013. The ratio of the flow area upstream (below) the passage (the area of chamber 19b) to the area at the passage is 120, and the ratio at the passage to the area downstream (perpendicular to the wall of lid 16a near the piston) is 1/13. The passage thus operates as a nozzle. In addition, the space 16b between the piston and the sleeve 16c constitutes a second nozzle downstream, through which air may escape from the container under pressure therein, and that air must flow from the first nozzle and, as explained below, cleans the space in the second nozzle.

The piston 12 contains ring-like cuts 12b along its lower end, and they provide a hydraulic dynamic seal without the use of rings, because hydraulic fluid in these seals is evenly distributed, under even pressure, around the piston, which helps align the piston and lubricate it as it moves in the internal cylinder 18. (As an alternative, a single metallic piston ring may be used in the groove furthest from the piston face to limit the flow past the piston.) Following conventional technology, the cylinder contains ports 18a along that part of its vertical length that is within the area

immersed in fluid 20. As the piston strokes down, fluid is displaced through these ports from chamber 19a to chamber 19b. The number of remaining ports decreases (this is not shown) during the downstroke, and thus the flow area decreases, which increases the resistance to fluid flow as the piston moves down the cylinder. At the same time, the piston speed decreases as the elevator is decelerated and the rate of flow of fluid through the port area is correspondingly reduced. Thus, the buffer stopping force remains substantially constant with piston displacement, thus imparting a substantially uniform deceleration to the elevator. A spring 22 surrounds the piston 12 and is located at the uppermost portion of the piston between the container 16 and a striker plate 24. The spring biases the piston up, holding it in a position at which the chamfer portion 12a rests against the lowestmost portion of sleeve 16c. On top of the plate is a hard rubber block (resembling a hockey puck) 25, which is contacted by the object, i.e., the elevator car or counterweight, to force the piston down into the cylinder (into the fluid).

A filler hole 26 is located at a special vertical height 28 on the container. It may have a screw-in cap and is oriented at a selected angle 30 to the horizontal 32. The angle 30, which in the preferred embodiment is about 20° , is such that fluid can be poured into the container until it reaches a level which corresponds to the level of the lowest surface 26a on the outermost portion of the filler hole 26. (If the angle is too large, air will be trapped inside the container, preventing more fluid from entering.) The distance between the upper level 26a and the lower level defined by the lower surface 26b of the innermost portion of the filler hole, is the distance between the maximum and minimum fluid levels; simply by looking

in the filler hole it can be checked that the fluid is between these levels.

During operation of the buffer (as it is pushed down under load) fluid is pushed up in chamber 19b, and this occurs, as mentioned, through the ports 18a in the internal cylinder 18. It should not go unnoticed that this internal cylinder does not extend all the way up to the lid 16a; as mentioned previously there is that small space 19d between the lid 16a and the upper portion of the cylinder 18. This configuration creates a nozzle. The upper end of the cylinder 18 is chamfered (see Fig.3) around the piston to provide a fluid funnel around the piston. As the fluid is pushed up (see arrow 40), a mixture of fluid and air (the bubbles that are shown) is produced in the upper area by the fluid agitation as the fluid rises. This mixture is forced through the space 19d, and it acts as a nozzle; that is, agitation and pressure change across the space cause the air and fluid (oil) to separate, and the fluid drops down (condenses) in chamber 19c (it acts as a funnel) around the piston, lubricating the piston as it moves down. The air is forced up under the pressure in the cylinder and out through the space 16b between the piston and the sleeve, removing dirt and dust from that space (it should be as clean as possible). In contrast, other buffers have seals that are located in the space around the piston for these cleaning and sealing purposes. But, the seals deteriorate (as a result of the dirt and dust which they wipe off and age), and, as a result, normally have to be replaced from time to time. But, in this buffer such seals are not present, and hence, such routine maintenance is unnecessary.

The foregoing demonstrates that by comparison to current buffers, a buffer embodying the present invention is very simple and reliable, inexpensive

20

- 7 -

and easy to maintain.

The foregoing description of a buffer embodying the present invention will suggest, to one skilled in the art, various modifications and alterations, 5 without departing from the scope of the invention as defined in the claims.



21

- 8 -

CLAIMS

1. A hydraulic buffer including
a fluid container;
a piston which extends through the top of
the container;

a piston cylinder within the container, said piston extending into said cylinder, the top of said cylinder being in close proximity to the top of the container to provide a small annular nozzle around the piston; and

there being a space between the piston and the container about said nozzle for allowing air to flow from said container under pressure therein.

2. A hydraulic buffer including:

a fluid container;

a piston cylinder within said container, said cylinder defining two fluid chambers within the container, one within the cylinder, the second around the cylinder, said cylinder also containing one or more fluid ports between the two chambers;

a piston extending through a sleeve in the top of the container into said piston cylinder, said sleeve being above the top of said piston cylinder, there being space between the piston and the sleeve for flow of air under pressure from within the container;

nozzle means for allowing fluid/air mixture to pass from said second chamber to the top of said piston cylinder, whereby fluid is separated out from said mixture through said nozzle means and directed to the piston, air being forced out of the container through the space between piston and sleeve.

3. A hydraulic buffer as claimed in claim 2 wherein the uppermost portion of the cylinder defines a small fluid collection reservoir below the sleeve



- 9 -

and an annular passage around the cylinder acts as said nozzle means.

4. A hydraulic buffer substantially as herein described with reference to the accompanying drawings.
