C. E. EMERY.

HYDRAULIC CUSHION VALVE.

No. 171,218. Patented Dec. 21, 1875.

Fig 2.

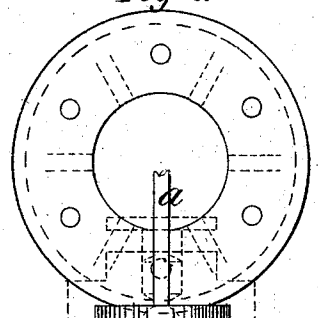


Fig. 1.

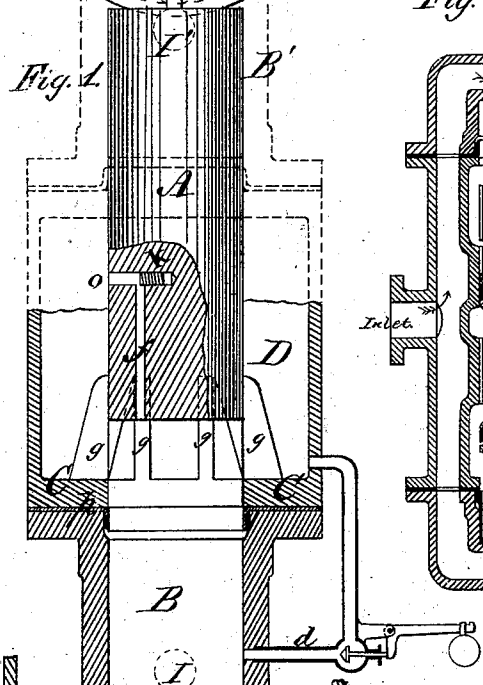


Fig. 7.

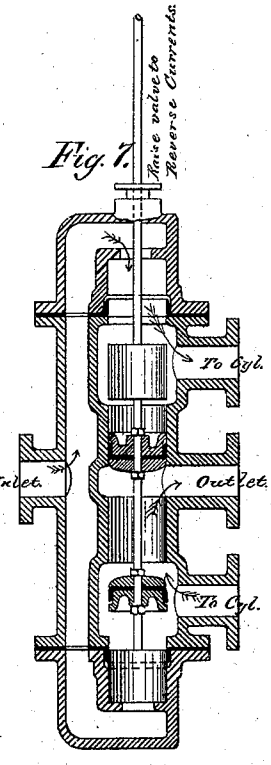


Fig. 4.

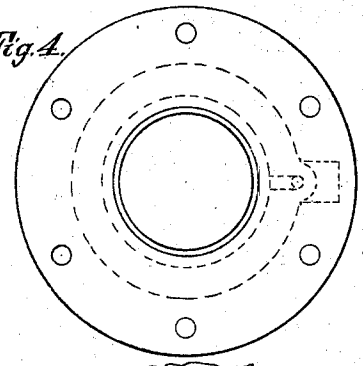


Fig. 3.

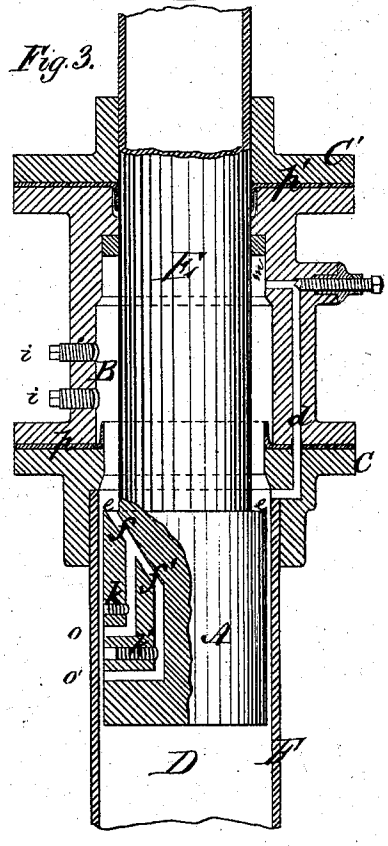


Fig. 5.

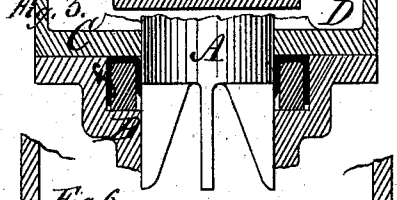
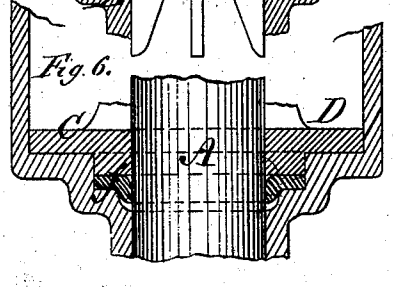


Fig. 6.



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UNITED STATES PATENT OFFICE.

CHARLES E. EMERY, OF BROOKLYN, NEW YORK.

IMPROVEMENT IN HYDRAULIC CUSHION-VALVES.

Specification forming part of Letters Patent No. **171,218**, dated December 21, 1875; application filed September 9, 1875.

To all whom it may concern:

Be it known that I, CHARLES E. EMERY, of the city of Brooklyn, in the State of New York, (office New York city,) have invented a new and Improved Hydraulic Cushion-Valve; and I hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, making part of this specification.

The object of the invention is to construct a simple and efficient hydraulic dash-pot or cushioning apparatus, adapted particularly for use in telescopic hydraulic elevators, to prevent severe jars when the collars on the cylinders or tubes meet, as the several sections are extended. The same apparatus, in simpler form, is also adapted, either as a hydraulic dash-pot or valve for general use.

The object is accomplished, chiefly, by the combination, with a plunger and pressure chamber, of a lip-packing at the entrance of the chamber, and facing toward the same, the result being that, when the plunger enters the packing, the pressure of the fluid in the chamber will set out the lip tightly against the plunger and make a simple and tight joint, and the plunger may be entirely drawn out of the packing and replaced without difficulty.

In the particular form used in telescopic hydraulic elevators, the plunger above named is operated by an attached cylinder passing through the pressure-chamber, making the latter annular without in any way changing the combination of the other parts, or their mode of operation.

Another distinguishing feature is a channel or channels in the plunger above mentioned, arranged to permit the gradual escape of fluid from the pressure-chamber to an outer chamber, the ends of which channels at the surface of the plunger finally pass the packing, when, further escape of fluid being prevented, the plunger is brought to rest.

In the drawings, Figure 1 represents a vertical central section of a cushion-valve in one of its simpler forms, showing also, in dotted lines, a convenient duplication, applicable when used as a valve only. Fig. 2 is a top view of the construction, shown in full lines in Fig. 1. Fig. 3 represents a vertical central section of the cushion-valve, adapted with an annular pressure-chamber for use on telescopic hydraulic elevators, in which form the device embodies all the distinguishing features of the invention. Fig. 4 is a plan view of the construction shown in Fig. 3. Figs. 5 and 6 are sectional representations of lip-packings of different forms, shown in connection with parts for adapting them for use in the cushion-valves. Fig. 7 represents a double-acting valve embodying the principal distinguishing feature of the invention.

The same letters in all the figures refer to corresponding parts.

We will first describe the apparatus in its simpler form, shown in Fig. 1, in which A represents a plunger, which is to be attached by any suitable connection, *a*, to an object, the descent of which it is desired to regulate—a steam-engine poppet-valve, for instance. B is a pressure-chamber, into which the plunger A descends. Near the upper part of chamber B is arranged a lip-packing, *p*, with the lip turned toward the chamber. The plunger A is guided to enter the packing *p*, in any suitable manner—for instance, by guides *g g* attached to a ring, C, bored to fit the plunger. A suitable chamber, D, surmounts the cushion-chamber B, which latter, when plunger is withdrawn, is filled with fluid above packing *p*, and preferably above top of ring C. If then the plunger A be pushed or dropped downward, the fluid will first be displaced between the outer surface of A and the ring C, but when the plunger enters the lip-packing *p* the lip will be closed tightly against the plunger by the pressure produced, and the plunger brought suddenly to rest, unless some escape of fluid is permitted. An escape is provided for through a suitable opening—for instance, a branch or pass-over pipe, *d*, which permits the plunger to descend with a velocity regulated by a valve therein, and the plunger may run over and close, or nearly close, the inlet to such pass-over pipe *d*, and thereby be brought to rest.

In the complete apparatus shown in Fig. 3 a cylinder, E, which may be solid or hollow to form a pipe, is attached to the plunger A, and extends through the cushion-chamber B,

thereby reducing the effective area of the plunger for cushioning to that of the annular space *e*, due to the difference in size and area of the plunger A and the connecting-cylinder E.

It will be observed that in this arrangement the pressure-chamber B is inverted, as compared with Fig. 1, the plunger moving toward the top of said chamber B. A packing of some kind—a lip-packing, *p'*, for instance—is fixed near the upper part of pressure-chamber to maintain a tight joint around the attached cylinder E. The annular cushion-chamber B and plunger A in this arrangement will operate in precisely the same manner as a circular one of same area would, on plan shown in Fig. 1, and the regulation of velocity may be made by a valve in a pass-over passage or pipe, *d*, the same as in said Fig. 1. The bottom of cushion-chamber (which as aforesaid, is at the top in Fig. 3) may also be made to fit the plunger A, whereby opening to passage *d* may be closed by the passage of the plunger over it, the same as in Fig. 1. Any form of valve may be used in pipe *d*—for instance, a check-valve held down by a weight or spring, as in Fig. 1, or an ordinary screw-valve, as in Fig. 3.

A different, and in some cases a preferable, method of regulating velocity of plunger after it enters the packing *p*, is to make a channel or passage, *f*, in the plunger itself, forming a communication from the pressure-chamber E to the surface of the plunger at O. (See Figs. 1 and 3.) In operation the fluid would flow through channel *f* until the discharge-outlet O ran within the packing *p*, when the plunger would be brought to rest. Two or more channels, *f*, with a number of outlets at different distances from end of plunger may be used to permit the gradual shutting off of the discharge, and bring the plunger to rest slowly. (See *f'* and *o'*, Fig. 3.) Valves *k k'* may be made to regulate the discharge through the channels, which valves, in constructions like Fig. 3, may be operated by bringing plunger into proper position through openings *i i* made through the wall of chamber E and closed ordinarily by plugs.

It is evident that the passages *f* may be simple grooves of different lengths in the surface of the plunger, which would run by the packing into pressure-chamber at different periods of the movement, and successively close the several openings, and thus bring the plunger gradually to rest.

An elastic buffer, *m*, may, if desired, be placed at the extreme end of pressure-chamber to deaden any shock cased by the imperfect action of the cushioning apparatus.

When used on a telescopic hydraulic elevator the cylinder E, Fig. 3, would represent one of the inner cylinders or tubes, and to the walls of the pressure-chamber B, by means of the bonnet C, for instance, one of the larger tubes F would be attached, in which case the interior of F would form the equivalent of chamber D in Fig. 1, and form a pressure-chamber by containing, relatively, a higher pressure than would exist in said chamber D.

Any well-known form of lip-packing may be used. As shown in Figs. 1 and 3, the lip is formed like a flange on a piece of leather, used also to form a joint. The well-known double lip-packing, shown in Fig. 5, may, however, be employed, particularly for high pressures, or a simple rubber packing, shaped as in Fig. 6, which has sometimes been used in hydraulic elevators.

It will be observed that the plunger acts as a valve to prevent the flow of water from pressure-chamber B, and would so act whether the pressure in said chamber B were caused by the movement of the plunger, or by external sources—for instance, if, with the plunger A in said chamber B, fluid under pressure were admitted to such chamber through opening *i*, Fig. 3, or I, dotted in Fig. 1, the regulating-passages *d* and *f* being omitted, the movement of plunger A would regulate the flow of fluid from chambers B to D, and the arrangement form a hydraulic valve of a novel construction, operated by pulling the plunger out of the packing and forcing same back into it. A single plunger-valve, as shown in Fig. 1, would be well adapted as a safety-valve. For regulating purposes the pressure on plunger A should be balanced by corresponding pressure in an opposite direction in the other end of the plunger, or one of similar size, connected thereto. Such an arrangement is shown in dotted lines in Fig. 1, in which the corresponding chambers B and B' are to be connected. In such case the valve may be single acting, only one plunger pulling out of the packing, or double acting, both plungers pulling out. In the latter case the delivery may be into the same chamber D, or said chamber may be duplicated or divided by a partition, with packing thereon, into two or more parts, so that the delivery from each plunger will be into separate channels. Another modification is shown in Fig. 7, in which plungers, sliding through packings, as in Fig. 1, are combined with pistons carrying packings, whereby a valve is produced, which at each end admits water under working-pressure to a passage, or permits its return to an exhaust-channel, as in other hydraulic valves.

When an annular pressure or cushion-chamber is adaapted, as described, to a hydraulic telescopic elevator, it is desirable that the moving tube be brought to rest gradually as motion is transferred to the next tube. The cushion-chamber, whether constructed like pressure-chamber E or not, should therefore be of such length that it will require at least one-fourth second for the plunger to move through the length of the chamber, for if the moving tube be arrested at once a jar will be produced whether the blow be absorbed by rubber, water, or anything else.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination of a lip-packing, turned toward a pressure-chamber, with a plunger constructed to reciprocate in and out of the packing, suitable guides being provided to direct the plunger within the packing, when said plunger is being moved toward the packing, substantially as and for the purposes specified.

2. The combination of a pressure-chamber, provided with packing at both ends thereof, with a plunger and attached cylinder, when the plunger is arranged to operate in and out of the chamber, and one of the packings, substantially as and for the purposes specified.

3. The combination, with a pressure-chamber, and plunger operating in and out of the same, of a channel or channels in the plunger, arranged to run inside the pressure-chamber, thereby regulating the escape of fluid, and bringing the plunger relatively to rest, substantially as and for the purposes specified.

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E. HUGENTOBLER.