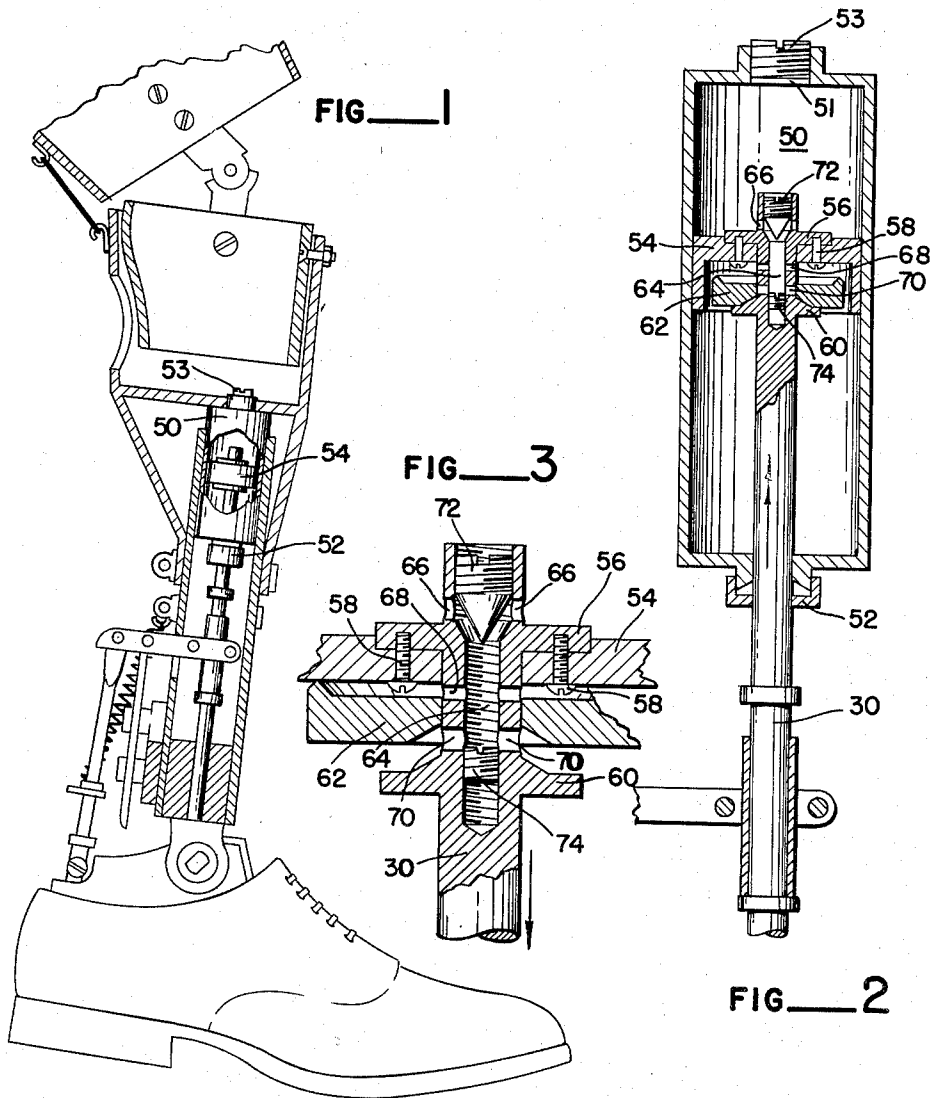


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HYDRAULIC BUFFER ASSEMBLY

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HYDRAULIC BUFFER ASSEMBLY

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My invention relates to a hydraulic buffer assembly and, more particularly, to an adjustable hydraulic buffer assembly for the accommodation of external forces in two directions.

The hydraulic buffer has proved to be a useful control device in many types of machines. Presently known hydraulic buffers are designed for use in mechanisms in which it is desirable to resist the movement of a member in two directions reciprocally. No suitable means is provided for varying the retarding action in either direction or for synchronizing the retarding action in one direction in relation to the retarding action in the other direction to meet particular buffer requirements.

My hydraulic buffer assembly will be described in connection with its use in an artificial leg and depicted in the attached drawings as part of an artificial leg assembly. This description and depiction is employed only to illustrate a specific embodiment of my invention and my device is useful in many other types of apparatus.

It is an object of my invention to provide a hydraulic buffer assembly for the accommodation of external forces in two directions reciprocally. It is further important to provide for adjusting the retarding action in either direction and for adjusting the resistance to movement in one direction in relation to the resistance in the other direction. That the construction should be inexpensive; have a high rate of efficiency; require little maintenance; and be easily adjustable are among other objects of this invention.

These objectives are met in the present invention by providing a cylinder with a piston and piston rod disposed for reciprocal movement therein. The piston rod has an axial passageway extending longitudinally, between opposite sides of the piston, through which fluid in the cylinder travels between the sides of the piston. A fluid port in the wall of said passageway is disposed at the free end of said piston rod on a first side of the piston and paired fluid ports are disposed on the other or second side of the piston. The paired fluid ports are spaced apart longitudinally of said rod. A valve plate is slidably mounted on said rod to move in the area of said paired ports. The valve plate is of a thickness to cover only one set of fluid ports at a time and means is provided to limit the travel of said valve plate so that the plate will cover a set of fluid ports at one end of its path and cover the other set of fluid ports at the other end of its path. The positioning of the valve plate is determined by the action of the liquid in the cylinder against

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the valve plate as the piston rod moves in one direction or the other.

The degree of resistance of the buffer assembly is determined by the sizes of the ports; and the relative retarding action, in one direction as compared with the retarding action in the other direction, is determined by the relative sizes of the openings. The area of the fluid ports free to the passage of fluid from one side of the piston to the other side is rendered adjustable by means of threaded check members, positioned in the axial passageway, which may be moved longitudinally of the piston rod in order to partially cover the ports. Two such members are positioned in the passageway at either end outside of the portion through which the fluid passes, one movable to obstruct the set of fluid ports in the free end of the piston rod on the first side of the piston and one movable to obstruct the ports farthest from the piston on the second side of the piston.

The means by which the objects are carried out will best be understood from the following description of a specific embodiment of my invention when read with reference to the accompanying drawings, in which:

Figure 1 is an elevational view, partly in section, showing my hydraulic buffer assembly incorporated in an artificial leg;

Figure 2 is an enlarged longitudinally sectional view of the hydraulic buffer assembly depicted in Figure 1, showing the piston moving upwards; and

Figure 3 is a fragmentary view, partly in section, showing in detail, portions of the piston and piston rod while moving downwards.

Referring to Figure 1, there is shown the incorporation of an hydraulic buffer assembly, constructed according to the teachings of my invention, in an artificial leg. This artificial body member is more completely described in my co-pending application, Serial No. 782,276, now U. S. Patent Number 2,490,796.

Referring specifically to the hydraulic buffer assembly, the hollow cylinder 50 has an access opening 51 in one end, closed by screw plug 53, and a fluid tight passage at the other end, in which the piston rod 30 is slidably positioned, there being a compression gland 52 that permits movement of the piston rod under sealed conditions. A piston 54 is secured to the inner side of an annular flange 56, near the free end of the piston rod, by a plurality of tap screws 58. The piston 54 is hollow and open on the side 55 away from the free end of the piston rod 30.

The piston rod carries a collar 60 adjacent the open end of the piston 54, and an annular valve plate 62 is slidably mounted on the piston rod to move between the closed end of the piston and the collar 60.

Rod 30 has an axial passage 64 extending longitudinally therein between opposite sides of said piston. There are a set of fluid ports 66 in the free end of said rod communicating with said passage, and a paired set of fluid ports 68, 70, on the other side of said piston. The valve plate 62 bears against the collar 60 and covers the lower set of fluid ports 70 when the piston rod 30 moves upward, as shown in Figure 2; and bears against the piston 54 and covers the upper set 68 of the paired fluid ports when the piston rod 30 moves downward, as shown in Figure 3. The valve plate changes positions in the upward and downward movements due to the resistance of the fluid in the cylinder. The position of the piston and the fluid ports in relation to the piston rod could be reversed and the assembly function in a similar manner as will be readily apparent to those skilled in this art.

The piston would move at an equal speed upward and downward with the same amount of force applied to the piston rod if the fluid ports were of the same size and unobstructed.

The fluid ports 66 and 70 are larger than fluid ports 68, however, and there are corresponding threaded check members 72, 74, for the fluid ports 66 and 70, positioned in the passageway 64. The relationship between the upward and downward speed of the piston, with the same amount of force applied, may be varied by longitudinal positioning of the check members 72, 74.

If ports 66 and 70 are unobstructed, the speed upward is slower than the speed downward, with an equal force applied. If ports 66 are unobstructed and ports 70 are obstructed so that their area is less than the area of ports 68, the speed upward is faster than the speed downward, with an equal force applied. If it is desired to slow the movement upward, check member 72 is moved to partially obstruct ports 66 so that the unobstructed area of ports 66 is less than the area of ports 68. Under those conditions the speed downward could be equal to or less than the speed upward, controlled by the positioning of check member 74, but the speed downward could not be greater than the speed upward, because the unobstructed area of the fluid port 64 is a limiting factor.

It can be seen that the hydraulic buffer assembly is susceptible of varied adjustment according to the needs of the mechanism in which it is incorporated. In conjunction with an artificial leg, the buffer mechanism may be adjusted in a manner pleasing to the wearer so that the movement of the leg will be comfortable and life-like.

Adjustment of the buffer mechanism is accomplished by removing the screw plug 53, with or without removing the liquid in the cylinder, and moving the check members 72, 74 by means of a screw driver, the members having slotted heads. The check member 72 is removed to gain access to the check member 74.

The buffer mechanism is of simple construction, yet it is susceptible to accurate and varied adjustment in a simple manner. The assembly is quite efficient and requires little maintenance.

While I have shown and described a particular embodiment of my invention, it will occur to those skilled in the art that various changes and modifications may be made without departure from the invention, and I, therefore, aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

I claim:

1. A hydraulic buffer assembly for the accommodation of external forces in two directions, comprising: a cylinder having in one end an opening; a piston rod positioned slidably in said opening in a fluid tight manner; a piston on said piston rod laterally spanning said cylinder; said rod having an axial passage extending longitudinally therein between opposite sides of said piston, said rod having a fluid port through the wall of said passage on a first side of said piston, said rod having paired fluid ports through the wall of said passage on a second side of said piston, said paired fluid ports being spaced apart from each other longitudinally along said rod; a valve plate of a thickness to cover each of said paired ports and slidably mounted on said piston rod on the second side of the piston; means to limit sliding movement of the valve plate so that the same covers one or the other of said paired ports according to the direction of travel of said piston in said cylinder; a check member positioned in said passageway movable longitudinally of said passageway for variably obstructing the fluid port on the first side of the piston; and a second check member positioned in said passageway movable longitudinally of said passageway for variably obstructing the fluid port of said pair most remote from the piston.

2. A hydraulic buffer assembly for the accommodation of external forces in two directions, comprising: a cylinder having in one end an opening; a piston rod positioned slidably in said opening in a fluid tight manner; a piston on said piston rod laterally spanning said cylinder; said rod having an axial passage extending longitudinally therein between opposite sides of said piston, said rod having a fluid port through the wall of said passage on a first side of said piston, said rod having paired fluid ports through the wall of said passage on a second side of said piston, said paired fluid ports being spaced apart from each other longitudinally along said rod; a valve plate slidably mounted on said piston rod on said second side of said piston; means to limit sliding movement of said valve plate so that the same covers one or the other of said paired ports according to the direction of travel of said piston in said cylinder; means for varying the size of said fluid port on said first side of the piston to regulate the flow therethrough; and means for varying the size of the paired fluid port most remote from said piston on said second side thereof.

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