May 12, 1953 M. P. TAYLOR 2,638,339

FLUID BUFFING DEVICE

Filed Feb. 9, 1951 2 Sheets-Sheet 1

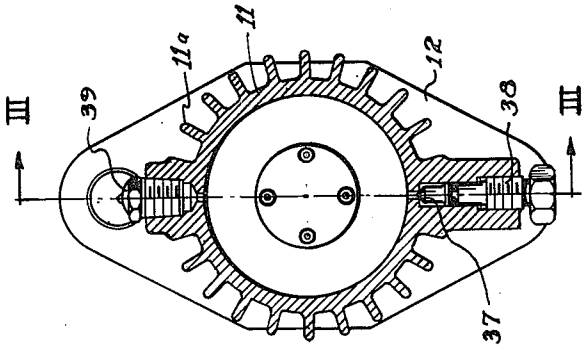


Fig. 2

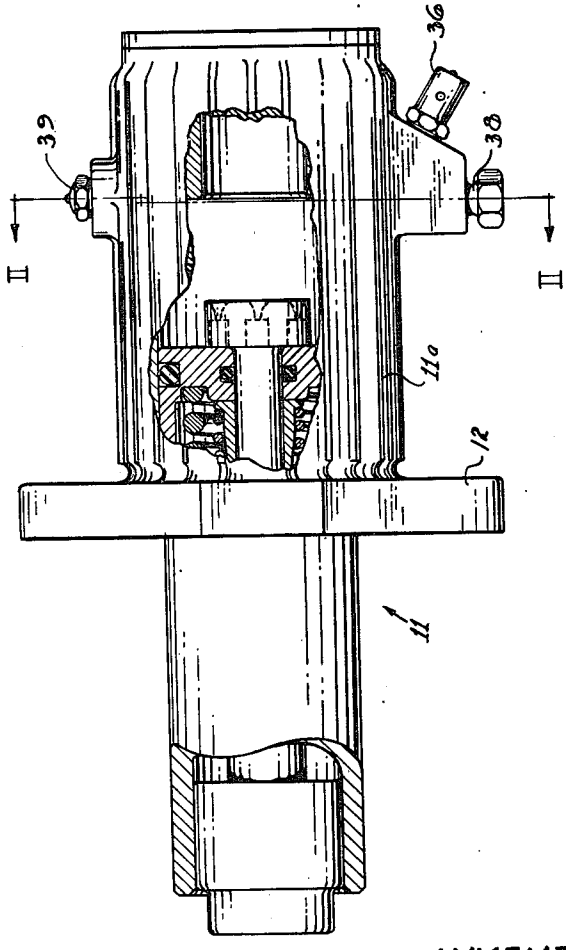


Fig. 1

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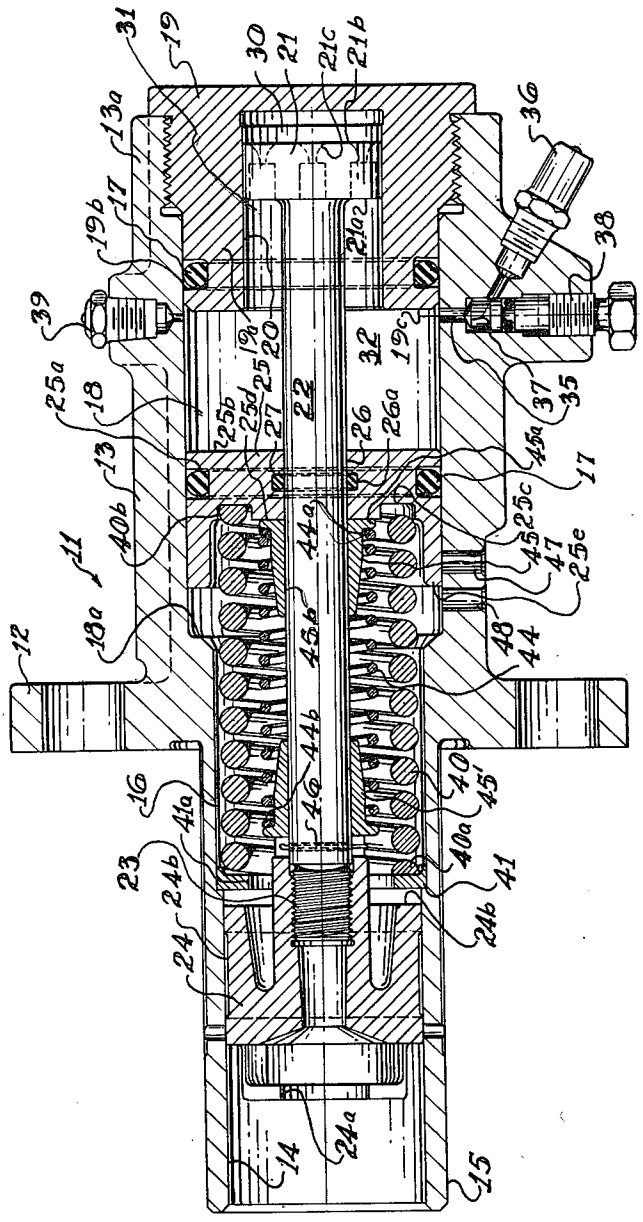


Fig. 3

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FLUID BUFFING DEVICE

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1 Claim. (Cl. 267—1)

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This invention relates to improvements in fluid buffing devices, and more particularly to hydraulic buffing devices for gun mounts wherein the fluid in the buffer reservoir is subjected to a substantially uniform pressure during all phases of the operating cycle.

An important object of the invention is to provide a hydraulic buffer which develops a substantially uniform buffing action under varying conditions of temperature and which includes positive means for retracting the buffer to its initial position at the end of each energy-absorbing stroke.

Another object of the invention is to provide a hydraulic buffer having a self-contained fluid reservoir which is subjected to a substantially uniform pressure during all phases of the operating cycle and which is also provided with means for determining whether the total quantity of fluid in the reservoir falls within predetermined limits.

It is also an object of the invention to eliminate sponginess and slugginess in the action of a hydraulic buffer by providing means for the removal of occluded air and entrained gases from the buffing fluid.

It is still another object of this invention to provide a means for filling the self-contained fluid reservoir of a hydraulic buffer in such a manner as to remove entrained air and gases from the fluid therein.

It is also an object of this invention to provide a self-contained fluid reservoir for a hydraulic actuator which is subjected to substantially the same fluid pressure throughout the buffing cycle and which includes means for removing entrained air and gases from the fluid in the reservoir.

It is another object of this invention to produce a means of filling with substantially air and gas free fluid the reservoir of a hydraulic buffer which is continuously subjected to a substantially uniform positive pressure in such a manner that sluggishness and sponginess in the operation of the buffer are minimized or substantially avoided.

Further objects are to provide a construction of maximum simplicity, economy and ease of assembly and disassembly, also such further objects, advantages and capabilities as will fully appear and as are inherently possessed by the device and the invention described herein.

The invention further resides in the combination, construction and arrangement of parts illustrated in the accompanying drawings, and while

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there is shown therein a preferred embodiment thereof, it is to be understood that the same is illustrative of the invention and that the invention is capable of modification and change and comprehends other details of construction without departing from the spirit thereof or the scope of the appended claim.

Referring to the drawings:

Figure 1 is a transverse elevational view of the improved hydraulic buffer showing buffer in the retracted position.

Figure 2 is a sectional view taken along the lines II—II in Figure 1.

Figure 3 is a longitudinal sectional view taken along the lines III—III in Figure 2 and shows the relative position of the parts at the end of the buffing stroke.

Referring now more particularly to the drawings, in which like reference numerals indicate like parts in the several views, there is shown generally at 11 a cylindrically shaped buffing device having cooling fins 11*a* thereon and a mounting flange 12 carried by the exterior housing 13 thereof. The cylindrical device 11 has an inner bore 14 of reduced diameter at the actuator end 15 thereof, the bore 14 being in axial alignment with an intermediate bore 16 of slightly greater diameter than the bore 14, and an outer bore 18 of still greater diameter disposed longitudinally along the exterior housing 13. A buffer plug 19 threadedly engages with the outer portion 13*a* of the housing and has an insert portion 19*a* which projects inwardly into the outer bore 18. An annular groove 19*b* formed in the insert portion of the buffer plug 19 is adapted to receive an O-ring seal 17 which inhibits fluid leakage past the insert portion 19*a* of the buffer plug.

The plug 19 has a cylindrical bore 20 extending inwardly from the inside surface 19*c* thereof, the bore 20 being adapted to slidably accept and receive a buffer piston 21 carried by a plunger 22, which is disposed substantially along the longitudinal axis of the cylinder 11, and which has its opposite end secured by the threads 23 or other suitable means to a guide piston 24 which is freely slidable within the inner bore 14. A floating piston 25 is slidable within the bore 18 between the inner end 18*a* thereof and the inner surface 19*c* of the buffer plug. The piston 25 has a hole 26 extending centrally therethrough which has a diameter slightly greater than the diameter of the cylindrical plunger 22, the piston 25 being retained in sliding and substantially

fluid-tight sealing engagement with the surface of the plunger 22 by an O-ring seal 27 which is contained within the annular recess 26a formed interiorly within the piston 25. An O-ring seal 17 retained around the periphery of the piston by the annular recess 25a also inhibits fluid leakage past piston 25 as the latter slides along the bore 18.

An actuator arm, not shown, extends into the actuator end 15 of the cylinder 11 and is adapted to be coupled in a readily removable manner with the bayonet fitting 24a in the end of the guide piston 24. The piston 24 has an oil retaining groove 24b around the periphery thereof, and as the piston 24 is moved along the bore 14 by the actuator arm, the plunger 22 moves with respect to the floating piston 25 and causes the buffer piston 21 carried by the opposite end of the plunger 22 to reciprocate within the bore 20 formed in the insert end of the buffer plug 19.

The buffer piston 21 has a plurality of fluid dampening or flow restricting orifices 21c extending therethrough from the inner surface 21a to the outer surface 21b thereof. As the piston 21 moves outwardly along the bore 20 during the buffing stroke fluid entrapped within the fluid recess 30 bounded by the surface 21b and the interior surfaces of the plug 19 is caused to pass across the piston 21, through the flow restricting orifices 21c, and into the annular space 31 which is in communication with a fluid reservoir 32 bounded by the walls of the bore 18, the inner end 19c of the buffer plug, and the surface 25b of the floating piston 25. During the inward or retracting movement of the buffer piston 21 within the bore 20, fluid flows in the reverse direction through the orifices 21c in the piston 21 from the annular space 31 into the outer fluid recess 30.

An inflow passageway 35 is adapted to be placed in communication with the spring loaded inflow fitting or check valve 36 whenever the needle valve 37 is opened by turning the valve stem 38 carried by the housing 13. Preferably, the inflow fitting 36 is formed to readily receive a coacting fitting carried by the free end of a flexible supply hose which is adapted to be placed in communication with a pressure gun or other pressurized source of hydraulic fluid. Diametrically opposed to the valve stem 38 and extending through the housing 13 is a spring loaded release valve 39 which is adapted to release excess fluid from the reservoir 32 during the filling operation, the valve 39 also providing a means of removing entrained air or gases from the reservoir 32 by forcing additional hydraulic fluid into the reservoir through the inflow fitting 36. The valve 39 does not release fluid from the cylinder 11 unless abnormal and excessive fluid pressures are developed within the high pressure reservoir.

Disposed along the central portion of the plunger 22 with its axis substantially concentric with the axis of the plunger is a compression spring 40, one end of which presses against a washer or retaining ring 41 which is disposed in the end of the intermediate bore 16 which is immediately adjacent to the iner bore 14 of reduced diameter which slidably receives the guide piston 24. The other end of the spring 40 exerts substantially constant resilient pressure on the inner surface 25c of the floating piston, thereby causing the piston 25 to exert a substantially uniform pressure on the fluid in the reservoir 32, which pressure is substantially independent of temperature conditions within the cylinder 11 or the particular position of the buffer piston 21 along the bore 20.

An inner compression spring 44 of lesser diameter than the spring 40, disposed longitudinally therein with its axis substantially concentric with the axis of the plunger 22, has one end 44a in contact with the flange 45a of a sleeve 45. This sleeve has a centrally disposed hole 45b therein having a slightly greater diameter than the diameter of the plunger 22, and the spring 44 therefor retains the sleeve 45 in resilient contact with the inner surface 25d of the floating piston 25. The other end 44b of the spring 44 exerts resilient pressure on the upwardly extending flange of a similar but oppositely disposed sleeve 45', which is restrained against sliding movement along the plunger 22 by the key 46. Thus, the spring 44 tends to increase the lateral displacement between the sleeves 45 and 45', and on the retraction stroke of the piston 21 the spring 44 moves the sleeve 45' through the hole 41a in the ring 41, thereby tending to move the pistons 21 and 24 to the retracted position shown in Figure 1.

Operation

The fluid reservoir 32 of the hydraulic buffer is first filled with gas-free fluid by connecting the delivery fitting of a pressure gun to the inflow check valve 36 and opening the needle valve 37 by turning the valve stem 38. As the reservoir 32 is filled with fluid, the floating piston 25 is moved inwardly along the plunger 22 in opposition to the resilient action of the compression spring 40. During the filling operation, air in the reservoir 32 is forced out of the cylinder 11 through the release valve 39, and the filling operation is continued until the inner end 25e of the floating piston moves past the low fluid level indicating hole 47 and so that the end 25e of the piston is just visible through the high fluid level indicating hole 48 in the side of the housing 13. Preferably, the fluid in the reservoir 32 is allowed to remain under pressure of the spring 40 for several minutes before the pressure gun is removed from the fitting 36, in order that all air and entrained gases in the reservoir 32 may be bled out through the release valve 39 by admitting additional fluid into the high pressure reservoir. As soon as the fitting operation has been completed, the needle valve 37 is closed and the pressure gun is removed from communication with the inflow check valve 36. Whenever the end 25e of the floating piston moves outward because of fluid leakage so that the edge of the piston is visible through the indicator hole 47, the reservoir 32 should be filled with additional hydraulic fluid.

When no load is applied to the bayonet fitting 24a of the guide piston 24, the resilient action of the inner compression spring 44 urges the plunger 22 and the guide piston 24 and buffer piston 21 carried thereby to the retracted position illustrated in Figure 1. At the beginning of the buffing stroke the plunger 22, and the pistons 24 and 21 carried thereby, move laterally outwardly with respect to the floating piston 25 and the interior housing 13. During this outward movement of the buffer piston 21, fluid entrapped within the fluid recess 30 in the buffer plug 19 is caused to flow across the piston 21 through the flow restricting orifices 21c and into the annular space 31 on the opposite side of the buffer piston. Since the total area of the floating piston 25 is substantially greater than the effective area of the buffer

piston 21, the transfer of buffing fluid across the piston 21 effects only a slight movement in the position of the floating piston 25 within the buffer cylinder. The shape and configuration of the flow restricting orifices 21c in the buffer piston 21 may be varied in accordance with the nature of the buffing operation to be performed and the magnitude of kinetic energy which must be absorbed.

As soon as the buffing load ceases to act on the bayonet fitting 24a carried by the guide piston 24, the inner compression spring 44 exerts sufficient resilient pressure on the sleeve 45' and the key 46 to overcome the resistance of the O-ring seal 27 in the floating piston 25 and the flow resistance of the hydraulic fluid through the orifices 21c in the buffer piston, thereby moving the plunger and piston assembly to its normally retracted position. Throughout the entire operating cycle, the hydraulic fluid in the reservoir 32 is subjected to substantially the same pressure by the action of the compression spring 40 on the floating piston 25, and the pressure normally present in the reservoir 32 is substantially independent of temperature conditions within the buffer cylinder. Since provision has been made to remove entrained gases from the hydraulic fluid within the cylinder and to remove air which may leak into the reservoir 32, sponginess in the action of the hydraulic buffer may readily be eliminated and positive buffing action thereby assured whenever the buffer is required to absorb large amounts of kinetic energy and to operate at high rates of speed.

I claim:

In a fluid buffing device, the combination which comprises an elongated housing forming a cylinder having an intermediate portion of a given diameter constituting a fluid reservoir, a closed

end portion of a reduced diameter constituting a buffing chamber, and an open end portion, a buffing piston slidable within the said buffing chamber, the said piston having flow restricting orifices therein communicating with said buffing chamber on one side of the said piston with said fluid reservoir on the opposite side of the said piston, said buffing chamber and said reservoir being filled with hydraulic fluid, an actuating plunger adapted to be connected to a load and operable to reciprocate the said buffing piston in the said fluid filled chamber, a guide piston fast on said plunger and slidable in said open end portion, a floating piston reciprocably slidable on the plunger, an expansion spring acting between said floating piston and said housing operable substantially independently of temperature for imparting a substantially uniform fluid pressure to the fluid in the said reservoir, and resilient means acting between said floating piston and said guide piston tending to retract the buffer piston and to increase the quantity of fluid entrained within the said buffing chamber whenever the said load is removed from the said actuating plunger.

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