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HYDRAULIC DASH-POT CONTROLLER FOR AN ACTUATOR

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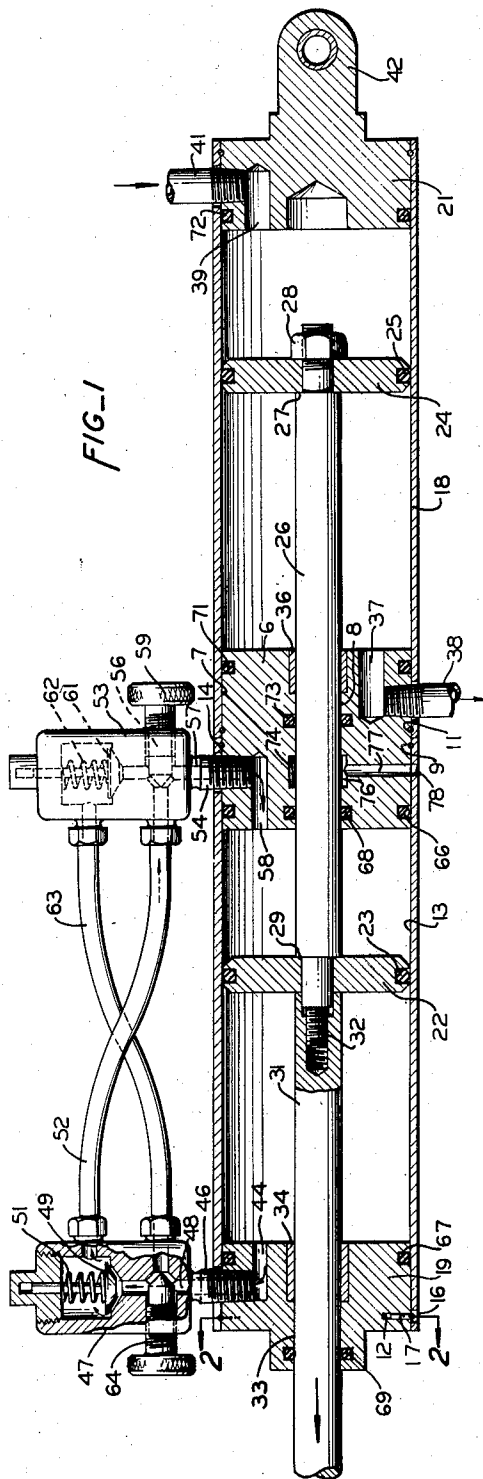


FIG-2

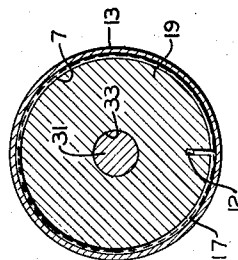
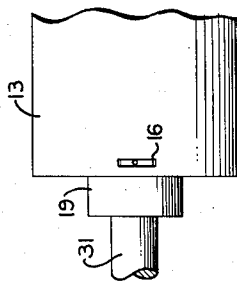


FIG-3



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HYDRAULIC DASH-POT CONTROLLER FOR AN ACTUATOR

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1 Claim. (Cl. 188—97)

Our invention relates to hydraulic dash-pot controllers for actuating mechanisms particularly useful in the periodic operation of various sorts of machinery and utilizing compressed air as motive power. It is customary to use air cylinders, both single acting and double acting, for effectuating various cyclic, reciprocatory movements in various types of machines. The air cylinder is cheap, effective and widely used. There are instances, however, in which the operation of the air cylinder is likely to be somewhat erratic. If the resistance to be overcome by the cylinder varies from time to time or varies at different points in the stroke of the mechanism or if the supply of air to the cylinder varies greatly in pressure (usually due to the operation of attendant mechanism) there is a likelihood that the air cylinder will stall in part stroke or will effectuate the desired movement not in a smooth continuous fashion but in a series of jerks of indefinite extent and indefinite timing.

It is therefore an object of our invention to provide an actuating cylinder, powered by air, which is controlled in its operation so that it uniformly and consistently carries out the desired stroke in a substantially uniform and predictable fashion despite some of the difficulties mentioned above.

A still further object of our invention is to provide an actuating cylinder which can readily be utilized in place of a standard air cylinder but which produces a much better control of the motion of the mechanism.

A still further object of our invention is to provide a packaged actuating cylinder having an effective regulating or controlling mechanism incorporated therewith.

Another object of the invention is to provide a controlled actuating cylinder which can readily be installed in the place of standard air actuating cylinders without substantial mechanical change in the environment.

A still further object of the invention is to provide a controlled actuating cylinder having a liquid dash-pot mechanism in which leakage between the air structure and the oil structure is prevented.

A still further object of the invention is to provide, in general, an improved, controlled actuating cylinder.

The controlled actuating cylinder of our invention has proved successful in practice especially in connection with food handling machinery in which reciprocatory motion is necessary for the operation of the structure. While the device can be embodied in a number of different forms, it has successfully been embodied as described in the accompanying description and as illustrated in the accompanying drawings, in which

Figure 1 is a cross section on a transverse, longitudinal plane through a controlled actuating cylinder constructed in accordance with our invention, certain parts being shown semi-diagrammatically.

Figure 2 is a cross section, the plane of which is indicated by the line 2—2 of Figure 1.

Figure 3 is a fragmentary end elevation of the portion of the cylinder at the left in Figure 1.

Preferably, the device of our invention includes a

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central plug 6, usually of metal, having an external circular cylindrical surface 7 and having a central circular cylindrical bore 8. The plug is externally provided with a pair of grooves 9 and 11 semi-circular in cross section and each intersected with a radial hole 12, as shown in the Figure 2 and 3 illustration of a similar part. Designed to fit over the central plug 6 is a first sleeve 13 circular cylindrical in cross section and extending for any desired length. The sleeve adjacent one end is provided with a semi-circular groove 14 designed in one axial position of the sleeve 13 to match with the groove 9 in the plug. At one point in its periphery the sleeve 13 is pierced by a slot 16 which can be turned substantially into registry with the hole 12.

To secure the first sleeve on the central plug, a wire 17 is inserted through the slot 16 into the grooves 9 and 14 and has one end bent into the hole 12. The first sleeve 13 is in this manner kept from endwise motion with respect to the central plug 6.

In a comparable fashion with a wire in the groove 11, a second sleeve 18 is joined to the central plug 6 so that both the sleeves 13 and 18 are mounted substantially in alignment with the bore 8. The end of the first sleeve 13 is closed by an end head 19 secured by a wire in the described way and the second sleeve 18 is closed by an end head 21 held in place by a similar wire.

In accordance with the invention, there is disposed in the interior of the first sleeve 13 a first piston 22 having a packing ring 23 around its periphery. Similarly, there is a second piston 24 disposed within the second sleeve 18 and having a packing ring 25 around its periphery. Joining the first piston 22 and the second piston 24 is a piston rod 26 passing through the bore 8. A shoulder 27 at one end of the rod is in abutment with the piston 24. A removable nut 28 holds the parts in position.

The other end of the piston rod 26 has a shoulder 29 abutting the piston 22. The parts are held in position by an operating rod 31 having a threaded connection 32 to the piston rod 26. The rod 31 extends through an opening 33 in the head 19 so that the operating rod is available for connection to a device to be actuated. It is of interest that the operating rod 31 and the piston rod 26 are of the same diameter and, in effect, one is an extension of the other so that they both can be referred to as a piston rod. Preferably, the piston rod is especially supported in bushings 34 and 36 in the head 19 and the central plug 6.

The actuating force is derived from compressed air directed to one side or the other of the piston 24 within the sleeve 18. For that reason, the central plug 6 has a duct 37 therein joined to a pipe 38 passing through a hole in the sleeve and preventing rotation of the parts. The pipe leads to an air supply. Similarly, the head 21 has a duct 39 therein joined to a pipe 41 also leading to the air supply. While one direction of flow is indicated by the arrows in Figure 1, it is to be understood that the pipes 38 and 41 are connected through suitable valving to the air supply and to an air release. By suitably setting the pressures on opposite sides of the piston 24, the piston rod 26 is moved either to the right or to the left and with substantial force. This force is resisted by the mounting (not shown) of the structure preferably joined to a pierced lug 42 forming part of the head 21. The resulting movement of the piston rod 26 is imposed on the operating rod 31 so that when the air pressure relationship is as indicated by the arrows, the operating rod 31 moves in the direction of the indicated arrow.

To control the operation of the piston rod under the differential air pressure exerted on the piston 24, the interior of the first sleeve 13 is filled with oil to serve as a control fluid. The oil cannot pass from one side

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of the piston 22 to the other around the piston because of the packing 23 and, consequently, means in the nature of a closed pipe is supplied for interconnecting or shunting the interior of the sleeve 13 on opposite sides of the piston 22. For that reason, the end head 19 has a passage 44 therein leading to a connection 46 on a valve body 47 screwed into the head 19.

Flow through a duct 48 in the interior of the body 47 is readily accomplished in one direction through a check valve 49 normally urged closed by a spring 51. The valve 49 opens under suitable oil pressure to permit continuance of flow from the passage 48 into a pipe 52 extending into a similar body 53 having a screw connection 54 with the central plug 6. Flow through the pipe 52 is past a needle valve 56 into a bore 57 leading to a passage 58 in the plug 6. The needle valve 56 is adjustable by means of a thumb wheel 59 so that the rate of flow past the needle valve is variable.

If the piston 22 is moved from the right toward the left in Figure 1 as indicated by the arrows therein, oil is displaced by the piston 22 through the passage 44 to lift the check valve 49 against the spring 51 and to flow through the closed pipe 52 at a rate regulated by the position of the needle valve 56 back through the passage 58 into the interior of the first sleeve 13 on the opposite side of the piston 22. Thus, the rate of travel of the piston 22 and correspondingly of the piston 24 and operating rod 31 is regulated by the rate at which the needle valve 52 permits the dash-pot oil to flow.

In a comparable fashion, oil travelling up the passage 57 in the body 53 flows through a check valve 61, urged closed by a spring 62, and then goes through a closed pipe 63 into the body 47 and past an adjustable needle valve 64 back to the passage 44. When the air pressure is reversed and the direction of flow is opposite to that of the arrows in Figure 1, then oil displaced by the piston 22 through the passage 58 endeavors to flow past the needle valve 56 and through the pipe 52 but the attempted flow shuts the check valve 49 if it has not already been closed and, thus, no return flow is permissible in that path. Yet, flow in the passage 57 can still occur since the valve 61 is lifted. Then flow through the pipe is at a rate regulated by the needle valve 64. The return flow in each direction is separately regulated and adjusted. If the needle valves 59 and 64 happen to be set for the same openings then the rate of movement is exactly the same in both directions. Since both the operating rod 31 and the piston rod 26 are of the same diameter, the displacement on one side of the piston 22 is exactly the same as that on the other side thereof.

Since the liquid is normally under something more than atmospheric pressure, the sleeve 13 is sealed in the central plug 6 by a packing ring 66 and in the end plug 19 by a packing ring 67. Similarly, the oil is retained by a sealing ring 68 around the piston rod 26 and by a ring 69 around the operating rod 31. The air side or second sleeve 18 is pressure sealed by a packing ring 71 in the central plug 6 and a similar ring 72 in the end head 21. The piston rod 26 is sealed by a ring 73 in the central plug 6. These seals may not be absolute. Some

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leakage may eventually occur. It is detrimental for oil to get into the air cylinder and detrimental for air to get into the oil cylinder. For that reason the central plug 6 is internally formed to provide walls 74 affording a space 76 around the piston rod 26. A conduit 77 leads through a hole 78 in the side of the sleeve 13 to the atmosphere. With this arrangement, any leakage past either of the rings 68 or 73 is into the space 76 and through the conduit 77 and the hole 78 to the atmosphere. There can be no interchange of pressure fluids from one side of the central plug 6 to the other.

There has thus been provided a simple controlled actuating cylinder effective to utilize the operating force of compressed air in a regulated traverse of the operating mechanism from one end to the other in either direction at regulated rates.

What is claimed is:

A hydraulic dash-pot controller for an actuator comprising a cylinder, a first head at one end of said cylinder and having a first axial bore therethrough, a second head at the other end of said cylinder and having a second axial bore therethrough, a piston rod extending through said cylinder and projecting therefrom through said bores, a piston on said rod and reciprocable within said cylinder, a first valve body at one end of said cylinder, said first valve body having therein a first main passage forking into a first branch passage and a second branch passage, means connecting the interior of said cylinder between said piston and said first head with said first main passage, a first adjustable restriction in said first branch passage, a first check valve in said second branch passage and adapted to close toward said first main passage, a second valve body at the other end of said cylinder, said second valve body having therein a second main passage forking into a third branch passage and a second branch passage, means connecting the interior of said cylinder between said piston and said second head with said second main passage, a second adjustable restriction in said third branch passage, a second check valve in said fourth branch passage and adapted to close toward said second main passage, a first conduit interconnecting said first branch passage and said fourth branch passage and between said first adjustable restriction and said second check valve, and a second conduit interconnecting said second branch passage and said third branch passage between said second adjustable restriction and said first check valve.

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