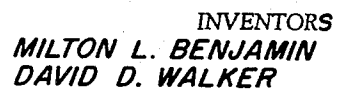


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CUSHIONING CYLINDER FOR INDEX FIXTURES AND THE LIKE

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1

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CUSHIONING CYLINDER FOR INDEX FIXTURES AND THE LIKE

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5 Claims. (Cl. 74—821)

ABSTRACT OF THE DISCLOSURE

A cushioning cylinder vented at one end and provided with longitudinal grooves in the inner wall intermediate the ends thereof permitting free flow of gas from one side of the piston to the other through such longitudinal grooves during an initial portion of its stroke toward the other end. A restriction in the other end permits restricted flow therefrom during the remainder of the piston stroke beyond the longitudinal grooves for cushioning the end movement of the piston.

The present invention relates generally, as indicated, to a cushioning cylinder for index fixtures and the like and, more particularly, to certain improvements in cushioning cylinders for permitting rapid indexing of an indexing plate and workpiece carried thereby without incurring any severe stresses or shock loads as the indexing plate is stopped in its indexed position.

As is well-known in the art, index fixtures may be used for rapid indexing of a workpiece from one work station to another for increased production without imposing excessive stresses on the various indexing parts of the fixture during stopping of the workpiece if means are provided for effectively cushioning or decelerating the indexing movement just prior to reaching the final indexed position so that the indexing parts are subjected to the greatest resilient retarding force. An example of such a cushioning means which has proven to be quite satisfactory in use may be found in the patent to Milton L. Benjamin, Patent No. 2,883,886, granted Apr. 28, 1959. However, there is a need for a more simple and less expensive cushioning cylinder capable of permitting the same rapid indexing while limiting the stress buildup to a safe level which is a principal object of the present invention.

Another object is to provide such a cushioning cylinder with novel means for permitting rapid movement of the piston therewithin except when the piston approaches the end of its stroke, at which time there is a restricted flow of trapped air from the cylinder for cushioning the piston movement to a stop.

A further object is to provide a cushioning cylinder of the type described with a novel flapper valve and needle valve arrangement in the head end for permitting unrestricted flow of air into the cylinder through the flapper valve and restricted flow therefrom through the needle valve.

Other objects and advantages of the present invention will become apparent as the following description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features herein-after fully described and particularly pointed out in the claims, the following description and the annexed drawing

2

setting forth in detail a certain illustrative embodiment of the invention, this being indicative, however, of but one of the various ways in which the principles of the invention may be employed.

5 In such annexed drawing:

FIG. 1 is a perspective view of a preferred form of cushioning cylinder in accordance with the present invention shown mounted on the housing of an index fixture or the like;

10 FIG. 2 is a partial longitudinal section of such cushioning cylinder;

FIG. 3 is a transverse vertical section through the cushioning cylinder of FIG. 2 taken on the plane of the line 3—3 thereof; and

15 FIG. 4 is also a transverse vertical section through the cushioning cylinder of FIG. 2, but taken on the plane of the line 4—4 thereof.

Turning now to the details in the drawing and first of all to FIG. 1, the preferred embodiment of cushioning cylinder in accordance with this invention is generally indicated at 1, it being shown mounted on the housing 2 of an index fixture 3 as by means of a plurality of tie rods 4 projecting from the housing 2 through aligned openings in the ends of the cylinder with nuts 5 threaded onto the ends of the tie rods 4. The index fixture 3 may be of any well-known type such as disclosed in the aforementioned Benjamin Patent No. 2,883,886, including an indexing plate 6 provided with a plurality of mounting holes to enable mounting of a workpiece thereon, and a pair of coaxial single-acting hydraulic cylinders 7 and 8 with interconnected pistons secured to opposite sides of the housing 2 for intermittently advancing the indexing plate 6 in the same direction, in this case clockwise.

There is a four-way valve 10 for directing the flow of 35 air under pressure from a suitable supply, not shown, to one or the other of the cylinders 7 and 8 through supply lines 11 and 12. Thus, for example, when the four-way valve 10 is in the FIG. 1 position, air is permitted to pass under pressure through the valve 10 to the lefthand cylinder 7 and the righthand cylinder 8 is connected to the atmosphere through such valve, whereby the pistons for the cylinders 7 and 8 are moved toward the right to cause rapid counterclockwise movement of the various indexing parts in the housing 2, but not the indexing plate 6. Then the four-way valve 10 is reversed to admit air under pressure to the righthand cylinder 8 and the lefthand cylinder 7 is connected to exhaust, whereby the cylinder pistons are moved toward the left to drive the indexing parts and indexing plate 6 in a clockwise direction. For a more detailed discussion of the operation and construction of the indexing mechanism for the index fixture 3, reference may be had to the aforementioned Benjamin patent.

The rate at which the indexing plate 6 may be advanced 55 from one position to another will vary depending on the air pressure supplied to the cylinder 8 and the rate at which air is permitted to exhaust from the cylinder 7. Obviously, in order to achieve maximum production, the indexing should be accomplished in a minimum of time. However, the large inertia forces which occur in the rapid indexing of relatively large workpieces will impose undue stresses on the various motion arresting parts of the indexing mechanism when the indexing plate 6 approaches its final indexed position unless some means such as the cushioning cylinder 1 disclosed herein is provided for

cushioning the stopping of the indexing plate just prior to the end of the indexing movement.

The cushioning cylinder 1 as clearly shown in FIGS. 2-4 comprises a cylindrical housing 15 containing a piston 16 and piston rod 17 with the rod 17 extending through aligned openings 18 and 19 in the rod end 20 of the cylinder 1 and the housing 2, respectively, into the interior of the index fixture 3. The inner end of the piston rod 17 is adapted to be connected in suitable fashion to a pawl support member or the like of the indexing mechanism for reciprocating movement in response to oscillating movement of such indexing mechanism, similar to the piston rod 53 in the Benjamin Patent 2,883,886 referred to above. Extending through the rod end 20 of the cylinder 1 there is a passage 21 which communicates the interior of the cylinder 1 with the atmosphere for permitting free flow of air to and from that end of the cylinder.

The head end 25 also has a passage 26 therethrough communicating that end of the cylinder interior with the atmosphere. Preferably, there is a transverse bore 27 connecting the passage 26 with a central opening 28, and there is a flow control needle valve 29 in such bore 27 which may be adjusted to vary the rate of exhaust of air from the cylinder 1 through passages 26, 27 and 28 by loosening the jam nut 30 and rotating the needle valve 29 with a screwdriver or the like to the desired adjusted position. The inner end of the opening 28 is covered by a flapper valve 31 of thin neoprene or other rubber-like material attached to the inner surface of the head end 25 by suitable fasteners 32. This flapper valve 31 acts as a one-way check valve permitting air to pass freely into the head end of the cylinder 1 through the nipple 33 and central opening 28, but not in the reverse direction. Moreover, the inner surface of the cylindrical housing 15 is provided with one or more longitudinally extending grooves 34 which extend for a substantial length of the cylinder housing from a point slightly beyond the innermost position of the piston 16 (phantom lines, FIG. 2) to a point just short of the outermost position of the piston (solid lines, FIG. 2) whereat the cushioning of the piston movement to a stop begins.

When the pistons for the index cylinders 7 and 8 are moved toward the right to cause a counter-clockwise movement of the fixture indexing mechanism, the cushioning cylinder piston 16 is moved toward the left in its cylindrical housing 15, as is the rod 53 in the Benjamin Patent 2,883,886. During this leftward movement of the piston 16, trapped air is permitted to escape freely through the passage 21 in the rod end 20 of the cylinder 1 and, in addition, air is permitted to enter freely into the head end 25 of the cylinder through the central opening 28 and flapper valve 31. Moreover, once the piston 16 is between the ends of the grooves 34, air may be displaced from the rod end to the head end through such grooves. Accordingly, movement of the piston 16 toward the left is free and in no way interferes with counter-clockwise movement of the indexing mechanism for the index fixture 3.

Nor is the clockwise movement of the indexing mechanism together with the indexing plate 6 and workpiece carried thereby restricted by the return movement of the piston 16 except when the piston approaches the end of its stroke, since trapped air at the head end of the cylinder 1, although precluded from escaping through the central opening 28 by the flapper valve 31, may freely pass through the grooves 34 out the passage 21 until the piston 16 reaches the ends of such grooves. By that time, the indexing plate 6 has almost reached its final indexed position, and accordingly the cushioning cylinder 1 will smoothly cushion or decelerate the remainder of the indexing movement so as to subject the indexing mechanism to a substantial resilient retarding force by permitting the still trapped air to escape only through the re-

stricted passage 26, the size of which may be varied through adjustment of the needle valve 29 as aforesaid.

From the foregoing, it can now be seen that the cushioning cylinder of the present invention is of a unique and yet simple construction which is especially suited for permitting rapid indexing with smooth cushioning of the indexing mechanism of an index fixture as it approaches an indexed position to eliminate severe stress buildup.

Other modes of applying the principles of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims or the equivalent of such be employed.

We therefore, particularly point out and distinctly claim as our invention:

1. A cushioning cylinder comprising a cylindrical housing, a piston reciprocable in said housing, means permitting a free flow of gas to and from one end of said housing, means permitting a free flow of gas only in one direction into the other end of said housing, means permitting a free flow of gas from one side of said piston to the other during an initial portion of its stroke toward said other end, and means permitting restricted flow out of said other end during the remaining portion of the stroke of said piston toward said other end for cushioning the end movement of said piston, said last-mentioned means comprising an adjustable needle valve disposed in an opening in said other end communicating the interior of said housing adjacent said other end with the atmosphere.

2. The cushioning cylinder of claim 1 wherein said means permitting a free flow of gas from one side of said piston to the other comprises a plurality of longitudinally extending grooves in the inner surface of said housing, said grooves extending from a point beyond the end of the stroke of said piston toward said one end to a point adjacent the end of the stroke of said piston toward said other end.

3. The cushioning cylinder of claim 1 wherein said means permitting a free flow of gas only in one direction into the other end of said housing comprises a passage extending through said other end communicating the interior of said housing adjacent said other end with the atmosphere, and a check valve means disposed in said passage in said other end for permitting free flow in said one direction, said opening communicating with said passage in said other end outwardly of said check valve means.

4. A cushioning cylinder comprising a cylindrical housing, a piston reciprocable in said housing, a passage means in one of the ends of said housing communicating the interior of said housing adjacent said one end with the atmosphere for permitting a rapid displacement of gas from said one end of said housing interior during movement of said piston toward said one end, a pair of passages in the other end of said housing, check valve means in one of said pair of passages for permitting free flow of gas through said one of said pair of passages in one direction only into said other end of said housing interior, a flow restrictor means in the form of an adjustable needle valve in the other of said pair of passages permitting restricted displacement of gas from said other end of said housing interior during movement of said piston toward said other end, and at least one groove means extending longitudinally along the inner surface of said housing for a substantial length, said groove means being adapted to permit displacement of gas from said other end of said housing interior to said one end during movement of said piston toward said other end for permitting a rapid motion of said piston in that direction, said groove means terminating short of the end of the stroke of said piston toward said other end, whereby the remainder of the stroke of said piston will be at a reduced rate cushioned by such restricted displacement

5

through the flow restrictor means in said other of said pair of passages.

5. The cushioning cylinder of claim 4 wherein said check valve means comprises a thin flexible member disposed in said housing, and means for fastening said flexible member to said other end of said housing adjacent said one of said pair of passages, said flexible member extending from said fastening means across said one of said pair of passages to cover the same, said other of said pair of passages communicating with said one of said pair of passages outwardly of said check valve means.

6

References Cited

UNITED STATES PATENTS

998,962	7/1911	Doyle -----	188—96.7
1,151,595	8/1915	Ingham -----	188—96.7
3,005,523	10/1961	May -----	137—525.3 X
419,916	1/1890	Blount -----	188—96.7 X
763,285	6/1904	Herman -----	251—55 X

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