# United States Patent

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[54] **RAM WITH CUSHIONED PISTON STROKE**
**7 Claims, 3 Drawing Figs.**


[52] **U.S. Cl.** ..... **92/85, 91/409**
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[50] **Field of Search** ..... 92/85; 91/408, 409, 28, 407, 405



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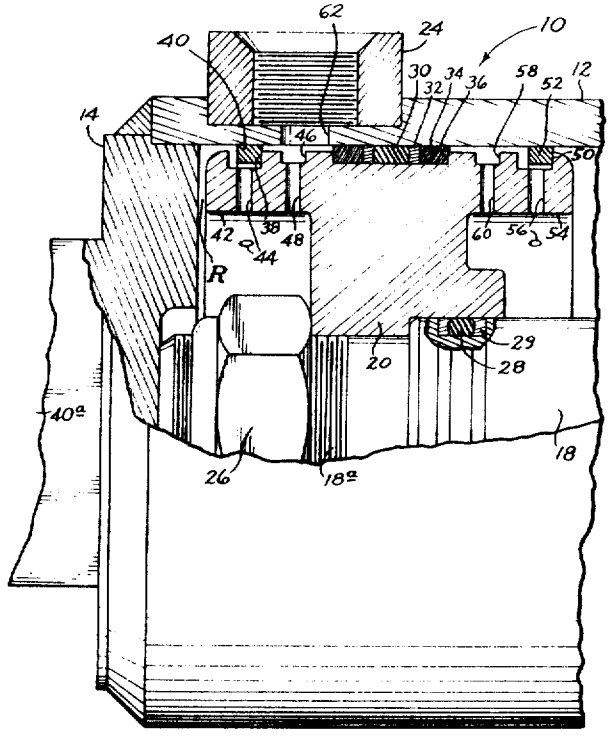
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**ABSTRACT:** A ram with a construction for cushioning the ram's piston as it nears the end of a stroke while accommodating a fast return stroke in the piston. A metallic piston ring is loosely mounted to permit limited axial movement within an annular groove on the piston. A fluid passage connects this groove with an end of the piston. The ring on movement of the piston toward the end of a stroke moves to a position tending to close off the fluid passage, to capture cushioning fluid. With pressure fluid admitted to the ram to produce a return stroke, the ring shifts axially to a position tending to open up the fluid passage.

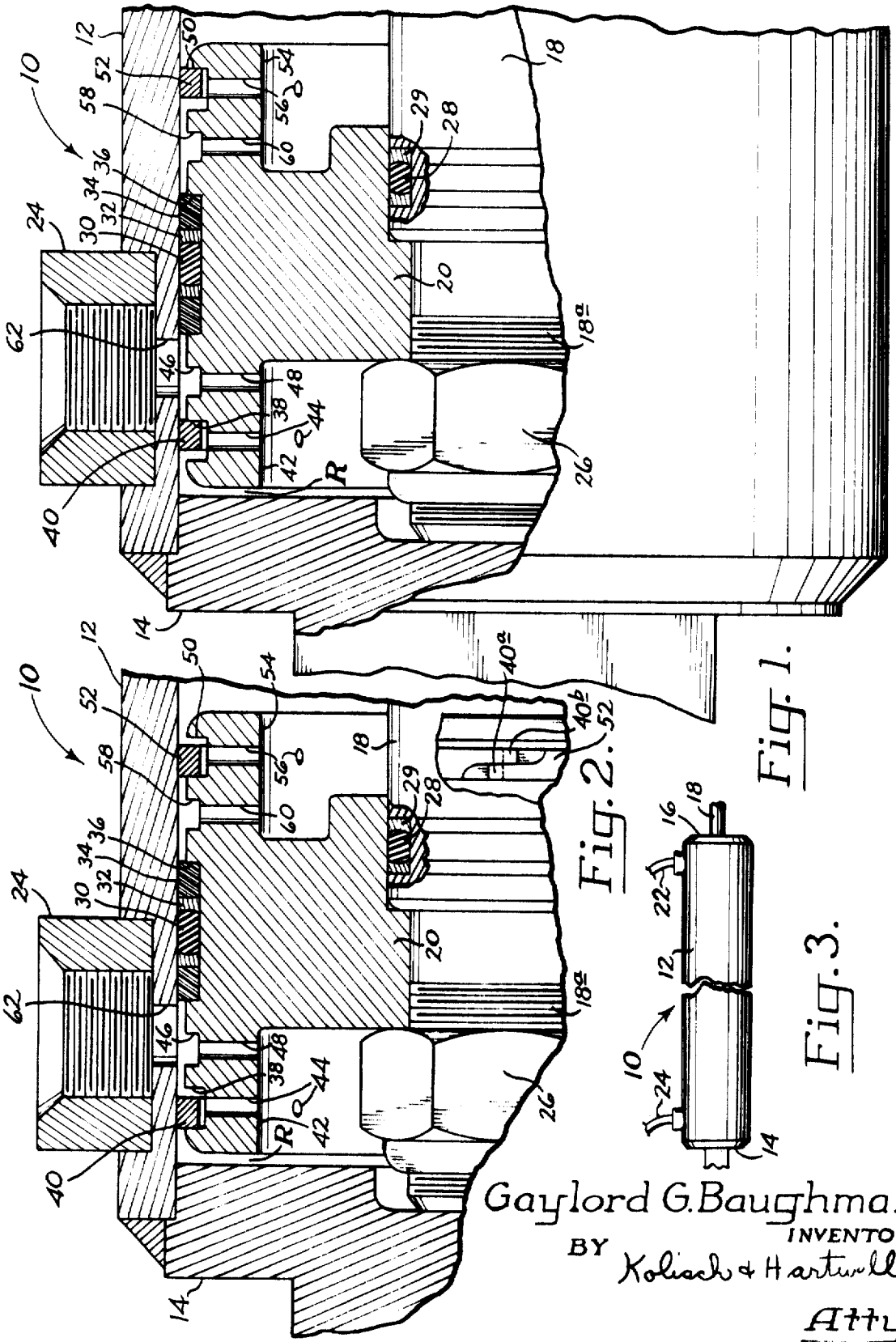



Fig. 1.

Fig. 2.




Fig. 3.

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# RAM WITH CUSHIONED PISTON STROKE

This invention relates generally to fluid-operated piston cylinder devices, also referred to herein for brevity's sake as rams, provided with a construction for cushioning the ram's piston on such nearing the end of a stroke and for providing a fast return stroke in the piston when such is subsequently cycled in the opposite direction.

Where a piston is permitted to complete a full stroke against the end wall of a cylinder, without being earlier stopped or slowed down, an impact is produced which shortens the life of the ram, produces noise, and results in other undesirable features. To prevent such from occurring, it has been the practice to provide a construction wherein a portion of the fluid within the cylinder which is being expelled by the piston on a stroke be captured within an end wall region of the ram as the piston nears the end of its stroke, with further movement of the piston being accompanied with metered flow of this fluid from such end wall region through a metering passage. If the piston is to have a fast return stroke on moving in the opposite direction, there must be provided some means for the quick introduction of a significant volume of fluid into this end wall region. If flow into this region is permitted only through the metering passage which produces the cushioning action, obviously return movement of the piston at least during the start of its return stroke will be rather slow. To obviate this difficulty, various approaches have been taken, including the provision of a ball-check valve which closes when cushioning is being produced and which opens to provide an alternate route for the inflow of fluid on the return stroke of the piston.

Generally, an object of this invention is to provide an improved construction for cushioning the piston, and for permitting a fast return stroke, which is relatively simple, and permits the elimination of ball-check valves and the like, which tend to complicate the construction of the ram, and have other disadvantages, such as being bulky, subject to wear, etc.

A more specific object of the invention is to provide such a construction wherein a valving action is provided controlling flow to the region in a ram which captures fluid for cushioning purposes, by a ring mounted on the ram's piston which is axially shiftable to a limited degree to produce such valving action.

In a preferred embodiment of the invention, the ring takes the form of the usual metallic piston ring found in many mechanical applications for sealing the gap between a piston and a cylinder wall.

As contemplated by this invention, and as a further object thereof, a double-acting ram is provided which includes such axially shiftable rings adjacent opposite ends of the ram's piston. Between the ends of the piston, a fluidtight sealing ring, referred to herein as a sealing annulus, is provided. Providing for the metered flow of fluid are metering passages which come into play with the piston of the ram moving in a stroke to each of the ram's opposite ends.

Various other objects and advantages of the invention will become more fully apparent as the following description is read in conjunction with the accompanying drawings, where:

FIG. 1 is a view, partially broken away, illustrating the end of a ram as contemplated herein, such being equipped with rings adjacent opposite ends of its piston functioning to control flow between the sides of the piston and regions on opposite ends of the piston adjacent end walls in the ram (where fluid producing cushioning collects);

FIG. 2 is a view similar to portions of FIG. 1, but showing he rings in a different position; and

FIG. 3 is a view on a slightly smaller scale showing the ram in its entirety.

Referring to the drawings, and first of all more particularly to FIG. 3, here a double-acting fluid pressure operated ram is shown generally at **10** which includes a ram cylinder **12** and end walls **14** and **16** closing off opposite ends of the ram cylinder. Projecting out from one end of the cylinder is a piston rod **18** which as can be seen in FIGS. **1** and **2**, has the



usual piston **20** secured to one end. Piston 20 is reciprocable within the cylinder. To move the piston in a stroke from the right end of the ram to the left in FIG. **3**, fluid is introduced to the ram through conduit **22** and exhausted through conduit **24**. To move the piston and its rod in a return stroke, fluid is introduced through conduit **24** and exhausted through conduit **22**.

Referring more particularly now to FIGS. **1** and **2**, the piston **20** is secured to the end of the rod by a nut **26** which bears against the piston and is screwed onto threaded end portion **18***a* of the piston rod. Producing a seal between the piston rod and the piston is O-ring **28**, with backup rings **29** being provided on either side of ring **28**.

A fluidtight seal is produced between the outer periphery of the piston and the inner wall of the cylinder by O-ring **30**, also referred to herein as a fluidtight sealing annulus. The O-ring together with backup rings **32** and rider rings **34** (which may be made of nylon) are all disposed within an annular groove **36** provided about the circumference of the piston approximately midway between its ends.

Considering first of all the left end of the piston in FIGS. **1** and **2** (which faces left end wall **14**), adjacent the left end of the piston is a groove **38** which mounts a piston ring shown at **40**. The piston ring resembles conventional piston rings, and comprises a split metal ring sealing the gap between the circumference of the piston and the inside of cylinder **12**. The periphery of the ring, therefore, is radially outwardly of the periphery of the piston and such slides against the inner cylindrical wall of the cylinder.

The ring is loosely mounted in groove **36** with some clearance provided on opposite sides, whereby it is axially movable to a limited degree within the groove. The clearance need not be great, and actually has been somewhat exaggerated in the drawing for the purpose of best illustrating the invention. In FIG. **2**, the ring is shown snugly against the side of groove **38** which is directly adjacent the left end of the piston, whereas in FIG. **1**, the ring is shown shifted axially and to the right and against the wall of the groove which is more remote from the left end of the piston.

A cylindrical recess **42** is shown indented inwardly from the left end of the piston. Connecting the base of groove **28** with this recess, and through this recess with the region bounded between the left end of the ram and end wall **14** such as the region R shown in FIGS. **1** and **2**, are multiple bores **44** which may be equally circumferentially spaced about the piston. These bores and recess **42** collectively constitute fluid passage means connecting the groove with the recess.

Disposed inwardly from the left end of the piston, and more specifically between groove **36** containing O-ring **30** and groove **38**, is another annular groove **46**. Connecting the base of this groove with recess **42** is a metering bore or passage **48**.

The piston ring illustrated in the drawings, as exemplified by the portion of the ring protruding upwardly from the base of FIG. **2**, is provided with an overlapping end construction, with tongues **40***a*, **40***b* at the ends of the ring overlapping where the split ring comes together. This overlapping construction is effective to give a better seal at this particular part of the piston ring. A so-called conventional square-ended split ring may also be utilized, with squared ends coming together at the point where the ring is split. The latter construction, however, does not provide as good a seal at this region of the ring.

The right end of the piston in FIGS. **1** and **2** has a construction which closely resembles the left end of the piston. Thus, there is provided a groove **50** which loosely mounts a piston ring **52**. A cylindrical recess **54** is indented inwardly from the left end of the piston. Bores **56** constitute a fluid passage means connecting recess **54** with groove **50**. Disposed between groove **50** and groove **38** is a groove **58** connected through a metering passage or bore **60** with recess **54**.

Conduit **24** connecting with the left end of the ram connects with a port **62** which communicates with the inside of the cylinder at a point located between grooves **36**, **38**, with the piston adjacent the left end of the ram. Conduit **22** at the op-

osite end of the ram connects with the inside of the cylinder etween grooves **38** and **50** with the piston adjacent the opposite end of the ram.

Explaining the operation of the ram, and assuming that the iston is being moved in a stroke from the right to the left end f the ram in FIG. **3**, fluid is introduced through conduit **22** nd exhausted through conduit **24**. On the piston-moving iston ring **40** to the left of port **62** in FIG. **1**, fluid captured etween the left end wall of the ram and the left end of the iston produces a buildup in pressure in the space or region icated between this wall and the left end of the piston, such gion being indicated at R in FIG. **1**. This results in piston ng **40** moving axially to the right and snugly against the side f groove **38** which is remote from the left end of the piston. 'ith the piston ring thrust tightly against this side of the oove, significant flow of fluid through bores **44** and past the iston ring to port **62** is prevented. Fluid captured in region R, ierefore, is permitted to exhaust only at a controlled rate irough metering bore **48**. This functions, therefore, to roduce a cushioning action slowing down the travel of the iston as it nears end wall **14**.

At the start of a return stroke, and with fluid under pressure dmitted through conduit **24** and exhausted through conduit **2**, such fluid under pressure operates to shift the piston ring the left, as shown in FIG. **2**. With the ring in this position, ores **44** accommodate the admission of fluid to region R igether with metering bore **48**. Fluid under pressure, thereire, rapidly builds up on the left end of the piston, whereby ie piston moves in a return stroke at a rapid rate.

Piston ring **52** operates in a similar fashion, in blocking off ow, and in permitting on a return stroke rapid inflow of pressire fluid, when the piston is adjacent right end wall **16**.

The construction requires no ball-check valves or similar evices for producing one-way flow between the sides of the iston and the ends of the piston. Major modification of the iston, the cylinder, or the end walls, is not required. The conruction is easily put together, and repair and replacement of arts is readily facilitated.

While an embodiment of the invention has been described, bviously changes and variations are possible as would be aparent to one skilled in the art.

I claim:

**1**. In a ram including a cylinder, a piston within the cylinder, id an end wall closing off one end of the cylinder, a construcon providing for cushioning of the piston when it moves in ne direction to a position adjacent said end wall and peritting rapid return movement of the piston when moved in ie opposite direction, comprising

an annular groove extending about the piston including one side which is adjacent and an opposite side which is remote from said end wall,

a ring mounted within said groove with the periphery thereof disposed radially outwardly of the periphery of the piston and against the inside of the cylinder, said ring being loosely mounted in said groove whereby it is axially shiftable within the groove,

fluid passage means connecting the end of the piston which faces said end wall of the cylinder with said groove, and

a port in the ram cylinder for the supply and exhaust of fluid to said ram communicating through said groove and said fluid passage means with said end of the piston when said piston is adjacent said cylinder end wall and said ring is against said one side of the groove,

said port being closed off from said end of the piston with said ring against said opposite side of the groove.

**2**. The ram of claim **1**, wherein said piston has a recess indented inwardly from its said end which faces said end wall, and said fluid passage means includes said recess.

**3**. The ram of claim **1**, which further comprises metering passage communicating with said end of said piston and joining with the side of the piston at a point located toward the piston's opposite end from the location of said groove.

**4**. The ram of claim **3**, wherein a fluidtight sealing annulus is provided which extends about said piston and which is located toward said opposite end of the piston from the point where said metering passage means joins with the side of the piston.

**5**. A double-acting ram as claimed in claim **1**, which includes an opposite end wall closing off the opposite end of the cylinder, said piston having an end opposite its said one end which faces said opposite end wall, another annular groove extending about the piston adjacent said piston's opposite end, said other groove including one side which is adjacent and an opposite side which is remote from said opposite end wall, another ring mounted within said other groove with the periphery thereof disposed radially outwardly of the periphery of the piston and against the inside of the cylinder, said other ring being loosely mounted in said other groove whereby it is axially shiftable within said other groove, a second fluid passage means connecting said opposite end of the piston with said other groove, and another port in the ram cylinder for the supply and exhaust of fluid to said ram, said other port communicating through said other groove and said second fluid passage means with said opposite end of the piston when said piston is adjacent said opposite cylinder end wall and said ring is against said one side of the other groove, said port being closed off from said opposite end of the piston with said ring against said opposite side of said other groove.

**6**. The ram of claim **5**, which further comprises a fluidtight sealing annulus extending about the piston at a location intermediate said first and said other groove.

**7**. The ram of claim **6**, which further comprises metering passage means communicating with said opposite end of the piston and joining with the side of the piston at a point located between said annulus and said other groove.