

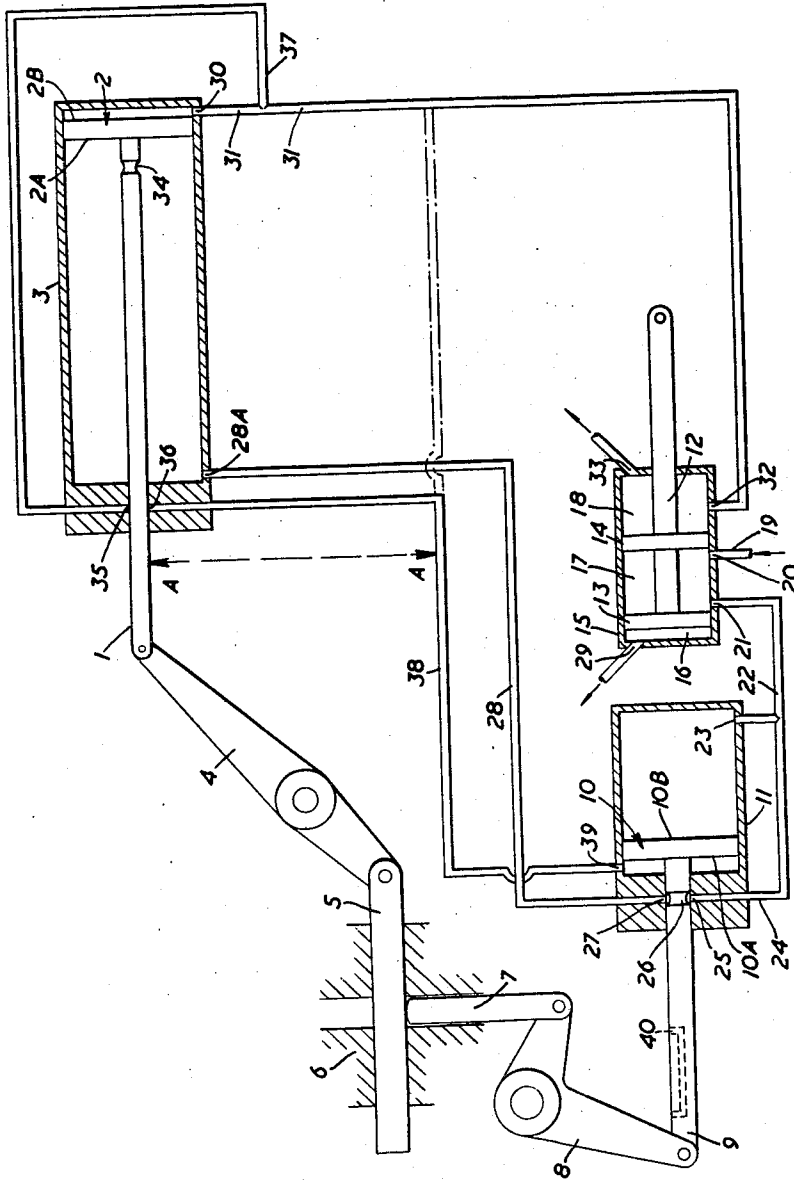
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SELF-LOCKING PNEUMATIC ACTUATORS

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SELF-LOCKING PNEUMATIC ACTUATORS

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This invention relates to hydraulic or pneumatic actuator systems.

In particular the present invention is concerned with actuator systems including a mechanical locking means for locking a ram of the system in one or the other of its rest positions.

It is an object of the present invention to ensure that the locking means is moved to its released position before the main ram is moved from the rest position in which the locking means is applied towards its other rest position.

Another object is to provide a pneumatic actuator with mechanical locking means which are automatically actuated by the actuating fluid pressure to lock the main ram when it reaches one of its end positions and to automatically unlock it at the beginning of its return stroke from said end position while minimizing wear and strain as well as power requirements of the locking mechanism.

According to the present invention there is provided an actuator system, wherein mechanical locking means are provided for locking a ram of the actuator system in one of its end positions, the mechanical locking means being arranged to be automatically moved into its locked position whenever the ram moves into said one position, and wherein the fluid pressure used for moving the ram into its other end position is arranged to effect the unlocking of the mechanical locking means before it causes the ram to move.

A further aspect of the invention provides an actuator system including a main ram unit, mechanical means for locking the main ram in one of its end positions and a second ram which is connected to operate the locking means, the ram of the second ram unit being moved to effect the locking of the locking means by a fluid pressure under the control of the main ram on attaining said end position, and the second ram having further control means whereby when moved to unlock the main ram by the admission of fluid pressure it subsequently causes said fluid pressure to be applied to the first ram to move it to its other rest position.

Preferably the first valve includes a fluid passageway on the main ram unit ram which is arranged, when the main unit ram is in said one position, to line up with ports included to a pressure fluid path leading to the cylinder of the second ram unit, thereby to complete said path to the cylinder.

Conveniently the further valve includes a passageway on the second ram unit ram which is arranged, when the latter is in the position which unlocks the locking means, to line-up with ports including in a further fluid path leading to the cylinder of the main ram unit thereby to complete the further fluid path to the main ram unit cylinder.

For a better understanding of the invention to show how the same may be carried into effect reference will now be made to the accompanying drawing which is a schematic diagram illustrating a pneumatically operated actuator system incorporating a pneumatically operated mechanical lock.

The actuator system includes a main ram piston rod 1 connected at one end to a piston 2 which is movable

within a cylinder 3 by means of high pressure air applied to one or the other of the sides 2A and 2B of the piston.

The ram rod 1 is connected by a pivoted member 4 to a mechanical locking mechanism including a baulk rod 5 which is slidable within a suitable guide schematically indicated at 6. The detent or locking element 7 of the locking mechanism is constituted by a baulk roller or latch 7 which is connected via a crank member 8 to one end of a locking rod 9, whose other end is connected with a piston 10 which is slidable within a further cylinder 11. The application of high-pressure air to one or the other of the sides 10A and 10B of the piston 10 is controlled by means of a selector valve unit including a valve member 12 having two lands 13 and 14 which is slidable within a valve housing 15, the lands 13 and 14 effectively dividing the housing 15 into three separate sections 16, 17 and 18. The high-pressure air supply is fed to the interior of the housing 15 via a suitable supply conduit 19 which connects with a port 20 in the housing wall.

For convenience of explanation it will be presumed that initially the locking mechanism is in its off position as is shown in the drawing; that the ram piston 2 is retracted as is shown in the drawing and that the ram rod 9 in its extended position as is shown in the drawing. In addition it will be assumed that the selector valve 12 is in the position indicated in the figure. In this position of the valve 12 the high-pressure air supply is fed from the conduit 19, via the port 20, the section 17, a port 21 in the housing 15, conduit 22 and a port 23 into the interior of the housing 11 so as to hold the piston 10 in the position shown in the drawing. In addition, the high-pressure air supply communicates with the interior of the cylinder 3 by way of the conduit 22, a conduit 24, a port 25 in the housing 11, a groove 26 in the ram rod 9, a second port 127 in the housing 11 and a conduit 28 which connects via a port 28A with the interior of the ram cylinder 3, the pressure being applied to the piston side 2A so as to hold the ram piston rod 1 in the position shown. At the same time the chamber 16 of the selector valve housing is vented to atmosphere via the exhaust duct 29 and the non-pressurised side 2B of the ram piston 2 is vented to atmosphere via a port 30 connecting with conduit 31 which communicates with a port 32 opening into the section 18 of the housing 15 and port 33 which vents to the atmosphere.

In order to move the ram rod 1 towards its extended position the selector valve 12 is moved to its other end position so that the land 14 moves to the right in the figure of the port 32 and the land 13 moves to the right of the port 20. With the selector valve in this position the right-hand of the ram cylinder 11 is vented to atmosphere via the port 23, the conduit 22, the port 21, the chamber 16 and the vent port 20. The interior of the ram cylinder 3 is vented to atmosphere via the port 28A, the conduit 28, the port 27, the channel 26, the port 25, the conduit 24, the conduit 23, the port 21, the chamber 16 and the port 29 to atmosphere, and high-pressure air from conduit 19, is fed via the ports 20 and 32, the conduit 31 and the port 30 into the ram cylinder 3 to exert pressure on the face 2B of the piston 2 to cause the ram piston rod 1 to move to its extended position. At this stage the branch 37 of line 31 is blocked by the piston rod 1. The outward movement of the ram piston rod 1 causes the baulk rod 5 to be withdrawn from the path of the latch 7 until, when the ram 1, 3 is fully extended, the locking element 7 is able to move into the path of the rod 5, at the same time a groove, 34 provided in the ram rod 1 aligns with two ports 35 and 36 in the ram cylinder 3, thus admitting this position high-pressure air via the conduit 31, a branch conduit 37

leading from the conduit 31, the port 35, the groove 34, the port 36, conduit 38 and a port 39 into the left-hand end of the ram cylinder housing 11, to exert pressure against side 10A of the piston 10 to move the latter towards the right thereby moving the rod 9 inwardly into its retracted position. The inward movement of the rod 9 moves, via the crank 8, the latch 7 into the path of the baulk rod 5 thereby locking the ram 1, 3 in its extended position. When the locking rod 9 is in its corresponding retracted position, a venting duct 40 lines up with the port 27 so as to maintain the venting of the interior of the ram cylinder 3 to atmosphere to prevent pressure build-up by leakage past the piston 2.

When it is required to return the ram 1, 3 into its retracted position the selector valve 12 is returned to the position shown in the drawing. On moving the selector valve the supply of high pressure air into the conduit 31 is cut off, so that the application of pressure on the sides 2B and 10A of the pistons 2 and 10 is removed. At the same time the side 2B of the piston 2 is vented to atmosphere via the port 30, the conduit 31, the port 32, the housing section 18 and the port 33. In addition, the side 10A of the piston 10 is vented to atmosphere via the port 39, the conduit 38, the port 36, the groove 34, the port 35, the conduit 37, the conduit 31, the port 32, the chamber section 18 and the port 33.

High pressure air exerts pressure against the piston side 10B via the port 20, the chamber section 17, the port 21, the conduit 22, and the port 23.

Since the ram 9, at this stage is in its retracted position the groove 26 is not aligning with the ports 25 and 27 so that the high pressure supply cannot be applied via the path previously described into the interior of the cylinder 3 to exert pressure on the piston side 2A. In other words, bearing in mind that both sides of the piston 2 are vented—in the manner described—to atmosphere, it will be apparent that the ram 1 remains in its retracted position.

On applying the high pressure to the piston side 10B the ram rod 9 moves to its extended position, simultaneously withdrawing the latching or locking element 7 back to the released position shown in the figure. While the element is moved out of the path of the rod 5, the vent 40 moves out of alignment with the port 27, and when the element 7 is clear of the path of the rod 5 the groove 26 aligns with the two ports 25 and 27 thereby completing the high pressure supply path to the interior of the ram cylinder 3 to exert pressure on the piston side 2A. The piston 2 is then moved thereby retracting the ram rod 1.

So long as the selector valve is maintained in the position indicated in the drawing the ram rod 1 is maintained in its retracted position and the locking mechanism is maintained in its off position.

It will be understood that in a practical form of the above described system many of the conduits would be constituted by ducts or the like in the walls of the various cylinder housings.

Furthermore, the housing 11 and the housing 15 could be incorporated in a common valve body.

In a particular application in which the ram 1 is of the kind termed a non-feed back ram, the branch conduit 37, the ports 35 and 36 and the section of the conduit 38 extending from A—A in the figure is replaced by a conduit or duct B shown in dashed lines in the figure.

What we claim is:

1. A self-locking fluid-pressure-operated actuator, having a ram cylinder and a piston movable in said cylinder between a first and a second relative position, a baulk element operatively connected to said ram to be moved from a first to a second position as said piston moves from said first to said second relative position and vice versa, a latch member movable, when said baulk element is in its first position, between a locking position in which it prevents the baulk member from moving to-

wards its second position, and a free position in which it permits such movement of the baulk member, a locking ram operatively connected to the latch member and having a locking ram cylinder and a piston movable therein, a selector valve for connection to a fluid-pressure supply, said valve being movable between a first position in which it establishes connection between such supply and a first service line supplying fluid pressure to the locking ram for moving the latch member to its free position, said first service line having a branch leading to one end of the main ram cylinder for permitting the admission of fluid pressure to move the main ram piston to its said first position, and a second position in which it establishes connection between said supply and a second service line leading to the other end of the main ram cylinder, for permitting the admission of fluid pressure to move the main ram piston to its second position, said second service line having a branch leading to the locking ram cylinder for the supply thereto of fluid pressure to move the latch to said locking position, and said branch of the first service line including a cut-off valve means operatively connected with the latch member to permit fluid to pass through said branch of the first line only when the latch member is in said free position.

2. An actuator as claimed in claim 1, wherein the branch of said second service line includes a latch-locking valve means operatively connected with the baulk member to only permit passage of fluid through said branch of the second service line when said baulk member is in said first position.

3. A self-locking pneumatic actuator, comprising a main ram cylinder having a peripheral wall and two end walls, a piston movable in said cylinder between a first and a second position, output means including a piston rod attached to said piston and extending through a bore in one of said end walls, a latch member movable into and out of a position of locking engagement with said output means when said piston is in said first and second position, latch-actuating means including a locking cylinder having a peripheral wall and two end walls, a locking piston movable in said locking cylinder between a locking position in which said latch member is in such locking engagement, and a free position, means operatively connecting the locking piston to the latch and including a locking-piston rod extending through a bore in one of the end walls of the locking cylinder, a wall having a bore through which the locking piston-rod passes, and having a passage so arranged as to traverse said bore thereof and be normally closed by the piston rod of the locking piston, a two-position selector valve having a pressure-inlet port, a first and a second service port, and atmospheric port means, and a valve element for selectively connecting one of the service ports to the inlet and the other to the atmospheric port means when the selector valve is in one position and vice versa when the selector valve is in the other position, a first service line leading from said first service port to one end of said locking cylinder for the admission of fluid to effect withdrawal of the latch, and also leading from said first service port to one end of said passage, an actuator line leading from the other end of said passage to one end of the main cylinder for the admission to said main cylinder of fluid to move the main piston to its second position, the piston rod of the locking piston being provided with first port means which, when the locking piston is in the free position removes the closure of said passage, and a second service line having a first branch leading from the second service port to the main cylinder for supplying thereto fluid to move the main piston to its first position and a second branch leading from said second service port to the locking cylinder for the supply of fluid to the locking cylinder to urge the latch member to its locked position.

4. An actuator as claimed in claim 3 including a fur-

ther wall having a bore through which the main ram piston rod passes, said second branch of the second service passage extending through said further wall across said bore so as to be normally closed by said main-ram piston rod, said main ram piston rod having a port so arranged as to open said normally closed branch of the second passage in said further wall when the main ram piston is in its first position.

5. An actuator as claimed in claim 4, wherein said further wall is constituted by said end wall of the main ram cylinder. 10

6. An actuator as claimed in claim 3, wherein said passage is arranged in said end wall of the locking-ram cylinder.

7. An actuator as claimed in claim 3, wherein the 15

locking piston rod is provided with second port means which when the locking piston is in the locked position, vent that end of the passage which is connected to the main cylinder by said first service line.

References Cited in the file of this patent

UNITED STATES PATENTS

1,085,964	Briggs -----	Feb. 3, 1914
1,189,251	Harden -----	July 4, 1916
2,130,618	Gnavi -----	Sept. 20, 1938
3,003,472	Ferris et al. -----	Oct. 10, 1961

FOREIGN PATENTS

384,715	Germany -----	Nov. 5, 1923
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