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ACTUATOR LOCK MECHANISM

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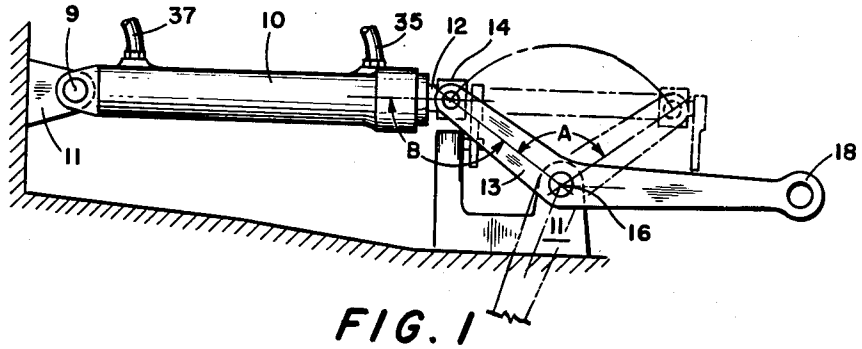


FIG. 1

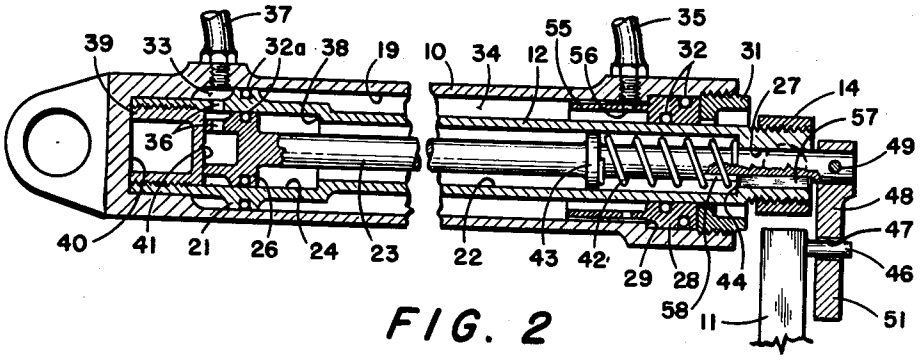


FIG. 2

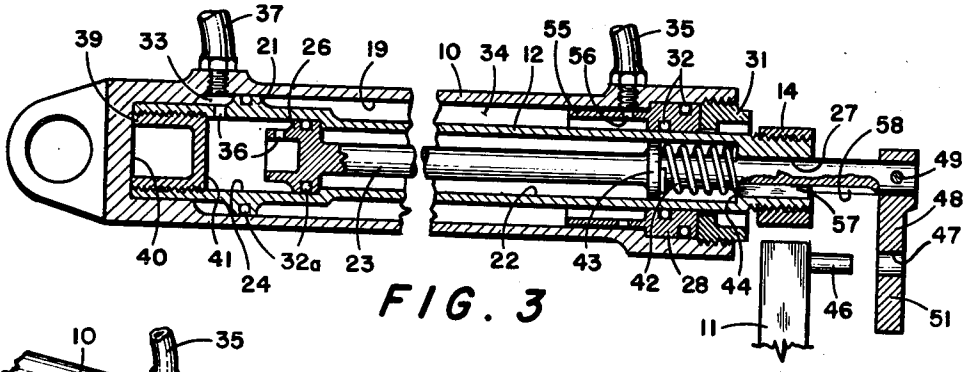


FIG. 3

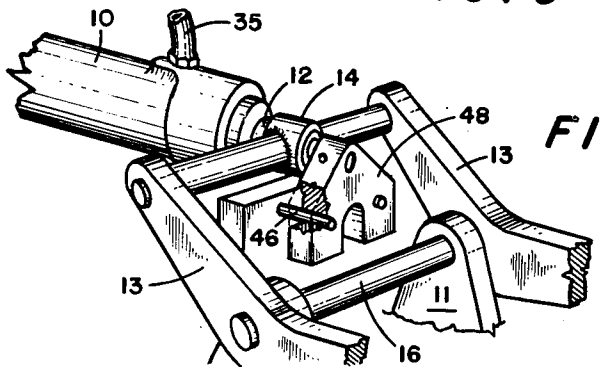


FIG. 4

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ACTUATOR LOCK MECHANISM

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5 Claims. (Cl. 121—40)

This invention relates to actuators in general and more particularly to a new and improved actuator lock mechanism adapted to lock the actuator in one extreme position of its stroke.

It is an important object of this invention to provide an actuator lock mechanism which is light weight and dependable in operation.

It is another important object of this invention to provide a combination actuator and lock therefor which locks the actuator in one extreme position of its stroke and which is released by the pressure fluid used to operate the actuator.

It is still another object of this invention to provide an actuator including relatively movable piston and cylinder members wherein a lock plunger is mounted in the piston member for axial movement relative thereto in such a manner that the piston member is releasably locked in one extreme position of its stroke.

Further objects and advantages will appear from the following description and drawings, wherein:

Figure 1 is a side elevation of an actuator incorporating a lock mechanism according to this invention;

Figure 2 is a side elevation in longitudinal section showing the actuator and lock structure with the elements in the locked position;

Figure 3 is a view similar to Figure 2 showing the position of the elements in the unlocked position; and,

Figure 4 is a fragmentary perspective view of the latch portion of the lock mechanism.

Referring to the drawings, an actuator incorporating a lock mechanism according to this invention is provided with a cylinder **10** pivotally connected at one end as at **9** to a base or frame **11** and provided with a piston tube **12** extending from the other end. The piston tube **12** is pivotally connected to a load arm **13** by a trunnion member **14** in such a manner that axial movement of the piston tube rotates the load arm around a pivot **16** on the frame or base **11**. The load arm **13** is provided with a pivot bore **18** to which a load can be connected. The various elements are shown in solid in Figure 1 with the piston tube **12** in the left hand extreme position of its stroke, and in phantom with the piston tube in the right hand extreme position of its stroke. When the piston tube **12** moves between the two extreme positions, the load arm **13** rotates around the pivot **16** through an angle "A."

Referring to Figures 2 and 3, the piston tube **12** is formed with a piston head **21** which moves along a cylinder wall **19** formed in the cylinder **10**. The right or outer end of the piston tube **12** is supported by a gland member **28** which is mounted in the right end of the cylinder **10** against a shoulder **29** by a gland nut **31**. Thus the piston tube **12** is axially movable within the cylinder **10** between a left hand extreme position wherein the left end of the piston tube **12** engages a radial wall **40** formed in the cylinder **10** and a right hand extreme position wherein the piston head **21** engages a skirt portion **55** formed on the gland member **28**.

The piston tube **12** is provided with a first axial bore **22** and a second larger coaxial bore **24** through which a lock plunger **23** projects. A piston head **26** formed on

the lock plunger **23** engages the wall of the second bore **24** to laterally support the left end of the lock plunger **23** while the right end thereof is supported by a bearing portion **27** formed in the piston tube **12**. Thus the lock plunger **23** is carried by the piston tube **12** and is axially movable relative thereto between a left hand extreme position wherein the left end of the lock plunger **23** engages a radial wall **41** on a stop member **39** which is threaded into the end of the piston tube **12** and a right hand extreme position wherein the piston head **26** engages a shoulder **38** between the two bores **22** and **24**. The lock plunger **23** is normally maintained in its left hand extreme position by a spring **42** which extends between a collar **43** on the lock plunger **23** and a radial wall **44** on the piston tube **12**.

The gland member **28** is provided with a pair of seals **32** which prevent fluid leakage out of the cylinder **10** and the piston heads **21** and **26** are provided with fluid seals **32***a* which prevent leakage of fluid past the piston heads. Therefore, the cavity within the cylinder **10** is divided into two chambers **33** and **34** which are adapted to receive pressure fluid. It should be understood that the chamber **33** includes the zone around the piston tube to the left of the piston head **21** as well as the zone within the bore **24** to the left of the piston head **26**. Fluid communication is provided between these two zones through radial ports **36**. Therefore pressure fluid in the chamber **33** produces an axial force to the right on the piston head **26** as well as on the piston head **21**. However, pressure fluid in the chamber **34** only produces an axial force on the piston head **21** because the piston head **26** is not exposed to pressure fluid in this chamber. Pressure lines **37** and **35** provide a fluid connection between a source of pressure (not shown) and the two chambers **33** and **34** respectively. A port **56** formed in the skirt **55** to permit fluid to flow freely between the pressure line **35** and the chamber **34**. A suitable valve mechanism should be provided to selectively connect one of the chambers **33** or **34** to the source of pressure fluid and also connect the other chamber to a reservoir return.

The frame or base **11** is provided with a pair of stationary pins **46** which are parallel to the axis of the actuator when it is locked. These pins are proportioned to project through cooperating bores **47** formed in a latch member **48** which is in turn mounted on the end of the lock plunger **23** by a cross pin **49**. The various proportions are arranged so that the load arm **13** is inclined relative to the axis of the cylinder **10** when the piston **12** is in the left hand extreme position. In other words, the line through the center of the pivot **16** and the trunnion member **14** intersects the axis of the piston **12** to form an angle B which is substantially larger than 90°. Therefore, when the load arm **13** rotates from the left hand extreme position, which is the locked position shown in solid in Figure 1, to the phantom position, the initial movement of the piston tube **12** is inclined relative to its axis so that there is initially a vertical or normal component of movement. The pins **46** provide surfaces parallel to the axis of said piston which are engaged by the walls of the bores **47** and prevent such vertical or normal movement so long as they project through the cooperating bores **47** formed in the latch member **48**. Therefore, the load arm **13** cannot be rotated from the locked position while the lock plunger is in the left hand or locked position. It should be understood that the spring **42** holds the lock plunger **23** in this position when pressure fluid is not supplied to the chamber **33**. As soon as pressure fluid is supplied to the chamber **33** through the pressure line **37**, the lock plunger **23** moves to the right against the force of the spring **42** until the latch member **48** moves clear of the pins **46**. At this time the load arm **13** can rotate in a clockwise direction around

the pivot **16** under the influence of pressure fluid in the chamber **33**. This movement will continue until the piston head **21** engages the stop skirt **55** formed on the gland member **28** which limits its movement to the right.

When it is desired to operate the actuator to move the load arm **13** from the phantom position of Figure 1 back to the locked position, pressure fluid is introduced into the chamber **34** and the piston **12** moves to the left toward the position shown in Figure 2. The latch member **48** is provided with a lower portion **51** which engages the ends of the pin **46** as the piston approaches the locked position. This overcomes the force of the spring **42** and prevents the lock plunger **23** from moving axially with the piston **12** as the latter continues to the left. As soon as the piston rod **12** has moved to the left extreme position, the pins **46** are aligned with the cooperating bores **47** so that the force of the spring **42** can move the lock plunger to the left relative to the piston rod **12**. The elements then assume the position shown in Figure 2 at which time the actuator is again locked. A key **57** on the piston tube **12** projects into an axial groove **58** on the lock plunger **23** and prevents relative rotation between the two members so that bores **47** will always align with the pin **46**. Those skilled in the art will recognize that an actuator and lock according to this invention has many uses wherein the connected load must be mechanically locked in one position while being movable by the actuator to other positions.

Although a preferred embodiment of this invention is illustrated, it will be realized that various modifications of the structural details may be made without departing from the mode of operation and the essence of the invention. Therefore, except insofar as they are claimed in the appended claims, structural details may be varied widely without modifying the mode of operation. Accordingly, the appended claims and not the aforesaid detailed description are determinative of the scope of the invention.

I claim:

1. An actuator comprising cooperating piston and cylinder members axially movable relative to each other in response to pressure fluid, a load on a base with one portion constrained to move in a predetermined locus, one of said members being connected to said base and the other to said one portion of said load, lock means carried by said other member axially movable relative thereto between a locked position and an unlocked position and movable from said locked position to said unlocked position in response to said pressure fluid, spring means biasing said lock means toward said locked position, and a latch engageable by said lock means only when said lock means are in said locked position, said predetermined locus being inclined relative to the axis of said members when said latch and lock means are engaged, said latch and lock means preventing movement of said lock means and other member along said predetermined locus upon said engagement.

2. An actuator comprising cooperating piston and cylinder members axially movable relative to each other in response to pressure fluid, a load on a base with one portion constrained to move in a predetermined locus, one of said members being connected to said base and the other to said one portion of said load, lock means carried by said other member axially movable relative thereto between a locked position and an unlocked position and movable from said locked position to said unlocked position in response to said pressure fluid, spring means biasing said lock means toward said locked position, and a latch engageable by said lock means only when said lock means are in said locked position, said predetermined locus being inclined relative to the axis of said members when both said latch and lock means are engaged, said latch and lock means permitting movement of said lock means and other member only in a direction along the axis thereof upon said engagement.

3. An actuator comprising a cylinder member, a piston member in said cylinder member cooperating therewith to define a chamber adapted to receive pressure fluid and thereby produce relative axial motion between said members from a first to a second relative position, a load on a base with one portion constrained to move in a predetermined locus, one of said members being connected to said base and the other to said one position of said load, lock means carried by said other member axially movable relative thereto from a locked position to an unlocked position in response to pressure fluid in said chamber, spring means biasing said lock means toward said locked position, and a latch on said base engageable by said lock means only when said lock means is in said locked position and said members are in said first position, said predetermined locus being inclined relative to the axis of said members when said latch and lock means are engaged, said latch and lock means being proportioned to prevent movement of said lock means and other member along said predetermined locus upon said engagement.

4. An actuator comprising a cylinder, a piston in said cylinder cooperating therewith to define a chamber adapted to receive pressure fluid and thereby produces relative axial motion between said piston and cylinder from a first to a second relative position, said piston being formed with an axial passage, a lock plunger exposed to said chamber axially movable in said passage between a locked and an unlocked position, spring means normally maintaining said lock plunger in said locked position, said lock plunger being movable in response to said pressure fluid to said unlocked position, said cylinder being pivotally connected to a frame and said piston being pivotally connected to a load arm which is in turn pivoted on said frame, the proportions being arranged so that movement of said piston from said first position rotates said load arm around its pivot on said frame and moves the pivot of said piston on said load arm in a direction inclined relative to the axis of said piston, latch means operably connected between said lock plunger and frame providing a surface parallel to the axis of said piston adapted to prevent movement of said lock plunger and in turn said piston in said inclined direction only when said piston is in said first position and said lock plunger is in said locked position.

5. An actuator comprising a cylinder, a piston in said cylinder cooperating therewith to define a chamber adapted to receive pressure fluid and thereby produces relative axial motion between said piston and cylinder from a first to a second relative position, said piston being formed with an axial passage, a lock plunger exposed to said chamber axially movable in said passage between a locked and an unlocked position, spring means normally maintaining said lock plunger in said locked position, said lock plunger being movable in response to said pressure fluid to said unlocked position, said cylinder being pivotally connected to a frame and said piston being pivotally connected to a load arm which is in turn pivoted on said frame, the proportions being arranged so that movement of said piston from said first position rotates said load arm around its pivot on said frame and moves the pivot of said piston on said load arm in a direction inclined relative to the axis of said piston, a latch member on said lock plunger formed with a bore parallel to the axis of said piston, a stationary pin on said frame projecting into said latch member bore only when said piston is in said first position and said lock plunger is in said locked position, said pin preventing movement of said lock plunger and in turn said piston in said inclined direction when it projects into said latch member bore.

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