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F. J. MARTIN ET AL
ACTUATOR FINGER LOCK

2,887,091

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2 Sheets-Sheet 1

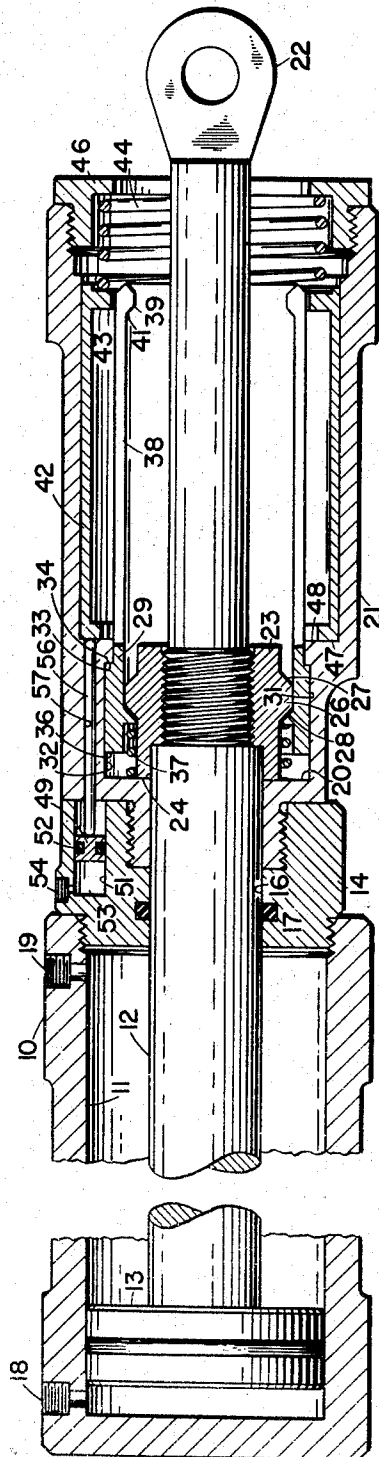


FIG. 1

INVENTORS
FRANCIS J. MARTIN
OLIVER W. SCHEFLOW
BY *W. W. Tail*
ATTORNEY

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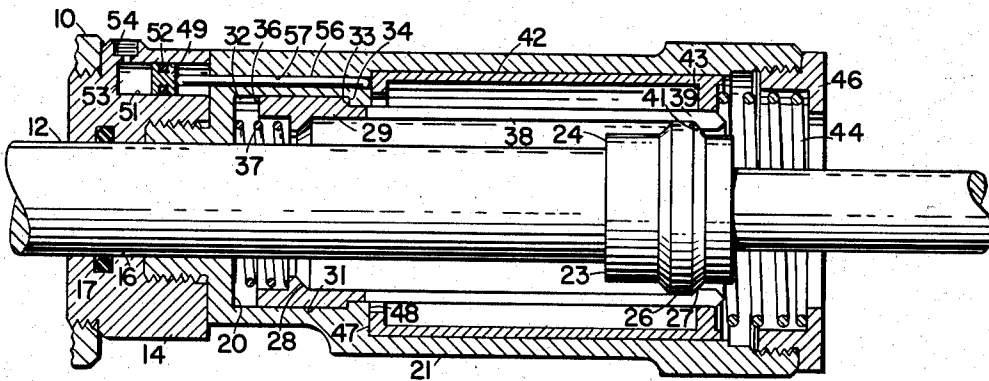


FIG. 2

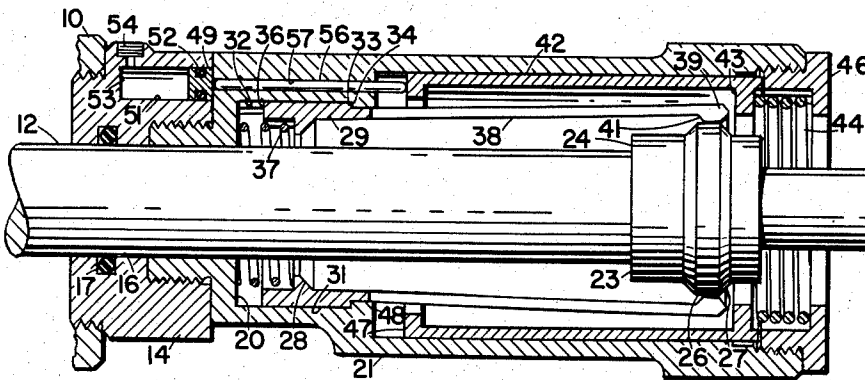


FIG. 3

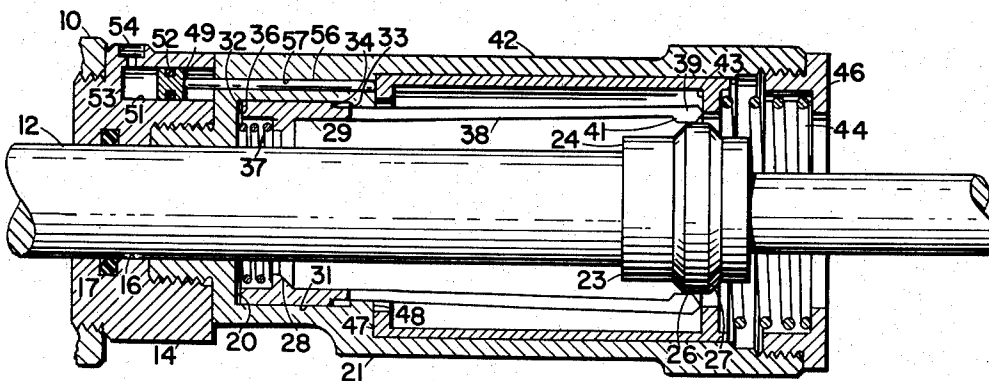


FIG. 4

INVENTORS
FRANCIS J. MARTIN
BY OLIVER W. SCHEFLOW
W. Schefflow
ATTORNEY

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2,887,091

ACTUATOR FINGER LOCK

Francis J. Martin and Oliver W. Scheffow, Kalamazoo, Mich., assignors to Cleveland Pneumatic Industries, Inc., Cleveland, Ohio, a corporation of Ohio

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7 Claims. (Cl. 121—38)

This invention relates generally to actuator lock mechanisms, and more particularly to a device normally limiting the stroke of an actuator and operable to permit full stroking of the actuator.

It is an important object of this invention to provide a lock device for axially movable shafts or the like which normally limits the stroke of the shaft and is operable to allow the shaft to move to a full stroke.

It is another object of this invention to provide an actuator and lock combination wherein the lock normally limits the stroke of the actuator and is operable to permit full stroking.

There is still another object of the invention to provide an actuator finger lock assembly which normally limits the stroke of the actuator to a predetermined length and which lock is operable to allow the actuator to operate through a stroke greater than said predetermined length.

It is still another object of this invention to provide in combination with an actuator a lock mechanism which normally limits the stroke of the actuator to a predetermined range, and is operable to allow the actuator to move beyond the predetermined range, wherein the lock mechanism automatically allows the actuator to return to the predetermined range under all conditions of lock operation.

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

Figure 1 is a side elevation partially in longitudinal section illustrating the preferred actuator lock mechanism in combination with the conventional piston and cylinder actuator;

Figure 2 is a longitudinal section of the lock mechanism alone showing the position of the elements when the lock mechanism limits the stroke of the actuator;

Figure 3 is a view similar to Figure 2 showing the position the elements assume when the lock mechanism is operated to permit full stroke of the actuator; and,

Figure 4 is a view similar to Figures 2 and 3 showing the position the elements assume as the actuator moves back into the limited stroke range.

Referring to the drawings in Figure 1, the preferred mechanism is shown in combination with the conventional piston and cylinder actuator including a cylinder 10 formed with a cylinder bore 11 and a cooperating piston rod 12 provided with a piston head 13. Threaded into the open end of the cylinder 10 is a connector 14 formed with a central bore 16 in which is mounted an O-ring type seal 17 which engages the piston rod 12. The cylinder 10 is provided with fluid ports 18 and 19 which connect the left and right ends respectively of the cylinder to a fluid pressure system (not shown) in the conventional manner. When fluid under pressure is supplied to the port 18 and the port 19 is connected to the exhaust or reservoir, the piston head 13 moves to the right and, conversely, when the opposite fluid connections are made, the piston moves to the left. This actuator forms no part of the invention except insofar as it cooperates

with the lock mechanism described below, and is merely shown as environment for the invention. It should be understood that the lock mechanism described can be used with any axially movable shaft or the like which has a predetermined stroke range.

Threaded on to the connecting member 14 is a tubular housing 21 which cooperates with the connecting member to form the housing assembly of the lock mechanism. The piston rod 12 extends through the housing 21 and is provided with a connector portion 22 adapted to be connected to an associated load. Threaded on the piston rod 12 within the housing 21 is an annular stop 23 which is formed with an end surface 24 engageable with a radial wall 20 in the housing 21 to act as a stop when the piston rod 12 is at the full left end of the stroke. Also formed on the annular stop 23 is a radial projection 26 having opposed conical inclined faces 27 and 28.

Positioned within the housing 21 is a lock sleeve 29 having a cylindrical outer surface 31 which is guided in a bore 32 in the housing 21 for axial movement. The bore 32 terminates in a depending shoulder 33 which is engageable with a radial shoulder 34 on the lock sleeve 29 to limit the travel of the lock sleeve to the right to the first position shown in Figures 1, 2 and 3. The lock sleeve is also formed with an end face 36 which is engageable with the wall 20 to limit axial movement of the lock sleeve to the left. A coil spring 37 extends between the wall 20 and the lock sleeve 29, and resiliently urges the sleeve to its first or normal position.

Extending to the right from the lock sleeve 29 are a plurality of symmetrically arranged flexible fingers 38, each of which is provided with a depending projection or head 39 at its right end. Each head 39 is formed with a conical stop surface 41, which is positioned to engage the conical face 27 and limit axial movement of the piston rod 12 to the right to the intermediate position, as shown in Figure 2, when the fingers 38 are in the unstressed position. To prevent the engagement between the surfaces 27 and 41 from deflecting the fingers 38 radially, an operator tube 42 is positioned within the housing 21. The tube 42 is provided with a depending annular shoulder 43 which is engageable with the outer surfaces of the fingers 38 adjacent to the projections 39 when the operator tube 42 is in the normal locked position shown in Figures 1 and 2. The operator tube 42 is axially moved relative to the housing 21 between the locked position shown in Figures 1 and 2 and an unlocked position shown in Figure 3 wherein the shoulder 43 is displaced from the fingers 38. A second coil spring 44 extends between the end of the operator tube 42 and a spring retainer 46 threaded on the housing 21, and operates to normally maintain the operator tube 42 to the locked position wherein the left end 47 engages a shoulder 48 formed on the housing 21.

Those skilled in the art will recognize that the piston rod 12 cannot move from the retracted position of Figure 1 beyond the intermediate position of Figure 2 when the operator tube 42 is in the first or locked position, since the two surfaces 27 and 41 will engage at the right end of the limited stroke to prevent movement of the piston rod 12 to the right beyond the position shown in Figure 2.

In order to release the lock so that the piston rod 12 will be free to move beyond the position in Figure 2, a lock release mechanism is provided which is operable to move the operator tube 42 against the action of the spring 44. This mechanism includes a piston 49 positioned in a bore 51 formed in the connector member 14. An O-ring seal 52 on the piston 49 engages the surface of the bore 51, so that the piston 49 and the walls of the bore 51 cooperate to provide a fluid pressure chamber 53 adapted to be connected to a source of control pres-

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sure through a port 54. A pin 56 extends through a bore 57 in the housing 21 and engages the operator tube 42 on one end and the piston 49 on its other end. Therefore, when the piston 49 moves to the right under the influence of fluid pressure within the chamber 53, it causes the operator tube 42 to move to the right relative to the housing 21 against the action of the spring 44. The various elements are proportioned so that the movement of the operator tube 42 to the right causes the shoulder 43 to move beyond the end of the fingers 38, so that they are free to flex radially due to the engagement of the surface 27 and 41 to permit passage of the projection 26 beyond the projection 39, as shown in Figure 3. Therefore, whenever fluid under pressure is supplied to the chamber 53 through the port 54, the operator tube 42 is moved to the right to its unlocked position and the piston rod is free to move through its entire stroke; but whenever the operator tube 42 is in the normal locked position, the lock mechanism operates to limit the stroke of the actuator.

If the piston rod is beyond its limited stroke position wherein the projection 26 is to the right of the projection 39, and the operator tube 42 is in the locked position, engagement of the face 28 with the outer end of the projection 39 will cause the lock sleeve 29 to move to the left against the action of the spring 37 until the ends of the fingers 38 clear the shoulder 43, at which time the camming action of the conical surface 28 radially deflects the fingers 38 and permits passage of the projection 26. Therefore, the lock mechanism is arranged so that the piston rod 12 can move back into the limited range even though the operator tube 42 is in the locked position, but the piston rod can only move beyond the limited range when the operator tube is moved to the unlocked position under the influence of the pressure in the chamber 53. In other words, the unlocking operation can be achieved only by movement of the operator tube 42 to the right by the piston 49, but the stop 23 can automatically release the lock mechanism by moving the lock sleeve 29 to the left under the influence of engagement with the conical face 28 to permit return of the piston rod 12 to positions in the limited range.

Although the 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 descriptions are determinative of the scope of the invention.

We claim:

1. A lock mechanism for a shaft axially movable between extended and retracted positions comprising a housing, a pair of elements in said housing each resiliently urged to a locked position, said elements cooperating when both of them are in said locked position to engage said shaft and prevent axial movement thereof in one direction beyond a predetermined intermediate position, one of said elements being axially movable from its locked position in said one direction and the other of said elements being axially movable from its locked position in the opposite direction, and power means connected to move said one element in said one direction to permit movement of said shaft in said one direction beyond said predetermined position.

2. A lock mechanism for a shaft axially movable between extended and retracted positions comprising a housing, a pair of elements in said housing each resiliently urged to a locked position, said elements cooperating when both of them are in said locked position to engage said shaft and prevent axial movement thereof in one direction beyond a predetermined intermediate position, one of said elements being axially movable from its

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locked position in said one direction and the other of said elements being axially movable from its locked position in the opposite direction, power means connected to move said one element in said one direction to permit movement of said shaft in said one direction beyond said predetermined position, and a surface on said shaft operable to engage said other element and move it in said other direction when said shaft moves in said other direction past said predetermined position.

3. A lock mechanism for a shaft axially movable between extended and retracted positions comprising a housing, a lock sleeve in said housing axially movable relative thereto between first and second positions formed with stop surfaces normally positioned to engage said shaft and prevent movement thereof toward said extended position beyond a predetermined intermediate position and movable to positions permitting movement beyond said intermediate position, an operator in said housing axially movable relative thereto between a locked position and an unlocked position, said operator providing an abutment engageable with said sleeve preventing radial movement of said stop surfaces only when said operator is in said locked position and said sleeve is in said first position, and power means connected to move said operator to said unlocked position.

4. In combination an actuator including a fixed member and an output element axially movable between extended and retracted positions, a housing on said fixed member, a pair of elements in said housing each resiliently urged to a locked position, said elements cooperating when both of them are in said locked position to engage said output element and prevent axial movement thereof in one direction beyond a predetermined intermediate position, one of said elements being axially movable from its locked position in said one direction and the other of said elements being axially movable from its locked position in the opposite direction, power means connected to move said one element in said one direction to permit movement of said output element in said one direction beyond said predetermined position, and a surface on said output element operable to engage said other element and move it in said other direction when said output element moves in said other direction past said predetermined position.

5. A lock mechanism for a shaft axially movable between extended and retracted positions comprising a housing, a lock sleeve in said housing axially movable relative thereto between first and second positions formed with radially movable stop surfaces normally positioned to engage said shaft and prevent movement thereof toward said extended position beyond a predetermined intermediate position and radially movable to positions permitting movement beyond said intermediate position, an operator in said housing axially movable relative thereto between a locked position and an unlocked position, said operator providing an abutment engageable with said sleeve preventing radial movement of said stop surfaces only when said operator is in said locked position and said sleeve is in said first position, power means connected to move said operator in said unlocked position, a camming face on said shaft engageable with said sleeve and operable to move it to said second position and cam said stop surface away from said normal position upon movement of said shaft past said intermediate position in a direction toward said retracted position.

6. A lock mechanism for a shaft axially movable between extended and retracted positions comprising a housing, a sleeve in said housing normally in a first position and axially movable in one direction to a second position, an operator in said housing normally in a locked position and axially movable in the opposite direction to an unlocked position, said sleeve providing a radially movable stop surface normally in an engagement position wherein it is engageable with said shaft to prevent movement thereof in said one direction be-

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yond a predetermined intermediate position, an abutment on said operator engageable with said sleeve preventing radial movement of said stop surface from said engagement position only when said operator is in said locked position and said sleeve is in said first position, and power means connected to move said operator to said unlocked position.

7. An actuator lock combination comprising cooperating piston and cylinder members axially movable relative to each other between retracted and extended positions, a housing on one of said members, a sleeve in said housing formed with a plurality of axially extending flexible fingers, each of said fingers being formed with a radially extending stop surface normally positioned to engage the other of said members and prevent movement thereof toward said extended position beyond a predetermined position, said sleeve being resiliently maintained in a first position and axially movable to a second position, an operator axially movable in said hous-

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ing between a locked position and an unlocked position, a shoulder on said operator engageable with said fingers only when said sleeve is in said first position and said operator is in said locked position to maintain said stop surfaces in said normal position, power means connected to move said operator to said unlocked position, and a cam on said other member operable to engage said sleeve and move it to said second position when said other member moves past said predetermined position toward said retracted position.

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