

June 13, 1961

A. M. STOTT

2,988,066

DOUBLE ACTING ACTUATOR

Filed April 28, 1960

2 Sheets-Sheet 1

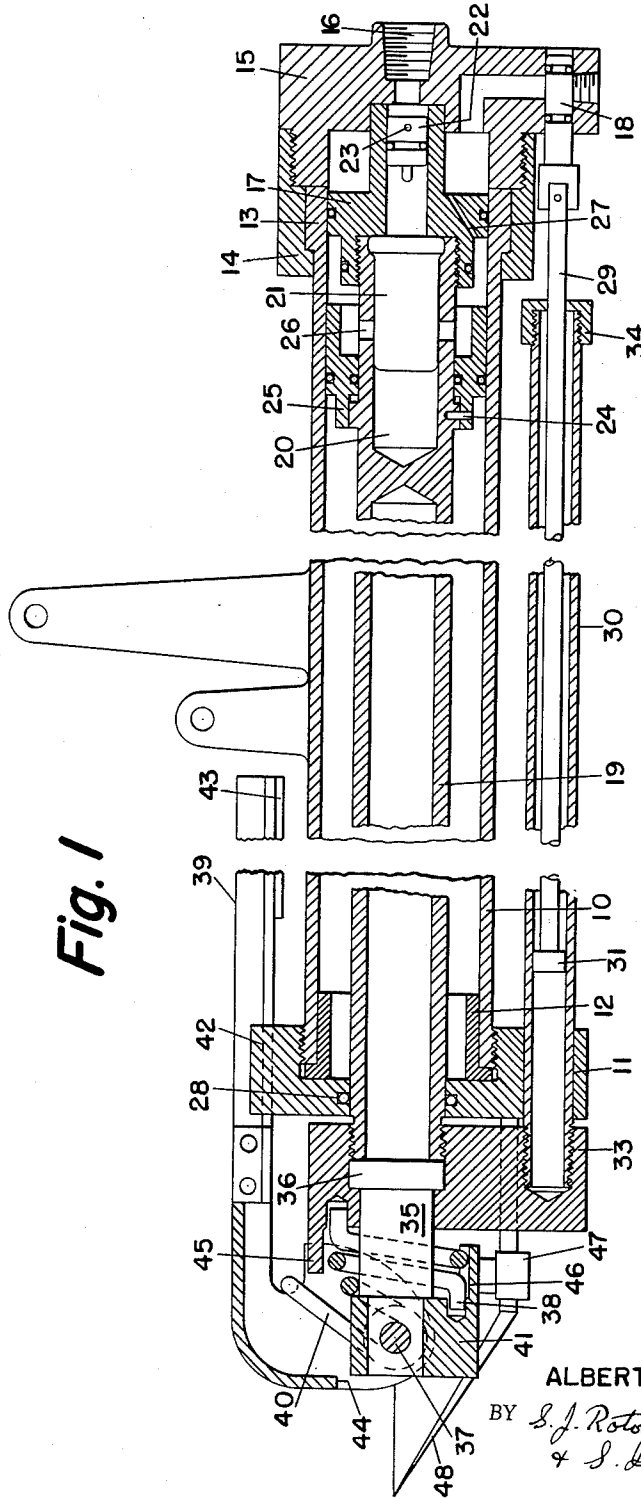


Fig. 1

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Fig. 2

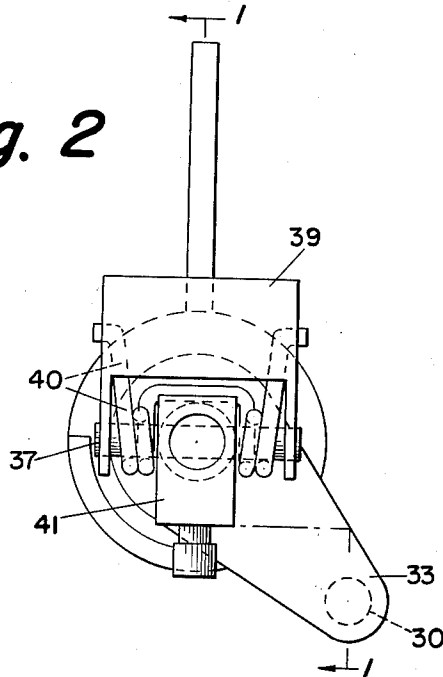
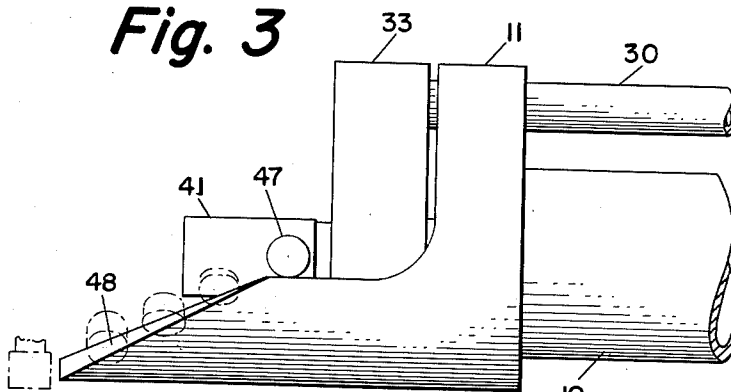


Fig. 3



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DOUBLE ACTING ACTUATOR

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4 Claims. (Cl. 123-24)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

This invention relates to actuators such as are motivated by a gas pressure incident to the firing of an explosive cartridge. Its purpose is to provide an improved actuator which is capable of effecting a complex movement of a load engaging arm or member.

Previously available actuators generally have a load engaging member which is constrained to move linearly, rotatively or reciprocally. In certain applications, such as the positioning of an airman's legs prior to his ejection from an aircraft, a more complex motion of the load engaging member is required. The present invention accomplishes this result by means of an apparatus including a double acting thruster and a spring biased mechanism, this mechanism being operable in response to movement of the thruster piston to move a load engaging arm to the front of the airman's legs, thence to a position where the legs are properly located, and thence to a position where the arm does not interfere with the movement of the legs.

The invention will be better understood from the following description when considered in connection with the accompanying drawings and its scope is indicated by the appended claims.

Referring to the drawings:

FIG. 1 is a sectional view showing various details of the improved actuator,

FIG. 2 is an end view of the actuator, and

FIG. 3 depicts the relation between a cam and a roller which cooperate in the movement of the load engaging arm.

As indicated by FIG. 1, the actuator includes a cylinder 10 having an end cap 11 within which is a timing sleeve 12. At the other end of the cylinder 10 is an external shoulder 13. Fastened to this end of the cylinder by a collar 14 and the shoulder 13 is an inlet end cap 15. The cap 15 has an inlet 16 which leads to the interior of the main piston 17. It also has an exhaust valve 18 for venting the operating gas ahead of the piston 17 on its return stroke.

The piston 17 is fixed to a rod 19 which has at its end a firing chamber 20 adapted to contain an explosive cartridge 21. A firing pin 22 actuated by a gas pressure applied through the inlet 16 is fixed to the piston 17 by a shear pin 23.

Also fixed to the rod 19 by a shear pin 24 is a floating piston 25, and through firing chamber wall is a port 26. Another port or gas metering aperture 27, extending through the piston 17, completes a passageway between the firing chamber 20 and the inlet side of the piston 17. A seal ring 28 is located between the rod 19 and the end cap 11. Similar seal rings are located between other relatively movable parts.

The valve 18 has an operating rod 29 which extends into a tube 30 and has a collar 31 at its inner end. The tube 30 has an end cap 34, extends through the end cap 11 and is threaded into a member 33 which is threaded onto the outer end of the piston rod 19.

In the operation of the above-described thruster, a gas

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pressure applied through the inlet 16 to the firing pin 22 severs the shear pin 23 and drives the firing pin 22 against the primer of the cartridge 21. Operating gas generated by the firing of the cartridge 21 passes through ports 26 and 27 to the cylinder 10 and moves the pistons 17 and 25 toward the other end of the cylinder. As these pistons near the end of the cylinder, the floating piston 25 strikes the timing sleeve 12, the shear pin 24 is severed, and the piston 25 is moved to a point where the port 26 is on the opposite side of the piston and the gas emanating from it functions to reverse the motion of the piston. Just before this reversal occurs, the collar 31 engages an end cap 34 on the tube 30, opening the valve 18 and exhausting the gas ahead of the piston on its return stroke.

This motion of the piston actuates a mechanism which is supported on the outer end of the piston through the medium of the member 33. This mechanism includes a spindle 35 which is rotatable in the member 33, has a collar 36 on its inner end, has a pin 37 in its outer end, and is rotatively biased by a spring 38. Pivoted on the pin 37 is an arm or load engaging member 39 which is influenced by a spring 40 to move to a position perpendicular to the axis of the rod 19. The spring 38 has one end attached to the non-rotatable member 33 and the other end attached to a member 41 which is fixed to the spindle 35 by the pin 37.

In its illustrated standby condition, the bar 39 is locked to the end cap 11 by means of a slot 42 which is attached to or forms a part of the end cap 11. When the piston nears the end of its forward stroke, the load engaging member 39 is released from the slot and moved by the spring 40 to a position perpendicular to the axis of the rod 19. The device is so mounted that this movement brings the shin pad 43 on the arm 39 in front of one leg of the airman where it is terminated by engagement between a stop 44 and the member 41. Thereafter, the arm 39 is rotated about the axis of the rod 19 through an angle of 90°. This rotational movement properly positions the airman's leg and is completed upon engagement of a stop 45 with a stop 46.

Rotation of the arm 39 to its original angular position with respect to the axis of the rod 19 is effected during the return stroke of the thruster. This is accomplished by means of a roller 47 which is fixed to the member 41 and engages a cam 48. This cam is fixed to the end cap 11 which is threaded onto the end of the cylinder 10 as previously indicated.

In connection with the foregoing description, it is to be understood that the above-described actuator is utilized in a pair, one for each leg of the airman.

I claim:

1. In an actuator, the combination of a cylinder having at one end an exhaust valve and at the other end an internal timing sleeve, a main piston movable in said cylinder and having a gas metering aperture extending therethrough, a rod fixed to said main piston and extensible from said cylinder, said rod being hollowed out to form at one side of said piston a cartridge firing chamber having a gas outlet completing a passageway from said chamber through said metering aperture to the opposite side of said piston, a floating piston attached to said rod at the opposite side of said gas outlet from said main piston and releasable upon contact with said timing sleeve for movement to the same side of said gas outlet as said main piston, and a control member movable by said rod upon the completion of said movement to open said exhaust valve.

2. In an actuator, the combination of a cylinder having at one end an exhaust valve and at the other end an internal timing sleeve, a main piston movable in said cylinder and having a gas metering aperture extending

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therethrough, a rod fixed to said main piston and extensible from said cylinder, said rod being hollowed out to form at one side of said piston a cartridge firing chamber having a gas outlet completing a passageway from said chamber through said metering aperture to the opposite side of said piston, a floating piston attached to said rod at the opposite side of said gas outlet from said main piston and releasable upon contact with said timing sleeve for movement to the same side of said gas outlet as said main piston, a control member movable by said rod upon the completion of said movement to open said exhaust valve, a first member movable with said rod and rotatable about the axis thereof, a second member movable with said rod and pivoted to said first member for rotation about an axis perpendicular to the axis of said rod, means biasing said first and second members to rotation of said first and second members to a predetermined angle.

3. In an actuator, the combination of a cylinder having at one end an internal timing sleeve, a main piston movable in said cylinder and having a gas metering aperture extending therethrough, a rod fixed to said main piston

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and extensible from said cylinder, said rod being hollowed out to form at one side of said piston a cartridge firing chamber having a gas outlet completing a passageway from said chamber through said metering aperture to the opposite side of said piston, a floating piston attached to said piston, a floating piston attached to said rod at the opposite side of said gas outlet from said main piston and releasable upon contact with said timing sleeve for movement to the same side of said gas outlet as said main piston, a control member movable by said rod upon the completion of said movement to open said exhaust valve, a load positioning arm and a mechanism operable by forward movement of said piston to move said arm successively in planes which are perpendicular to one another, the movement in each plane being limited to 90°.

4. An actuator according to claim 3 wherein a cam is arranged to return said arm through an angle of 90° in one of said planes upon the return movement of said rod.

References Cited in the file of this patent

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