APPARATUS FOR QUICKLY OPENING, DAMPING, HOLDING OPEN, AND CLOSING A HINGED CLOSURE MEMBER

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Filed: July 12, 1972
Appl. No.: 271,133

Foreign Application Priority Data
Dec. 7, 1971 France 71.43874

U.S. Cl. 49/379, 16/82, 16/51, 49/386
Int. Cl. E05F 1/00
Field of Search 49/379, 340, 386; 16/49, 16/51, 54, 58, 82, 84, 48.5

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ABSTRACT

Apparatus for quickly opening, damping, holding open and closing a hinged closure member such as a door, comprising a spring urging a door in an open direction, and a fluid operable jack the piston rod of which is hinged to a variable reduction lever linked to the door, and the jack and lever are connected to damping and locking systems.

5 Claims, 11 Drawing Figures
APPARATUS FOR QUICKLY OPENING, DAMPING, HOLDING OPEN, AND CLOSING A HINGED CLOSURE MEMBER

The invention relates to a device intended for the damping and holding in open position of a quick opening door.

Certain types of missiles are launched from sealed containers which simultaneously serve the function of the launching ramp.

During the launching sequence and before firing, the container front and rear doors must be very rapidly opened (a few tenths of a second).

The opening of these doors is remote controlled through explosive bolts associated with powerful springs mounted inside the container, thus driving the door in the opening direction with a force of great magnitude.

Under no circumstances should the door be allowed to rebound or to reclose during the time of the launching sequence. Therefore, the door should be locked in the open position. After the launching is completed, the door should be reclosed to seal the container and to protect its internal elements against outside environmental damage. The door reclosure can be performed either locally or through remote control.

The aforementioned conditions imply that such a device should have the following specifications:

It should provide efficient damping; i.e., quickly absorb a very large amount of energy (2,000 Joules in 0.3 seconds, for example) to avoid an undesired opening.

The end-of-travel should be gradually decelerated to avoid shocks and rebounds likely to damage the door and the locking device.

It should ensure complete immobilization of the door at the end of the opening travel, during the firing sequence and up to the moment when the unlocking order is given. This immobilization will be maintained irrespective to the external effects acting upon the system, such as missile take-off blast, green seas, squalls, etc.

It should enable the door to be reclosed, i.e., be capable of compressing the springs acting upon the door. It should be remotely controllable.

It should be contained within the external dimensions of the stand.

Currently known hydraulic devices allow the opening of a door with end-of-travel braking, holding in open position and then reclosure of the door. Such devices make use of a jack which ensures a motive function for the door. As a result, and due to the inertia involved, these devices do not provide very quick opening of the door.

Furthermore, locking in the open position should be perfect, regardless of the operating conditions, which is not the case with known devices.

The present invention achieves a device for opening and stably holding in open position a quick opening door meeting the above stated requirements.

The invention more particularly concerns a damping and open-position holding device for a quick opening door. The latter will be of the type featuring at least one spring causing the door to open, said device being characterized by the fact that it comprises a jack, the piston rod of which is hinged to a variable reduction lever connected to the door; the jack and the lever are associated with means allowing the opening motion to be decelerated, as well as with the devices for locking the door in the open position.

More precisely, the device according to this invention may incorporate a hydraulic jack fitted with an end-of-travel brake comprising a truncated cone-shaped end which penetrates into a diaphragm internal to the jack. The locking means may either consist of a hydraulic element which traps part of the fluid discharged during the damping, such as a controlled non-return valve, or a mechanical locking element of the locking hook type actuated by a hydraulic control unit.

The following description together with the appended drawings illustrate, as an illustrative example not intended to be exhaustive, an embodiment of a device in accordance with this invention.

FIG. 1 is a diagram of the automatic hydraulic equipment for door actuation.

FIGS. 2 and 3 illustrate the extreme positions of the linking elements and door.

FIGS. 4, 5 and 6 illustrate the "automatic hydraulic locking and reclosure" version in its various configurations.

FIGS. 7 and 8 illustrate the "mechanical locking and reclosure" version.

FIGS. 9 and 10 illustrate the "mechanical locking, hydraulic unlocking and reclosure" version.

FIG. 11 illustrates a sealed container launching ramp incorporating the present invention.

The advantageous apparatus of the present invention may be used for damping during opening, locking, and closing the front and rear doors or closure members of a missile container (which may also serve as a launching ramp) as illustrated in FIG. 11. The container and inventive apparatus comprise variable reduction lever 3 linked with door 1 of container 50 through yoke 4 having 1° of freedom. Damping cylinder 2 ensures that the movement of the door is damped during opening, that the door is locked in open position, and may reclose the door.

In FIG. 1, linking element A comprises lever 3, two sections of which are made integral with the container door through yoke 4, with 1° of freedom opposite this yoke; element 5 of the lever is detachable to retain the yoke in the lever, the latter being connected to the stand by a pin. The support includes a yoke and a duckbill 22 used only in the "mechanical locking" version.

Lever 3 is linked with actuating element B through piston rod 6. Element B consists of a hydraulic cylinder linked with the stand through pin 12; at the end-of-travel, the truncated cone-shaped end 8 of piston 7 penetrates into a diaphragm provided inside the cylinder, as shown in FIG. 3.

The jack is single or double acting depending on whether the locking is performed hydraulically or mechanically.

In the "hydraulic locking" version, the jack operation is ensured by a hydraulic control unit C connected to an oil supply and pressurizing system D1 or D2. The hydraulic control unit as shown in FIGS. 2-6, comprises

a block 10, mounted on the jack, including a non-return valve 10C which is calibrated to five bars and controlled by a two-direction hydrovalve 10H.

The block may be supplemented by a valve cali-
brated to 10 bars and fitted into the oil reservoir return line. This block is interconnected with both ends of the cylinder chamber by means of lines or ports. The oil feed and pressurization assembly consists either of an accumulator 13 capable of absorbing a very high instantaneous flow or a reservoir 17 collecting the oil upon door opening; it also allows feeding a hand-operated or motor driven oil pump 18 used for door reclosure.

The equipment operates as follows:
The door is caused to open by the bursting of an explosive bolt. At the time of bursting, the door is actuated in the opening direction up to its end-of-travel under the action of powerful springs. The door then pushes back lever 3 which acts upon piston 7, thus compressing the oil contained within the cylinder chamber including diaphragm 11 located on the opposite side of the piston from the piston rod. The oil flows through the diaphragm, the corresponding end port of the chamber, hydropulse 10H, non-return valve 10C calibrated to 5 bars, partly to the chamber recess containing the piston rod and partly through valve 19 calibrated to 10 bars towards accumulator 13 or reservoir 17. At the end-of-travel, the truncated cone shaped end 8 penetrates into the diaphragm and gradually decelerates the opening motion by fluid throttling.

The door locking is performed by non-return valve 10C which traps the fluid within the chamber recess containing the piston rod.

Unlocking and reclosure of the door are ensured by pump 18. When actuated, the latter discharges the pressurized fluid into hydropulse 10H which lifts valve 10C thus allowing the fluid trapped in the chamber recess, containing the piston rod, to return to the reservoir via valve 19.

Simultaneously, the displacement of hydropulse 10H applies the fluid to the face of the piston opposite rod 6.

Upon door reclosure, the hydropulse and the valves are returned to their original positions.

In the “mechanical locking” version, the chamber recess containing the piston rod is air vented. The other chamber recess is interconnected with oil accumulator 13.

A hinged duckbill 22 actuated by spring 20 permits the yoke of lever 3 to be latched at the end-of-travel, as shown in FIGS. 7–10.

The door reclosure is performed by a mechanical device which applies torque c upon the lever pin.

The opening procedure is identical to the preceding case. The oil compressed within the recess containing the diaphragm flows through the latter towards the accumulator. At the opening end-of-travel, the yoke of lever 3 is latched by the duckbill.

Unlocking takes place through manual action f upon the duckbill while reclosure is obtained by applying a torque c upon the lever.

In the “mechanical locking, hydraulic unlocking and reclosure” version, the mechanism is similar to the previous one with the exception of the following additional items: a hydropulse-jack assembly 21, a pressurized oil generator including reservoir 17 and hand-operated or motor driven pump 18.

Upon door opening, the hydropulse is in the rest position and the whole operating procedure takes place as described above.

The unlocking and reclosure of the door are achieved by starting the pump which discharges the pressurized oil into the hydropulse; the latter then lifts the duckbill and allows the oil to flow into the chamber recess containing the diaphragm, thus causing the door to close.

The present invention is applicable for use in sealed containers for missiles and in all devices requiring sudden opening and locking of a door-type closure element.

The herein described apparatus may be subjected to modifications involving the replacement of the mechanical or hydraulic elements by their technical equivalents. For example, the non-return valve 10C may be replaced by an electrovalve, whereas the hydraulic system may be replaced by a pneumatic system, the first stated however being preferable for use in missile containers.

What is claimed is:

1. Apparatus for quickly opening, damping and holding open a hinged closure member, comprising:
a hinge closure member and resilient means urging said closure member in an open direction;
a variable reduction lever linked to said closure member;
a fluid operable jack having a piston cylinder in which is mounted a movable, solid piston member which divides said cylinder into two chambers for containing fluid, said piston member attached to said variable reduction lever by a piston rod extending from one face of said piston member;
a truncated cone-shaped member extending from the other face of said piston member and cooperating with a passage which extends through a diaphragm located within said cylinder, for regulating fluid flow through said passage;
and means for locking said closure member in an open position by trapping fluid within one of said chambers.

2. The apparatus of claim 1 wherein the piston is moved toward the diaphragm leaving the larger of said chambers on the side of said one face of said piston member when the closure member is in open position.

3. The apparatus of claim 2 wherein said locking means comprises hydraulic means for trapping at least a portion of fluid in said larger chamber.

4. The apparatus of claim 3 wherein said hydraulic means comprises a non-return valve controlled by a dual direction hydropulse.

5. Apparatus for quickly opening, damping and holding open a hinged closure member, comprising:
a hinge closure member and resilient means urging said closure member in an open direction;
a variable reduction lever linked to said closure member;
a fluid operable jack having a piston cylinder in which is mounted a movable, solid piston member which divides said cylinder into two chambers for contacting fluid, said piston member attached to said variable reduction lever by a piston rod extending from one face of said piston member;
a truncated cone-shaped member extending from the other face of said piston member and cooperating with a passage which extends through a diaphragm located within said cylinder, for regulating fluid flow through said passage;
a spring loaded, hinged duckbill cooperating with said variable reduction lever for locking said closure member in an open position; and hydraulic means connected to said piston cylinder and associated with said duckbill, for coordinating the operation of said piston and said duckbill.