

April 5, 1960

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2,931,341

STORE EJECTION PISTON WITH GAS RETURN

Filed Jan. 7, 1957

4 Sheets-Sheet 1

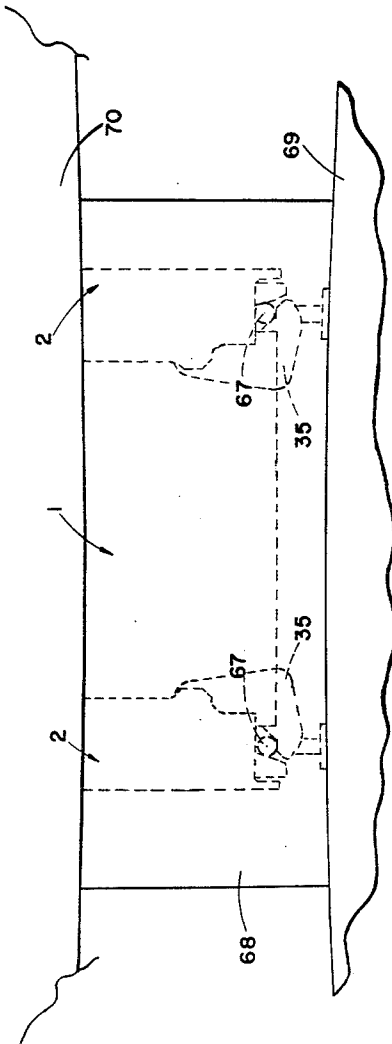


FIG. 1

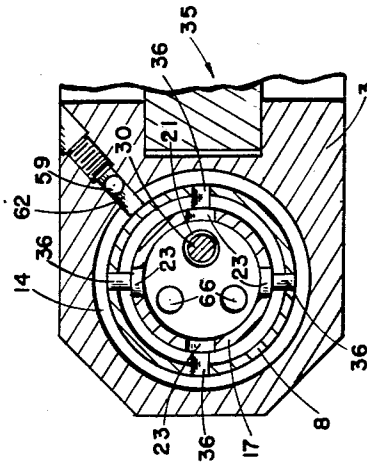


FIG. 10

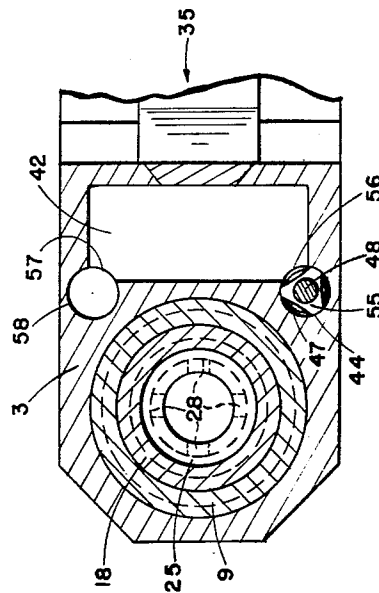


FIG. 9

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4 Sheets-Sheet 2

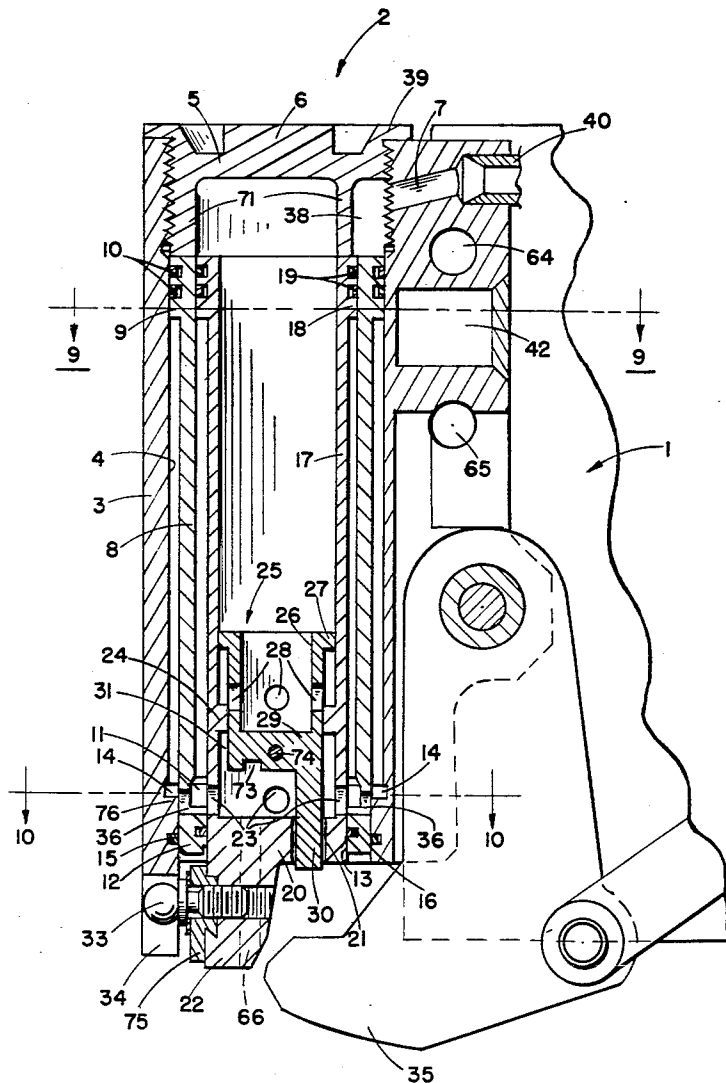


FIG. 2

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4 Sheets-Sheet 4

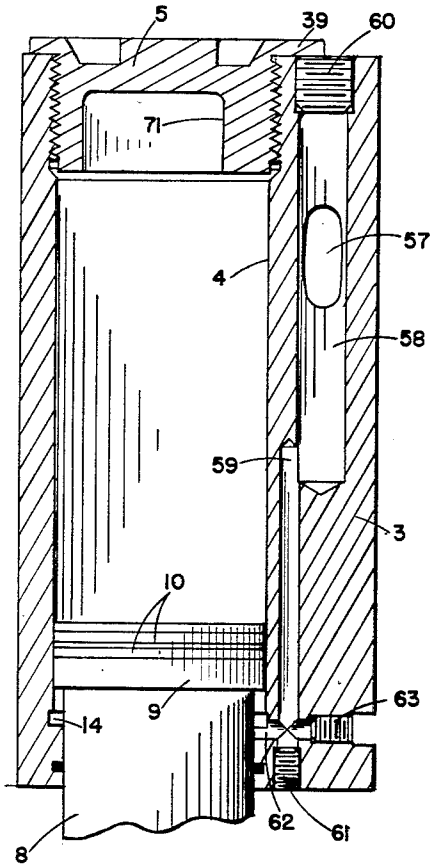


FIG. 6

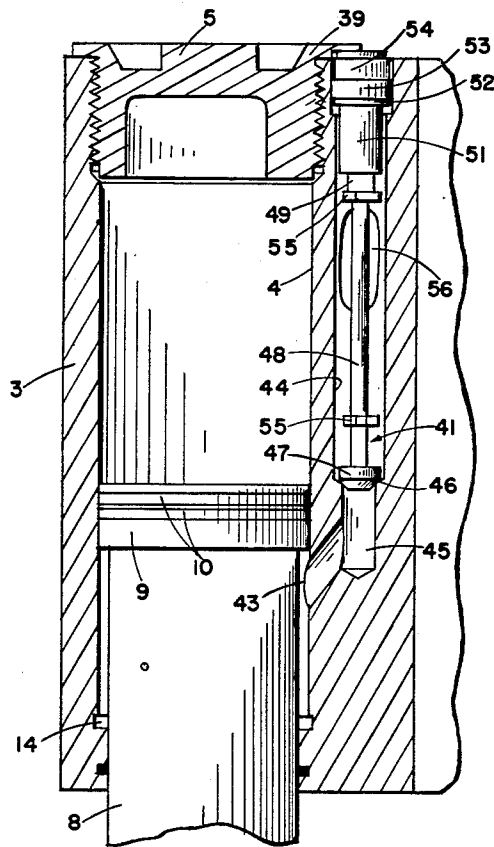


FIG. 7

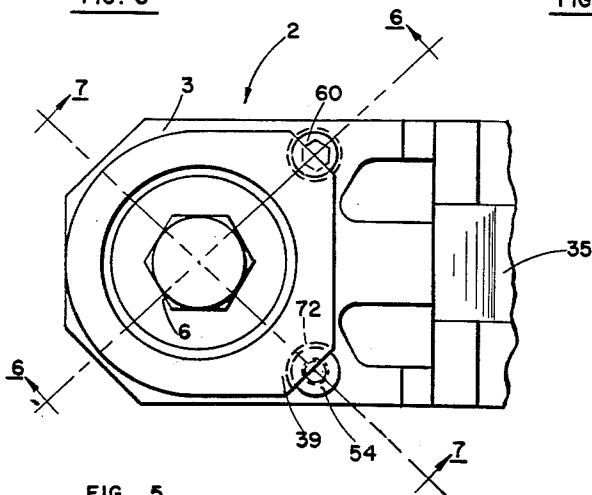


FIG. 5

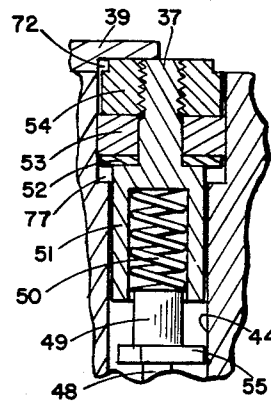


FIG. 8

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2,931,341

STORE EJECTION PISTON WITH GAS RETURN

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Application January 7, 1957, Serial No. 632,915

6 Claims. (Cl. 121—38)

This invention pertains to a store suspension and release device and more particularly it relates to an extendible device for forcibly ejecting an attached store wherein the ejecting device is automatically returned to its retracted, store-suspending position upon ejection of the store.

The gas-return telescopic ejecting pistons of the present invention constitute an improvement and an advance in the art over the spring-return pistons incorporated in and forming a part of the store ejector disclosed in Patent No. 2,822,207 and assigned to North American Aviation, Inc., the assignee of the present application.

The occurrence of spring failures in the standard type of spring-returned pistons has resulted in inability to raise the pistons into a retracted position after firing of the ejector mechanism and release of the store. The extended ejection pistons cause an increase in drag on high speed aircraft which cannot be tolerated due to the significant loss in speed and range resulting therefrom.

These and other objections and disadvantages of the prior type of spring-return pistons have been overcome and eliminated by the present gas-operated construction for retraction of the extendible ejector pistons. The present invention contemplates a plurality of hollow, telescoping, concentric pistons within a cylinder, each piston having a head portion that can be acted on by pressurized gases in a direction to retract the pistons within the cylinder as well as extend the pistons therefrom, and a means for applying pressurized gases to said pistons to first extend and then to retract them. More specifically it provides a gas pressure storage chamber that is placed in communication with the pressurized gases in the interior of the cylinder after a predetermined amount of piston stroke and which successively communicates with the spaces under the aforementioned piston head portions, and it also provides a means for releasing the gas pressure within the hollow pistons after ejection of the store whereby the pistons will be successively retracted by the pressurized gases acting against the under surfaces of the piston head portions.

Accordingly it is an object of this invention to provide an automatic, positive-acting piston type store ejector that automatically retracts after release and ejection of the store.

It is also an object of this invention to provide a gas-actuated piston type store ejector that is not dependent upon mechanical means for retraction.

It is a further object of this invention to increase the dependability and operability of the store ejectors presently in use.

It is also an object of this invention to replace the conventional spring-return type of ejection pistons by an automatic gas-pressure-operated return and thereby reduce maintenance as well as operational hazards.

These and other objects and advantages of this invention will become more apparent when read in the light of the accompanying drawings and specifications wherein:

Fig. 1 is an installational view showing the relation of the gas-operated ejector and piston return of this

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invention relative to the remainder of the store suspension and ejection device which is mounted from a supporting element and carries a store suspended therefrom.

Fig. 2 is a longitudinal sectional view of the device of this invention showing the cylinder and the telescopic pistons retracted therein and also showing the stored supporting hook in a latched position but without a store suspended therefrom.

Fig. 3 is a longitudinal cross-sectional view of the device of this invention showing the telescopic pistons fully extended from the cylinder in a store ejecting position.

Fig. 4 is a longitudinal cross-sectional view of the invention showing the telescopic pistons partially retracted.

Fig. 5 is a top plan view of the cylinder block of this invention.

Fig. 6 is a cross-sectional view of the cylinder block of this invention taken in the plane of line 6—6 in Fig. 5, fragmentarily showing the pistons nearly fully extended and showing the gas-return conduits communicating to the space under the outer piston head.

Fig. 7 is a sectional view of the cylinder body taken in the plane of line 7—7 in Fig. 5, showing the gas-reservoir intake port covered by the outer piston and showing the gas-return system intake check valve.

Fig. 8 is an enlarged cross-sectional view of the upper portion of the check valve mechanism shown in Fig. 7.

Fig. 9 is a transverse cross-sectional view of the cylinder block and pistons taken in the plane of line 9—9 in Fig. 2, and showing the gas-return system accumulator chamber.

Fig. 10 is a transverse cross-sectional view of the cylinder block and pistons taken in the plane of line 10—10 in Fig. 2 with the relief valve omitted and showing the relationship of the gas inlet apertures at the bottom of each piston to the gas inlet conduit as well as showing the residual gas bleed-off conduits.

Referring specifically to the drawings wherein like reference characters have been used throughout the several views to designate like parts and referring at first to Fig. 1, reference numeral 1 generally designates the suspension and ejection device of which the gas-retracted ejection-pistons of the present disclosure form a part. The suspension and ejection device 1 is enclosed in a streamlined pylon 68 and supports a store 69, such as a bomb or fuel tank, from a wing or fuselage surface 70 of an aircraft. As best shown in Figs. 2—4, the extendible and retractable piston ejector device 2 of the present invention comprises a cylinder block 3 having a cylinder bore 4 extending longitudinally therethrough. The upper end of the cylinder bore 4 is internally threaded to receive a threaded cylinder closure member 5 having an overlapping flanged portion 39 and a central hexagonal head portion 6 permitting easy installation and removal with a wrench. Closure member 5 includes a depending axially eccentric annular portion 71 of a variable wall thickness which provides a stop for limiting the upward travel of pistons 8 and 17. A chamber 38 is formed in one edge of annular portion 71 and provides initial access by the gases to at least a portion of the upper surfaces of piston heads 9 and 18, see Fig. 2. Access to chamber 38 is provided for the pressurized gases generated in the suspension device combustion chamber (not shown) by conduit 7 in block 3. Conduit 7 has a counterbore at its outer end for reception of the tubing 40 which conducts the pressurized gas from the combustion chamber to the ejector piston assembly.

The device for performing the actual ejection of the store comprises a pair of hollow, coaxial, telescopically-extendible pistons nested one within the other and all positioned within the cylinder bore 4 when retracted. Outer concentric piston 8 is slidably positioned within cylinder bore 4 and has an annular outwardly extending

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flanged head portion 9 closely conforming to and slidable within cylinder bore 4. Expansion rings 10 are positioned in annular grooves in flange 9 to seal the piston against pressure loss and leakage. The bottom end of piston 8 is generally closed by an end wall 12 centrally apertured at 13 for the passage of the inner coaxial piston 17 with aperture 13 having a suitable O ring sealing means 16 for allowing sliding movement of inner piston 17 relative to piston 8. An annular recess 11 is formed in the inner surface of the piston wall at the bottom of piston 8 to assist in distributing the gas pressure evenly under the annular head portion 18 of piston 17. An O ring 15 is positioned in an annular groove in the reduced diameter lower portion 76 at the bottom of cylinder bore 4 to allow reciprocal movement of piston 8 without leakage or pressure loss therefrom. Coaxial inner hollow piston 17 is formed with an annular flanged piston head portion 18 similar in construction to that of piston 8 and having annular expansion rings 19 positioned in grooves in head portion 18 to provide a seal between the two pistons. The radial pressures exerted by the piston expansion rings and the sealing O rings are sufficient to hold the pistons in their retracted position. The lower end of piston 17 is closed by an end wall 20 having an axially offset longitudinal opening 21 therethrough. In addition a plurality of equally spaced radially disposed circular openings 23 connect the lower end of the interior of hollow piston 17 with annular recess 11. It will be noted that the annular, flanged head portions of the pistons in conjunction with the piston and cylinder walls form annular chambers separating the individual pistons and the cylinder. Spaced a short distance above end wall 20 an annular internal flange 24 on the inner surface of piston 17 forms an exhaust gas chamber 31 in the lower end of piston 17, with access into the chamber being provided by relief valve 25. This chamber is sealed from the interior of the pistons and cylinder when the relief valve 25 is held in its uppermost position by the store but upon ejection of the store the valve is moved downwardly by the gas pressure within the pistons in a manner to place the interior of the pistons in communication with the exhaust chamber 31.

Relief valve 25 performs the function of relieving the residual gas back pressure within the pistons and cylinder so that the pistons may be retracted. It generally comprises a hollow cylindrical valve body 26 having an end wall 29 closing the lower end thereof and an annular radial outwardly extending flange 27 at the upper end thereof for sliding contact with the interior of piston 17. Apertures 28 are circumferentially spaced in the wall of cylinder 26 and are positioned a predetermined distance above the end wall 29 so that when relief valve 25 is held in its uppermost position apertures 28 are above flange 24 or at most are in juxtaposition thereto and the interior of the pistons and cylinder are not in communication with chamber 31. A valve body finger 30 depends from the lower end of the valve 25 and extends through aperture 21 for contacting the store suspending lug 67 as shown in Fig. 1. When thus held in its upper position by lug 67, valve 25 is in a closed attitude and the exhaust chamber 31 is not in communication with the interior of the piston and cylinder assembly. Upon ejection of the store the valve is no longer restrained and is free to move downwardly under the pressure of the residual gases in the cylinder and piston, and the interior of the pistons and cylinder are thus placed in communication with chamber 31. As shown in Figs. 3 and 4 when the pistons are in an extended position and the store has been ejected chamber 31 is then in communication with the ambient atmosphere through the apertures 23 and thus the residual gas pressure within the pistons and cylinder may be exhausted to the atmosphere. The bottom surface of the relief valve end wall 29 contains a slot 73 extending chordwise therethrough and communicating at each end with chamber 31. Directly below slot 73 two bleed-off conduits 66 extend longitudinally

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through end wall 20 and integral depending lug 22, to atmosphere. These conduits 66 provide a further means for relieving any gas pressure within exhaust chamber 31, since they communicate directly with chamber 31 when valve 25 is in a raised position and indirectly by means of slot 73 when valve 25 is bottomed on end wall 20, as in Figs. 3 and 4. A pin 74 is positioned in a diametral bore in the closed end 29 of the valve body. The ends of this pin project sufficiently therefrom to contact annular flange 24 in the upper closed position of the relief valve and prevent further upward movement of the valve.

As shown in Patent No. 2,822,207 a lug 22 depends from the end wall 20 of the inner piston and contains a radially extending stud 33 which is adapted to engage the V-shaped groove 34 in the depending cylinder wall to properly align piston 17 relative to the store lug and hook 35. The stud 33 also secures a strike plate 75 to lug 22 in alignment with the lower edge of piston 8. Upon downward movement of piston 8 this lower edge contacts plate 75 and carries piston 17 down with it. This insures that piston 8 does not act on the store lug 67 to separate it from finger 30 and thereby allow release of the gas pressure before inner piston 17 has been fully extended. Thus pistons 8 and 17 move downwardly as a unit until piston 8 bottoms on portion 76 of cylinder bore 4 while piston 17 continues to move downwardly to its fully extended position.

Radially spaced in the bottom portion of the wall of piston 8 are apertures 36 connecting annular recess 11 in piston wall 8 with an annular recess 14 formed in the inner wall of the cylinder bore 4. Apertures 36 are so positioned with respect to end wall 12 of the piston that they form grooves in the upper surface of the end wall. Thus, when piston head 18 abuts end wall 12 in the extended position, gas pressure may be exerted under the piston head 18 by means of the grooves in a manner to raise piston 17. It will be noted that apertures 36 and 23 in pistons 8 and 17 respectively are in registry with and allow communication between the annular recesses 14, 11 and the exhaust chamber 31 when the pistons are in a retracted position.

The gas return system retracts the ejector pistons by means of the residual gas pressure remaining in the system near the end of the power stroke. It comprises generally a gas pressure storage means and a conduit system for applying the gas pressure under the annular flanged piston heads in a manner to retract the extended pistons. More specifically the residual gas within the downwardly moving pistons is at a sufficiently high pressure to open check valve 41 and flow into the accumulator or reservoir chamber 42 when the pistons have moved downwardly and uncovered port 43 in the side of bore 4. As the pressure within the cylinder and pistons drops below the pressure in the reservoir upon operation of relief valve 25, check valve 41 closes, retaining high pressure gas in reservoir chamber 42 and the conduits connected thereto.

As shown in Fig. 6, reservoir chamber 42 communicates through port 57 with conduit 58 and thence through conduits 59 and 62 with annular recess 14 in the cylinder wall. It will be noted that conduit 62 forms a groove in the lower surface of recess 14. This allows the high pressure gas to act under piston head 9 of piston 8 when the piston is in its outermost extended or bottomed position. It will be noted that for ease of construction the conduits are formed by drilled intersecting bore holes having their outer ends threaded for the reception of closure members 60, 61 and 63 in conduits 58, 59 and 62 respectively.

Check valve 41 comprises a valve body 47 seated on the shoulder 46 formed between valve chamber 44 and reduced diameter inlet chamber 45 which connects to inlet port 43 in the cylinder wall 4. Valve stem 48 extends axially through valve bore 44 and has an enlarged head portion 49 at its upper end. A spring 50 is seated

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in a retainer cup 51 and bears against the head portion 49 to bias valve 47 to a closed position. Valve guides 55 near the top and bottom of valve stem 48 insure axial movement of the valve and valve stem without cocking. Valve bore 44 connects through port 56 into reservoir chamber 42 for the storage of gases.

As best shown in Fig. 8, the closed upper end of spring retainer cup 51 has an integral axially extending threaded stem 37. A washer 52 is located in an enlarged counterbore 77 at the upper end of valve bore 44 on stem 37 with a seal 53 located on the washer 52 to prevent escape of the gas through the counterbore. This whole assembly is held in position by a nut detent 54 threadedly engaging the upper end of stem 37. Detent 54 bears against the undersurface of a cut-out portion 72 formed in the undersurface of flange 39 of the closure 5. This undercut portion 72 has a hemi-cylindrical configuration and is so disposed in the closure member that it is positioned over the detent 54 and partially covers the same when closure 5 is threaded into cylinder block 3 to its fullest extent to close the bore 4. Since retainer cup 51, washer 52, seal 53 and detent 54 are biased in an upward direction by spring 50, detent 54 is moved upwardly into undercut portion 72 thereby locking closure 5 against rotation. Ready installation and removal of closure 5 may be accomplished by simply depressing detent 54 to a position below or flush with the top of block 3, by means of pressure on its exposed outer edge, thereby allowing closure member 5 to be threaded into or out of engagement with block 3. It will be noted that the counterbore 77 is of a sufficient depth to allow axial movement of the detent assembly to permit ready unlocking of the detent.

Cylinder block 3 may be suitably connected to suspension device 1 by means of bolts or other suitable fasteners engaging the cylinder block through the transverse fastener apertures 64 and 65.

The gas pressure for operation of the ejection and retraction mechanism may be secured from stored pressurized gases or as set forth in Patent No. 2,822,207 it may be generated by the combustion of a suitable powder charge in a breech block.

In operation, therefore, upon release of the hook locking mechanism 35 as taught in Patent No. 2,822,207 the gas pressure is applied through conduit 7 to the heads of pistons 8 and 17 to extend them to their outermost positions as shown in Fig. 3. The power stroke of the telescopic pistons forcibly ejects the store away from the aircraft. Upon movement of the store away from the lower end of piston 17 the finger 30 is no longer restrained against downward movement by store lug 67. The gas pressure thereupon forces the release valve into its lowermost position and places the interior of the hollow pistons and cylinder in communication with exhaust chamber 31 through apertures 28. The residual gas pressure within the pistons can then exhaust to atmosphere through apertures 23 in the piston.

As the pistons move downwardly gas intake port 43 is uncovered and the residual gas pressure in the cylinders overcomes the force of spring 50 to open valve 47 and pressurize reservoir chamber 42. From chamber 42 the gas flows through conduits 58, 59 and 62 into annular recess 14 to act under the head portion 9 of cylinder 8 and thereby raise the same. It will be noted that there is nothing to prevent the flow of gas to the space under the head portion of piston 8 once the gas begins to enter the reservoir chamber 42. This tends to cushion the piston head at the bottom of its downward stroke and prevent abrupt contact of piston head 9 with the bottom surface of annular recess 14. With release of the residual gas pressure from the cylinder and piston interiors by means of valve 25, the pressurized gas retained in the accumulator and associated conduits by check valve 47 acts under the head 9 to raise piston 8 into its retracted position, as shown in Fig. 4. This brings aperture 36 in

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the lower portion of piston 8 into registry with the annular recess 14 and thereby permits the pressurized gas to flow into annular recess 11 in piston 8 and under head 18 of piston 17 thereby retracting piston 17 to its uppermost position against stop portion 71. Upon complete retraction of piston 17 apertures 36 and 23 are in registry, as shown in Fig. 2, and the residual gases within the gas return system may then exhaust to atmosphere through slot 73 and bleed conduits 66.

It is a feature of this invention that the relief valve 25 permits the ejector to be fired without having a store loaded thereon, without damage to the ejector. If the ejector should be inadvertently fired without a store suspended thereon the relief valve would have nothing to react against and, accordingly, would not be maintained in its retracted position but would immediately be forced downwardly so as to uncover apertures 28, if the valve was not initially in its lower, open position. This would allow all of the explosive gases to escape without reacting against pistons 8 and 17 so that there would be no damage to these pistons by means of their being forced violently to the limits of their travel.

It will thus be seen that by the present invention we have provided a reliable, improved, positive-acting piston return means for an aircraft stores-ejector which is not dependent upon any mechanical type return means, such as a spring, which in the past have been subject to malfunctioning and failure due to the high pressures and forces acting thereon.

While a particular embodiment of this invention has been illustrated and described herein, it will be apparent that various changes and modifications may be made in the construction and arrangement of the various parts without departing from the spirit and scope of this invention in its broader aspects or as defined in the following claims.

We claim:

1. In a gas-operated device adapted to be carried by an aircraft for forcibly ejecting a store which has means thereon for releasable attachment to said device comprising in combination, a latch means for releasably securing the store, a source of pressurized fluid, a body having a cylindrical bore open at one end and closed at the other end and connected at its closed end to the source of pressurized gas, a first hollow piston slidable within said bore and having an exterior annular head portion operatively contacting said bore and forming an annular chamber between said first piston and said bore, a second hollow piston axially and telescopically slidable within said first piston and having an annular head portion operatively contacting the interior of said first hollow piston and forming an annular chamber between said second piston and the inner wall of said first hollow piston, said pistons being extendable to forcibly eject the store when acted on by the pressurized gas, reservoir means communicating with the cylindrical bore intermediate its ends operable to store a portion of the pressurized gas therein after a predetermined amount of extension of the pistons, means for releasing the gas pressure within said bore and hollow pistons upon ejection of said store, and conduit means for successively applying the reservoir gases under the annular head of the first piston and then under the annular head of the second piston to successively retract the said pistons.

2. An apparatus adapted to be carried by an aircraft for forcibly ejecting a store which has means thereon for releasable attachment to said apparatus comprising in combination, a latch means for releasably securing the store; a source of pressurized fluid; a cylinder means communicating directly with the source of pressurized fluid; a plurality of hollow concentric pistons slidably positioned within said cylinder and telescopically extendable therefrom, each of said pistons having opposed pressure surfaces thereon; one of said pistons having a portion contacting the store attaching means adapt-

ed to release the latch and forcibly eject the store when said pistons are extended by the application of the pressurized fluid to one of said surfaces of the said pistons; means operatively contacting the store attaching means and operable thereby upon extension of said pistons and ejection of the store to release the internal fluid pressure in said hollow pistons and said cylinder; means communicating with said cylinder for withdrawing and storing pressurized fluid from within said cylinder after a predetermined amount of travel of said pistons; means for automatically applying said stored pressurized fluid upon substantially full extension of the said pistons first to the other of said surfaces of one of said pistons and then to the other of said surfaces of the other of said pistons to sequentially return the same to a retracted position.

3. An apparatus to be carried by an aircraft for forcibly ejecting a store which has means thereon for releasable attachment to said apparatus comprising in combination, a body member having a chamber therein with a closed head end and an opened lower end, a latch means on said body for releasably securing the store thereto by the attachment means; a source of pressurized fluid connected directly to the head end of said chamber; reciprocable inner and outer telescoping pistons means in said chamber operatively contacting the store attachment means and extendible outwardly from said chamber upon the application of pressurized fluid thereto whereby the latch is released and the store may be forcibly ejected; a reservoir communicating with said chamber intermediate said ends for storing a portion of the fluid pressure, a check valve interposed between the reservoir and said chamber preventing flow of pressurized gas back into said chamber upon release of the pressure within said chamber; means in said body member providing communication from said reservoir directly to the lower end of said chamber; valve means in the inner piston normally biased to closure by the store attachment means and operable upon ejection of said store and release of said store attachment means to exhaust the remainder of the applied pressure from said chamber; means for applying the stored portion of fluid pressure beneath said outer piston to cushion the outward movement of the same and then acting beneath first said outer piston and then said inner piston to sequentially retract first said outer piston and then said inner piston.

4. An apparatus adapted to be carried by an aircraft for forcibly ejecting a store which has means thereon for releasable attachment to said apparatus comprising in combination, a body having a cylindrical bore open at one end and closed at its other end and connected at its closed end to a source of pressurized gas; a latch means on said body for releasably securing the store thereto by the attachment means; a first hollow piston having an enlarged head portion contacting the cylinder wall and reciprocable therein and extendible therefrom; a second hollow piston having an enlarged head portion contacting the interior wall of said first piston and reciprocable therein and extendible therefrom, said second piston being open at its upper end and having an outlet at its lower end; a valve normally closing said lower end outlet but operable upon ejection of the store and release of the store attaching means to open and exhaust fluid pressure from said cylindrical bore and said pistons; a reservoir communicating with said bore intermediate its ends for withdrawing and storing a portion of the applied fluid pressure, said reservoir communicating directly with the lower end of said bore whereby the stored fluid pressure portion may be applied beneath said first piston head portion to return the same to a retracted position.

said first piston having apertures therethrough near its lower end whereby upon retraction of said first piston communication is effected between said reservoir and the underside of said second piston to retract said second piston.

5. An apparatus adapted to be carried by an aircraft for forcibly ejecting a store which has means thereon for releasable attachment to said apparatus comprising in combination, a latch means for releasably securing the store; a source of pressurized fluid; a cylinder communicating directly with the source of pressurized fluid; a first hollow piston reciprocable in said cylinder and including apertures in the piston wall surface thereof at its lower end; a second hollow piston reciprocable within said first hollow piston and forming with said first piston wall apertures a slide valve, each of said pistons having opposed pressure surfaces thereon and being telescopically extendible upon the application of pressurized fluid to one of said surfaces; said second piston having an outlet at its lower end; a relief valve normally closing said lower end outlet operable upon ejection of the store and release of the store attaching means to open and exhaust the fluid pressure from said cylinder and said pistons; a reservoir communicating with said cylinder intermediate its ends for storing a portion of the applied fluid pressure; port means in the cylinder wall at the lower end of said cylinder communicating with said reservoir whereby the stored fluid pressure portion may be applied first to the other of said pressure surfaces of the first piston to return the same to a retracted position and then sequentially by operation of said slide valve whereby the stored fluid pressure may then be applied to the other of said pressure surfaces of the second piston to return the same to its retracted position.

6. A dual piston actuator operable under the action of a high pressure, short duration pulse generated by combustion of an explosive charge to sequentially extend and retract comprising a cylinder member having its head end connected directly to the explosive charge filler; a first hollow open ended piston reciprocable within said cylinder and extendible therefrom and having port means in the piston wall near its lower end providing communication from its exterior to its interior surfaces; a second hollow piston means reciprocable within said first piston means and extendible therefrom and having an outlet at its lower end; a valve means normally closing said lower end outlet operable upon extension of the pistons to open and exhaust the gas pressure from within said cylinder and pistons; a reservoir means communicating with said cylinder intermediate its ends for storing a portion of the applied fluid pressure; port means in the lower end of said cylinder communicating with said reservoir and in alignment with said first piston port means upon retraction of said first piston whereby the store fluid pressure may be applied successively first beneath said first piston and then beneath said second piston through said first piston ports whereby said first and second pistons are sequentially retracted.

References Cited in the file of this patent

UNITED STATES PATENTS

2,703,558	Wilcox	Mar. 8, 1955
2,730,401	Rea	Jan. 10, 1956
2,736,522	Wilson	Feb. 28, 1956
2,746,425	Schafer	May 22, 1956
2,749,063	Low	June 5, 1956

FOREIGN PATENTS

897,102	France	May 15, 1944
1,003,250	France	Nov. 14, 1951