June 11, 1963 P. G. WERMAGER ET AL 3,093,034

PNEUMATIC JETTISONING DEVICE

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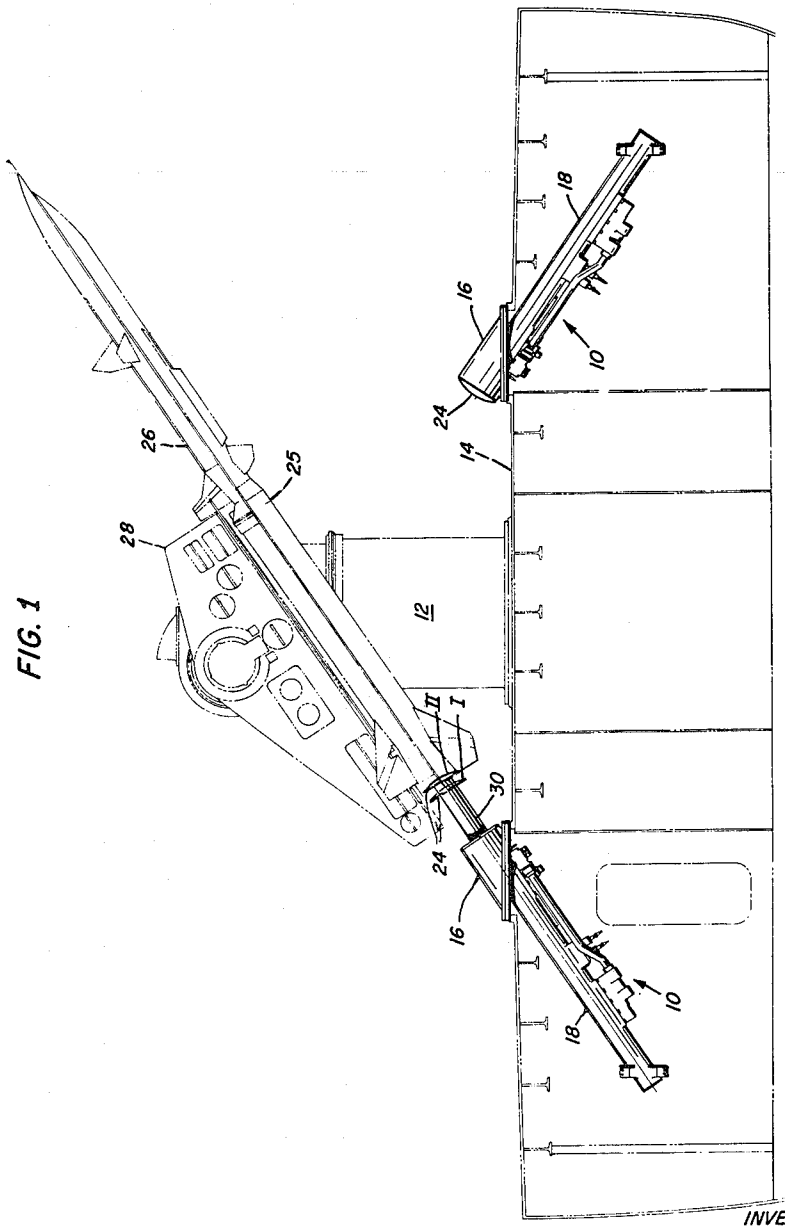


FIG. 1

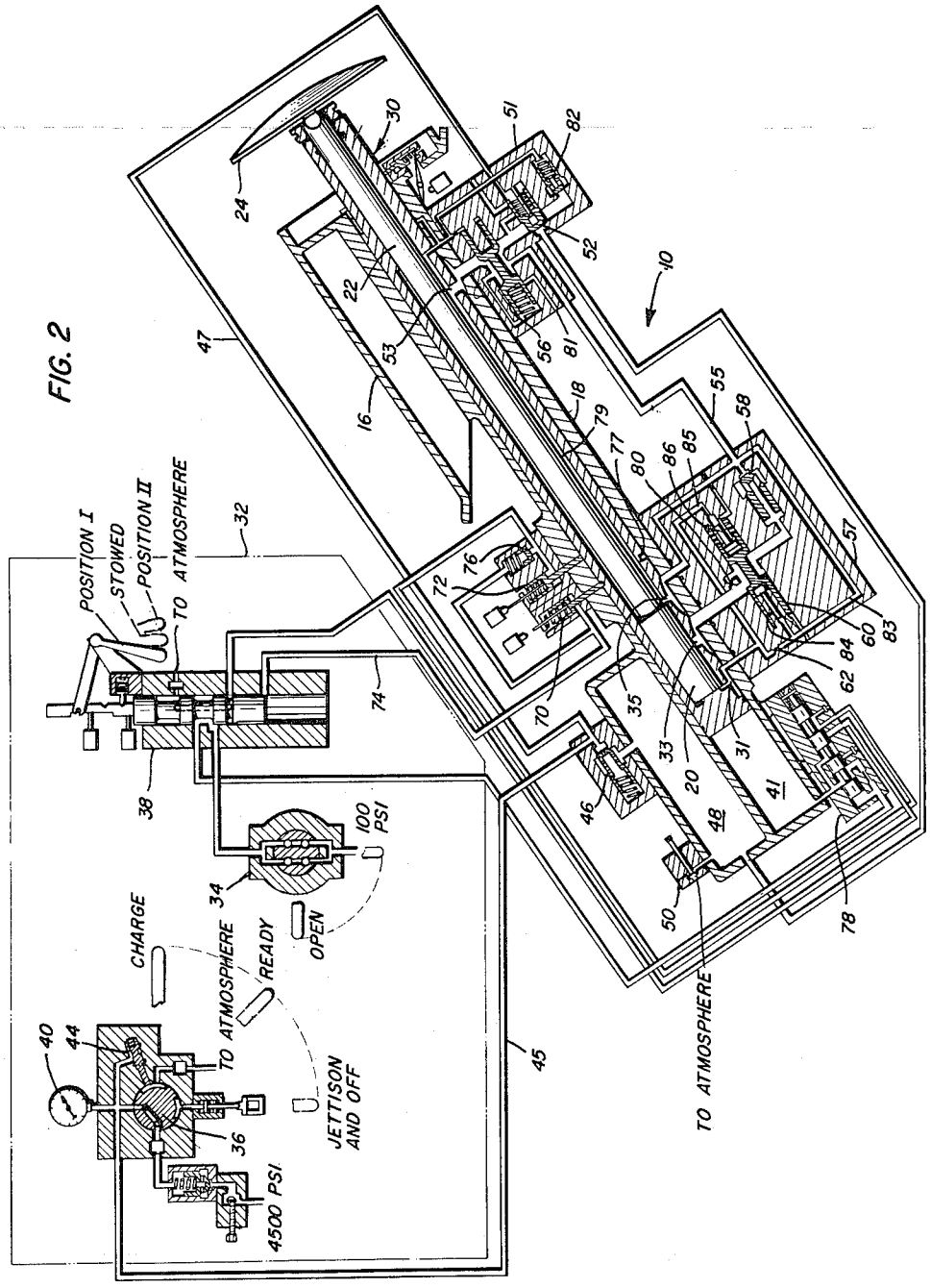
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FIG. 2

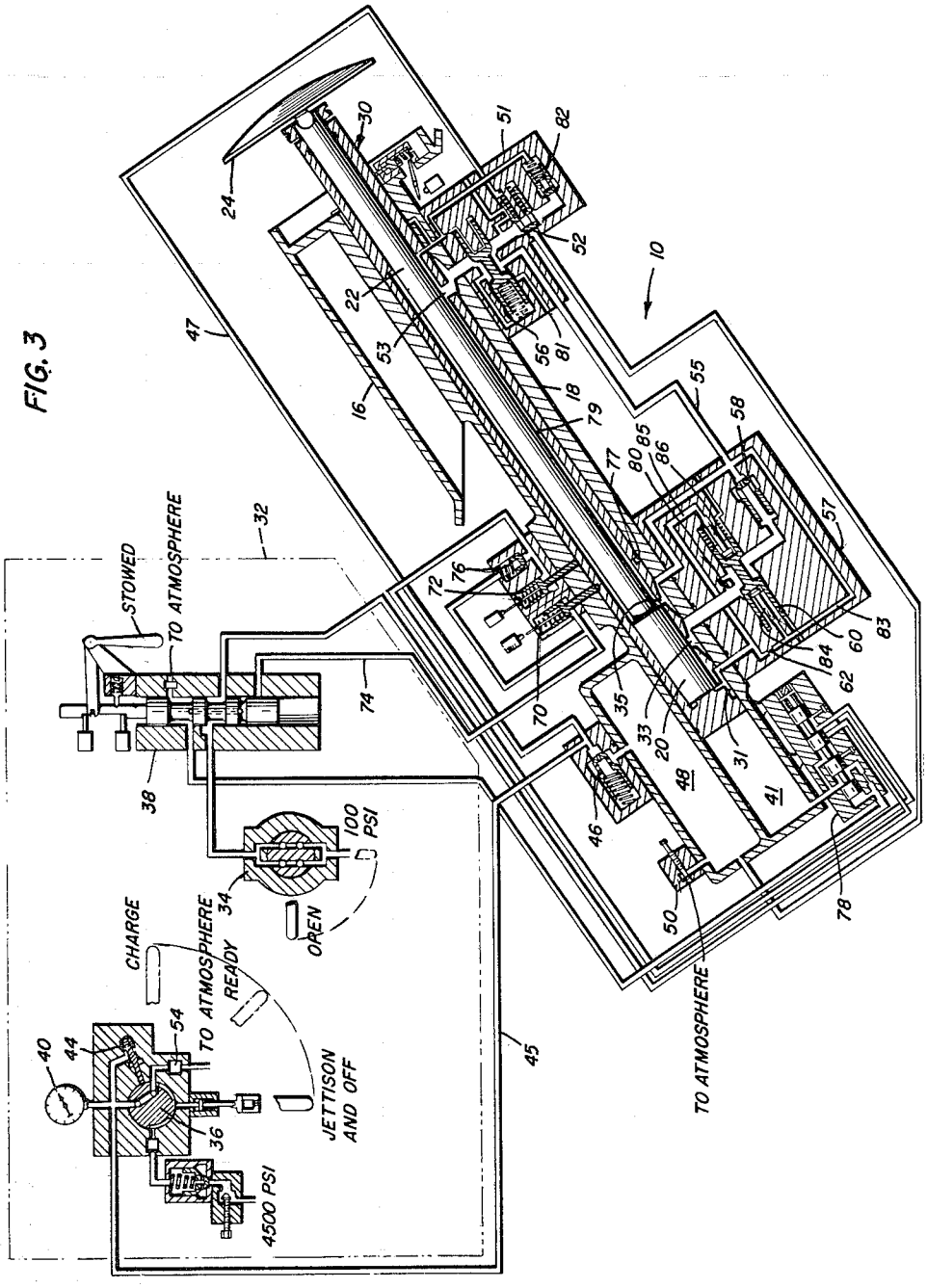


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FIG. 3



United States Patent Office

3,093,034
Patented June 11, 1963

3,093,034

PNEUMATIC JETTISONING DEVICE

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Filed Sept. 19, 1961, Ser. No. 139,581
3 Claims. (Cl. 89—1.7)

This invention relates generally to catapult devices, and more particularly it pertains to a dud jettison device for jettisoning defective missile-booster weapons from a missile launcher.

During the operation of high speed semi-automatic missile launchers of the type to which this invention relates, misfires occasionally occur with the result that a missile may remain engaged with its launching rails after the firing switch has been actuated, and in such cases the operation of the launcher must be suspended until the missile can be removed from the rails. Heretofore, it has been necessary on such occurrences for the operator either to wait for the missile to be expelled under its own force or to obtain volunteers to manually eject the missile from the rail, which latter step can be taken only after numerous safety precautions and at great risk to launching crew personnel. Moreover, when a misfire occurs a prime disadvantage lies in the time loss involved in the launcher being incapacitated for service during the presence of a dud in one of the launching rails, and further disadvantages reside in the time loss involved in the manual removal of the dud and the possibility of injury to the dud removal crew due to the delayed ignition of the rocket or missile propellant during such removal operations.

With regard to the prior art dud jettisoning systems, it has not been feasible to attempt ejection of varying lengths of missiles and missile boosters with the same dud ejection system. To accomplish this in the most desirable manner, the jettisoning system should accommodate a variable length ejection stroke which can effect smooth and reliable ejection of varying length missiles and missile boosters. The present device attains this desirable objective in tn efficient and reliable fashion without sacrifice to overall operation.

A primary object of this invention is to provide a pneumatic arrangement for prompt overboard jettisoning disposal of a hazardous or useless missile-booster weapon aboard a ship.

Another object of this invention is to provide an ejector device which is inconspicuous and non-interfering, but which can be brought quickly into engagement with a booster of a missile-booster weapon on a launcher for rapid disposal of the missile-booster weapon.

A further object of the invention is to provide a jettisoning device for ejecting dud missiles over the side of a vessel in such a manner that the launching crew personnel will not be subjected to danger.

Still another object of the invention is to provide a dud jettisoning device capable of being variably positioned, thereby accommodating varying lengths of missiles and missile-boosters.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIG. 1 is a vertical elevation, partly in section, looking either in the forward or aft direction of a missile ship showing a general shipboard installation of a pair of dud jettison units with their associated missile launcher;

FIG. 2 is a schematic diagram of the pneumatic system

for a jettisoning device showing the components in the control and charge sequence; and

FIG. 3 is a schematic diagram similar to FIG. 2 in which the pneumatic components and related parts are shown in the fire and return sequence.

Referring now to the details of the drawings, in accordance with the invention a spaced pair of jettisoning or ejector devices **10** shown in FIG. 1 are radially spaced about a guided missile launcher **12**, each being set into a deck of a ship **14**. Each ejector device **10** is installed at an angle to the deck **14**, with the top end of each ejector device **10** being covered by a protective housing **16** which protrudes above the deck **14**.

Each ejector device **10** consists essentially of a coaxial arrangement of a long cylinder **18** which contains a positioner cylinder **30** as illustrated best in FIGS. 2 and 3. A long piston rod **22** is located in each cylinder **30**.

The end of the piston rod **22** above the deck **14** is provided with a bumper disc **24** having a spherical segment shape to permit uniform contact with various diameter booster nozzles. The disc **24** is ball socketed to the end of the piston rod **22** so as to have a limited tilting freedom and provide self-sealing against the housing **16** where it serves as a weather cover when the ejector device **10** is stowed. This same tilting freedom of the disc **24** provides good seating in thrust against the booster end of a missile-booster weapon **25**, **26** when the piston rod **22** is extended pneumatically in a jettisoning operation thereon.

In preparing to jettison a dud missile-booster weapon **25**, **26**, the launcher **12** is slewed and its guide arm **28** is elevated until the dud missile-booster weapon **25**, **26** is in alignment with the ejector devices **10** for that arm.

Each ejector device **10** is controlled from a dud jettisoning panel **32**, as illustrated in FIGS. 2 and 3. This panel **32** contains three manual control valves **34**, **36**, and **38**, which are connected by piping to the ejector device **10** as shown in FIG. 2 for controlling the air supply and positioning, charging, and firing it. A pressure gauge **40** informs the operator of the air pressure during the charging. Indicator lights (not shown) provide ejector positioning (to accommodate different length missile-booster weapons **25**, **26**), safe to fire, and ejector stowed information.

A bubble type clinometer is mounted nearby to indicate the movement of the ship in roll and allow the operator in case roll amplitudes are greater than approximately 20° to fire the ejector device **10** at the proper time so the missile-booster weapons **25**, **26** will clear the rail of the ship. Various relays and interlock switches not within the scope of the present invention first assure that the launcher **12** and the missile-booster weapons **25**, **26** are correctly positioned and in condition to jettison safely.

When the air supply valve **34** is rotated to "Open" as shown in FIG. 2, approximately 100 p.s.i. from the pneumatic supply system aboard ship passes therethrough to the positioner valve **38**. This valve **38** is then manually moved from the "Stowed" position to either "Position I" or "Position II." "Position I" is for a longer missile-booster weapon **25**, while "Position II" is for a shorter missile-booster weapon **26**. Let it be assumed that "Position I" as shown in FIG. 2 is chosen for the longer missile-booster weapon **25**. Then 100 p.s.i. will be channeled through the positioner valve **38** to dump valve **78**. Air is ported through the dump valve into a positioning chamber **41**. With air pressure expanding positioning chamber **41** below it, the positioning cylinder **30** moves upwardly until arrested by engagement of a detent-like spring-urged position I latch **70** within detent **77** formed in the positioning cylinder **30**. This places the bumper disc **24** a predetermined distance from the booster end of the longer

missile-booster weapon 25 as shown in split detail I of FIG. 1.

The fire and control valve 36, which may be positioned simultaneously with positioner valve 38, is then rotated from "Off" to "Charge" position shown in FIG. 2, and compressed air at approximately 4500 p.s.i. passes therethrough to a safety valve 44 and to line 45. The purpose of safety valve 44 is to prevent operation of the jettison device when the air pressure is too low. If the air pressure is not at least approximately 3500 p.s.i. there is danger that the missile may not be ejected with sufficient force to clear the side of the ship. Thus valve 44 is provided with a plunger which is integral with the differential area body of the valve and extends into a recess in the valve 36. This plunger prevents the fire and control valve 36 from being rotated to the ready position. A compression spring urges the plunger into the recess and holds it in that position until air pressure in the differential area body of valve 44 moves the body and compresses the spring. This withdraws the plunger from the recess and permits the fire and control valve 36 to be rotated to the ready and jettison positions. When the pressure gauge 40 reaches 3500 p.s.i. pressure, the fire control valve 36 is moved to a "Ready" position.

A spring loaded charging valve 46 admits this high pressure air to a storage or charging chamber 48. A bleeder valve 50 is attached to this chamber 48 for manual release of the air pressure therein to atmosphere in event the ejector device 10 is not to be cycled. High pressure air is also fed through lines 45 and 47 to one side of a firing valve 52. The other side of firing valve 52 is exposed to an equal pressure from the chamber 48 but differential area and spring pressure keep it seated.

On a jettison command, the operator rotates fire control valve 36 from the "Ready" position to the "Jettison and Off" position as shown in FIG. 3. The back side of firing valve 52 is thereby momentarily vented to atmosphere through a diffuser 54 by way of piping 45, 47 and control valve 36. This unbalances valve 52 causing it to open and allows air from the storage or charging chamber 48 to rush by and move through a shuttle valve 56.

The firing charge of air flows into the positioner cylinder 30 by way of return air port 53 to the bumper disc 24 side (front side) of the ejector piston 20 and also through piping 55 to the rear valve block 57. At the rear valve block the air is divided into three portions. One portion flows through an orifice 62 and a first stage ejection port 31 formed in the wall of positioner cylinder 30 to the rear of the ejector piston 20. This orifice controls the rate at which the piston 20 moves upward inside the positioner cylinder 30 until the bumper disc 24 contacts the booster end of missile-booster weapon 26. The second portion flows through a check valve 58 and a control valve 60 before entering intermediate stage ejection port 33 in the positioner cylinder 30. This port is uncovered by the ejector piston 20 as the bumper disc 24 contacts the booster allowing the firing charge of air to force the ejector piston 20 upward at a controlled velocity.

This upward velocity is controlled by a control valve 60 which in turn is controlled by two plungers 84 and 86. The smaller plunger 84 is subjected to the firing charge air pressure in conduit 83. The larger plunger 86 is subjected to the air pressure behind the ejector piston 20, as conveyed by conduit 85. If the bumper disc 24 contacts a booster, the pressure behind the ejector piston 20 is great enough to force the larger plunger 86 to shift the control valve 60 to the open position illustrated in FIGS. 2 and 3, thereby porting the firing charge air directly to the back side of the ejector piston 20. Conversely, if the bumper disc 24 does not contact a booster, the pressure behind the ejector piston 20 will not become great enough to overcome the force of the firing charge air against the smaller plunger 84. Consequently, the control valve 60 would remain in the closed position. This restricts the flow of the firing charge air to the back side of the ejector piston 20 to that flowing through orifice 80 which limits the upward velocity of the ejector piston 20. The third portion of the firing charge air is ported directly behind the ejector piston 20 as the piston uncovers a final stage ejection port 35 on its upward movement.

As the ejector piston 20 nears the limit of its travel, the entrapped air in front of the piston within the annularly-shaped return air chamber is compressed to approximately 15,000 p.s.i. This high pressure air (buffing pressure) shifts the shuttle valve 56 in the forward valve block 51 down and to the left as viewed in FIGS. 2 and 3, thereby uncovering vent 81. This ports the air on the back side of the ejector piston 20 through the rear valve block 57 and through conduits 83, 55 to the forward valve block and out to atmosphere by way of vent 81. As the air pressure on the back side of the ejector piston 20 decreases, the ejector piston 20 is forced back by the entrapped air on the front side thereof. This entrapped air is supplemented through a check valve 82 and finally directly through the forward valve block, with air that remains in the storage or charging chamber 48.

The last three inches of return travel of the ejector piston 20 is controlled by orifice 62. When the ejector piston 20 is completely returned within the positioner cylinder 30, all remaining pressure is vented through porting directly in front of the ejector piston 20 through port 35 and through the rear valve block to the forward valve block and atmosphere.

The ejector device 10 is stowed by moving the lever of the positioner valve 38 to the "Stowed" position as shown in FIG. 3. This vents dump valve 78 to atmosphere, which in turn allows chamber 41 to also vent through valve 38 to atmosphere. When the pressure in chamber 41 decays to approximately 15 p.s.i., the dump valve 78 shifts and ports 100 p.s.i. air from positioner valve 38 to the underside of position II latch 72. This pressure also goes through check valve 76 to position I latch 70. This air pressure lifts both latches and the pull of gravity withdraws the positioner cylinder 30 within cylinder 18. At the completion of this withdrawal disc 24 seals against housing 16 providing a weather cover for the ejector 10.

In the event the positioner valve 38 is set at "Position II" for jettisoning of the shorter missile-booster weapon 26, the 100 p.s.i. air is channeled thereby to the air control chamber 41 as was related for position I. In addition, air is also ported to a pipe 74 raising the latch 70 against its spring force.

Because of a check valve 76, air from the conduit 74 is unable to pass to the position II latch 72 which remains under its spring tensioned condition. Therefore, when the positioner cylinder moves upwardly, the circumferential groove 77 moves under the retracted latch 70 and is captured by the spring tensioned latch 72 for position II, which is the longer extended position II in FIG. 1 for shorter missile-booster weapons 26. The remainder of the jettison and retract strokes is the same as previously related.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A dud jettisoning device for use with a missile launcher comprising a support; positioning means including a hollow positioner cylinder having a circumferential groove mounted in said support, means for moving said cylinder longitudinally, a plurality of spring biased, pneumatically actuated latch means mounted adjacent and spaced axially along said cylinder and valve means to effect selective actuation of any one of said latch means, said extensible dud ejecting means comprising a piston within said positioner cylinder, a bumper disc, a piston

rod interconnecting said piston with said bumper disc and means for driving said piston, said piston rod and said positioner cylinder cooperating to form an annularly shaped space therebetween for compressing a fluid as said piston is moved by said driving means.

2. A dud jettisoning device as recited in claim 1 further characterized by a source of fluid under pressure, a plurality of ports spaced axially along said cylinder adjacent the end remote from said bumper disc, and means connecting said source and said ports whereby to uncover said ports sequentially and deliver controlled amounts of fluid under pressure to said cylinder as said piston is driven therethrough.

3. A dud jettisoning device as set forth in claim 1

wherein said last mentioned means includes a port extending through the wall of said positioner cylinder adjacent the end nearest said bumper disc, a shuttle valve communicating with said port and operative to assume a closed position upon emission of air from said port as said piston is driven from an initial position, thereby to compress a quantity of air, and means for utilizing the same to return said piston to its said initial position.

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