Aug. 20, 1963 M. O. JACOBSON ET AL 3,101,026

RETRACTABLE SPANNING RAIL AND BLAST DOOR ARRANGEMENT

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FIG. 2

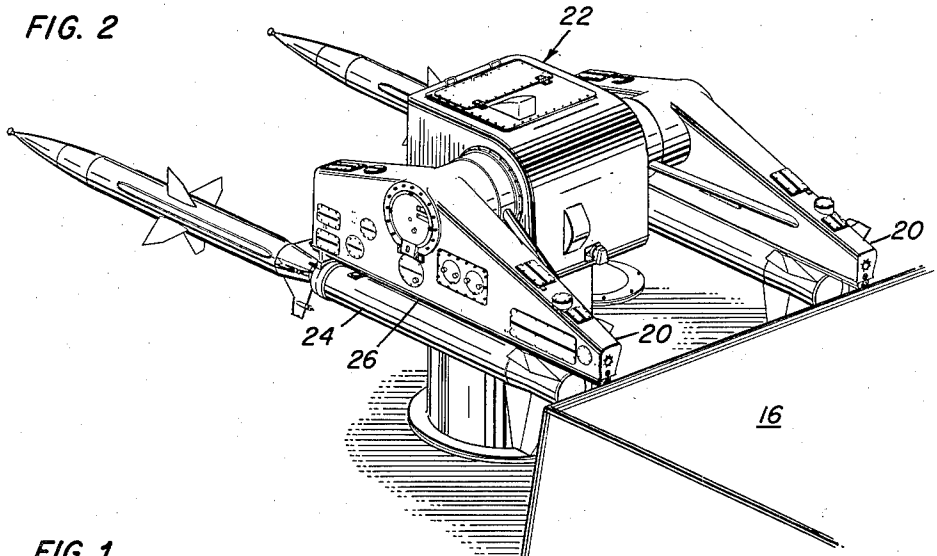
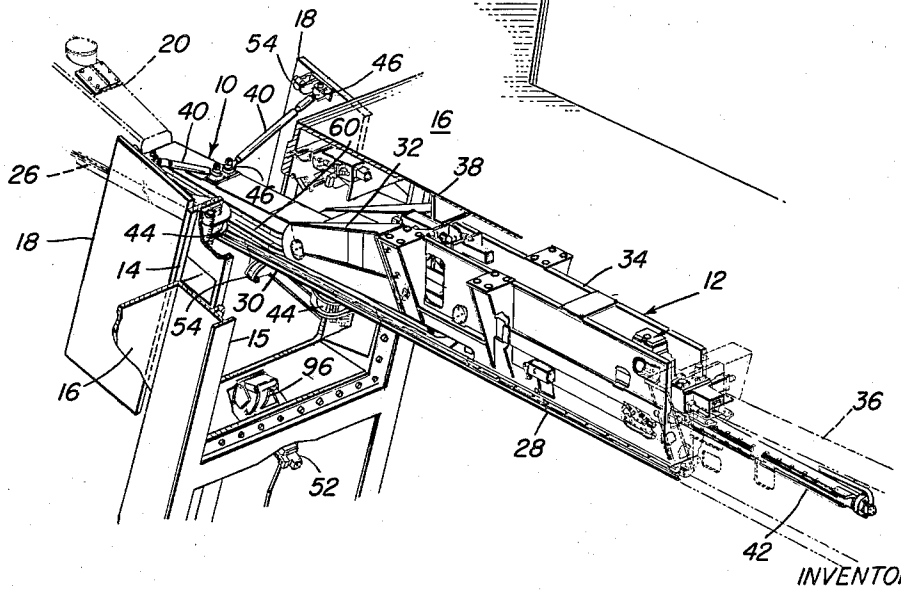


FIG. 1



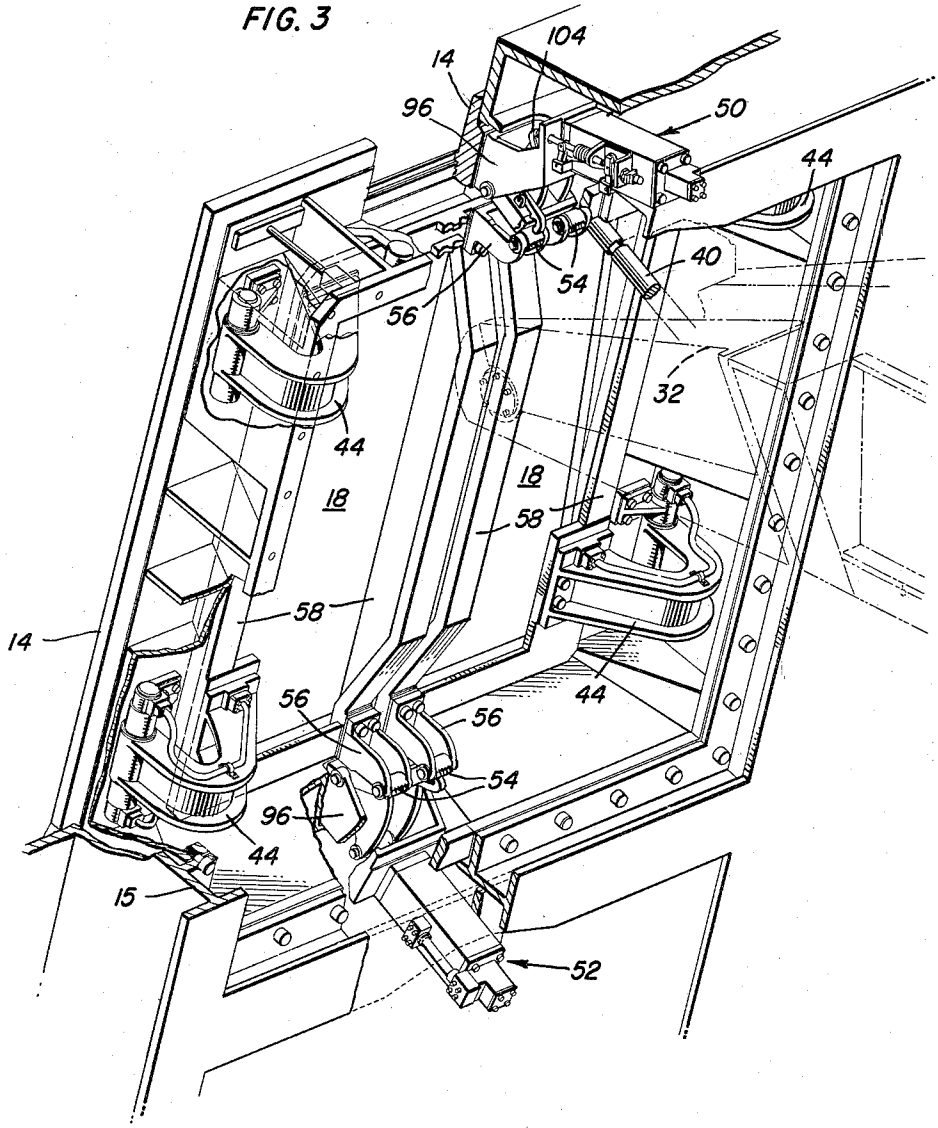
INVENTORS
Melvin O. Jacobson
Bertram J. Matson
Palmer G. Wermager

BY W. O. Luxenberg
Claude Funkhouser
ATTORNEYS
R. R. Anderson
AGENT

RETRACTABLE SPANNING RAIL AND BLAST DOOR ARRANGEMENT

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FIG. 3



RETRACTABLE SPANNING RAIL AND BLAST DOOR ARRANGEMENT

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FIG. 4

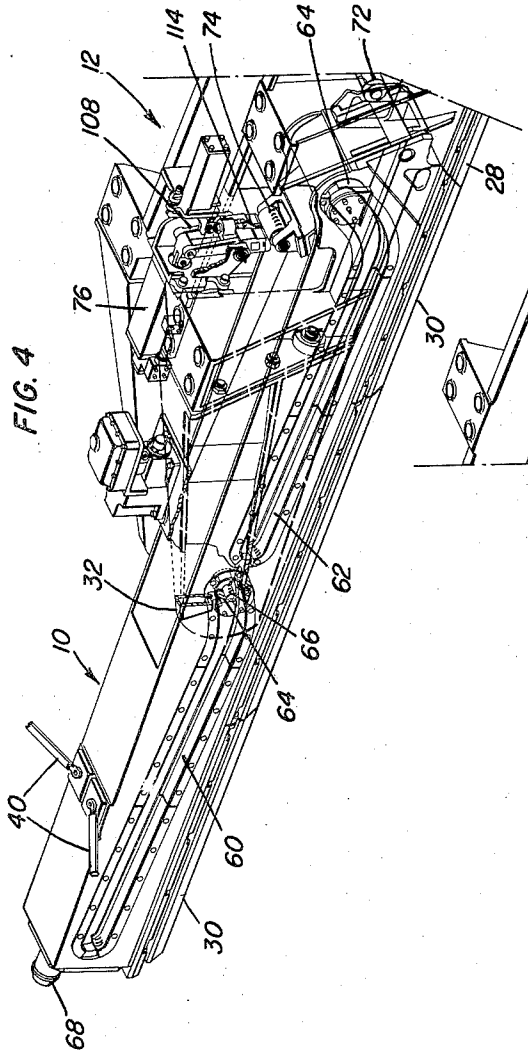
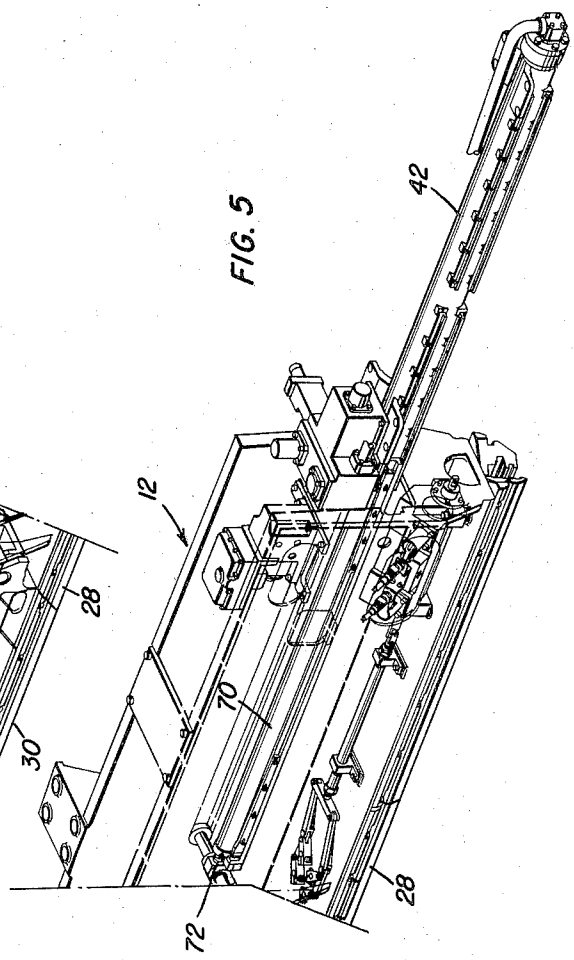


FIG. 5



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RETRACTABLE SPANNING RAIL AND BLAST DOOR ARRANGEMENT

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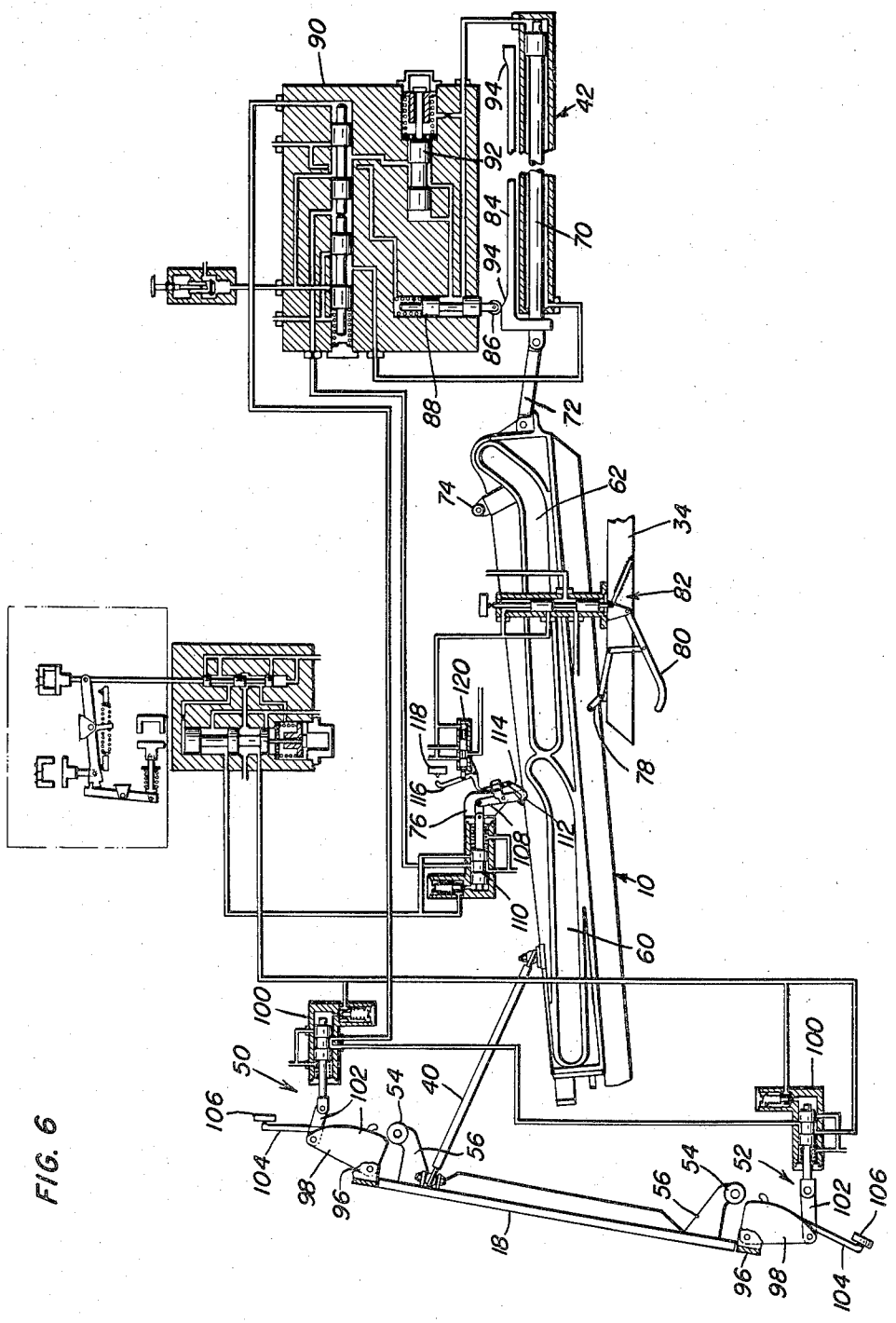


FIG. 6

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3,101,026

RETRACTABLE SPANNING RAIL AND BLAST DOOR ARRANGEMENT

Melvin O. Jacobson, Coon Rapids, and Bertram J. Matson and Palmer G. Wermager, Minneapolis, Minn., assignors, by mesne assignments, to the United States of America as represented by the Secretary of the Navy

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7 Claims. (Cl. 89—1.7)

This invention relates generally to conveyor systems, and more particularly it pertains to a conveyor rail which is extensible through a doorway, such as a spanning rail extending through a pair of blast doors.

The spanning rail and blast doors of this invention are part of a loader for a guided missile launching system as described and illustrated in a co-pending U.S. patent application, Serial No. 848,163, filed Oct. 22, 1959 by Myron J. Bauer et al. for "Guided Missile Launching System."

In the open position, the blast doors allow passage of missile weapons from a loader rail onto a launcher rail when loading, or from the launcher rail to the loader rail when the missile weapons are being unloaded. In the closed position, the blast doors protect the interior of a deckhouse from the blast of the exhaust gases from the booster of the missile weapon as well as from adverse weather.

It is an object of this invention to provide a conveyor rail which can be effectively extended through a doorway to pass objects therealong between two spaced stations and which can be retracted with its doors to close and seal the doorway.

It is another object of the present invention to provide a spanning rail and blast doors which work together to bridge a gap between a missile weapon loader and the end of a guide arm of a missile weapon launcher.

Another object of this invention is to provide a missile weapon conveying spanning rail which retracts compactly into a trunk section of a missile weapon loader above the rails thereof.

Another object of this invention is to provide a spanning rail and blast door arrangement which is operable by a common hydraulic power piston at an automatically controlled speed.

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 dimetric view of the retractable spanning rail and blast doors of this invention;

FIG. 2 is a dimetric view of a guided missile weapon launcher and adjacent deckhouse between which missile weapons are transferred in either direction;

FIG. 3 is a dimetric view of a blast door arrangement with a portion of the loader trunk shown in dashed lines to illustrate the relation therebetween;

FIG. 4 is a detailed dimetric view of a spanning rail and a part of a trunk section of a missile weapon loader partly skeletonized for clarity;

FIG. 5 is a continuation to the right of the dimetric view of FIG. 4; and

FIG. 6 is a schematic diagram of the hydraulic operating and related components for the spanning rail and blast doors arrangement.

Referring now to the details of the drawings in FIGS. 1 to 6, the retractable spanning rail is designated generally throughout the drawings by reference numeral 10. As shown best in FIG. 1, this spanning rail 10 is part of a loader 12 of a missile weapon feeder for a guided missile launching system, which is intended to extend and retract

through a door frame 14 provided in an opening 15 in the bulkhead of a deckhouse 16. In extending, the spanning rail 10 opens a pair of blast doors 18 and bridges the gap between the deckhouse 16 and one guide arm 20 of a pair of guide arms 20 of a dual missile weapon launcher 22 as best illustrated in FIG. 2.

In practice, two loaders 12 forming a missile weapon feeder with their associated spanning rail 10 and blast doors 18 are used so that both guide arms 20 of the dual launcher 22 may be loaded at one time, either simultaneously or alternately. For the purposes of this invention, however, it is necesary to describe only one of the loaders 12 briefly.

Missile weapons 24, consisting usually of a missile and a booster connected thereto, are suspended by spaced fore and aft shoes on the booster and moved on rails 26 on these launcher guide arms 20 and on similar rails 28 and 30 provided on the loader 12 and the spanning rail 10, which are all in continuous alignment when the latter is extended as shown best in FIG. 1.

The loader 12, although it has a number of trunk sections, has three trunk sections 32, 34, and 36 which are associated with the spanning rail 10 and which are supported from the overhead structure 38 of the deckhouse 16. The blast doors 18 connect through operating links 40 to the forward end of the spanning rail 10. The base end of spanning rail 10, in turn, is linked to a long power piston 42 which is attached to the trunk section 36 so that both blast doors 18 and the spanning rail 10 function mechanically as one unit. Power for movement of the components is furnished by a conventional accumulator, not shown, which ports hydraulic pressure to a power piston 42 housed within the trunk section 36.

The door frame 14 is a square-shaped weldment which is set into the opening 15 which is covered by the blast doors 18 when the doors are in a closed position. These blast doors 18 swing outward each on a vertical pair of hinges 44 along their outboard edges within the frame 14 and which are completely hidden from the outside of the deckhouse 16 when the blast doors 18 are closed as shown best in FIG. 3.

In accordance with a co-pending patent application entitled "Blast Door Seal" invented by Melvin O. Jacobson and Palmer G. Wermager, Serial No. 106,422, filed April 27, 1961, now U.S. Patent 3,075,254, along the outermost edges where the frame 14 and doors 18 come together, blast seals are formed by adjoining surfaces machined to close tolerances. Just within the perimeter formed by the blast seals, recessed grooves holding rubberized strips behind the blast edgings protect the interior of the deckhouse 16. These special rubberized seals are also installed full-length along the blast doors 18 where the leading edges meet during closure of the blast doors 18.

Between the top of each blast door 18 and the spanning rail 10, the previously mentioned operating links 40 mechanically coordinate the movement during the opening or closing movement of the doors. When the spanning rail 10 is latched in the extended position as shown in FIG. 1, the operating links 40 hold the blast doors 18 firmly in an open position. When the blast doors 18 are closed and latched, these same operating links 40 hold the spanning rail 10 secure in its retracted position. Each end of an operating link 40 terminates in a ball-type socket joint 46. These socket joints 46 allow angular movement between the spanning rail 10 and the blast doors 18 during operation, and thus act as a pair of compensating push-pull rods.

FIG. 3 shows how the upper and lower latches 50 and 52 hold the blast doors 18 closed. The latches 50 and 52 are of a spring-loaded, hydraulically released type and are mounted on a vertical centerline of the frame 14.

Each latch 50 or 52 is wide enough to capture a roller 54 from both blast doors 18 as they close and engage.

Each blast door 18 has its own rollers 54 mounted in brackets 56 located inside the blast doors 18, which engage the frame-mounted latches 50 and 52 whenever the blast doors 18 are closed.

These blast doors 18 are kept from possible misalignment by stiffeners and steel reinforcements 58 placed around the perimeter of each. A recessed groove and wedge-shaped lip (not shown) run full length in the right and left blast doors 18, respectively, and mate in tight engagement when the blast doors 18 are closed.

As shown best in FIG. 4, the spanning rail 10 is an elongated hollow steel bar structure. Two cam tracks 60 and 62 are located within the rail 10 on each side thereof and run horizontally for approximately half its length before curving upwardly. These cam tracks 60 and 62 slide on rollers 64 which are mounted within the trunk sections 32 and 34. Shafts 66 on which these rollers turn, extend through the spanning rail 10, while the cam tracks 60 and 62 ride on these rollers 64, and provide the upward and backward motion needed to cause the rails 30 of the spanning rail 10 to clear the rails 28 of the loader and then slide back thereover.

Nylon bumper pads and a positioner spud 68 provided on the forward end of the spanning rail 10 engage the rear end of the guide arm 20 of the launcher 22 to provide positive alignment of rails 30 and 26 in the extended condition of FIG. 1.

As shown in FIGS. 4 and 5, the base end of the spanning rail 10 is fastened to the piston rod 70 of a power piston 42 by means of an adjustable link 72. A latch block 74 is provided on top of the base end of spanning rail 10 to act as a snubber for a spanning rail latch 76. This snubbing action secures the spanning rail 10 when it is extended and thus also holds the blast doors 18 open.

Between the rails 28 of trunk section 34, there is provided a positioner or actuator arm 80, shown best in FIG. 6. This arm 80 is extended downwardly by means of a cammed lever 78 when the latter is disengaged by the retracted position of the spanning rail 10 as shown in FIG. 6. When so extended, the actuator arm 80 is in the path of an accidently moved missile weapon 24 and will be tripped thereby to move a loader safety shut-off interlock valve 82 which is suitably connected to the drive mechanism of the loader 12. When the spanning rail 10 extends and the rail continuity is restored, the lever 78 lifts the actuator arm 80 clear so that a missile weapon 24 is allowed to continue to the left onto the spanning rail 10.

As shown best in FIGS. 5 and 6, as the power piston 42 extends the spanning rail 10, a sliding cam track 84 which is yoked to the end of the piston rod 70 is drawn alongside the power piston 42 by the piston rod 70. A cam roller 86 which is attached to a spring-loaded servo valve 88 in a valve block 90 rides on this cam track 84. As shown in FIG. 6, the cam follower roller 86 opens or closes this servo valve 88, which, in conjunction with a metering valve 92, controls the speed of retraction or extension of the spanning rail 10. An inclined slope 94 is provided at either end of the sliding cam track 83 which causes the servo valve 88 to close off. Rise and fall of the cam follower roller 86 results in a controlled hydraulic flow to or from the power piston 42.

The previously mentioned upper and lower latches 50 and 52 for the blast doors 18 as shown in FIGS. 3 and 6, are alike, one being mounted inverted with respect to the other. Each latch 50 and 52 consists of a latch bracket 96 fastened to the door frame 14. A hook-like latch block 98 and a spring-loaded latch piston 100 are attached together by means of a linkage 102, as best shown in FIG. 6, by suitable pivot pins. Along the side of each latch 50 or 52, a spring-loaded lever 104 actuates electrical interlock switches 106 to provide status indications as to whether the blast doors 18 are closed and latched.

The pistons 100 of the latches 50 and 52 in addition to releasing their latch blocks 98 also act as sequence valves and are hydraulically connected together as shown in FIG. 6 to insure that both the latch blocks 98 are in a full retract position before pressure fluid from the accumulator is ported to the power piston 42 for an extend stroke.

As previously mentioned, the spanning rail latch 76, as shown in FIGS. 4 and 6, is located above the aft end of the spanning rail 10. Its operation through a jointed linkage 108 causes the spanning rail 10 to be held fast against the bottom portion of the trunk section 34. One end of the linkage 108 is attached to a piston 110 while the other end is fastened to a latch striker 112. This striker 112 is joined to a spring-loaded pivot 114. The previously mentioned latch block 74 on the spanning rail 10 rides forward and trips the latch 76 which secures the spanning rail 10 in an extended position.

Latch operation is also supplemented by an L-shaped lever 116, as shown best in FIG. 6, to trip an interlock switch 118 and an interlock valve 120 to prevent operation of the loader 12 unless the blast doors 18 are open and the spanning rail 10 is latched.

Obviously many modifications and variations of the present invention are possible in 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. In a missile launcher system of the type having a spaced loader and launcher equipped with alignable missile supporting rails, a retractable spanning rail and blast door arrangement comprising an elongated spanning rail for spanning the space between said loader and launcher rails, means to slidingly support the spanning rail, a mounting frame, a pair of blast doors pivotally mounted in said frame for safeguarding a missile on said loader from said launcher, a hydraulic piston having a piston rod, a link pivotally connected to one end of the spanning rail and to said piston rod, connecting means joining the other end of the spanning rail and the blast doors, and control means, said control means including a fluid metering valve, a servo valve in fluid communication with the metering valve and the hydraulic piston, a cam track carried by and movable with said piston rod, piston means disposed within said servo valve for controlling the flow of fluid to and from the hydraulic piston as the piston means moves from an open position to a closed position, a roller carried by said piston means engageable with the cam track for moving the piston means to and from said positions, said servo and metering valves cooperating to control the flow of fluid into the hydraulic piston thereby to control the rate of speed at which the hydraulic piston moves the spanning rail through its support.

2. The arrangement of claim 1 and further comprising a limit switch, said switch including a pivotally mounted actuating lever movable into operable engagement with said switch, a movably mounted spring loaded member in engagement with said actuating lever for moving the lever into operable engagement with the switch, striker means pivotally connected to said spring loaded member for moving said member, roller means on the spanning rail engageable with said striker means for actuating the striker means thereby terminating the sliding movement of the spanning rail, a fluid operated valve means pivotally connected to the actuating lever for moving the lever out of engagement with the switch.

3. The arrangement of claim 2 and further comprising hydraulically actuated latches for the blast doors, each of the latches including fluid actuated devices in the hydraulic pressure system and actuated concurrently with the actuation of the hydraulic system, spring biased pis-

tons carried by the fluid actuated devices, latch means pivotally mounted on the frame near the uppermost and lowermost edge of the door, bracket means carried by said doors, roller means on said bracket means engageable with the latch means for maintaining the doors in a closed position and for releasing the doors for movement to an open position concurrently with the actuation of the hydraulic piston.

4. In a missile launcher system of the type having a spaced loader and launcher each equipped with missile supporting rails, a retractable spanning rail and blast door arrangement comprising an elongated spanning rail for spanning the space between said loader and launcher rails, rollers for supporting the spanning rail, a pair of blast doors on said loader for safeguarding a missile on said loader from said launcher, a hydraulic pressure system, a power piston connected to the hydraulic system and to the rearward end of the spanning rail, connecting means joining the forward end of the spanning rail and the blast doors, a cam surface attached to and movable with the power piston, and a cam follower riding on the cam surface, a spring biased servo valve included in the hydraulic system in fluid communication with the power piston, said cam follower activating said servo valve in the hydraulic system whereby the power piston rolls the spanning rail forward and simultaneously opens the blast doors, a metering valve in the hydraulic system in fluid communication with the servo valve for controlling the rate of speed at which the power piston functions, thereby to control the forward movement of the spanning rail.

5. The arrangement of claim 4 and further comprising a fluid actuated valve in fluid communication with the hydraulic system, a spring loaded element mounted along the top of the spanning rail, a latch striker connected to said spring loaded element, connecting means joining the latch striker with said valve in the hydraulic system, and a latch block at the extremity of the spanning rail engageable with said latch striker for securing the spanning rail when the rail has reached its extended position.

6. The arrangement of claim 5 and further comprising an additional fluid actuated valve in fluid communication with the hydraulic system, a second means operable by said spring loaded element and pivotally connected to said additional fluid actuated valve in the hydraulic system whereby operation of the retractable rail and blast doors with a weapons loader is prevented unless the blast doors are open and the spanning rail is latched.

7. The arrangement of claim 6 and further comprising latch means for each of the blast doors, latch pistons having piston rods, pivotally mounted latch blocks, linkages pivotally connected to said latch blocks and to said piston rods, roller means on the door and engageable with said latch blocks for latching said door as the latch pistons are actuated by the fluid pressure, and means connecting the latch pistons to the hydraulic system, whereby activation of the hydraulic system causes the power piston to move the spanning rail and at the same time unlatch and open the blast doors.

References Cited in the file of this patent

UNITED STATES PATENTS

1,455,607	Du Bois	May 15, 1923
2,218,684	Murray et al.	Oct. 22, 1940
2,414,301	Harris	Jan. 14, 1947
3,054,330	Carlberg	Sept. 18, 1962