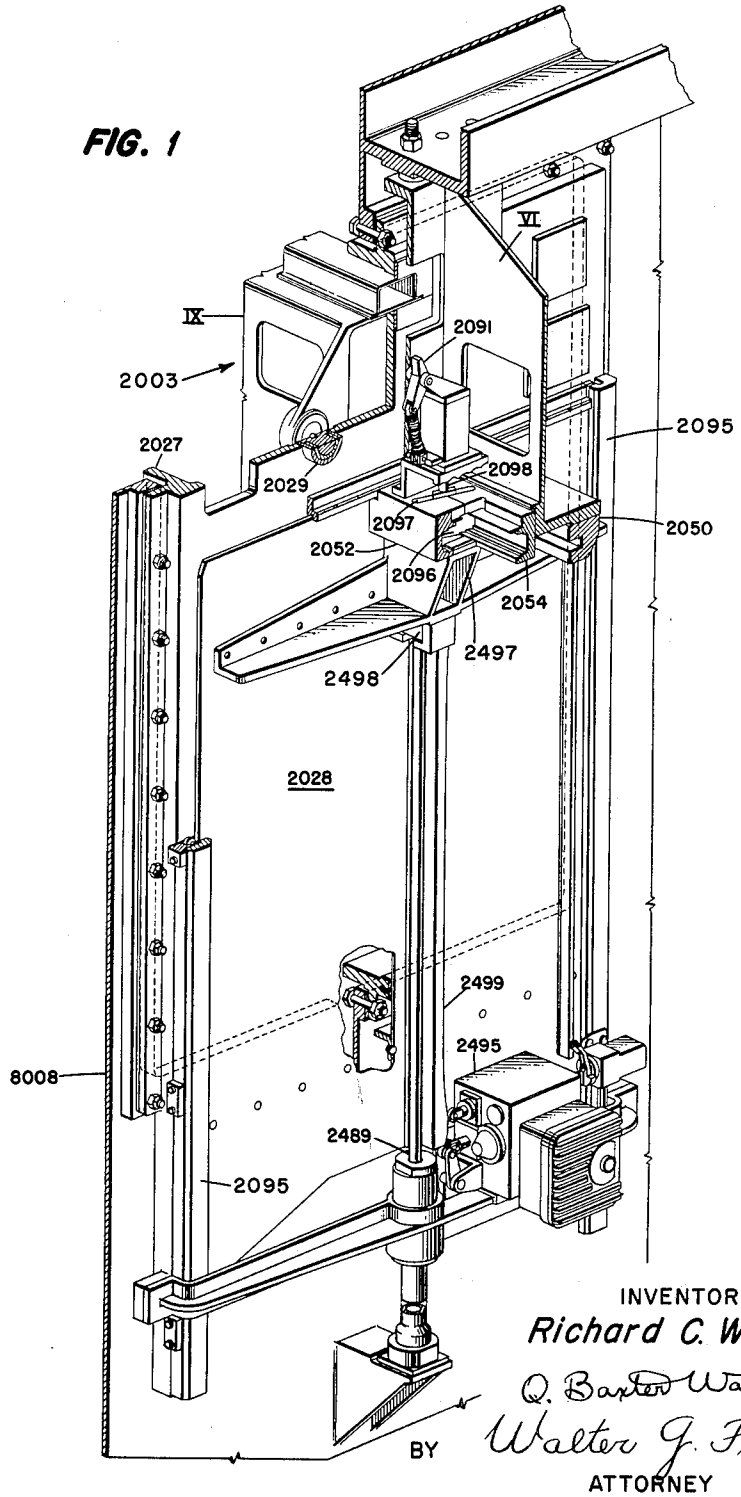
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FLAMETIGHT DOOR AND FLAME SEAL FOR GUIDED MISSILE LAUNCHING SYSTEM

Original Filed Oct. 22, 1959

4 Sheets-Sheet 1

FIG. 1



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FLAMETIGHT DOOR AND FLAME SEAL FOR GUIDED MISSILE LAUNCHING SYSTEM

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FIG. 2

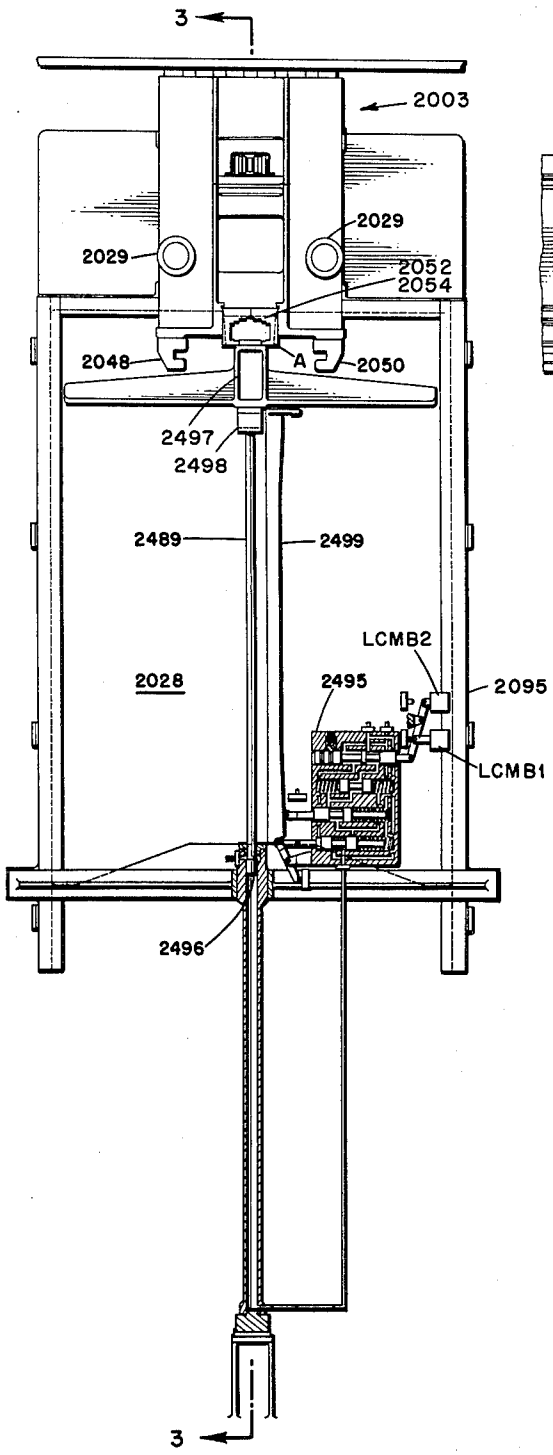
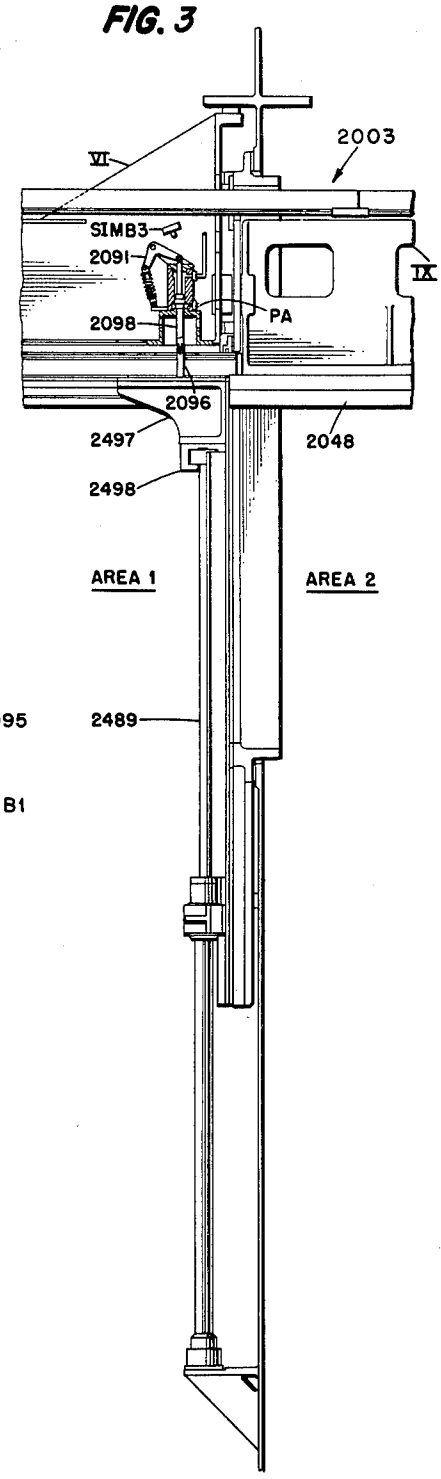


FIG. 3



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FIG. 4

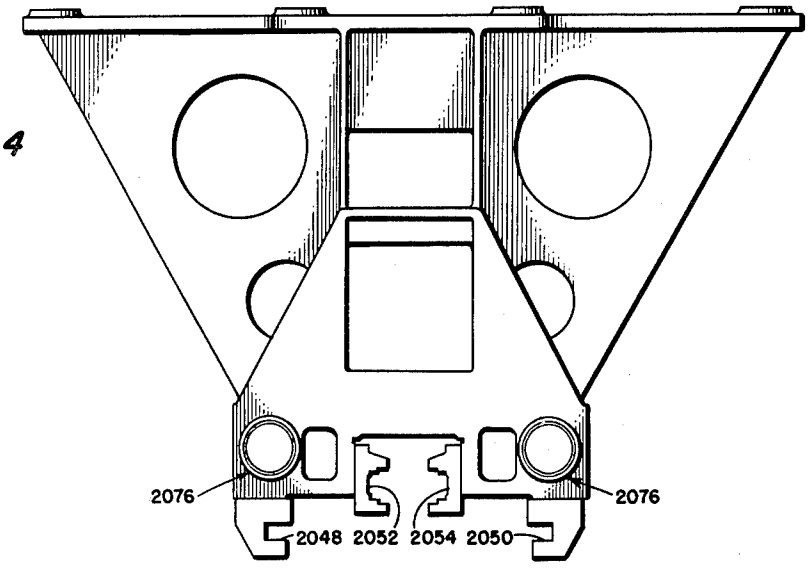
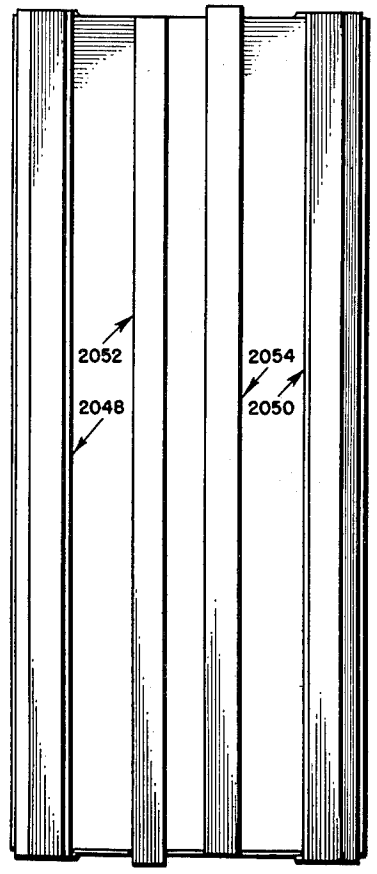


FIG. 5

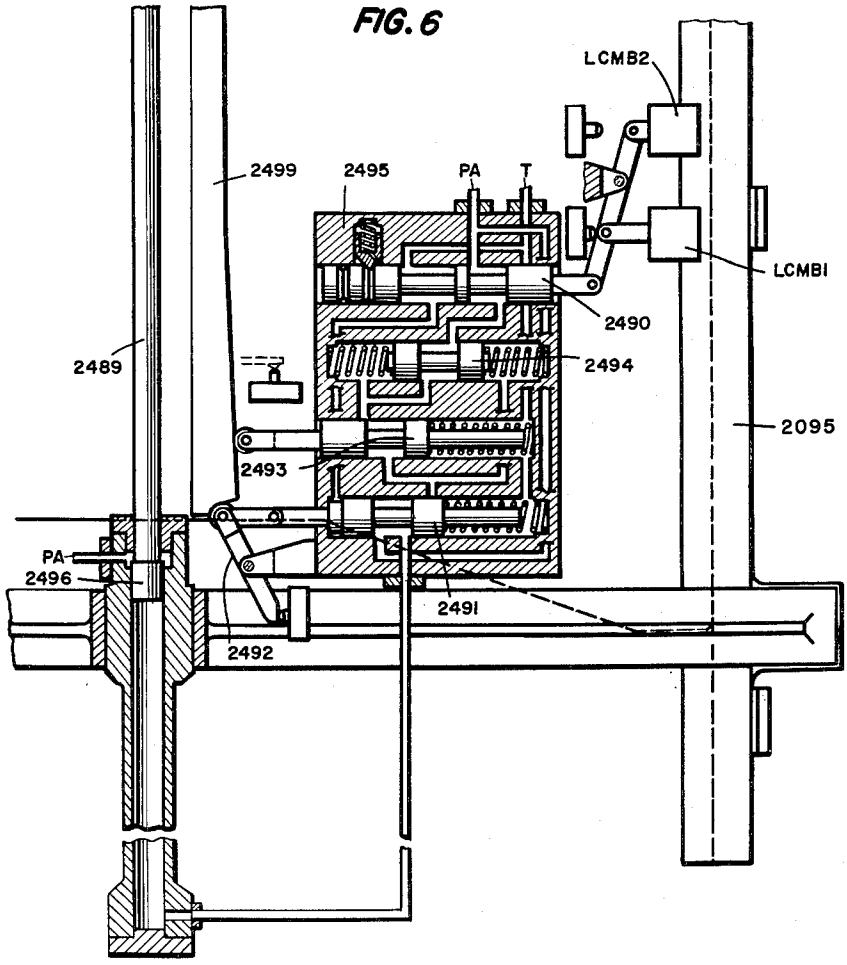


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FIG. 6



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FLAMETIGHT DOOR AND FLAME SEAL FOR GUIDED MISSILE LAUNCHING SYSTEM

Richard C. Wilson, Champlin, Minn., assignor, by mesne assignments, to the United States of America as represented by the Secretary of the Navy

Original application Oct. 22, 1959, Ser. No. 848,163. Divided and this application Nov. 30, 1959, Ser. No. 856,318

9 Claims. (Cl. 268—53)

This invention relates generally to closure operators, and more particularly it pertains to automatically operated flametight doors and flame seals therefor.

This patent application is a division of U.S. patent application Serial Number 848,163, entitled, "Guided Missile Launching System," filed by Myron J. Bauer et al., on October 22, 1959.

In ordnance armament, it is often necessary to store explosive missile weapons in close proximity to their preparatory or testing or employment area. Because of the danger of fire, it is customary to provide a closed-off storage magazine. All delivery of missile weapons is then handled through as small an aperture as possible and a shutter or door kept closed thereover at all other times.

It is important that the door be made to operate rapidly yet without undue shocks of start and stop. The door should be controllable from electric signals so that automatic interlocking with the movement of the transported missile weapon on a conveyer is easily accomplished with properly placed switches.

All apertures, such as passages for a drive chain, and skid tracks for the missile weapon, must be sealed and fail-safe provisions made to cover contingencies of hydraulic or electrical system failure. The door assembly, in addition, must be kept to the conveyer trunk for accuracy of fit and to maintain operability and flame tightness under adverse conditions such as encountered in moving vehicular structure.

It is, therefore, an object of the present invention to provide a rapidly operating flametight door having controlled acceleration and deceleration.

Another object of this invention is to provide an automatically operated flametight door passing missile weapons from a ready service mechanism or magazine as used in a guided missile launching system.

Another object of this invention is to provide a flametight door for a conveyor trunk which will accurately conform to and seal all apertures therearound in reliable, fail-safe manner.

In accordance with the invention, a flametight door is provided between two magazines, and in the guided missile launching system referred to above between two trunk sections. When the flametight door is closed, it separates the trunk sections of area 1 from the trunk sections of area 2 and it allows free passage of missile-booster combinations from area 2 into area 1 when it is open. It is the function of the flametight door to seal off the magazine area of area 2 while the lower and upper blast doors of the guided missile launching system are open. The frame of the flametight door is mounted to the athwartships bulkhead of a vessel and it is aligned to the adjacent loader trunk sections.

The flametight door frame is maintained in its position by two locating dowels fitted to the trunk sections. The flametight door is formed of three-eighth inch steel plate.

In addition to sealing the doorhead, the top edge of the flametight door passes through a gap in skid tracks and it is contoured to fit around chain tracks, leaving the tracks open for passage of a loader chain. The

flametight door is linked to the interlock system of the missile loader.

A section of the chain stowage track passes through the upper portion of the door frame of the flametight door. The door frame is fitted to the outside contour of the chain stowage track to provide a seal therefor.

A chain track flame seal is also provided for the flametight door. This chain track flame seal is not hydraulically or electrically connected with the flametight door. Both the chain track flame seal and the flametight door are closed when a loader saddle cart is in the ready service area 2. However, the flametight door is closed and the chain track flame seal is open when the loader saddle cart is extended beyond the flametight door.

These and other objects and advantages of the invention will become more readily apparent and understood from the accompanying detailed specification and drawings in which:

FIG. 1 is a diametric view of a flametight door with parts removed and partly broken away;

FIG. 2 is a schematic of the flametight door of FIG. 1;

FIG. 3 is a cross section with parts removed taken along line 3—3 of FIG. 2;

FIG. 4 is an end view of a typical trunk section;

FIG. 5 is a bottom view of a typical trunk section, such as shown in FIG. 4; and

FIG. 6 is a schematic of the hydraulic system for the flametight door.

Referring now to FIGS. 1, 2, and 3 where there is shown a flametight door 2028 and its components, the flametight door 2028 is mounted in a frame 2027. This frame 2027 is accurately maintained in its position between sections VI and IX of an overhead weapons conveyer or loader trunk 2003 by two locating dowels 2029. The dowels 2029 are inserted in dowel supports 2076 provided in the sections VI and IX, a typical section of which is illustrated in FIGS. 4 and 5.

The door 2028 is formed of three-eighth inch steel and slides in vertical gibs 2095 over a large aperture in the frame 2027. In addition to sealing the aperture, the top edge of the flametight door 2028 passes through a gap in a pair of skid tracks 2048 and 2050 which are used in supporting a missile weapon as it is conveyed over the trunk 2003.

As shown by the dotted lines at A, the top of the flametight door 2028 is contoured to fit around a chain track 2052 and 2054, other components of the conveyer or loader trunk 2003 and thus leaves the track open for passage of a loader chain (not shown).

The flametight door 2028 is linked to the interlock system of the conveyor for missile weapons, as will be pointed out subsequently. In the preferred form here described, the flametight door frame 2027 is considered mounted in a bulkhead 8008 of a vessel for providing passage of a weapon therethrough from an area 2 (an area where missile-booster combinations are stored for use) to an area 1 (an area where missile-booster combinations have their wings and fins assembled thereto and where other preparations are performed on the missile weapons) when the door 2028 is down.

A flametight door operating piston 2496 operates the flametight door 2028. This piston 2496 is mounted to the door frame 2027 and it is connected to a door bracket 2497 through a piston rod 2489 and a self-aligning link 2498, as shown in FIGS. 2 and 3. This floating arrangement excludes the precise alignment necessary between the travel of the flametight door 2028 and the stroke of the piston 2496.

The flametight door 2028 is provided with a control

valve block 2495, shown generally in FIG. 2 and in detail in FIG. 6, which contains a solenoid-operated selector valve 2490, a metering valve 2494, a velocity control valve 2493, and a latch valve 2491. This assembly gives smooth automatic control of the flametight door 2028 during a transfer cycle of a weapon.

The velocity control valve 2493 is spring-loaded against an elongated control cam 2499 which is attached to the flametight door 2028. The velocity control valve 2493 and control cam 2499 function together to sense the position of the flametight door 2028. Together with the metering valve 2494, the velocity control valve 2493 and the control cam 2499 rate control the flametight door operating piston 2496 which opens and closes the flametight door. The latch valve 2491 latches the flametight door 2028 in the closed position.

When the selector valve 2490 is shifted to open the flametight door 2028, a flametight door latch 2492 is then released before the fluid pressure PA from an accumulator (not shown) is ported to the door operating piston 2496. The latch 2492 actually contacts the bottom edge of the control cam 2499 while holding the flametight door 2028 closed. The latch 2492 is held in a retracted position by the control cam 2499 until the flametight door 2028 is completely closed.

FIG. 6 shows the selector valve 2490 and latch valve 2491 in block form. The control cam 2499 is attached to the piston rod 2489 which carries the load. The travel of the flametight door operating piston 2496 ends approximately in the middle of the stroke. In closing the flametight door 2028, the selector valve 2490 ports accumulator pressure fluid to the metering valve 2494. The controlled fluid is then ported to the bottom side of the flametight door operating piston 2496.

As shown best in FIGS. 2 and 6, a velocity control valve 2493, which is attached to the control cam 2499, functions as a variable orifice in the flow path of the hydraulic fluid, while the metering valve 2494 maintains a constant pressure drop across this orifice. During the acceleration part of the operation, the opening of the orifice increases, and the opening of the orifice is controlled by the control cam 2499. Constant velocity for the flametight door 2028 is maintained across the flat portion of the control cam 2499. As the flametight door operating piston 2496 is decelerated, the control cam 2499 closes the orifice opening once more. The movement of the control cam 2499 is reversed during the return stroke of the flametight door operating piston 2496. The metering valve 2494 of the flametight door 2028 is spring-centered about the two lines leading to the valve before a cycle of operation is initiated.

At the beginning of a cycle of operation of the flametight door 2028, there is no resistance to the flow of hydraulic fluid in the system until the fluid reaches the variable orifice comprising velocity control valve 2493. This velocity control valve 2493 then builds up a back pressure of hydraulic fluid which is ported to the left side of the spring-centered metering valve 2494. This back pressure of the hydraulic fluid causes the metering valve 2494 to shift to the right and attempt to cut off the flow of hydraulic fluid to the orifice.

It will be noted that the opposite end of the metering valve 2494 is connected to the downstream side of the variable orifice. Because of the load on the piston rod 2489 and the flametight door operating piston 2496, the pressure of the hydraulic fluid in the line will build up. The building up of the hydraulic pressure in the line results in a constant pressure drop across the orifice. As the flow of the hydraulic fluid increases, the spring-centered metering valve 2494 will meter the added volume of hydraulic fluid to assure the same specific pressure drop.

A constant pressure drop is maintained across the variable orifice opening by the metering valve 2494 when the flametight door 2028 is cycled to open. The hydraulic line labelled T leading from the metering valve 2494 to a fluid return header tank (not shown) is ported by the selector valve 2490. The pressure PA of the accumulator fluid moves the flametight door operating piston 2496 downwardly. This pressure PA of the accumulator fluid is constantly available on top of the flametight door operating piston 2496. The accumulator pressure fluid from the bottom side of the flametight door operating piston 2496 is regulated for desired flow characteristics as it passes through the control valve block 2495. The combination of the control cam 2499, the variable orifice or velocity control valve 2493 and the metering valve 2494 assure a smooth acceleration, constant velocity, and a uniform deceleration of the flametight door 2028 regardless of existing load conditions.

Now with suitable electrical interlock circuitry signalling that the weapon with its conveyer loader chain is in area 1, the left side of the door, as shown in FIG. 3, and ready for passage through to area 2, on the right, a solenoid LCMB1 is energized to open the flametight door 2028.

As shown in FIG. 6, when solenoid LCMB1 is energized, the flametight door solenoid operated selector valve 2490 is actuated and detented with solenoid LCMB1 being then de-energized. Now the latch valve 2491 for the flametight door 2028 is actuated to release the latch 2492 and to port a return volume of hydraulic fluid to the velocity control valve 2493.

Valve 2493 is actuated by the control cam 2499 to port a volume of hydraulic fluid to the metering valve 2494. The metering valve 2494, working along with the variable orifice effect of velocity control valve 2493, causes the flametight door operating piston 2496 to shift. The flametight door operating piston 2496 retracts and the flametight door 2028 is opened.

After the weapon is passed through into the area 2 over the skid tracks of the conveyer trunk, a solenoid LCMB2 is energized to close the flametight door 2028. Energizing the solenoid LCMB2 shifts and detents the flametight door selector valve 2490, the solenoid being then de-energized.

The metering valve 2494 is now actuated. The velocity control valve 2493 is cam and spring actuated and actuates the latch valve 2491. As the flametight door operating piston 2496 is extended to close the door 2028, the latch 2492 returns to a latched position.

The hollow open bottom chain track 2052 and 2054 is provided with a separate closure because in one case when the weapon is on one side of the door 2028, the conveyer chain occupies the track. In the other case, the track 2052, 2054 is empty and capable of flame transmission and must be closed off.

For this purpose a chain track flame seal 2096 is provided. The chain track flame seal 2096, as shown best in FIGS. 1 and 2, is located in trunk section VI and closes the chain tracks 2052 and 2054 when the weapon is in area 2, thus simultaneously sealing off the loader trunk 2003 of area 2 from its continuation loader trunk 203 of area 1 along with the flametight door 2028. This action is necessary for the safety of the weapons crew and the magazine personnel in areas 1 and 2, respectively. The chain track flame seal 2096 is linked to the operation of the conveyer trunk.

FIG. 1 shows a small slot 2097 just below the junction of trunk sections VI and IX. This slot 2097 is the opening through which the flame seal 2096 depresses to close off the chain track 2052 and 2054 fore and aft. In FIG. 1, the flame seal 2096 is shown in the extended position which would indicate that the weapon with its drive chain is retracted and therefore clear of the bulkhead and chain tracks.

It will be noted that the flame seal 2096 is arranged in a slanted or angled position. In order that the surfaces of the weapon support shoe may move smoothly through

this area, no two opposite rollers of the chain are permitted to roll over the chain track flame seal slot **2097** at the same time. This angled slot **2097** through the chain track area necessitates the like-angled flame seal **2096**.

An electrical interlock switch SIMB3, shown best in FIG. 3, indicates the retraction of the flame seal **2096**. When the weapon is ready to be transferred into area 1, fluid pressure is ported to the smaller side of a flame seal operating piston **2098**, also shown in FIG. 1. Inasmuch as hydraulic pressure in the larger piston area subsides, the flame seal **2096** is forced back into a retracted position. This causes compression type toggle-spring operated arm **2091** to act as an actuator to contact the adjacent interlock switch SIMB3, shown in FIG. 3.

It will be noted from FIGS. 1, 2, and 3, that the flametight door bracket **2497** when up in the door closed position effectively closes the open bottom of the chain tracks **2052** and **2054** directly below the flame seal **2096**.

The chain track flame seal **2096** otherwise is not mechanically hydraulically or electrically connected with the previously mentioned flametight door **2028** but operates therewith under movement of the transported weapon. Both the chain track flame seal **2096** and the flametight door **2028** are closed when the weapon is in area 2. However, the flametight door **2028** is closed and the chain track flame seal **2096** is open when the weapon is extended beyond the flametight door **2028** because of the aforementioned presence of the conveyor drive chain in the chain in the chain tracks **2052** and **2054**.

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 combination with an overhead conveyor tramway having at least one trunk section with skid tracks located on opposite sides of a wall separating two areas from each other, closure means for automatically opening as well as closing an aperture in said wall separating said areas from each other, including a frame located in said wall and encompassing said aperture for allowing objects to slide along said skid tracks and pass back and forth through said aperture in said wall frame between said spaced areas, track means located at opposite sides of said frame, a door slidably mounted in said track means for opening as well as closing said aperture in said frame, means connected to said door for automatically controlling the acceleration and deceleration movements thereof during the opening and closing of said aperture in said frame, said means comprising a fluid motor having a piston operably positioned therein, said piston having first and second sides, a piston rod having a first end connected to said first side of said piston, said piston rod having a second end operably connected to said door, a source of pressurized fluid, said fluid being continuously applied to said first side of said piston, valve means controlling the flow of said fluid to said second side of said piston, said valve means comprising a selector valve, a metering valve, a velocity control valve, and a latch valve, said selector valve being operable to start and reverse the movement of said piston and said door, said velocity control valve being operable to control the rate of movement of said piston and said door, said metering valve meing operable to maintain a constant pressure drop across said velocity control means thereby insuring smooth movement of said piston and said door, said latch valve being movable to a door closed position wherein said fluid pressure is continuously supplied to said second side of said piston thereby forcing said piston to one end of its stroke.

2. Closure means as recited in claim 1, wherein means are provided for sealing the edge periphery of said door to said frame when said aperture is closed by said door.

3. Closure means as recited in claim 1, wherein said skid tracks for sliding said objects through said aperture in said frame are spaced from each other.

4. Closure means as recited in claim 3, and other track means positioned within said skid tracks for encompassing and guiding a chain for moving said objects through said aperture in said frame.

5. Closure means as recited in claim 4, and means including a seal for sealing off the interior of said other track means at said wall when said other track means are empty.

6. Closure means as recited in claim 5, wherein said seal is located at an angle to said other track means.

7. Closure means as recited in claim 6, and means for controlling the operation of said seal.

8. Closure means as set forth in claim 1, wherein cam means are rigidly secured to said door, and spring means bias said velocity control valve against said cam means whereby when said door moves said velocity control valve is positioned in accordance with the shape of said cam means thereby controlling the rate of movement of said door.

9. The closure means as recited in claim 8 wherein retractable means are positioned between said frame and said door to thereby lock said door against movement, said retractable means being positioned by movement of said latch valve to said door closed position.

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