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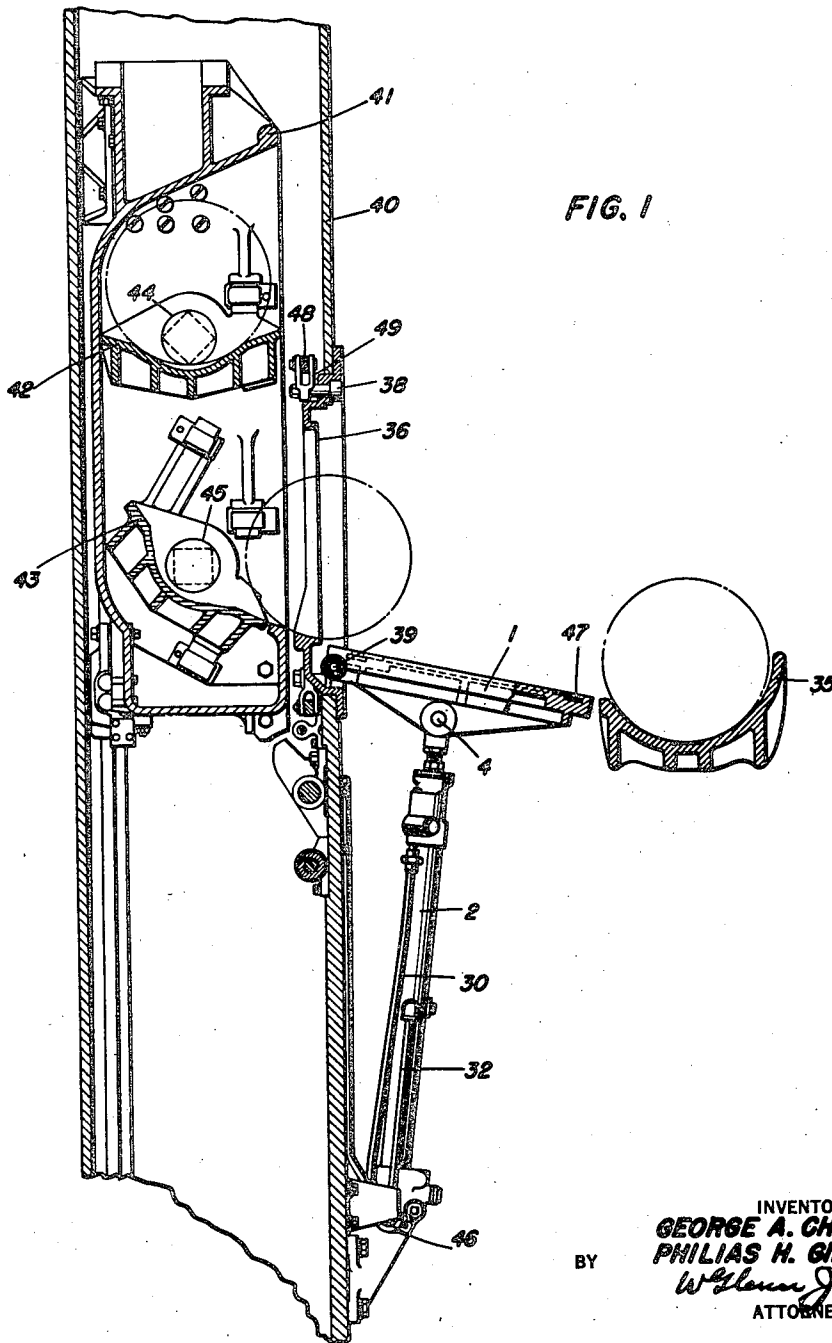
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2,452,035

DOOR OPERATING MECHANISM FOR POWDER HOISTS

Filed March 10, 1944

4 Sheets-Sheet 1



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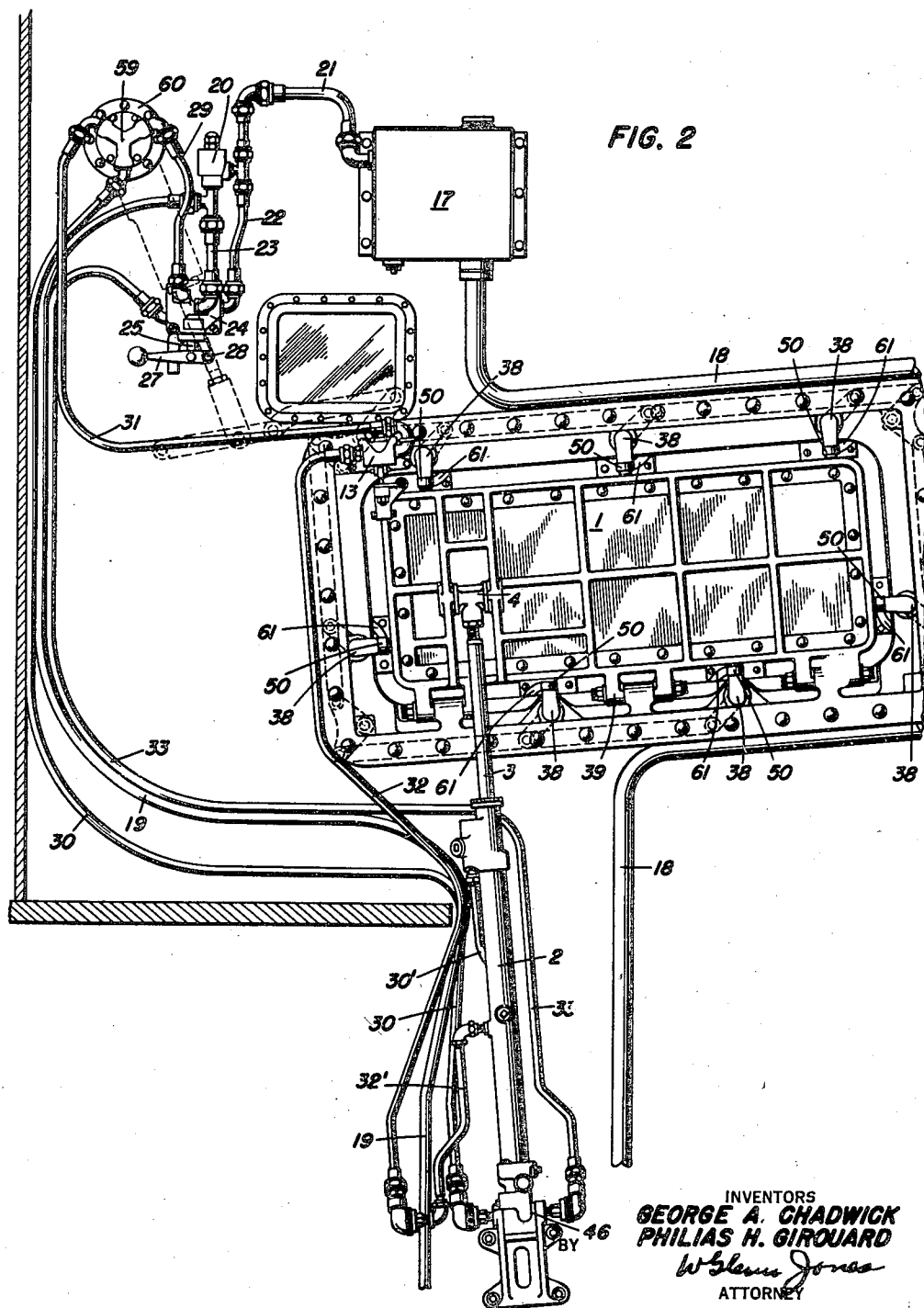
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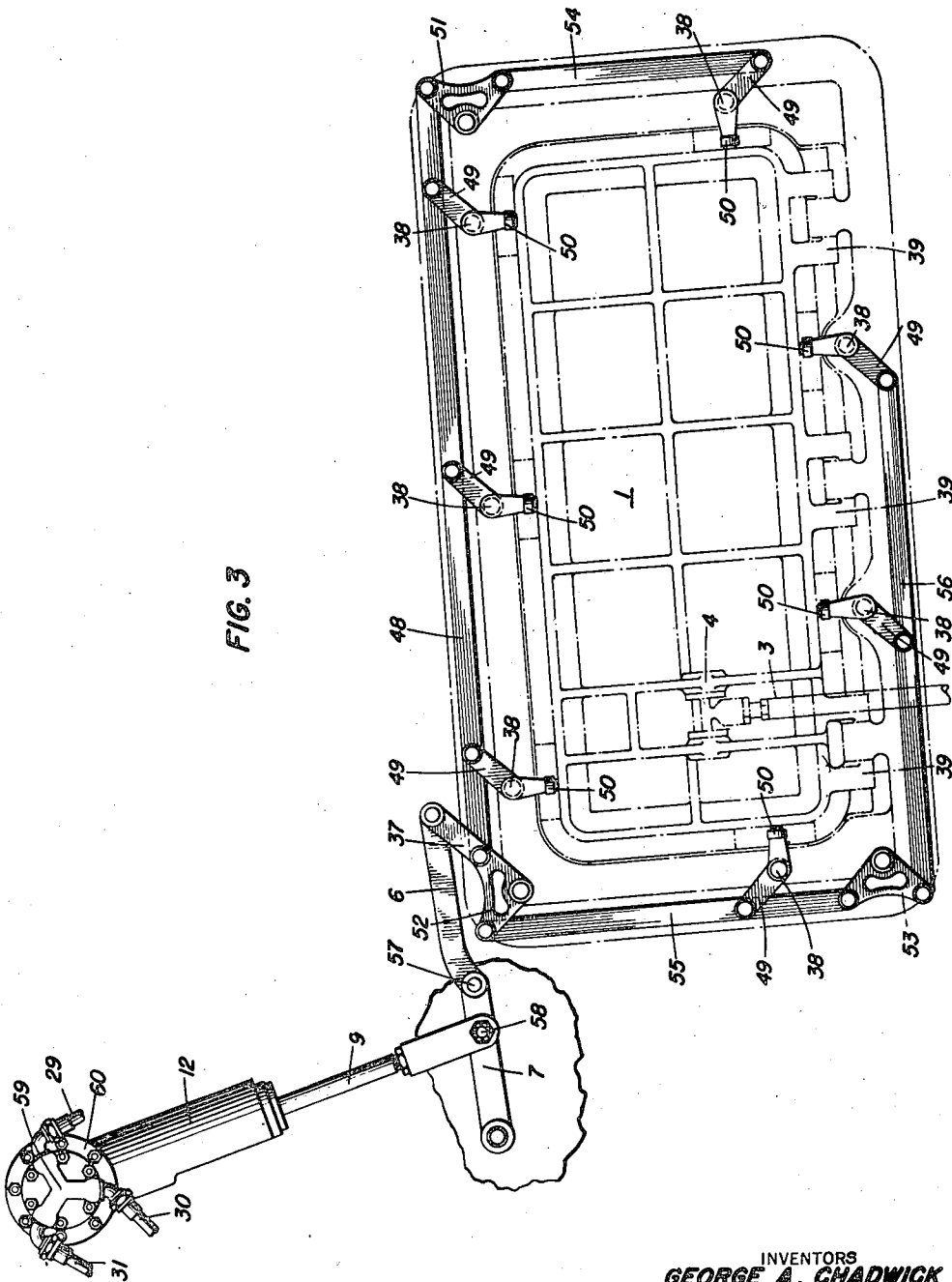
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FIG. 3



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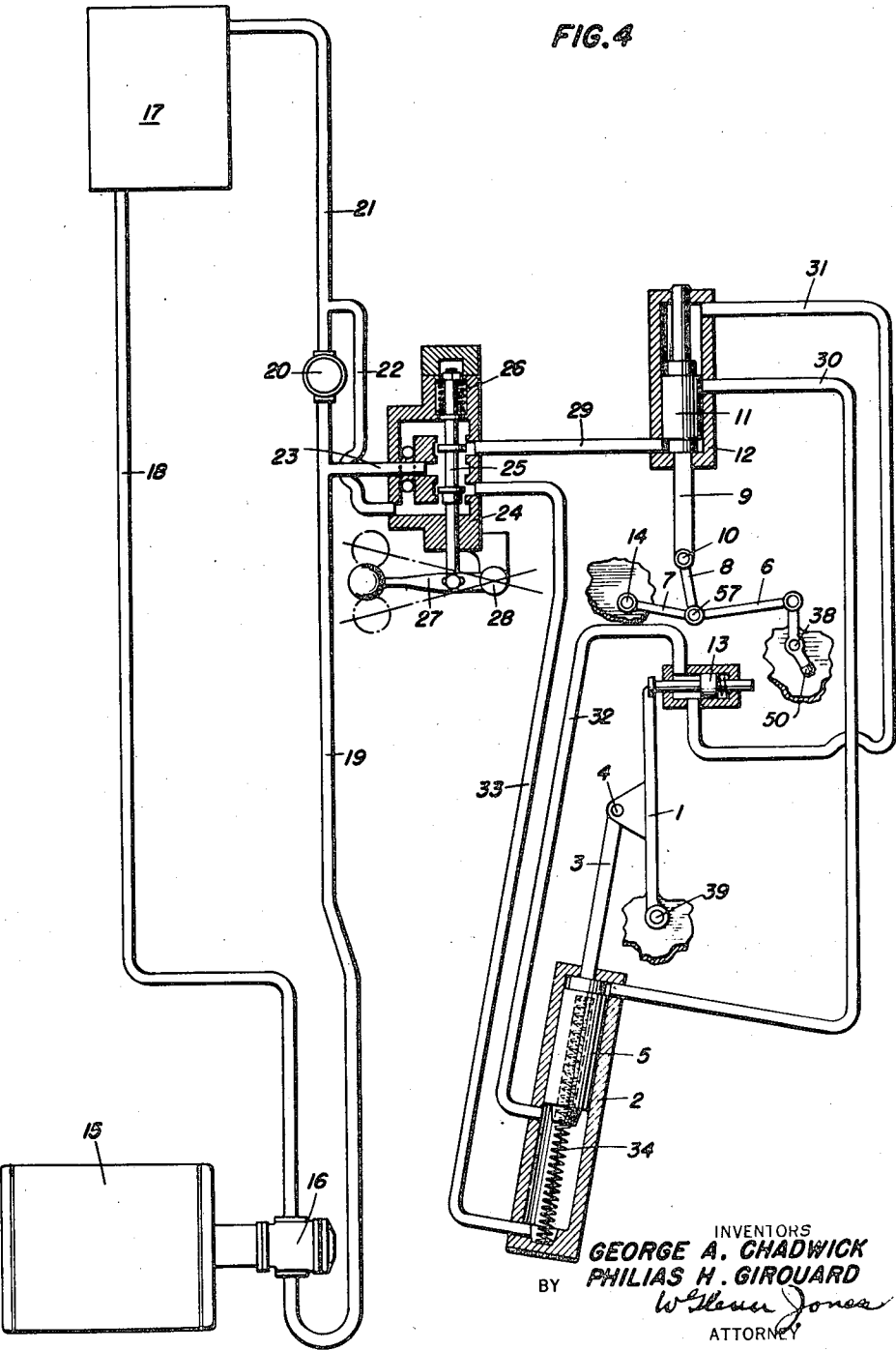
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UNITED STATES PATENT OFFICE

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DOOR OPERATING MECHANISM FOR
POWDER HOISTSGeorge A. Chadwick, Detroit, Mich., and Phyllis
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4 Claims. (Cl. 89-46)

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The following disclosure relates to door closing and sealing means, and is particularly adapted for operating and sealing a swinging door at the upper end of a powder hoist for powder bags used in heavy guns.

The several objects of the device herein described are:

(a) To provide a means for closing the upper end of the powder trunk while the powder car is in motion;

(b) To provide a flame-tight seal for the closing means;

(c) To provide a means for transferring the powder bags from the powder car trays to the gun loading tray;

(d) To provide an automatic means of controlling the closing means and the sealing means so that each operation occurs in the proper sequence.

The device is illustrated in its preferred form in the accompanying drawings, in which:

Fig. 1 is an end view of the door in open position, partly in section, with a cross-sectional view of the upper end of the powder hoist trunk and of the powder cars therein, as well as the gun loading tray onto which the powder bags are rolled from the powder cars.

Fig. 2 is a side view of the door in closed position and the sealing dogs in position to seal the door tightly in place.

Fig. 3 shows the detail structure and arrangement of the sealing dogs and the mechanism which operates them, and

Fig. 4 is a schematic illustration of the hydraulic system used in the control of the operating means for the opening and closing of the door and for the movement of the sealing dogs in the proper sequence with relation thereto.

The closing means illustrated consists of a swinging door 1, hinged at its lower end at 39 and operated by a hydraulic cylinder 2. When the door is opened, the space between the powder car 41 and the gun loading tray 35 will be bridged by the door, as shown in Fig. 1. It should be noted also that the port (defined by the door framing 36 of the trunk 40) and the hinge 39 for the door 1 is located at a higher elevation than the receiving position of the loading tray 35, thus providing the means for rolling the powder bags into the gun loading tray. When the powder bags have been transferred from the powder car to the gun loading tray, they will then be rammed into the gun (not shown).

The sealing means illustrated consists of a series of dogs 50 which force the door against a

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fixed frame 36, thereby compressing the door gasket 47 and forming a flame-tight seal. The dogs are connected by an operating linkage to a second hydraulic cylinder 12, as shown more clearly in Fig. 3.

The means for controlling the operation of the door and the dogs consists of the hydraulic system shown schematically in Fig. 4. It comprises a pump 16 driven by an electric motor 15, a control valve 24, a door operating cylinder 2, a dog operating cylinder 12, and interconnecting piping as shown.

The operation of the hydraulic circuit is as follows:

To open the door, the door control valve handle 27 is shifted to and held by hand in its upper position. Oil under pressure will then be ported from the pump 16 through pipes 19 and 23, control valve 24, and pipe 29 to the lower end of the dog operating cylinder 12. The piston 11 will move upward, thereby rotating the dog operating linkage and unlocking the door. As soon as the dogs 50 have been rotated sufficiently to clear the door, the dog operating cylinder piston 11 will uncover a port for a pipe line 30 to convey the pressure to the upper end of the door operating cylinder 2. The door operating piston 5 will then move down against the pressure of spring 34 and open the door. When the door is opened, the operator releases the handle of the door control valve and it is returned to its neutral position by spring 26, thus unloading the pump discharge through the valve to the expansion tank 17 via pipes 22 and 21. An overload relief valve 20 is used in the line between the pump discharge pipe 19 and return pipe 21.

After the powder bags have been removed from the powder car 41 (the car, as shown, will stop in two successive positions in order to unload both trays 42 and 43), the door control valve will be moved to and held manually in its lower position. Oil under pressure from the pump will then be ported through the door control valve to the lower end of the door operating cylinder 2 through pipe 33. The door operating piston 5 will be moved upward, thereby closing the door. Near the end of the upward travel of the door operating piston, a port will be uncovered, and the pressure will be ported via pipe 32 to the door operated valve 13. However, this pressure will be blocked by the valve 13 until the door is almost completely closed, at which time the pressure will be ported to the upper end of the dog operating cylinder 12 via pipe 31. The dog operating piston 11 will then move downward, thereby rotating the dog operat-

ing linkage and dogging the door. When the door is thus locked, the door control valve is released by the operator and is returned by spring 26 to its neutral position, thus unloading the pump discharge to the expansion tank through pipes 22 and 21.

The purpose of the door operated valve 13 is to prevent the porting of pressure for closing of the dogs until the door is almost completely closed. Theoretically, the center port in the door operating cylinder will perform this function, but due to the actual arrangements of the door operating cylinder with respect to the door, the movement of the door when it approaches the closed position is quite large compared with the movement of the door operating piston. For example, using a port which is only about 0.1" wide, the door may be about 15° from the closed position when the port is completely uncovered. As a result, the dogs would rotate and strike the sides of the door. The door operated valve 13 is arranged so that the pressure from the pump will be blocked until the door opens the valve; the door operated valve will therefore be opened only when the upper end of the door is very near its completely closed position.

The spring 34 in the door operating cylinder is provided to approximately counterbalance the door.

A relief valve 20 is provided in the hydraulic circuit to limit the maximum pressure in the system. The dog operating piston 11 is arranged for equal areas on both sides of the cylinder in order to have equal forces for opening and closing the dogs (the toggle linkage 6, 7 for operating the dogs moves past the dead center position in order to provide a more positive lock).

The control valve is arranged to equalize the pressures in opposite sides of the cylinders when released into neutral position so as to permit manual operation of the dog linkage and the door in the event of failure of the hydraulic system, or the power supply to the electric motor.

Fig. 1 shows the powder car 41 in its uppermost position with the lower powder tray 43 tilted to discharge the powder bag hoisted on it and thereby permit it to roll down the door 1 into the gun loading tray 35. The door operating cylinder 2 is pivoted at 46 and the pipes 30, 32 and 33 have swivelled connections at this pivot to the portions connected to and movable with the cylinder.

The dog operating cylinder 12 is pivoted at 59 where pipes 29, 30 and 31 have a swivelled connection to their movable portions incorporated in the body of the cylinder 12.

The details of the dog operating mechanism may be seen in Fig. 3. The dogs 50 are pivoted at 38 and are all connected to move in unison by the links 54, 48, 55 and 56 and the bell cranks 51, 52 and 53. Bell crank 52 has integral lever 37 connected for operation to the linkage 6, 7 which is actuated by piston rod 9 pivoted thereto at 58 in Fig. 3. The piston rod may be connected to the pivot 57 between links 6 and 7 as shown in the schematic diagram, and the link 6 may be connected directly to one of the dog levers as shown in Fig. 4.

The dogs 50 operate against the wedges 61, as shown in Fig. 2, to press the door tightly against the fixed frame 36, compressing the gasket 47 all the way around the door, thus forming a flame-tight seal. Suitable clearance is provided in the hinges 39 to permit this.

Various modifications in form and arrangement of the present device may be made without de-

parting from the scope of this invention as defined by the appended claims.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalty thereon or therefor.

What is claimed is:

1. In a gun emplacement, an ammunition hoist including a trunk and a car, a gun loading tray a door hinged at its bottom edge to the trunk and so constructed and arranged as to substantially bridge the space between the trunk and the loading tray when the door is open, fluid pressure mechanism arranged to operate the door, sealing means arranged to secure the door to the trunk fluid pressure mechanism arranged to operate the sealing means, and a fluid pressure system including said mechanisms for sequentially actuating said mechanisms both to release the sealing means prior to opening the door and to close the door prior to fastening the sealing means.

2. In a gun emplacement, an ammunition hoist including a trunk and a hoisting car, a gun loading tray, a door hinged at its bottom edge to the trunk and so constructed and arranged as to substantially bridge the space between the car and the loading tray when the door is open, a dog coacting with the door to secure the door to the trunk, a dog operating mechanism actuated by a fluid under pressure, a door operating mechanism actuated by a fluid under pressure, and a fluid pressure system including a control valve and said mechanisms arranged to sequentially actuate the dog operating mechanism prior to the door operating mechanism in opening the door and the door operating mechanism prior to the dog operating mechanism in closing the door.

3. In a gun emplacement; an ammunition hoist including a trunk having a port therein, a hoisting car movable within said trunk; a gun loading tray; a door hinged at its bottom edge to the trunk at said port; the door being so constructed and arranged when open as to substantially bridge the space between the trunk and the loading tray, whereby ammunition is supported by the door as it is transferred from the hoisting car to the loading tray; a dog coacting with the door to hold the door in sealing relation with respect to said port; a fluid pressure system comprising a dog operating mechanism, a door operating mechanism, means including a control valve for directing a fluid under pressure to first actuate one of said mechanisms, and means including said first actuated mechanism for further directing the fluid to thereafter actuate the other of said mechanisms, whereby the dog operating mechanism releases the dog prior to the operation of the door operating mechanism in opening the door and the door operating mechanism closes the door prior to the operation of the dog operating mechanism in fastening the dog to seal off the said port.

4. In a gun emplacement, an ammunition hoist including a trunk and a hoisting car therein with a tiltable tray, a gun loading tray, a door on the trunk with a hinge at the bottom edge of the door located higher than loading tray, the door being so constructed and arranged as to substantially bridge the space between the tiltable tray and the loading tray when the door is open whereby ammunition rolls from the tiltable tray across the door onto the loading tray, a door frame on the trunk, a gasket on the inner side of the door, a wedge on the outer side of and near an edge of

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the door, a dog pivotally attached to the trunk and movable against the wedge to press the gasket against the frame to form a flame tight seal, a dog operating piston and coacting cylinder provided with an outlet which is uncovered by the piston near the end of the dog releasing stroke, a door operating piston and coacting cylinder provided with an outlet which is uncovered by the piston near the end of the door closing stroke, the door operating piston and cylinder serving as a support for the door when open and having a spring counterbalancing the weight of the door, a source of fluid under substantially constant pressure, means including a single manually operable control valve to direct the fluid to one side of the dog operating piston to release the dog, means including the dog operating cylinder outlet to thereafter further direct the fluid to one side of the door operating piston to open the door, means including the control valve to direct the fluid to the opposite side

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of the door operating piston to close the door, and means including the door operating cylinder outlet and a valve operating by the door to thereafter further direct the fluid to the opposite side of the dog operating piston to seal the door.

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