June 13, 1961 F. N. EATON 2,987,963

BOOM MISSILE LOADER

Filed April 12, 1960

2 Sheets-Sheet 1

FIG. 1.

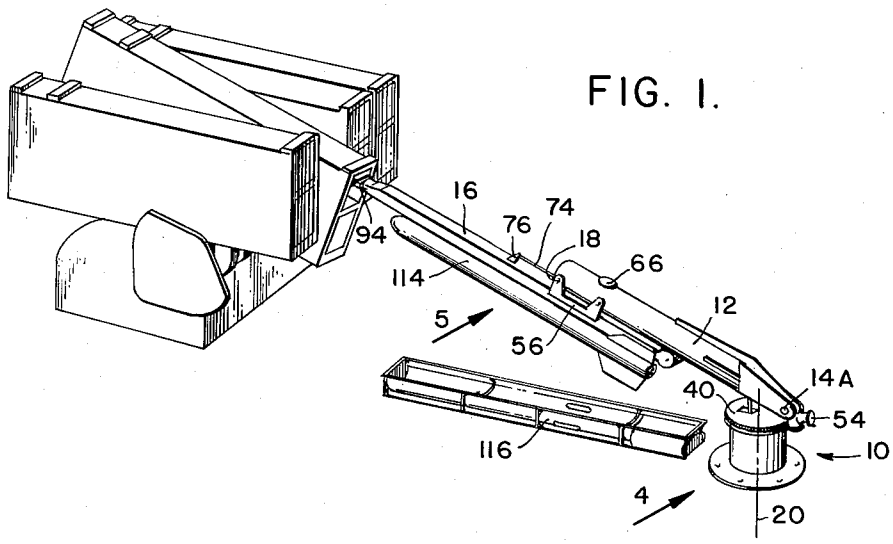
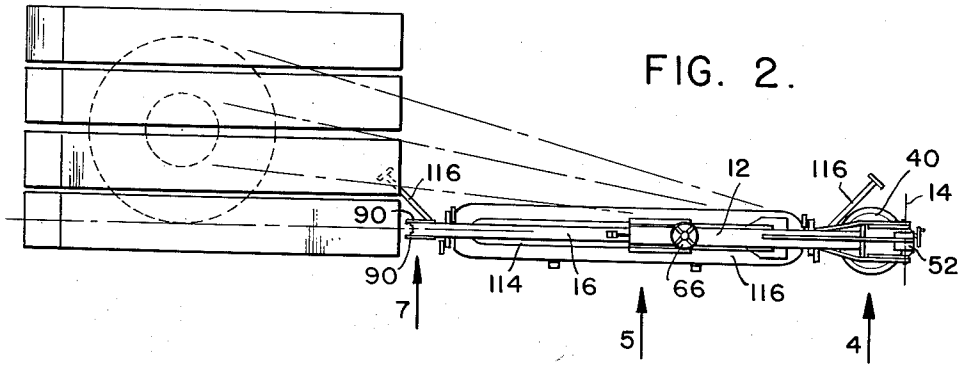


FIG. 2.



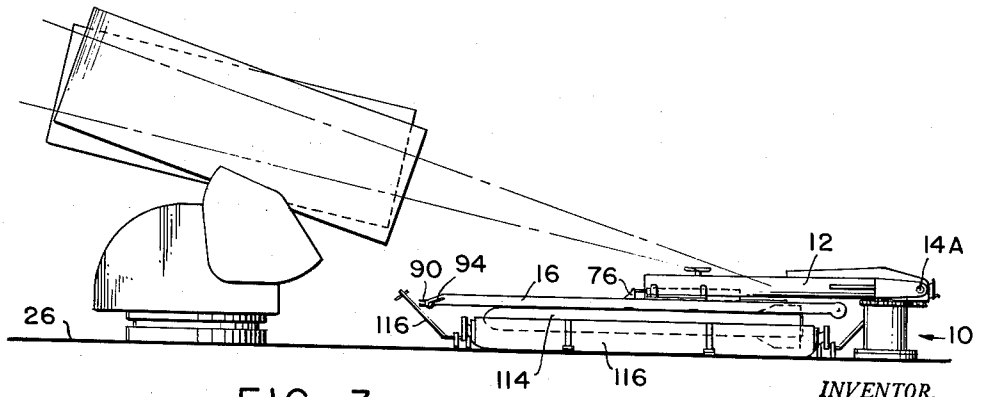


FIG. 3.

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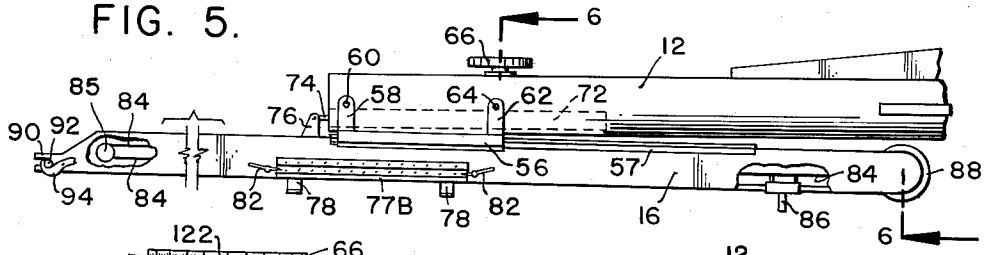
FIG. 5.



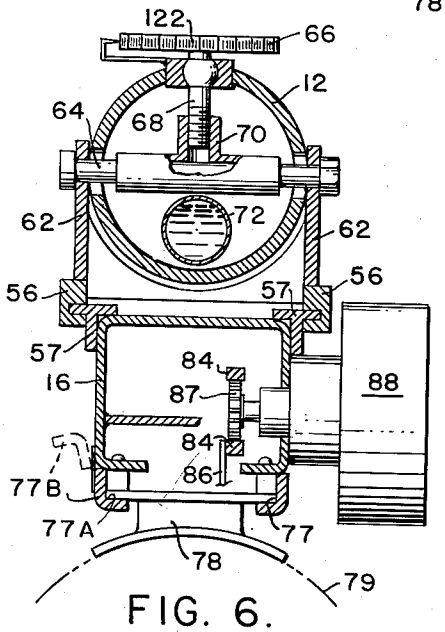


FIG. 6.

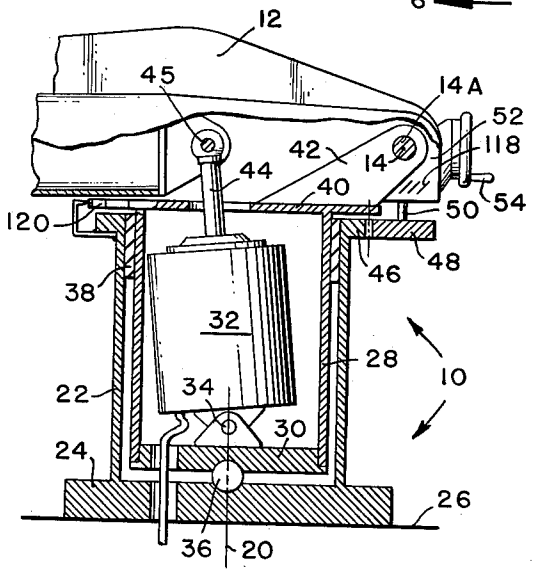


FIG. 4.

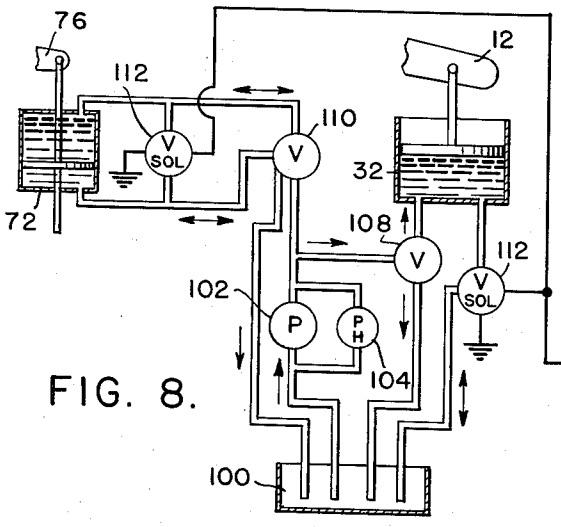


FIG. 8.

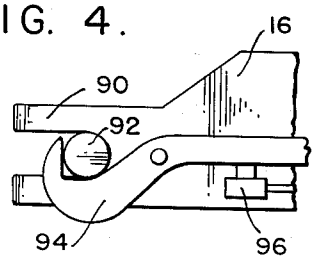


FIG. 7.

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BOOM MISSILE LOADER

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Filed Apr. 12, 1960, Ser. No. 21,841
6 Claims. (Cl. 89—1.7)
(Granted under Title 35, U.S. Code (1952), sec. 266)

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 royalties thereon or therefor.

This invention relates to material handling apparatus and more particularly to apparatus for transferring rocket propelled missiles from a position, such as adjacent the deck of a ship, to a missile launcher disposed on the deck.

The type of missile assembly to be handled by this invention comprises a torpedo, a separable air frame and a rocket motor adapted to project the assembly from a shipboard launcher through a desired ballistic trajectory, after which the air frame separates from the torpedo and the latter falls into the sea, checked in its descent by a parachute, after which the parachute separates at water entry and the torpedo searches or is otherwise directed to a target.

The launcher for the missile comprises a mount affixed to the deck of a warship and trainable in azimuth, like a gun turret, which carries four adjacent launcher housings, each comprising a pair of superposed cells, each cell containing a guide or launching rail, the four housings being individually trainable in elevation about a common horizontal axis.

Each missile is provided with a pair of longitudinally spaced upwardly projecting lugs, which must be loaded onto the mating launching rails of the launcher from the breech (rear end) of the latter. During the loading of each missile onto its launching rail it is essential that the launching lugs be axially aligned with the launching rail in a position to the rear of the launcher after which the missile is moved forwardly and transferred to its loaded position on the launching rail. Since the bases of both the launcher and handling apparatus are fixed above the deck of the ship it becomes apparent that eight different relative positions of the launcher parts and handling equipment parts must be established so that each missile may be rectilinearly moved to its proper position.

The prior art apparatus for attaining this loading operation comprises a hydraulically operated vertically telescopic column, the upper end of which carries an extensible loading rail, pivoted between its ends to the upper end of the column in such manner that the rail may be bodily raised or lowered and rotated about a vertical axis and also rotated about a horizontal axis at its pivotal connection to the column. The extensible rail is supported at one side of the column thus placing eccentric loading on its telescopic bearings producing binding effects, particularly when operation is desired during rolling and pitching of the ship. The apparatus is also unduly heavy, difficult to stow when not needed, hazardous in operation, costly to fabricate and provided with no means for alignment adjustment in picking up or capturing a missile from a sloping deck.

The principle objects of the invention are to obviate disadvantages of the prior art and provide a loader which is more simple and less costly in construction and maintenance, requires less space in its operating and stowed positions, is less hazardous in operation, more versatile in use, and provides greater ease of operation.

Further objects, advantages, and salient features will become more apparent from the description to follow, the

appended claims, and the accompanying drawing in which:

FIG. 1 is a perspective of the subject of the invention shown in its relationship to a missile launcher;

FIG. 2 is a top plan of FIG. 1;

FIG. 3 is a side elevation of FIG. 1;

FIG. 4 is an enlarged side elevation, partly in section, of the portion indicated by arrow 4, FIGS. 1 and 2;

FIG. 5 is an enlarged side elevation of the portion indicated by arrow 5, FIGS. 1 and 2;

FIG. 6 is an enlarged cross section taken on line 6—6, FIG. 5;

FIG. 7 is an enlarged side elevation of the portion indicated by arrow 7, FIG. 2, and

FIG. 8 is the hydraulic system.

Referring now to the drawing, and particularly to FIG. 1, the subject of the invention comprises, in general, a base support 10, fixed above the deck of a ship, which supports a cantilevered boom 12, pivoted about horizontal axis 14, and a transfer member 16, pivoted to the boom about horizontal axis 18. The boom and transfer member carried by it may be rotated about vertical axis 20 and the transfer member may be rotated relative to the boom for alignment purposes as will hereinafter more fully appear.

Referring now to FIG. 4, support 10 comprises a tube 22 having a flange 24 bolted to deck 26 in which is journaled a tube 28, the bottom wall 30 of which supports a single acting hydraulic piston type actuator 32 pivotally connected at its lower end to base 30 by a pivot pin 34. A suitable radial thrust bearing 36, disposed between the support and wall 30 transfers the weight of all of the movable parts of the apparatus to the ship and a suitable bushing 38 is also subjected to the radial forces of such apparatus. An end plate 40 is provided on the upper end of tube 28 which carries a pair of spaced ears 42 to which the boom is pivoted by a pivot pin 14A for movement about horizontal axis 14. A piston rod 44 is pivotally connected at its upper end to similar ears on the boom by a pivot pin 45. A gear 46 is affixed to the upper end of tube 22 which meshes with a pinion 48 rotated by a shaft 50 which projects from a speed reducer 52 carried by plate 40 which contains a motor (not shown) for rotating the pinion by power and a hand wheel 54 for manually rotating the pinion. As will be apparent, when pinion 48 is rotated the boom will rotate about vertical axis 20 and when piston rod 44 is raised or lowered the boom will rotate about horizontal axis 14.

Referring now to FIG. 5, a machine guide 56 is pivoted at its forward end to boom 12 by ears 58 and a pivot pin 60 which extends through the boom. Similar ears 62 are provided at the rear end of the machine guide, as best shown in FIG. 6, which engage a similar pivot pin 64 which may be raised or lowered by a hand wheel 66 which is secured to a screw 68 threadedly engaging a nut 70 which carries pin 64. As will be apparent, when hand wheel 66 is rotated, the machine guide will rotate about axis 18 of pivot pin 60, thus providing limited angular adjustment of the guideway relative to the boom.

Transfer member 16, having affixed guide rails 57, is rectilinearly slideable in machine guide 56, as shown in FIG. 6, and may be moved relative to the boom by a hydraulic actuator 72, contained within the boom, its piston rod 74 (FIG. 5) being pivotally connected at one end to ears 76 carried by the transfer rail. This actuator is of the double acting type which enables movement of the transfer rail in opposite directions by fluid under pressure.

Transfer member 16 is provided with a T-slot guideway 77, 77A between its ends and adjacent its lower face, as best shown in FIG. 6, which slideably receive a pair of longitudinally spaced T-shaped launching lugs 78 which project upwardly from the missile 79. To permit

loading of the lugs into the guideway a portion 77B of the guideway is pivotally connected to it and may be moved to the dotted line position, FIG. 6, to permit the guideway to be lowered to a position over the lugs. Slight relative lateral movement of the lugs and guideway permits engagement of the lugs in the continuous guideway 77 after which hinged portion 77B is moved to the full line position in FIG. 6 and latched in such position by camming clamp dogs 82.

The mechanism for sliding the missile lugs along the transfer member comprises an endless chain 84 which extends around sprockets 85, 87 disposed at the front and rear ends of the transfer member which carries a projecting finger member 86, slideably carried by guides 77, 77B, which engages the rear end of missile 79. A suitable motor 88 rotates the rear sprocket 87 in either direction. The front end of the transfer member is provided with a pair of laterally spaced forwardly open forks 90, FIGS. 2 and 7, which engage a pair of similarly spaced pins 92, carried by the launcher, which may be positively latched to the pins by any suitable latch mechanism 94. When latch mechanism 94 is moved to latched position a normally open switch 96 is closed for a purpose to be hereinafter described.

The hydraulic system for operating the apparatus so far described, shown diagrammatically in FIG. 8, comprises a sump 100 which supplies hydraulic fluid, such as oil, to a motor operated pump 102 and a bypass hand operated pump 104, employed in case of motor pump failure or for manual operation, these pumps selectively delivering fluid to a valve 108, communicating with actuator 32 which raises boom 12 or permits it to lower by force of gravity, depending upon its particular position. A similar valve 110 is provided for operating double acting actuator 72 in either direction. Switch 96, previously referred to, opens a normally closed solenoid operated valve 112 when the switch is closed by operation of latch 94, providing communication between opposite ends of actuator 72 which then serves as a dashpot to permit the actuator to move independently of operation of valve 110. A similar valve 112 is simultaneously opened by the closing of switch 96, which permits actuator 32 to move independently of valve 108. Valve 112 is preferably of the bleed type which will permit fluid to flow between actuator 32 and sump 100 and also limit the rate of flow to thus prevent rapid downward movement of its piston and the boom actuated by the piston.

In the operation of the apparatus, a missile 114, contained within a wheel or caster supported missile shipping container 116 is disposed at a suitable location on the deck of the ship. With transfer member 16 in its retracted position the boom is lowered over the missile with hinged portion 77B in its open position. The spaced launching lugs on the missile are then disposed within the continuous guide rail and the hinged portion is closed and latched to thus capture the missile for movement by the boom. The boom is then swung in azimuth by operation of motor 52 and the boom raised by actuator 32 to a desired position above the deck at which convenient connection can be made between forks 90 and pins 92 on the launcher. While these operations are taking place the launcher is being rotated in azimuth and elevation for the particular cell to be loaded. The transfer member is now extended until forks 90 engage pins 92 and latch 94 is secured, closing switch 96. The launcher housing and boom are now in their final positions of azimuth but are not yet aligned in a vertical plane. Since movement of the boom and the transfer member may now move independently of operation of their control valves the vertical movement of the launcher cell will now raise the boom and also translate the transfer member carried by the boom. When the transfer member and the launcher rails within the cell are in alignment the missile is ready for ramming into the cell. Motor 88 is then operated and finger 86, which engages the rear end of the missile, rams the missile forward, transferring it from the transfer member to the launching rail. This procedure is repeated for the various launching cells and as will be understood, the particular angles of azimuth and elevation at which ramming will occur will vary for the various cells. Suitable indices on the launcher (not shown) and indices 118, 120 on the loading apparatus are provided so that desired cell positions may be matched to desired positions of the loading apparatus.

The loading operation just described is based upon the assumption that the transfer member will always capture a missile on deck in precisely the same position in space. When this position is varied, which may be caused by slope of the deck, a slight adjustment may be necessary to facilitate its capture. In such event handwheel 66 is operated to rotate the transfer member relative to the boom and thus permit the plane of the transfer member to be varied relative to the deck of the ship. Index 122 provides means for determining the angle of this adjustment.

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. In a shipboard missile launcher of the type having a deck mount rotatable about a vertical axis and a plurality of parallel laterally adjacent superposed pairs of cells carried thereby for individual pivotation of each pair about a common horizontal axis, each cell having a launching rail extending between its muzzle and breech ends, each missile having a pair of longitudinally spaced upwardly projecting launching lugs adapted to be rectilinearly guided along a launching rail, the improvements comprising; apparatus affixed to the ship and disposed above said deck for transferring missiles from adjacent said deck to said cells, said apparatus comprising a boom pivoted at one end thereof for movement about horizontal and vertical axes, an extensible transfer member carried by said boom extending in the same longitudinal direction thereof, means for extending and retracting said transfer member, a guide rail carried by said transfer member engaging the missile lugs for slideably guiding a missile from the guide rail to the launching rail of a launcher cell, means for moving the missile along the guide rail, and means for removably latching the outermost end of said member to the breech end of a launcher cell in a position such that the guide rail forms a rearward extension of the launching rail within a cell.

2. Apparatus in accordance with claim 1 including means for adjusting said transfer member relative to said boom about a horizontal axis whereby the guide rail carried by the transfer member may be disposed at various angles relative to the deck of the ship.

3. Apparatus in accordance with claim 1 wherein said means for extending and retracting said member comprises a double acting hydraulic actuator.

4. Apparatus in accordance with claim 1 including a hydraulic actuator for moving said boom about its horizontal axis of movement.

5. Apparatus in accordance with claim 1 wherein said means for extending and retracting said member comprises a double acting hydraulic actuator, a hydraulic actuator for moving said boom about its horizontal axis of movement, a source of fluid under pressure for operating both of said actuators, and means adapted to be operated upon latching of said member to a launcher cell for rendering said source of fluid inoperative for operating said actuators and for converting both of said actuators to dashpots, whereby vertical movement of a cell may move the boom vertically to align a launcher rail with the guide rail and said dashpots prevent rapid descent of the boom and rapid retrograde movement of the transfer

member relative to the boom in event of unauthorized detachment of the transfer member from the breech end of a launcher cell.

6. Apparatus in accordance with claim 1 wherein said means for moving the missile along the guide rail includes a sprocket disposed adjacent opposite ends of said transfer member, an endless chain trained around said sprockets, means carried by the chain for engaging the missile, and means for rotating one of said sprockets in opposite directions for rotation.

No references cited.