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MECHANISM FOR MISSILE TRANSFER

Filed April 6, 1964 2 Sheets-Sheet 1

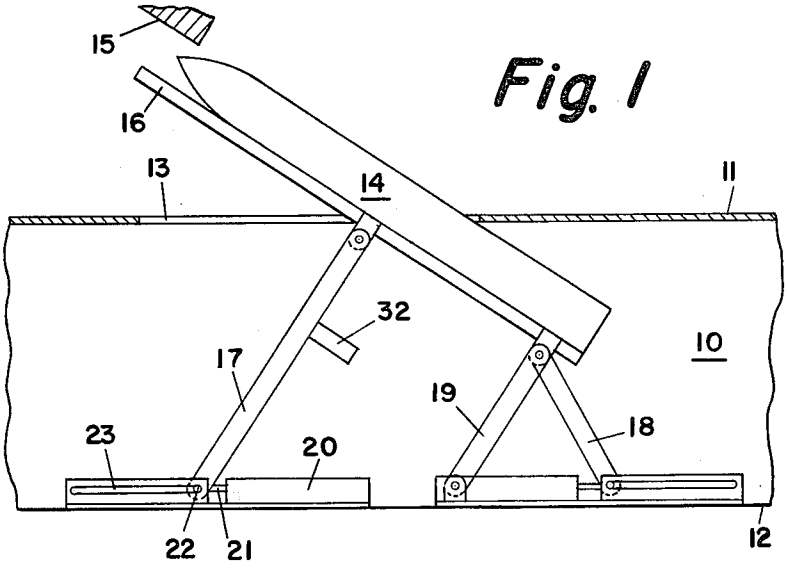


Fig. 1

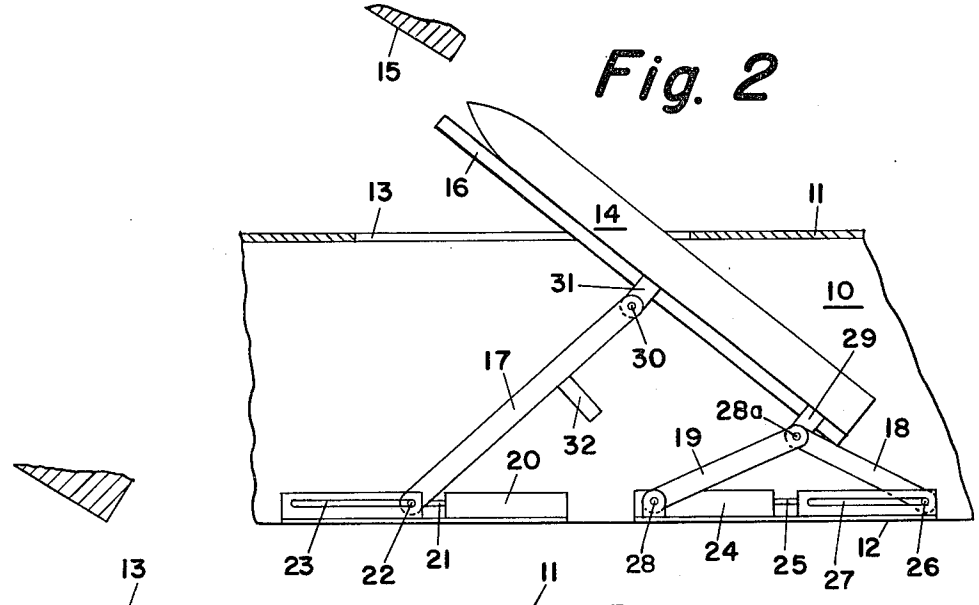


Fig. 2

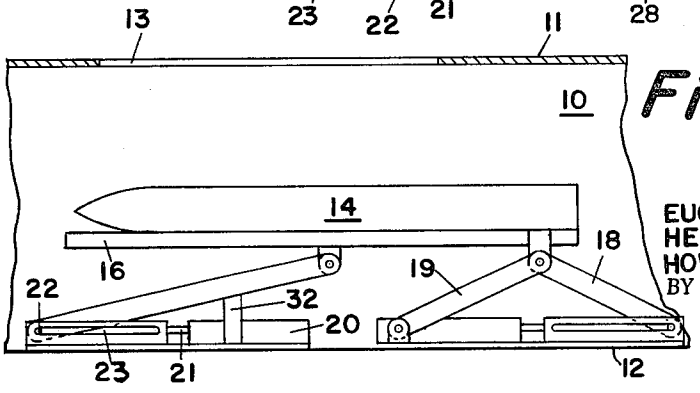


Fig. 3

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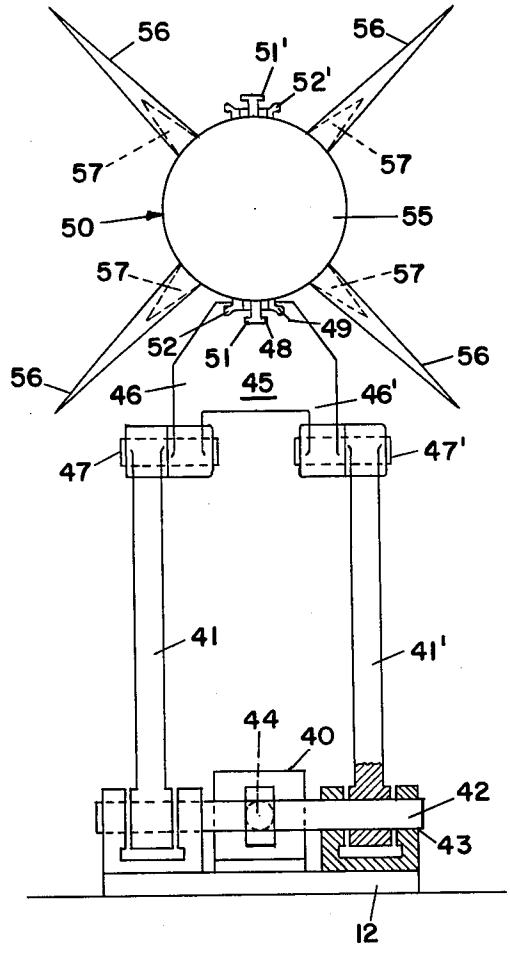
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Fig. 4



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MECHANISM FOR MISSILE TRANSFER

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7 Claims. (Cl. 214—1)

The present invention relates to missile launching systems and is concerned particularly with arrangements for overcoming problems inherent in transporting or handling of missile structures on shipboard.

In general, a system for launching missiles from shipboard requires an area where a number of missiles are stored and which is located remotely from the launching area. In large naval vessels, the storage area is usually located at a lower deck in order to provide some physical or cover protection for the missiles against enemy attack, while the launching area is located on an exposed deck to permit ready operation or firing of the missile. Various conveying equipment is required to handle the missiles in their transport to the storage area when they are delivered on shipboard and also in their transport from the storage area to the launching area. This conveying equipment is in the form of wheeled transfer cars having elevating equipment for transporting the missile structures along a surface and for moving the structures between decks. Since the missile structures are of substantial length, overhead rails are utilized for the purpose of suspending the assembled missile complements to permit their being inspected and readied for launching.

The missile structures which require the above outlined conveying equipment are of the type which are comprised of two complemental tubular bodies, one termed a booster containing the propellant or explosive medium, while the other is termed the missile and contains the electrical guidance, warhead, etc. components. The booster complement differs in certain respects from the missile complement in that it has connecting elements for suspending it directly from the overhead rail and in turn functions to support the missile complement. The overhead rail and booster connecting elements are so designed as to permit an assembled booster and missile to move along the overhead rail and to be launched, after which the booster complement separates during flight from the missile complement which continues in flight.

This invention is concerned with supporting apparatus, for the transfer of missile assemblies or missile complements, in a vertical plane between upper and lower decks of a vessel. The invention is directed to the problems incident to transferring, for example, an assembled missile from the launching area in the upper deck to a lower deck through a hatch or opening in the upper deck.

The broad object of the invention is to provide a support for an elongate structure which is so articulated as to position the structure variously between a lower horizontal position and an upper inclined position.

Another object of the invention is to provide a support for an elongate structure having a system of linkages which coact to selectively move the ends of the elongate structure in such a manner so that one end of the structure is raised or lowered relative to the other end to permit the structure to pass through an opening of relatively confined area.

Another object is to provide a support for an elongate

structure having front and rear linkages which permit the independent raising or lowering of the front and rear ends of the structure.

A more specific object of the invention is to provide a support for an elongate structure which permits the structure to be transferred through an opening having a length less than the length of the elongate structure.

For a better understanding of the invention reference should be made to the accompanying drawings wherein:

FIGURE 1 is a view showing some details of the supporting apparatus in extended position and diagrammatically showing a missile assembly in its elevated position relative to an upper deck of a vessel.

FIGURE 2 is a view similar to that of FIGURE 1 showing the supporting apparatus and missile assembly in an intermediate position.

FIGURE 3 is a view similar to FIGURES 1 and 2 showing the supporting apparatus and missile assembly in the contracted position.

FIGURE 4 is an enlarged end view of a modification of the supporting apparatus of the invention with a missile assembly connected thereto showing some details of the connections.

Referring to FIGURES 1, 2 and 3, the numeral **10** indicates a compartment formed between upper and lower walls **11** and **12** which represent respectively the upper and lower decks of a ship. The upper deck **11** is provided with an open hatch **13** having a length as shown in full lines between the hatched areas of wall **11** and which is somewhat less than the overall length of a missile assembly which is represented at **14**. The missile assembly is to be moved between its angular position of FIGURE 1 and its horizontal position of FIGURE 3 by means of the supporting apparatus of the invention.

Copending application Serial No. 346,360 filed in the names of Eugene D. Legg and Herman W. Kupetzky for Missile Booster Device and Attachments Therefor, discloses an overhead rail from which a missile assembly is suspended for launching or for inspection. In FIGURES 1, 2 and 3, of the instant disclosure, the structure identified by numeral **15** represents an elongate launcher rail which suspends the missile assembly **14** in the upper deck area at a suitable position and in readiness for firing or launching. The supporting structure of this present invention provides an arrangement which permits the missile assembly to be received thereby at generally the angle at which the missile assembly is suspended by the launcher rail **15**.

The supporting apparatus is formed of an upper rail represented at **16** which receives the missile assembly **14** and a system of front and rear linkages **17–18** respectively with an intermediate tensioning linkage **19** by which the rail **16** is articulated from the position of FIGURE 1 to those of FIGURES 2 and 3. Details of the supporting structure are identified particularly in FIGURE 2. The means for moving the front linkage **17** consists of a horizontally disposed piston and cylinder assembly **20** fixed to deck **12**. The assembly has a rod **21** movable thereby and which is connected to the linkage **17** by a pivot pin **22** which moves in a horizontal guideway **23** from the position of FIGURE 1 to that of FIGURE 3. The means for moving the rear linkage **18** is generally similar in that it has a piston cylinder assembly **24** fixed to the deck **12** and has a rod **25** movable thereby and which is connected by a pivot pin **26** to linkage **18** which moves in horizontal guideway **27**. The tensioning linkage **19** is pivotally

mounted to the assembly 24 by a pin 28 or to the deck 12 and is also pivoted to linkage 18 by another pin 28a. A hanger 29 is provided to receive the pin 28a and connects the linkages 18 and 19 to the rail. The front linkage 17 is pivotally connected to a pin 30 which is connected to the rail 16 by another hanger 31. A brace 32 is fixed to front linkage 17 and extends toward the deck 12 to provide a rest for the assembly when it is in the position of FIGURE 3.

The articulation of the supporting apparatus can best be explained by way of the following description:

The upper rail 16 of the supporting apparatus is first aligned with the launcher rail 15 in a vertical plane and the supporting apparatus is adjusted to the position of FIGURE 1 and the missile assembly 14 is manipulated to its shown position on the rail 16.

The rear cylinder assembly 24 is then operated to move the pin 26 and the lower end of the link 18 rearwardly causing the forward and tensioning linkages 17 and 19 to pivot and the rail to tilt in the same direction or rearwardly. When the pin 26 is fully extended, the elements will be at the intermediate position shown in FIGURE 2. The forward hydraulic cylinder 20 is then operated causing pin 22 to move forward, the linkage 17 to move downwardly and the rail 16 to acquire the position shown in FIGURE 3, at which time the brace 32 will prevent further movement of the rail 16 and the missile assembly 14 and hence prevent the supporting structure from moving to a self-locking position.

To extend the missile, the reverse operation is followed. The forward cylinder assembly is retracted pushing the missile to the position of FIGURE 2 then the rear cylinder assembly is retracted raising the rail to the position of FIGURE 1 in proper position for manipulation to the launcher 15. After the missile is transferred to the launcher, the rail 16 is placed in the retracted position of FIGURE 3 for stowage and to permit the hatch 13 to be closed. It is necessary to operate the cylinder assemblies in the sequence described so that the missile will pass through the hatch 13 without damage to ship or missile structure. This sequence of operation permits use of a hatch having the shortest length relative to the rail 16 or missile assembly 14.

Referring to FIGURE 4, wherein the supporting structure is formed of paired linkage systems which are similar to the systems described in connection with FIGURES 1, 2 and 3. At 12 is represented the lower deck which fixedly supports, for example, a hydraulic piston cylinder assembly 40 for operating the front linkages of a lever system which are indicated at 41–41'. These linkages are interconnected by a transverse pin 42 which is horizontally reciprocable in a guideway 43 through the actuation of a piston rod 44 connected to the transverse pin 42. At 45 is shown the upper support rail which has connecting legs 46–46' pivotally connected to the linkages 41–41' by pivot pins 47–47'. The upper rail 45 is provided with longitudinal inner and outer guideways 48 and 49 for attachment of the missile assembly 50 thereto. For this purpose the missile assembly is provided with inner and outer connectors generally as shown in the aforementioned copending application of Eugene D. Legg and Herman W. Kupetzky. The outer connectors are shown at 51 of T-shape for reception in the inner T-shaped guideway 48 of the rail and the inner connectors are shown at 52 and are C-shaped to be received in an outer C-shaped guideway 49. As also shown, connectors 51'–52' are arranged diametrically opposite connectors 51–52 for the purpose of attachment to a launcher rail which will be provided with guideways in a manner similar to the rail 45.

One tubular complement of the missile assembly is indicated at 55 and has wing structures 56 radiating outwardly therefor which in actual use are arranged to rotate for guidance purposes. Additionally, stabilizers 57 radiate from the complement 55 but are fixed to function as stabilizers. In moving the missile assembly between decks 11 and 12, the linkage system is arranged to utilize a hatch of the least possible length or area taking into consideration the extent of the wing structures 56.

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.

We claim:

1. A device for moving an elongate structure in a vertical plane through an opening having a lesser length than that of the elongate structure which comprises
   (a) a frame having an upper face for mounting the elongate structure longitudinally thereof,
   (b) front and rear linkages depending from the lower face of the frame,
   (c) each of said linkages being pivoted adjacent its upper end and having its lower end mounted for longitudinal movement relative to the elongate structure and in a horizontal plane,
   (d) actuating means connected to the lower end of one linkage and other actuating means connected to the lower end of the other linkage and
   (e) one of said actuating means being operable to move one end of the frame vertically and the other of said actuating means being operable to move the other end of the frame vertically whereby the frame may be positioned variously between a lower position and an upper position.

2. A device for moving an elongate tubular missile structure through an opening having a lesser length than that of the missile structure which comprises
   (a) an elongate rail having an upper face mounting the missile longitudinally thereof,
   (b) a front linkage depending from the rail having an upper pivotal connection and a front transverse guide pin adjacent its lower end,
   (c) a rear linkage depending from the rail having an upper pivotal connection and a rear transverse guide pin adjacent its lower end,
   (d) a support mounting a front horizontal guideway and a rear horizontal guideway aligned therewith,
   (e) said front guideway receiving the front transverse guide pin and said rear guideway receiving the rear transverse guide pin,
   (f) a first actuator connected to the front transverse guide pin for moving it in the front guideway and a second actuator connected to the rear transverse guide pin for moving it in the rear guideway and
   (g) said first actuator being operable to selectively move one end of the rail vertically and said second actuator means being operable to selectively move the other end of the rail vertically whereby the rail may be positioned variously between upper and lower positions relative to the support.

3. A device as in claim 2, further characterized by another linkage having its lower end pivotally mounted to said support and its upper end pivotally mounted to one of the front or rear linkages for tensioning the rail during its movement.

4. A device as in claim 2, further characterized by another linkage between the front and rear linkages having its lower end pivotally mounted to said support and its upper end pivotally mounted to the rear linkage for tensioning the rail during its movement.

5. A device as in claim 2, further characterized by said front linkage being longer than the rear linkage and said front and rear guideways being of generally equal length permitting the rail to be lowered to a horizontal position or raised to an angular position relative to the support.

6. A device as in claim 5, further characterized by a brace fixed to the front linkage and extending inwardly

thereof toward said support providing a stop for the rail when it is lowered to horizontal position.

7. A device as in claim 2, further characterized by said first actuator comprising a piston cylinder assembly mounted in tandem with the first horizontal guideway and having a piston rod connection with the front transverse guide pin and said second actuator comprising a piston cylinder assembly mounted in tandem with the second horizontal guideway and having a piston rod connected within the rear transverse guide pin.

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