SHIPBUILDING AND LAUNCHING SYSTEMS, METHODS AND APPARATUS

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ABSTRACT

Multiple groups of wheeled truck units are located on railroad tracks which extend from a ship construction area to a ship launching area adjacent a body of water. Each group of truck units carries an elongated support beam or tilt beam which extends transversely across the railroad tracks and is tiltable in such transverse direction. During the construction phase, the truck units are positioned in the construction area, the tilt beams are maintained in a horizontal position and elongated, slidable skid assemblies are positioned on top of the tilt beams in a lengthwise manner. The hull of the ship is then constructed on top of these skid assemblies, the longer dimension of the hull running crosswise to the skid assemblies and underlying tilt beams. Launching is accomplished by moving the loaded truck units to the launching area and alongside an inclined launchway structure which slopes downwardly to the adjacent body of water. The tilt beams are tilted and the ship hull and skid assemblies slide down the launchway and into the body of water, the hull entering the water in a sidewise manner.

24 Claims, 10 Drawing Figures
BACKGROUND OF THE INVENTION

This invention relates to shipbuilding and launching systems, methods and apparatus. While not limited thereto, the present invention is particularly useful in the building and launching of large oceangoing ships. The shipbuilding art is relatively old. Many different systems and methods have been heretofore proposed and used for the building and launching of ships and boats of various sizes and shapes. One method heretofore used involves building the ship on the very same launchway from which it is to be eventually launched. This has several drawbacks. It requires the use of multiple launchways if more than one ship is to be under construction at the same time. Also, the launchway is usually an inclined structure and this tends to complicate the construction process. Among other things, supporting structures must be constructed for maintaining the ship on an even keel during the construction process, which structures are subsequently knocked down during the launching of the ship. It has also been heretofore proposed to construct the hull of a ship in a first area and thereafter to move the completed hull to a launching area and transfer it to a separate launching structure which may be operated at the appropriate moment to accomplish the desired launching. For the case of large oceangoing ships, the proposed method suffers from the disadvantage that it takes a considerable length of time, as much as several days, and a considerable expenditure of labor to transfer the completed hull to the launching structure.

SUMMARY OF THE INVENTION

It is an object of the invention, therefore, to provide a new and improved shipbuilding and launching method wherein the construction and launching of a large ship may be accomplished more quickly and at less expense. It is another object of the invention to provide a new and improved shipbuilding and launching system which enables several ships to be under construction at the same time and thereafter enables them to be launched one at a time from one and the same launchway. It is a further object of the invention to provide a new and improved shipbuilding and launching apparatus which is readily capable of accommodating a relatively wide variety of different hull configurations.

In accordance with one feature of the invention, a method of building and launching ships comprises positioning a carriage mounted tiltable support structure in a ship construction area. The tiltable support structure is maintained in a horizontal position and the hull of the ship is constructed on top thereof. Thereafter, the tiltable support structure and ship hull are moved to a launching area adjacent a body of water. The tiltable support structure is then tilted to launch the ship into the body of water. In accordance with another feature of the invention, a shipbuilding and launching system comprises track means extending from a ship construction area to a ship launching area adjacent a body of water. The system also includes movable carriage means located on the track means. The system further includes tiltable support means pivotally mounted on the carriage means for supporting a ship during its construction in the construction area and for launching the ship into the body of water after the carriage means has been moved to the launching area.

For a better understanding of the present invention, together with other and further objects and features thereof, reference is had to the following description taken in connection with the accompanying drawings, the scope of the invention being pointed out in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Referring to the drawings:
FIG. 1 is an overall plan view of a shipbuilding and launching system constructed in accordance with the present invention;
FIG. 2 is an enlarged cross-sectional view taken along section line 2-2 of FIG. 1;
FIG. 3 is an enlarged plan view of a portion of the launchway structure of FIG. 1;
FIG. 4 is a cross-sectional view taken along section line 4-4 of FIG. 3;
FIG. 5 is an enlarged plan view showing in greater detail one of the support carriage units of the FIG. 1 system;
FIG. 6 is a cross-sectional view taken along section line 6-6 of FIG. 5 and showing in an elevational manner the support carriage tilt beam structure;
FIG. 7 is a cross-sectional view taken along section line 7-7 of FIG. 6 and showing in a side elevational manner a rocker beam structure for pivotally coupling the tilt beam structure to the more central ones of various wheeled truck units;
FIG. 8 is an enlarged cross-sectional view taken along section line 8-8 of FIG. 5 and showing in greater detail one of the truck mounted carriage units which receives one end of the FIG. 7 rocker beam structure;
FIG. 9 is a perspective view showing a portion of one of the slidable skid assemblies and the manner in which it is carried on top of one of the tilt beams; and
FIG. 10 is an elevational view of one of the slidable skid assemblies.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, the shipbuilding and launching system there shown includes three railroad tracks 10, 11 and 12 which extend from a ship construction area 13 to a ship launching area 14 adjacent a body of water 15, part of the shoreline of which is indicated at 16. A fourth railroad track 17 extends only over the length of the construction area 13. All four railroad tracks 10, 11, 12 and 17 run parallel to one another, the middle two 11 and 12 being located closely adjacent to one another and the outer two 10 and 17 being spaced apart a greater distance therefrom. Located in the ship launching area 14 alongside track 12 is an inclined launchway 18 comprised of a series of elongated way structures 19 which extend from locations near the waterside side of track 12 to the body of water 15, such way structures 19 running at right angles to track 12. As indicated in FIG. 2, the upper surfaces of the way structures 19 slope downwardly toward the body of water 15.

Movable mounted on tracks 10, 11 and 12 is a ship support machine 20 comprised of a series of interconnected support carriage units 22. In FIG. 1, the ship support machine 20 is shown positioned in the ship launching area 14. Each of the support carriage units 22 includes movable carriage means represented by a set of four carriage units or wheeled truck units 23, 24, 25 and 26. Each of the support carriage units 22 also includes tiltable support means represented by an elongated support beam or tilt beam 27 which is pivotally supported by the four carriage units or truck units 23, 24, 25 and 26. These tilt beams 27 extend transversely across the tracks 10, 11 and 12 and, hence, transversely to the direction of movement of the truck units 23, 24, 25 and 26. As indicated in FIG. 2, an elongated slidable skid assembly 28 is positioned on top of each one of the support beams or tilt beams 27 in a lengthwise manner. The various skid assemblies 28 are longer than the tilt beams 27 and extend a substantial distance beyond the two ends of their respective tilt beams 27. For sake of clarity, the skid assemblies 28 are not shown in FIG. 1. The waterside extremities of the tilt beams 27 extend to a point just short of a line running down the innermost rail of the track 17. The pivot axis for the particular tilt beam 27 shown in FIG. 2 is indicated at 30 and runs at right angles to the plane of the paper, the pivot axes for the remaining tilt beams 27 being in line with this axis 30. Thus, tilt beams 27 are adapted to tilt in the transverse direction relative to tracks 10, 11 and 12.
The outline of the hull of a ship is indicated at 31 in FIG. 1. As there seen, the longer dimension of the hull 31 runs crosswise to the tilt beams 27. As indicated in FIG. 2, this hull 31 is constructed on top of the slidable skid assemblies 28 which, in turn, rest on top of the tilt beams 27. The tilt beams 27 enable the hull 31 to be tilted so that the hull 31, together with the skid assemblies 28, may slide down the way structures 19 and into the body of water 15. Various successive positions for the hull 31 and skid assemblies 28 are indicated in outline form in FIG. 2, the hull 31 and skid assemblies 28 being shown in solid line form after they have entered the body of water 15. As shown on the solid line representation, the skid assemblies 28 are tied to the hull 31 by means of hangar cables 32 which run from each end of each skid assembly 28 to appropriate structures on an upper portion of the hull 31. After the hull 31 has come to rest in the water 15, the hangar cables 32 are unfastened and the skid assemblies 28 are hauled back to shore for later reuse on another ship hull.

For sake of example only, the ship hull 31 may have a length on the order of 400 to 500 feet, a width on the order of 80 feet, a height on the order of 70 feet and a weight on the order of 10,000 tons. The invention is, of course, not limited to use with ships of these particular dimensions.

Each of support carriage units 22 further includes at least one additional carriage unit or truck unit, represented by truck unit 34, located at the landward end of the tilt beam 27 for supporting such end of the beam 27 when the beam 27 is in a horizontally positioned posture. These side located truck units 34 for the different tilt beams 27 are movably mounted on the landwardmost track 10. As indicated in FIG. 2, these side located truck units 34 are not permanently attached to the tilt beams 27 and, as a consequence, the truck units 34 will remain on the track 10 when the beams 27 are tilted. When the ship hull 31 is under construction in the construction area 13, the water side ends of the tiltable structures may be supported by temporary supports which are located thereunder. These temporary supports may take the form indicated in FIG. 1 wherein they include a series of carriage units or truck units 35 mounted on the track 17. Each of these truck units 35 carries an adjustable bolster assembly which may be raised to contact and support the water side end of one of the skid assemblies 28 and which may thereafter be lowered to provide clearance when the time comes to move the ship hull 31 to the launching area 14. Thus, truck units 35 are used only in the construction area 13. If desired, other appropriate forms of temporary support structures may be used in place of the truck units 35.

As indicated in FIG. 2, the ship hull 31 is constructed in an off-centered manner with respect to the pivot axis 30 of the tilt beams 27 so that the center of gravity 36 of the hull 31 is located intermediate such pivot axis 30 and the side located truck units 34 when the tilt beams 27 are in a horizontal position. Among other things, this prevents tilting of the tilt beams 27 while the ship hull 31 is being moved from the construction area 13 to the launching area 14. Preferably, the hull 31 is constructed so that when the tilt beams 27 are tilted, the center of gravity 36 shifts to a point 36' which is in line with, or a little to the waterward side of, a vertical line passing through the tilt beam pivot point 30. By way of example, the center of gravity 36 may be located somewhere on the order of 2% feet to the landward side of the pivot point 30 when the hull 31 is horizontal.

Various mechanisms may be used for tilting the tilt beams 27 and the structures carried thereon when it is desired to launch the hull 31. One type of mechanism is illustrated in FIG. 4 and operates by a jack mechanism 58 with a jack 55 located on the landward side of the landwardmost track 10 and which include lifting members which may be forced upwardly against the bottom side of the hull 31. Another system that may be used is to provide a series of overhead hoisting mechanisms having hoisting lines which are tied to the ends of rigid arms which are secured to and extend outwardly from the landward side of the hull 31. The truck unit coupling assembly 20 may be moved from the construction area 13 to the launching area 14 by means of a cable and winch system (not shown) having a motor driven winch located at the left-hand end of tracks 11 and 12 and having a cable running from the winch drum and tied to the left-hand support carriage unit 11.

Referring now to FIGS. 2, 3 and 4, there will be considered in greater detail the manner of construction of the inclined way structures 19. As there seen, each of the elongated way structures 19 includes a concrete base portion 40 having a series of wooden planks or timbers 41 bolted to the upper surface thereof. The uppermost end of each way structure 19 includes a depressed portion or shoulder portion 42 for receiving the waterside end of one of the tilt beams 27. As indicated in FIG. 2, the shoulder portions 42 are constructed with the proper dimensions so as to align the upper surfaces of the tilt beams 27 with the upper surfaces of the wooden timbers 41. The vertical wall 43 of each shoulder portion 42 includes a recess or slot 44 extending across the width thereof. These slots 44 in the different way structures 19 are adapted to receive movable key members or latch members which are carried at the ends of the tilt beams 27 and which may be extended into engagement with the slots 44 for holding the beams 27 in a tilted position immediately following launching of the ship hull 31. The way structures 19 are constructed so that the angle of inclination of the upper surfaces of the wooden timbers 41 is the same as the angle of inclination of the upper surfaces of the tilt beams 27 when such beams are in their maximum tilted positions. By way of example, such angle of inclination may be on the order of seven degrees with respect to horizontal.

Referring now to FIGS. 5–8, there will be considered in greater detail the manner of construction of one of the support carriage units 22 of FIG. 1. As indicated in FIG. 5, the more centrally located or intermediate wheeled truck units 23, 24, 25 and 26 are in the form of more or less conventional railway type truck units. Considering in detail only the left hand forward truck unit 23, such truck unit includes four flanged wheels 23a which are connected in pairs by axles 23b. These axles 23b are journaled in appropriate bearing assemblies in side frames 23c and these side frames 23c are interconnected by a transverse truck beam 23d. The remaining truck units 24, 25 and 26 are of the same form of construction. The forward pair of truck units 23 and 24 are interconnected by means of an overhead truck loading beam 45 which is coupled to the transverse truck beams 23d and 24d to allow vertical movement of the structure along the guiding rails 47. In a similar manner, the rearward truck units 25 and 26 are interconnected by an overhead truck loading beam 48 (part of which is broken away in the drawing) which is coupled to the transverse truck beams 25d and 26d by coupling assemblies 49 and 50.

An elevational view of the rearward truck loading beam 48 is shown in FIG. 8. Such truck loading beam 48 is in the form of a large I-beam having side plates and end plates covering the sides and ends thereof, the ends of the I-beam being cut at an angle and the end plates being inclined at these same angles. The right-hand coupling assembly 50 for the truck loading beam 48 is shown in detail in FIG. 8. As there indicated, the coupling assembly 50 includes a beveled, circular bearing plate 51 mounted in a circular recess 52 formed in a raised center portion 53 of the transverse truck beam 26d. The bearing plate 51 cooperates with a cylindrical bearing member 54 which is secured to the underside of the truck loading beam 48 at the right-hand end thereof. The lower end of bearing member 54 is tapered or beveled inwardly so as to fit the bevel of the bearing plate 51. The other truck unit coupling assemblies 46, 47 and 49 are constructed in the same manner.

As indicated in FIG. 5, the tilt beam 27 is supported intermediate the forward truck units 23 and 24 and the rearward truck units 25 and 26 by means of a coupling mechanism which includes a rocker beam structure 55 which is attached to the ends of right angles to the tilt beam 27 on both the forward and rearward sides thereof. The forward and rearward ends of the rocker beam structure 55 are provided with rocker members 56 and 57 which are journaled in socket as-
The effect of this tilting action is indicated in outline form in FIG. 8. The solid line position for the upside down T-shaped member 60 represents the position thereof when the tilt beam 27 is horizontal. Reference line 27a represents the top surface of the tilt beam 27 when horizontal. The broken line construction 55a represents the outline of the main body of the rocker beam assembly 55 when the tilt beam 27 is horizontal. As the tilt beam 27 starts to tilt downwardly toward the right in FIG. 8, the rocker member 57 starts to rock toward the right. This causes a movement of the roller mounted bearing plate 74 toward the left. As a consequence, the rocker member 57 undergoes a rotational movement with respect to the pivot axis indicated at 30. Reference line 27b represents the location of the top surface of the tilt beam 27 when the beam 27 is at a maximum tilted position (as fixed by the shoulder portion 42 of the way structure 19). The outline construction 55b represents the outline of the rocker beam structure 55 for this same maximum tilt condition. The forward and rearward truck loading beams 45 and 48, of course, do not tilt. They remain horizontal and the truck units 23, 24, 25 and 26 maintain their position on the railroad track 12.

As indicated in FIGS. 5 and 6, each of the support carriage units 22 also includes at least one additional truck unit 34 located at one end of the transverse tilt beam 27 for supporting such end of the beam 27 when in its horizontal position. This side located truck unit 34 includes flanged railway wheels 34a connected by axle 34b which, in turn, are rotatably carried by side frames 34c. A transverse truck beam assembly 34d (FIG. 6) interconnects the two side frames 34c.

As indicated in FIG. 6, the truck unit 34 includes a coupling assembly 80 similar in construction to the coupling assemblies 46-50 previously considered. Coupling assembly 80 serves to maintain the desired positional relationship between truck unit 34 and tilt beam 27 until such time as the beam 27 is tilted. The coupling assembly 80 includes a beveled circular bearing plate 81 secured to the top of the transverse truck beam assembly 34d and a cooperating cylindrical bearing member 82 secured to the underside of the tilt beam 27 and having a beveled lower edge. The coupling assembly 80 also includes a guide pin 83 having an elongated lower stem which is carried in a cylindrical passage drilled vertically into the top of the transverse truck beam 34d. Guide pin 83 acts to keep the transverse truck beam 34d positioned under the cylindrical bearing member 82 of the tilt beam 27 in case the bearing plate 81 and bearing member 82 should lose contact with one another during the tilted position of the side plate 29. Mounted on top of the rollers 71 is a moveable bearing member or bearing plate 74. This bearing plate 74 is normally maintained against a side spacer 72 by means of a biasing spring 73 which is seated in an opposing manner through the interior of the side plate 29. Mounted on top of the side plate 72 is a movable biasing spring 73 and 75 within the socket assembly structure. The socket assembly 67 is further strengthened by means of brace plates 77 and 78 which are welded to the side plates 68 and 69 at right angles thereto and which are further welded at their upper ends to the underside of the truck loading beam 48. An end plate 79, which is only partially shown in FIG. 8, is welded to the rearward end of the socket assembly 67.

The rocker member 56 at the forward end of the rocker beam structure 55 is journaled in a socket assembly which is identical in construction to the socket assembly 67 of FIG. 8 except, of course, that its end plate is on the opposite end. This forward socket assembly is secured to and extends downwardly from the underside of the forward truck loading beam 45. Thus, the rocker beam structure 55 is pivotally supported at both ends by means of socket assemblies carried by the two truck loading beams 45 and 48. This enables the elongated tilt beam 27 to tilt or pivot, in the manner of a teeter-totter, about a pivot axis running at right angles to the longitudinal dimension of such beam and located at an intermediate point with respect to the length of the beam. Such pivot axis is displaced a short distance to the waterward side of the center point of the tilt beam 27.
opening in the end plate at the waterside end of the beam 27 for purposes of sliding into engagement with the key slot 44 (FIG. 2) at the landward end of the way structure 19 which receives the beam 27 when it is tilted.

The other support carriage units 22 are constructed in the same manner as the support carriage unit 22 shown in detail in FIGS. 5–8. The various support carriage units 22 are interconnected by means of left side and right side tie rods 90 and 91 which, as indicated in FIG. 5, are welded between adjacent tilt beams 27 near the ends thereof. As indicated in FIG. 6, these tie rods 90 and 91 may take the form of angle members and may be welded to appropriate plates 92 and brackets 93 which are, in turn, welded to the various tilt beams 27. Tie rods 90 and 91 assist in maintaining the desired spacings between the various support carriage units 22 on the tracks 10, 11 and 12. These spacings are such that the center lines of the tilt beams 27 are spaced apart the same distance as are the center lines of the way structures 19.

As indicated in FIG. 2 and partially indicated in FIG. 6, a slidable skid assembly 28 is adapted to be located in a lengthwise manner along the top of each of the tilt beams 27. A partial view and a cross-sectional view of one of these slidable skid assemblies 28 are shown in FIGS. 9 and 10, respectively. As there indicated, each skid assembly 28 includes an elongated U-shaped channel beam 94 which is adapted to ride in the channel beam 88 welded to the top of the tilt beam 27. Sufficient lateral clearance is provided so that the skid assembly channel beam 94 is free to move in a longitudinal direction within the channel beam 88. As indicated in FIG. 2, the length of the skid assembly 28 and, hence, of the skid assembly channel beam 94 is somewhat longer than the length of the tilt beam 27. Carried by the skid channel beam 94, is a wooden cradle structure 95 formed by a series of wooden timbers 95a, 95b, 95c and 95d which are arranged lengthwise in an end-to-end manner in the channel of the skid assembly channel beam 94. The bottom portion secured to the skid channel beam 94 by means of vertically extending bracket plates 96 welded to the flanges of the beam 94 along both sides thereof, if desired, nails or bolts 97 may be driven into the timbers 95a–95d, such nails or bolts 97 passing through suitable apertures in the bracket plates 96. As indicated in FIG. 10, brackets 98 are welded to the inner portion of the beam 94, and, at the indicated location, brackets 98 being provided with apertures or eyelets 99 to which may be tied the hangar cables 32 (FIG. 2) which secure the skid assembly 28 to the ship hull 31.

The upper surface of the wooden cradle structure 95 is contoured to correspond to the contour of the bottom portion of the hull of the ship being constructed. This contouring is accomplished by proper selection of the vertical dimensions of the wooden timbers 95a–95d and by sawing and shaping such timbers 95a–95d to provide the desired overall shape for the cradle structure. The number of timbers shown in FIG. 10 is purely by way of illustration. A greater or lesser number may be used, depending on the length of the skid assembly 28 and on the lengths of the individual timbers. In addition, the wooden cradle structure may, where necessary, be built up by stacking timbers on top of one another. If desired, the channel member 94 may be omitted and the skid assembly 28 formed by the wooden cradle structure 95 alone. In such case, the individual timbers could be fastened to one another by nailing connecting plates to the sides of the timbers in a manner to overlap the joints therebetween.

To facilitate a smooth launching operation, it is desirable to provide some form of lubrication between the lower surfaces of the various skid assemblies 28 and the upper surfaces of the various tilt beam channel members 88. This could be accomplished by greasing the upper surfaces of the channel members 88 before the skid assemblies 28 are set in place. Preferably, however, this lubrication is provided by the placement of a low friction interface material between the channel members 88 and the bottoms of the skid assemblies 28. Such low friction interface material is indicated at 100 in FIG. 9. This material 100 is comprised of three thin sheets of plastic material laid out one on top of the other. The upper and lower sheets are formed of a hard plastic material, such as nylon or acrylonitrile-butadiene-styrene (ABS) or the like, while the middle sheet is formed of Teflon. These thin sheets are spread to cover the entire length of each of the tilt beam channel members 88 before the skid assemblies 28 are set in place on top thereof. The width of these plastic sheets is preferably the same as the inner width of the tilt beam channel members 88. The low static coefficient of friction of the Teflon material enables a high degree of uniformity in the initial movements of the various skid assemblies 28 at the commencement of the launching operation when the skid assemblies 28 first start to slide off of the tilt beams 27. The upper and lower layers of hard plastic material insure a more uniform surface against which the Teflon material may operate.

Considering now the steps involved in building and launching a ship by means of the system and structure hereinabove described, the carriage mounted tiltable support structure or ship support mechanism 20 is first positioned in the ship construction area 13. The sheets of plastic material 100 (FIG. 9) are laid out in place in the channels of the channel beams 88 atop each of the tilt beams 27. The slidable skid assemblies 28 are then positioned in the channels 88 on top of the sheets of plastic material 100. Temporary supports are then placed under the ends of the skid assemblies 28 which extend beyond the waterside ends of the tilt beams 27 to prevent tilting of the tiltable structure during the earlier phases of the construction process. These temporary supports are provided by the bolster assemblies carried by the side located truck units 35 on track 17. The bolster assemblies are adjusted to engage and support the extended undersides of the skid assemblies 28. The ship hull 31 is then constructed on top of the skid assemblies 28. As indicated in FIG. 2, the ship hull 31 is constructed in an offcentered manner with respect to the pivot axis 30 for the tilt beams 27 so that the center of gravity 36 of the hull 31 is located intermediate such pivot axis 30 and the landward ends of the tilt beams 27 when the beams 27 are in a horizontal position.

After the construction of the hull 31 is completed, the various skid assemblies 28 are tied thereto by way of the hangar cables 32 (FIG. 2). Hangar cables 32 should not be pulled taut. Instead, some 1 to 2 per cent of their length should be left slack, the sole purpose of the hangar cables 32 being to prevent loss of the skid assemblies 28 after the hull 31 is launched into the water.

In order to launch the hull 31, the ship support machine 20 is moved to the launching area 14 and the individual tilt beams 27 are brought into alignment with different ones of the way structures 19. Before this movement is commenced, the bolster assemblies carried by the side located truck units 35 are lowered out of the way so as not to hinder movement of the skid assemblies 28. Also, at some appropriate point before the actual launching, the wooden timbers 41 atop the way structures 19 are coated with wax and then greased thoroughly.

The launching is accomplished by activating the jack mechanisms 37 and 38 (or other suitable elevating mechanisms) so as to raise the landward side of the hull 31 and, hence, to cause a pivoting or tilting of the tilt beams 27 about the pivot axis 30. As the angle of tilt reaches the maximum value set by the shoulders 42 on the way structures 19, the hull 31 develops a sufficient lateral component of force to cause the skid assemblies 28 and hull 31 to commence sliding down the incline. The hull 31 and skid assemblies 28 then slide down the inclined launchway 18 with each skid assembly 28 traveling along the wooden planks 41 atop its respective one of the way structures 19. Successive positions of the hull 31 and skid assemblies 28 are indicated in FIG. 2. As indicated in FIG. 2, the hull 31 and skid assemblies 28 slide off the way structures 19 and into the sea. Thereafter, the skid assemblies 28 are disconnected from the hull 31 and returned back to shore for subsequent reuse.
One significant feature of the above described shipbuilding and launching system is that it enables several ship hulls to be under construction at one and the same time and thereafter enables each of them to be launched one at a time from a single common launchway. In terms of FIG. 1, the various carriage tracks 10, 11, 12 and 17 in the ship construction area 13 may be extended a sufficient distance to the right to enable two or more complete and separate ship support machines 20 to be located thereon at the same time and thereby to enable two or more ship hulls to be under construction at one and the same time. As each hull is completed, it is moved to the launching area 14 and launched down the inclined launchway 18. Thus, only a single launchway is required. In addition, in the event that it should be necessary to keep the bottom of the body of water 15 dredged out adjacent the launchway 18, the use of a single launchway reduces the amount of periodic dredging that may be required. The performance of the ship construction in a separate area which is clear of any of the launchway structure facilitates the movement of structural members into place on both sides of the hull.

While there has been described what is at present considered to be a preferred embodiment of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore, intended to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A shipbuilding and launching system comprising:
   a. A shipbuilding area adjacent to a railroad track means extending from a ship construction area to a ship launching area adjacent a body of water;
   b. Movable carriage means located on the railroad track means; and
   c. Tiltable support means pivotally mounted on the carriage means for supporting a ship during its construction in the construction area and for launching the ship into the body of water after the carriage means has been moved to the launching area.

2. A shipbuilding and launching system in accordance with claim 1 wherein the track means includes a plurality of railroad tracks running parallel to one another and the carriage means includes a plurality of carriage units movably mounted on each of the railroad tracks.

3. A shipbuilding and launching system in accordance with claim 1 wherein the tiltable support means includes a series of elongated support beams extending transversely across the track means.

4. A shipbuilding and launching system in accordance with claim 3 wherein the tiltable support means further includes a series of slidable skid assemblies individually positioned on top of each one of the elongated support beams for engaging the bottom portion of the hull of the ship to be constructed.

5. A shipbuilding and launching system in accordance with claim 4 wherein the upper surfaces of the slidable skid assemblies are contoured to fit the contour of the bottom portion of the hull of the ship to be constructed.

6. A shipbuilding and launching system in accordance with claim 1 wherein the carriage means includes multiple groups of carriage units movably mounted on the track means and the tiltable support means includes a series of elongated support beams extending transversely across the track means, each support beam being pivotally supported by a group of the carriage units.

7. A shipbuilding and launching system in accordance with claim 1 wherein the track means includes three railroad tracks running parallel to one another, a first two of which are located closely adjacent to one another and run under an intermediate portion of the tiltable support means and the third of which is spaced apart from the first two and runs under a side portion of the tiltable support means, wherein the movable carriage means includes a series of carriage units movably mounted on each of the railroad tracks, the carriage units on the first two tracks being located in a side-by-side manner, and wherein the tiltable support means includes a series of elongated support beams extending transversely across the three railroad tracks, each support beam being supported by a set of four of the carriage units, two of which are located on one and of which are located on the other of the first two railroad tracks.

8. A shipbuilding and launching system in accordance with claim 1 and including inclined way means located in the launching area and extending from a location near the track means to the body of water into which the ship is to be launched, the launching being accomplished by moving the carriage means to the launching area and then tilting the tiltable support means to transfer the ship to the inclined way means.

9. A shipbuilding and launching system in accordance with claim 8 wherein the way means are located along side the track means and wherein the tiltable support means includes a series of elongated support beams extending transversely across the track means and over end portions of the way means when in the launching area, such end portions of the way means including depressed portions for receiving the ends of the support beams when tilted and aligning the upper surfaces of the tilted support beams with the upper surface portions of the inclined way means.

10. A shipbuilding and launching system in accordance with claim 9 wherein the tiltable support means and inclined way means are constructed to that the angle of inclination of the upper surfaces of the tilted support beams is the same as the angle of inclination of the upper surface portions of the inclined way means.

11. A shipbuilding and launching system in accordance with claim 9 wherein end portions of the inclined way means facing the track means include slot means facing the track means and the support beams include movable key means adapted for movement into the slot means for holding the support beams in a tilted position following the launching of the ship.

12. A shipbuilding and launching system in accordance with claim 8 wherein the tiltable support means includes a series of elongated support beams extending transversely across the track means and over end portions of the inclined way means when in the launching area and wherein the inclined way means includes a series of elongated way structures extending at right angles to the track means and having inclined upper surface portions sloping downwardly toward the body of water, such way structures being spaced apart from one another so that when the tiltable support means is moved to the launching area the elongated support beams thereof may be individually aligned with different ones of the way structures.

13. A shipbuilding and launching system in accordance with claim 12 wherein the tiltable support means further includes a series of slidable skid assemblies individually positioned on top of different ones of the elongated support beams for engaging the bottom portion of the hull of the ship to be constructed, such skid assemblies being adapted to slide off of the support beams and on to the way structures when the support beams are in alignment with the way structures and the support beams are tilted.

14. A support carriage unit for use in a shipbuilding and launching system comprising:
   a. Wheeled truck means for movement from a ship construction area to a ship launching area;
   b. Elongated support beam means extending transversely to the direction of movement of the truck means; and
   c. Coupling means for pivotally coupling the support beam means to the truck means with the pivot axis being parallel to the direction of movement of the truck means.

15. A support carriage unit in accordance with claim 14 wherein the truck means includes forward and rearward truck means and wherein the coupling means includes socket means carried by each of the forward and rearward truck means and rocker means attached to the support beam means and extending transversely therefrom on both the forward and rearward.
ward sides thereof, such rocker means being journaled in the socket means of the forward and rearward truck means.

16. A support carriage unit in accordance with claim 15 wherein each socket means includes a lower support member, a movable bearing member located above the lower support member and roller means disposed intermediate the lower support member and the bearing member for enabling movement of the bearing member in a direction transverse to direction of movement of the truck means, and wherein the portions of the rocker means journaled in the two socket means each includes a curved rocker member the curved portion of which rests on the corresponding socket means bearing member with the curvature being in a direction to enable a rocking action transversely to the direction of movement of the truck means.

17. A support carriage unit in accordance with claim 14 wherein the wheeled truck means includes left and right forward truck units interconnected by a first overhead truck loading beam and left and right rearward truck units interconnected by a second overhead truck loading beam, wherein the support beam means comprises an elongated support beam structure located intermediate the forward and rearward truck units and extending transversely a substantial distance beyond the outer sides of both the left and right truck units and wherein the coupling means includes socket means carried by each of the two overhead truck loading beams at positions intermediate the left and right truck units and a rocker beam structure attached to the elongated support beam structure at a point intermediate the left and right truck units and extending forwardly and rearwardly therefrom and having terminal rocker members journaled in the socket means carried by the forward and rearward truck loading beams.

18. A support carriage unit in accordance with claim 17 wherein each socket means includes a lower support member, a movable bearing member located above the lower support member and roller means disposed intermediate the lower support member and the bearing member for enabling movement of the bearing member in a direction transverse to the direction of movement of the truck means and wherein the terminal rocker members of the rocker beam structure include curved lower surfaces which rest on the corresponding socket means bearing members with the curvature being in a direction to enable a rocking action transversely to the direction of movement of the truck means.

19. A support carriage unit in accordance with claim 17 and including at least one additional truck unit located at one end of the elongated support beam structure for supporting such end when the support beam structure is in a horizontal position.

20. A method of building and launching ships comprising: positioning carriage mounted tiltable support structure in a ship construction area; maintaining the tiltable support structure in a horizontal position and constructing the hull of a ship on top thereof; moving the tiltable support structure and ship hull to a launching area located adjacent a body of water; and tilting the tiltable support structure to launch the ship into the body of water.

21. A method of building and launching ships in accordance with claim 20 wherein the hull of the ship is constructed in an offcentered manner with respect to the pivot axis of the tiltable support structure so that the center of gravity of the hull is located intermediate such pivot axis and the landward side of the tiltable support structure when the tiltable support structure is in a horizontal position.

22. A method of building and launching ships in accordance with claim 20 wherein a series of slidable skid assemblies are placed on top of the tiltable support structure and the hull of the ship is constructed on top of these slidable skid assemblies.

23. A method of building and launching ships in accordance with claim 22 wherein the slidable skid assemblies are tied to the hull of the ship before the tiltable support structure is tilted.

24. A method of building and launching ships comprising: positioning in a ship construction area horizontally extending tiltable support means carried by a number of carriage units, wherein the carriage units are movable in a first direction and the support means is tiltable in a second direction at right angles to the first direction, an intermediate portion of such tiltable support means being pivotally mounted on intermediate carriage units and a first side of such tiltable support means running parallel to the first direction and resting on side located carriage units; placing temporary supports under a second side of the tiltable support means located opposite the first side and running parallel to the first direction to prevent tilting of the tiltable support means when in the construction area; constructing the hull of a ship on top of the tiltable support means with the longer dimension of the hull running parallel to the first direction; moving as a unitary group the carriage units, tiltable support means and ship hull to a launching area having a body of water located adjacent the second side of the tiltable support means; and tilting the tiltable support means to cause same to slope downwardly toward the body of water to launch the ship hull into such body of water.

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CERTIFICATE OF CORRECTION

Patent No. 3,650,115 Dated March 21, 1972

Inventor(s): HARRY J. FEIGEL, JR.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, line 4, change "ll" to --22--.
Column 9, line 73, change "movable" to --movably--.
Column 10, line 28, change "to" to --so--.

Signed and sealed this 18th day of July 1972.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR. ROBERT GOTTSCALK
Attesting Officer Commissioner of Patents