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(54) LOG BARGE

(71) I, THOMAS TRYGVE LUNDE, of 6 Locksley Avenue, San Francisco, California, United States of America, a citizen of the United States of America, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 This invention relates generally to a buoyant transporting vessel, and more particularly to a coastal and seagoing vessel especially adapted to serve as a log barge.

15 Many efforts in the past to provide a seagoing vessel suitable for the safe transport of logs have been quite unsatisfactory, as evidenced by the significant number of accidents occurring during instances of rough seas. It has been found that merely providing additional bracing and securing lines is inadequate when considering the significant forces exhibited by the shifting of a sizeable log load, which problem is magnified due to the irregular configuration of the individual logs comprising the load.

25 According to the present invention, an improved log barge is provided having a load supporting deck surface constructed with a particular configuration adapted to utilize the effect of a shifting log load to advantage, whereupon such shifting will actually lead to a more compact disposition of the logs. This is achieved by constructing the deck surface as a whole along a major catenary curve extending transversely between the vessel hull sides so as to provide a general depression having its lowest point disposed adjacent the centerline of the barge. This generally depressed back surface in turn comprises a plurality of adjacent deck plates or sections, each of which preferably defines a minor catenary curve as herein-
30 after defined, likewise extending transversely of the deck, whereby a plurality of parallel depressed areas are provided throughout the extent of the deck surface. Although the arrangement illustrated herein

reflects a major catenary curve and a plurality of minor catenary curves, it will be understood that alternative geometric configurations may be employed to provide a variable surface configuration as will be referred to hereinafter. Abutment means are provided along both sides of the deck and define a load area therebetween into which the logs are initially placed and suitable load securing lines are thereafter thrown over the top of the log load to contain the logs within the load area.

60 An additional feature of the present invention includes the provision of automatic means for constantly maintaining a predetermined tension upon the load securing lines as the log load shifts so that the cross-sectional area of the load is, in effect, compacted as the barge pitches and rolls during transport. This means includes pressure sensing devices associated with the load securing lines, whereby as slack occurs and the tension of any single line falls below the predetermined level, motor means associated with the particular winch to which the line is secured is activated in order to take up the slack of the line until the minimum pre-selected tension is achieved. In view of the above-described construction, it will be appreciated that lateral motion of the loaded logs will be impossible since the supporting base on which any motion must occur is provided with a constantly variable surface. In the above manner, not only is safe compaction of the log load ensured during travel of the barge upon rough seas, but also, it will be seen that a minimum tension will at all times be applied to all of the load securing lines to further preclude unwanted displacement of any of the logs being transported.

90 Self-dumping of the load of the present log barge is achieved by means of a self-bailing trim tank provided adjacent one side of the barge hull. The dumping of the log load is facilitated by the use of removable abutment means on the hull side adja-

cent the trim tank whereby it will be appreciated that upon removal of these temporary posts and flooding of the adjacent trim tank, the hull will be rolled in the direction of the flooding trim tank to permit dumping of the load by gravity over the side of the deck.

Accordingly, one of the primary objects of the present invention is to provide an improved log barge having a load supporting deck wherein the log load mass follows a major curve and each log in contact with the deck follows one of a plurality of minor curves, all of said curves being of non-constant curvature.

A further object of the present invention is to provide an improved log barge having a load supporting deck having a plurality of curved deck sections, each of which defines a minor catenary curve and all of which are mounted upon cross beams defining a major catenary curve.

Still another object of the present invention is to provide a log barge including a downwardly curved load supporting deck bound along one side by a plurality of fixed abutment means and bounded along the other side by a plurality of removable abutment means and including load securing lines spanning the area between both abutment means and tensioned by automatically actuated power winch means.

A preferred and practical embodiment of the invention is shown in the accompanying drawings, in which:

Fig. 1 is a side elevation of the log barge of the present invention.

Fig. 2 is a top plan view of the log barge of Fig. 1.

Fig. 3 is a transverse sectional view taken along the line 3—3 of Fig. 2.

Fig. 4 is a transverse sectional view illustrating the self-dumping operation of the log load.

Fig. 5 is a rear elevation of one of the automatic winches of the present invention.

Fig. 6 is an end elevation of the winch drum of Fig. 5.

Similar reference characters designate corresponding parts throughout the several figures of the drawings.

Referring now to the drawings, particularly Figs. 1—3, the log barge of the present invention will be seen to include a hull, generally designated H, having a substantially planar bottom 1 and vertical sides 2—2. The exact configuration of the bow and stern of the barge is not as critical in carrying out the present invention as is the construction of the load supporting deck, generally designated D. As shown most clearly in Figs. 2 and 3, this deck D encompasses substantially the entire area between the uppermost portions of the hull sides 2—2 from a point immediately aft

of the bow of the barge to a point just short of the stern thereof.

The deck D is adapted to support a significant number of individual logs L deposited thereupon with their axes parallel to the centerline or longitudinal axis of the barge. Suitable upstanding abutment means 3 and 4 are provided along each side of the deck D to assist in retaining the loaded logs until the full load is achieved, whereupon a plurality of load securing lines 5 are thrown over the log load to retain the load as shown in Figs. 1—3. With a conventional load supporting deck, it has been found from experience that regardless of the amount of tension applied to the load securing lines, the log load will undergo a significant lateral shifting, especially during high seas, with the result that the cross-sectional area encompassed by the log load will vary, usually with a reduction in the occupied cross-sectional area of the log load. With the foregoing in mind, it will be appreciated that the thus slackened load securing lines produce an extremely dangerous situation and the subsequent pitching and rolling of of the barge will often lead to a loss of a part of or the entire log load at sea. By the present invention, a unique deck construction has been provided which includes an arrangement whereby an advantage is made of the inherent shifting of the individual logs L so that a more compact loading is achieved without danger of lateral motion of the logs on the deck or a load loss at sea. This deck construction is coupled with means for automatically self-tightening the load securing lines 5 during the formation of a more compact log load to preclude unwanted shifting of individual logs L and further encourage the desired formation of a more compact load.

The aforementioned deck construction is shown most clearly in Fig. 3, wherein it will be seen that the principal supporting structure for the deck forming elements comprises a plurality of cross beams 6, each of which extends transversely of the hull between the upper portions of the two sides 2—2 thereof and are arranged in parallel spaced apart manner from the bow section to the stern section. As will be noted in this Figure, each cross beam 6 is not a straight member, but rather is curved in the manner of a major catenary curve extending from the two sides of the hull so that a single smooth concave upper surface 7 is formed thereon having an irregular curvature. Attached to the upper surface 7 of the cross beams 6 are a plurality of laterally spaced apart and parallel longitudinal support beams 8 having their axes parallel to the longitudinal axis of the large hull and which are preferably equi-spaced from one another. Spanning the distance between the top of

each adjacent pair of longitudinal beams 8 is a curved deck section or plate 9 which defines a minor catenary curve. Each of the curved deck plates 9 forms a portion of the overall load supporting deck D, and it is the very concavity of the upper surface 10 of each section 9 that encourages the retention of the log load and precludes unwanted lateral motion in view of the non-constant curvature of the surfaces 10. This feature will be readily understood when one realizes that a constant downward force is being directed to the deck D not only by the weight of the supported logs themselves, but also by the constant tension being applied to the logs by the load securing lines 5. Thus, it will follow that as the individual logs in the interior of the load mass are shifted during pitching and rolling of the barge, each of the logs will be urged to seek the lowest, most compact level both within the intermediate area of the log load as well as immediately adjacent the upper log supporting surfaces 10 of the plurality of deck plates 9. As pointed out earlier, the mass of the log load follows the major curve as defined by the cross beams 6 while simultaneously each log L in contact with the deck follows the minor curves defined by plates 9.

It is to be understood that the term "curved" or "curvature" when referring to the line defined by both the upper surface 7 of the cross beams 6 as well as the surfaces 10 of the plates 9, should not be construed as ruling out any analogous configuration not employing curved structural elements. Similar major and minor deck deformations may be formed to provide configurations which are not of constant curvature.

The previously mentioned abutment means 3 and 4 along the two side edges of the deck D are provided to initially assist in the loading of the log load and serve subsequently to provide additional lateral support to the loaded logs in the form of non-yielding abutment means. The abutment means 4 provided along one side edge of the deck D, for example the starboard side as shown in Fig. 3, comprises a plurality of fixed posts, each of which includes a lower upright section 11 and an upper angled section 12, the tip 13 of which will be seen to be inclined inwardly toward the centerline of the deck D. The abutment means 3 located along the opposite or port side of the deck D comprises a plurality of temporary posts, each of which may comprise a log itself which is adapted to be removably inserted within an angled socket 14 extending through the deck and side 2 of the hull. Considering the two abutment means 3 and 4, it will be seen that both types of posts provide upwardly projecting elements which are inclined inwardly toward the log load and

extend to a height which is approximately one-half of a full log load.

The aforementioned load securing lines 5 preferably comprise wire rope adapted to be tensioned by powered winches, generally designated W, and associated with each of the fixed posts 4. The lines are thrown over the full log load such as shown in Fig. 3 of the drawings following attachment of one free end to a guard and securing plate 15 provided adjacent each of the temporary post sockets 14. Slackening of the lines 5 is precluded during subsequent shifting of the log load if a constant tension is maintained upon these lines 5. This tension is achieved by the arrangement shown most clearly in Figs. 5 and 6 of the drawings. Each winch assembly W is preferably mounted within the confines of each fixed post 4. By mounting the winch upon the top of the upright section 11 and between the side plates 16—16 of the angled section 12, it will be apparent that the winch will be protected against damage from the logs L during loading, transport or dumping of the barge.

Each winch W includes a drum 17 adapted to receive a portion of the line 5 between an outside flange 18 and an inside ratchet wheel 19. The lines are of a length sufficient to pass over the top of a maximum log load and include any suitable fastening means 5a on the ends opposite the ends anchored to the plates 15, which fastening means are adapted to be removably attached to the drum 17. Rotary displacement is imparted to the drum 17 by means of a hydraulic winch motor 20 adapted to receive its power from any suitable power drive hydraulic pump (not shown). Alternatively air motors, electrical constant torque motors or stroking cylinders may be used to constantly exert a preselected torque upon each winch drum 17. Suitable means are provided to rigidly mount the winch assembly such as the winch supports 21—21 shown anchored to the top of the upright section 11. Journalled through one of the winch supports 21 is a suitable lock and release mechanism comprising a spring or gravity actuated pawl 22 located adjacent the periphery of the teeth of the ratchet wheel 19 and a release lever 23 fixedly attached to the other end of the latch rod 24. To provide suitable access to the winch assembly in order to service and operate the same, each of the fixed posts 4 may be provided with ladder rungs 25 both on the exterior of the upright section 11 as well as the angle section 12 while through passage for the barge operators is provided by means of the open arch 26 formed in each side of the upright section 11.

The loading and self-dumping sequence of operations will now be reviewed. First, suitable temporary posts 3 are inserted in each

of the sockets 14 extending throughout the length of the load supporting deck D whereafter the bundles of logs L are then loaded upon the upper log supporting surfaces 10 of the curved deck plates 9 comprising the load supporting deck D. The individual logs may be loaded in a manner to provide a single mass log load, or, on the other hand, may be loaded in lots defining separate log loads as shown in Figures 1 and 2 of the drawings. Upon attainment of the desired loading, each individual load securing line 5 is positioned transversely of the load as shown in Fig. 3 from the securing plate 15 and over a pulley 27 located adjacent the tip 13 of the fixed post 4 to the winch W whereupon the free end of the line 5 is attached to the drum 17 by way of the fastening means 5a. When the appropriate lines 5 have been thus secured, the associated winch motors 20 are suitably actuated in order to apply the appropriate predetermined tension upon each of the lines 5, it being understood that the pawls 22 will engage with the teeth of the ratchet wheels 19 of each winch W to prevent unwinding of the drum or loosening of the lines 5.

During transport of the log load, the predetermined minimum tension desired to be maintained upon each line 5 may be readily achieved by means of well known pressure switches disposed within the hydraulic circuitry serving each winch motor 20. Thus, if the valves leading to each winch motor 20 are initially set to respond to a normal operating pressure of 1500 p.s.i., thence, any time there is a shifting of the log load and any one of the lines 5 becomes slackened or its tension drops below the 1500 p.s.i. setting, then the appropriate winch motor 20 would be activated to wind the associated drum 17 to take up this slack until the 1500 p.s.i. tension is again achieved in the line 5. By this arrangement, it will be seen that as shifting occurs within the log load, which in view of the described novel deck construction means that a more compact loading is achieved, all of the affected lines 5 will be automatically maintained at a constant tension to preclude unwanted displacement of the logs located adjacent the outer periphery of the log load area.

When it is desired to dump the log load, either the entire loading on the barge or merely one or more individual lots thereon, the appropriate adjacent temporary posts 3 are removed. This may be accomplished by driving the bottom of each temporary post 3 upwardly from the lower open portion of its socket 14, or by sawing off the upwardly projecting portion of the temporary post flush with the adjacent upper deck surface, in which case, of course, the remaining stub located in the socket 14 will have to be subsequently removed prior to re-loading of the

log barge. Next, it is necessary to disconnect or remove the lines 5 from the position shown in Fig. 3 of the drawings. In order to disconnect the winch end of each line 5 from its attachment to the drum, it is necessary to first relieve the tension under which the line 5 is being subjected. This is most readily accomplished by re-setting the valving controlling the affected winch motors 20 so that a higher tension is applied to the lines, for example 3000 p.s.i., whereupon as the lines 5 are thence stretched, the ratchet pawls 22 may be released, and then all of the tension may be released upon the lines 5 so that the drum may be unwound to permit automatic release of the line fastening means. Self-dumping of the log load is then possible in view of the inclusion of a suitable trim tank T within the hull adjacent the side 2 juxtaposed the temporary post sockets 14. As the trim tank T is flooded, the barge will tilt as shown in Fig. 4, and the released logs L will roll by gravity into the adjacent water where they become readily accessible for subsequent handling. By employing either pumps or a self-bailing trim tank, it will be understood that the barge may be returned to its normal position following dumping of all the logs thereon.

From the foregoing, it will be appreciated that the disclosed system for the fore/aft stowage of logs offers a significant advance over arrangements involving transverse log stowage. Considering that the fore/aft dimension of a vessel is 5—7 times greater than transverse dimensions, it will follow that with the subject system, more logs may be accommodated since logs of various lengths can be stowed end-to-end with less loss of cubic due to air space. Additionally, with the fore/aft stowage, the logs are rolled off the vessel deck during discharge while transversely stowed logs must slide during discharge, the latter requiring a greater angle of inclination before gravity overcomes friction.

WHAT I CLAIM IS:—

1. A log transporting vessel comprising, a hull provided with a load-supporting deck extending substantially between the upper portion of the hull sides, abutment means projecting upwardly from the outer edges of said deck adjacent the hull sides and defining a log load area therebetween, said deck including a plurality of adjacent curved sections as hereinbefore defined with the curvature extending transversely of said hull whereby each said section defines an upwardly facing depression, and securing means extendable over said load area from opposite sides thereof to maintain tension upon logs contained within the load area.

2. A vessel according to Claim 1 including, means supporting said adjacent curved

of the sockets 14 extending throughout the length of the load supporting deck D whereafter the bundles of logs L are then loaded upon the upper log supporting surfaces 10 of the curved deck plates 9 comprising the load supporting deck D. The individual logs may be loaded in a manner to provide a single mass log load, or, on the other hand, may be loaded in lots defining separate log loads as shown in Figures 1 and 2 of the drawings. Upon attainment of the desired loading, each individual load securing line 5 is positioned transversely of the load as shown in Fig. 3 from the securing plate 15 and over a pulley 27 located adjacent the tip 13 of the fixed post 4 to the winch W whereupon the free end of the line 5 is attached to the drum 17 by way of the fastening means 5a. When the appropriate lines 5 have been thus secured, the associated winch motors 20 are suitably actuated in order to apply the appropriate predetermined tension upon each of the lines 5, it being understood that the pawls 22 will engage with the teeth of the ratchet wheels 19 of each winch W to prevent unwinding of the drum or loosening of the lines 5.

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2. A vessel according to Claim 1 including, means supporting said adjacent curved



sections to define a major catenary curve extending substantially from one hull side to the other hull side whereby the lowest point of said major catenary curve is disposed adjacent the vessel center-line.

3. A vessel according to Claim 1 wherein, each said adjacent curved section defines a minor catenary curve.

4. A vessel according to Claim 1, wherein, said abutment means adjacent one hull side includes a plurality of rigidly attached posts.

5. A vessel according to Claim 1 wherein, said abutment means includes a plurality of fixedly attached posts adjacent one hull side and a plurality of removably attached posts adjacent the other hull side.

6. A vessel according to Claim 1 wherein, said securing means comprises a plurality of flexible lines, winch means adjacent one hull side about which said lines are wound,

and anchor means adjacent the other hull side about which said lines are wound, and anchor means adjacent the other hull side for attachment of the free ends of said lines.

7. A vessel according to Claim 6 wherein, said winch means includes a plurality of winches each provided with a line drum and a motor, and pressure sensing means actuated by the tension of said lines to operate said motors and maintain a predetermined tension upon said lines as the logs contained within said load area shift.

8. A log transporting vessel as herein described with reference to the accompanying

For the Applicant:
EDWIN C. AXE & CO.,
Chartered Patent Agents,
113 Kingsway,
London WC2B 6QP.

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