Sept. 22, 1936. C. E. WARREN 2,055,369

RIVER TRAIN

Filed Feb. 23, 1934 2 Sheets-Sheet 1

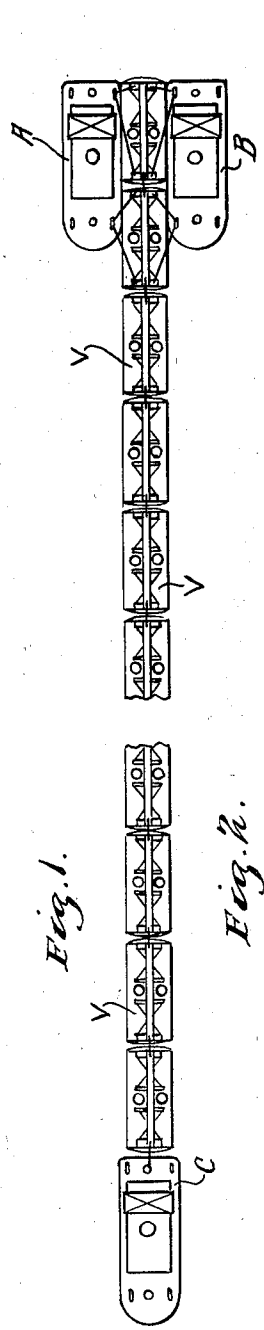


Fig. 1.

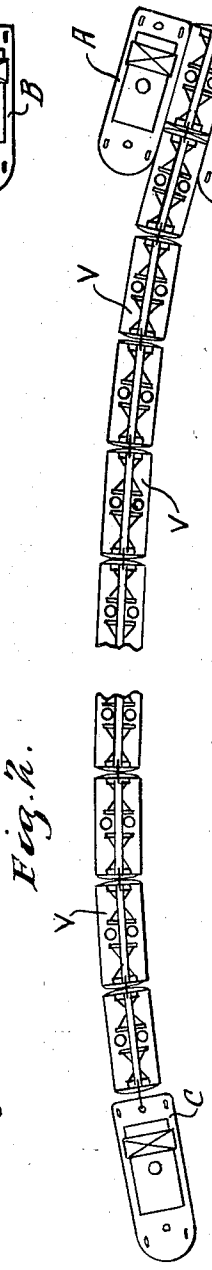


Fig. 2.

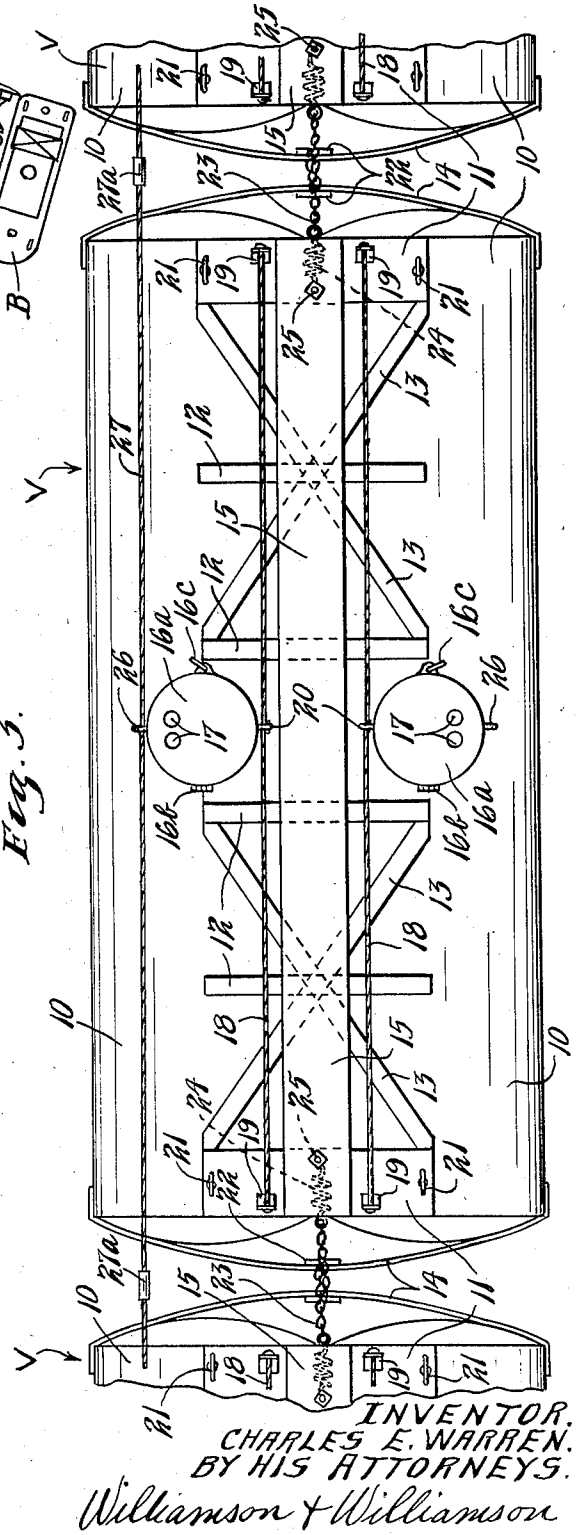


Fig. 3.

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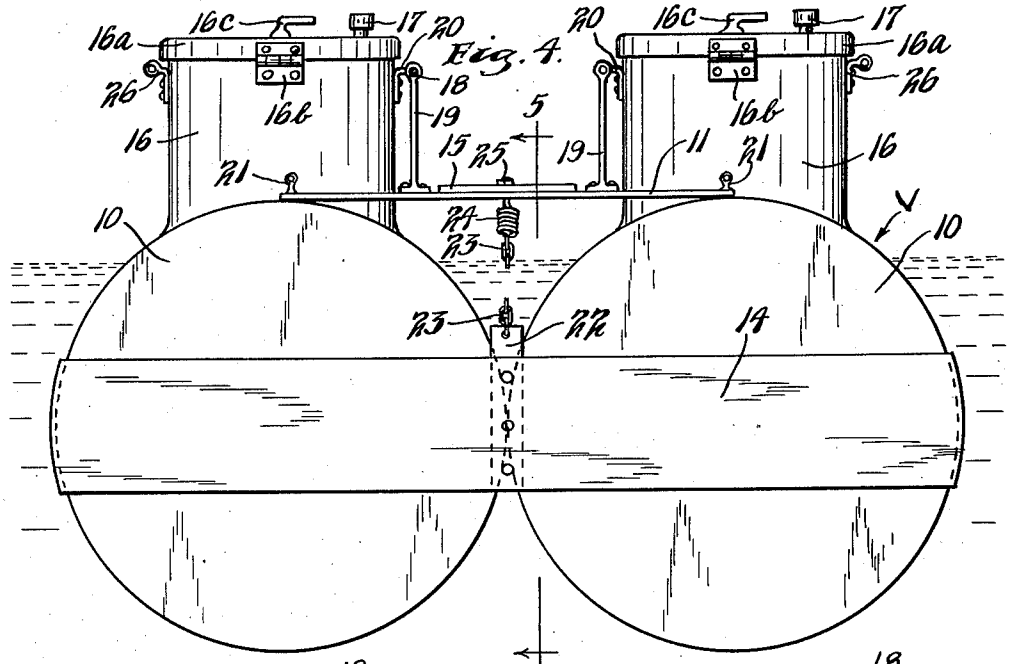


Fig. 4.

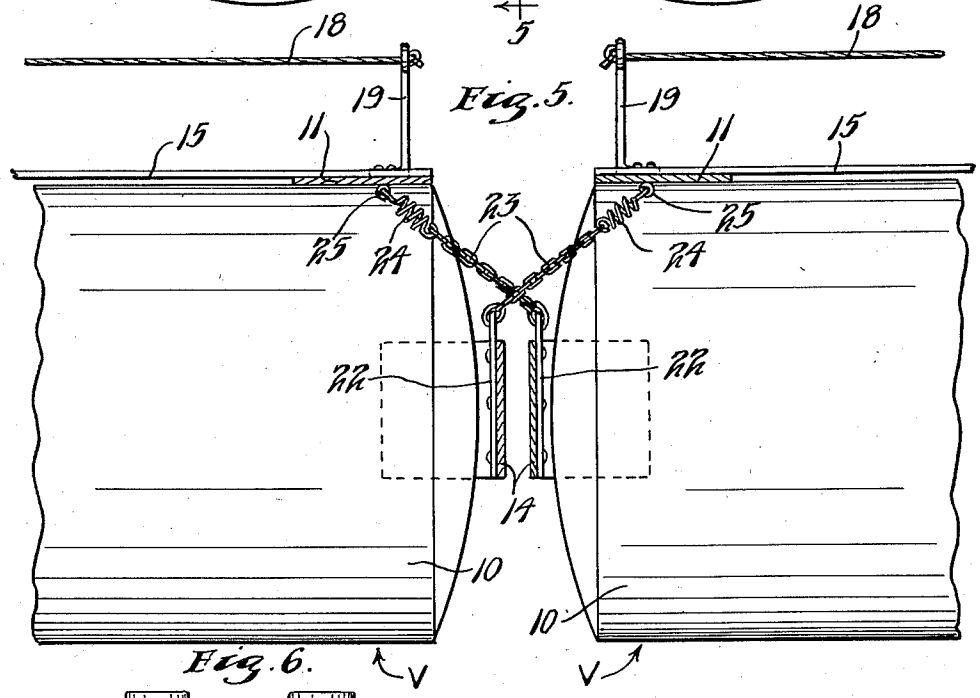
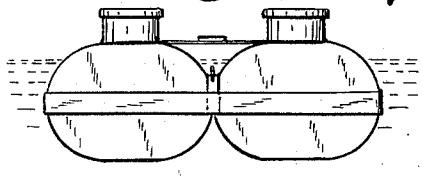


Fig. 5.

Fig. 6.



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RIVER TRAIN

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Application February 23, 1934, Serial No. 712,546

1 Claim. (Cl. 114—235)

My invention relates to freight carrying vessels and particularly to vessels adapted to be towed by tugboats through shallow waterways.

In hauling of freight on inland waterways up to the present time, river tows have been composed of large and clumsy barges pushed by large and costly boats rigidly hawsered to the rear end of the tow. The barges ordinarily employed present a considerable area above water against which cross winds can blow. Steering is normally done by means of rudders located a considerable distance to the rear of the head end of the tow so that pressure of wind against the tow must be overcome by rudders operating under considerable disadvantage and absorbing considerable power.

The general object of my invention is to provide a new and improved system of transportation for use in inland waterways whereby commodities may be transported at much lower cost than heretofore, whereby navigation of shallow waterways may be made both possible and commercially profitable, whereby many of the present difficulties in navigating shallow channels are eliminated and whereby the need of equipment which is exorbitantly costly of construction and maintenance is eliminated.

An object of my invention is to provide a freight transportation system comprising a plurality of small vessels flexibly coupled together in a train and adapted to be moved by tugboats.

Another object is to provide such a system comprising a train of vessels with tugboats coupled thereto in a manner whereby the tugboats may be manipulated to move and guide the train along a narrow waterway such as a river or canal and whereby the tugboats may be manipulated to arcuately dispose the train for negotiating curves in a waterway.

Another object is to provide a train comprising unit vessels adapted to float in nearly submerged position to eliminate pressure from side winds and to utilize the low temperature of the surrounding water to keep the cargo cool.

Yet another object is to provide such a system wherein individual vessels thereof may be uncoupled from the remainder of the train for unloading or loading at intermediate points along the route of the train in a manner corresponding to the uncoupling and sidetracking of individual cars of a railway freight train.

Still another object is to provide a unit vessel adapted to be coupled to other similar unit vessels to form such a train and so constructed that a single imperforate shell serves simultaneously as the hull of the vessel and as a receptacle for bulk freight, such as gasoline, oil, grain and other similar commodities.

A further object is to provide such a unit vessel comprising a pair of parallel cylindrical shells rigidly joined together to form a raft-like structure capable of maintaining a substantially fixed attitude when afloat.

A yet further object is to provide such a unit vessel having means facilitating passage of members of the operating personnel from one end to the other of a train of such vessels.

A still further object is to provide such a transportation system of inexpensive, rugged and simple construction and capable of rapid, convenient and efficient operation.

These and other objects and advantages of the invention will more fully appear from the following description, made in connection with the accompanying drawings, wherein like reference characters refer to the same or similar parts throughout the various views, and in which:—

Fig. 1 is a general plan view of one form of my river train;

Fig. 2 is a view of my river train in curved position as for rounding a bend in a river;

Fig. 3 is a broken top view of a portion of my river train showing one of my unit vessels and adjacent ends of adjoining unit vessels;

Fig. 4 is an end view of one of my unit vessels;

Fig. 5 is a longitudinal sectional view of adjacent ends of adjoining unit vessels taken along the line 5—5 of Fig. 4 as indicated by the arrows, and

Fig. 6 is an end view of a modified form of my unit vessel.

Referring to the drawings, and particularly to Figs. 3, 4 and 5, the unit vessels V, of which a plurality are included in my river train, are each built of a pair of cylindrical tanks or shells 10 having convexly arched ends. The pair of tanks 10 are disposed parallel to and against each other in horizontal alignment and joined along their line of tangency by welding, riveting or other suitable means to form a raft-like structure.

A horizontally disposed cross brace 11, in the form of a heavy plate extending transversely of the vessel V is attached at its respective ends to the highest points of the respective tanks 10 at each end of the vessel V to improve the rigidity of the structure and to constitute an anchor plate to which coupling means to be described later may be attached. Other horizontal cross braces 12, also extending transversely of the vessel V, are similarly attached at their respective

ends to corresponding points on the medial portions of the tanks 10. Horizontally disposed diagonal braces 13 are also attached to the tanks 10 as shown in Fig. 3.

A bumper plate 14 of arcuate shape extends horizontally across each end of the vessel V to arch outwardly therefrom as shown. Approximately the end quarters of the bumper plate 14 lay along the convex ends of the respective tanks 10 and the endmost portions are bent to form ears lapping over the outer sides of the respective tanks. The bumper plates are secured to the tanks 10 by welding, riveting or other suitable means.

A walkway 15, consisting of a heavy plate, is secured to the upper sides of the respective cross-braces 11 and 12 and extends the full length of the vessel V in centered relation to the width of the vessel. The top surface of the walkway 15 may be roughened or provided with a suitable tread if desired.

Each of the tanks 10 is provided with an open topped dome 16 having a closure member or cover 16*a*. The cover 16*a* is connected at one portion of its edge to the dome 16 by means of hinges 16*b* and at a diametrically opposite portion by a releasable clamping device 16*c* whereby the cover 16*a* may be clamped down to close the open top of the dome 16. The cover 16*a* is provided with a gasket or other suitable sealing means. A pair of safety valves 17 are provided in the cover 16*a*, one of the valves 17 being arranged to relieve pressure in the interior of the tank 10 and the other being arranged to relieve a vacuum within the tank 10.

A life line 18, disposed above each of the longitudinal edges of the walkway 15, is supported at its respective ends by one of four standards 19 mounted at the corners of the walkway. The center portions of the life lines 18 are supported by brackets 20 respectively mounted on the inner sides of the upper portions of the domes 16.

A hawser cleat 21 is mounted on each end of each of the cross braces 11 to facilitate connections between the vessel V and tugboats.

For the purpose of coupling a plurality of similar vessels V together in end to end relation, suitable coupling means is provided. At each end of each vessel V, a heavy vertically disposed coupling plate 22 having an aperture in its upper portion is secured to the inner side of the center portion of the bumper plate 14 with its upper portion projecting above the upper edge of the bumper plate. A chain 23, connected at one of its ends to the apertured portion of the coupling plate 22 of one vessel V, extends upwardly and outwardly toward the adjacent end of a second vessel V and is connected at its upper and outer end to one end of a heavy helical tension spring 24. The remaining end of the spring 24 is connected by means of an eye bolt 25 to the cross brace 11 of the second vessel V. A similar chain 23 extends upwardly and outwardly from a coupling plate on the second vessel V, crosses the chain 23 referred to above and is similarly connected through a spring 24 and an eye bolt 25 to the cross brace 11 of the first vessel V as shown. The arrangement and proportions of the coupling elements described is such that the bumper plates 14 of a pair of coupled vessels V are spaced apart only slightly if at all.

With the above described coupling scheme the walkway plate 15 and the sides of the tanks 10 serve jointly as drawbars and the helical tension springs 24 serve to cushion jars and reduce stresses.

To form a train of similar vessels V, a plurality of such vessels are coupled together as described above. A tugboat A is connected by means of hawsers attached to hawser cleats 21 of the vessels V to the left or port side of the head end of the train thus formed and a second tugboat B is similarly connected to the right or starboard side of the head end of the train as shown in Figs. 1 and 2. A third tugboat C is connected to the rear end of the train.

Brackets 26 may be mounted on the outer side of each of the domes 16 to support telephone or signal wires or bell cords 27 for communication between the tugboat C at the rear of the train and one or both of the tugboats A and B at the head end of the train. Separable connectors 27*a* may be inserted in such wires or cords.

Fig. 6 illustrates a modified form of my unit vessel wherein the construction is identical with that of the form described except that oval-shaped tanks or shells are used. This form is particularly adapted for use in shallow water.

Operation

My unit vessel V is particularly adapted for transportation of liquids which are lighter than water or bulk materials such as grain or the like but obviously may be used for transportation of other types of materials and objects. The dome 16, when the cover 16*a* is opened, constitutes a hatchway through which material may be loaded into or removed from the interior of the shell 10. The cover 16*a*, when closed, seals the dome against loss of materials from or entrance of water into the interior of the shell 10. The safety valves 17 in the cover 16*a* function to limit pressure or vacuum which are created by expansion or contraction of a liquid cargo such as would occur due to changes in the temperature of the liquid cargo.

When my vessel V is disposed in water and is filled with a cargo of liquid having a specific gravity less than that of water, buoyancy of the combined vessel and cargo is produced due to the differential between the respective specific gravities of the cargo and the water in which the vessel is situated. When the cargo consists, for example, of gasoline, the buoyancy is such that the vessel will float with a major portion thereof submerged as indicated in Figs. 4 and 5. The depth to which the vessel sinks in the water may, of course, be decreased by reducing the amount of cargo placed in the vessel to a suitable percentage of the total capacity of the vessel. The train of vessels when floating nearly submerged offer extremely little surface above water against which cross-winds may exert a pressure. The effect of wind is also reduced due to the curvature of the exposed surfaces.

Due to the low level at which my unit vessels V float in the water, all difficulty due to low bridge clearances is eliminated.

When repairs are necessary on my unit vessels, the use of a dry-dock or skidways is not necessary as in the case of conventional barges since my unit vessels may be readily beached for repair purposes. Repairing is quite simple since it can be done entirely by means of welding.

When a train of unit vessels is loaded with a liquid cargo and the tanks 10 are not filled to the top acceleration or decelaration of the train will cause the weight of the liquid to be shifted to the rear or front respectively of each vessel.

Under these conditions, since the lighter end of one vessel is coupled to the heavier end of the vessel adjacent and the coupling means includes diagonally disposed chains 23, the lightness of one end of the first vessel is cancelled by the heaviness of the adjacent end of the second vessel and hence pitching of the individual vessels of the train is prevented.

In moving a train of unit vessels V, the tugboats A and B at the forward end of the train apply equal amounts of power to tow the train along a straight line. The tub C at the rear of the train may apply a moderate amount of power to assist the tugs A and B.

To produce moderate changes in the direction in which the train is towed the relative amounts of power applied by the tugs A and B may be changed to produce a differential, the tub at the outer side of the desired curved course applying more power than the tug at the inner side. The necessary differential may be produced by respectively increasing and decreasing the power applied by the individual ones of the two tugs. Also, when both tugs normally operate continuously at a fixed fraction of their maximum power, one tug may act as the pilot tug and produce the required power differential by increasing its power above normal to steer toward the side opposite itself and decreasing its power below normal to steer toward its side of the train. The tug C at the rear of the train by suitable manipulation of its rudder and power may assist in steering the train or a portion thereof. As a change of course is initiated by the tugboats A and B, the forwardmost ones of the unit vessels are turned into the new course and act as a rudder to guide the following unit vessel into the new course. Each unit vessel, as it turns into the new course, automatically acts temporarily as a rudder to guide the next following unit vessel into the new course.

When a relatively short turn is to be made as in negotiating a relatively sharp curve in a river, the front tugs A and B are manipulated substantially the same as described above. The rear tug C applies a relatively large amount of power to place the train under longitudinal compression and hence buckle or arch the train outwardly as shown in Fig. 2 into a suitably curved course wherein all of the unit vessels track behind the preceding vessel instead of following shorter courses.

When it is desired to uncouple and land one or more unit vessels at an intermediate point along the route of my river train, the rear tug may cast off from the main portion of the train to perform such service. In many such cases the main portion of the train may proceed without stopping or delay and the rear tug, after performing the service referred to, may overtake and again be coupled to the rear of the train.

The unit vessels of my river train may operate with very shallow draft and hence may be used in rivers that are very shallow or that have many sand bars. The tugboats used should be designed for more shallow draft than the unit vessels so as to clear obstructions which would be struck by the unit vessels. If sand bars or mud bars are encountered by the unit vessels, the vessels may be dragged or skidded thereover. In particularly serious situations of this kind the train may be split up into small groups of unit vessels or into individual unit vessels if necessary, whereupon such groups or the individual vessels may be skidded over the obstruction one at a time.

My system of transportation is particularly valuable in shiping of gasoline in that the tanks 10 are nearly completely submerged and hence keep the gasoline therein at substantially the same temperature as the water in which the vessels are floated. Keeping the gasoline cool reduces evaporation of the gasoline and hence minimizes losses. Also, since it is the lighter components of the gasoline that are lost by evaporation, the gasoline arrives at its destination as a higher grade of gasoline than if it were transported by rail where more of the lighter components would be lost by evaporation.

It is obvious that the tanks or shells from which my unit vessels are constructed may be varied in shape and that numbers thereof other than two may be rigidly joined together to form a unit vessel. It is also obvious that my unit vessels may be connected together side by side in addition to being coupled end to end so as to form trains of various widths to suit various conditions.

It is apparent that I have invented a novel, inexpensive rugged and flexible system of transportation for use in shallow channels wherein great economy in construction, operation and maintenance are effected, whereby the usual difficulties attending navigation of shallow channels are minimized and whereby bridge clearance requirements are reduced.

It will, of course, be understood that various changes may be made in the form, details, proportions and arrangement of the parts, without departing from the scope of my invention, which generally stated, consists in a device capable of carrying out the objects above set forth and in the novel parts and combinations of parts disclosed and defined in the appended claim.

What is claimed is:—

In cargo carrying vessels adapted to be coupled together to form a train of such vessels, coupling means for connecting said vessels together in end to end relation to form a train, said coupling means consisting of one coupling link swingably connecting a horizontally centered relatively high point on the end of one vessel to a horizontally centered somewhat lower point on the end of a second vessel and a second coupling link swingably connecting a horizontally centered relatively high point on the end of said second vessel to a horizontally centered somewhat lower point on said first vessel whereby each vessel is laterally swingable relative to adjacent vessels to make said train laterally flexible and each vessel is substantially restrained from tilting of its longitudinal axis.

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