

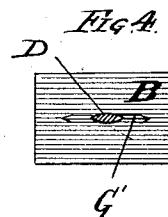
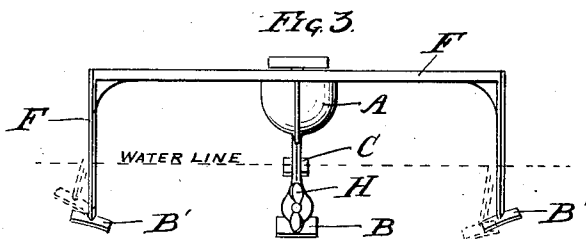
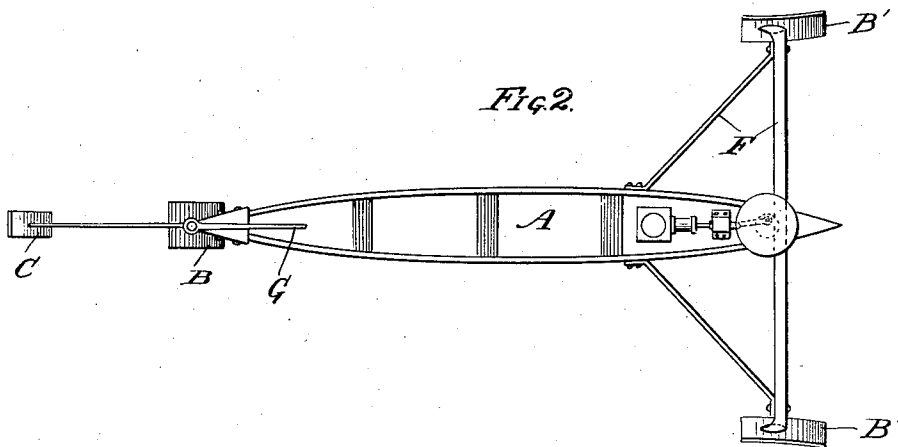
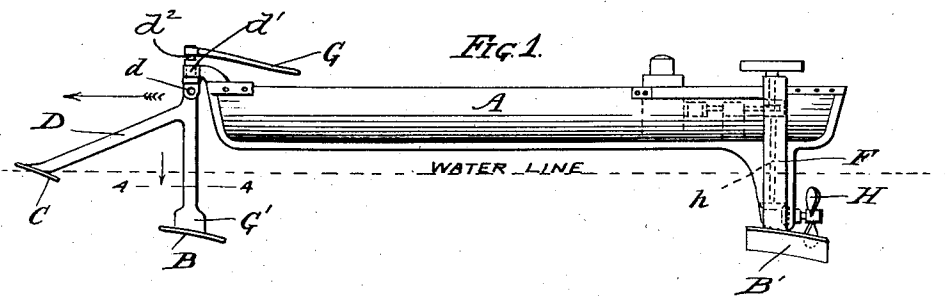
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W. M. & L. E. MEACHAM.

WATER CONVEYANCE.

APPLICATION FILED SEPT. 19, 1896.



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WATER-CONVEYANCE.

No. 857,951.

Specification of Letters Patent.

Patented June 25, 1907.

Application filed September 19, 1896. Serial No. 606,374.

To all whom it may concern:

Be it known that we, WILLIAM M. MEACHAM and LARNED E. MEACHAM, citizens of the United States, residing in Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Water-Conveyances, of which the following is a specification.

Our invention relates to water conveyances.

The object of our invention is to provide a device of a simple construction, which may be conveyed through or over water at a high rate of speed.

In our invention the load is supported, when in motion, by inclined plates which project below the bottom of the body of a vessel and move edgewise through the water so as to encounter little resistance therefrom, the plates being arranged at a slight angle to the horizontal to give an upward force or support to the conveyance and its load.

The principle involved is that of the hydroplane and its advantages are theoretically illustrated by the following proposition: Given a flat plate which is constant under all conditions, deeply submerged in water, drawn edgewise horizontally, through the water, with front edge, in direction of motion, raised at a small angle to the horizontal. The power applied to the plate is divided into two components, one of which furnishes the supporting force, the other overcoming frictional resistance. The component of supporting force varies as the square of the speed. The component of frictional resistance also varies as the square of the speed. It then follows that, if the supporting force is kept constant by reducing the width of the plate, across the line of motion, as speed increases, the frictional resistance of plate, taken as a whole, (not as per unit of area) remains constant. Or in other words, if area of plate is varied (in width across line of motion) inversely as the square of the speed, the resistance due to skin friction and that due to the inclination of the plate will remain constant, and the supporting force will also remain constant. Since the resistance is constant and the distance through which the force acts varies directly as the speed, the power required will vary directly as the speed instead of as the cube of the speed as would be the case if weight was supported by displacement.

In our invention no attempt is made to ad-

just the plates in width as the speed increases, but the advantage of the application of this principle is secured by designing the plates for one speed only (maximum speed) and obtaining the lifting force required at other speeds (between starting and maximum) by the automatic regulation of said plates in such manner as to give them at all times, when under sufficient speed, such lifting force as is necessary to support the load.

Our boat, sustained by its supporting plates (or hydroplanes) is practically a soaring machine, and has the same mechanical advantages over an ordinary boat, in the water, as has a soaring bird over a balloon, in the air; and this relation holds, in practice, also in respect to their skin friction areas. It possesses the special advantage that it soars in and its propelling force is exerted upon, water, which is seven hundred times as dense as air, while the displacement of the hull, with its necessarily large frictional surface, is all carried in the rarer medium, air.

In the practical application of the hydroplane principle to boats, we discovered, in tests made by us prior to the filing of this application, that, with supporting plates of the proper form and area, arranged below the bottom line of the boat, in such a manner as to be constantly submerged, we could, by putting the boat under sufficient speed, cause it to rise entirely above the surface of the water and be there sustained, during continued speed, solely by reason of the support afforded by the supporting plates. It was found, too, that when plates were entirely submerged, at a proper depth, their supporting efficiency for a given application of power very greatly exceeded that of a plate at or near the surface. Another discovery was that it became a matter of difficulty to prevent the plates, when of proper form and area, and under proper speed, from rising immediately to the surface of the water, in which position, as above explained, their efficiency was much reduced and also they were detrimentally affected in their operation by a roughness of water so slight as to be unnoticed when they were kept submerged. To overcome this disadvantage, we devised a construction whereby we maintain, automatically, a desired minimum depth of submergence of said plates above which they cannot rise, and this feature we consider as the most important part of our invention. By its use our plates soar through the water as distinguished from

gliding upon its surface. In order that the support, or lifting force, of said plates shall be sufficient and properly proportioned, the angle at which they are set to the horizontal must be varied in accordance with the speed for which the conveyance is designed, a greater speed requiring a less angle and a less speed a greater angle in order to support a given load above the level of the water.

To automatically adjust the angle of the plates as the forward speed may vary, so as to always give the proper increment of supporting force, we so arrange the plates, or so combine them together, that the inclination of one of said plates (the one at the front) to the horizontal, is increased the more it sinks below the level of the water. This may be accomplished by any suitable means, but preferably by connecting the said front supporting plate, by means of a frame work and a forwardly projecting arm, to a regulating or leveling plate or float that carries little or no load and that is set at such an angle as to be forced continually to remain substantially at the surface of the water, while the conveyance is in motion. This regulating plate thus becomes a fulcrum or center about which all the frame work and connected parts, including the front supporting plate, turn, in the same manner as though said regulating plate were a pivot. The front end of the body of boat, being connected to this frame work at a point above the front supporting plate, is raised or lowered in exact accordance as said front supporting plate rises or falls, and the rear supporting plates, those at the sides, being rigidly connected to the body of the boat, have communicated to them every changing angle incident to the changing levels or elevations of the front end of the boat—and in this manner the regulating plate accomplishes for them, though indirectly, the same positive regulation as it does for the front supporting plate.

To prevent the conveyance from tilting sidewise, and to cause it to automatically right itself laterally, we arrange two or more of the supporting plates at opposite angles to each other in respect to a transverse horizontal line, so that when the conveyance tends to tilt laterally the effective supporting area of the plate on the sinking side will increase as the conveyance tilts, and the effective supporting area of the plate on the rising side correspondingly diminish; thus causing the device to automatically preserve its equilibrium.

The invention is fully disclosed in the description given below and will be understood therefrom, and it is also illustrated in its simplest form in the accompanying drawing forming a part of this specification.

In the drawing, in which similar letters of reference indicate like parts throughout all the figures, Figure 1 is a side elevation of a

device or water conveyance embodying our invention; Fig. 2 is a plan view; Fig. 3 is a rear view and Fig. 4 is a section on the line 4—4 of Fig. 1.

In the drawing A represents the body or receptacle of the conveyance for receiving and holding the load or passengers to be conveyed. The body or receptacle A is preferably made boat-shaped and of sufficient capacity to enable it and its load to be supported in the water by its own buoyancy when the conveyance remains at rest. By making the body A boat-shaped it will also encounter less resistance from the water in starting, and from the air when the body of the conveyance is lifted entirely out of the water by the inclined supporting plates of the conveyance when under full speed.

B, B¹, B² are inclined supporting plates which are submerged entirely under the water and move edgewise through it so as to encounter little resistance from the liquid, and which are set at a slight angle to the longitudinal horizontal line or water level to cause the plates as they move rapidly through the water to give the necessary support to the conveyance and the load carried by it. As illustrated in the drawing the inclined supporting plates are three in number, although a greater or less number may be employed, and they are arranged one in front and two at the rear, one on each side, although other arrangements may be employed if desired. The two rear plates B¹, B² are located or arranged one at each side of the conveyance, and these rear plates are arranged not only at an angle to the longitudinal horizontal line, as indicated in Fig. 1, but also at opposite angles to each other in respect to the transverse horizontal line as indicated in Fig. 3. This arrangement of the two rear plates, one on each side of the conveyance and at opposite inclinations to each other in respect to the transverse horizontal line, enables the conveyance to automatically preserve its equilibrium: as the more the conveyance tends to tilt to one side the greater support is given by the plate on that side and the less by the one on the opposite side. This will be apparent from the dotted lines in Fig. 3.

C is a regulating plate or float, arranged in advance of the front supporting or carrying plate B, but connected rigidly thereto by a frame or connection D. This forward or regulating plate or float C is designed to carry little or no load, and to remain always substantially at the surface of the water, and thus serve as a fulcrum for adjusting the angle of the supporting or carrying plates B, B¹, B², according to the varying requirements as the speed of the conveyance through the water may change, or as the loads to be carried may vary. The frame or connection D between the forward or regulating plate or float C and the front supporting plate B may

preferably consist of bars rigidly secured together and set edgewise in respect to the length of the conveyance so as to encounter as little resistance as possible from the water.

5 F is a frame or connection between the rear supporting or carrying plates $B^1 B^1$ and the body or receptacle A. This frame or connection F may be of any suitable construction and rigid with the body. The
10 frame D is provided with a vertical pivotal portion d^2 which is fitted in a bracket d' attached to the boat, and thereby the frame D is permitted to be turned at an angle for steering the conveyance in any direction desired, and for this purpose, the frame D is
15 provided with a steering lever or device G and the frame D is provided with a vertical or rudder plate G^1 as shown. Immediately below the bracket d' , the frame D is pivotally
20 attached to the steering pivot d^2 by a horizontal pivot d , this feature enabling frame D and the plates carried by it to swing freely to their proper positions in accordance with the speed at which the conveyance may be
25 moving. The inclination relative to the line of motion of the rear supporting plates is, of course, affected by the height of the front end of the vessel, and the greater their inclination, the greater their lifting power, so
30 that the rear end of the boat will adjust itself to the position of the forward end. The plates B, $B^1 B^1$ are preferably made slightly curving, as indicated in Fig. 1, instead of true or flat planes, although their shape in
35 this respect may be varied without departing from our invention. As the forward or regulating plate C is designed to ride over or upon the surface of the water instead of passing through the water like the submerged plates
40 B, $B^1 B^1$, it may, if desired, be made hollow or in the nature of a float without materially increasing the resistance even when the conveyance is moved at very high speeds.

The conveyance may be propelled by any
45 suitable means or operated by any suitable motor or engine. We prefer however to employ a screw propeller H connected by a shaft h with the motor in the body or receptacle A of the conveyance.

50 As the supporting plates B, $B^1 B^1$ may be made very thin, (we prefer to make them of sheet metal) and as they move edgewise through the water at just a sufficient angle to the horizontal to give the necessary support
55 or upward force to maintain the body of the conveyance and its load out of the water, the conveyance will encounter a comparatively slight resistance from the water whatever its speed. The apparatus is, therefore, adapted
60 to be propelled at a very high speed through the water. The force required to propel a steamboat or other vessel supported by its buoyancy or water displacement through the water increases with the square of the ve-
65 locity. So that with such vessels only a

comparatively low rate of speed is possible. In our conveyance however the greater the velocity the less force is required to move the conveyance a given distance, as the angle at which the supporting or carrying plates are
70 required to stand to the horizontal diminishes as the velocity increases, thus diminishing the resistance, and for the further reason that as the velocity increases the time diminishes during which the conveyance is re-
75 quired to be supported in the water to move a given distance. For these and other obvious reasons the speed of our conveyance is only limited by the amount of power that can be applied by the screw or other pro-
80 peller and its motor, or sails, or other means which may be employed for imparting to the conveyance the forward propelling force.

In the conveyance or apparatus illustrated in the drawing the body, receptacle or vessel
85 A is illustrated as being designed to be lifted entirely out of the water and supported wholly by the upward force due to the inclination of the supporting or carrying plates B, $B^1 B^1$, and this is the preferred way in
90 which we use our invention. But it will be understood by those skilled in the art that the body or vessel A, especially if the same is made boat shaped, may be in part supported by the inclined plates B, $B^1 B^1$, and in part by
95 buoyancy due to a partial sinking of the body A of the vessel in the water. In this latter case the supporting plates serve to diminish the draft of the vessel in the water, and to that extent to diminish the resistance of the
100 vessel in its movement through the water.

Our invention is specially designed and intended for use in conveying passengers and other comparatively light loads where high rates of speed are desired or required.
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We claim:

1. In a water conveyance, the combination with a body or vessel for receiving the passengers or load, of inclined supporting plates connected thereto and moving edge-
110 wise through the water at an inclination to the longitudinal horizontal line to give support to the body or vessel, and a regulating plate or float connected to the forward supporting plate for automatically regulating or
115 adjusting the inclination of the supporting plate, substantially as specified.

2. In a water conveyance, the combination with a body or vessel for receiving the passengers or load, of inclined supporting
120 plates connected thereto and moving edgewise through the water at an inclination to the longitudinal horizontal line to give support to the body or vessel, a regulating plate or float connected to the forward supporting
125 plate for automatically regulating or adjusting the inclination of the supporting plate, and a propeller for imparting forward motion to the conveyance, substantially as specified.

3. In a water conveyance, the combina- 130

- tion with a body or vessel A, of a front inclined supporting or carrying plate B; rear inclined carrying plates B¹ B¹, one at each side of the conveyance, and arranged at opposite angles to each other in respect to a transverse horizontal line, and a regulating plate or float connected to the front supporting or carrying plate, substantially as specified.
4. In a water conveyance, the combination with a body or vessel A, of a front inclined supporting or carrying plate B, rear inclined carrying plates B¹ B¹, one at each side of the conveyance and arranged at opposite angles to each other in respect to a transverse horizontal line, a regulating plate or float connected to the front supporting or carrying plate, and a connection or frame pivotally united to the boat and connecting the front supporting plate with the regulating plate or float, substantially as specified.
5. In a water conveyance, the combination with a body or vessel A, of a front inclined supporting or carrying plate B, rear inclined carrying plates B¹ B¹, one of the latter at each side of the conveyance and arranged at opposite angles to each other in respect to a transverse horizontal line, a regulating plate or float connected to the front supporting or carrying plate, a pivoted connection or frame connecting the front supporting plate with the body, and a connection or frame rigid with the boat and connecting the rear supporting plates with the body, substantially as specified.
6. In a water conveyance, the combination with a body or vessel A, of a front inclined supporting or carrying plate B, rear inclined carrying plates B¹ B¹, one at each side of the conveyance, and arranged at opposite angles to each other in respect to a transverse horizontal line, a regulating plate or float connected to the front supporting or carrying plate, and a propeller, substantially as specified.
7. In a water conveyance, the combination with a body or vessel A, of a front inclined supporting or carrying plate B, rear inclined carrying plates B¹ B¹, one at each side of the conveyance and arranged at opposite angles to each other in respect to a transverse horizontal line, and a propeller, said front carrying plate having a pivotal connection to the boat enabling it to be turned for steering purposes, and said rear supporting plates being rigidly attached to the body, substantially as specified.
8. In a water conveyance, the combination with a body or vessel A, of a front inclined supporting or carrying plate B, rear inclined carrying plates B¹ B¹, one at each side of the conveyance and arranged at opposite angles to each other in respect to a transverse horizontal line, a regulating plate or float, said front carrying plate being pivotally attached to the boat by both vertical and horizontal pivots so that it can be turned laterally in steering and also assume different vertical positions, and a steering lever or device, substantially as specified.
9. In a water conveyance, the combination with a body or vessel A, of a forward inclined submerged supporting plate moving edgewise through the water at an inclination to the longitudinal horizontal line or direction of motion of the conveyance to give support to the body of the vessel, and two inclined submerged supporting plates projecting one at each side of the rear portion of the body or vessel and moving through the water, and means for automatically regulating or adjusting the inclination of all of said submerged plates according to their depth below the surface of the water as they move through the same, substantially as specified.
10. In a water conveyance, the combination with a body or vessel, of inclined supporting plates moving edgewise through the water at an inclination to the longitudinal horizontal line or direction of motion to give support to the body or vessel, and means for automatically regulating or adjusting the inclination of one of said submerged plates according to its depth below the surface as it moves through the water and incidentally regulating the inclination of the other plates by its action upon the boat.
11. The combination with a vessel, of a leveling plate adapted to ride upon the water, and means carried by said vessel arranged to support and adjust said leveling plate, substantially as described.
12. In a water conveyance, the combination of a hull or body, an inclined supporting plate, and means for automatically decreasing the angle of the plate as the speed increases and the hull rises out of the water.
13. In a water conveyance, the combination of a hull or body, a swinging standard attached to the hull, and a supporting plate rigidly secured to said standard.
14. The water conveyance having a supporting plate and a regulating device, operated by the surface of the water, by means of which said supporting plate is prevented, automatically, from rising above a given minimum depth of submergence.
- WILLIAM M. MEACHAM.
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- Witnesses:
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