Sept. 16, 1958 H. P. SMITH ET AL 2,851,705

BOAT WITH RETRACTABLE WHEELS

Filed Aug. 2, 1955 2 Sheets-Sheet 1

FIG_1.

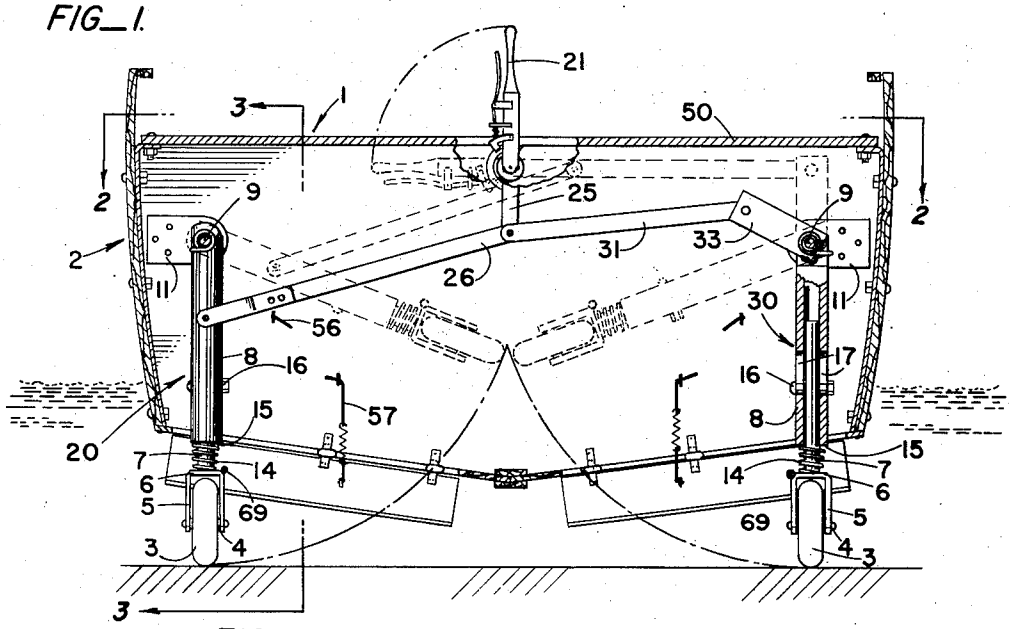


FIG_2.

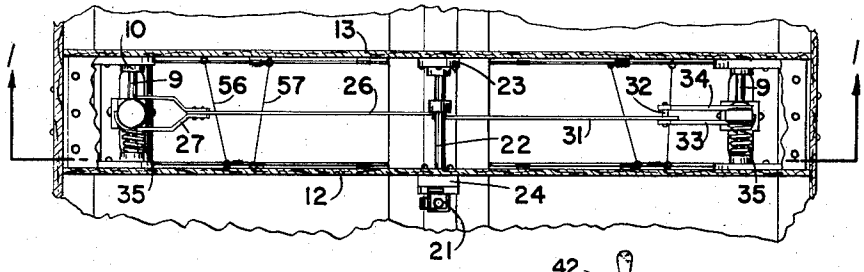


FIG_3.

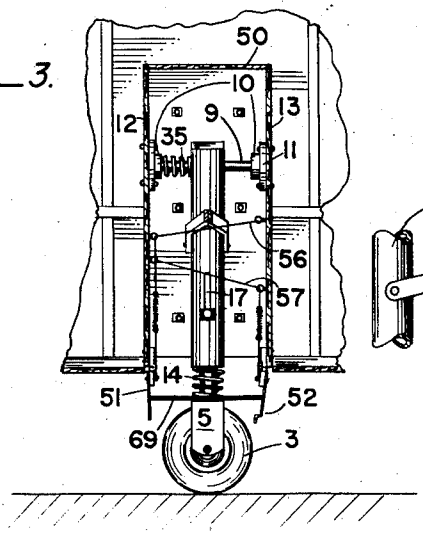
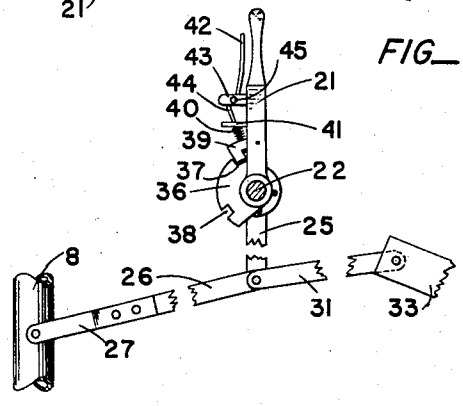


FIG_4.



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FIG_5.

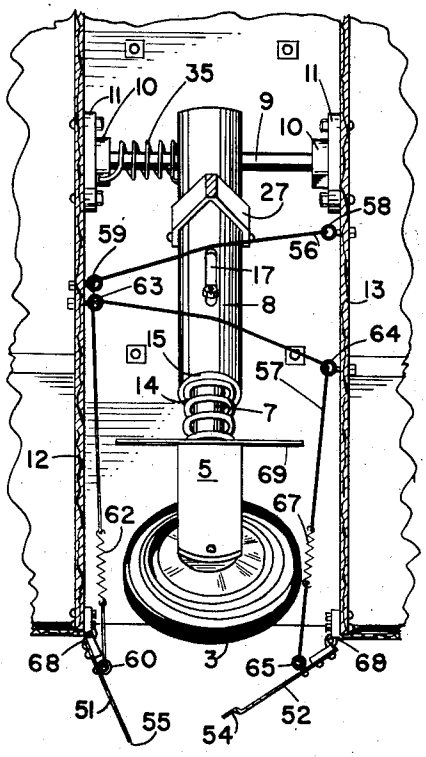


FIG_6.

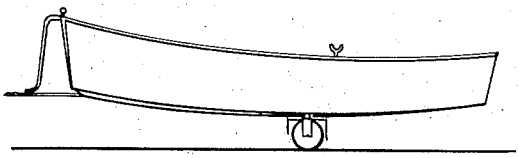


FIG_7.

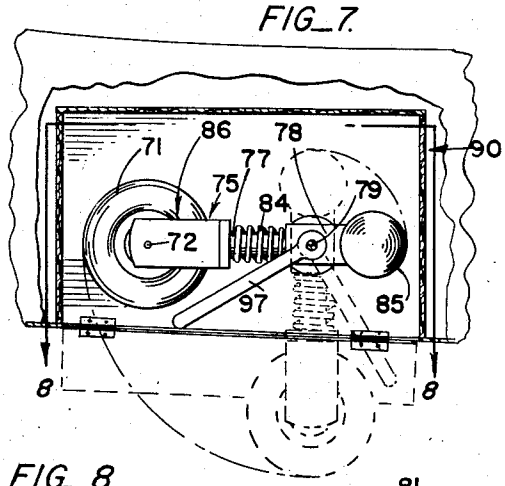


FIG_9.

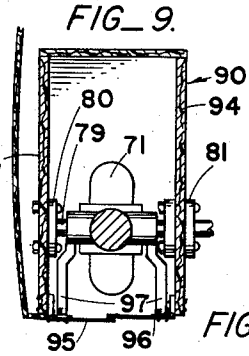


FIG_10.

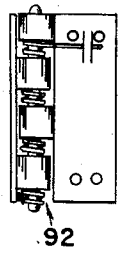


FIG_8.

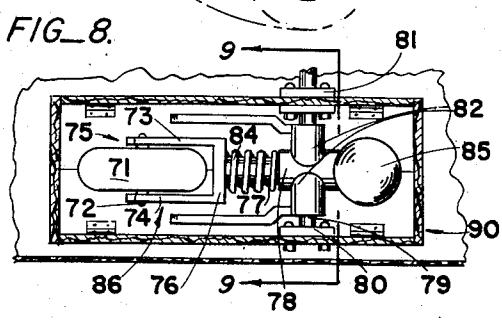


FIG_12.

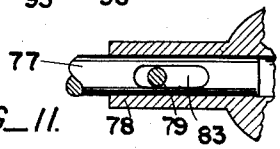
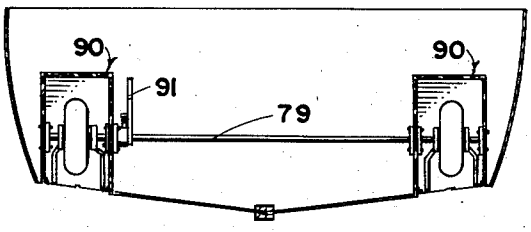


FIG_11.



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BOAT WITH RETRACTABLE WHEELS

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Application August 2, 1955, Serial No. 525,905

2 Claims. (Cl. 9—1)

This invention relates to amphibious vehicles, and more particularly to boats provided with an improved means for trailing behind a powered vehicle.

Previously, attached ground wheels for boats have been proposed, these have generally proven impractical for one or more of the following reasons: cost, difficulty of operation, and resultant unbalance of the boat while afloat. The cost of providing ground wheels on some boats has even exceeded the cost of the boat itself, while the operation of other applications of the art has proven to be a time consuming and vexing operation.

With the shortcomings of the prior art in mind, the present invention proposes the application of efficient and practical ground wheels retractably mounted to a boat.

It is an object of the present invention to provide an economical means of providing self contained retractable ground wheels within a boat.

Another object of the invention is to provide a novel means by which the ground wheels can be lowered or raised by an operator from within the boat, in a single manual operation.

Still another object of the invention is to provide buoyancy chambers to compensate for the necessary additional weight of the ground wheel mechanism. It will be also apparent from the accompanying drawings and detailed description that the said buoyancy chambers also greatly stabilize the boat against pitching and rolling and tend to reduce the draft of the boat resulting in less effort required to propel the boat through the water.

Essentially, the present invention comprises a pair of coaxially placed ground wheels with the axles of said ground wheels connected at the lower marginal end of an elongated supporting element, and said supporting element swingably mounted within a downwardly opening air tight compartment.

The accompanying drawings illustrate the present invention complete in its preferred form, and also one modification of the same invention.

Fig. 1 is a transverse sectional view taken substantially along line 1—1 of Fig. 2, showing the detail of the mechanism within the air tight compartment and showing a portion of the structure in elevation.

Fig. 2 is a top plan view, taken substantially along lines 2—2 of Fig. 1, of the air tight compartment with the uppermost portion of said compartment removed.

Fig. 3 is a side, partly sectional and partly elevational view of the air tight compartment taken substantially along lines 3—3 of Fig. 1.

Fig. 4 is an enlarged elevational view of the control handle and locking device with the connecting levers broken and foreshortened to accommodate the sheet.

Fig. 5 is an enlarged view similar to Fig. 3, showing the wheel being retracted and the detailed operation of the means for operating the closures.

Fig. 6 is a side elevational view of the boat, with a hitch attached to a self propelled vehicle (not shown),

showing the general appearance of the invention when being trailed on land.

Fig. 7 is a partially broken away and partly sectional side elevational view of a modified form of the invention.

Fig. 8 is a top partly sectional view taken substantially along lines 8—8 of Fig. 7, showing the top plan view of the modified form of the invention.

Fig. 9 is a sectional view of the modified invention, taken substantially along lines 9—9 of Fig. 8.

Fig. 10 is a greatly enlarged view of a typical device utilized to yieldably urge the closures of the compartment to an upward or closed position.

Fig. 11 is a transverse section taken through the hull of the boat showing the air tight compartments, retracted ground wheels, and a means for operating the latter.

Fig. 12 is a fragmentary, partly sectional view showing the intersection of shafts within support sleeve of the modified invention.

Referring to the accompanying drawings the invention is shown in its preferred form in Figs. 1 through 6.

As seen in Fig. 1, the mechanism of the invention is housed within an air tight compartment, generally designated 1, said compartment being structurally affixed to a standard boat hull 2. The term "boat" as used herein is intended to be understood as any small craft designed to operate on water and of a size that will enable it to be removed from the water and trailed behind a vehicle operating upon the public highways.

In detail, the invention comprises a pair of coaxially placed, independently mounted ground wheels 3 placed to rotate in a plane parallel to the longitudinal axis of the boat 1. Said ground wheels are rotatably mounted on axle shafts 4 which are secured to the lower portions of bifurcated yokes 5. Said ground wheels being mounted rotatably within the downwardly opening channels defined by the yokes 5. Substantially centrally placed on the top closed portion 6, of yoke 5, is an elongated vertical cylindrical member 7. Member 7 is adapted to be slidably mounted within an elongated, cylindrical support sleeve 8. The upper marginal portion of the said support sleeve is swingably mounted to supporting shaft 9 (Fig. 2). Supporting shaft 9 is parallel to the longitudinal axis of the boat, and is rotatably mounted in bearing sockets centrally placed within bosses 10. Said bosses are integrally mounted on support blocks 11, and the support blocks 11 are coaxially mounted as by bolts to the inner surfaces of the forward and aft bulkheads 12, 13, respectively, of the air tight compartment 1. As a means of cushioning the bumping of the boat while being trailed, helical, coiled, compression springs 14 (Fig. 1) are provided. Said springs mounted atop portion 6 of yoke 5 and surrounding the cylindrical member 7. The lower end portion 15 of support sleeve 8 is adapted to form a seat for the upper portion of spring 14. As a means of limiting the reciprocation and to prevent complete disengagement and rotation in a horizontal plane of member 7 within sleeve 8, a pin device 16 such as a bolt is mounted perpendicularly through the longitudinal axis of member 7. It is apparent that a press fit between element 7 and 16 is desirable. The end portions of pins 16 pass through vertical slots 17 in support sleeve 8. The width of the slots 17 being sufficient to allow pin 16 to move slidably upward and downward between the bearing surfaces of the slot. Slots 17 need be only of a length sufficient to accommodate the reciprocatory travel of member 7 that will be allowed by springs 14.

The raising and lowering of the ground wheels 3, while operating simultaneously, will be described for one wheel at a time because of the difference in the structure

of the connecting devices. Referring to the wheel and support assembly **20**, on the left side of Fig. 1, it is seen that by moving lever handle **21** to the left through an arc of substantially 90 degrees, the wheel assembly **20** is urged inwardly and upwardly, swinging in an arc about support shaft **9** to the dotted line fully retracted position shown in Fig. 1.

To accomplish the aforementioned movement, lever handle **21** is rigidly affixed to handle shaft **22**. As best seen in Fig. 2, lever handle is mounted substantially in the vertical plane of the keel and adjacent the forward bulkhead **12**. Handle shaft **22** is rotatably mounted within bearing block **23** on bulkhead **13** and passes through bearing **24** which is fitted with a sealing means (not shown) to retain the air tight properties of compartment **1**. Rigidly affixed to handle shaft **22**, within compartment **1**, is lever arm **25**. With wheels in the down position lever arm **25** projects substantially vertically downward (Figs. 1, 4). Pivotally connected at one end to the lower end of lever arm **25** is an elongated retracting arm **26**. The opposite end of retracting arm **26** terminates in a bifurcated yoke **27** which may be fabricated as shown or in any other suitable manner. The lower ends of yoke **27** are pivotally connected to support sleeve **8** and thereby form the means by which wheel assembly **20** may be retracted and lowered.

Referring to the wheel assembly **30**, on the right side of Fig. 1, we provide a retracting arm **31**, one end of which is also pivotally connected to the lower end of lever arm **25**. It is apparent that by having the pivoting device at the juncture of members **25**, **26** and **31** long enough, both retracting arm **26** and retracting arm **31** can be connected to the same pivoting device. The opposite end of arm **31** is pivotally connected to shaft **32** which passes centrally through the upper ends of the elongated angled extensions **33**, **34** of the upper portion of wheel assembly **30**. The lower ends of extension **33**, **34** being rigidly affixed, as by means of welding to a flattened block portion on the upper end of right support sleeve **8**.

As best seen in Fig. 1, when the lever handle **21** is rotated to the left about shaft **22**, in an arc of substantially 90 degrees lever arm **25** moves to the right through the same angular displacement as handle **21** thereby urging retracting arm **31** outwardly and slightly upwardly, retracting arm **31** by being pivotally connected to the angled extensions **33**, **34** of wheel assembly **30**, then urges said extensions upwardly and outwardly thereby causing wheel assembly **30** to pivot about the axis of support shaft **9**. The fully retracted position of wheel assembly **30** is indicated by the dotted line position.

As a means to assist in the retraction of the wheels a torsion spring **35** (Figs. 2, 3, 5) may be utilized. Said torsion spring is placed surrounding support shaft **9** with one end of the spring anchored to support block **11** and the other end embracing the outer portion of support sleeve **8** at some point just below the axis of support shaft **9**.

As a means of locking the wheel assemblies **20**, **30** in either the retracted or lowered position a notched circular segment **36** (Fig. 4) is provided coaxially and fixedly mounted adjacent to the lever handle **21**. Pivotally mounted to lever handle **21** so as to fall into engagement with the notches **37**, **38** is locking lug **39**. Locking lug is constantly urged radially inwardly of shaft **22** by means of compression spring **40**. Apertured bar **41** rigidly fastened at right angles to lever handle **21** above the pivot point of lug **39** provides a seat for the upper portion of compression spring **40**. The top surface of lug **39** provides the seat for the lower end of spring **40**. As a means for releasing lug **39** from engagement with the notches **37**, **38** an eccentrically pivoted handle **42** is pivotally mounted to member **43**, which is mounted at substantially right angles to lever handle **21** at a point above the apertured bar **41**. Shaft **44** connects the eccentric portion of handle **42** with the lug **39**, said shaft **44** passes

longitudinally through the coils of compression spring **40**.

When the operator grasps the handle **42** and moves it toward the lever handle **21**, the eccentric portion of handle **42** rotates about pivot point **45** drawing the shaft **44** upward which pulls lug **39** out of engagement with the notches **37**, **38**. When lug **39** is in notch **37**, the wheel assemblies **20**, **30** are locked in the down or trailer position; when the lug **39** is in notch **38** the wheel assemblies **20**, **30** are locked in the retracted position.

As previously stated the compartment **1** is air tight. This is accomplished by conventional boat caulking means, and sealing devices provided on all fastening and operational elements where an air leak from within the confines of said compartment are probable. It is immediately apparent that the air-tight buoyancy provided by compartment **1** functions automatically when the boat is afloat in water. The approximate water line or draft of the hull is indicated on Fig. 1. By entrapping air within the confines of compartment **1** additional buoyancy is gained to assist in offsetting the additional weight of the wheel mechanism.

When the boat is settled to its normal operating draft, the entrapped air is slightly compressed within the compartment. The said compressed air, acting with equal force in all directions upon the confining elements is allowed to yield an upwardly directed force acting upon the top member **50** of compartment **1**. This upwardly directed force exerted by the air tends to urge the hull upward out of the water resulting in a shallower draft and increased stabilization against rolling and especially pitching. It is obvious that the downwardly directed openings of the compartment **1** need not be sealed by mechanical means as this is accomplished by the surrounding water; operating similar to a diving bell.

To provide a smooth under surface for the hull, thereby eliminating the possibility of turbulence around the downwardly directed openings of the compartment **1**, two pairs of swingably mounted transverse closures **51**, **52** are hingedly mounted to the lower marginal inner surfaces of bulkheads **12**, **13** respectively (Fig. 5). As seen in Fig. 5, the said closures form an overlapping joint when the wheel assemblies **20**, **30** are retracted to within compartment **1**. Because the offset portion **54** of the aft closure **52** forms a seat for the trailing edge **55** of forward closure **51**, it is obvious the aft closure **52** must be in the closed position prior to the forward closure **51**. This is automatically accomplished by means of flexible draw cords or cables **56**, **57**. The operation of the closures **51**, **52** and draw cables **56**, **57** will be described for wheel assembly **20** only, as the operation is identical for wheel assembly **30**. Anchored as by means of eye hook **58**, to aft bulkhead **13**, cable **56** extends inwardly and downwardly to cable eye **59**, secured to forward bulkhead **12** inwardly and downwardly from hook **58**.

Cable **56** thence passes through eye **59** and projects substantially vertically downward to be attached to closure **51** as by means of eye hook **60**. Interposed in the length of cable **56** is a tension spring **62**. Tension spring **62** allows cable **56** to be yieldably elongated during the closing operation of closure **51**, and when said closure is in the closed position, spring **62** tends to restrain said closure from accidentally opening. Swivveledly anchored as by means of eye hook **63** to forward bulkhead **12** draw cable **57** extends slantingly inwardly and downwardly to cable eye **64**, secured to aft bulkhead **13**. Cable **57** passes through cable eye **64** and then projects substantially vertically downward to be attached as by means of eye hook **65** to closure **52**. Interposed in the length of cable **57** is tension spring **67**. Tension spring **67** allows cable **57** to be yieldably elongated during the closing operation of closure **52**, and when said closure is closed, tension spring tends to restrain said closure from accidentally opening.

Starting with wheel assembly **20** in the down or trailer position, and closures **51**, **52** in the open position of

Fig. 3, the draw cables 56, 57 are in place as just described. When the wheel assembly is in the process of being retracted the inner lower portion of support sleeve 8 yieldably engaged the portion of cable 57 between eye hook 63 and cable eye 64. As the upward swing of support sleeve 8 continues an upward movement is imparted to the portion of draw cable 57 between cable eye 64 and closure 52, this said upward movement urges closure 52 to rotate upwardly about the axis of hinging elements 68.

Upon further upward swinging of support sleeve 8, the portion of draw cable 56 between eye hook 58 and cable eye 59 is engaged. This causes the same upward travel to be imparted to the lower end of draw cable 56 urging closure 51 to rotate upwardly about the axis of hinging elements 68. As seen in Fig. 1, 2, 3, 5, the anchor eye hooks 58, 63 and cable eyes 59, 64 are located on opposite inner surfaces of bulkheads 12, 13 at predetermined dissimilar positions in order to accomplish the described movement of the closures.

When starting from the retracted position, wheel assembly 20 is rotated downwardly about the axis of support shaft 9. This allows the tension in draw cables 56, 57 to be releasably disengaged in the reverse order they were engaged. Upon further downward rotation of the wheel assembly 20, ground wheel 3 engages closures 51, 52 urging them to swing downwardly about the axes of hinging elements 68. When wheel assembly 20 is fully down in the trailer position, spacer bar 69 (Fig. 3) prevents accidental engagement between the closure elements 51, 52 and the outer periphery of the ground wheel 3.

While described for wheel assembly 20, the operation of the closures and draw cables is identical for wheel assembly 30.

It is seen by the description of the closures and mechanism for operating the same that the said operation is automatic with the retracting operation of the wheel assemblies 20, 30.

In the modified form of the invention, Figs. 7–11, ground wheels 71 are rotatably mounted to axle shafts 72. Axle shaft 72 is centrally affixed to the lower marginal portion of extensions 73, 74 of bifurcated yoke 75 in a manner to allow ground wheels 71 to be interposed between said yoke extensions 73, 74 and to rotate in a plane parallel to the longitudinal axis of the boat. Rigidly secured perpendicularly to the upper surface of the connecting cross piece 76 of yoke 75 is an elongated cylindrical member 77. Said member 77 is adapted to be slidably mounted within an elongated support sleeve 78 swingably mounted on support shaft 79. Support shaft 79 is rotatably mounted in support bearings 80, 81. Support sleeve 78 is rigidly connected to support shaft as by keyways (not shown) in bosses 82 integrally connected perpendicular to support sleeve 78.

To prevent disengagement between members 77 and 78 and to prevent relative rotation of the same, support shaft 79 passes through an elongated slot 83 (Fig. 12) in the upper portion of member 77 that is enclosed within support sleeve 78. Said slot 83 is adapted to slidably engage the support shaft 79 and is long enough to accommodate the reciprocating motion of member 77 within support sleeve 78 allowed by the coiled compression spring 84. Said spring 84 (Figs. 7, 8) is interposed between cross piece 76 and the lower end of support sleeve 78 and surrounding the lower portion of member 77.

Integrally connected coaxially with the upper end of support sleeve 78 is a counterweight 85.

Said counterweight 85 is adapted to provide a moment acting to oppose the moment of the wheel assemblies 86 and to thereby assist in the lowering and retracting of said wheel assemblies 86 (Fig. 7).

In this modification each wheel assembly is mounted within an air tight compartment 90 with a downwardly directed opening. Said air tight compartment is sealed by conventional caulking means, and sealing devices such as O rings (not shown) are provided on bearing blocks 81.

Both wheel assemblies 86 are coaxially mounted to support shaft 79 and are manually operable simultaneously as by means of lever handle 91 similar to the lever handle 21 described in the preferred form of the invention.

Longitudinally mounted as by means of spring loaded hinging devices 92 to the lower marginal inner surfaces of longitudinal bulkheads 93, 94 are closure elements 95, 96. Said closure elements close in an overlapping manner as before described for the preferred form of the invention, necessitating the earlier closing of closure 96, with respect to closure 95.

Closure opening struts 97, integrally connected coaxially to bosses 82, provide a means for slidably engaging opening closures 95, 96 by exerting a downwardly directed force upon said closures causing them to rotate downwardly about the axes of hinging elements 92. When wheel assemblies 86 are rotated substantially 90 degrees about the axis of support shaft 79, to the dotted line position shown in Fig. 7, the closure opening struts provide a means of retaining the closures 95, 96 in the open position. By varying the length or angular placement of a closure opening start 97, closure 96 will be allowed to close prior to closure 95.

The spring loaded hinging devices 92 tend to urge said closure elements 95, 96 to rotate upward to the closed position and thereby provide a means of insuring the prevention of any accidental opening of said closures while wheel assemblies 86 are in the retracted position.

The above described invention provides for the use of two wheels rather than one. This is believed to be an important feature as great danger attends the use of a one-wheel trailer on the highway. In fact, legislation in many states prohibits the use of one-wheel trailers.

In use, when it is desired to launch the boat, the user may back the same to the shoreline and into the water. The operator may then board the craft and maneuver it to a floating position at which time the wheels may be retracted into their compartment. The cover plates will of course automatically close to provide a relatively smooth continuous bottom for the craft.

Conversely, when it is desired to remove the vessel from the water, the wheels may be swung out by the user from inside the hull and the boat then hitched to any desired hitching means.

This detailed description of our invention and a modified form, while complete, are not to be taken as restrictive thereof, as many minor modifications can be made without departing from the spirit and scope of the invention.

Having completely described our invention in a preferred and modified form, we claim:

1. In a boat structure having a hull, the bottom of said hull being provided with a pair of openings on opposite sides of the keel, means forming a compartment within said hull extending across said openings, said compartment being air tight except for said openings, a pair of opposed wheel supporting members swingably secured at one of their ends within said compartment and provided with ground wheels at their opposite ends for swinging about parallel axes disposed generally longitudinally of said hull from retracted positions wholly within said compartment to projected positions extending outwardly thereof to permit engagement of said wheels with the ground, lever means housed in said compartment and connected to both of said members, and single handle means extending from said lever means externally of said compartment for actuating said lever means.

2. In a boat structure having a hull, the bottom of said hull being provided with a pair of openings on opposite sides of the keel, means forming a compartment within said hull extending across said openings,

said compartment being air tight except for said openings, a pair of opposed wheel supporting members swingably secured at one of their ends within said compartment and provided with ground wheels at their opposite ends for swinging about parallel axes disposed generally longitudinally of said hull from retracted positions wholly within said compartment to projected positions extending outwardly thereof to permit engagment of said wheels with the ground, lever means housed in said compartment and connected to both of said members, and single handle means extending from said lever means externally of said compartment for actuating said lever means, cover plates extending across said openings and

swingable from a closed position to an open position, and means associated with said members and said plates for swinging said plates to said closed position upon swinging said members to said retracted positions.

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