

Jan. 12, 1971

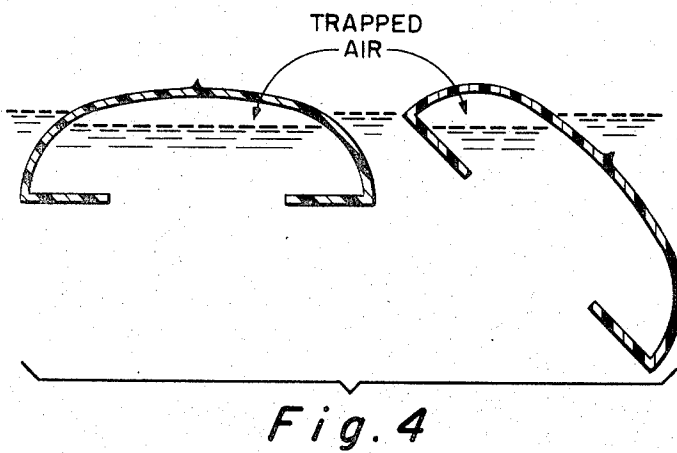
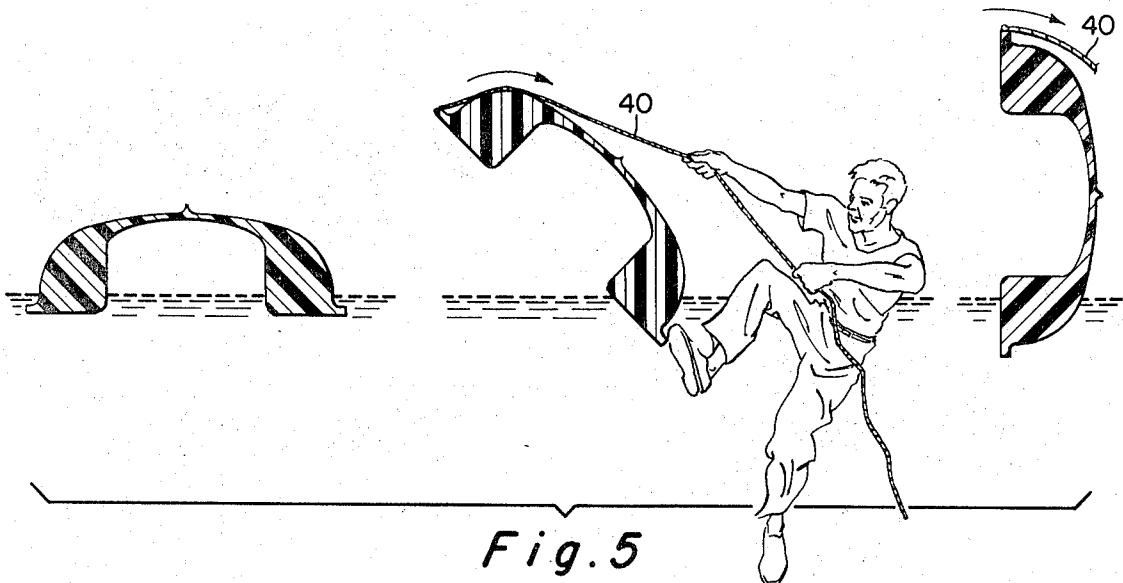
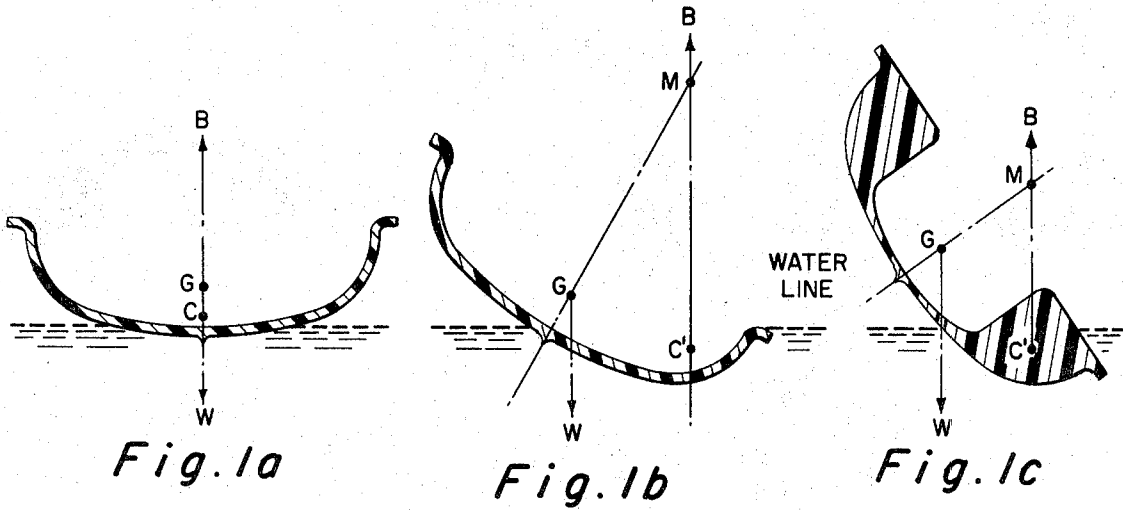
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3,553,750

SMALL BOAT WITH BUILT-IN SAFETY FEATURES

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3 Sheets-Sheet 1



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SMALL BOAT WITH BUILT-IN SAFETY FEATURES

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3 Sheets-Sheet 3

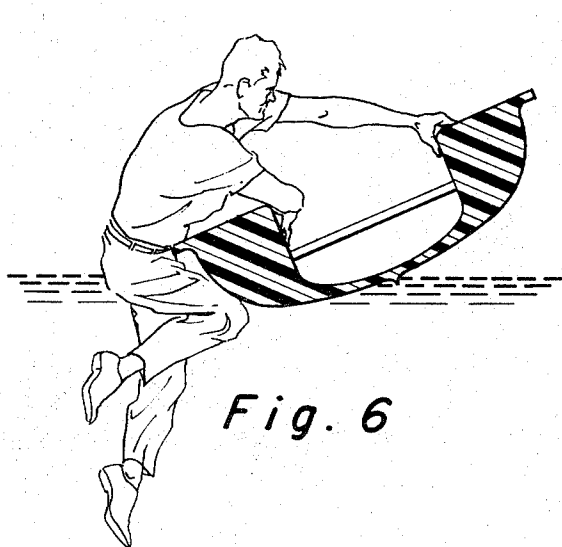


Fig. 6

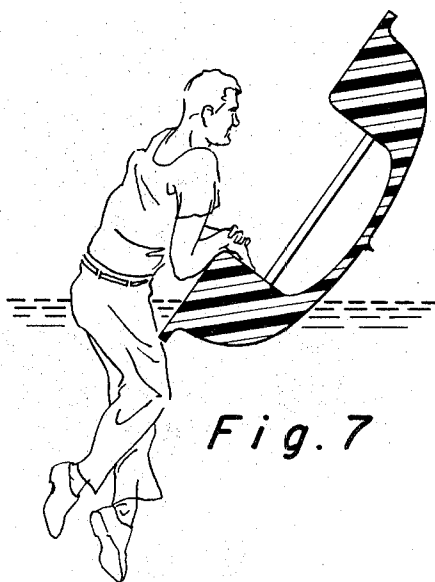


Fig. 7

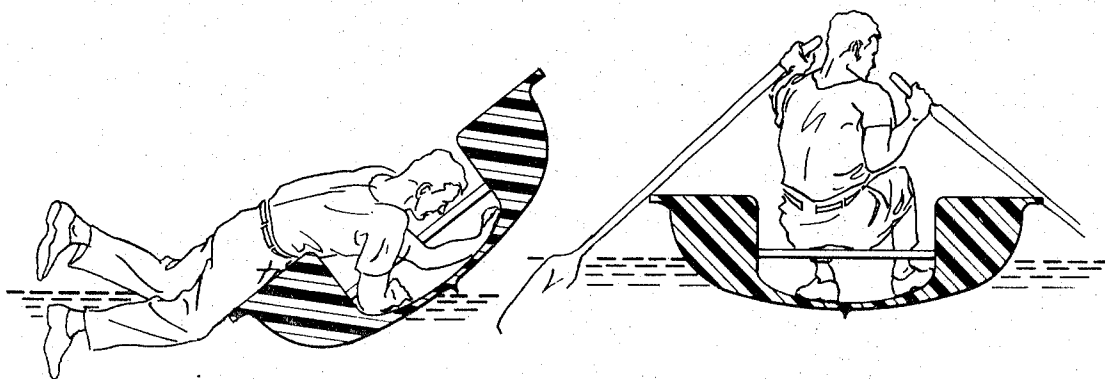


Fig. 8

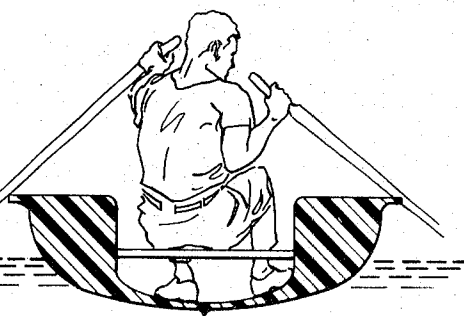


Fig. 9

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SMALL BOAT WITH BUILT-IN SAFETY FEATURES
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1 Claim

ABSTRACT OF THE DISCLOSURE

A small boat manufactured of highly-buoyant lightweight material and which possesses unusual stability due to a low center of gravity. A feature of the design is the provision of a double-hulled construction and wide deck areas which prevent water from entering when the boat is righted after being capsized.

STATEMENT OF GOVERNMENT INTEREST

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

BACKGROUND OF THE INVENTION

It is well known in the boat-building art that the metacenter of a vessel must lie above its center of gravity in order to establish a stable condition of equilibrium. The greater the separation distance between these centers, the more likely the vessel will tend to return to its original position after being disturbed by an outside force. All water-borne vehicles are constructed with this basic factor in mind.

In the case of small craft, such as lifeboats and dinghys, additional safety considerations are (1) the ease with which the vessel may be righted after being capsized, and (2) whether or not this righting operation can be performed without the vessel shipping any appreciable amount of water. The first of these is obviously dependent to a large extent upon the craft's size and weight, but the latter is achieved only by taking into account the various design interrelationships involved. Specifically, the buoyancy of the craft must be such as to support the weight of an occupant re-entering the boat from the water after it has capsized, and the deck configuration must be related to the buoyancy factor in the sense that the inner deck line must remain above water level during such occupant re-entry. Otherwise, serious shipping of water will result. Still further, a double-hulled construction is necessary to prevent the retention of water during the righting sequence, as without this provision inwardly-protruding deck areas would act to trap water as the boat undergoes a 180° movement from a capsized to an upright position, and this trapped water would remain in the occupant area unless and until removed by bailing.

SUMMARY OF THE INVENTION

The present concept is directed to the design and construction of a small boat in which the allowable angle of list or heel is extended to approach the maximum of 90° without danger of swamping. This is made possible in part by the employment of a deck area of a width sufficient to maintain the inner boundary above water level even at the maximum list angle. Furthermore, by utilizing a double-hulled construction, the amount of positive buoyancy is such as to enable an individual to enter the boat from the water without causing the inner boundary of the deck to be depressed below the level at which water would enter the occupant area.

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STATEMENT OF THE OBJECTS OF THE INVENTION

One object of the present invention, therefore, is to provide a small boat or dinghy having maximum safety features and which is virtually unsinkable.

Another object of the invention is to provide a small boat constructed of lightweight, highly-buoyant material which can be righted and entered after being capsized without shipping water.

A further object of the invention is to provide a small boat having unusual stability due to the provision of buoyancy chambers which have the effect of maintaining high positive buoyancy while the boat is in any position.

An additional object of the invention is to provide a small boat having a double-hulled construction with wide deck areas the respective inner boundaries of which are chosen in accordance with the positive buoyancy of the craft at a high list angle when subjected to the downward force of an individual entering the craft from the water, the respective inner deck boundaries so chosen being such as to lie above the water line at the said list angle and under the stated force conditions.

Other objects, advantages and novel features of the invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawings wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1a is a schematic diagram of a vessel illustrating the relationship between its center of gravity and its center of buoyancy when in normal upright position;

FIG. 1b illustrates the manner in which permissible list of a conventionally-designed vessel is limited by submergence of a gunwale to result in a swamped condition;

FIG. 1c illustrates how a double-hulled wide-decked vessel may experience an even greater list than in FIG. 1b without swamping;

FIG. 2 is a perspective view of an improved boat designed in accordance with a preferred embodiment of the present invention;

FIG. 3 is a sectional view of FIG. 2 taken along the line 3-3;

FIG. 4 is a schematic showing of the manner in which air is trapped within a conventional boat after capsizing, and how even the presence of wide deck areas per se does not prevent water from remaining in the passenger area after the boat is righted;

FIG. 5 illustrates one manner in which the boat of the present invention may be righted after overturning; and

FIGS. 6 through 9 illustrate in sequence how the righted boat of the present invention may be entered, without shipping water, by an individual climbing over the side.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIGS. 1a, 1b, and 1c of the drawings are set forth schematically certain of the principles upon which the present invention is based. In considering these showings, the following definitions apply:

W=Weight of boat and occupants

G=Center of gravity (W acts downward through G)

B=Buoyant Force (equal and opposite to W)

C=Center of buoyant force

C'=Center of buoyant force shifted because of list.

M=Metacenter—the point of intersection of two lines when the boat is listing: One lies vertically through the center of buoyancy (C'), and the other is a line which extends vertically through the center of gravity when the boat is upright. For stability M must be above G—in order to have a restoring couple.

Although all boats must possess a metacenter M above the center of gravity G for stability, the angle of list or heel in conventional designs such as shown in FIG. 1a is severely limited because of the danger of submerging a gunwhale (as shown in FIG. 1b) resulting in a swamped condition.

As shown in FIG. 1c, the present concept utilizes a double-hulled construction plus a wide deck area (as shown in FIG. 1c) to prevent entry of water into the occupant area even when the angle of list or heel approaches the maximum of 90°. At this extreme angle the conventional boat of FIG. 1b would be completely swamped, losing its restoring couple beyond the angle where the gunwale reaches the water line, as illustrated in the drawings.

In FIGS. 2 and 3 is shown a small boat embodying the principles of the present invention. The concept is applicable to all small craft such as dinghies, prams, yacht tenders, lifeboats, etc. All of which, because of their small size, are subject to considerable wave and surf action, currents, winds, and other environmental stresses.

Originally such craft were constructed of planked wood, following which various materials such as plywood, fiberglass and plastic were substituted. At the present time, practically all have a certain amount of flotation material added to the interior, consisting usually of a small airtight compartment or mass of foam located under some or all of the seats. This expedient is generally satisfactory for establishing a small degree of positive buoyancy in the event the craft is swamped or flooded. This prevents the boat from sinking. If the passengers choose to remain with the boat, they might be afforded a small degree of buoyancy, although they would be in a generally submerged condition.

In summary, such craft as are now known are generally acceptable as long as the weather is clear, the water is calm, and the boat not unbalanced. However, in the event a conventional dinghy is swamped or capsized, it is extremely difficult if not impossible to right the boat, clear it of water, and then reenter it from the water to resume normal operation. In certain favorable situations, two or more men in the water can right and reenter a conventional dinghy, but such favorable situations seldom exists, since high winds and/or waves are usually the primary causes of the craft capsizing and will be present during the attempted righting operation.

With the above in mind, reference is made to FIGS. 2 and 3 of the drawings for an illustration of a small boat designed according to the principles of the present concept. Basically, a craft embodying the concept possesses a high center of large positive buoyance, wide deck areas, and a low center of gravity generally located over the boat's keel and achieved in part by locating the passenger area at that point. The high degree of positive buoyancy is the result of a double-hulled construction, with air or foam material filling the spaces between the inner and outer hulls.

Referring specifically to FIGS. 2 and 3, the dinghy 10 of the present invention is made up of an inner shell or hull 12 and an outer shell or hull 14 each formed by some process such as molding and bonded together both at the gunwale 16 and longitudinally along the keel line 18. The respective shells or hulls 12 and 14 are differently dimensioned so as to form wide deck areas 20, 22 and 24 after the bonding operation has been performed. The space between hulls (designated as 26 and 28 in FIG. 3) may be filled with plastic foam or be made airtight, as desired.

A storage compartment access cover 30 is shown in FIG. 2, a second identical cover being present opposite but not visible in the drawing. Greater than normal stability is achieved by confining the seating to an area generally over the craft's keel, the seats 32 and 34 being so located and being molded in place if desired. An optional middle seat 36 is positioned as far down as possible

to aid in establishing a low center of gravity. This middle seat 36 is removable so that the craft's occupant or occupants can lie down in the boat during foul weather, thereby still further lowering the center of gravity, increasing stability, and offering greater protection from the hostile environment.

The transom 38 (for a dinghy) does not have a wide deck because of the shortness of the boat. However, for craft of larger overall dimensions a wide deck at this point can easily be incorporated into the design.

The above characteristics of a small boat designed in accordance with the present concept result in three main advantages:

- (1) high resistance to swamping;
- (2) easily righted after capsizing; and
- (3) ease of re-entry from the water.

The first of the above advantages is brought out by FIG. 1c of the drawings, illustrating how the inner boundary of the wide deck remains above the water line even when a list angle of 90° is approached. A conventional boat (FIG. 1b) would take water and be swamped under such circumstances.

The second advantage is the ease with which an upturned or capsized dinghy may be righted. An ordinary craft (even one with wide decks as shown in FIG. 4) cannot readily be righted since air is trapped under the deck surface and the lack of any substantial amount of positive buoyancy renders the task difficult of achievement. However, as shown in FIG. 5, the craft of the present invention, due to its high buoyancy and light weight, can be simply returned to normal position by an individual pulling on a line 40 attached to one gunwale and passed over the bottom of the hull. Note that the inner edge of the deck remains above water level during the righting operation, so that the interior of the craft is dry when re-entry is effected as shown in FIGS. 6 through 9.

Such re-entry comprises the third advantage realized by practicing the invention. The weight of an individual entering the boat from the water, FIGS. 6, 7, and 8, does not submerge the inner deck boundary below water level, as brought out in the drawings. Consequently, there is no water in the boat to be bailed out after entry, and normal operation can be resumed as shown in FIG. 9.

Other benefits which accrue from practicing the present concept are the freedom from maintenance (since no corrosion or weathering occurs) and the fact that, when filled with plastic monocellular foam, the boat is puncture proof and can, if desired, be adapted to armorplate construction as protection from small arms fire. For clandestine operation, it may be colored black and hauled by frogmen to carry explosives or underwater tools to the scene of operations. It is easily beached and, when made without foam, can be sunk by opening a seacock to fill the inter-hull area with water.

Since the foam-filled version is virtually unsinkable, it may act as a life raft, the occupants wearing a safety harness which may be linked to the boat by a lanyard snapped to an elongated fitting preferably running parallel to the gunwale.

The craft is always ready for use without requiring any preparation. It may be provided with a highly visible exterior coating to facilitate sighting by rescue parties. It can also possess a coating having good radar reflective properties. It is easily fitted with a radar-reflective sail and an outboard motor. For survival at sea, the stores to be kept in the compartment closed by cover 30 in FIG. 2 might include fresh water, fishing lines, sea rations, flares, life jackets, radio transmitter, flashlights, etc.

In one prototype of the invention now in use, the overall weight is 75 lbs. and its length approximately 7' 2". The width of the deck areas 20 and 22 (FIGS. 2 and 3) is 10½", with the total buoyancy of the hull being 1,460

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lbs. and the total buoyancy of the flotation chambers being 726 lbs. This is sufficient buoyancy to permit an individual of average weight to enter the righted boat from the water as shown in FIGS. 6, 7, and 8 without admitting any water whatsoever to the occupant area.

Although not illustrated in the drawings, the occupant-accommodating area may, if desired, be offset to one side of the center line and counter weighted by stores and goods located on the other side of such line. The only requirement is that balance be present during operation of the craft.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that the invention may be practiced otherwise than as specifically described.

I claim:

1. A small boat capable of attaining a list angle up to 90° without submerging a gunwale or shipping water into the occupant area, said boat also being characterized by a high degree of positive buoyancy, a deep cockpit, and a low center of gravity which render the boat easily righted after capsizing and make for ease of subsequent re-entry, said boat comprising:

an outer shell composed of relatively thin, lightweight corrosion-resistant material;

an inner shell also composed of relatively thin, lightweight corrosion-resistant material and having a flanged upper section extending around a major portion of the periphery thereof;

means securing said inner and outer shells together to

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form an enclosed region therebetween the presence of which contributes to the overall buoyancy of the boat regardless of its instantaneous orientation;

the flanged upper section of said inner shell forming a wide planar deck area for the craft after the two shells have been secured together;

the enclosed inter-shell region being completely filled with a substance possessing a high degree of positive buoyancy;

the configuration of the said outer shell being such that essentially none of the buoyant material completely filling said inter-shell region lies below a plane defined by the floor of said occupant area, thereby causing said boat to possess a center of positive flotation above its center of gravity;

the inner edge of the wide deck area so formed remaining above water level, due to the positive buoyancy contributed by said enclosed inter-shell region, even when said boat has attained a list angle up to 90°.

thereby preventing submergence of a gunwale with consequent shipping of water into said occupant area and allowing the boat to be easily righted and re-entered after capsizing.

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TRYGVE M. BLIX, Primary Examiner