

Aug. 18, 1931.

D. K. WARNER

1,819,216

AIR CUSHION BOAT

Filed Aug. 20, 1929

2 Sheets-Sheet 1

Fig. 1.

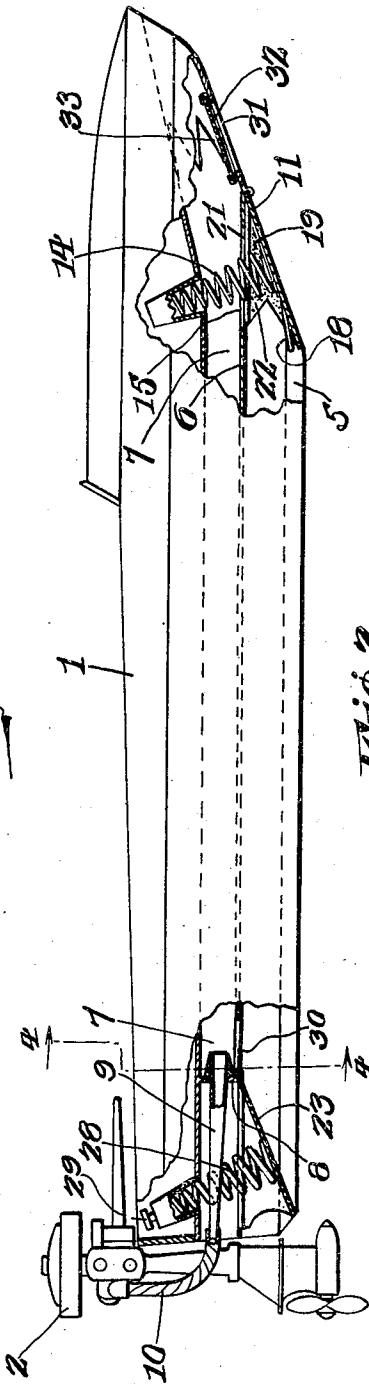
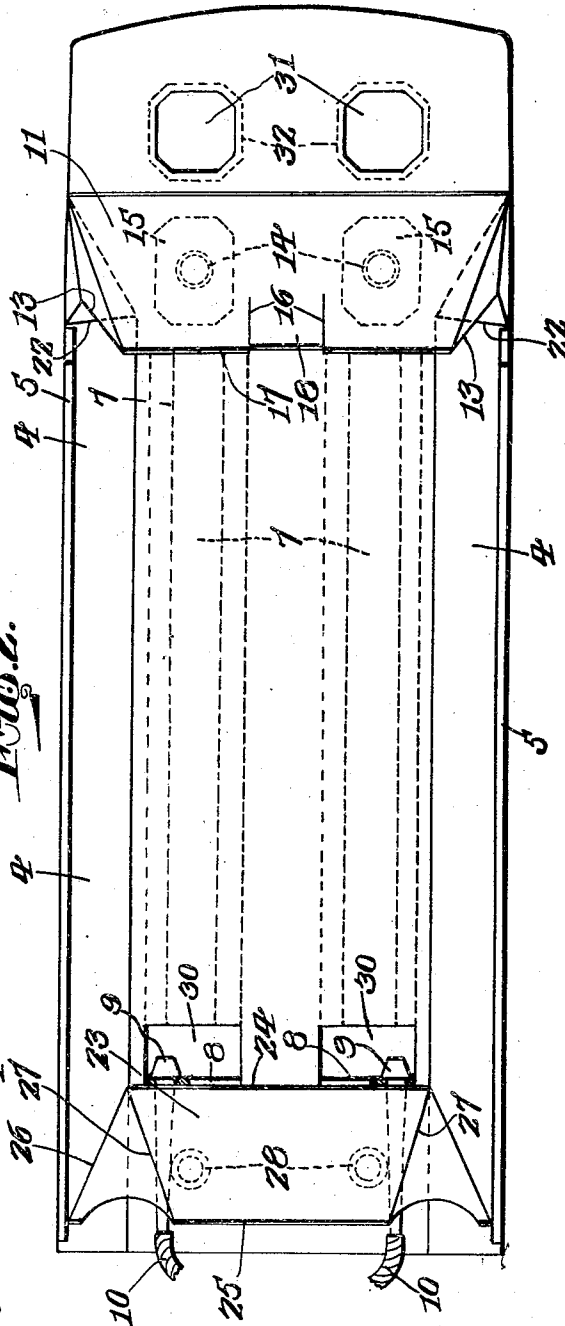


Fig. 2.



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2 Sheets-Sheet 2

Fig. 3.

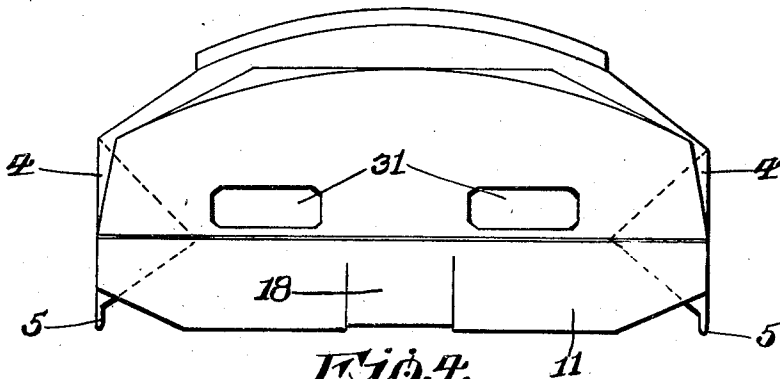


Fig. 4.

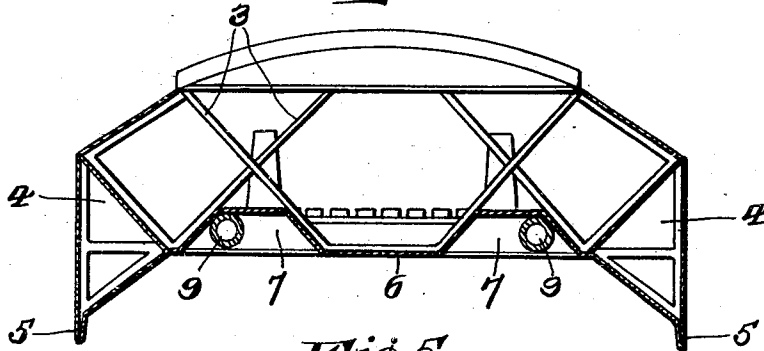
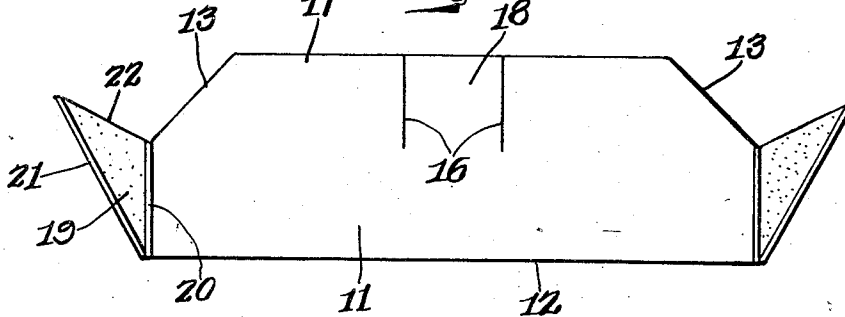


Fig. 5.



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AIR CUSHION BOAT

Application filed August 20, 1929. Serial No. 337,152.

This invention relates to an air cushion boat particularly adapted for application to boats of the speed boat type, but it is to be understood that the invention may be applied to boats of any size or type or to airplane pontoons.

The primary object of the invention is to provide, in a manner as hereinafter set forth, a boat which is adapted to ride on a cushion of air, thereby preventing the boat from being rocked by the waves and enabling the boat to travel at high speed over rough water without the likelihood of any damage to the boat.

A further object of the invention is to provide a boat of the class aforesaid, including spring resisted bow and stern flaps to permit the tops of high waves to pass under the boat without disturbing the force of the waves and to prevent any suction from being created under the boat by the waves.

A further object of the invention is to provide a boat of the class aforesaid which is formed at its sides with balancing air chambers whereby sidewise tipping of the boat is prevented.

A further object of the invention is to provide a boat of the class aforesaid, in which the speed of the boat and the exhaust gases from the power plant therefor are utilized to replenish the supply of air under the boat in case such supply of air is washed away by a wave or by natural suction under the stern flap.

A further object of the invention is to provide a boat of the class aforesaid which is provided with longitudinally extending air passages whereby air under the boat may be transmitted from the stern to the bow.

A further object of the invention is to provide a boat of the class aforesaid, including means for trapping air in water sprays in front of the boat and passing such air under the boat.

A further object is to utilize the velocity energy in the exhaust gas in suitable nozzles so that the engine cylinders will be completely scavenged by inertia, the exhaust gas will be put under the boat, and air under the boat will be drawn forward through air passages under the boat.

With the foregoing and other objects in view, the invention consists of the novel construction, combination and arrangement of parts as hereafter more particularly described, and as illustrated in the accompanying drawings wherein is shown an embodiment of the invention, but it is to be understood that the description and drawings are to be taken as illustrative, and that the invention is intended to be limited only by the scope of the claims hereunto appended.

In the accompanying drawings in which like numerals are employed to designate like parts throughout the same:—

Figure 1 is a sectional elevation of a boat constructed in accordance with this invention.

Figure 2 is a bottom plan thereof.

Figure 3 is a front elevation thereof.

Figure 4 is a section taken on line 4—4 of Figure 1.

Figure 5 is a plan of the bow flap and webs connected therewith.

Referring to the drawings in detail, the numeral 1 indicates the hull of a boat of the speed boat type equipped with an outboard motor 2. The hull 1 is preferably formed of metal and provided with suitable struts 3. Extending longitudinally of the boat at each side thereof is an air tight balancing chamber 4 which is preferably formed integrally with the hull and of triangular form in cross section. Depending from each of the chambers 4 is a longitudinally extending runner 5 which in the operation of the boat cuts through the water. The chambers 4 normally ride just above the water line and upon being depressed, plane on the water to prevent the boat from tipping sidewise.

The bottom of the boat is indicated at 6 and forms the bottom walls of spaced air passages 7, which extend longitudinally of the boat, and one of which is adjacent each of the chambers 4. Extending into each of the passages 7 through the rear wall 8 thereof is a nozzle 9 which is connected with the exhaust of the motor by means of a flexible hose 10 in order that the exhaust gases from the motor may be directed into the air passages 7.

At the bow of the boat I provide a bow flap 11, the upper edge 12 of which is suitably

hinged to the bottom of the boat and which extends downwardly and rearwardly from said upper edge. The flap 11 extends across the entire width of the boat and has the lower and rearward corners thereof cut away as indicated at 13. In very high speed boats this flap may be reduced to only two narrow flexible strips which plane over the water and hold the bow a predetermined distance above the average water surface, the bottom of the boat thus being open to the outside air all across the bow but trapped at the sides and stern. At still higher speeds the stern flap may also be replaced by narrow skids thus reducing the variation in air pressure caused by large waves and holding the boat even steadier.

Bearing against the inner face of the flap 11 is a pair of relatively light springs 14, which extend through relatively large openings 15 in the bottom walls of the air passages 7. The springs 14 are arranged in spaced relation and between the springs, spaced slits 16 are formed in the flap 11 from the rearward edge 17 thereof in order to provide a portion 18 of the flap which is free from the action of the springs 14. The flap is preferably formed of a resilient metal and when a downward force is exerted on the flap by the springs 14 to maintain the flap from being forced upwardly by the friction of the water, the tongue portion 18 will bend upwardly from the main flap body permitting some of the air to pass under the boat.

Connecting the flap 11 with the pontoons 4 is a pair of webs 19 which are preferably formed of rubber or light springy metal. Each of the webs 19 is triangular in shape and has one edge 20 thereof connected with a side edge of the flap 11 and has another edge 21 thereof connected with a balancing chamber 4. The rearward edge 22 of the web is free and the connections of the web with the flap 11 and chamber 4 are air-tight. Owing to the triangular shape of the webs and to the cut-away corners 13 of the flap, a recess is provided between the flap and each of the balancing chambers to permit the entrance of air under the boat as it is trapped in the spray from the prow of the runners.

Adjacent the stern of the boat I provide a stern flap 23, the upper edge 24 of which is secured to the bottom of the boat and which extends downwardly and rearwardly from said upper edge. The stern flap 23 increases in width from its upper edge 24 to its lower edge 25 and the side edges 26 thereof are secured to the balancing chambers 4. The flap 23 is preferably formed of resilient metal and is crimped as indicated at 27 to provide a bulge adjacent each side thereof in order to permit motion adjacent the ends of the flap and still seal the ends.

Bearing against the upper face of the flap 23 are relatively heavy springs 28, each of

which is provided with a tension adjusting element 29 by means of which the tension of the springs 28 may be adjusted from the interior of the hull according to the load carried by the boat.

As the air pressure under the boat operates against the tension of the springs 28 and with the tension of the springs 14, it is essential that the springs 28 be of materially greater strength than the springs 14. The air under the boat is preferably maintained at a pressure slightly greater than the outside pressure on the bow flap 11 and due to this difference in pressure, the bow flap 11 will be normally forced downwardly and forwardly without the aid of the springs 14.

In case the air under the bow is washed back by a wave, the flap 11 will be forced downwardly as soon as the wave has passed and the gases from the nozzles 9 draw the air through openings 30 formed in the bottom walls of the passages 7 and the air is returned through the passages 7 and openings 15 to the bow of the boat, thereby preventing a suction from being created under the boat by the waves. In operation the lower edges 17 and 25 of the flaps 11 and 23 normally skim the surface of the water and the cut away corners 13 and slits 16 of the bow flap 11 provide for a constant supply of air under the boat by the forward motion of the latter and close proximity of the water which holds the air with it.

To further lessen the possibility of all of the air being washed out from under the boat, I provide the bow with spaced ports 31, each of which is in communication with one of the passages 7. The ports 31 are normally closed by means of safety valves 32 which are preferably hinged at their upper edges. The valves 32 are provided with light springs 33 which normally maintain them in position to close the ports 31 and in case the pressure within the passages 7 is reduced materially below that of the outside pressure on the bow, the valves 32 will swing open to permit air to rush through the ports 31 from where it passes under the boat to replace a large quantity of air taken away by a wave. In boats of larger sizes, additional safety valves similar to the valves 32 should be placed in funnels extending above the deck, or in the top wall of passage 7.

Due to the forward motion of the boat, the air beneath the boat has a tendency to flow from bow to stern whereby a portion of the air will be lost by passing beneath the stern flap. To decrease such loss, the nozzles 9 are positioned to empty into the passages 7 adjacent the stern flap and the suction caused by the discharge from the nozzles will draw some of the air through the openings 30 into the passages 7 to be returned to the bow.

It is thought that the many advantages of a boat in accordance with this invention will be readily apparent, and although the pre-

ferred embodiment of the invention is as illustrated and described, it is to be understood that various changes in the size, shape and arrangement of parts may be resorted to, so long as such changes fall within the scope of the invention as defined in the appended claims.

What I claim is:—

1. A boat having its sides formed with a pair of longitudinally extending air chambers, a longitudinally extending runner depending from each chamber, and bow and stern flaps extending downwardly and rearwardly from the bottom of the boat and coacting with the walls of the air chambers and runners to provide an air pocket beneath the boat.

2. A boat having its sides formed with a pair of longitudinally extending air chambers, and bow and stern flaps extending downwardly and rearwardly from the bottom of the boat and coacting with the walls of the air chambers to provide an air pocket beneath the boat.

3. A boat formed at its sides with a pair of longitudinally extending runners, and resilient bow and stern flaps extending downwardly and rearwardly from the bottom of the boat and coacting with the runners to provide an air pocket beneath the boat.

4. A boat having its sides formed with a pair of longitudinally extending air chambers, a longitudinally extending runner depending from each chamber, and bow and stern flaps extending downwardly and rearwardly from the bottom of the boat and coacting with the runners and walls of the air chambers to provide an air pocket beneath the boat, said boat formed in its bottom with a pair of spaced air passages extending from bow to stern.

5. A boat comprising a hull having its sides formed with a pair of longitudinally extending air chambers, a longitudinally extending runner depending from each chamber, and bow and stern flaps extending downwardly and rearwardly from the bottom of the boat and coacting with the runners and walls of the air chambers to provide an air pocket beneath the boat, said boat having its bottom formed with a pair of spaced air passages extending from bow to stern, each of said air passages having its bottom wall formed with openings communicating with said air pocket, one of said openings being disposed adjacent each end of each air passage.

6. A boat comprising a hull having its sides formed with a pair of longitudinally extending air chambers, a longitudinally extending runner depending from each chamber, and bow and stern flaps extending downwardly and rearwardly from the bottom of the boat and coacting with the runners and walls of the air chambers to provide an air pocket beneath the boat, said boat having its bottom

formed with a pair of spaced air passages extending from bow to stern, each of said air passages having its bottom wall formed with openings communicating with said air pocket, one of said openings being disposed adjacent each end of each air passage, said hull having its bow formed with a pair of spaced ports communicating with said air passages.

7. A boat comprising a hull having its sides formed with a pair of longitudinally extending air chambers, a longitudinally extending runner depending from each chamber, and bow and stern flaps extending downwardly and rearwardly from the bottom of the boat and coacting with the runners and walls of the air chambers to provide an air pocket beneath the boat, said boat having its bottom formed with a pair of spaced air passages extending from bow to stern, each of said air passages having its bottom wall formed with openings communicating with said air pocket, one of said openings being disposed adjacent each end of each air passage, said hull having its bow formed with a pair of spaced ports communicating with said air passages, and a spring actuated valve normally closing each of said ports.

8. A boat having its sides formed with a pair of longitudinally extending air chambers, a longitudinally extending runner depending from each chamber, bow and stern flaps extending downwardly and rearwardly from the bottom of the boat and coacting with the runners and walls of the air chambers to provide an air pocket beneath the boat, a tension element normally forcing the bow flap downwardly and forwardly, and a tension element normally forcing the stern flap downwardly and forwardly.

9. A boat having its sides formed with a pair of longitudinally extending air chambers, a longitudinally extending runner depending from each chamber, bow and stern flaps extending downwardly and rearwardly from the bottom of the boat and coacting with the runners and walls of the air chambers to provide an air pocket beneath the boat, a tension element normally forcing the bow flap downwardly and forwardly, and a tension element normally forcing the stern flap downwardly and forwardly, the tension element for said stern flap being materially stronger than the tension element for said bow flap.

10. A boat having its sides formed with a pair of longitudinally extending air chambers, a longitudinally extending runner depending from each chamber, bow and stern flaps extending downwardly and rearwardly from the bottom of the boat and coacting with the runners and walls of the air chambers to provide an air pocket beneath the boat, a tension element normally forcing the bow flap downwardly and forwardly, and a tension element normally forcing the stern flap downwardly and forwardly, the tension ele-

ments for the stern flap being adjustable from the interior of the boat.

11. A boat having its sides formed with a pair of longitudinally extending air chambers, a longitudinally extending runner depending from each chamber, bow and stern flaps extending downwardly and rearwardly from the bottom of the boat and coacting with the runners and walls of the air chambers to provide an air pocket beneath the boat, said bow flap having its downward and rearward corners cut away, and a pair of flexible webs connecting the sides of the bow flap with the walls of said chambers.

12. A boat having its sides formed with a pair of longitudinally extending air chambers, a longitudinally extending runner depending from each chamber, bow and stern flaps extending downwardly and rearwardly from the bottom of the boat and coacting with the runners and walls of the air chambers to provide an air pocket beneath the boat, and a pair of spaced springs normally forcing the bow flap forwardly and downwardly, said bow flap having a pair of spaced slits formed therein between its points of engagement with said springs.

13. A boat having its sides formed with a pair of longitudinally extending air chambers, a longitudinally extending runner depending from each chamber, bow and stern flaps extending downwardly and rearwardly from the bottom of the boat and coacting with the runners and walls of the air chambers to provide an air pocket beneath the boat, said boat having its bottom formed with a pair of spaced air passages extending from bow to stern, and a pair of nozzles adapted for connection with the exhaust from the power plant for the boat and discharging into said air passages.

14. A boat having its sides formed with a pair of longitudinally extending air chambers, a longitudinally extending runner depending from each chamber, bow and stern flaps extending downwardly and rearwardly from the bottom of the boat and coacting with the runners and walls of the air chambers to provide an air pocket beneath the boat, said boat having its bottom formed with a pair of spaced air passages extending from bow to stern, and a pair of nozzles adapted for connection with the exhaust from the power plant for the boat and discharging into said air passages, said stern flap being flexible and having its sides connected to the walls of said chambers.

15. A boat having its sides formed with a pair of longitudinally extending air chambers, a longitudinally extending runner depending from each chamber, bow and stern flaps extending downwardly and rearwardly from the bottom of the boat and coacting with the runners and walls of the air chambers to provide an air pocket beneath the

boat, said boat having its bottom formed with a pair of spaced air passages extending from bow to stern, and a pair of nozzles adapted for connection with the exhaust from the power plant for the boat and discharging into said air passages, said stern flap being flexible and having its sides connected to the walls of said chambers, said stern flap further being crimped to provide a bulge adjacent each side thereof.

16. A boat having its sides formed with a pair of longitudinally extending air chambers, a longitudinally extending runner depending from each chamber, bow and stern flaps extending downwardly and rearwardly from the bottom of the boat and coacting with the runners and walls of the air chambers to provide an air pocket beneath the boat, said boat having its bottom formed with a pair of spaced air passages extending from bow to stern, and a pair of nozzles adapted for connection with the exhaust from the power plant for the boat and discharging into said air passages, said stern flap being flexible and having its sides connected to the walls of said chambers, said stern flap further being crimped to provide a bulge adjacent each side thereof, said nozzles discharging into said air passages adjacent the stern flap, the bottoms of said air passages being formed adjacent said nozzles with openings into said air pockets.

17. A boat having its sides formed with a pair of longitudinally extending runners, bow and stern flexible supporting means extending downwardly and rearwardly from the bottom of the boat into engagement with the water under the boat and coacting with the pontoons or runners to provide an air pocket under the boat to support most of the weight of the latter when in motion.

18. A boat with balancing runners extending longitudinally along each side, a stern flap extending downwardly and rearwardly from the bottom of the boat, and flexible supporting means extending downwardly and rearwardly from the bottom at the bow to hold the bottom of the boat higher than the tops of the waves so that air freely admitted at the bow will support most of the boat's weight, while the flexible supporting means hold the boat at the proper angle to prevent its diving or soaring up in the air.

In testimony whereof, I affix my signature hereto.

DOUGLAS K. WARNER.