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944,501



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Date of filing Complete Specification: June 11, 1959.

Application Date: June 12, 1958.

Complete Specification Published: December 18, 1963.

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944,501

No. 18825/58

Index at Acceptance:—B7 K.

International Classification:—B 64 c.

COMPLETE SPECIFICATION

DRAWINGS ATTACHED

Improvements in or relating to Vehicles for travelling over Land and/or Water

We, HOVERCRAFT DEVELOPMENT LIMITED, a British Company of Tilney Street, London, W.1., England, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to vehicles primarily adapted for travelling over water, of the kind described in Patent Specification Serial No. 854211.

In such vehicles at least one jet of fluid is discharged from the bottom of the vehicle in the form of a curtain which, with the structure of the vehicle and the surface over which the vehicle travels or hovers, encloses a pressurised cushion of gas which supports the vehicle, the total thrust produced by the jet of fluid as it leaves the vehicle being substantially less than the total weight of the vehicle. Such vehicles will hereinafter be referred to as "vehicles of the type described".

The above-described method of support is also applicable to a platform primarily intended to remain stationary, for example for supporting a radar installation, and the term vehicle as used herein is to be understood as including, where the context permits, a platform.

For operation over rough water a vehicle of the type described should be so designed that its main body does not come into contact with any wave, the impact of which might cause damage to the vehicle or inconvenience to its passengers. One way of ensuring this is to design the vehicle so that it has a hover-height greater than that of the crest of the highest wave likely to be encountered. Since, however, the movement of the water is, in general, random, this would mean that for most of the time the vehicle would be travelling at a greater

height than necessary, with a consequent wastage of power. An object of the present invention is to reduce the power necessary to enable the vehicle to operate with its main body at a height above the water which will keep it clear of waves likely to cause damage.

According to the invention there is provided a vehicle for travelling over water and which in operation is supported above the surface of the water by at least one cushion of pressurised gas formed and contained beneath the vehicle, comprising at least two walls which project below the bottom of the vehicle extending substantially parallel to the fore and aft axis of the vehicle and each forming part of the boundary of a cushion, at least part of the remainder of the boundary of the cushion being formed by a curtain of moving fluid.

The walls have a width which is only a small fraction of the total width of the main body of the vehicle, and the hydrodynamic lift experienced by the vehicle when the walls meet a wave is much less than would be the case if the main body of the vehicle were to meet the wave.

A vehicle according to the invention may be so designed and operated with side walls which are at all times partially immersed in the water, it being understood that owing to their small lateral dimensions they contribute little to the drag experienced by the vehicle. In this case no provision is made for the formation of a fluid curtain under the side walls, the boundary for the pressurised cushion being constituted by the two side walls and by two fluid curtains one at the front part and one at the back part of the vehicle. The side walls may contribute to the lift by making them hollow, so that they act as buoyancy chambers.

If preferred, side walls may be provided with ports which are fed with fluid for the

[Price 4s. 6d.]

formation of curtains additional to the front and back curtains, the combined thrust of all the curtain-forming jets of fluid being such that, while the main body of the vehicle

5 is held above the level of the waves, the lower parts of the side walls are immersed in wave crests above a height which can be predetermined by predetermining the thrust of the side-wall jets. An advantageous arrangement is one in which the side walls cut through the crests of waves of average height. It will be understood that the flow of fluid through the side wall ports ceases when the ports are immersed. Again, the side walls, with or without the ducts leading to the ports, may be designed to act as buoyancy chambers.

10 It will be understood that in a vehicle according to the invention with side curtains as well as front and back curtains, the latter must have a greater height than the former. The difference in height may be brought about by various methods. For example, the fluid forming the front and back curtains may be given a greater thrust per unit length of curtain than that forming the side curtains. Alternatively the front and back curtains may, by suitable arrangements of ports and ducts as described, for example, in Patent Specification Serial No. 919,350, be given the form of a vortex or of multiple curtains formed by recirculation of the fluid, the side curtains being formed from simple jets of fluid. In this case the greater efficiency obtained by recirculation enables front and back curtains of greater height to be secured for a given thrust.

According to a feature of the invention, however, there is provided a deflector at the front and/or back of the vehicle which is located in the path of the fluid forming the curtain, and is so shaped in cross-section as to deflect the fluid with a component of motion inwards, thereby forming in effect a second curtain which is an extension of that formed by the fluid issuing from the vehicle. The deflector may advantageously be horizontal and located substantially at the same height as lower part of the side walls.

50 Instead of a single deflector, it is preferred to use a bank of deflectors spaced from each other in a fore-and-aft direction. This increases the efficiency with which the curtain fluid is caught and deflected inwards. It will be understood that for the curtain to be deflected inwards efficiently, the spacing between the deflectors for a given angle of deflection of the fluid is a function of their width in a vertical direction.

60 More than one bank of horizontal deflectors may be provided, one below the other thus effectively further extending the height of the curtain for a given port width as compared with that which it would have if no deflectors were provided. Since the

recovery of the curtain at the first bank is not 100% efficient, the next lower bank is located nearer to the first bank than the latter is to the bottom of the vehicle.

A secondary advantage of the use of side walls which are immersed in the water lies in the fact that they tend to give directional stability to the vehicle. If, for example, the vehicle is on a course parallel to the prevailing direction of wave motion, the wavelength being substantially less than the length of the vehicle, the side walls will at any instant be immersed at a number of points along their length in successive wave crests, and this will tend to hold the vehicle on course.

It has been mentioned above that the front and back curtains may have the form of vortices or multiple curtains formed by recirculation. If desired, the side curtains may be so formed with or without similar formation of the front and back curtains, though in either case the side curtains will need less strength than the front and back curtains, owing to the difference in height.

In order to enhance the stability of the vehicle, the front and back curtains or the side curtains, or both, may be duplicated as described in Patent Application No. 9900/59 (Serial No. 944,502).

In addition to the two side walls described above, a central wall may be provided which likewise projects from the bottom of the vehicle and runs substantially parallel to the aforesaid walls. This central wall may function analogously to a keel, but its more important function is to divide the cushion into compartments to stabilise the vehicle. Each side wall may be replaced by a pair of side walls for the same purpose.

The invention will be described by way of example with reference to the accompanying drawings in which

Fig. 1 is a front elevation of a vehicle according to the invention.

Fig. 2 is a side elevation of the vehicle illustrated in Fig. 1.

Fig. 3 is a plan view of the vehicle illustrated in Fig. 1.

Fig. 4 is a sectional plan view of the front and rear portions of the vehicle approximately on the line A-A of Fig. 2.

Fig. 5 is a cross section of part of the vehicle on the line B-B of Fig. 4.

Fig. 6 is a cross-section of one of the side walls on the line C-C of Fig. 4.

Fig. 7 is a cross-section of an alternate shape of side wall.

Fig. 8 is a side elevation of the inside face of the front portion of a side wall, showing the relative positions of the mouths and front deflectors.

Fig. 9 is a side elevation of the inside face of the rear portion of a side wall, showing the relative positions of the mouths and rear



height

95

divide

105

110

115

120

125

130

deflectors.

Fig. 10 illustrates various cross-sections of blades suitable for the front deflectors.

Fig. 11 illustrates various cross-sections of blades suitable for the rear deflectors.

Fig. 12 illustrates further alternate cross-sections of the side wall, with varying forms of mouths or outlets.

Fig. 13 is a horizontal cross section through the side walls illustrating an alternative construction.

The vehicle illustrated in Figs. 1, 2 and 3 is of a form substantially rectangular, the ends being rounded in the plan view to give a better aerodynamic shape. The length of the vehicle is approximately twice the width, the height varying according to the purpose for which the vehicle is constructed. Preferably the side elevation, as in Fig. 2, is of a form giving good aerodynamic qualities. To further improve the aerodynamic quality, side fins extending upwards at each side of the body may be provided, as shown by dotted lines 1 and Figs. 1 and 2. The vehicle is of inverted channel form in the end view, there being a main body 2 provided with side walls 3 depending from the main body and extending for the length of the vehicle. The side walls are provided at their lower parts with ports extending along their length, as shown by dotted lines 4 and 5 in Fig. 4, and further ports extend across the bottom of the main body at the front and rear, shown at 6 and 7 in Fig. 4.

At the front of the vehicle are provided two air inlets 8, one on each side. Behind the inlets are situated several propellers 9, each, in the example illustrated, driven by a gas turbine engine 10, and being mounted in individual chambers 11. Air is compressed by the propellers, the air passing through the individual chambers into main air galleries 12. Combustion air for the gas turbines enters the turbine via inlet 13, Fig. 5, the exhaust gases passing into the main air galleries 12 with the air from the propellers. The turbines, and propellers, are mounted in the ducts on suitably shaped struts 14, through which can pass the fuel pipes and engine controls. The propellers 9 may be of fixed or variable pitch design, and may of course be driven by any other suitable means.

From the main air galleries 12 the air passes downwardly into a duct 15. The duct passes right round the vehicle, being contained within the side walls when passing along the sides of the vehicle. From the duct 15 the air is impelled through the peripheral nozzles 4, 5, 6 and 7, to form curtains which are continuous round the periphery of the vehicle.

The cross-section of the side walls may vary, but in the example illustrated they are as shown in Fig. 6. The bottom of the side

wall is of V formation, the point of the V being offset to the outside of the vehicle, the port 4 being formed along the inner edge of the V. In operation, air is expelled from the port 4 in an inwards and downwards direction to form the aforesaid curtain. Similarly air is expelled from the port 5 in the other side walls, and from the ports 6 and 7 at the front and rear. A pressure is built up beneath the vehicle to the extent that is necessary to raise the vehicle from the ground or from the water. As the pressures rises, the curtain is deflected outwardly from the space beneath the vehicle.

A bank of deflector blades 16 is arranged between the side walls 2 and 3, the centre line of the bank being vertically below the port 6. A similar bank of deflector blades 17 is arranged at the rear of the vehicle, similarly placed below the port 7. Each bank of deflector blades is curved, in plan form, so that they are always in the correct position relative to the ports 6 and 7, and is supported along its length by struts 18 of streamline form.

The position and action of the front bank of deflectors 16 is more clearly illustrated in Fig. 8. The air being expelled from the port 6 in the form of a curtain is bent outwards in a curve by the pressure of the air underneath the vehicle and which is contained by the curtains of air from the ports. When the air curtain has been bent outwards to a position substantially vertically beneath the port 6, it flows through the bank of deflector blades. The deflector blades are of suitable aerofoil section, having a convex surface directed away from the space below the vehicle and a concave surface facing the space below the vehicle. The action of the deflector blades is to deflect the curtain of air from the port 6 so that it issues once more with a direction inwards towards the underside of the vehicle. The pressure once again bends the curtain until it is flowing outwards away from the space under the vehicle.

A similar bank of deflector blades 17 can be used at the rear as shown in Fig. 9. The curtain of air being expelled from the port 7 is first directed inwardly being then bent by the pressure beneath the vehicle until it reaches a position substantially vertically beneath the port 7. It then flows through the bank of deflector blades 17, the blades of which may be of the same form as the blades of the deflector bank 16, the convex face facing out from the space beneath the vehicle and the concave face facing the space beneath the vehicle. The action of the rear deflector blades is the same as that of the front ones.

The use of deflector blades enables the curtain to be thinner, and thus the port narrower, than would be the case if deflector

blades were not used. Without the deflector blades the curtain would need to be "stiffer" to avoid being bent outwards too quickly by the cushion pressure. The increase in "stiffness" would require an increase in thrust through the port and thus increased power consumption. In order to reduce the drag of the banks of deflector blades, suitably shaped shields 19 are placed in front of and behind the banks.

When the bottom of the side walls 2 and 3 are shaped as shown in Fig. 6, a difficulty arises in sealing the edges of the air curtains expelled from the front and rear ports 6 and 7. The air in the curtains from the ports 6 and 7 flow vertically when viewed from the front or the rear, as shown by the dotted lines 20. This leaves a gap, shown at 21 between the end of the front, and rear, curtain and the side curtain. This gap would allow the air pressure beneath the vehicle to escape and must therefore be prevented. In the case of the side wall shaped as in Fig. 6 this can be done by slanting the end of the port 4, and port 5 in the other side wall, upward as at 22, Fig. 8, until it reaches the vertical inner wall 23 of the side walls. The same curving of the port 4, and port 5, is carried out at the rear end as shown at 24 in Fig. 9.

An alternative cross-sectional shape of the side walls is shown in Fig. 7. In this case the curtain expelled from the port 4 is in contact with the edge of the curtain from the ports 6 and 7 and no difficulty in sealing occurs. However, the pressure within the curtains is acting over a smaller proportion of the total bottom area than in the case where the side walls are formed as in Fig. 6 and the total lifting force is thus decreased.

The form of the blades comprising the front deflectors may vary depending upon the requirements. It will be appreciated that in order to enable the vehicle to operate in a stable manner, the cushion pressure must vary with the height of the vehicle. A small decrease or increase of cushion pressure due to increase or decrease in the height of the vehicle will cause the curtain to move inwards or outwards respectively. If, however, the blades of the bank of deflectors all have the same incidence, as in Fig. 10 (a), then over a certain range of heights, when the curtain is near the outer part of the bank, outward movement of the curtain will cause part of the air to spill over the outer edge of the bank, resulting in a weaker curtain beneath the bank. This tends to cancel out the increase of pressure, and hence the variation of pressure with height which is necessary to achieve stability. By making the blades with differing angles of incidence, to the vertical, as shown in Fig. 10 (b), the blade with the largest incidence being the outermost one from the cushion,

spilling over the outer edge is avoided or reduced and the strength of the curtain is maintained. This results in a sustained variation of cushion pressure with height. It will be appreciated that this is not the only factor necessary to achieve stability where local changes of height are experienced, as means must be provided as described for example in Application No. 9900/59 (Serial No. 944,502), for localising the pressure change due to a local change of height.

Figure 10 (c) illustrates blades each of which has a different radius of curvature, the radius being greater for the inside blade than for the outer. By this variation the curtain, which progressively thickens as it travels from the port to the deflectors, can be re-compressed to reduce its thickness and hence increase its stiffness as compared with the case in which all the blades have the same radius of curvature. Moreover with this arrangement the angle of the leading edge of each blade can be aligned to the angle of that part of the curtain which impinges upon it. In Figure 10 (d), while the blades are shown with the leading edges varied according to the angle at which the curtain meets the bank of deflector blades, the trailing edges are all parallel so that the air streams through the blades issue in parallel lines. Other forms of blades may be provided to meet other requirements and also blades may be made of a form combining two or more of the individual forms.

The form of the blades forming the rear deflectors may also be varied. It will be appreciated that if the vehicle is operating over water, with the rear deflector blades shaped as in Figure 11 (d), then if the deflectors should come into contact with the water, for example by hitting a wave, considerable drag and also considerable loads, will be caused by the action of the blades on the water. By reducing the angle through which the blades deflect the curtain, the hydrodynamic loads are reduced. Figure 11 (b) shows blades in which there is no velocity component towards the cushion, and Figure 11 (c) shows blades with a slight velocity component away from the cushion. This modification of the rear deflector blades will make them less efficient and it may be necessary to have more than one bank of deflector blades. Where two, or more, banks are used they are positioned one above the other being in a staggered formation, the lower bank being displaced slightly rearward relative to the upper bank so as to entrain the curtain.

Alternatively, the vehicle may be provided with a bank of deflector blades at the front only, the rear curtain being made thicker and thus "stiffer" by widening the port 7, or the curtain efficiency being increased by some other suitable method.



flows



wall



shaped

It will be understood that in each case, each bank of deflectors contains a sufficient number of blades to allow for the fore and aft movement of the curtains with varying cushion pressures.

Illustrated in Figure 12 are further suitable cross-sections for the side-walls. In (a), (b), (c) and (d) the port for the side curtain is formed at the top of the inside face of the wall, the inside face supporting the curtain until it reaches the bottom edge. This construction enables the actual nozzle forming the port to be placed in a position where it is least likely to be damaged by waves, etc., and also in a position where there is less likelihood of water entering the port and interfering with the flow of air along the duct supplying the port. The cross-sections at (e) and (f) in Figure 12 have the advantages that they produce the minimum lifting force on the vehicle when running into waves. These alternative cross-sections for the side-walls are likely to be used when the vehicle is operating so that the bottom of the side-walls just cut through the crests of the waves. The vehicle may operate at any suitable height varying from, for example, a height where the distance of the bottom of the main body from the water surface is twice the distance of the bottom of the side-wall from the surface, to a height where, as stated above, the walls are just cutting through the crests of the waves. Operating at this latter height would be advisable when the required direction of travel is at an angle to the line of the waves, and also at yet a different angle to any wind direction. Under such conditions, the walls cutting through the wave crests would maintain the vehicle in alignment with its direction of travel. If the vehicle was normally out of contact with the water, it would tend to swing round into the wind and have a sideways component of motion. Should a large wave then make contact with the side walls, there would be a large turning moment on the vehicle. Alternatively, a small fin could project down from the vehicle, preferably at the rear, so as to be always in the water and so maintain alignment.

The vehicle can be propelled by any suitable means, but in the vehicle described above, propulsion is obtained by providing the side curtains from ports 4 and 5 with a rearward velocity component by means of suitably shaped vanes 25 as shown in Figures 8 and 9.

Due to displacement of the water by the air curtain expelled from the side wall, and the wave motion due to the air cushion there is likely to be a slightly greater distance from the water surface to the bottom of the side wall and the bottom of the main body of the vehicle at the rear than at the front. This can be reduced by providing a stronger

curtain across the rear than the front and by suitably profiling the longitudinal cross-section of the side wall bottom.

It will be obvious that other forms of side wall can be provided depending upon the particular requirements of the operating conditions of the vehicle. For example, single, or multiple, planing steps may be formed on the bottom of the side walls, and on the sides of the side walls, to reduce the area of the surface in contact with the water in a known manner. Again, the side walls can be so constructed that they will form bouyancy chambers (e.g. pontoons) for the vehicle when resting in the water.

The side walls may vary in vertical height such that the front and rear ends fair off into the bottom surface of the main body. This variation in height of the side walls may be limited to a relatively short portion at each end, or the height may vary continuously along the length of the side walls, starting at zero at one end, reaching a maximum at some intermediate position and returning to zero at the other end.

Although, in the example described above, only one bank of deflector blades is employed at the front of the vehicle, two, or even more, banks may be employed, suitably positioned to redirect the air curtains.

Banks of deflector blades may also be provided where air curtains are used to divide the air cushion for the purposes of stability and trim control. As these air curtains may be bent in either direction depending upon the relative pressures in the separate portions of the cushion, the banks may consist of a set of deflector blades on either side of the vertical centre line of the air curtain and arranged to deflect the curtain back towards the vertical centre line.

In an alternative form of the vehicle, the banks of deflector blades are replaced by horizontal members, of suitable shape, which extend between the side walls, beneath the ports across front and rear of the main body. Each horizontal member has an opening approximately in the centre of the upper surface and extending from one side wall to the other. The curtain expelled from the front and rear ports, after being bent by the air cushion enters these openings. Two laterally displaced ports are formed in the bottom surface of the horizontal member, again extending from one side wall to the other, two air curtains being expelled from them and reaching the surface.

In a further alternative, the vertical curtain between the side walls is replaced by curtains issuing from vertical ports formed either in the sides of the side walls or vertical members placed between the side walls. In Fig. 13, vertical members 30 and 31, of suitable shape are positioned between the side walls. Vertical ports 32 and 33 are





where

formed in the sides of the vertical members, one on each side. Air is expelled from these ports to form horizontally directed curtains with a velocity component towards the air cushion, the curtains being bent by the cushion pressure, and entering vertical openings 34 and 35 in the side walls. The curtains may alternatively be expelled from vertical ports in the side walls and collected in the vertical member. In either case the air recovered from the horizontally directed curtains, or a fresh supply of air, is made to issue from horizontal members 36 located beneath the horizontally directed curtains at the front and rear at or near the bottom of the side walls, to form a vertically-directed curtain. where the width of the vehicle is large vertical deflectors could also be used, or additional vertical members forming additional curtains can be provided.

WHAT WE CLAIM IS:—

1. A vehicle for travelling over water and which in operation is supported above the surface of the water by at least one cushion of pressurised gas formed and contained beneath the vehicle, comprising at least two walls which project below the bottom of the vehicle extending substantially parallel to the fore and aft axis of the vehicle and each forming part of the boundary of a cushion, at least part of the remainder of the boundary of the cushion being formed by a curtain of moving fluid.

2. A vehicle as claimed in claim 1 wherein at least one wall is located each side of the vehicle each wall forming at least part of the boundary of a cushion along each side of the vehicle.

3. A vehicle as claimed in claim 1 or claim 2 wherein means are provided for causing fluid to issue from the bottom of the vehicle to form curtains of moving fluid extending normal to the fore and aft axis of the vehicle between the walls.

4. A vehicle as claimed in claim 1, 2 or 3 wherein each wall forms the upper part of the lateral boundary of a cushion, means being provided for causing fluid to issue from the lower parts of each wall for forming curtains of moving fluid, each curtain forming the lower part of the lateral boundary of a cushion.

5. A vehicle as claimed in claim 2 or claim 3 comprising two walls located one on each side of the vehicle, each wall being at all times being at least partly immersed in the water, each cushion boundary at each end of the vehicle being formed by at least one curtain of moving fluid.

6. A vehicle as claimed in any one of the preceding claims wherein means are provided for recovering into the vehicle at least part of the curtain forming fluid for reuse.

7. A vehicle as claimed in claim 6 wherein means are provided for causing the recovered

fluid to recirculate in the existing curtain or to form a further curtain.

8. A vehicle as claimed in claim 3 or claim 5 wherein at least one deflector is located in the path of at least one of the fluid curtains extending between the walls, the deflector being so shaped in cross-section as to deflect the fluid into a direction having a component of direction inwards towards a cushion, thereby forming in effect a second curtain which is an extension of that formed between the main body of the vehicle and the deflector by the fluid issuing from the main body of the vehicle.

9. A vehicle as claimed in claim 8, wherein in the said deflector forms one of a bank of deflectors spaced from each other in a fore-and-aft direction.

10. A vehicle as claimed in claim 8 or 9, wherein the deflector or bank of deflectors is or are substantially horizontal and located substantially at the same height as the lower part of the side walls.

11. A vehicle as claimed in claim 8 or 9, wherein the said deflector or bank of deflectors is or are substantially horizontal and one or more further deflectors or banks of deflectors is or are arranged below the afore-said deflector or bank of deflectors.

12. A vehicle as claimed in claim 9, or 10 or 11, wherein the angles of incidence to the vertical of the deflector blades in a bank vary from a maximum at the outermost blade to a minimum at the innermost blade.

13. A vehicle as claimed in claim 9, 10 or 11, wherein the radii of curvature of the deflector blades in a bank vary from a minimum at the outermost blade to a maximum at the innermost blade.

14. A vehicle as claimed in any one of the claims 8 to 13, wherein the or each deflector at the rear of the cushion is so formed that its lower edge is directed slightly rearwards so as to give a velocity component to the fluid which is slightly rearwards.

15. A vehicle as claimed in any one of the preceding claims, wherein the side walls, with or without ducts leading to ports therein, are designed to act as buoyancy chambers.

16. A vehicle as claimed in any one of the preceding claims, which further comprises a central wall projecting from the bottom of the vehicle and extending substantially parallel to the side walls.

17. A vehicle as claimed in any one of the preceding claims wherein two parallel walls extend along each side of the vehicle.

18. A vehicle substantially as described with reference to Figures 1-6, 8 and 9, or 12 Fig. 7 or any of Figs. 10, 11, 12 or 13.

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formed in the sides of the vertical members, one on each side. Air is expelled from these ports to form horizontally directed curtains with a velocity component towards the air cushion, the curtains being bent by the cushion pressure, and entering vertical openings 34 and 35 in the side walls. The curtains may alternatively be expelled from vertical ports in the side walls and collected in the vertical member. In either case the air recovered from the horizontally directed curtains, or a fresh supply of air, is made to issue from horizontal members 36 located beneath the horizontally directed curtains at the front and rear at or near the bottom of the side walls, to form a vertically-directed curtain. *where* the width of the vehicle is large vertical deflectors could also be used, or additional vertical members forming additional curtains can be provided.

WHAT WE CLAIM IS:—

1. A vehicle for travelling over water and which in operation is supported above the surface of the water by at least one cushion of pressurised gas formed and contained beneath the vehicle, comprising at least two walls which project below the bottom of the vehicle extending substantially parallel to the fore and aft axis of the vehicle and each forming part of the boundary of a cushion, at least part of the remainder of the boundary of the cushion being formed by a curtain of moving fluid.
2. A vehicle as claimed in claim 1 wherein at least one wall is located each side of the vehicle each wall forming at least part of the boundary of a cushion along each side of the vehicle.
3. A vehicle as claimed in claim 1 or claim 2 wherein means are provided for causing fluid to issue from the bottom of the vehicle to form curtains of moving fluid extending normal to the fore and aft axis of the vehicle between the walls.
4. A vehicle as claimed in claim 1, 2 or 3 wherein each wall forms the upper part of the lateral boundary of a cushion, means being provided for causing fluid to issue from the lower parts of each wall for forming curtains of moving fluid, each curtain forming the lower part of the lateral boundary of a cushion.
5. A vehicle as claimed in claim 2 or claim 3 comprising two walls located one on each side of the vehicle, each wall being at all times being at least partly immersed in the water, each cushion boundary at each end of the vehicle being formed by at least one curtain of moving fluid.
6. A vehicle as claimed in any one of the preceding claims wherein means are provided for recovering into the vehicle at least part of the curtain forming fluid for reuse.
7. A vehicle as claimed in claim 6 wherein means are provided for causing the recovered

fluid to recirculate in the existing curtain or to form a further curtain.

8. A vehicle as claimed in claim 3 or claim 5 wherein at least one deflector is located in the path of at least one of the fluid curtains extending between the walls, the deflector being so shaped in cross-section as to deflect the fluid into a direction having a component of direction inwards towards a cushion, thereby forming in effect a second curtain which is an extension of that formed between the main body of the vehicle and the deflector by the fluid issuing from the main body of the vehicle.

9. A vehicle as claimed in claim 8, wherein the said deflector forms one of a bank of deflectors spaced from each other in a fore-and-aft direction.

10. A vehicle as claimed in claim 8 or 9, wherein the deflector or bank of deflectors is or are substantially horizontal and located substantially at the same height as the lower part of the side walls.

11. A vehicle as claimed in claim 8 or 9, wherein the said deflector or bank of deflectors is or are substantially horizontal and one or more further deflectors or banks of deflectors is or are arranged below the aforesaid deflector or bank of deflectors.

12. A vehicle as claimed in claim 9, or 10 or 11, wherein the angles of incidence to the vertical of the deflector blades in a bank vary from a maximum at the outermost blade to a minimum at the innermost blade.

13. A vehicle as claimed in claim 9, 10 or 11, wherein the radii of curvature of the deflector blades in a bank vary from a minimum at the outermost blade to a maximum at the innermost blade.

14. A vehicle as claimed in any one of the claims 8 to 13, wherein the or each deflector at the rear of the cushion is so formed that its lower edge is directed slightly rearwards so as to give a velocity component to the fluid which is slightly rearwards.

15. A vehicle as claimed in any one of the preceding claims, wherein the side walls, with or without ducts leading to ports therein, are designed to act as buoyancy chambers.

16. A vehicle as claimed in any one of the preceding claims, which further comprises a central wall projecting from the bottom of the vehicle and extending substantially parallel to the side walls.

17. A vehicle as claimed in any one of the preceding claims wherein two parallel walls extend along each side of the vehicle.

18. A vehicle substantially as described with reference to Figures 1-6, 8 and 9, or Fig. 7 or any of Figs. 10, 11, 12 or 13.

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