

RESERVE COPY PATENT SPECIFICATION

DRAWINGS ATTACHED

968.191

Inventors: RICHARD STANTON JONES,
DEREK JAMES HARDY.

Date of filing Complete Specification: Sept. 26, 1960.

Application Date: Sept. 25, 1959.

No. 32698/59.

Complete Specification Published: Aug. 26, 1964.

© Crown Copyright 1964.



968.191

Index at acceptance:—B7 K

International Classification:—B 64 c

COMPLETE SPECIFICATION

Vehicle for Travelling Over Water

We, HOVERCRAFT DEVELOPMENT LIMITED, a British Company, of 1, Tilney Street, London, W.1, 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 of the kind which in operation are supported on a pressurised cushion contained in part by a curtain formed by a jet of fluid issuing from the bottom of the vehicle after the manner described in Letters Patent No. 854,211 and in part by side members or walls which depend from the bottom of the main structure of the vehicle as described in Letters Patent No. 944,501. In this kind of vehicle, although the fluid curtains at the front and back of the vehicle have to be of sufficient height to extend from the bottom of the vehicle proper to the surface of the water over which it is operating, at the sides of the vehicle curtains could be dispensed with altogether leaving the side walls to float in the water, or the side walls could be provided with curtains less in height than those at the front and back by approximately the height of the side walls, thus bringing about in either case a considerable economy in the power required to lift the vehicle, such economy, however, being at the expense of the additional drag due to any parts of the side walls which are immersed in the water.

Nevertheless, in order to sustain the additional height of the front and back curtains it was necessary to give these curtains a correspondingly high thrust or to provide certain structural devices described in Patent No. 944,501. An object of the present invention is to save power and/or obviate the need for the said structural devices.

According to the present invention there is provided a vehicle which, in operation, is supported at least in part by a cushion of pressurised gas formed and contained in a

space beneath the vehicle, wherein the said space is at least partly bounded on each side by a wall structure depending below the bottom of the vehicle and extending parallel to the fore and aft axis of the vehicle, at least one obturating member extending transversely between the wall structures and deflectably attached to the lower part of the vehicle to form part of the remaining boundary of the said space, the remainder of the boundary of the space being formed by at least one curtain of moving fluid issuing from a lower part of the vehicle and flowing towards the surface over which the vehicle is supported.

The obturating member or members which can be at the front of the vehicle or the back or both can be of varying construction; for example of rigid construction and flexibly attached to the vehicle, or of flexible construction. The obturating members may also be inflatable.

According to a further feature of the invention the wall structures may also be deflectably attached to the vehicle. The wall structures, again, may be of varying construction; for example of rigid or flexible construction. The wall structures may also be inflatable.

If the said obturating member is a flap or door, means are provided for preventing movement of the door in a forward direction beyond the normal position and the door is pivoted about a substantially horizontal axis perpendicular to the side walls or is otherwise capable of moving aft when struck by a wave crest and, in the case of a door at the rear of the vehicle, restoring means are provided to maintain the door in the said normal position against the pressure of the cushion. It will be understood that in the case of the forward door, no restoring means are necessary as the door is held in its normal position by the cushion pressure. It will further be understood that the terms "forward" and "front" on the one hand and "back" and "aft" on the other have reference to the

[Price 4s. 6d.]

intended direction of motion of the vehicle.

Where curtains of fluid are formed beneath the side walls and/or the obturating members, these may, and generally will, act to form and maintain the pressurised cushion or cushions. Alternatively or in addition, means for forcing fluid directly into the space or spaces occupied by the cushion or cushions, may be provided. Where the cushion is formed and maintained by curtains of fluid these may issue from both the side walls and the obturating members, or from the side walls only or the obturating members only. The choice from these alternatives is in the main a compromise between the power it is desired to expend on lift and propulsion respectively.

The side members may be at least partly immersed at all times or are only partly immersed for part of the time, for example, when waves are encountered. Since, however, the obturating members are capable of rising or moving aft, they do not in fact remain in their normal positions when a wave is encountered, but are impelled aft or upwards by the wave sufficiently far to clear it. Hence they do not seriously increase the drag on the vehicle nor do they have to withstand excessive impacts. On the other hand, they form a substantial part of the boundary enclosing the cushion without consuming any power.

The invention is applicable to platforms such as, for example, a platform for a radar installation at sea, and the term "vehicle" as used herein is to be understood as including, where the context permits, a platform.

The invention will be readily understood by the following description of various embodiments in conjunction with the drawings accompanying the Provisional Specification in which:—

Figure 1 is a side view of a vehicle according to the invention;

Figure 2 is a front view of the vehicle illustrated in Figure 1;

Figure 3 is a cross sectional view parallel to the longitudinal axis of the vehicle, to an enlarged scale, of the front and rear obturating members shown in Figures 1 and 2;

Figure 4 is a cross section, similar to that of Figure 3, to a larger scale, of an alternative form of front and rear obturating members;

Figures 5 to 9 are similar cross sections to that of Figure 4, illustrating various other forms of obturating members;

Figures 10 to 13 are further cross sectional views, similar to those of Figures 5 to 9, illustrating still further forms of obturating members, only one member being shown in each case;

Figure 14 is an isometric view of a part of the obturating member illustrated in Figure 12 together with a part of one of the co-operating side walls, and

Figure 15 is a cross sectional view, similar to that shown in Figure 3, illustrating a vehicle which has two obturating members at each end,

and also in conjunction with the accompanying drawings in which:—

Figure 1 is a modification of embodiment shown in Figure 7 of the drawings accompanying the Provisional Specification;

Figures 2A and 2B illustrate a modified form of supply ports shown in Figures 10 and 11 of the drawings accompanying the Provisional Specification;

Figures 3A and 3B are views to an enlarged scale of the supply ports of the embodiment illustrated in Figure 13 of the drawings accompanying the Provisional Specification showing more correctly and clearly the separate supply ducts for each supply port;

Figure 4 illustrates a modified form of the embodiment illustrated in Figure 12 of the drawings accompanying the Provisional Specification, particularly suitable for use as a flexible side wall and

Figure 5 is a cross section view normal to the longitudinal axis of the vehicle illustrating an embodiment of the invention in which the side walls are of the form illustrated in Figure 4 of the accompanying drawings.

The vehicle shown in Figs. 1, 2 and 3 of the drawings accompanying the Provisional Specification is generally rectangular in plan view and is provided with a main body 1 from which depend rigid hollow side walls 2, and is of the type which operates normally completely clear of the surface, fluid curtains being formed beneath the side walls. Air under pressure is supplied by fans 3 to the space in each side wall which acts as a main duct for supplying the curtain-forming air. A rigid door 4 having as low an inertia as possible is pivoted or hinged to the bottom of the vehicle near the forward end and a similar door 5 is hinged at the rear end of the vehicle. The width of each door is such that it fits as closely as possible between the side walls consistent with free movement on its hinge.

The vehicle is shown in its operative condition in which it is raised from the surface by a cushion of pressurised air enclosed between the side walls, air curtains (not shown) formed by jets of air issuing from ports (not shown) running the length of each side wall, and the front and rear doors. In this form of the invention the latter are not provided with curtain-forming jets but in their normal positions as shown in the drawings their lower edges are in contact with the surface when the vehicle is hovering. The pressurised cushion, assisted by gravity, normally holds the forward door 4 against a stop member 6. On the other hand the cushion pressure exerts a force on the rear door 5 which tends to open it, this force being much greater than the weight of the door. In

order to hold the rear door against its stop 7, therefore, a part of the air from the fans 3 is conducted by way of an opening 8 in the bottom of the vehicle to a space 9 behind the door which is enclosed by a flexible air-tight diaphragm 10 which may, for example, be made of a rubberised fabric. It will be seen that pressure in the space 9 is approximately the same as the stagnation pressure of the curtain-forming jets which is greater than the cushion pressure, so that the door 5 is normally held against the stop 7.

When the vehicle encounters a wave, the doors 4 and 5 are easily raised by the impact of the water to a height at which they clear the wave, little air being lost from the cushion in the process.

In case the force exerted on the forward door by the cushion is so great as to inhibit the upward movement of the door on encountering a wave, a tension spring or hydraulic device may be provided which partially counteracts the action of the cushion pressure.

The arrangement of Fig. 4 of the drawings accompanying the Provisional Specification is similar to that of Fig. 3, except that provision is made for the formation of curtains at the bottom edge of each door. The forward door is hollow and is provided at its lower edge with a supply port 13 extending along its width, the hollow space in the door being connected by way of a flexible tube 12 at each end with the ducts in the side walls. In the case of the rear door, the supply port for the curtain-forming air is formed by a slot 11 extending along the lower edge of the door, through which air from the space 9 issues. It will be seen that with this arrangement the jet from the supply port 11 as well as that from the supply port 13 issues in a downward and inward direction, which is the most efficient for curtain formation. It will also be seen that both doors are of such a length that they do not protrude below the side walls, the seal for the cushion being completed by the curtains from the bottoms of the doors.

Figure 5 of the drawings accompanying the Provisional Specification is similar to Fig. 4 except that the pressure chamber 9 formed by the diaphragm 10 is replaced by a spring operated plunger 10a and the two doors 4 and 5 are given a curved shape so that they maintain substantially the same angle of attack with respect to the water as the doors are raised. Since the pressurised space 9 is not provided, the rear door must be hollow to provide a duct for feeding the supply port 11. This duct curves inwards at the lower end and fairing 5a is provided to give the door the correct shape. Fig. 5 also shows a tension spring 6a which enables the stop 6 to be dispensed with. Similarly, the stop 7 can also be dispensed with as shown by correct adjustment of the strength of the spring of the spring operated plunger 10a.

In Fig. 6 fixed ducts 14 and 15 are mounted between the side walls at the front and back of the vehicle. The ducts are supplied with air from the side wall ducts by way of hollow struts 16. Each duct is provided with a supply port extending along its length, the orientation of the duct immediately upstream of the port being such as, in each case, to direct air from the port in a downward and inward direction. The tubular member constituting each of the ducts serves as a stop member in place of the stops 6 and 7 of Figs. 3 and 4. If a number of struts 16 are provided across the front and rear of the vehicle, the doors 4 and 5 can be made of flexible material.

The construction of Fig. 7 is the same as that of Fig. 4 except that the rigid hinged doors are replaced by flexible doors which are fixed to the bottom of the vehicle but are sufficiently flexible to be readily deflected by waves while being nevertheless rigid enough to remain substantially undeformed by the cushion pressure or the pressure in space 9 as the case may be. The doors may, for example, be made of inflated rubberised fabric subdivided into cells, in which case air for forming the curtain issuing from the forward door is the same as the air which inflates the fabric.

Figure 8 shows an arrangement in which two curtains issue from the lower edge of each of the doors 4 and 5. Air is fed to the forward door through hollow hinges 20. In order to accommodate the projecting part of the door 4, a recess 21 is provided in the bottom of the vehicle, while the rear of the vehicle is inclined as shown at 22 to accommodate the door 5. The provision of two curtains ensures that there is a pressurised cushion under the lower edge of each door. This will tend to cause the lower edge to follow the contour of the waves, thus reducing or eliminating the impact of the waves on the door. In the case of the forward door, however, the pressure of the said cushion is only about half the main cushion pressure, and it acts over a smaller area. It is therefore necessary to provide means such as a tension spring 23 to assist the upward movement of the door. A clearance 24 allows the main cushion pressure to act on the top or inner surface of the door in its uppermost position, so that the balance of forces remains correct in this position. If the pressure of the cushions under the doors, assisted in the case of the forward door by the spring 23, is sufficiently high they will serve to keep the doors in their normal positions (that is their correct positions over a smooth surface), and the stops 6 and 7 may then be dispensed with. The size of the space 9 may be adjusted to provide any required amount of counterbalance for the rear door.

Figure 9 shows an arrangement in which



the

each door is provided not only with a duct 25 for supplying air to the curtains, but also with a recovery duct 26 for ~~recovery~~ ^{recovering} air spent from the curtain jet to be used again

5 for recirculation in the same or a further curtain or for propulsion. In the case shown, the recovered air issues from rearwards directed outlets 27 in each side wall for the purpose of propelling the vehicle. It will be noted that the cross-sectional shape of each door is approximately the sector of a circle whose centre is at the hinge of the door, and the air is supplied from ducts 28 by way of chambers 29 whose lower boundaries are formed by the doors. By this means the loading of the doors by the cushion pressure is substantially eliminated. This expedient can be used whether or not recovery ducts are provided, and is effective in the case of the forward door whether or not the chamber 29 is provided. It will be appreciated that if no loading on the front door is required then a flexible duct or the like will be required between the duct 28 and the duct 25. To prevent loading of the rear door while dispensing with the chamber 29, the door should be pivoted on a central horizontal axis, but in this case, means for sealing the upper end of the door would have to be provided. For example the rear end of the vehicle could have the cross-sectional form of an arc of a circle whose centre is the pivotal axis of the door, the upper edge of the door fitting as closely as possible in this arc.

35 Figure 10 shows a vehicle in which parallel motion doors are provided. The doors may be identical forward and aft and only one of them is shown in Fig. 10. Air for the curtains is supplied through duct 30 into the space between the members 31 and 32 of the doors. Seals 33 are provided to seal this space. The curtain jets issue through supply ports 34 and 35 which are formed in a device 38 which is pivoted to the members 31, 32 and is provided with a central bar 39. It will be noted that the inner port 35 is directed in an outward direction. This enables a pressure as high as or higher than the main cushion pressure to be sustained in the auxiliary cushions under the doors. Spent air from jet 35 enters the main cushion space and any surplus escapes under the side walls. A spring 36, tension in the case of the forward door and compression in the case of the rear door provides any necessary compensation for the loading of the doors by the main cushion pressure.

Figure 11 shows a somewhat similar arrangement but with the door members 31, 32 replaced by pivoted links 40. Diaphragms 37 form a chamber 41 performing the same function as the space between members 31, 32 in Fig. 10.

In Fig. 12, the obturating member is constituted by a bag 42 which is fed with pres-

surised air from a duct 43. A similar member is used at the forward and rear ends of the vehicle, only one being shown in Fig. 12. The bottom of the bag is provided with a stiff member 44 in which are formed the supply ports 46, 47, for the curtain forming air. If necessary a restraining strap 45 may be provided between the member 44 and the under-side of the vehicle.

Figure 13 shows an arrangement which is similar to that of Fig. 12, but in which the supply ports 46 and 47 are fed by alternate tubes 48, and the space 41, within the bag 42 is fed with air from a separate source, for example, the engine supply reservoir of the vehicle. This enables a pressure relief valve 49 to be provided which will relieve the pressure in the bag when the latter is compressed by a wave.

Figure 14 is an isometric view of the inside of the door shown in Figure 12 together with part of the co-operating side wall. It will be seen that the supply ports 46 and 47 are not continuous as it is necessary to provide some means for connecting the walls of the bag together.

Figure 15 shows diagrammatically a vehicle in which two forward doors 4a and 4b, and two rear doors 5a and 5b are provided. Means such as are shown diagrammatically at 50 are provided to enable one door of each pair to be held in a retracted position against the bottom of the vehicle in order to adjust the position of the centre of pressure of the cushion and hence the trim of the vehicle. The means 50 may be hydraulic, and may be operated automatically in response to a trim-sensing device.

Figure 1 of the accompanying drawings shows a stiffer form of the doors shown in Figure 7 of the drawings accompanying the Provisional Specification. The doors 64 and 65 are much thicker adjacent to the bottom of the vehicle 1. In other particulars the construction is as described above. This stiffer form of construction is required, for example, when the vehicle is a comparatively high speed one.

Figures 2A and 2B of the accompanying drawings illustrates a modified supply port arrangement applicable to the examples illustrated in Figures 10 and 11 of the drawings accompanying the Provisional Specification the modification being shown as made to Figure 10. The supply ports 66 and 67 are of different widths the front port 66 being wider than the rear port 67, for the front door. For the rear door the rear port is wider than the front port. The strength of the inner curtain 68 is thus less than the outer curtain 69 and a curtain formation somewhat as shown in Figure 2A occurs. When, for any reason, the bottom of the door approaches more nearly to the surface the curtain formation alters until the formation shown in Figure

70

75

80

85

90

95

100

105

110

115

120

125

130

5

10

15

20

25

30

35

40

45

50

55

60

2B occurs. This creates an increased pressure in the cushion contained between the two curtains, assisting in lifting the door.

Figures 3A and 3B of the accompanying drawings illustrate to an enlarged scale the supply ports 46 and 47 and tubes 48 of Figure 13 of the drawings accompanying the Provisional Specification. Figure 3A is in the same plane as the aforementioned Figure 13 and Figure 3B is a cross section on the line A-A of Figure 3A. As described above the supply ports 46 and 47 are fed by alternate tubes 48 respectively, that is, in Figure 3B for example, tubes 48(i) and 48(iii) feed supply port 46 whilst tubes 48(ii) and 48(iv) feed supply port 47.

As stated above, the side walls may also be flexible or flexibly attached, and Figure 4 of the accompanying drawings illustrates a modification of the embodiment shown in Figure 12 of the drawings accompanying the Provisional Specification particularly suitable for a side wall. The use of curtain pressure fluid for inflating the bag 71 provides a reasonably stiff side wall, which is desirable. Air from a duct 72 is fed into the space 73 within the bag 71, and issues through supply ports 74 and 75 to form curtains. A tie 76 may be provided as before. To enable the vehicle to land on a hard surface when the supply of curtain air is stopped, with the consequent deflating of the bag 71, a further inflated bag 77 may be provided. This bag 77 is permanently inflated either by being completely sealed or by being fed from for example a small auxiliary compressor. The provision of the internal bag 77 prevents damage to the ports 74 and 75, when the vehicle lands.

A typical front view of a vehicle, similar to Figure 2 of the drawings accompanying the Provisional Specification, but showing the provision of side walls of the type illustrated in Figure 4 of the accompanying drawings is shown in Figure 5 of the accompanying drawings. The side walls 80 are of modified cross section at the front, and at the rear, where they co-operate with the doors 81, in order that a satisfactory seal is obtained, between the doors or obturating members and the side walls.

Many of the other examples illustrated in the drawings accompanying the Provisional Specification may also be used for flexible side walls, some suitable sealing means, such as a flexible membrane, being provided between each door and the side walls.

Attention is directed to copending applications Nos. 18552/64 (Serial Nos. 968192) and 18553/64, 968193, both divided from the present application.

WHAT WE CLAIM IS:—

1. A vehicle which, in operation, is supported at least in part by a cushion of pres-

surised gas formed and contained in a space beneath the vehicle, wherein the said space is at least partly bounded on each side by a wall structure depending below the bottom of the vehicle and extending parallel to the fore and aft axis of the vehicle, at least one obturating member extending transversely between the wall structures and deflectably attached to the lower part of the vehicle to form part of the remaining boundary of the said space, the remainder of the boundary of the space being formed by at least one curtain of moving fluid issuing from a lower part of the vehicle and flowing towards the surface over which the vehicle is supported.

2. A vehicle as claimed in claim 1 wherein at least two obturating members extend between the wall structures at spaced apart locations and which define a cushion space between them.

3. A vehicle as claimed in claim 1 or claim 2 wherein the obturating member or at least one of the obturating members is of rigid construction flexibly attached to the lower part of the vehicle.

4. A vehicle as claimed in claim 1 or claim 2 wherein the obturating member, or at least one of the obturating members, is of flexible construction.

5. A vehicle as claimed in claim 4 wherein the obturating member is inflatable.

6. A vehicle as claimed in any one of the preceding claims wherein the obturating member, or at least one of the obturating members, constitutes a duct for supplying a fluid which forms at least one curtain of moving fluid issuing from the lower part of the obturating member.

7. A vehicle as claimed in claim 5 and claim 6 wherein the fluid which issues from the lower part of the obturating member to form the curtain or curtains of moving fluid serves also to inflate the member.

8. A vehicle as claimed in claim 5 and claim 6 comprising at least one supply port formed in the lower part of the obturating member and means for supplying a fluid, other than that for inflating the obturating member, to the supply port to issue therefrom and form the curtain of moving fluid.

9. A vehicle as claimed in claim 8 comprising at least one port formed in the bottom surface of the vehicle and extending transversely thereof, wherein the means for supplying fluid to the supply port comprises two opposed flexible walls depending downward from the port, said supply port being formed by the lower ends of said flexible walls.

10. A vehicle as claimed in any one of the claims 6 to 9 wherein means are provided for forming two parallel curtains of moving fluid from the lower part of an obturating member whereby a subsidiary cushion of pressurised gas can be formed and contained beneath the bottom of an obturating member by the



ember of tl 12. with a d the 70	2B occurs. This creates an increased pressure in the cushion contained between the two curtains, assisting in lifting the door.	65
which is the ernate ag 42 e, for of the valve e the com- 75	Figures 3A and 3B of the accompanying drawings illustrate to an enlarged scale the supply ports 46 and 47 and tubes 48 of Figure 13 of the drawings accompanying the Provisional Specification. Figure 3A is in the same plane as the aforementioned Figure 13 and Figure 3B is a cross section on the line A-A of Figure 3A. As described above the supply ports 46 and 47 are fed by alternate tubes 48 respectively, that is, in Figure 3B for example, tubes 48(i) and 48(iii) feed supply port 46 whilst tubes 48(ii) and 48(iv) feed supply port 47.	70
inside gether ll. It nd 47 pro- ills of 90	As stated above, the side walls may also be flexible or flexibly attached, and Figure 4 of the accompanying drawings illustrates a modification of the embodiment shown in Figure 12 of the drawings accompanying the Provisional Specification particularly suitable for a side wall. The use of curtain pressure fluid for inflating the bag 71 provides a reasonably stiff side wall, which is desirable. Air from a duct 72 is fed into the space 73 within the bag 71, and issues through supply ports 74 and 75 to form curtains. A tie 76 may be provided as before. To enable the vehicle to land on a hard surface when the supply of curtain air is stopped, with the consequent deflating of the bag 71, a further inflated bag 77 may be provided. This bag 77 is permanently inflated either by being completely sealed or by being fed from for example a small auxiliary compressor. The provision of the internal bag 77 prevents damage to the ports 74 and 75, when the vehicle lands.	75
ehicle , and vided. lly at each gainst adjust of the hicle. ay be trim- 95	A typical front view of a vehicle, similar to Figure 2 of the drawings accompanying the Provisional Specification, but showing the provision of side walls of the type illustrated in Figure 4 of the accompanying drawings is shown in Figure 5 of the accompanying drawings. The side walls 80 are of modified cross section at the front, and at the rear, where they co-operate with the doors 81, in order that a satisfactory seal is obtained, between the doors or obturating members and the side walls.	80
wings vn in g the 4 and ottom s the stiffer mple, high 100	Many of the other examples illustrated in the drawings accompanying the Provisional Specification may also be used for flexible side walls, some suitable sealing means, such as a flexible membrane, being provided between each door and the side walls.	85
inying port illus- wings cation de to 7 are being front wider inner urtain at as r any aches orma- figure 105	Attention is directed to copending applications Nos. 18552/64 (Serial Nos. 968192) and 18553/64, 968193, both divided from the present application.	90
	WHAT WE CLAIM IS:—	95
	1. A vehicle which, in operation, is supported at least in part by a cushion of pres-	100
	surised gas formed and contained in a space beneath the vehicle, wherein the said space is at least partly bounded on each side by a wall structure depending below the bottom of the vehicle and extending parallel to the fore and aft axis of the vehicle, at least one obturating member extending transversely between the wall structures and deflectably attached to the lower part of the vehicle to form part of the remaining boundary of the said space, the remainder of the boundary of the space being formed by at least one curtain of moving fluid issuing from a lower part of the vehicle and flowing towards the surface over which the vehicle is supported.	105
	2. A vehicle as claimed in claim 1 wherein at least two obturating members extend between the wall structures at spaced apart locations and which define a cushion space between them.	110
	3. A vehicle as claimed in claim 1 or claim 2 wherein the obturating member or at least one of the obturating members is of rigid construction flexibly attached to the lower part of the vehicle.	115
	4. A vehicle as claimed in claim 1 or claim 2 wherein the obturating member, or at least one of the obturating members, is of flexible construction.	120
	5. A vehicle as claimed in claim 4 wherein the obturating member is inflatable.	125
	6. A vehicle as claimed in any one of the preceding claims wherein the obturating member, or at least one of the obturating members, constitutes a duct for supplying a fluid which forms at least one curtain of moving fluid issuing from the lower part of the obturating member.	
	7. A vehicle as claimed in claim 5 and claim 6 wherein the fluid which issues from the lower part of the obturating member to form the curtain or curtains of moving fluid serves also to inflate the member.	
	8. A vehicle as claimed in claim 5 and claim 6 comprising at least one supply port formed in the lower part of the obturating member and means for supplying a fluid, other than that for inflating the obturating member, to the supply port to issue therefrom and form the curtain of moving fluid.	
	9. A vehicle as claimed in claim 8 comprising at least one port formed in the bottom surface of the vehicle and extending transversely thereof, wherein the means for supplying fluid to the supply port comprises two opposed flexible walls depending downward from the port, said supply port being formed by the lower ends of said flexible walls.	
	10. A vehicle as claimed in any one of the claims 6 to 9 wherein means are provided for forming two parallel curtains of moving fluid from the lower part of an obturating member whereby a subsidiary cushion of pressurised gas can be formed and contained beneath the bottom of an obturating member by the	



- parallel curtains, said subsidiary cushion acting to maintain a clearance between the bottom of the obturating member and the surface over which the vehicle is operating.
- 5 11. A vehicle as claimed in any one of the claims 1 to 10 comprising an obturating member extending transversely at the rear of the vehicle, between the wall structures, wherein said member is provided with means
- 10 to provide a restoring force opposing the deflection of the member.
12. A vehicle as claimed in claim 11 wherein the means to provide a restoring force comprises a spring or hydraulic or pneumatic system.
- 15 13. A vehicle as claimed in claim 11 wherein the means to provide a restoring force comprises a diaphragm extending between the member and the lower part of the vehicle to
- 20 form an inflatable bag on the side of the member remote from the cushion space, and means for supplying a fluid to inflate said bag.
14. A vehicle as claimed in claim 13 wherein means are provided for controlling the inflation pressure of the inflatable bag.
15. A vehicle as claimed in claim 1 or claim 2 wherein the wall structure is of flexible construction.
- 30 16. A vehicle as claimed in claim 15 wherein the wall structure is inflatable.
17. A vehicle as claimed in one of the claims 1, 2, 15 or 16 wherein the wall structures constitute ducts for supplying a fluid
- 35 which forms at least one curtain of moving fluid which issues from the lower parts of the wall structures.
18. A vehicle as claimed in claim 16 and claim 17 wherein the fluid which issues from the lower parts of the wall structures to form
- 40 the curtains of moving fluid serves also to inflate the member.
19. A vehicle as claimed in claim 16 and claim 17 comprising at least one supply port
- 45 formed in the lower part of each of the wall structures and means for supplying a fluid, other than that for inflating the wall structures, to said supply port to issue therefrom and form the curtain of moving fluid.
- 50 20. A vehicle as claimed in claim 19 comprising at least one port formed in the bottom of the vehicle and along each side thereof, wherein the means for supplying fluid to each of the supply ports comprises two opposed
- 55 flexible walls depending downward from each of said ports, said supply ports being formed by the lower ends of said flexible walls.
21. A vehicle as claimed in any one of the claims 17 to 20 wherein means are provided
- 60 for forming two parallel curtains of moving fluid from the lower parts of each of the wall structures whereby a subsidiary cushion of pressurised gas can be formed beneath the bottom of each wall structure, said subsidiary cushion acting to maintain a clearance between the bottom of the wall structure and the surface over which the vehicle is operating.
22. A vehicle as claimed in any one of the preceding claims wherein at least two obturating members extend across the front and/or the rear of the vehicle, spaced apart in the direction of the fore and aft axis of the vehicle, whereby an auxiliary cushion or auxiliary cushions of pressurised gas can be formed between the obturating members.
23. A vehicle as claimed in claim 22 wherein means are provided for retracting one or other of said obturating members at the front and/or rear of the vehicle whereby the position of the centre of pressure of the cushion can be varied to control the trim of the vehicle.
24. 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 fluid forming a curtain.
25. A vehicle as claimed in claim 1 or claim 2 wherein the, or each, obturating member comprises two downwardly depending spaced apart parallel members, each member pivotally attached at its upper edge to the lower part of the vehicle, a horizontal base member extending between the bottom edges of the parallel members and pivotally attached thereto, two parallel supply ports formed in said base member and extending in the direction parallel to the longitudinal axis of the obturating member, and means for supplying a fluid to the space between the parallel members to issue from the supply ports and form the two parallel curtains of moving fluid whereby a subsidiary cushion of pressurised gas can be formed beneath the base member, the subsidiary cushion acting to maintain a clearance between the base member and the surface over which the vehicle is operating.
26. A vehicle as claimed in claim 25 wherein the outer of said supply ports is inclined inwards so as to cause the fluid forming the outer curtain to issue inwards towards the cushion space, and in which the inner of said supply ports is inclined outwards so as to cause the fluid forming the inner curtain to issue outwards away from the cushion space.
27. A vehicle as claimed in claim 26 wherein the inner supply port is narrower than the outer supply port.
28. A vehicle constructed substantially in accordance with any of the forms described herein with reference to the accompanying drawings and to the drawings accompanying the Provisional Specification.

H. W. GRACE,
Chartered Patent Agent, *llg*
Agent for the Applicant(s).