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(54) Title: AMPHIBIAN

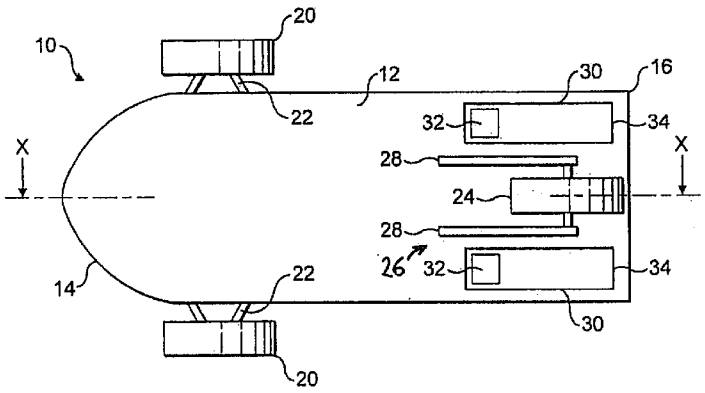


FIG. 1

(57) Abstract: An amphibian (10) capable of travel on land and on water is provided with a body and a planing hull (12), and three road wheels (20, 24) mounted on retractable suspension 22, 26 which may be protracted for road use, or retracted for use on water; and further comprises ride-on seating (40, fig. 2) for at least one driver to sit astride the body. Marine propulsion is provided by at least two jet drives (30), which have intakes (32) and nozzles (34). Fig. 3 shows a power train and retractable rear wheel suspension. Steering control may be by handlebars (42, fig. 2), or by a steering wheel (not shown). The jets may be driven by belts and/or driveshafts. A separate power source may be provided for marine use. A windscreen (44, fig. 2) may be fitted.

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# Amphibian

The invention relates to an amphibian, capable of travelling on water and on land.

Amphibians have been proposed and produced in various formats. Although amphibian bicycles have been proposed, the smallest engine driven amphibians have been motorcycles. Lehrberger (DE 19831324C2), Gong (US 6,540,569), and Buchanan (GB 2,254,831) all disclose designs for amphibian motorcycles.

Amphibians are dual purpose vehicles, and must therefore be equally usable on land as they are on water. Different classes of vehicle have different handling characteristics. Motorcycles are capable of fast acceleration and fast, steeply leaning cornering. The three machines described above, however, are heavy, wide, and bulbous in shape.

The addition to a motorcycle of equipment needed for travel on water leads to a large increase in weight. This additional weight will blunt performance on road, and reduce roadholding capability on corners. The width of the motorcycle must also be increased compared to the convention for a purely road machine, in order to provide both buoyancy and stability on water. This increased width limits the angle through which the machine can be leaned on corners on road. The additional weight and width will make the motorcycle feel cumbersome on road.

The present invention provides an amphibian according to claim 1. Thus, the amphibian is of a compact size, can rise rapidly onto the plane on water and is easy to handle on water.

Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a schematic underneath plan view of an amphibian of a first embodiment of the present invention;

Figure 2 is a side view of the amphibian of the first embodiment of the present invention; and

Figure 3 is a cut-away perspective view of the first embodiment of the present invention.

Referring to Figures 1, 2 and 3, an embodiment of the amphibian 10 is shown according to the present invention. The amphibian 10 comprises a buoyant "V" shaped hull 12. The hull 12 has a bow 14 and a stern 16. A body 11 is attached to the hull 12.

A pair of front wheels 20 are connected adjacent to the bow by front suspension 22. The front suspension 22 is preferably in the form of double wishbone suspension, or may alternatively be formed of any known type of suspension.

A single rear wheel 24 is connected adjacent to the stern by rear suspension 26. The rear suspension 26 is preferably in the form of a pair of rearwardly trailing arms 28, rotatably supporting the wheel 24 between them. The arms 28 are rotatably attached to the chassis by pivots 35 at their forward ends. The rearwardly trailing arms preferably

form an A-frame. A laterally extending strut 29 connects the arms 28 and forms an apex of the A-frame. A coil spring over shock absorber unit 31 is connected to the strut 29 to allow damped suspension movement of the arms 28. Alternatively, the rear suspension may comprise a single trailing arm supporting the wheel 24.

The front suspension 22 and rear suspension 26 are retractable for use of the amphibian on water. The suspension 22,26 is preferably retractable over a waterline of the vehicle when on water. The suspension 22,26 can be protracted for use on land.

The front wheels 20 may be retracted by any known means. For example, hydraulic suspension struts can provide for damping of wheel movement and also retraction of the wheels. Such struts are known from US 2003/0047899 of the present Applicant. Alternatively, wheel retraction may be achieved with an actuator rotating part of the suspension assembly, for example as known from US 5,531,179 of Roycroft. Alternatively, the wheels 20 may be retracted by rotation of the wheel or suspension upright about a local axis of rotation so that the outer derside of the wheels when on land is directed to face downwardly over water

The rear wheel 24 may be retracted by an actuator 33, e.g. a hydraulic actuator or pneumatic actuator, preferably attached to the coil spring over shock absorber unit 31. The trailing arms 28 may be rotated upwardly around the pivot 35 by the actuator 33.

The amphibian 10 is propelled on water by water jet drives. The amphibian comprises two water jet drives 30.

Each water jet drive 30 comprises a jet inlet 32, the jet inlet 32 preferably opening onto a bottom surface of the hull to take water in to the jet drive 30. Each jet drive 30 further comprises a jet nozzle 34, opening rearwardly. Water is expelled through the jet nozzles by an impeller to propel the amphibian 10 on water.

The two water jet drives 30 are offset laterally from a centreline X-X of the amphibian 10. The water jet drives 30 are located symmetrically about the centreline X-X. The water jet drives 30 are located outwardly of the rear wheel 24, such that water expelled from the water jet drives 30 passes either side of the rear wheel 24, when said wheel is protracted.

The water jet drives 30 are powered by a power source in the amphibian, preferably by an engine 37, e.g. an internal combustion engine. The output of the engine 37 is connected to a gearbox 46. The gearbox 46 may be a continuously variable transmission (CVT). The gearbox 46 is operably connected to a driveshaft 39, the driveshaft 39 connected to the rear wheel to drive the rear wheel. The output of the gearbox 46 is preferably on or near the longitudinal axis of the amphibian.

The engine also drives two belt drives 48, each belt drive 48 extending laterally outwardly from the vehicle centreline. Each belt drive comprises an endless belt looped around two spaced apart supporting wheels. Each belt drive 48 drives a driveshaft 50, the driveshafts 50 extending rearwardly and substantially parallel to the longitudinal axis of the amphibian. Each driveshaft 50 is connected to and drives the impeller of one of the water jet drives 30.

Each water jet is therefore independently (i.e. separately) driven. Each water jet is driven from a common power source.

Alternatively, the driveshafts may be connected to the gearbox by gears, in particular, bevel gears.

The front wheels 20 are preferably not driven when the amphibian 10 is on land. Alternatively, the front wheels 20 may be driven by the same power source as the water jet drives 30. Alternatively, the front wheels 20 may be driven by a power source separate from the power source driving the water jet drives 30. The separate power source may be a second engine (e.g. internal combustion engine) or an electric motor. The rear wheel may be driven in addition to the front wheels 20, either from the same power source as the water jet drives 30 or from the separate power source.

Although twin jets may be assumed to be heavier than a single jet drive, a surprising result occurs when comparing the two layouts. To provide equivalent performance from twin jets as from one jet, the twin jets will be specified as being of smaller diameter than the equivalent single jet. This reduces the tip speed of the jet blades compared to the single jet drive; which makes the twin jets less liable to cavitation at speed. It is also found that as forces at the tips of the blades go up as the square of the rotational speed, a smaller jet can be built more lightly than a single jet, because it is of smaller diameter. Hence, twin jets may in themselves be lighter than a single jet drive; and may still be lighter overall, even when a more complex transmission is necessarily specified than for a single jet drive.

An advantage of twin jets is that the amphibian can rise rapidly onto the plane on water, perhaps one or two seconds faster than an equivalent machine with a single jet drive. The drawbacks of twin jets are in cost, and packaging; and a reduction in top speed on water due to the increased pumping losses through the additional jet drive. The top speed might, for example, be reduced by four knots for a compact amphibian.

A twin jet machine will be easier to ride, less ultimately fast but more relaxing.

The amphibian 10 is a ride-on amphibian, in which a driver sits astride the body 11 of the amphibian. A seat 40 is located on the body 11, on which the driver can sit. The seat 40 may be large enough to seat a passenger behind the rider. One or more recesses (not shown) may be provided in seat 40 to allow the rider and/or passenger(s) to "step through" the seat.

The driver steers the amphibian through handlebars 42. The handlebars are connected to the front wheels 20 for steering the amphibian on land, and connected to a rudder or other steering means for steering the amphibian on water. Alternatively, a steering wheel may be used in place of the handlebars, for steering the amphibian 10 on land and water.

The seat 40 is located above the power source which provides power to the water jet drives and/or the wheels. A windscreen 44 may extend upwardly from the body 11, for spray and weather protection.

The amphibian 10 has been described as having two jet drives. Alternatively, the amphibian 10 may have three or more jet drives. Each jet drive is preferably driven by a driveshaft as described above.

It will be noted from the above description that unlike the prior art by Buchanan, Gong, Lehrberger, and Grzech (US 5 690 046), the amphibian according to the invention does not have body parts (e.g., wheel covers) which move when the amphibian changes mode from road to marine or vice versa. Such moving body parts have been proposed in numerous prior patents - even with four wheels, as in US 4,958,584 to Williamson - but they are rarely seen on production vehicles. They add weight, cost, and complexity; and are liable to be troublesome when they encounter real world obstacles to progress, such as sand, driftwood, and corrosion. The applicant has found when testing prototype amphibians that surprisingly, the reduction in planing area caused by leaving open a wheel well for a single rear wheel is more than compensated for by the greater ease with which the amphibian rises onto the plane when the weight of movable wheel covers and their associated drive mechanisms does not have to be lifted onto the plane.

To express this arrangement of "no moving body parts" another way, all road wheels are exposed to water when retracted by the retractable suspension.

It is considered that a combination of two front and one rear road wheels with twin jet marine drives provides an ideal combination of accessible marine performance, failsafe road stability, and carrying capacity. These characteristics may be combined with ride on seating, which provides best

visibility in all directions; and being aligned with the longitudinal centre line of the vehicle, gives good lateral weight distribution, even when there is only the driver on the vehicle.

The use of two front wheels offers good stability on road, while twin jet drives can be easily packaged either side of the single rear wheel. This is in contrast to US 5,690,046 to Grzech, where the single front wheel requires complex retraction arrangements and the twin rear wheels only allow use of a single jet drive. Furthermore, it is commonly agreed that Grzech's layout of one front and two rear wheels is not the most stable on land.

Any of the described features may be combined with any feature from any of the embodiments.

CLAIMS

1. An amphibian capable of travel on land and on water, provided with a body and a planing hull, and two front road wheels and a single rear road wheel mounted on retractable suspension which may be protracted for road use, or retracted for use on water;

and further comprising ride-on seating for at least one rider to sit astride the body,

wherein marine propulsion is provided by at least two jet drives.

2. An amphibian according to claim 1, where no part of the body or hull changes position when the retractable suspension protracts or retracts.

3. An amphibian according to claim 1, where the amphibian has a land mode and a marine mode, and where no part of the body or hull changes position in changing from land mode to marine mode or vice versa.

4. An amphibian according to claim 1, where all road wheels are exposed to water when the retractable suspension is retracted.

5. An amphibian according to claim 1, comprising two spaced apart jet drives, wherein each jet drive is offset laterally from a centreline of the amphibian.

6. An amphibian according to claim 5 comprising a power source, wherein each jet drive is driven by a belt drive connected to the power source.

7. An amphibian according to any one of the preceding claims wherein each jet drive is driven by a driveshaft extending substantially parallel to a centreline of the amphibian.

8. An amphibian according to claim 7 comprising a power source, wherein each driveshaft is driven by a belt drive connected to the power source.

9. An amphibian according to claim 8 wherein the power source is connected to each belt drive substantially at a centreline of the amphibian, the belt drives extending laterally outwardly in opposite directions from the centreline to the driveshafts.

10. An amphibian according to any one of the preceding claims wherein an intake of each jet drive is on an underside of the hull.

11. An amphibian according to any of the preceding claims, comprising a first power source providing power for travel on both land and water.

12. An amphibian according to any one of claims 1 to 10, comprising a first power source providing power for travel on land and a second power source for providing power for travel on water.

13. An amphibian according to claim 10 or 11 wherein seating for at least one person is located above the first power source.

14. An amphibian according to any one of claims 11 to 13 wherein the first power source is an engine.

15. An amphibian according to any one of the preceding claims, comprising handlebars for providing steering control of the amphibian.

16. An amphibian according to any one of claims 1 to 14, comprising a steering wheel for providing steering control of the amphibian.

17. An amphibian according to any of the above claims, comprising a windscreen.

18. An amphibian substantially as hereinbefore described with reference to and as shown in any one or more of the accompanying Figures.

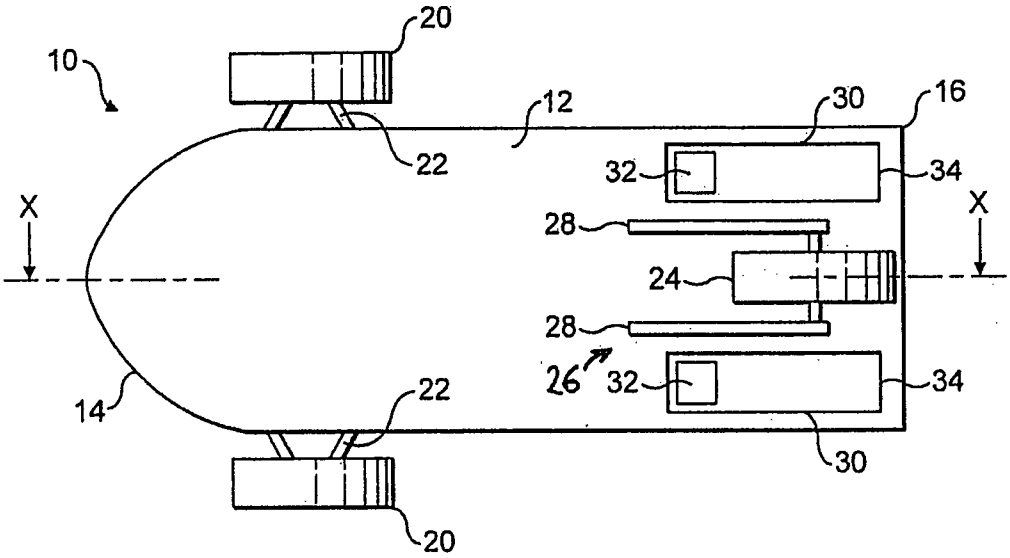
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FIG. 1

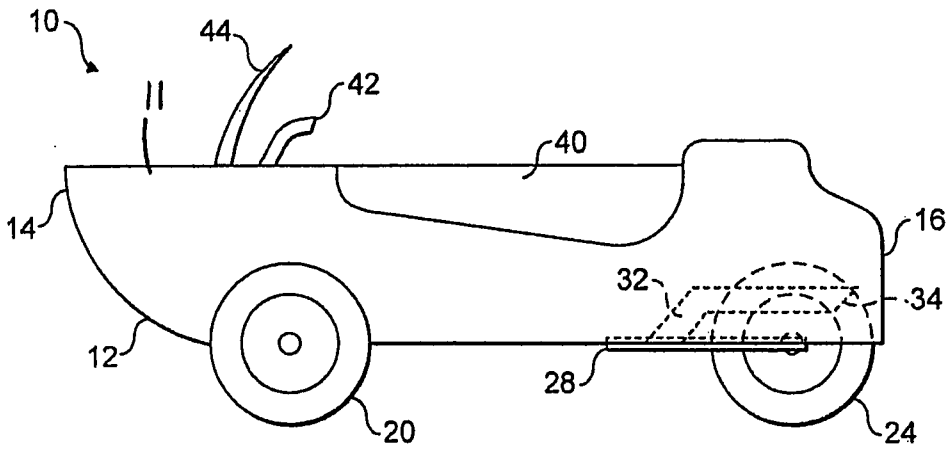
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FIG. 2

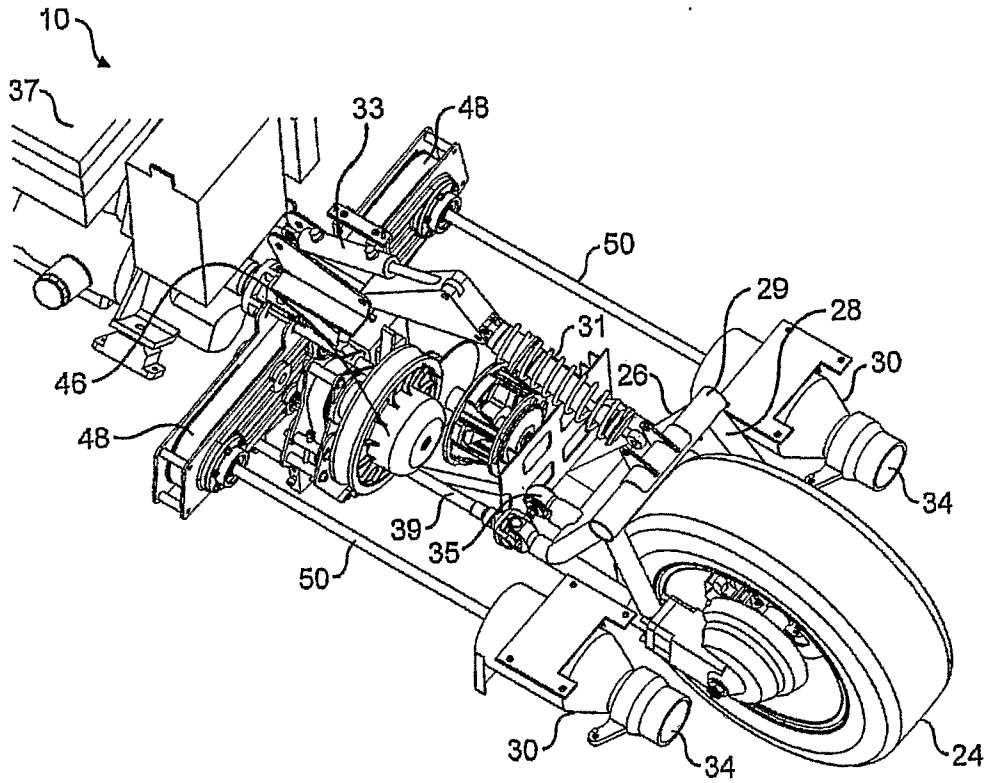


FIG.3

# INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2008/002860

A. CLASSIFICATION OF SUBJECT MATTER
INV. B60F3/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B60F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 11 November 2008 | 18/11/2008 |

| Name and mailing address of the ISA/ | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040,<br>Fax: (+31-70) 340-3016 | Untermann, Nils |

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International application No
PCT/GB2008/002860

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

International application No
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