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WATER VESSEL WITH FLOODING SPACE

Description

[0001] The invention relates to a watercraft with a hull, which has a flow channel or with which a flow channel is associated, wherein a motor-driven water acceleration arrangement, in particular a propeller, is associated with the flow channel.

[0002] A watercraft of this type is known from DE 10 2004 049 615 A1 or US 4341177. Such watercraft are used in particular as diving sleds. They have a handle arrangement which a user can grip while he or she lies with part of his/her upper body on the upper side of the hull of the watercraft. A flow channel, in which a propeller is accommodated, is arranged within the hull. The propeller is driven by an electric motor which is supplied with electricity via a rechargeable battery. During operational use, both the rechargeable battery and the engine develop waste heat that must be exchanged into the environment to be able to maintain a reliable continuous operation. To this end, the rechargeable batteries are inserted in an aluminium housing, wherein the accumulators are in thermally conductive contact with the aluminium housing. The hull has a lower-side receiving space into which the aluminium housing can be inserted and locked therein. In this way, the aluminium housing is, on the underside, in connection with the flowing water and the heat exchange can take place there.

[0003] For cooling purposes, the electric motor is arranged inside the flow channel. The water guided through the flow channel is directed around a housing of the electric motor, whereby an effective motor cooling is possible. The electric motor restricts the free flow cross-section in the flow channel. The flow channel must therefore be dimensioned to be sufficiently large to compensate for the shadowing caused by the electric motor. In this way, the scale of the watercraft is affected.

[0004] To be able to perform a drive operation with the known watercraft, both underwater and on the water, an accurate weight balancing is required. Accordingly, the watercraft should develop enough buoyancy that it is sufficiently floatable and therefore cannot sink. However, the buoyancy should not be too strong, so that a rapid change from surface running to underwater running is possible. Due to the dead weight of the electrical units, the watercraft hull must have sufficiently large buoyancy bodies as to affect the scale and thus the driving dynamics of the watercraft.

[0005] The object of the invention is to provide a watercraft of the type mentioned at the outset which provides sufficient operational reliability and high driving dynamics.

[0006] This object is achieved in that the hull has a flooding chamber which is

connected to the surroundings via water passage openings, in particular water inlet openings and water outlet openings.

[0007] The flooding chamber therefore provides a variable mass component with which the dead weight of the watercraft can be affected. The flooding chamber fills during operation. While the watercraft is diving, air is displaced from the flooding chamber and the watercraft can dive quickly and easily. When the watercraft is lifted out of the water after use, the flooding chamber then empties and does not affect the transport weight of the watercraft.

[0008] According to a preferred variant of the invention, it can be provided that at least one electrical unit is arranged in the flooding chamber. The flooding chamber is therefore additionally used in the cooling of the electrical unit. The electrical unit can release the waste heat thereof to the water flowing in the flooding chamber. An effective heat exchange is therefore possible, particularly because the flooding chamber is connected to the surroundings via both water inlet openings and water outlet openings. Consequently, a flow can thus be generated in the flooding chamber via which cool water is continuously supplied. Depending on the driving speed of the watercraft, the flow velocity in the flooding chamber can then also vary. This has the advantage that there is a high cooling volume available at high speeds when the generation of waste heat is also high.

[0009] The control electronics, the electric motor driving the water acceleration arrangement, and/or an energy storage unit can be arranged in the flooding chamber as electrical unit. These units produce relatively high power dissipation and are therefore particularly suitable for use in the flooding chamber.

[0010] A simple construction is then provided for the watercraft in that the hull comprises an upper part and a lower part, between which the flooding chamber is formed, and that the upper and/or the lower part form the outer shell of the hull at least in areas.

[0011] Advantageously, it can be provided that the lower part is detachably connected to the upper part. Then the flooding chamber can be made accessible for the purpose of easy maintenance. If contaminants have entered the flooding chamber, for example, these can easily be removed again. If electrical units are arranged in the flooding chamber, they can readily be maintained or replaced after removal of the lower part.

[0012] An effective flow through the flooding chamber can be achieved in that the hull forms at least one inlet opening in the region of the bow and at least one outlet opening in the region of the stern.

[0013] A preferred variant of the invention is such that the flow channel is arranged at

least in regions in the region of the flooding chamber and tapers the free cross-section of the flooding chamber, and in that an electrical unit is arranged in the region of the tapered cross-section. The flow rate in the flooding chamber can be changed through the cross-sectional tapering. Accordingly, the flow rate increases in some regions in the tapered cross-section so that the cooling performance can be affected thereby.

[0014] It is also conceivable that two partial regions are structurally delimited with respect to one another in the flooding chamber, wherein a water inlet and/or water outlet opening is associated with each partial region. By this measure, the volume flow rate can be selectively adjusted in the individual partial regions and can thus affect the cooling capacity.

[0015] A particularly preferred embodiment of the invention is such that the flow channel at least partially delimits two partial regions in the flooding chamber with respect to one another and that an electrical unit is arranged in each of the partial regions. Thus, using the flow channel for differentiating the regions will lower the parts cost.

[0016] A possible variant of the invention is configured such that the electrical unit is fixed by means of a suspension, and that the suspension holds the electrical unit at a distance from the wall elements delimiting the flooding chamber. In this way, a large-scale flow around the electrical unit and, consequently, an effective heat dissipation can be achieved.

[0017] A preferred embodiment of the invention provides that the watercraft with a flooded flooding chamber has a buoyancy of at least 4 kilograms. In this way, the watercraft is kept sufficiently afloat at sea. It is particularly advantageous if the buoyancy of the watercraft is at least 7 kilograms. Then, in case of damage, sufficient buoyancy can be provided to keep both the watercraft and the user buoyant.

The invention is described below in greater detail with reference to an exemplary embodiment shown in the drawings. In the figures:

Fig. 1 shows a watercraft in a perspective side view from the rear,

Fig. 2 shows the watercraft according to Fig. 1 in a perspective side view from below and with the lower part removed,

Fig. 3 shows a vertical section through the stern region of the watercraft according to the view according to Fig. 2, and

Fig. 4 shows the watercraft according to Fig. 2 in a detail view from below.

[0018] Fig. 1 shows a watercraft that has a hull 10. The hull 10 is composed from an upper part 20 and a lower part 30. The upper part is equipped with two control handles 14 which are arranged on the two sides of the hull 10. A user may hold onto said control

handles 14 and control the watercraft with operating elements applied on the control handles 14. In particular, the motor output of the watercraft may be varied here. The user, who holds onto the control handles 14, rests with the upper body partially on upper part 20 in the region behind a display 15.

[0019] As is clear from Fig. 2, the lower part 30 may be disassembled from the upper part 20. It is screwed onto the upper part 20 for this purpose. Fig. 2 shows the watercraft with the lower part 30 removed. As is clear from this depiction, a receiving space is consequently formed between the upper part 20 and the lower part 30. This receiving space is delimited on the upper side by means of a bottom wall 22 of the upper part 20. Components of the watercraft may be stably mounted to said bottom wall 22.

[0020] As is clear in Fig. 2, an electronic control system 40 is mounted in the region of the bow 11 of the watercraft. A drive assembly designed as electric motor 50 is accommodated downstream of the electronic control system 40 in a protected way in a housing offset in the direction toward the stern 12. The output shaft of motor 50 is inserted through a jacket tube 51 and bears a propeller 52 on its free end. The propeller 52 is arranged in a flow channel 60. The flow channel 60 is formed by a hollow body which forms a suction port 61 in the region of the underside of the watercraft. Said suction port 61 is stabilised by a guide element 62 arranged in the centre of the suction port 61. The guide element 62 has the task of stabilising the driving operation in addition to its mechanical protective function. It functions similarly to a centreboard of a sail boat. Furthermore, the guide element 62 also protects the flow channel 61 in the region of the suction port from mechanical loads, if the watercraft runs aground or is set down on land. In the region between the upper part 20 and the lower part 30, a receiving space is formed below the bottom wall 22, as previously mentioned, in which receiving space the electrical components, namely the control electronics 40, the motor 50, and the energy storage units 70 (accumulators) are accommodated. This receiving space is connected to the surroundings via water passage openings. The water passage openings are formed in the lower part 30. As is clear from Fig. 1, the water passage openings are designed in the region of the bow 11 as water inlet openings 35 and in the region of the stern 12 as water outlet openings 33. The receiving space consequently forms a flooding chamber. This chamber is flooded with water, which penetrates through the water passage openings, as soon as the watercraft is placed into the water. As soon as the watercraft transitions into drive operation, a flow is generated in the flooding chamber. Correspondingly, water enters into the flooding chamber through water inlet openings 35. The water flows through the flooding chamber and flows around electrical units mounted in the flooding chamber.

The water absorbs the power dissipation from the electrical units and cools them. After flowing through the flooding chamber, the water exits through the water outlet openings 33, which are arranged symmetrically on the two sides of the jet discharge 34.

[0021] It is additionally clear from Fig. 2 that the flow channel 60 extends in the region of the flooding chamber and partially delimits two partial regions lying opposite one another in the flooding chamber. An energy storage unit (accumulator) is arranged in each of the partial regions. Each of the partial regions also has one of the two water outlet openings 33. The electrical units are applied to the bottom wall 22 of the upper part 20 by means of suspensions. The suspension is selected so that the electrical units are mounted at a distance from the bottom wall 22 in the regions via which the waste heat is exchanged. Thus, the water may effectively flow around the units in the flooding chamber. It has been demonstrated that the arrangement of the flow channel 60 in the flooding chamber involves a cross-sectional tapering of the flooding chamber. In this way, an increase of the flow speed is achieved in the tapered region. Due to this speed variation, the water flow and thus the cooling effect may be adjusted depending on the electrical components to be cooled. In the present exemplary embodiment, the energy storage units 70 are arranged in the region of the tapered cross sections of the partial regions.

[0022] At the end facing away from the suction port 61 in the direction of flow, the hollow body forms a flange area on which an impeller housing 63 may be flange mounted. The propeller 52 projects into the impeller housing 63. A flow stator 53 is arranged downstream of the propeller 52 in the direction of flow. During operation, the propeller 52 sucks water through the suction port 61 into the flow channel 16, accelerates same, and discharges it through the impeller housing 63 in the region of the jet discharge 34. The stator 53 has the task of straightening out the rotating water movement so that the flow discharges from the jet discharge as free of twist as possible for the purpose of improving efficiency.

[0023] As is clear from Fig. 1, the upper part 20 has receptacles 21 in the region of the bottom wall 22. These receptacles 21 are arranged on the two sides of the flow channel 60.

[0024] As is clear from Fig. 3, the receptacles 21 are arranged on two sides of the central longitudinal plane of the watercraft extending through the central longitudinal axis L (see Fig. 2). The central longitudinal plane extends vertically in Fig. 3. The association of the two receptacles 21 with the central longitudinal plane is selected so that a symmetrical design results. Energy storage units 70, which are currently designed as electric accumulators, are arranged in the receptacles 21. Due to the symmetrical

arrangement of the receptacles 21, energy storage units 70 are also arranged symmetrically to the central longitudinal plane.

[0025] The arrangement of energy storage units 70 in the receptacles 21 can be clearly seen in Fig. 4. As Fig. 4 illustrates, the receptacle 21 is dimensioned longer in the longitudinal direction L of the watercraft than the extension of the energy storage unit 70 in this direction. Consequently, the receptacle 21 provides space for the alternative installation of another energy storage unit 70, which has a correspondingly larger structure and consequently a higher output.

VANDFARTØJ MED FYLDNINGSRUM

Patentkrav

1. Vandfartøj, nemlig en dykkeslæde med et skrog (10), som har en strømningskanal (60), eller til hvilket der er tilordnet en strømningskanal (60),
hvor en motordrevet vandaccelerationsanordning, særligt en propel, er tilordnet strømningskanalen (60),
kendetegnet ved,
at skroget (10) desuden indeholder et fyldningsrum, der via vandgennemløbsåbninger, nemlig en vandindløbs- og en vandudløbsåbning (35, 33), har forbindelse til omgivelserne, så der under sejladsen via vandindløbsåbningen (35) løber vand ind i fyldningsrummet, og at vandet til frembringelse af en vandstrømning i fyldningsrummet igen forlader fyldningsrummet via vandudløbsåbningen (33).

2. Vandfartøj ifølge krav 1,
kendetegnet ved,
at der i fyldningsrummet er placeret i det mindste en elektrisk enhed.

3. Vandfartøj ifølge krav 1 eller 2,
kendetegnet ved,
at den elektriske enhed er en styringselektronik (40), en elektromotor (50) og/eller en energiakkumulator (70).

4. Vandfartøj ifølge et af kravene 1 til 3,
kendetegnet ved,
at skroget (10) har en overdel (20) og en underdel (30), mellem hvilke fyldningsrummet er dannet, og at over- og/eller underdelen (20, 30) i det mindste områdevist danner skrogets (10) ydre skal.

5. Vandfartøj ifølge et af kravene 1 til 4,
kendetegnet ved,
at underdelen (30) er forbundet løsbart med overdelen (20).

6. Vandfartøj ifølge et af kravene 1 til 5,
kendetegnet ved,
at skroget (10) danner i det mindste en indløbsåbning (35) i området ved forstavnen (11) og i det mindste en udløbsåbning (33) i området ved agterstavnen (12).

7. Vandfartøj ifølge et af kravene 1 til 6,
kendetegnet ved,
at strømningskanalen (60) i det mindste områdevist er placeret i området ved fyldningsrummet og tilspidser det frie tværsnit af fyldningsrummet,
og **at** der i området ved det tilspidsede tværsnit er placeret en elektrisk enhed (energiakkumulator (70)).

8. Vandfartøj ifølge et af kravene 1 til 7,
kendetegnet ved,
at strømningskanalen (60) i det mindste områdevist afgrænser to delområder i fyldningsrummet i forhold til hinanden,
og **at** der i hvert af delområderne er placeret en elektrisk enhed (energiakkumulator (70)).

9. Vandfartøj ifølge et af kravene 1 til 8,
kendetegnet ved,
at to delområder i fyldningsrummet er afgrænset konstruktionsmæssigt i forhold til hinanden,
hvor der er tilordnet en vandindløbs- og/eller en vandudløbsåbning (35, 33) til hvert delområde.

10. Vandfartøj ifølge et af kravene 1 til 9,
kendetegnet ved,
at den elektriske enhed er fastgjort ved hjælp af en ophængning,
og **at** ophængningen holder den elektriske enhed i en afstand til vægelementet, der afgrænser fyldningsrummet.

11. Vandfartøj ifølge et af kravene 1 til 10,
kendetegnet ved,

at det ved fyldt fyldningsrum har en opdrift på mindst 4 kilogram, fortrinsvis 7 kilogram.

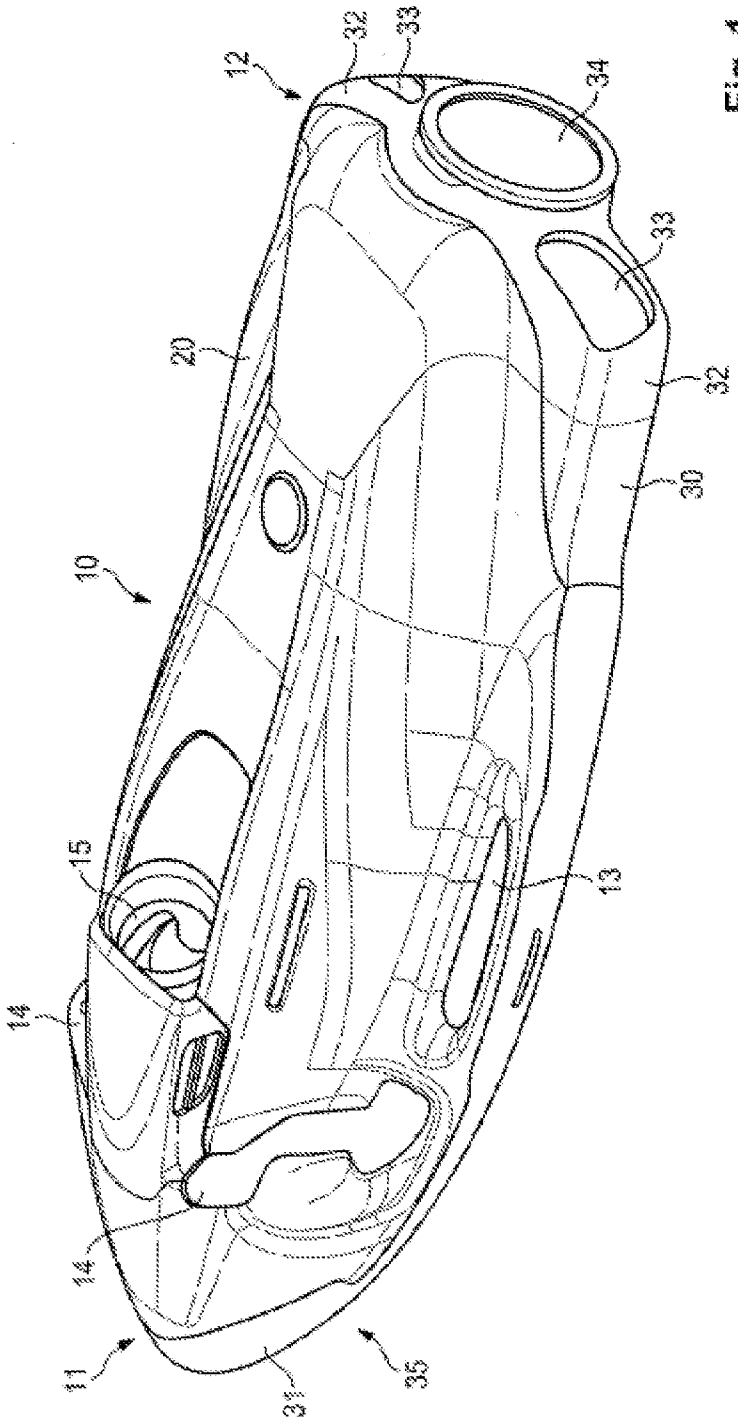

Fig. 1

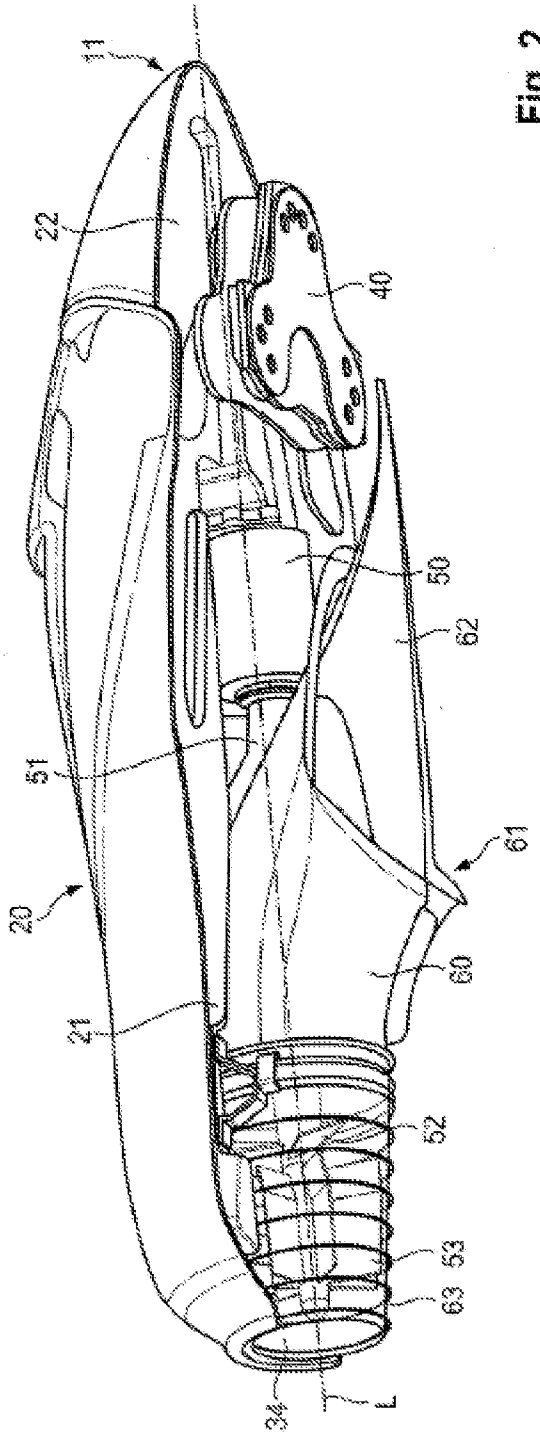

Fig. 2

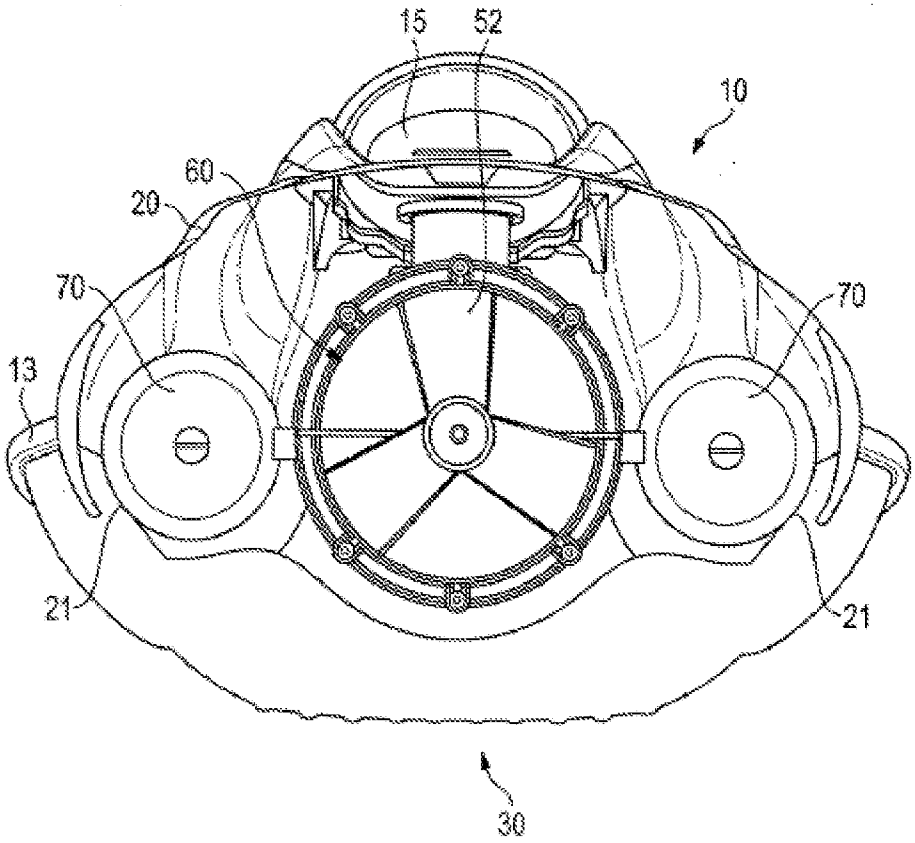

Fig. 3

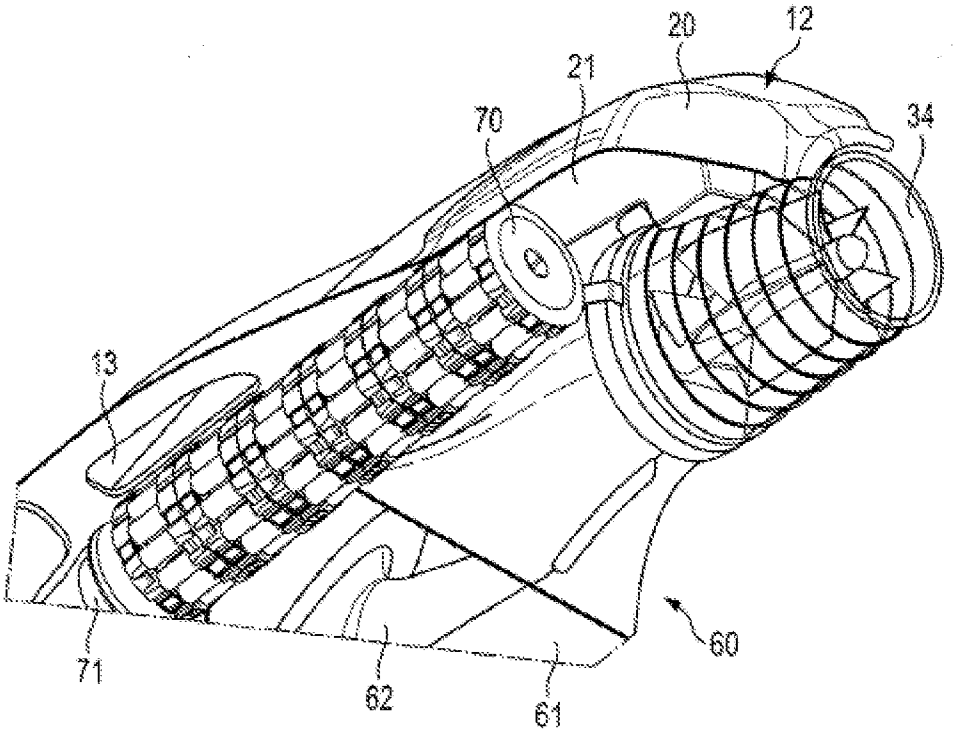

Fig. 4