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(56) Documents Cited:
GB 2428459 A **GB 2093152 A**
GB 1202228 A **GB 0519623 A**
GB 0244385 A **WO 2005/113336 A1**
US 4392621 A **US 3920203 A**
US 20030150962 A1

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(54) Abstract Title: **The use of porous surfaces for flight controls**

(57) A lift generating body has porous regions and a valve system for controlling flow through these regions for influencing the lift. Preferably flow, 1, approaches the aerodynamic body, 2, at an angle of attack intended to generate lift. The porous surface, 3, on one surface of the body, 2, allows part of the flow to pass through to the other surface, 4, when the valve, 5, is open thus reducing the lift which the body generates. When the valve, 5, is closed flow between the two surfaces is prevented and the aerodynamic body provides the lift as though the surfaces were continuous. The porosity of the porous regions may be anywhere between zero and one, some of the porous regions may be blown with fluid, the porous regions may be on the same side of the body, and the working fluid may be air or water.

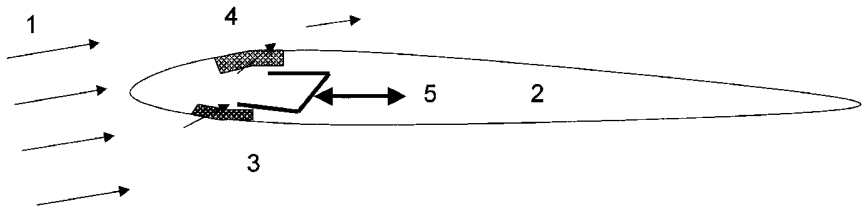

Figure 1

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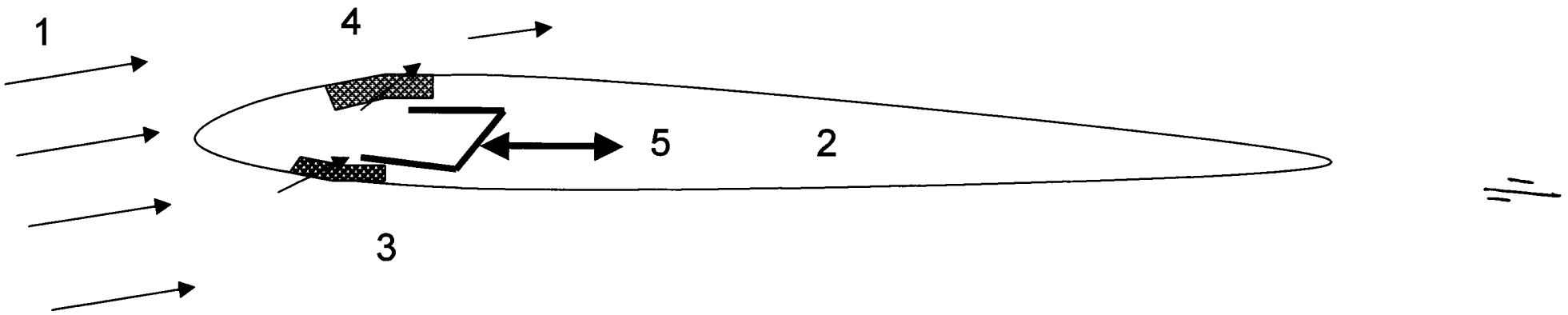

Figure 1

The Use of Porous Surfaces for Flight Controls

Most aerodynamic bodies have a means for changing the amount of lift that they generate. This is usually done via the deployment of part of the surface. For example elevators and ailerons normally deflect into the flow to increase or decrease lift; flaps are extended from the aerodynamic body in order to increase area and circulation and therefore lift; spoilers are deflected into the flow to cause separation to reduce lift and increase drag.

Sometimes, there may be a need to change the lift of an aerodynamic body without altering the shape or smooth contour of the body itself.

This invention relates to the use of porous parts of the aerodynamic surfaces to provide a means of changing lift without changing the external shape of the body.

On an aerodynamic body which is generating lift there is pressure difference between the upper and lower surfaces. This difference in pressure results from the relative flow paths of the surroundings over the two surfaces (circulation). By connecting the two surfaces at some discreet location (ports or openings) along the aerodynamic body, it is possible to reduce the pressure difference and change the lift generated. This can be achieved without changing the angle of attack of the aerodynamic body or the external profile of the surface. The action is similar in some ways to a spoiler – destroying lift locally along the surface.

In the simplest form, this can be achieved with slots or holes on both surfaces of the aerodynamic body. However, if the slots or holes are covered with a porous material the surfaces of the aerodynamic body may effectively appear to be continuous.

The lift of the aerodynamic body can be controlled internally by allowing or preventing flow between the two open or porous regions on the surfaces. All of the actuation mechanism can remain internal to the body.

The invention is more particularly described by way of Figure 1 which is a cross-section through a typical aerodynamic body. Flow, 1, approaches the aerodynamic body, 2, at an angle of attack intended to generate lift. The porous surface, 3, on one surface of the body, 2, allows part of the flow to pass through to the other surface, 4, when the valve, 5, is open. When the valve, 5, is closed flow between the two surfaces is prevented and the aerodynamic body provides the lift as though the surfaces were continuous.

Variations to this invention include the fact that it applies to hydrodynamic bodies as well as aerodynamic bodies. The porosity of opening in the surface can be varied and could be 1 in the limit. The valve could actuate on only one porous surface with the other surface being continuously open. There could be several different openings on the body at different locations each singly or multiply linked

and with individual valves. Two openings on the same surface could be linked and used to control lift. The flow to the surfaces could be augmented or replaced by forced (blown) flow from a compressor or from another part of the body.

The Use of Porous Surfaces for Flight Controls

CLAIMS

1 A lift generating body with porous regions and a valve system capable of controlling flow through these porous regions for the purpose of influencing the lift generated by the body.

2. A lift generating body as in claim 1 in which the porous regions are connected so that when flow is admitted through one porous region it is able to leave through another one under the control of the valve system.

3. A lift generating body according to any of the preceding claims in which the porosity of the porous regions can be anywhere between zero and one.

4. A lift generating body according to any of the preceding claims in which some of the porous regions can be blown with fluid.

5. A lift generating body according to any of the preceding claims in which the porous regions are on the same side of the body.

6 A lift generating body according to any of the preceding claims in which the working fluid is air.

7. A lift generating body according to any of the preceding claims in which the working fluid is water.

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Application No: GB0522437.3 **Examiner:** Chris Vosper

Claims searched: 1-7 **Date of search:** 23 February 2007

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-6	GB 0519623 A MESSERSCHMITT (figs. 1,2; page 1, lines 78-79)
X	1-6	GB 2093152 A WALMSLEY (fig. 3; page 1, lines 92-100)
X	1-5,7	GB 1202228 A SCHERER (figs. 3, 5; page 2, lines 56-74)
X,E	1-4,6	GB 2428459 A CITY (fig. 2b; page 11, lines 22-31)
X	1-4,6	GB 0244385 A AERO- (see whole document)
X	1-4,6	US 4392621 A VIETS (fig. 3; col. 4, line 10 to line 60)
X	1-3,5,6	US 2003/0150962 A1 ORBAN (see drawing)
X	1,3,4-6	US 3920203 A BOEING (figs. 1,2; col. 7, line 50 to col. 9, line 6)
X,E	1,3,5,6	WO 2005/113336 A1 AIRBUS (fig. 1; page 3, line 10 to page 4, line 15)

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art
Y	Document indicating lack of inventive step if combined with one or more other documents of same category	P	Document published on or after the declared priority date but before the filing date of this invention
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application

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Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC[X] :

F2R

Worldwide search of patent documents classified in the following areas of the IPC

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The following online and other databases have been used in the preparation of this search report

ONLINE:EPODOC,WPI,OPTICS