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Datasheet for the decision of 5 February 2009

Case Number: T 0325/05 - 3.3.05

Application Number: 99967724.8

Publication Number: 1140335

IPC: B01F 1/00

Language of the proceedings: EN

Title of invention:
Method and apparatus for reducing dissipation rate of fluid ejected into boundary layer

Applicant:
Cortana Corporation, et al

Opponent:
-

Headword:
Drag reduction/CORTANA

Relevant legal provisions:
EPC Art. 54, 56, 84, 123(2)

Relevant legal provisions (EPC 1973):
EPC Art.-

Keyword:
"Added subject-matter (main request, auxiliary requests I and II): yes"
"Clarity (main request, auxiliary requests I and II): no"
"Inventive step (auxiliary request III): yes - no pointer in prior art to use Görtler vortices"

Decisions cited:
-

Catchword:
-

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Case Number: T 0325/05 - 3.3.05

D E C I S I O N
of the Technical Board of Appeal 3.3.05
of 5 February 2009

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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 13 October 2004 refusing European patent application No. 99967724.8 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: G. Raths
Members: E. Waeckerlin
H. Preglau

Summary of Facts and Submissions

I. This appeal lies from the decision of the examining division to refuse European patent application No. 99 967 724.8.

II. The impugned decision is based on claims 1 to 12 filed with letter dated 10 July 2002 representing the main request, and claims 1 to 11 submitted during the oral proceedings before the examining division on 26 November 2003 and confirmed with letter dated 5 February 2004 as auxiliary request.

Independent claim 1 of the main request reads as follows:

"1. A method of releasing a drag-reducing substance into substantially only the near-wall region of the boundary layer of a first fluid (5) flowing relative to a first surface, said method comprising the following step:
(a) ejecting the drag-reducing substance, in solution or as a mixture with a fluid, through one or more slots, each slot including a Coanda surface over which the solution or mixture flows as it enters the flow path of the first fluid (5), said Coanda surface being located on the downstream side of the slot immediately adjacent the first surface."

III. In the decision, the examining division held that claim 1 of the main request lacked novelty over documents D1 and D2, respectively:

D1: US 4 987 844 A,

D2: US 4 186 679 A.

Claim 1 of the auxiliary request was found to be allowable.

IV. Notice of appeal was given with letter dated 10 December 2004. In the grounds of appeal dated 22 February 2005 the appellant argued *inter alia* that the employment of the Coanda effect in a method of releasing a drag-reducing substance is neither explicitly nor implicitly disclosed in D1 or D2.

V. In the annex to the summons to oral proceedings dated 30 June 2008 the board raised various objections under Articles 54, 56, 84 and 123(2) EPC.

VI. In reply the appellant submitted extensive comments with letter dated 5 January 2009, together with four sets of amended claims, representing the new main request, as well as three auxiliary requests I, II and III, respectively.

Moreover the appellant referred to three further documents, including in particular D16:

D16: P.A. Davidson: Turbulence. An Introduction for Scientists and Engineers.
Oxford : Oxford University Press, 2004,
p. 128 - 129.

VII. Oral proceedings were held on 5 February 2009. After discussion of the sets of claims submitted on 5 January 2009, the appellant introduced a further

amended set of claims 1 to 6 as the new auxiliary request III replacing the previous auxiliary request III.

VIII. Claim 1 of the main request reads as follows:

"1. A method of releasing a drag-releasing substance into substantially only the near-wall region of the boundary layer of a first fluid (5) flowing relative to a first surface, said method comprising the following step:
(a) ejecting the drag-reducing substance, in solution or as a mixture with a fluid, through one or more slots, each slot including a Coanda surface over which the solution or mixture flows as it enters the flow path of the first fluid (5), said Coanda surface being located on the downstream side of the slot immediately adjacent to the first surface."

Claim 1 of the auxiliary request I is identical with claim 1 of the main request.

Claim 1 of auxiliary request II reads as follows:

"1. A method of releasing a drag-releasing substance into substantially only the near-wall region of the boundary layer of a first fluid (5) flowing relative to a first surface, said method comprising the following steps:
(a) ejecting the drag-reducing substance, in solution or as a mixture with a fluid, through one or more slots, wherein on the upstream side of at least one of the slots a concave surface is provided, over which fluid flowing through the slot flows so as to create

Görtler vortices which pair together so as to produce lower pressure regions in the boundary layer of said fluid (5) adjacent said first surface, thereby causing the substance to remain in the vicinity immediately adjacent said first surface while said vortices are operative, and
(b) each slot includes a Coanda surface over which the solution or mixture flows a[s] it enters the flow path of the first fluid (5), said Coanda surface being located on the downstream side of the slot immediately adjacent the first surface."

Independent Claims 1 and 6, respectively, of the auxiliary request III of 5 February 2009 read as follows:

"1. A method of releasing a drag-reducing substance into a region consisting substantially of only the boundary layer of a first fluid flowing relative to a surface, said method comprising the following steps:
(a) conditioning the drag-reducing substance using fluid shear forces by causing a second fluid which includes said drag-reducing substance, as a mixture or in solution, to flow between the surfaces having dimples, grooves, or to flow through reduced areas, to thereby cause the drag-reducing molecules in said second fluid to unwind, lengthen, or to stretch in said second fluid; and,
(b) ejecting the drag-reducing substance, in solution or as a mixture with a fluid, through one or more slots, each slot including a Coanda surface over which the solution or mixture flows as it enters the flow path of the first fluid, said Coanda surface being located on the downstream side of the slot immediately

adjacent a wall and a concave surface, said concave surface being adapted to form Görtler vortices by the centrifugal effect of the fluid flow that is given angular velocity by the concave surface, wherein the Görtler vortices formed by the concave surface are paired in the opposite direction than naturally occurring quasi longitudinal vortex pairs in the boundary layer, such that the pressure differentials they create cause the vortices and the drag-reducing mixture to remain near the wall, wherein the time said vortices are operative is extended by causing the fluid to flow over a surface having dimples or grooves, and wherein the ejection velocity of the drag-reducing substance is in the range between 5 % and 10 % of the free stream velocity of the first fluid."

"6. An apparatus for ejecting a substance into a flowing fluid for carrying out the method according to claim 1, said apparatus comprising: a first slot including a concave surface on the upstream side and a Coanda surface on the downstream side of the first slot, said first slot including dimples or grooves on the Coanda surface."

IX. The arguments brought forward by the appellant in support of the main request may be summarised as follows:

The feature "*releasing a drag-reducing substance into substantially only the near-wall region of the boundary layer of a first fluid*" is disclosed in connection with the features of claim 6 as published under the regulations of the PCT. Consequently, the inclusion of

the feature in claim 1 does not offend against Article 123(2) EPC.

The expression *"near-wall region"* is conventionally used in the field of the invention, for example in:

D3: US 5 445 095 A.

The *"near-wall region"* includes the viscous sub-layer and the buffer zone of the boundary layer. A viscous sub-layer is where viscous forces predominate and the velocity profile is linear. Adjacent to the viscous sub-layer is the buffer zone which is a transitional zone between the viscous sub-layer and the logarithmic region. The logarithmic region is the outer portion of the turbulent wall layer where inertial forces predominate. According to D16 the *"near wall region"* is characterised in that the distance from the wall y is much smaller than the thickness of the boundary layer W, so that the inequation $y/W << 1$ applies. In the case of a torpedo or ship the *"near-wall region"* represents only a small portion of *"much less than 1 %"* of the total boundary layer thickness.

The method of claim 1 is distinguished from the methods disclosed in D1 and D2, respectively, by two features, namely:
(i) the drag-reducing polymer is ejected in tangential direction into the *"near-wall region"* of the boundary layer and not throughout the entire boundary layer and beyond, as described in D1 and D2; and
(ii) the downstream surface is a *"Coanda surface"* giving rise to a *"Coanda effect"* when the polymer is ejected. In contrast to that, in the case of D1 and D2,

the polymer is swept back by the flow stream, which is by definition outside the boundary layer. Neither D1 nor D2 discloses the employment of a *"Coanda effect"*. In view of the distinguishing features the claimed method is novel.

With regard to inventive step the appellant argued that the teaching of D1 and D2 leads away from the *"benefit of tangential ejection as manifest by the Coanda effect"*. Although the *"Coanda effect"* is a well known phenomenon as such, the prior art used other means to control the release of the drag-reducing substance in the ambient water flow, for example longitudinal riblets extending along the length of the surface as described in D3. In the appellant's view the conclusion, according to which a person skilled in the art would have applied the *"Coanda effect"* to improve the flow characteristics of a drag-reducing system and, thus, to reduce the consumption of drag-reducing substance, is based on hindsight. Prior to the present invention the focus did not lie on the improvement of the injector geometry, but on other features having an impact on drag reduction. Consequently the method of claim 1 involves an inventive step.

X. The appellant requested that the decision under appeal be set aside and that a patent be granted based on:
- claims 1 to 15 according to the main request submitted with letter dated 5 January 2009;
or on:
- claims 1 to 15 according to auxiliary request I;
or on:
- claims 1 to 14 according to auxiliary request II,

both auxiliary requests I and II, respectively, submitted with letter dated 5 January 2009;
or on:
- claims 1 to 6, page 8 to be deleted, according to auxiliary request III, filed during the oral proceedings before the board.

Reasons for the Decision

1. Allowability of amendments - Article 123(2) EPC

1.1 Claim 1 of the main request is based on the wording of independent claim 6 of the application as filed, i.e. as published under the PCT regulations, but with the exception that the feature of *"releasing a drag-reducing substance into* ***a region consisting substantially of only the boundary layer*** *of a first fluid"* has been replaced by the feature of *"releasing a drag-reducing substance into* ***substantially only the near-wall region of the boundary layer*** *of a first fluid"* (emphasis added). Having regard to Article 123(2) EPC, the question arises whether the amendment finds a basis in the application as filed.

1.2 Releasing the drag-reducing substance *"into a region consisting* ***substantially of only the near-wall region of a boundary layer*** *of the first fluid"* (emphasis added) is disclosed in claim 1 of the application as filed. It is not possible, however, to transfer this feature to claim 6 of the application as filed and, thus, to arrive at claim 1 of the main request. In fact, original claims 1 and 6, respectively, relate to two different methods. Whereas claim 1 relates to a method

of conditioning a drag-reducing substance comprising the steps of conditioning the drag-reducing substance by means of fluid shear forces, and releasing the drag-reducing substance by causing the fluid to flow over what is called *"a Coanda surface"*, claim 6 is concerned with one single step only, namely the ejection of the drag-reducing substance *"through one or more slots, each slot including a Coanda surface"* located *"on the downstream side of the slot immediately adjacent a wall"*.

In the board's view, it cannot be derived clearly and unambiguously from the contents of the application as originally filed that the feature set out in claim 1, according to which the drag-reducing substance is released *"into a region consisting substantially of only the near-wall region of a boundary layer"*, applies likewise to the method of claim 6. Therefore, the combination of this feature with the features of claim 6 of the application as originally filed leads to the definition of a new embodiment which has not been disclosed as such in the application as originally filed.

1.3 Apart from that, the concerned feature is worded differently in claim 1 of the application as filed and claim 1 of the main request, respectively, the two versions being as follows:

*"... the near wall region of **a** boundary layer of **the** first fluid ..."* (see original claim 1); and

*"... the near-wall region of **the** boundary layer of **a** first fluid"* (see claim 1 of the main request) (emphasis added).
Again there is no basis for such an amendment of the wording in the original application.

1.4 The applicant argued that the amendment emerges from page 1, lines 8 - 15; page 1, lines 27 - 28; and page 3, lines 14 - 20 of the description of the application as filed. The board cannot agree with this line of argument, because the statements referred to by the applicant are general in nature, none of them being specifically concerned with the method according either to claim 1 or to claim 6.

1.5 The board concludes, therefore, that the amendment of claim 1 of the main request contravenes Article 123(2) EPC.

1.6 The objections under Article 123(2) EPC apply likewise to claim 1 of auxiliary request I, which is identical to claim 1 of the main request.

1.7 Claim 1 of auxiliary request II also contravenes Article 123(2) EPC, because nowhere in the original application the feature of *"releasing a drag-reducing substance into substantially only the near-wall region of the boundary layer"* is disclosed in combination with the other features of claim 1.

2. Clarity of the claims - Article 84 EPC

2.1 There is no need to deal expressly with the requirement of clarity having regard to the main request and the

first and second auxiliary requests, since these requests fail for other reasons. Nevertheless the board finds it appropriate to make some comments, because the appellant has adapted the wording of the third auxiliary request in order to avoid any objection of lack of clarity.

2.2 According to the wording of the respective claims 1 of the main request and auxiliary requests I and II, the *"boundary layer"* encompasses what is called *"the near wall region"*. It is unclear, however, which specific part of the boundary layer is designated by the expression *"near-wall region"*. The board notes that no definition is given in the application as filed.

2.3 It has to be investigated, therefore, whether the expression *"near-wall region of the boundary layer"* has a generally recognised meaning in the relevant technical field, so that it can be regarded as being sufficiently clear in order to characterise the claimed method.

2.4 According to the appellant, the expression *"near-wall region"* is, in fact, a well known term describing *"the viscous sub-layer and adjacent buffer zone of the boundary layer"* (see letter dated 5 January 2009, page 6, paragraph 2.1). In support of this, the appellant referred to document D3, in particular column 2, lines 59 to 60, and document D16. These documents are discussed below in turn.

2.5 D3 uses the expression *"near wall region"* only once, namely in the passage referred to by the appellant. There it is explained that the turbulent skin friction

is reduced *"as the polymer reaches the near wall region"*. Similarly it is said in column 4, line 25, that effective skin friction reduction occurs in the *"near wall boundary layer"*. Neither the first, nor the second statement defines in any detail what is meant by the term *"near wall region"* as opposed to the *"boundary layer"*. Moreover the singular occurrence of the term *"near wall region"* in D3 neither means that the expression is well known, nor that it has a recognised meaning in the relevant technical field.

2.6 The second publication referred to by the appellant, i.e. D16, has been published only in 2004, more than four years after the priority date of the present application. For this reason alone, D16 must be disregarded for the purpose of establishing the proper meaning of the term *"near-wall region"* at the date of filing of the application.

2.7 But even if D16 was published earlier, it would not have led to the required clarification. D16 relates to a simple model of turbulent shear flow. The flow is divided into a number of regions including, in particular, an *"inner region"*, an *"overlap region"* and an *"outer region"* (see page 128, Figure 4.8(a)). None of these regions is designated as the *"near-wall region"*, however. The latter expression appears only later in the text, namely in conjunction with the statement according to which the mean axial velocity u_x of the flow depends in the *"near wall region"* on two parameters, namely *"$V_* y$"* and *"ν"*, respectively, but not on a third parameter called *"width W"* (see page 129, lines 1-4). While this explains certain characteristics of the model, it is not conclusive in respect of the

delimitation of the *"near wall region"* as opposed to the *"boundary layer"*. In particular it is unclear whether or not the *"near wall region"* can be equated with the *"inner layer"* of Figure 4.8(a), to which the inequation y/W << 1 applies.

2.8 In the case of claimed subject-matter defined by means of an essential feature which has a relative meaning such as "near" or "far", and which is furthermore uncommon in the respective technical field, the applicant is under a particular obligation to define such a feature in an objective and comprehensive manner, so that any person skilled in the art is able to verify without undue burden whether the feature is realised in a concrete embodiment, or not. Neither the main request, nor auxiliary requests I and II meet this requirement.

2.9 The board concludes, therefore, that the respective claims 1 of the main request and auxiliary requests I and II are not in accordance with the requirement of clarity laid down in Article 84 EPC.

3. Novelty of independent claim 1 of auxiliary request III - Article 54 EPC

3.1 In the appellant's view the presence of what is called a *"Coanda surface"* is a distinguishing feature of the claimed process. In fact, neither D1 nor D2 contains an explicit reference to a *"Coanda surface"*. The board is of the view, however, that this feature forms part of the implicit disclosure contained in D1 and D2, respectively. Both D1 and D2 disclose that the surface immediately adjacent the ejection slots on the downward stream side are curved (D1, Figures 1 and 2, surface

adjacent the ejection slot 14 or 57 in downward direction; D2, Figures 1 and 6, surface adjacent the discharge port 28 or 50 in downward direction). Furthermore, the documents reveal that the flow of the drag-reducing substance is directed at a slight rearward angle (D1, Fig. 1, flow lines adjacent the ejection slot 14; D2, column 3, lines 26-28; column 4, lines 38-43; Fig. 1, arrow beside reference sign 28). The drag-reducing substance is ejected into the boundary layer of the vehicle (D1, column 1, lines 29-35, 55-56, 60-61; 65-66; column 2, lines 1-2; column 3, lines 3, 37-41; column 4, lines 7-10; D2, claim 6, section (d); Fig. 1 in combination with Fig. 5, zone inside line D). Under these conditions the fluid emerging from the ejection slot tends inevitably to follow the curved surface adjacent the slot, even to the point of bending to a certain extent its initial direction. This effect, which is by definition nothing else than the "*Coanda effect*", is represented in Figure 1 of D2 in the form of a boundary layer of flow following the hydrodynamic form of the torpedo from the discharge port (28) along the hull to the tail (14), symbolically represented as an area with short wavy lines between the surface of the torpedo and the nominal outer limit (D) of the boundary layer. Having regard to this, the board concludes that the curved surfaces disclosed in D1 and D2, although not designated as such, are "*Coanda surfaces*" within the meaning of the present application. Thus, the reference to a "*Coanda surface*" in the respective claims 1 of the different requests does not distinguish the claimed method over the methods disclosed in D1 and D2.

The appellant cannot succeed with the argument that in the case of D1 and D2 the drag reducing substance is swept back after its ejection by the flow stream, so that no Coanda effect takes place. This argumentation is based on the assumption that the two effects are mutually exclusive. However, the appellant did not present any evidence in support of such an alleged incompatibility, which is in any case far from being plausible.

3.2 Document D1 discloses a method of releasing a drag-reducing substance (Fig. 1, reference sign 22) into a region consisting substantially of only the boundary layer of a low- or high-speed aquatic underwater vehicle (see D1, claim 1 and column 1, lines 9-12; column 1, line 58 to column 2, line 3; column 3, lines 40-43; column 4, lines 7-13; Fig. 1, reference sign 14), said method comprising the step of ejecting the drag-reducing solution of polymer and water (column 1, lines 38-43; column 2, lines 40-43) through a slot (Fig. 1, reference sign 14), the slot including a curved surface over which the solution flows as it enters the flow path of the first fluid, said curved surface being located on the downstream side of the slot immediately adjacent a wall and a concave surface (Fig. 1, surface located on the downstream side of slot 14).

There is no direct and unambiguous disclosure in D1, however, of a first step comprising the conditioning of the drag-reducing substance using fluid shear forces, and there is no disclosure at all to adapt the concave surface to form Görtler vortices, which are *"paired in the opposite direction than naturally occurring quasi*

longitudinal vortex pairs in the boundary layer, such that the pressure differentials they create cause the vortices and the drag-reducing mixture to remain near the wall, wherein the time said vortices are operative is extended by causing the fluid to flow over a surface having dimples or grooves, and wherein the ejection velocity of the drag-reducing substance is in the range between 5 % and 10 % of the free stream velocity of the first fluid."

The method according to claim 1 of auxiliary request III is therefore novel having regard to the disclosure of D1.

3.3 Document D2 discloses another method of releasing a drag-reducing substance into a region consisting substantially of only the boundary layer of a first fluid flowing relative to a surface, said method comprising the following steps:
(a) conditioning a water soluble slurry mixture comprising a water soluble polymer material and a liquid slurry forming base material (column 2, lines 47-49; Fig. 1, reference sign 34) using fluid shear forces by causing a second fluid which includes said drag-reducing substance, as a mixture or in solution, to flow through a reduced area in the form of a mixer inlet (column 3, lines 1-4; Fig. 1, reference sign 36) and,
(b) ejecting the drag-reducing substance, in solution or as a mixture with a fluid, through a slot having the form of an annular discharge port (column 2, lines 36-37; column 3, lines 26-28; Fig. 1, reference sign 28), the annular slot including a curved surface over which the solution or mixture flows as it enters

the flow path of the first fluid, said curved surface being located on the downstream side of the slot immediately adjacent a wall and a concave surface (Fig. 1, surface of the torpedo adjacent in downstream direction to the discharge port 28). Furthermore D2 discloses that the flow within the boundary layer is not necessarily laminar, but may well be turbulent (column 5, lines 34-40), the latter implying the presence of vortices.

As in the case of D1, there is no disclosure in D2 to adapt the surface to form Görtler vortices, which are *"paired in the opposite direction than naturally occurring quasi longitudinal vortex pairs in the boundary layer, such that the pressure differentials they create cause the vortices and the drag-reducing mixture to remain near the wall, wherein the time said vortices are operative is extended by causing the fluid to flow over a surface having dimples or grooves, and wherein the ejection velocity of the drag-reducing substance is in the range between 5 % and 10 % of the free stream velocity of the first fluid."*

Consequently the method according to claim 1 of auxiliary request III is also novel in respect of the disclosure of D2.

3.4 The board is satisfied that the method according to claim 1 of auxiliary request III is also novel having regard to the further documents referred to during the examination and appeal procedures. Since these documents are clearly more remote than D1 and D2, respectively, there is no need to discuss them in depth.

4. Novelty of independent claim 6 of auxiliary request III - Article 54 EPC

4.1 Independent claim 6 of auxiliary request III relates to an apparatus which is specifically designed for carrying out the method according to claim 1. In particular the apparatus comprises a first slot including a concave surface on the upstream side and a curved surface, i.e. a "*Coanda surface*" on the downstream side, the latter being equipped with dimples and grooves. The apparatus is devised so as to apply the method according to claim 1 which allows to reduce the dissipation rate of fluid ejected into the boundary layer. The construction features give rise to the creation of Görtler vortices having the properties required by the method of claim 1.

4.2 None of the documents referred to in the examination and appeal procedures discloses an apparatus according to claim 6 as set out above. The claimed apparatus is therefore novel having regard to the prior art.

5. Inventive step of independent claim 1 of auxiliary request III - Article 56 EPC

5.1 The invention according to claim 1 of auxiliary request III relates to a method for the injection of high molecular weight materials into the boundary layer of a fluid flow. As indicated on page 1, lines 28-30 of the description, the drag-reducing substance is conditioned prior to ejection, so that drag reduction occurs almost immediately following ejection. The drag reducing substance is released only into the boundary layer and retained there as long as possible, in order

to provide optimal drag reduction (see page 2, line 30 to page 2, line 3).

5.2 Document D2 can be regarded as the closest prior art, because it relates to the same technical field, namely methods for reducing the skin friction drag on the surface of a body that is in relative motion to a fluid, e.g. a hydrodynamic vessel. Moreover D2 has a high number of features in common with the claimed method.

5.3 Starting from D2, the technical problem to be solved by the claimed method consists in reducing the consumption rate of the drag reducing substance, while attaining high drag reduction along a large distance downstream (see page 1, lines 18-24).

5.4 As the solution to this problem, the application in suit proposes a method according to claim 1 characterised by:
(a) conditioning the drag-reducing substance to flow between the surface having dimples, grooves, or to flow through reduced areas; and
(b) ejecting the drag-reducing substance through one or more slots, each slot including a Coanda surface being located on the downstream side of the slot immediately adjacent a wall and a concave surface, said concave surface being adapted to form Görtler vortices, whereby the ejection velocity of the drag-reducing substance is in the range between 5 % and 10 % of the free stream velocity of a first fluid flowing relative to the surface.

5.5 Regarding the question whether the technical problem is solved by the claimed method, the board notes that the application contains no concrete examples illustrating specific embodiments that fall under the scope of claim 1. However this omission is compensated to a certain extent by the detailed description of a vortex ejector according to the present invention, including a cross sectional view of the inner components of the vortex duct ejector (see page 4, line 16-26; page 5, line 27 to page 12; page 7, lines 20-30; Figure 3). Furthermore, construction details showing a suitable diffuser (10) and a cone (12) for creating quasi-longitudinal vortices, are also given (see page 4, line 27 to page 5, line 26; Figures 4 and 5) together with a cross-sectional view of a portion of the ejector ring (32) equipped with dimples (33) (see page 6, line 12 to page 7, line 19; Figure 6). The description of these construction details provides a fair and sufficiently concrete idea of the characteristics and functions of the claimed method:

- Prior to ejection the drag reducing substance, as a mixture with a fluid or in solution, is forced to flow between surfaces having dimples, grooves or reduced areas, thereby applying fluid shear forces and causing the drag reducing substance, which is normally a polymer (see page 1, line 29), to unwind, lengthen or stretch;

- subsequently the drag reducing substance is ejected exclusively into the boundary layer of the primary fluid by means of a suitable ejector system comprising one or more slots, each slot including a curved surface over which the drag reducing substance flows as it enters the flow path of said primary fluid;

- the concave surface of the wall immediately adjacent the slots on the downward side is adapted to form Görtler vortices in the boundary layer, whereby the vortices are paired in the opposite direction than naturally occurring quasi longitudinal vortex pairs, thus retaining the drag reducing substance to remain near the wall. Such Görtler vortices are normally produced and amplified by means of specially adapted curvatures, dimples and/or elastic materials (see page 6, lines 9-12);
- the ejection velocity of the drag-reducing substance is set in the range of between 5 % and 10 % of the free stream velocity of the primary fluid.

5.6 Therefore, having regard to the contents of the description as a whole, and in the absence of any evidence to the contrary, the board is satisfied that the technical problem posed is solved by the claimed method.

5.7 It remains to be decided whether the method according to claim 1 of auxiliary request III is obvious, or not.

5.8 None of the documents referred to in the examination and appeal procedures mentions or foreshadows the use of Görtler vortices for the purpose of retaining the drag reducing substance in the boundary layer, let alone the employment of Görtler vortex pairs having a direction opposite to naturally occurring quasi-longitudinal vortex pairs. Thus, the skilled person, when confronted with the technical problem underlying the invention, received no indication or incentive from the documents comprised in the prior art to make use of Görtler vortices. For these reasons, the claimed method

cannot be regarded as being obvious to the skilled person.

5.9 Accordingly, the board is satisfied that the method of claim 1 of auxiliary request III involves an inventive step within the meaning of Articles 52(1) and 56 EPC.

6. Inventive step of independent claim 6 of auxiliary request III

Since the method according to claim 1 involves an inventive step, the apparatus according to claim 6, which is specifically adapted for putting said method into practice, is also inventive.

7. Dependent claims 2 to 5 of auxiliary request III

7.1 Claims 2 to 5 derive their patentability from claim 1 on which they depend directly or indirectly.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance with the order to grant a patent on the basis of claims 1 to 6 of auxiliary request III, filed during oral proceedings held on 5 February 2009, drawings Figures 1 to 6 as originally filed, and a description to be adapted as far as required.

The Registrar: The Chairman:

C. Vodz G. Raths