Abstract: A Bluff body adaptive wake reduction system includes a series of fairings mounted to outer surfaces of the aft end of the road vehicle. The fairings are streamlined in geometry with an outer surface, a partially hallow core, and with a rear end surface curved such that left and right hand sides are convergent behind the vehicle. The fairings are coupled to at least one ram air inlet and also include at least one blown slot positioned on the rear end of the fairings enabling air flow to exit the fairings tangent to the rear end surface of the fairings. Air flow enters the system through the ram air inlets and exits through the blown slots. Air flow exiting the blown slots promotes flow traveling over the outer surface to remain attached to the outer surface and thus to the rear end surface. The rear end surface then deflects air flow to follow a convergent trajectory behind the vehicle in such a fashion as to reduce the size of the wake, and as a result reduce the aerodynamic drag.
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TO ALL WHOM IT MAY CONCERN:

Be it known that I, Paul Vasilescu, a citizen of the United States of America whose post office addresses is: 6600 Kennedy Blvd East, Apt 19B, West New York, NJ 07093, have invented a

BLUFF BODY ADAPTIVE WAKE REDUCTION SYSTEM

BACKGROUND OF THE INVENTION  
TECHNICAL FIELD

[0001] This application claims priority to U.S. Provisional Patent Application Serial No. 61/955,797, filed on March 20, 2014, which is incorporated by reference herein and from which priority is claimed.

[0002] The present invention relates generally to aerodynamic drag reducing devices for road vehicles and, more particularly, a bluff body adaptive wake reduction system.

SUMMARY OF THE INVENTION

[0003] The wake reduction system disclosed is an aerodynamic drag reduction device designed to reduce aerodynamic drag of road vehicles with bluff bodies.

[0004] In an embodiment, the bluff body adaptive wake reduction system includes: a pair of side fairings mounted to the left and right hand sides of a road vehicle near the rear end, that are streamlined in geometry, with an outer surface, a partially hollow core, and with a rear end surface curved such that left and right
hand sides are convergent behind the vehicle. The bluff body adaptive wake reduction system also includes a single or plurality of ram air inlets, a single or plurality of blown slots positioned on the rear end of the side fairings enabling air flow to exit the side fairings tangent to the rear end surface of the fairings. The bluff body adaptive wake reduction system also includes internal flow passages connecting the ram air inlet or inlets to the blown slots. The bluff body adaptive wake reduction system may also include a top fairing positioned on the top surface of the road vehicle near the rear end similarly configured to the side fairings. The bluff body adaptive wake reduction system may also include a plurality of ram air inlets that are arranged such that one or more left hand side inlets are connected to the left hand fairing through flow passages and one or more right hand side inlets are connected to the right hand fairing through flow passages. The bluff body adaptive wake reduction system may also include a plurality of ram air inlets that are arranged such that one or more left hand side inlets are connected to the right hand fairing through flow passages and one or more right hand side inlets are connected to the left hand fairing through flow passages.

[0005] In the first configuration for the bluff body adaptive wake reduction system, air flow enters the ram air inlet, or inlets, located between the bottom surface of the vehicle and the ground, or along the top surface of the vehicle, and positioned in such an arrangement to enable the capture of ram air from a range of oncoming flow angles. Air flow is then redirected through a series of flow passages between the inlet, or inlets, and the cores of side fairings. Air flow then travels through the core of the side fairings and is redirected to the blown slots positioned along the rear end surface of the side fairings. Air flow then exits the blown slots. Flow exiting the slots promotes flow traveling over the outer surface to remain attached to the outer surface and thus to the rear end surface. The rear end surface then deflects air flow to follow a convergent trajectory between the left and right hand sides behind the vehicle in such a fashion as to reduce the size
of the wake, and as a result reduce the aerodynamic drag. The attachment of flow long the outer surface and rear end surface increases the effectiveness of the system across a wide range of operating conditions characterized by varying oncoming air flow vector directions.

[0006] In the second configuration, the overall arrangement and operation is identical to the first configuration but also includes a single or plurality of ram air inlets arranged along the front of the side fairings that are also coupled to the blown slots through a series of flow passages internal to the side fairings.

[0007] In the third configuration, the overall arrangement and operation is identical to the first configuration but also includes a top fairing similar in arrangement and operation to the side fairings, but mounted to the top surface of vehicle.

[0008] In the fourth configuration, the overall arrangement and operation is identical to the second configuration but also includes a top fairing similar in arrangement and operation to the side fairings, but mounted to the top surface of vehicle.

BRIEF DESCRIPTION OF THE FIGURES

[0009] Embodiments of the present invention will now be described more fully with reference to the accompanying drawings where like reference numbers indicate similar structure.

[0010] FIG 1 is a representation of an embodiment of a bluff body adaptive wake reduction system with a single ram air inlet positioned along the bottom of the system, and a top fairing with ram air inlets on the front of the top fairing.

[0011] FIG 2 is side view representation of the bluff body adaptive wake reduction system represented in FIG 1.
FIG 3 is a section view representation of left hand side fairing of the bluff body adaptive wake reduction system represented in FIG 1, with internal flow passages visible.

FIG 4 is a section view representation of left hand side fairing of an embodiment of the bluff body adaptive wake reduction system, with internal flow passages visible. The bluff body adaptive wake reduction system of FIG 4 also includes ram air inlets on the front of the side fairings.

FIG 5 is an alternate view of the bluff body adaptive wake reduction system of FIG 1.

FIG 6 is a representation of the bluff body adaptive wake reduction system of FIG. 4 with a plurality of ram air inlets located along the bottom of the system.

FIG 7 is a representation of the bluff body adaptive wake reduction system of FIG. 1 installed on a trailer.

FIG 8 is a representation of the bluff body adaptive wake reduction system of FIG. 1 installed on a trailer.

FIG 9 is a representation of the bluff body adaptive wake reduction system of FIG. 1 installed on a trailer.

FIG 10 is a representation of the bluff body adaptive wake reduction system of FIG. 1 with air flow streamlines illustrated.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 shows a schematic representation of a bluff body adaptive wake reduction system in accordance with an embodiment of the present invention. The bluff body adaptive wake reduction system is an aerodynamic device designed to reduce aerodynamic drag of road vehicles. The system includes a right hand side fairing 101, a left hand side fairing 102, an optional top fairing 103, a single or plurality of ram air inlet(s) 104, and flow passages 105. The left and right hand side fairings further include an outer surface 201 and rear surface 202 as shown in
FIG. 2. Air flow enters the system through ram air inlet 104, and is redirected to the right hand fairing 101 and the left hand fairing 102 through flow passage 105. Air flow is then directed through the core of the left and right hand side fairings through internal flow passage of the side fairings 301 to the blown slots 302 as shown in FIG 3. Air flow then exits the blown slots 302. Flow exiting the blown slots 302 promotes flow traveling over the outer surface 201 to remain attached to the outer surface and thus to the rear end surface 202. The rear end surface deflects air flow to follow a convergent trajectory between the left and right hand sides behind the vehicle in such a fashion as to reduce the size of the wake, and as a result reduce the aerodynamic drag.

[0021] In an embodiment, as illustrated in FIG. 1, a single ram air inlet 104 is connected to side fairings 101 and 102 through flow passages 105 and thus supplies the air flow to both the left and right hand sides, agnostic of flow vector direction.

[0022] In another embodiment, as illustrated in FIG. 4, air flow is provided to the blown slots 402 by a combination of air flow moving up the core of the side fairing 401 and by ram air inlet(s) 403 connected to blown slots 402 by internal flow passage 404.

[0023] In another embodiment, as illustrated in FIG. 6, a plurality of ram air inlets are connected to the side fairings such that air flow is supplied to the left hand side and right hand side fairings from any or all of the ram air inlets.

[0024] While the bluff body adaptive wake reduction system implementations as herein disclosed and shown through the figures are fully capable of obtaining the objects and providing the advantages a bluff body adaptive wake reduction system, they are merely illustrative of the presently preferred embodiments of the invention, and as such, no limitations are intended to the details of construction or design herein shown. Further, while the embodiments have been described with a combination of side fairings and a top fairing, one skilled in the art would recognize that a bluff body adaptive wake reduction system cositing of a single or
any combination of these fairings may be utilized. Further, while the embodiments have been described with ram air inlets positioned on the bottom of the system, one skilled in the art would recognize that a bluff body adaptive wake reduction system incorporating ram air inlets located along the top of the system, or any other appropriate location as required by the application may be utilized.
What is Claimed is:

1. A road vehicle incorporating a mechanism for reducing aerodynamic drag comprising:
   a road vehicle having a forward end and an aft end where the aft end forms a bluff body shape with a top side, bottom side, left hand side, and right hand side;
   a pair of side fairings mounted to outer surfaces of the left hand and right hand sides of the aft end of the road vehicle where the side fairings are streamlined in geometry with an outer surface, a partially hollow core, and with a rear end surface curved such that left and right hand sides are convergent behind the vehicle.
   a single or plurality of ram air inlets mounted to the road vehicle and positioned facing forward;
   a single or plurality of blown slots positioned on the rear end of the side fairings enabling air flow to exit the side fairings tangent to the rear end surface of the side fairings;
   a single or plurality of internal flow passages connecting the ram air inlet or inlets to the blown slots;

2. The road vehicle of claim 1, comprising
   a top fairing mounted to outer surfaces of the top side of the aft end of the road vehicle where the top fairing is streamlined in geometry with an outer surface, a partially hollow core, and with a rear end surface curved such that it directs airflow in a downward trajectory behind the vehicle.
   a single or plurality of blown slots positioned on the rear end of the top fairing enabling air flow to exit the top fairing tangent to the rear end surface of the top fairing;
   a single or plurality of internal flow passages connecting the ram air inlet or inlets to the blown slots

3. The road vehicle of claim 1, the ram air inlets positioned along the
bottom side of the road vehicle.

4. The road vehicle of claim 1, the ram air inlets positioned along the top side of the road vehicle.

5. The road vehicle of claim 1, the ram air inlets positioned along the leading edges of the side fairings.

6. The road vehicle of claim 2, the ram air inlets positioned along the leading edge of the top fairing.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

B62D 37/02(2006.01)

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)

B62D 37/02; B60J 1/00; F15D 1/12; B62D 35/02; B62D 35/00

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & keywords: vehicle, trailer, bluff body, cargo, rear, fairing, deflector, drag, wake, aerodynamic, inlet, slot, and passage

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents:
  "A" document defining the general state of the art which is not considered to be of particular relevance
  "E" earlier application or patent but published on or after the international filing date
  "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  "O" document referring to an oral disclosure, use, exhibition or other means
  "P" document published prior to the international filing date but later than the priority date claimed
  "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
  "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
  "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
  "&" document member of the same patent family

Date of the actual completion of the international search 23 July 2015 (23.07.2015)

Date of mailing of the international search report 24 July 2015 (24.07.2015)

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