Title: AUTOMATIC ADJUSTABLE VEHICLE SPOILER SYSTEM

Abstract: The present invention relates generally to an adjustable vehicle spoiler system, wherein the said adjustable vehicle spoiler system is able to adjust the position of the airfoil (308) automatically and manually according to the movement condition of the vehicle; and said airfoil (308) is made of flexible twistable material to provide at several angle of attacks simultaneously using the same airfoil (308).
AUTOMATIC ADJUSTABLE VEHICLE SPOILER SYSTEM

TECHNICAL FIELD OF INVENTION

The present invention relates generally to an adjustable vehicle spoiler system, comprising of at least one airfoil, at least one main actuator, at least one first secondary actuator, at least one second secondary actuator, control unit and sensors, wherein said adjustable vehicle spoiler system is able to adjust the position of the airfoil automatically and manually according to the movement condition of the vehicle; and said airfoil is made of flexible twistable material to provide several angle of attacks simultaneously using the same airfoil.

BACKGROUND OF THE INVENTION

Vehicle spoiler is generally used to improve air flow of vehicles. In the past, unfavourable air flow is one of the causes of vehicle accidents because it can cause instability to the vehicles. This instability is caused by the undesirable lift by unfavourable air flow, which causes the vehicle to overturn or roll when the driver performs sharp turns at fast speed. Another damaging effect of unfavourable air flow is excessive down-force to the vehicle. This down-force will increase the contact surface between the tires and the ground and will decrease the efficiency of the vehicle due to
excessive traction. In both situations, the effect of drag increases because the surface area exposed to the air flow increases which in turn generate more force to pull the car backward that result in less effective aerodynamics and the vehicle would need extra power to force themselves forward to counter such undesirable effect of drag. Furthermore to this, unfavourable air flow can vary depending on the speed and motion of the vehicle.

The usage of vehicle spoiler is beneficial in order to improve the mentioned unfavourable air flow. Current vehicle spoilers are typically in a fixed condition, whereby it is only able to disrupt a certain type of unfavourable air flow. If the vehicle spoiler is arranged to disrupt unfavourable air flow during sharp turnings, the same vehicle spoiler will create excess drag to the vehicle during straight and high speed motion of the vehicle, which is not efficient. Likewise, if the vehicle spoiler is arranged to disrupt unfavourable air flow during straight and high speed motion of the vehicle, the same vehicle spoiler will not create enough down force to the car to create stability to the vehicle during sharp turnings at high speed.

Spoilers typically have airfoils in the shape of a wing with a rounded leading edge followed by a sharp trailing edge, which when moved through air will create a force perpendicular to the motion called lift. The angle of attack for an airfoil is the angle between the chord line of the airfoil and the
vector representing the relative motion between the airfoil and the air. The angle of the current vehicle airfoil can only be changed manually if there is a need to have another vehicle airfoil angle. It is not able to change automatically according to the speed and motion of the vehicle. Furthermore to this, in order to change the height of the vehicle spoiler, extra bracket structures need to be added or replaced to the existing structure, which is very cumbersome.

Certain speed activated spoilers are available, but the system can only automatically control the angle of the airfoil and has the ability to retract the whole airfoil into the vehicle rear compartment when the vehicle engine is not turned on. When there is a need to increase the height of the airfoil and/or change the position of the airfoil, the current spoiler system will not be able to do it automatically without changing the hardware of the system.

Furthermore, the current speed activated spoilers are not universal enough to be transferred between vehicles. Certain speed activated spoilers are only customized to a certain vehicles due to the required shape and configuration of the spoiler system that suits the vehicle.

Another disadvantage for the current spoiler systems is that the airfoils have a fixed shape once it is installed to the vehicle. This provides disability
to have different shapes of airfoil for different types of vehicle movement. Furthermore, the current airfoil is only able to provide a single angle of attack at a time. There is a need to have different angle of attacks for different sides of the vehicle. For example, if the vehicle is turning right, the angle of attack for the right side of the airfoil should be higher than the angle of attack for the left side of the airfoil in order to provide the best down-force to the vehicle during turning.

The present invention overcomes, or at least partly alleviates the above shortcomings by providing an automatic adjustable vehicle spoiler system to adjust the position and angle of the vehicle spoiler automatically or manually according to the movement condition of the vehicle, universal enough to be transferable between vehicles and provides an ability to have different airfoil angle of attacks for different sides during vehicle turning.

SUMMARY OF THE INVENTION

Accordingly, it is the primary aim of the present invention to provide an adjustable vehicle spoiler system comprising of at least one airfoil (308), at least one main actuator (302), at least one first secondary actuator (304), at least one second secondary actuator (306), control unit (208) and sensors at the braking system (204), steering wheel system (206), vehicle body and
airfoil (308), wherein the said adjustable vehicle spoiler system is able to adjust the position of the airfoil (308) automatically and manually according to the movement condition of the vehicle.

It is yet another object of the present invention to provide an adjustable vehicle spoiler system, wherein the said adjustable vehicle spoiler system is able to adjust the angle of the airfoil (308) automatically and manually according to the movement condition of the vehicle.

It is yet another object of the present invention to provide a universal adjustable vehicle spoiler system, wherein the said universal adjustable vehicle spoiler system is able to adjust the height of the airfoil (308) automatically and manually according to the type of vehicle and movement condition of the vehicle, without the need to change another vehicle spoiler for different vehicle types.

It is yet another object of the present invention to provide an adjustable vehicle spoiler system, wherein the said adjustable vehicle spoiler system is universal and can be installed in any type of vehicle.

It is yet another object of the present invention to provide an adjustable vehicle spoiler system, wherein the said adjustable vehicle spoiler system can be easily installed and removed from one vehicle to another.
It is yet another object of the present invention to provide an adjustable vehicle spoiler system, wherein a minimum amount of secondary parts are needed because the main actuators (302) act as the main support for the said adjustable vehicle spoiler instead of bracket structure.

It is yet another object of the present invention to provide an adjustable vehicle spoiler system, wherein the said control unit (208) contains a database, which has the optimum airfoil angle of attack and optimum airfoil height for most vehicles.

It is yet another object of the present invention to provide an adjustable vehicle spoiler system, wherein the said adjustable vehicle spoiler system is able to adjust the height of the airfoil (308) to prevent the airfoil (308) from blocking the view of the driver.

It is yet another object of the present invention to provide an adjustable vehicle spoiler system, wherein the said adjustable vehicle spoiler system has the ability to provide several angle of attacks simultaneously using the same airfoil.

Other and further objects of the invention will become apparent with an understanding of the following detailed description of the invention or upon employment of the invention in practice.
According to a preferred embodiment of the present invention there is provided,

An adjustable vehicle spoiler system comprising of:

at least one airfoil (308);

at least one main actuator (302);

characterized in that

the said main actuators (302) are used as the main support and are retractable linearly to provide different height to the airfoil (308);

said airfoil is made of flexible twistable material to enable the airfoil to provide different angle of attacks simultaneously when needed;

the said adjustable vehicle spoiler system further comprises:

at least one first secondary (304) actuator coupled to the main actuators (302) in parallel and attached to the airfoil (308) to adjust the angle of the airfoil (308);
at least one slide coupling (412) coupled to the main actuator (302);

at least one second secondary actuator (306) used to adjust the position of spoiler;

at least one control unit (208);

at least one solenoid or pump;

at least one sensor at the vehicle braking system (204), steering wheel (206), airfoil (308) and/or vehicle body.

In another embodiment, the present invention provides,

An adjustable vehicle spoiler system comprising of:

at least one airfoil (308);

at least one main actuator (302);

characterized in that

the said main actuators (302) are used as the main support and are retractable linearly to provide different height to the airfoil (308);
said airfoil is made of flexible twistable material to enable the airfoil to provide different angle of attacks simultaneously when needed;

the said adjustable vehicle spoiler system further comprises:

- at least one first secondary actuator (304) coupled to the main actuators (302) in parallel and attached to the airfoil (308) to adjust the angle of the airfoil (308);

- at least one second secondary actuator (306) to adjust the position of the spoiler;

- at least one control unit (208);

- at least one solenoid or pump;

- at least one sensor at the vehicle braking system (204), steering wheel (206), airfoil (308) and / or vehicle body.
BRIEF DESCRIPTION OF THE DRAWINGS

Other aspects of the present invention and their advantages will be discerned after studying the Detailed Description in conjunction with the accompanying drawings in which:

FIG. 1 is a flowchart describing the positions of the adjustable vehicle spoiler at different conditions of the vehicle.

FIG. 2 is a diagram of the feedback and control system of the adjustable vehicle spoiler system.

FIG. 3A is a diagram showing the front view of the adjustable vehicle spoiler system in the first embodiment.

FIGS. 3B, 3C, 3D, 3E, 3F, 3G and 3H are diagrams showing the side view of the adjustable vehicle spoiler system in the first embodiment in stop mode (100), rising mode (101), start mode (102), drift mode (106), maximum down-force mode (109), emergency brake mode (108) and drag mode (104) respectively.

FIG. 4A is a diagram showing the front view of the adjustable vehicle spoiler system in the second/preferred embodiment.
FIGS. 4B, 4C, 4D, 4E, 4F and 4G are diagrams showing the side view of the adjustable vehicle spoiler system in start mode (102), drift mode (106), maximum down-force mode (109), emergency brake mode (108), stop mode (100) and drag mode (104).

DETAILED DESCRIPTION OF THE DRAWINGS

The invention will be more clearly understood from the following description of the preferred embodiments thereof, given by way of example only with reference to the accompanying drawings. In the descriptions that follow, like numerals represent like elements in all figures. For example, where the numeral (2) is used to refer to a particular element in one figure, the numeral (2) appearing in any other figure refers to the same element.

Referring now to FIG. 1, there is shown a flowchart describing the positions of the adjustable vehicle spoiler at different conditions of the vehicle, such as vehicle speed, braking actions and frequency of steering wheel (206) turning. Step 1 represents the state of the adjustable vehicle spoiler when the vehicle is in stationary position and vehicle engine is not turned on. The control unit (208) is programmed to control the main actuators (302) together with the first (304) and second secondary actuators (306) to
retract to the minimum length in order to bring the airfoil (308) to the lowest and innermost position while the angle of the said airfoil (308) is paralleled to the vehicle. The airfoil (308) is arranged to be in this position in order to save space. This position of the adjustable vehicle spoiler is hereafter referred to as stop mode (100). This arrangement applies to second embodiment only. For the first embodiment, the first secondary actuators (304) retract to the maximum length in order to maintain the airfoil parallel to the vehicle.

Step 2 represents the state of the adjustable vehicle spoiler when the vehicle engine is turned on and the said vehicle is in stationary position. When the vehicle is in this condition, the sensors at the braking system, steering wheel (206) and airfoil (308) will detect that the vehicle is stationary. Thus, the sensors will instruct the control unit (208) to control the first (304) and second secondary actuators (306) to extend to the maximum length in order to bring up the airfoil (308) and to remain in parallel with the vehicle body or adjusted to the optimal angle of attack. The main actuators (302) will remain retracted to the minimum length. In this arrangement, the airfoil (308) is hereafter referred to as start mode (102).

When the vehicle is in motion, the sensors at the braking system (204), steering wheel (206), speedometer, vehicle body and airfoil (308) will constantly check the condition of the vehicle, whether it is cruising on a
straight road, having high frequency of turning or applying brakes. The position and motion of the adjustable vehicle spoiler will depend on the condition of the vehicle, as sensed by the sensors mentioned.

When the vehicle is moving in a straight direction and increasing speed, the sensors at the braking system, car suspension system, steering wheel (206), the wheel axle, the speedometer and airfoil (308) will instruct the control unit (208) to control the main actuators (302) to extend to the maximum length to bring the airfoil (308) to the relevant height, depending on the type or model of the vehicle. As the speed increases further, the second secondary actuator (306) will slowly retract to the minimum length to bring the airfoil (308) to the lowest and most outward position to the back. This position of the adjustable vehicle spoiler is hereinafter referred to as drag mode (104), which increases the energy efficiency of the vehicle while travelling at high speed by decreasing the amount of drag in the form of reducing the air resistance but maintaining the right amount of down-force to keep the vehicle from lifting. By doing this, less energy is needed to reach a higher speed for the vehicle because there are less air friction and tire friction.

As the speed decreases for the first embodiment, the sensors at the braking system and the airfoil (308) will instruct the control unit (208) to control the second secondary actuator (306) to extend to the maximum length
while maintaining the main actuators (302) to be in the maximum length and the first secondary actuator (304) in the retracted position in order to bring the airfoil (308) to the relevant height and parallel with the vehicle body. For the second embodiment, the mentioned process is similar, but with the first secondary actuator (304) to be in the lengthened to bring the airfoil (308) to be parallel with the vehicle body. This position of the adjustable vehicle spoiler is hereafter referred to as drift mode (106). As more brakes are applied to the vehicle in order to further slowing down the vehicle, the main actuator (302) will further retract shorter while the first secondary actuator (304) will keep on retracting in order to bring down the position of the airfoil (308) while keeping the airfoil (308) angle to be parallel with the body of the vehicle. This position of the adjustable vehicle spoiler is useful when the vehicle is in slow speed condition in order to generate down-force to the vehicle, which will increase the stability of the vehicle.

When the vehicle comes to a stop, with the engine still operating, the adjustable vehicle spoiler will be controlled by the control unit (208) and the sensors to be in start mode (102). Similarly, if the vehicle engine is turned off, the adjustable vehicle spoiler will be controlled by the control unit (208) and the sensors to be in the stop mode (100).
The drift mode (106) of the adjustable vehicle spoiler is also applicable when the vehicle is turning. The sensors at the braking system and steering wheel (206) will be prompted when the vehicle driver applies brake to the vehicle and/or turns the steering wheel (206). When the sensors are prompted, they will instruct the control unit (208) to control the adjustable vehicle spoiler to be in drift mode (106). Typically, when a vehicle is turning, either in high speed or low speed, the vehicle will need extra down-force in order to stabilize the vehicle. This is done by disrupting the airflow passing over and around the vehicle to reduce the amount of lift generated by the shape of the vehicle when it is moving. This is even more critical in a racing condition and the vehicle is applied brakes at a high speed. If the down-force is not sufficient enough, the lift is enough to cause the vehicle to take off from the ground and sent it flying or rolling.

Another mode that the adjustable vehicle spoiler can operate in is emergency brake mode (108). In this mode, the first and second secondary actuator (306) will extend to their maximum length. This will tilt the airfoil (308) angle to be paralleled with the main actuators (302) instead of the vehicle body to achieve maximum down-force. The arrangement is valid for the first embodiment. For the second embodiment, this position of the airfoil is created by having the first secondary actuator (304) to be retracted while the second secondary actuator (306) to extend to the maximum length. This
mode is only applied when the emergency brake is applied while the vehicle is in motion. The sensors at the hand-brake of the vehicle will be able to sense this and instruct the control unit (208) to control the adjustable vehicle spoiler to be in this mode. This mode of adjustable vehicle spoiler will create maximum down-force to the vehicle, which is essential when the handbrake (202) is applied in the event of car racing or emergency braking, wherein the case of car racing, handbrakes (202) are applied to the vehicle when the driver intends to turn the car at high speed at sharp corners and wherein the case of emergency braking, handbrakes (202) are applied when the driver intends to stop the vehicle at the fastest time.

Referring to FIG. 2, there is shown the feedback and control system of the adjustable vehicle spoiler system, which comprises of the sensors, control unit (208) and the adjustable vehicle spoiler. The sensors are placed at the vehicle braking system, which comprise of the handbrake (202) and the foot brake (204), car suspension system, the steering wheel (206), the wheel axle, the speedometer, the body of the vehicle and also the airfoil (308). The sensors at the braking system will determine whether brakes are being applied to the vehicle and the frequency. The sensors at the steering wheel (206) and wheel axle will determine the frequency and speed of vehicle turning by the driver. Meanwhile, the sensors at the vehicle body, speedometer and the airfoil (308)
will detect the speed and direction of the airflow to the said vehicle body and the airfoil (308).

Once the condition of the vehicle is being sensed by all these sensors, the said sensors will provide signals to the control unit (208). The control unit (208) has an algorithm which will control the adjustable vehicle spoiler depending on the input signals from the sensors. The control unit (208) also contains a database of the optimal angle of attack and height of the airfoil for different cars to ensure the right amount of down-force is created, with less drag. This universal feature of the control unit (208) is important so that the adjustable vehicle spoiler system can be applied to any type of vehicle without any physical customization.

The control unit (208) will send signals to the pump or solenoids, based on the algorithm programmed in the control unit (208) and the said pump or solenoids will control the adjustable vehicle spoiler accordingly. The algorithm is programmed so that when no brakes are applied, the steering wheel (206) is in straight position and the vehicle is in fast position, the adjustable vehicle spoiler will be in drag mode (104). When there are turnings detected by the sensors at the steering wheel (206), application of brakes detected by the sensors at the brakes system and the vehicle is in counter-steer condition, the adjustable vehicle spoiler will be in drift mode (106).
When the emergency brake is applied, the said adjustable vehicle spoiler will be in emergency brake mode (108).

Referring to FIG. 3A, there is shown the front view of the adjustable vehicle spoiler system, which comprises of a pair of main actuators (302), a pair of first secondary actuators (304), a second secondary actuator (306), an elongated airfoil (308) and a pair of optional side plate (310) attached to the ends of the elongated airfoil (308). The main actuators (302), first and second secondary actuators (306) are pneumatically, electro-hydraulically or hydraulically operated in order to adjust to different lengths linearly to control the airfoil (308) to different modes. The main actuators (302) and the second secondary actuator (306) also act as the main support for the whole adjustable vehicle spoiler. This eliminates the need to have extra brackets to support the whole spoiler system and further reduces the materials used. The elongated airfoil (308), including the side plate can be of any type, design, pattern and size. There are two types of airfoil: 2D and 3D. 2D airfoils are usually positioned higher than the ceiling of the vehicle while 3D airfoils are usually positioned lower than the ceiling of the vehicle.

The airfoil (308) can be made of flexible twistable materials such as Polyurethane Foam (PUF) to allow flexibility to the airfoil (308). If the airfoil (308) is made of this typed of material and it is controlled by several forces,
different angle of attacks can be created on a single airfoil (308). Since the airfoil (308) in the adjustable vehicle spoiler system is attached to a plurality of main actuators (302) and first secondary actuators (304), the airfoil (308) will be in a twisted condition if the left first secondary actuator (304) is retracted and the right first secondary actuator (304) is lengthened. This twisted condition allows the airfoil (308) to provide several angles of attack simultaneously using a single airfoil (308).

Referring to FIGS. 3B, 3C, 3D, 3E, 3F, 3G and 3H, there is shown the side view of the adjustable vehicle spoiler in stop mode (100), rising mode (101), start mode (102), drift mode (106), maximum down-force mode (109), emergency brake mode (108) and drag mode (104) respectively. The first secondary actuators (304) are coupled to the main actuators (302) in parallel and attached to the airfoil (308), which are retractable linearly to adjust the angle of attack of the said airfoil (308). In this embodiment, the first secondary actuators (304) needs to be retracted to the minimum length in order to force the airfoil (308) to be parallel to the body of the vehicle and needs to be lengthened in order to tilt the airfoil (308). The adjustable vehicle spoilers in the said modes contain a pair of side plates (310). Emergency brake mode (108) and maximum down-force mode (109) can be categorized as the same mode but only happens at a different speed of the vehicle. Emergency brake mode (108) happens when the vehicle is applied brakes during low speed
while the maximum down-force mode (109) happens when the vehicle is applied brakes during high speed.

Referring to FIG. 4A, there is shown the front view of another embodiment of the adjustable vehicle spoiler, which comprises of a pair of main actuators (402), a pair of first secondary actuators (404), a pair of second secondary actuators (406), an elongated airfoil (308) and a pair of side plate (310). The functionalities of each part are the same as the former embodiment, except with the addition of the slide coupling (412), which is essential in order to achieve the drift mode (106), emergency brake mode (108) and drag mode (104). Similarly to the embodiment in FIG 3A, the airfoil (308) can be made of flexible twistable materials such as Polyurethane Foam (PUF) to allow flexibility to the airfoil (308), which will in turn provide several angle of attacks simultaneously using a single airfoil (308).

Referring to FIGS. 4B, 4C, 4D, 4E, 4F and 4G, there is shown the side view of the adjustable vehicle spoiler in start mode (102), drift mode (106), maximum down-force mode (109), emergency brake mode (108), stop mode (100) and drag mode (104). Similar to the first embodiment, the first secondary actuators (404) are coupled to the main actuators (402) in parallel and attached to the airfoil (308), which are retractable linearly to adjust the angle of attack of the said airfoil (308). In this embodiment, the first secondary
actuators (404) needs to be lengthened to the maximum length in order to force the airfoil (308) to be parallel to the body of the vehicle and needs to be retracted in order to tilt the airfoil (308). The second secondary actuators (406) are attached to the main actuators (402) by means of a slide coupling (412). The slide coupling (412) enables the main actuators (402) to extend or retract without affecting the position of the second secondary actuators (406). For example, in order to change from start mode (102) to drift mode (106), the main actuators (402) need to extend the length without moving the second secondary actuators (406) because the slide coupling (412) will ensure that the joint between the main actuators (402) and second secondary actuators (406) are movable. When the main actuators (402) are retracted, the slide coupling (412) will ensure that the joint between the main actuators (402) and second secondary actuators (406) are at the end of the main actuators (402) nearer to the airfoil (308). When the main actuators (402) are extended, the slide coupling (412) will ensure that the joint between the main actuators (402) and second secondary actuators (406) are at the end of the main actuators (402) nearer to the vehicle body.

It will be understood by those skilled in the art that changes and modifications may be made to the invention without departing from the spirit and scope of the invention.
Therefore it is intended that the foregoing description is merely for illustrative purposes and not intended to limit the spirit and scope of the invention in any way but only by the spirit and scope of the appended claim.
WHAT IS CLAIMED IS:

1. An adjustable vehicle spoiler system comprising of:

   at least one airfoil (308);

   at least one main actuator (302);

characterized in that

   the said main actuators (302) are used as the main support and are
   retractable linearly to provide different position to the airfoil (308).

2. An adjustable vehicle spoiler system as claimed in Claim 1 wherein the
   said airfoil (308) comprises of an elongated leading edge and trailing edge
   to provide lift or drag effect.

3. An adjustable vehicle spoiler system as claimed in Claim 1 wherein said
   airfoil (308) can be of any type, design, pattern and size.

4. An adjustable vehicle spoiler system as claimed in Claim 1 wherein said
   airfoil (308) can be made of flexible twistable materials to provide at least
   one angle of attack simultaneously.
5. An adjustable vehicle spoiler system as claimed in Claim 1, further comprising first secondary actuators (304) coupled to the main actuators (302) in parallel and attached to the airfoil (308), which are retractable linearly to adjust the angle of attack of the said airfoil (308).

6. An adjustable vehicle spoiler system as claimed in Claim 1 or 5, further comprising at least one second secondary actuator (306), which are retractable linearly to position the said main actuators (302) to a selective relative movement between a certain angle and parallel with the body of vehicle.

7. An adjustable vehicle spoiler system as claimed in Claim 1, 5 or 6 wherein said main actuators (302), first secondary actuators (304) and second secondary actuators (306) comprise of hydraulic, electro-hydraulic, or pneumatic cylinders for linear movement.

8. An adjustable vehicle spoiler system as claimed in Claims 1 to 7, further comprising at least one solenoid or pump to control movement of the said main actuators (302), first secondary actuators (304) and second secondary actuators (306).
9. An adjustable vehicle spoiler system as claimed in Claims 1 to 8, further comprising sensors at the vehicle braking system to detect events of braking to the vehicle.

10. An adjustable vehicle spoiler system as claimed in Claims 1 to 9 further comprising sensors at the vehicle steering wheel (206) system to detect frequency of turning to steering wheel (206).

11. An adjustable vehicle spoiler system as claimed in Claims 1 to 10 further comprising sensors at the vehicle speedometer to detect the speed of the vehicle.

12. An adjustable vehicle spoiler system as claimed in Claims 1 to 11, further comprising sensors at the vehicle airfoil (308) and/or the vehicle body to measure airflow pressure acted upon parts of the vehicle.

13. An adjustable vehicle spoiler system as claimed in Claims 1 to 12, further comprising a control unit (208) that is able to instruct the said solenoid or pump to change the position and/or angle of the airfoil (308) based on the feedback of the said sensors.
14. An adjustable vehicle spoiler system as claimed in Claims 1 to 13, further comprising an optional slide coupling (412) at the joints between the main actuator (302), first secondary actuator (304) or second secondary actuator (306) to assist coordinated movement between the three types of actuators.
STOP MODE

START ENGINE

AIR SPOLER RISE TO START MODE

VEHICLE IN MOTION (CRUISING)

CRUISING ON STRAIGHT ROAD AND NO TURNING OF STEERING WHEEL?

NO

AIR SPOLER RISE TO FULL HEIGHT ACCORDING TO TRAVELLING SPEED (DRIFT MODE)

YES

AIR SPOLER RISE TO FULL HEIGHT AND SLOWLY LOWER DOWN TO DRAG MODE ACCORDING TO TRAVELLING SPEED

SPEED DECREASE

AS SPEED DECREASE THE AIR SPOLER WILL AGAIN RISE TO DRIFT MODE

VEHICLE COME TO A STOP

RESUME CRUISING

AIR SPOLER LOWER TO START MODE

STOP ENGINE

LOWER DOWN TO STOP MODE

IF EMERGENCY BRAKE WAS APPLIED ANYWAY ALONG THE PROCESS THE WING PIVOT ANGLE WILL BE ADJUSTED TO ACHIEVE MAXIMUM DOWN FORCE REQUIRED
FIG 2
# INTERNATIONAL SEARCH REPORT

### A. CLASSIFICATION OF SUBJECT MATTER

**INV.** B62D35/00  B62D37/02

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

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, WPI Data

### C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>X</td>
<td>US 6 030 028 A (RADMANIC STJEPAN [DE] ET AL) 29 February 2000 (2000-02-29) column 2, line 31 - column 4, line 20; figures 1, 2</td>
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<td>US 2004/256885 A1 (BUI LE TRONG [US]) 23 December 2004 (2004-12-23) page 1, paragraph 14 - page 2, paragraph 16; figures 1-5</td>
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- **A** document defining the general state of the art which is not considered to be of particular relevance
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- **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)
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- **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
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Date of the actual completion of the international search

2 February 2009

Date of mailing of the international search report

10/02/2009

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Spinelli, Vito

Form PCT/ISA/210 (second sheet) (April 2005)
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