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(54) **AUGMENTED REALITY PROTECTIVE HELMET**

(57) The object of the invention is a protective helmet with augmented reality, comprising a shell (1) constituting the outer protective surface of the helmet, the impact absorbing layer attached to the inner surface of the shell (1), at least partially transparent visor (2), tiltably fixed to the shell (1) so that it can move from closed and open position, AR display (3), placed inside the helmet in the user vision area, mounted on the manipulator system (4),

which ensures its movement between the extended and retracted position, wherein the protective helmet further comprises an AR display movement release system (5) coupled to the manipulator system (4) such that when the visor (2) is in the closed position, the AR display (3) is in the extended position and when the visor (2) is in the open position, the AR display (3) is in the retracted position.

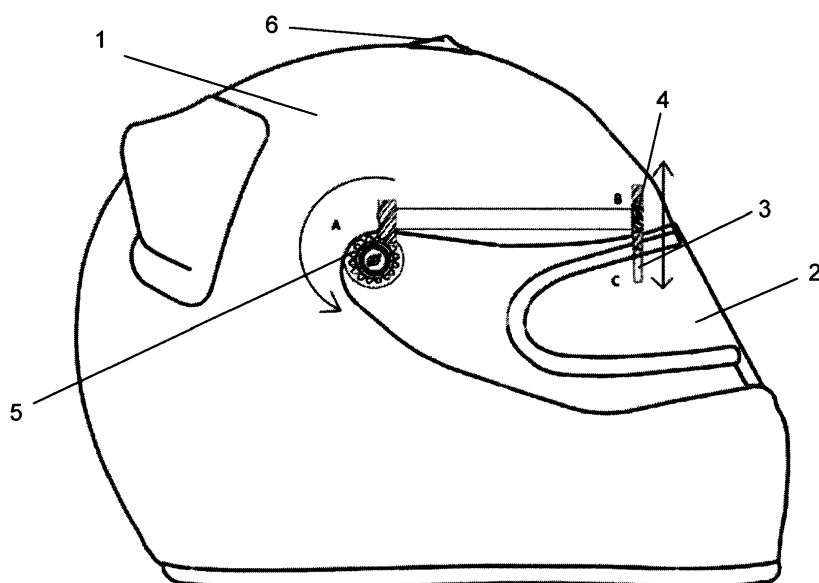


Fig. 1

Description

[0001] The object of the invention is a protective helmet with augmented reality, allowing to display additional information in front of the user of the protective helmet with augmented reality, used in particular in motorcycle helmets.

[0002] In the event of a traffic collision, protective helmets are one of the basic safety devices for motorists, in particular motorcyclists. The consequences of a traffic collision are usually much more serious for a motorcyclist than for a car driver. He does not have such safety measures, and motorcycles do not have so many solutions and technologies that reduce the risk of accident.

[0003] According to research conducted by IPSOS ("European Driving Responsibility Barometer" report), drivers are well aware of the dangers they face on the road. Recklessness and distraction are indicated as the second leading cause of fatal accidents (just after driving under the influence of alcohol and drugs). 30% of respondents indicate this factor as a cause of fatal accidents on motorways (immediately after excessive speed and drowsiness).

[0004] Almost half of motorcyclist accidents are caused by their actions, including deconcentration on the road. One of the reasons of distraction is checking the current parameters. Reading the clocks and looking in the mirror takes the motorcycle driver 1.5 seconds. At that time at a speed of 90 km/h, the vehicle moves by 37.5 meters (University of Michigan survey). If the motorcyclist looks away from the driving track for 2 seconds, the risk of an accident or a dangerous situation rises twice (University of Michigan survey). Therefore, introducing technologies that reduce the risk of motorcyclist deconcentration is an essential part of driving safety. Easier and faster access to information, without having to look away from the driving track, will directly affect the safety and comfort.

[0005] HUD (head-up display) and Augmented Reality (AR) technology allow you to quickly display the necessary data in front of the motorcyclist without compromising visibility. This is the maximum reduction of time needed to check the parameters and the moments during which he must look away from the road. The motorcyclist is able to read and process data quicker. This way of transmitting information is far less burdensome than the use of other methods (Monash University Accident Research Centre, November 2015). Augmented reality AR is a technology in which a live real-world image is enhanced with computer-generated graphics, such that the user is presented a composite view that includes live view and computer-generated graphics, such as superposition.

[0006] A U.S. patent application US2016070109A1 discloses a helmet with a device for displaying augmented reality content. Disclosed helmet includes a guide, a lens frame, display surface mounted to the lens frame. The guide extends from a cavity of the helmet and the

lens frame can move along the guide between a first position (e.g. extended) and a second position helmet (e.g. retracted in the cavity of the helmet). As described in the cited patent application, the lens of the display may, for example, slide out or hide on the basis of a voice command, a user gesture, or a position of a watch communicating with a helmet.

[0007] In turn, international patent application WO2016022984A1 discloses a helmet provided with a primary visor and a secondary visor, operating as a display for augmented reality content. In one embodiment of the cited invention a secondary visor and primary visor may move from extended position and retracted independently of one another. In an inactive position, the secondary visor (i.e. AR display) retracts into the cavity formed in the individual components of the helmet. The embodiment shown provided also a manual handle bar for the secondary visor, and in an alternative embodiment of the invention the helmet is provided with an actuator that causes the secondary visor to move from the extended position to the retracted position in response to the input signal.

[0008] Another U.S. patent application US2014130241A1 discloses a helmet with a display providing augmented reality information. The substance of the cited invention is a helmet-mounted display that has the retracting option. The display assembly is attached by means of a fixing assembly that moves the display from the storage position to the active position. One embodiment provides for the use of a double-push display mechanism to retract and extend it (push-push system).

[0009] The technical problem posed by the present invention is the construction of such a helmet with augmented reality that provides convenient and practical access to data such as: actual and permitted speed, navigation, rear view mirror, traffic jams, accident warnings and upcoming POIs, without the need to change the head position, the displayed information not obstructing the observation of the road. Furthermore, it is preferred to provide a helmet with augmented reality in which the AR display will be in front of the helmet user, while the helmet user will not use it, the AR display will not occupy the user's viewing area, while the change of these conditions will take place automatically without the need for manual manipulation. Surprisingly, the above-mentioned technical issues have been solved by the invention shown.

[0010] The object of the invention is a protective helmet with augmented reality, comprising a shell constituting the outer protective surface of the helmet, the impact absorbing layer attached to the inner surface of the shell, at least partially transparent visor, tiltably fixed to the shell so that it can move from closed and open position, AR display, placed inside the helmet in the user vision area, mounted on the manipulator system, which ensures its movement between the extended and retracted position, characterized in that it further comprises a visor position detection system coupled to the manipulator system such that when the visor is in the closed position, the AR dis-

play is in the extended position and when the visor is in the open position, the AR display is in the retracted position.

[0011] In preferred embodiment of the invention a protective helmet further comprises a switch forcing one of the operating modes: automatic extension/retraction of the AR display, constant extension of the AR display, permanent retraction of the AR display.

[0012] In another preferred embodiment of the invention, the manipulator system ensures that the AR display is moved in one or more directions: the first side; the other side, opposite the first side; upward; downward.

[0013] In a further preferred embodiment of the invention, the manipulator system is a drive system selected from the group consisting of mechanical, electric, magnetic, pneumatic, hydraulic drive.

[0014] In the next preferred embodiment of the invention, the AR display is a display selected from the group consisting of LCD, LED, OLED, OLED, DLP, LCOS, SED, FED, QDLED, iMOD, TMOS, DMS, LPD, FLC, TDEL, TPD, laser and surface on which the image is shown.

[0015] In preferred embodiment of the invention, the AR display movement release system is selected from a group consisting of a mechanical gear, preferably a toothed, visor positioning sensor, preferably optical, inductive, potentiometric, eddy-current, capacitive or ultrasonic, element that changes the fluid pressure in the circuit.

[0016] Preferably, a protective helmet is an integral, jawed, open or enduro motorcycle helmet.

[0017] A protective helmet with augmented reality according to the invention provides convenient and practical access to data such as: actual and permitted speed, navigation, rear view mirror, traffic jams, accident warnings and upcoming POIs, without the need to change the head position, the displayed information not obstructing the observation of the road. That way, the driver stays focused on what's going on around him, keeping full control, increasing the safety - his and other road users. In addition, the AR display is located in front of the helmet user while it is being used, and when the helmet user does not use it (e.g. at stops), the AR display is retracted inside the helmet and does not occupy the user's field of view.

[0018] This minimizes the risk of damage to the face or the eye when the viewfinder is raised in the event of an accident. Changing these conditions is automatic, without the need for manual manipulation, but a button is also provided on the helmet to select additional modes of displaying the content of augmented reality, such as constant extension of the AR display and content display, permanent retraction of the AR display and not displaying the content of augmented reality. Moreover, the display retraction/extension signal comes from the inside of the helmet, which makes the solution more reliable.

[0019] Exemplary embodiments of the invention are shown in the drawing, in which Fig. 1 shows a schematic

side view of the helmet with augmented reality according to the first embodiment of the invention, Fig. 2 shows a schematic side view of the helmet with augmented reality according to the second embodiment of the invention, Fig. 3 shows a schematic side view of the helmet with augmented reality according to the third embodiment of the invention, while Fig. 4 shows a schematic side view of the helmet with augmented reality according to the fourth embodiment of the invention.

Example

[0020] A protective helmet with augmented reality according to one embodiment was presented in a schematic side view in Fig. 1. Figs. 2, 3, 4 present successive embodiments of the present invention, respectively. In presented embodiments a protective helmet has a form of a motorcycle integral helmet. In general, this protective helmet comprises an outer surface called a shell 1 which is an outer protective surface. It is usually made of plastic or composite. The impact absorbing layer is attached to the inner surface of the protective helmet. It is one of the most important components of modern protective helmets, since it is mainly responsible for proper distribution of impact energy and protection of the head of the helmet's user from damage. As a rule, the next layer inside the helmet is a liner, which in essence is a soft element to fit the helmet to the user's head and provide ease of use. Protective helmet is additionally fitted with a fastener, normally attached to the shell 1 and ensures that the helmet is in the correct position. The protective helmet of the present invention comprises a viewfinder 2, tiltably fixed to the shell on both sides of the helmet, so that the viewfinder 2 can move from closed position in which it covers the eyes and the nostrils of the helmet user from the wind to open position in which the facial elements are not covered. The visor 2 is generally made of transparent plastic to ensure a good vision for the user. In the prior art there are also coloured or tinted visors 2 which are characterized by a degree of transparency that allows for a clear observation of the environment. However, it should be emphasized that the colour and degree of transparency of the visor 2 is not a limitation of the present invention. In order to provide augmented reality information AR to the user, the AR display 3 is located inside the helmet, which is located in the user vision area. In the embodiment of the invention presented in Fig. 1, AR display 3, is located above the sight of the helmet user and extends from the upper part of the protective helmet. The type of AR display 3 used is not a limitation of the present invention and may include LCD, LED, OLED, OLED, DLP, LCOS, SED, FED, QDLED, iMOD, TMOS, DMS, LPD, FLC, TDEL, TPD, laser displays and surface on which the image is shown. The AR 3 is located inside the helmet on the manipulator system 4, which allows it to be moved in at least two planes (preferably three planes) in order to fit its position to the requirements of the user (e.g. height, angle, lateral displacement), allowing the

helmet to be retracted into the helmet space when it is not used (e.g. at stops). In the present embodiment of the present invention, the manipulator system 4 provides retracting of the AR display 3 at the upper part of the protective helmet. The retracting direction of the AR display 3, however, is not a limitation of the present invention, and the AR display 3 itself can be retracted to the left, right, upward, downward or a combination of these directions without departing from the spirit of the present invention. In the vicinity of the tilting connection of a visor 2 with the protective helmet shell 1 there is an AR display movement release system 5 coupled to the manipulator system 4 so that when the visor 2 is in the closed position, the AR display 3 is in the extended position when the visor 2 is in the open position, the AR display 3 is in the retracted position. In the embodiment schematically shown in Fig. 1 the AR display movement release system 4 takes the form of a bevel gear that transmits the rotational motion of the element connecting the visor 2 to the shell 1 to the coupled bevel gear, which in turn is connected to the shaft with the manipulator system 4 also via the gear. Visor 2 tilting transfers the rotational motion from the element connecting the visor 2 to the protective helmet shell 1 onto the shaft, which in turn transfers the motion further to the manipulator system 4, causing the AR display 3 to be extended/retracted. In the embodiment schematically shown in Fig. 1 the manipulator system 4 is a mechanical drive system (mechanical transmission) in the form of gears. The present invention for extending/retracting AR display 3 also envisages the use of other types of manipulator systems 4 based, for example, on electric (as shown in the embodiment of Fig. 2), magnetic (as shown in the embodiment of Fig. 3), pneumatic drive (as shown in the embodiment of Fig. 4). In view of the above, it is noted that the type of drive used in the manipulator system 4 is not a limitation of the present invention. In addition, depending on the drive used in the manipulator system 4, the following AR display movement release systems can be used: mechanical transmission, preferably toothed, visor positioning sensor, preferably optical, inductive, potentiometric, eddy-current, capacitive or ultrasonic, element that changes the fluid pressure in the circuit. The type of AR display movement release system 5 also is not a limitation of the present invention. Also on the protective helmet, for example on the top of the shell 1, there is a switch 6 forcing one of the operating modes: automatic extension/retraction of the AR display 3, constant extension of the AR display 3, permanent retraction of the AR display 3, further enhancing the functionality of the protective helmet. Apart from the mode of automatic extension/retraction of the AR display 3 the user may select the option of constant extension and permanent retraction of the AR display 3. The type of switch used, as well as its location, are also not the essence of the present invention.

[0021] The description of the embodiment of the invention presents only components of the protective helmet important for the essence of the invention. For the clarity

of the description, obvious safety elements of the protective helmet necessary for its proper functioning, as well as additional components of the AR content display system, such as the processor controller - responsible for communication and display and the battery have not been described. It is also worth noting that the entire AR display module 3 is mounted inside the protective helmet. There are no unnecessary components outside that could limit the driver's field of view and reduce driving comfort. Only the AR display 3 is right in front of the driver's eyes, and due to the adjustment, it is possible to fully adapt it to the sight of the motorcyclist. Moreover, when visor 2 is opening, e.g. at the stop, the AR display 3 automatically retracts, increasing the driver's vision range and not restricting the view area, and analogically, when the visor is closing, the AR display automatically extends, providing the driver with augmented reality content. Additionally, use of the switch 6 allows one of the AR display 3 modes to be retained, e.g. when a driver with a closed visor 2 does not want to use the AR display 3 or when the driver with an open visor 2 continues to use the augmented reality content displayed on the AR display 3.

Claims

1. A protective helmet with augmented reality, comprising a shell (1) constituting the outer protective surface of the helmet, the impact absorbing layer attached to the inner surface of the shell (1), at least partially transparent visor (2), tiltably fixed to the shell (1) so that it can move from closed and open position, AR display (3), placed inside the helmet in the user vision area, mounted on the manipulator system (4), which ensures its movement between the extended and retracted position, **characterized in that** it further comprises a AR display movement release system (5) coupled to the manipulator system (4) such that when the visor (2) is in the closed position, the AR display (3) is in the extended position and when the visor (2) is in the open position, the AR display (3) is in the retracted position.
2. A protective helmet according to claim 1, **characterized in that** it further comprises a switch (6) forcing one of the operating modes: automatic extension/retraction of the AR display (3), constant extension of the AR display (3), permanent retraction of the AR display (3).
3. A protective helmet according to claim 1 or 2, **characterized in that** the manipulator system (4) ensures that the AR display (3) is moved in one or more directions: the first side; the other side, opposite the first side; upward; downward.
4. A protective helmet according to any one of claims 1 to 3, **characterized in that** the manipulator system

(4) is a drive system selected from the group consisting of mechanical, electric, magnetic, pneumatic, hydraulic drive.

5. A protective helmet according to any one of claims 1 to 4, **characterized in that** the AR display (3) is a display selected from the group consisting of LCD, LED, OLED, DLP, LCOS, SED, FED, QDLED, iMOD, TMOS, DMS, LPD, FLCD, TDEL, TPD, laser and surface on which the image is shown. 5 10
6. A protective helmet according to any one of claims 1 do 6, **characterized in that** the AR display movement release system (5) is selected from a group consisting of a mechanical gear, preferably a toothed, viewfinder positioning sensor, preferably optical, inductive, potentiometric, eddy-current, capacitive or ultrasonic, element that changes the fluid pressure in the circuit. 15 20
7. A protective helmet according to any one of claims 1 do 6, **characterized in that** it is an integral, jawed, open or enduro motorcycle helmet. 25

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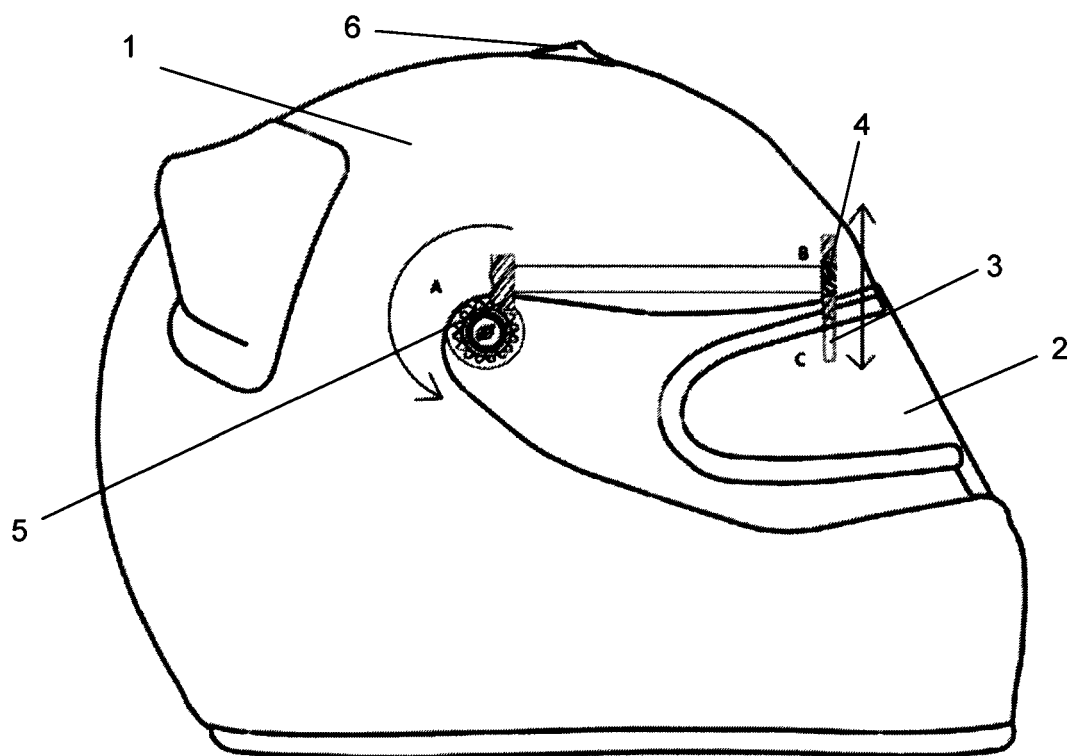


Fig. 1

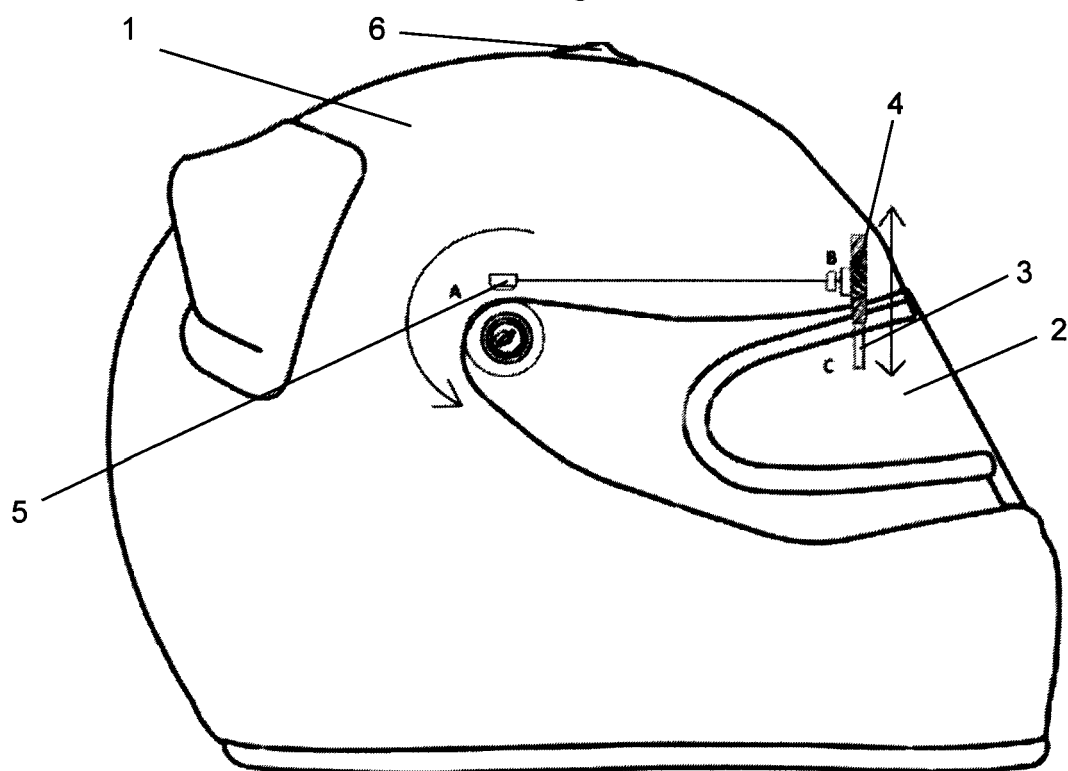


Fig. 2

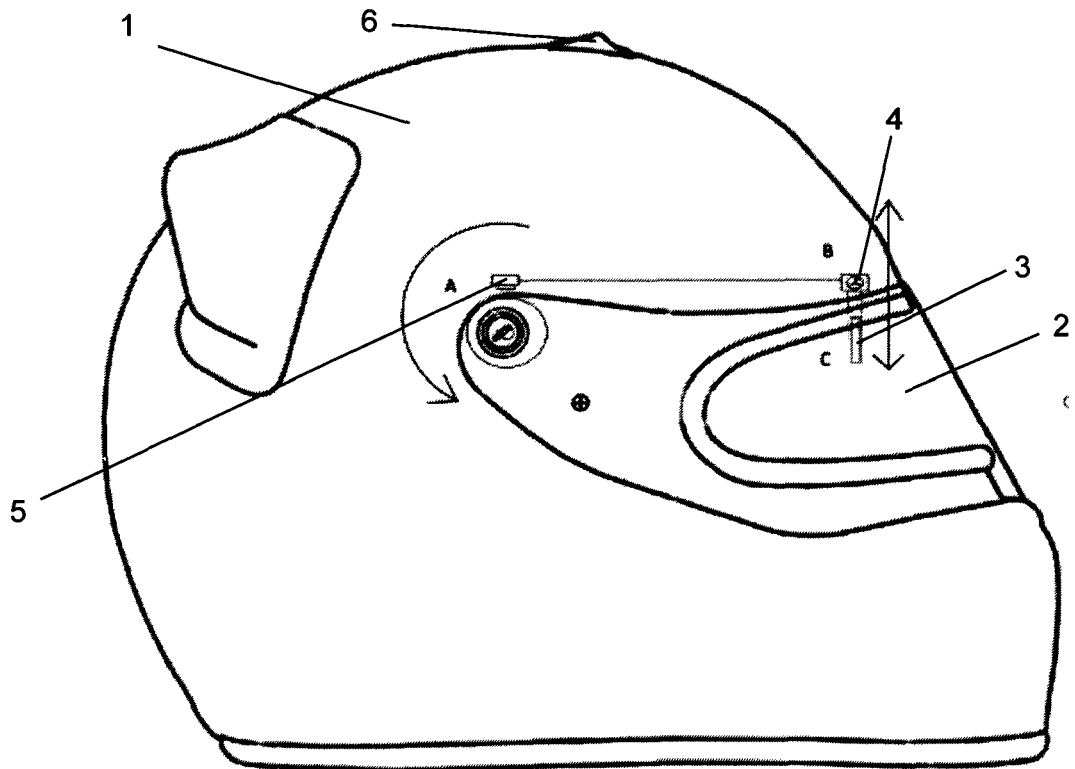


Fig. 3

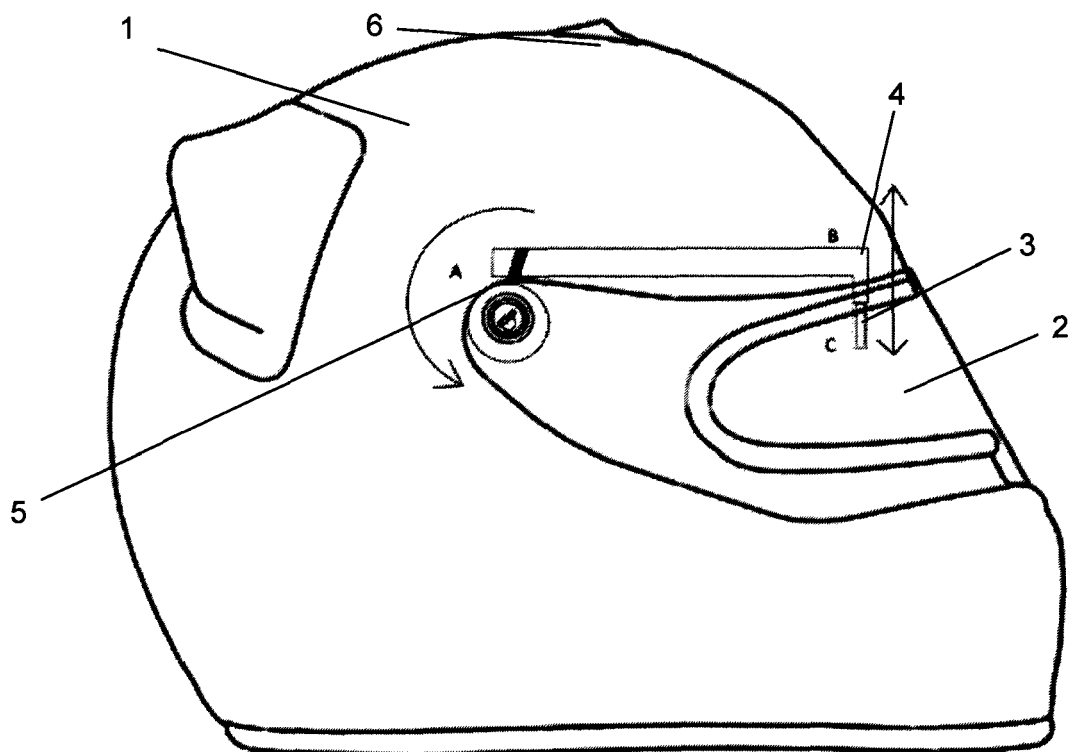


Fig. 4



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 Application Number
 EP 17 19 4576

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A	US 5 266 930 A (ICHIKAWA HIROSHI [JP] ET AL) 30 November 1993 (1993-11-30) * column 8, line 6 - column 9, line 43; figures 1-3 *	1-7	TECHNICAL FIELDS SEARCHED (IPC) A42B G02B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 29 January 2018	Examiner D'Souza, Jennifer
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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