



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
21.04.2010 Bulletin 2010/16

(51) Int Cl.:
A42B 3/04 (2006.01)

(21) Application number: **08751761.1**

(86) International application number:
PCT/JP2008/001243

(22) Date of filing: **19.05.2008**

(87) International publication number:
WO 2008/142861 (27.11.2008 Gazette 2008/48)

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR
Designated Extension States:
AL BA MK RS

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(30) Priority: **21.05.2007 JP 2007134784**

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(54) **HOLDER FOR HELMET, INFORMATION DISPLAY DEVICE, AND INFORMATION DISCLOSURE DEVICE**

(57) A helmet holder 10 of the present invention which is attached with a device is detachably attached to a helmet 60, **characterized in that** the helmet holder 60 is elastic and is attached to the helmet such that the helmet holder retains the helmet from outside in a rightward and leftward direction, in a forward and rearward direction and in an upward and downward direction.

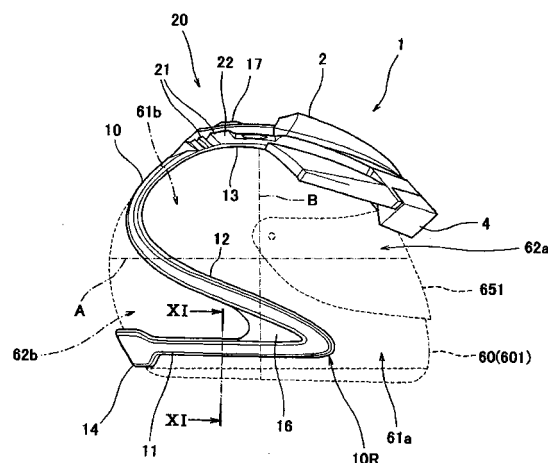


Fig. 7

Description

TECHNICAL FIELD

[0001] The present invention relates to a helmet holder which is attached with a device or the like such as a display device for displaying an image, for example, and is removably attached to a helmet. The present invention also relates to an information display device including the display device attached to the helmet holder, and an information disclosure device including the information display device.

BACKGROUND ART

[0002] Users wear helmets during construction work or driving of leisure vehicles. There are many kinds of helmets according to uses, etc. As the leisure vehicles, motorcycles, off-road vehicles, personal watercraft, and so on are known. Gauges for displaying a vehicle speed, an engine speed, an engine coolant temperature, and others are arranged in the vicinity of a handle of the motorcycle or the like. In recent years, in the motorcycles or the like, it is proposed that a display device for displaying images of various information such as navigation information is attached to the helmet, for the convenience to a rider.

[0003] Patent document 1 discloses a band-like head band removably attached to a center portion of the helmet in a forward and rearward direction so as to extend rightward and leftward, to removably attach a communication device to a helmet for construction work. In Patent document 1, a helmet which is attached to a head part of the user and exposes ears and face part of the user is assumed, and ear pads containing communication devices are connected to the head band.

Patent document 1: Japanese Laid-Open Patent Application Publication No. Sho. 64-68507

DISCLOSURE OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0004] The shape of the helmet, for example, the size is varied according to the kind. Therefore, there is need for a purpose-made head band or the like to which a display device is attached and which is removably attached to the helmet, when the display device is removably attached to the helmet in the conventional example. When using a different kind of helmet, the associated purpose-made head band and an expensive display device must be prepared. This is disadvantageous to the user. Furthermore, when applied to a helmet used during driving of the motorcycle, the head band is required to be retained to the helmet against an external force such as a blowing wind pressure.

[0005] The present invention has been developed un-

der the circumstances, and an object of the present invention is to provide a helmet holder which enables a device or the like to be removably attached to plural helmets. Another object of the present invention is to provide an information disclosure device including a display device which is attached to the helmet holder.

MEANS FOR SOLVING THE PROBLEMS

[0006] To achieve the above described object, a helmet holder of the present invention, including a mounting portion by which a device is attached to the helmet holder and being detachably attached to a helmet, **characterized in that** the helmet holder is elastic and is attached to the helmet such that the helmet holder retains the helmet from outside in a rightward and leftward direction, in a forward and rearward direction and in an upward and downward direction.

[0007] In accordance with this configuration, the device is detachably attached to the helmet together with the helmet holder. Since the holder is elastic, it is capable of absorbing a difference in size of the helmet and of securely retaining the helmet. In a state where the helmet holder is attached to the helmet, a restoring force of the holder acts on the helmet from outside to inside and securely retains the helmet from outside. If the user wishes to wear other helmet instead of the helmet which is currently used, the device can be used easily by changing the helmet holder. The user of the helmet need not newly buy a helmet containing a display device. When changing the used helmet into a new one, the user can select it more freely.

[0008] The helmet holder may comprise a pair of right and left first retaining portions respectively extending forward and rearward; a pair of right and left second retaining portions respectively extending rearward and upward from front end portions of the first retaining portions; and a pair of right and left third retaining portions respectively extending forward from rear end portions of the second retaining portions. In accordance with this configuration, the first retaining portions serve to retain a lower region of the helmet in the forward and rearward direction, the second retaining portions serve to retain side portions of the helmet in the forward and rearward direction and in the upward and downward direction, and the third retaining portions serve to retain an upper region of the helmet in the forward and rearward direction. When an external force is exerted in a rightward direction or a leftward direction on the helmet holder attached to the helmet, the first to third retaining portions at one of right and left sides keep adhering to the helmet and securely retain the helmet. When an upward external force is exerted on the helmet holder, the first to third retaining portions keep adhering to the helmet. When a downward external force is exerted on the helmet holder, the second and third retaining portions keep adhering to the helmet. When an external force in the forward and rearward direction is exerted on the helmet holder, the first to third

retaining portions keep adhering to the helmet. In this way, the helmet holder keeps adhering to the helmet against the external forces in all directions and securely retains the helmet securely from outside. Since the holder including the pair of right and left retaining portions has a simple structure having a Z-shape as viewed from the side, the weight of the helmet holder can be reduced.

At least one of the first to third retaining portions may have an arch shape so as to protrude outward of the helmet in a state where the helmet holder is attached to the helmet. This can increase a retaining force of the helmet. In the state where the helmet holder is attached to the helmet, a large part of the first and second retaining portions may be disposed at a rear side the helmet. Thereby, the holder is less affected by a forward external force such as a wind pressure, and is less likely to be detached from the helmet.

When the helmet holder further comprises a fourth retaining portion connecting rear end portions of the pair of right and left first retaining portions, the fourth retaining portion keeps adhering to the rear portion of the lower region of the helmet and a structure for retaining the helmet more securely is attained. The pair of third retaining portions may be coupled to each other and the first to fourth retaining portions may form a loop shape. This increases a spring constant of the holder so that the retaining force of the helmet can be increased.

The helmet holder may further comprise: a suction member which is removably attached to the helmet such that the suction member is suctioned to the helmet. This makes it difficult that the holder is detached from the helmet. A mounting position of the suction member may be adjustable. This makes it possible to properly change the mounting position of the suction member according to the shape of the helmet.

It is preferred that the mounting portion includes an adjustment mechanism for adjusting a mounting position of the device. Thereby, a difference in size between plural helmets is absorbed and the display device is moved to the front surface side of the helmet and is easily set so that the user can see an image.

[0009] The mounting portion may include a pivot mechanism for vertically pivoting a screen section of the device. Thereby, the screen section can be retracted when the user need not the image presented by the display device.

A front upper surface of the holder may be tilted upward from a front end portion thereof in a rearward direction. In this case, a down force pressed against the helmet is exerted on the holder when a wind blows from forward. This makes it more difficult that the holder is detached from the helmet.

An information display device of the present invention comprises the above helmet holder, and a display device for displaying information which is seen by a user. In accordance with this configuration, the information display device having the above mentioned advantage is applicable to plural helmets.

[0010] A screen section of the display device may be attached to a front portion of the holder. In accordance with this configuration, in the state where the helmet holder is attached to the helmet, the information displayed on the screen section can be positioned in an upper vision of a forward vision of the user of the helmet, and is not obstacle to the user of the helmet.

The device may be attached to a front portion of the holder, and a front upper surface of the device may be tilted upward from a front end portion thereof in a rearward direction. In this case, a down force pressed against the helmet is exerted on the holder when a wind blows from forward. This makes it more difficult that the holder is detached from the helmet.

[0011] An information disclosure device of the present invention comprises the above-mentioned information display device; and an in-vehicle apparatus which is mounted in the vehicle and sends information to be displayed to the display device.

[0012] In accordance with this configuration, when the rider of the vehicle changes the helmet currently used, the head mount display device may be attached to a new helmet. Thereby, the information is presented to the user during driving of the vehicle. Thus, the rider of the vehicle need not prepare a helmet containing a display device. The device may include a lighting device for lighting a region in the vicinity of the vehicle and an imaging device for taking an image of the region in the vicinity of the vehicle. In this case, a helmet mount type lighting device or a helmet mount type imaging device, which can achieve the advantages similar to those described above, can be provided.

The above and further objects, features and advantages of the present invention will more fully be apparent from the following detailed description with reference to the accompanying drawings.

ADVANTAGE OF THE INVENTION

[0013] As should be appreciated from the above, in accordance with the present invention, only the device such as the display device are changed and the device can be attached easily to other helmet.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

[Fig. 1] Fig. 1 is a perspective view showing an external appearance of a helmet mount display device according to the present invention.

[Fig. 2] Fig. 3 is a block diagram showing a configuration of an information disclosure device according to the present invention.

[Fig. 3] Fig. 3 is a schematic view showing a motorcycle into which an in-vehicle apparatus is built, as viewed from the side.

[Fig. 4A] Fig. 4A is a left side view of the helmet

mount display device attached to a full-face-type helmet.

[Fig. 4B] Fig. 4B is a left side view of the helmet mount display device attached to a jet-type helmet.

[Fig. 4C] Fig. 4C is a left side view of the helmet mount display device attached to an off-road-type helmet.

[Fig. 5] Fig. 5 is a plane side view of the helmet mount display device attached to the full-face-type helmet.

[Fig. 6] Fig. 6 is a rear view of the helmet mount display device attached to the full-face-type helmet.

[Fig. 7] Fig. 7 is a right side view of the helmet mount display device attached to the full-face-type helmet.

[Fig. 8] Fig. 8 is a bottom view of the helmet mount display device attached to the full-face-type helmet.

[Fig. 9] Fig. 9 is a front view of the helmet mount display device attached to the full-face-type helmet.

[Fig. 10] Fig. 10 is a view taken in the direction of arrows taken along X-X of Fig. 5.

[Fig. 11] Fig. 11 is a view taken in the direction of arrows taken along XI-XI of Fig. 7.

EXPLANATION OF REFERENCE NUMERALS

[0015]

1	head mount display device
2	housing
3	image projection unit
4	screen
10	holder
11	first retaining portion
12	second retaining portion
13	third retaining portion
14	fourth retaining portion
17d	suction pad
20	adjustment mechanism
30	in-vehicle apparatus
40	information disclosure device
50	motorcycle
60	helmet

BEST MODE FOR CARRYING THE INVENTION

[0016] Hereinafter, preferred embodiments of the present invention will be described with reference to the drawings. Fig. 1 is a perspective view showing an external appearance of a head mount display device (hereinafter referred to as HMD device) including a helmet holder 10 according to the present invention. Fig. 2 is a block diagram showing a configuration of an information disclosure device 40 according to the present invention. The information disclosure device 40 of this embodiment is configured to provide a great deal of information to a rider of the motorcycle which is an example of a vehicle.

[0017] As shown in Fig. 1, the HMD device 1 includes a holder 10 which is removably attached to a helmet and an image display device attached to the holder 10. The

image display device includes a housing 2 containing an image projection unit 3 (Fig. 2) and a screen 4 attached to the housing 2. As used herein, the direction is referenced from the perspective of the user wearing the helmet properly attached with the HMD device 1.

[0018] As shown in Fig. 2, the information disclosure device 40 includes the HMD device 1 and an in-vehicle apparatus 30 built into the motorcycle. The HMD device 1 includes the image projection unit 3 and the screen 4 which are described above, a head-side radio communication device 5 which performs radio communication with an in-vehicle radio communication device 31 of the in-vehicle apparatus 30 over a short distance, and an information processing device 6 including, for example, a microprocessor. The image projection unit 3, the head-side radio communication device 5 and the information processing device 6, and a battery (not shown) for use as an electric power supply for supplying electric power to these components, are built into the housing 2. The image projection unit 3 includes a segment-type projector using LED, for example, and projects a definite image according to the information to be provided. The screen 4 includes a half mirror, for example, and reflects and projects the image from the image projection unit 3.

[0019] The in-vehicle apparatus 30 includes the in-vehicle radio communication device 31 which performs radio communication with the head-side radio communication device 5 of the HMD device 1 over a short distance, and an information processing device 32 including a microprocessor, for example. The in-vehicle apparatus 30 includes, as devices which are electrically connected to the information processing device 32 to provide various information to the information processing device 32, a night vision device 33, a navigation device 34, an approaching vehicle detector 35, a vehicle controller 36, a vehicle speed sensor 37, a tire pneumatic pressure monitoring device 38, and a road-to-vehicle communication device 39. The night vision device 33 detects a person walking forward relative to the vehicle at night and outputs the detected information. The navigation device 34 outputs distance information to a next intersection (or intersection at which a driving course should be changed next) on a driving path to a destination, and driving direction command information at the intersection. The approaching vehicle detector 35 detects locations and speeds of the vehicle and other vehicle by vehicle-to-vehicle communication and outputs approaching vehicle detection information indicating that the vehicle about which caution should be raised has been detected. The vehicle controller 36 outputs detected information such as an engine speed or a gear position. The vehicle speed sensor 37 outputs detected information of a driving vehicle speed. The tire pneumatic pressure monitoring device 38 detects whether or not a tire pneumatic pressure is insufficient and outputs pneumatic pressure insufficiency detection information, upon the detection that the tire pressure is insufficient. The road-to-vehicle communication device 39 detects whether or not there is an obstacle

or the like on the driving path by the road-to-vehicle communication and outputs obstacle detection information indicating that the obstacle has been detected, upon the detection of the obstacle. The information processing device 32 outputs commands according to the information output from the devices 33 to 39.

[0020] Fig. 3 is a schematic view showing a motorcycle 50 into which the in-vehicle apparatus 30 is built, as viewed from the side. As shown in Fig. 3, the in-vehicle radio communication device 31 and the information processing device 32 are accommodated in a case and are arranged in a rear seat portion 51 of the motorcycle 50. The night vision device 33 is disposed in a front portion 52 of the motorcycle 50. The navigation device 34 is disposed in a portion 53 which is located in the vicinity of a handle of the motorcycle 50. The approaching vehicle detector 35 and the vehicle controller 36 are disposed in a lower portion 54 of a driver seat of the motorcycle 50, while the vehicle speed sensor 37 and the tire pneumatic pressure monitoring device 38 are arranged in wheel portions 55 and 56 of the tires of the front and rear wheels. The road-to-vehicle communication device 39 is disposed in the rear seat portion 51 of the motorcycle 50 and is accommodated into the same case as the in-vehicle radio communication device 31 and the information processing device 32.

[0021] The head-side radio communication device 5 and the in-vehicle radio communication device 31 are configured by using a short distance radio communication unit conforming with a radio communication standard such as Bluetooth (registered mark), for example. In the head-side radio communication device 5 and the in-vehicle radio communication device 31 using the short distance radio communication unit, a grouping is preset and a space range (e.g., radius 5m) within which communication can be made is set. When the rider wearing the helmet attached with the HMD device 1 is approaching the motorcycle 50, the head-side radio communication device 5 and the in-vehicle radio communication device 31 are automatically placed into a state where they are able to perform communication between them, causing the information disclosure device 40 to be turned ON. When the rider wearing the helmet is moving away from the motorcycle 50, the communication between the head-side radio communication device 5 and the in-vehicle radio communication device 31 is automatically stopped, causing the information disclosure device 40 to be turned OFF.

[0022] When the information disclosure device 40 is turned ON, the in-vehicle radio communication device 31 sends a command from the information processing device 32 to the head-side radio communication device 5. The head-side radio communication device 5 outputs received command information to the information processing device 6. The information processing device 6 outputs a driving control signal to the image projection unit 3 according to the received command. The image projection unit 3 projects a definite image according to the received

driving control signal. Thereby, various images according to the information to be presented to the rider of the motorcycle 50 are displayed on the screen 4. To be specific, an image indicating a distance to a next intersection on a driving path leading to a destination, a navigation image which is an image indicating a driving direction at the intersection, and operation panel images which are images indicating an engine speed, a gear position, or a vehicle speed, are displayed on the screen 4. In addition, an image indicating that a person is present forward relative to the motorcycle 50 at night, an image indicating that there is an approaching vehicle about which caution should be raised, an image indicating that a tire pneumatic pressure is insufficient, and an image indicating that an obstacle or the like is present on the driving path, can be displayed on the screen 4.

[0023] As should be appreciated from the above, the information disclosure device 40 provides, various information which are helpful in driving, the rider wearing the helmet attached with the HMD device 1 and driving the motorcycle 50 equipped with the in-vehicle apparatus 30.

[0024] Figs. 4 to 9 are views of the HMD device 1 attached to the helmet 60, as viewed from six directions. First, the helmet 60 will be described in brief. The helmets for use by the rider of the motorcycle are classified into various types according to the use and function. In this embodiment, Fig. 4A indicates a full-face-type 601, Fig. 4B indicates a jet-type helmet 602, and Fig. 4C indicates an off-road-type helmet 603. Figs. 5 to 9 show the full-face-type helmet as a representative.

[0025] As shown in the left side views of Figs. 4A to 4C, the full-face-type helmet 601 has an outline of an egg shape. The jet-type helmet 602 has a shape in which the front surface is wide open and a region corresponding to a chin is omitted, as compared to the full-face-type helmet 601, for the purpose of improving ventilation. The off-road-type helmet 603 has a larger front lower portion covering a region surrounding the chin of the user, as compared to the full-face-type helmet 601. Each of the helmets 601, 602, and 603 has a substantially symmetric shape in a rightward and leftward direction. The front lower portions of the helmets 601, 602 and 603 are different in shape.

[0026] Shields 651 and 652 are vertically pivotally attached to the full-face-type helmet 601 and the jet-type-helmet 602, respectively, in open regions in the vicinity of the user's eyes. The rider pivots the shield 651 or 652 upward to open the open portion to improve ventilation, or pivots it downward to close the open portion to protect the rider from a blowing wind pressure.

[0027] The plane cross-sectional outer shape of the full-face-type helmet 601 has a substantially oval shape which is elongated in a forward and rearward direction and is varied in size according to the vertical position in cross-section. In the plane view of Fig. 6 and the bottom view of Fig. 9, the outer shape which is the largest in a plane cross-sectional view is expressed as a contour A. In the right side view of Fig. 7, the schematic of the con-

tour A is expressed as one-dotted line. Hereinafter, a region below a vertical position indicated by one-dotted line A in Fig 7 is referred to as a lower region 61a of the helmet 60 and a region above the vertical position is referred to as an upper region 61b of the helmet 60. The plane cross-sectional outer shape of each of the lower region 61a and the upper region 61b is smaller than that indicated by the contour A. The front cross-sectional outer shape of the full-face-type helmet 601 has a substantially oval shape which is elongated vertically and is varied in size according to the forward and rearward position in cross-section. In the front view of Fig. 5 and the rear view of Fig. 8, the outer shape which is the largest in a front view is expressed as a contour B. In the right side view of Fig. 7, the schematic of the contour B is expressed as one-dotted line B. Hereinafter, a region forward relative to a forward and rearward position indicated by one-dotted line B in Fig 7 is referred to as a front region 62a of the helmet 60 and a region behind the forward and rearward position indicated by the one-dotted line B is referred to as a rear region 62b of the helmet 60. The width of the plane cross-sectional outer shape of the full-face-type helmet 60 in the rightward and leftward direction is the largest in the vicinity of the center in the forward and rearward direction through which the one-dotted line B roughly passes and decreases from that position in a forward direction or in a rearward direction. The jet-type helmet 602 and the off-road-type helmet 603 have substantially the same shape.

[0028] Subsequently, a structure of the HMD device 1 will be described. As shown in Figs. 4 to 9, in a state where the HMD device 1 is attached to the helmet 60, the holder 10 surrounds the helmet 60, the housing 2 is disposed at the upper portion of the helmet 60, and the screen 4 is disposed at the front upper portion of the helmet 60.

[0029] The housing 2 is disposed at the upper portion of the helmet 60 and the center portion of the helmet 60 in the rightward and leftward direction such that it is located forward relative to the center portion in the forward and rearward direction. To be greater detail, at least a part of the housing 2 is disposed in a region which is lower than an uppermost position of the helmet 60 and forward relative to the uppermost position. The housing 2 has an outer shape conforming to the outer surface of the helmet 60. To be specific, the housing 2 has a plate shape so as to have a small vertical dimension and extend in the rightward and leftward direction and in the forward and rearward direction, and has an upper surface tilted upward from the front end portion in a rearward direction. Therefore, the housing 2 is subjected to a down force for pressing the housing 2 against the helmet 60, due to a blowing wind, thereby preventing that the holder 10 is detached from the helmet 60. Alternatively, a portion of the upper surface of the holder 10 which is forward relative to the center portion in the forward and rearward direction may be tilted upward from the front end portion in a rearward direction. In such a configuration, the holder

10 is prevented from being detached from the helmet 60 in the same manner during driving of the vehicle.

[0030] The holder 10 is entirely molded integrally using synthetic resin and is elastic. The holder 10 is formed of an elastically deformable material, preferably resin which is lower in stretchability than rubber and has an elastic modulus of 10MPa or larger, for example.

[0031] The holder 10 has a shape covering an imaginary body of a substantially egg shape, i.e., imaginary rotational oval body formed by rotating around a long axis of an oval. The imaginary body is set to have a size which is smaller than a smallest helmet of helmets to which the holder 10 is assumed to be attached. The inner surface of the holder 10 extends so as to conform to the outer surface of the imaginary oval body. The holder 10 has a pair of a right portion 10R and a left portion 10L which serve to sandwich and retain the imaginary oval body from both sides in a short axis direction. The right portion 10R and the left portion 10L are band-shaped to be curved smoothly and is Z-shaped as viewed from the side. Each of the right portion 10R and the left portion 10L includes a first retaining portion 11 extending in the forward and rearward direction, a second retaining portion 12 extending rearward and upward from the front end of the first retaining portion 11, and a third retaining portion 13 extending forward from the rear end of the second retaining portion 12. The first to third retaining portions are arch-shaped. The holder 10 further includes a fourth retaining portion 14 connecting the rear ends of the right and left first retaining portions 11 to each other, and a connecting portion 15 connecting the front end portions of the right and left third retaining portion 13 to each other. Because of the fourth retaining portion 14 and the connecting portion 15, the pair of right and left first to third retaining portions 11 to 13 are integrally loop-shaped. A rib 16 is provided to connect the first retaining portion 11 to the second retaining portion 12. This makes it difficult that the second retaining portion 12 is pivoted vertically around the front end portion thereof which is a boundary between the first retaining portion 11 and the second retaining portion 12.

[0032] The inner surface of the first retaining portion 11 is oriented inward in the rightward and leftward direction. The first retaining portion 11 is curved in an arch-shape so as to protrude outward in the rightward and leftward direction.

[0033] As shown in Fig. 7, the first retaining portion 11 is located in the lower region 61a of the helmet and extends along a plane extending vertically. A large part of the first retaining portion 11 is located in the rear region 62b of the helmet, while the front end portion thereof is located in the front region 62a. As shown in Fig. 9, the first retaining portions 11 are arch-shaped such that intermediate portions in the forward and rearward direction protrude outward in the rightward and leftward direction with respect to the both end portions in the forward and rearward direction. In other words, in the first retaining portions 11, the front end portions and the rear end por-

tions are located inward in the rightward and leftward direction relative to the outermost portions of the outwardly protruding portions in the rightward and leftward direction. In a state where the first retaining portions 11 adhere to the helmet, the front end portions of the first retaining portions 11 are in contact with the helmet so that displacement of the first retaining portions 11 in the forward and rearward direction is prevented. In addition, since the ribs 16 are provided at the front end portions of the first retaining portions 11, displacement of the first retaining portions 11 in the forward and rearward direction is further prevented.

[0034] The second retaining portion 12 extends rearward and upward from the front end of each first retaining portion 11 such that the second retaining portion 12 is twisted. Because of the twist, the inner surface of the second retaining portion 12 is oriented substantially inward in the rightward and leftward direction at the front end portion thereof connected to the first retaining portion 11 and is oriented substantially forward at the rear end portion thereof.

[0035] As shown in Fig. 5, the second retaining portion 12 extends from the lower region 61a of the helmet to the upper region 61b of the helmet in a direction from the one end portion to the other end portion and is formed in an arch-shape so as to protrude outward in the rightward and leftward direction. As shown in Fig. 9, in the lower region 61a of the helmet 60, the second retaining portions 12 are curved so as to protrude outward in the rightward and leftward direction in a direction from the lower end portions connected to the first retaining portions 11 toward the other end portions, and are shaped such that the intermediate portions in the forward and rearward direction protrude outward in the rightward and leftward direction relative to the both end portions in the forward and rearward direction. Also, in the lower region 61a of the helmet 60, the second retaining portions 12 extend outward in the rightward and leftward direction relative to the associated first retaining portions 11 continuous with the second retaining portions 12. Since the second retaining portions 12 are disposed outside in the rightward and leftward direction relative to the first retaining portions 11, the first retaining portions 11 and the second retaining portions 12 adhere to the helmet 60, thereby preventing the holder 10 from being detached from the helmet 60 in an upward direction from the helmet 60. As shown in Fig. 7, in the upper region 61b of the helmet 60, the second retaining portion 12 is substantially-inverted U-shaped such that it extends rearward, then is bent and extends forward in the direction from the portion continuous with the first retaining portion 11 toward the other end portion.

As shown in Fig. 6, in the upper region 61b of the helmet 60, the second retaining portion 12 is curved in U-shape toward the center in the rightward and leftward direction in the direction from the portion continuous with the first retaining portion 11 toward the other end portion. The second retaining portion 12 is disposed at the upper por-

tion of the helmet 60 and extends substantially in the forward and rearward direction at the end portion at an opposite side of the side continuous with the first retaining portion 11. In the upper region 61b of the helmet 60, the second retaining portion 12 is shaped such that an upward portion is disposed inward in the rightward and leftward direction and a rearward portion is disposed outward in the rightward and leftward direction. This makes it possible to avoid that the holder 10 is detached from the helmet in a downward direction. A large part of the second retaining portion 12 is positioned in the rear region 62b of the helmet 60 and the front end portion thereof is positioned in the front region 62a of the helmet 60. Since the wind directly collides against the front region 62a of the helmet 60, it is possible to suppress direct collision of the blowing wind against a large part of the second retaining portion 12 and to prevent that the second retaining portion 12 is detached in a rearward direction.

[0036] The inner surface of the third retaining portion 13 is oriented substantially vertically, and is curved in an arch shape so as to protrude outward in an upward direction.

[0037] Fig. 10 is a view taken in the direction of arrows along X-X of Fig. 5. As shown in Fig. 10, a thread member 17a is mounted to the center portion of a connecting portion 15 of Fig. 7. The thread member 17a has a cylindrical nut portion 17b protruding from a reverse surface thereof. A bolt 17c is threadedly engaged with the nut portion 17b. A suction member, to be specific, a suction pad 17d is provided at the lower end of the bolt 17c. When the thread member 17a is rotated by an external force, the suction pad 17d moves up and down. Since the suction pad 17d is suctioned to the upper portion of the helmet, a chance that the holder 10 is detached from the helmet 60 is reduced.

[0038] As shown in Fig. 6, the thread member 17a is received in a slit groove 18 formed to extend at the connecting portion 15 in the forward and rearward direction and the position of the thread member 17a in the forward and rearward direction is adjustable along the slit groove 18. Therefore, according to the shape of the helmet, the mounting position of the suction pad can be changed properly.

[0039] Alternatively, the suction member may include a magnet attached to the reverse surface of the helmet and a magnet attached to the lower end of the bolt, instead of the suction pad.

[0040] Fig. 11 is a view taken in the direction of arrows along XI-XI of Fig. 7. As shown in Fig. 11, the first retaining portion 11 has a width (dimension in an upward and rearward direction in Fig. 10) decreasing from the reverse surface 11a side which adheres to the outer surface of the helmet 60 toward an obverse surface 11b side which is an opposite side of the reverse surface 11a side. The second to fourth retaining portions 12 to 14 are formed in the same manner, although not shown.

[0041] As shown in Figs. 6 and 7, an adjustment mech-

anism 20 is provided between the housing 2 and the holder 10 to adjust a mounting position of the housing 2 in the forward and rearward direction with respect to the holder 10. The adjustment mechanism 20 is provided so as to protrude upward and rearward from the rear portions of the right and left third retaining portions 13. The adjustment mechanism 20 includes plural ribs 21 arranged forward and rearward and a pair of right and left brackets 22 extending rearward from the housing 2 and covering the ribs 21 from above. At the reverse surface side of the brackets 22, an engagement portion (not shown) extending forward and downward and rearward and upward is fitted between adjacent ribs 21. Thereby, the brackets 22 engage with the ribs 21.

[0042] A slit groove 23 is formed in each bracket 22 so as to extend forward and rearward. A nut (not shown) is provided to protrude upward from the front end portion of the third retaining portion 13. The nut is disposed within the slit groove 23 in a state where the bracket 22 engages with the rib 21. A bolt 24 is threadedly engaged with the nut via a washer having a diameter larger than the width of the slit groove 23. By tightening the bolt 24 in a downward direction, a downward pressing force is exerted from the washer on the bracket 22, enabling the bracket 22 to be fastened securely to the third retaining portion 13.

[0043] By loosening the bolt 24 and moving it upward, the rib 21 and the bracket 22 in the adjustment mechanism 20 are disengaged and the housing 2 is raised up. In a state where the bolt 24 is loose, the position of the housing 2 in the forward and rearward direction is adjusted along the slit groove 23, the housing 2 is raised at a desired position, and the engagement portion of the bracket 22 is fitted between adjacent engagement ribs 21 again. Further, the bolt 24 is tightened to cause the washer to adhere to the periphery of the slit groove 23 on the upper surface of the bracket 22. Thereby, the bracket 22 is fastened to the third retaining portion 13, and the mounting position of the housing 2 connected to the bracket 22, or the mounting position of the screen 4 attached to the housing 2 with respect to the holder 10 are changed.

[0044] As shown in Figs. 5 and 6, pins 7 are provided integrally with the screen 4 so as to protrude from right and left ends of the screen 4. The pins 7 are tightly fitted to boss holes recessed in the rightward and leftward direction at the front end portion of the housing 2, so that the screen 4 is attached to the image projection unit 3 such that the screen 4 is vertically pivotable. It should be noted that the screen 4 stops at a position where the screen 4 is released from an external force for pivoting the screen 4 although the screen 4 is pivotable.

[0045] To attach the HMD device 1, the mounting positions of the image projection unit 3 and the screen 4 with respect to the holder 10 are pre-adjusted using the adjustment mechanism 20 so that they are mounted at predetermined positions using the adjustment mechanism 20. In addition, the position of the suction pad in the

forward and rearward direction is pre-adjusted. Then, the front ends of the first retaining portions 11 are elastically deformed outward in the rightward and leftward direction and the front ends of the third retaining portions 13 are elastically deformed in an upward direction. In this state, the holder 10 is attached to the helmet 60 from behind. In a state where the inner surface of the fourth retaining portion 14 adheres to the rear portion of the lower region 61a of the helmet 60, the first retaining portions 11 and the third retaining portions 13 are returned to undeformed state. Thereby, as shown in Fig. 7, the inner surfaces of the first retaining portions 11 adhere to the lower region 61a of the helmet 60 in the forward and rearward direction. In addition, the inner surfaces of the second retaining portions 12 adhere from the front portion of the lower region 61a to the rear portion of the upper region 61b of the helmet 60. At this time, since the second retaining portions 12 are twisted as described above, they securely adhere to the outer surface of the helmet 60, which is a curved surface. The inner surfaces of the third retaining portions 13 adhere to the upper region 61b of the helmet 60 in the forward and rearward direction. The connecting portion 16 covers and adheres to the upper center portion of the helmet. The holder 10 exerts a restoring force in an inward direction of the helmet 60 and surrounds the helmet 60 and externally retains it. Then, the bolt 17 is tightened to cause the suction pad to be suctioned to the outer surface of the helmet 60.

[0046] When the rider wearing the helmet 50 attached with the HMD device 1 as described above is driving the motorcycle 50, the blowing wind pressure acts on the HMD device 1. As shown in Fig. 11, each of the first to fourth retaining portions 11 to 14 has a width decreasing in the direction from the reverse surface side adhering to the outer surface of the helmet 60 toward the obverse surface side which is an opposite side. As shown in Fig. 6, the front end of the screen 4 is pointed. For this reason, the wind blowing against the HMD device 1 flows smoothly rearward, reducing an air resistance applied to the HMD device 1.

[0047] During driving, the HMD device 1 may receive an external force due to an influence of air resistance or the like. But, the HMD device 1 keeps adhering to the helmet 60 against the external force and is less likely to be detached from the helmet 60. To be specific, when a leftward external force is exerted on the HMD device 1, the first to third retaining portions 11 to 13 of the right portion 10R keep adhering to the helmet 60. When a rightward external force is exerted on the HMD device 1, the first to third retaining portions 11 to 13 of the left portion 10L keep adhering to the helmet 60. When an upward external force is exerted on the HMD device 1, the pair of right and left first retaining portions 11 adhering to the lower region 61a do not move up to the upper region 61b and keep adhering to the helmet 60. Since the front end portions of the pair of right and left second retaining portions 12 which adhere to the lower region 61a do not move up to the upper region 61a and keep adhering to

the helmet 60. When a downward external force is exerted on the HMD device 1, the pair of right and left third retaining portions 13 adhering to the upper region 61b do not move to the lower region 61a and keep adhering to the helmet 60. When a rearward external force is exerted on the HMD device 1, the front end portions of the pair of right and left first to third retaining portions 11 to 13, which adhere to the front region 62a, do not move to the rear region 62b and keep adhering to the helmet 60. When a forward external force is exerted on the HMD device 1, the rear end portions of the pair of right and left first to third retaining portions 11 to 13, which adhere to the rear region 62b, do not move to the front region 62a and keep adhering to the helmet 60. Further, the fourth retaining portion keeps adhering to the helmet.

[0048] At this time, the housing 2 is disposed on the upper portion of the helmet 60, and the screen 4 is disposed so as to cover the front upper side of the shield 65 of the helmet 60. Therefore, an image reflected on the screen 4 is located in a vision above a center vision, of a vision from inside the helmet 60 of the user. Since the screen 4 is a half mirror, the user of the helmet 60 can see a forward scene through a portion of the screen 4 on which the image is not projected. For this reason, even when the screen 4 is disposed so as to cover the front side of the shield, the vision of the user is not narrowed.

[0049] When the user of the helmet 60 need not the image presented by the HMD device 1, the screen 4 is pivoted around axes of the pins 7 to be retracted to a position above the shields 651 and 652. When an operation is performed to pivot and retract the screen 4, the screen 4 stops in a position at which the hand performing the operation is released, and the screen 4 is maintained in a retracted state.

[0050] Since the screen 4 is retracted to a location above the shield, the shield 65 can be pivoted without interfering with the screen 4. It should be noted that the direction in which the shields 651 and 652 are opened conforms to the direction in which the screen 4 is retracted. For this reason, when the shield 65 is pivoted to be opened, the shield 65 engages with the screen 4, enabling the screen 4 to be pivoted upward together with the shield 65. Thus, the pivot operation of the screen 4 can be performed easily.

[0051] When the HMD device 1 is detached from the helmet 60, the first retaining portions 11 are pushed outward to the right and to the left and elastically deformed, and the entire HMD device 1 is pulled rearward while displacing the third retaining portions 13 upward.

[0052] The HMD device 1 is separate from the helmet 60 and is applicable to plural helmets 60. For this reason, it is not necessary to newly buy a helmet containing a display device. In addition, the helmet is changeable regardless of the HMD device 1.

[0053] As shown in Fig. 7, the front ends of the pair of right and left first retaining portions 11 and the front ends of the pair of right and left second retaining portions 12

are located forward relative to one dotted line B and do not extend to the front surface of the helmet 60 but to side portions of the helmet 60. For this reason, the HMD device 1 can withstand a rearward external force, and is applicable to three types of helmets 601, 602, and 603 which are different in shape of the front lower portion, as shown in Fig. 4. Since the first retaining portions 11 and the second retaining portions 12 are formed in this way, versatility of the HMD device 1 is improved.

[0054] The holder for retaining the helmet 60 includes band-shaped first to fourth retaining portions 11 to 14. The holder is capable of surrounding the helmet 60 and securely retaining the helmet 60 from outside with a simple structure of Z-shape as viewed from the side. Therefore, the HMD device 1 can be made small-sized and lightweight.

[0055] By attaching the device to the holder detachably attached to the helmet, the versatility of the HMD device can be improved as compared to a case where the device is attached to the helmet. It is desirable to devise the shape of the holder so that the holder is attachable to a number of helmets as in this embodiment. It is also desirable to devise the shape of the holder so that the holder is not detached from the helmet due to a blowing wind pressure during driving.

[0056] So far, the embodiments of the HMD device and the information disclosure device according to the present invention are described. The scope of the present invention is not limited to the above scope and can be suitably changed. For example, an elastic body made of rubber, silicon, resin, or the like may be provided on the reverse surface of the holder 10 (i.e., at least one of first to fourth retaining portions 11 to 14, the connecting portion 15 and the rib portions 16). This improves the adhering state of the holder 10 to the helmet 60. As a result, the helmet 1 is less likely to be detached from the helmet.

[0057] The display device of the present invention is not limited to the segment-type projection device using the LED but may be other display device such as a liquid crystal display device. That is, a screen section of the display device is not limited to a combiner-type screen illustrated in the above-mentioned embodiment, but may be other screen section such as a liquid crystal monitor.

[0058] Although the information disclosure device 40 of the present invention is applied to the motorcycle 50 in the above-mentioned embodiment, it is applicable to other vehicles such as off-road vehicles or personal watercraft.

[0059] Having illustrated that the image display device is attached to the helmet holder 10 of the present invention, other device such as a lighting device or an imaging device may be mounted to the helmet holder 10. This provides a head mount type lighting device for lighting a forward region of the user according to the direction of the user's eyes, or a head mount type imaging device for taking an image of the forward region.

[0060] As this invention may be embodied in several

forms without departing from the spirit of essential characteristics thereof, the present embodiments are therefore illustrative and not restrictive, since the scope of the invention is defined by the appended claims rather than by the description preceding them, and all changes that fall within metes and bounds of the claims, or equivalence of such metes and bounds thereof are therefore intended to be embraced by the claims.

INDUSTRIAL APPLICABILITY

[0061] The helmet holder and the information disclosure device of the present invention can be used in various cases where the helmet is used.

Claims

1. A helmet holder including a mounting portion by which a device is attached to the helmet holder and being detachably attached to a helmet, **characterized in that** the helmet holder is elastic and is attached to the helmet such that the helmet holder retains the helmet from outside in a rightward and leftward direction, in a forward and rearward direction and in an upward and downward direction.
2. The helmet holder according to Claim 1, comprising:
 - a pair of right and left first retaining portions respectively extending forward and rearward;
 - a pair of right and left second retaining portions respectively extending rearward and upward from front end portions of the first retaining portions; and
 - a pair of right and left third retaining portions respectively extending forward from rear end portions of the second retaining portions.
3. The helmet holder according to Claim 2, wherein at least one of the first to third retaining portions has an arch shape so as to protrude outward in a state where the helmet holder is attached to the helmet.
4. The helmet holder according to Claim 2, wherein a large part of the first and second retaining portions are disposed at a rear side of the helmet in a state where the helmet holder is attached to the helmet.
5. The helmet holder according to Claim 2, comprising:
 - a fourth retaining portion connecting rear end portions of the pair of right and left first retaining portions.

6. The helmet holder according to Claim 5, wherein the pair of third retaining portions are coupled to each other and the first to fourth retaining portions form a loop shape.
7. The helmet holder according to Claim 1, further comprising:
 - a suction member which is removably attached to the helmet such that the suction member is suctioned to the helmet.
8. The helmet holder according to Claim 7, wherein a mounting position of the suction member is adjustable.
9. The helmet holder according to Claim 1, wherein the mounting portion includes an adjustment mechanism for adjusting a mounting position of the device.
10. The helmet holder according to Claim 1, wherein the mounting portion includes a pivot mechanism for vertically pivoting a screen section of the device.
11. The helmet holder according to Claim 1, wherein a front upper surface of the holder is tilted upward from a front end portion thereof in a rearward direction.
12. An information display device comprising:
 - the helmet holder according to Claim 1; and
 - a display device for displaying information which is seen by a user.
13. The information display device according to Claim 12, wherein a screen section of the display device is attached to a front portion of the holder.
14. The display device according to Claim 12, wherein the device is attached to a front portion of the holder; and wherein a front upper surface of the device is tilted upward from a front end portion thereof in a rearward direction.
15. An information disclosure device comprising:
 - the information display device according to Claim 12; and
 - an in-vehicle apparatus which is mounted in the vehicle and sends information to be displayed to the device.
16. The information disclosure device according to Claim 15,

wherein the device include a lighting device for lighting a region in the vicinity of the vehicle and an imaging device for taking an image of the region in the vicinity of the vehicle.

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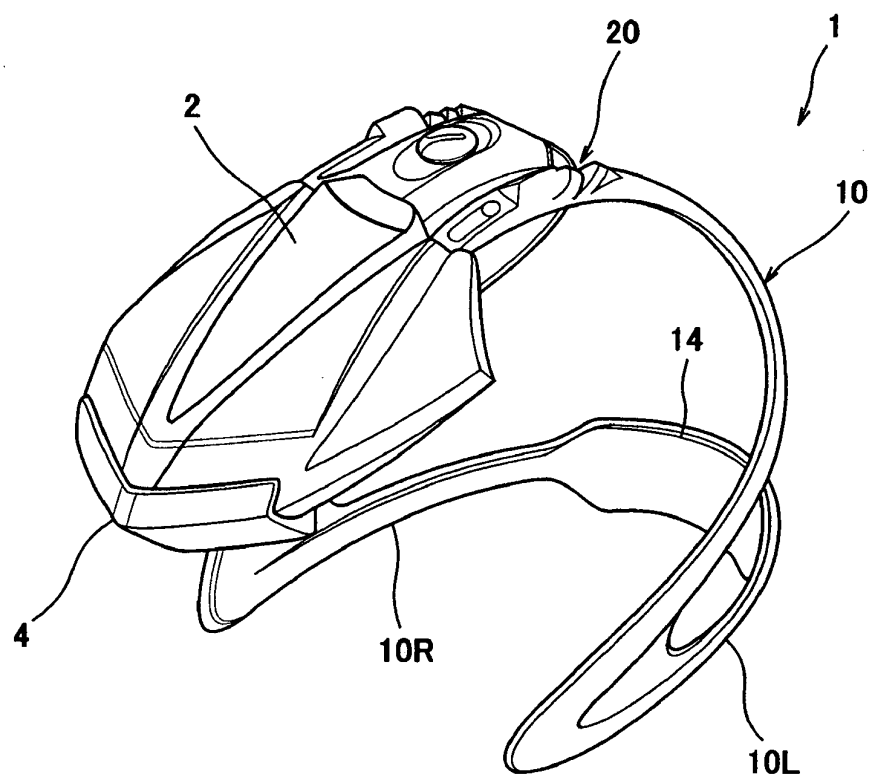
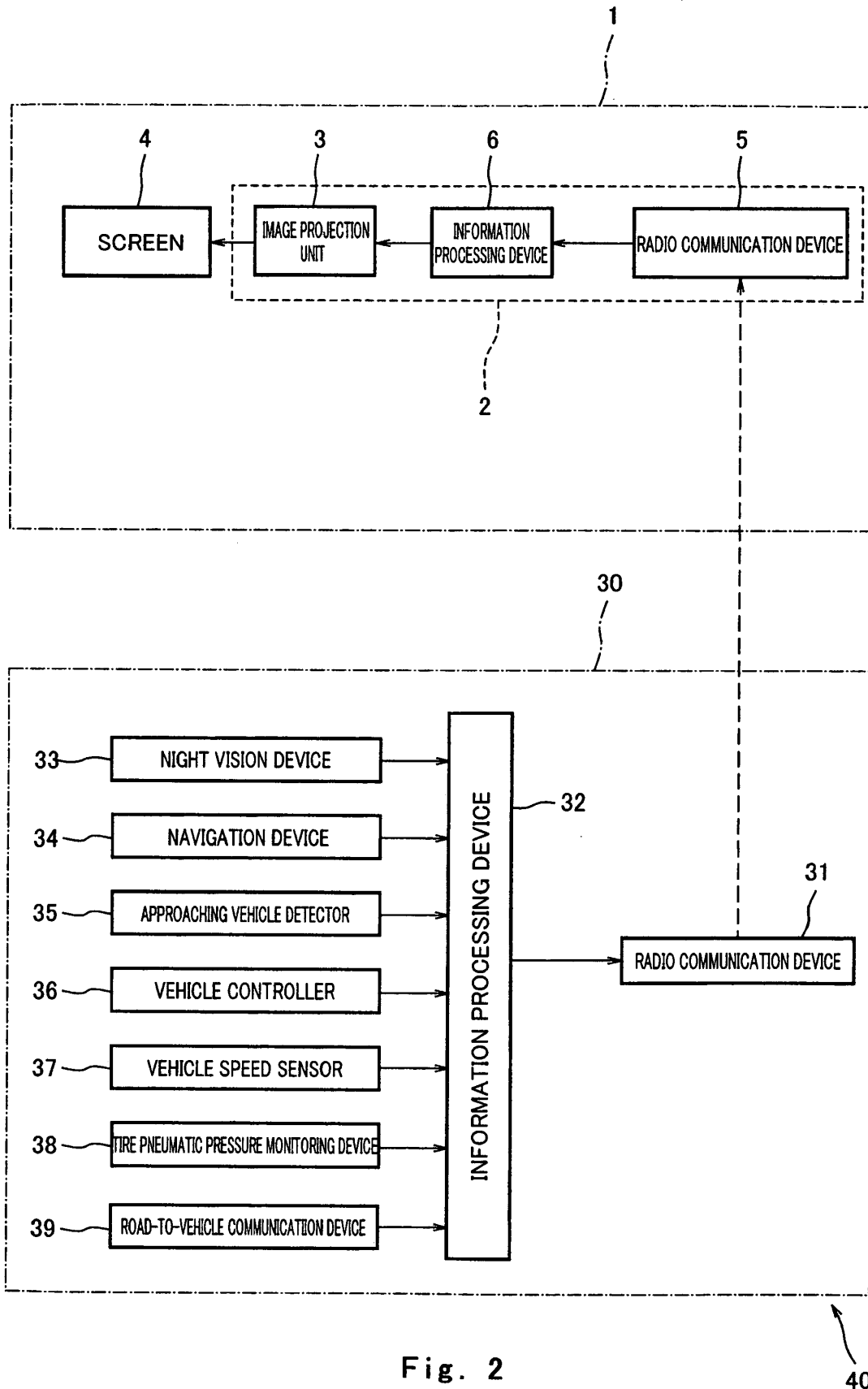


Fig. 1



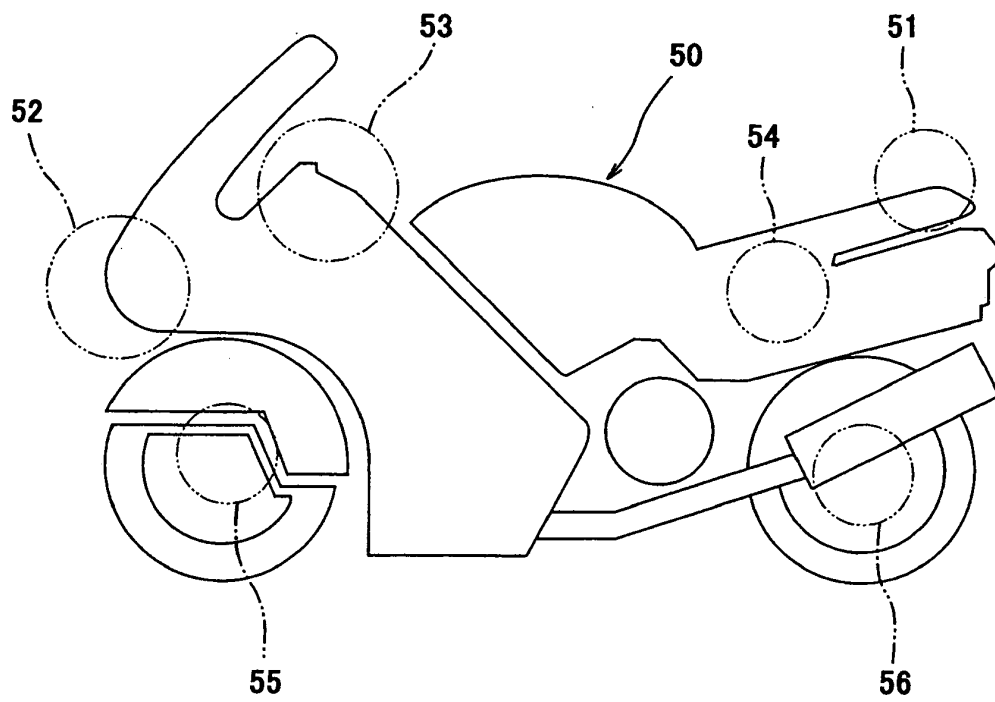


Fig. 3

Fig. 4A

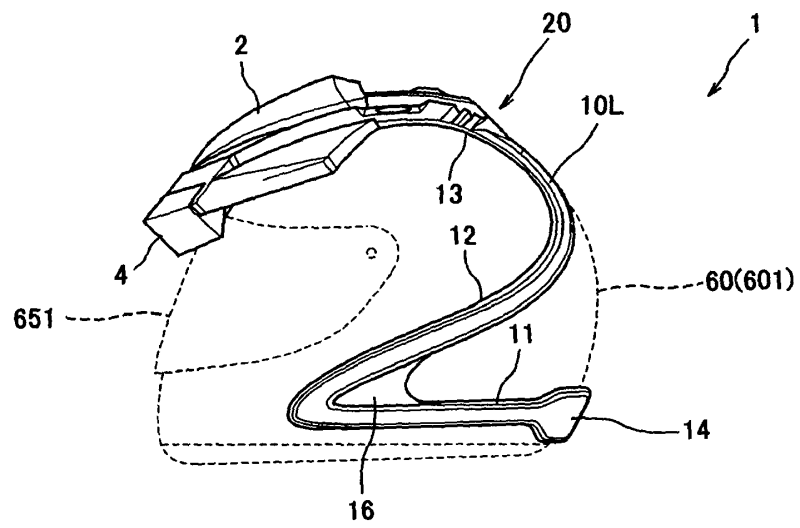


Fig. 4B

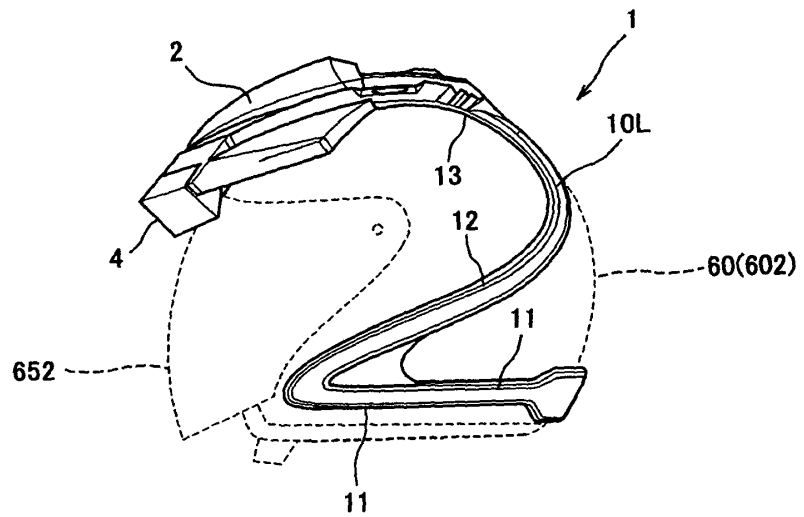
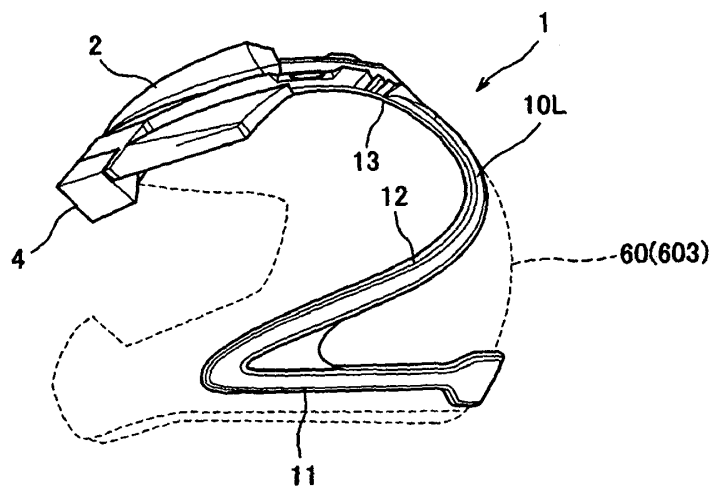


Fig. 4C



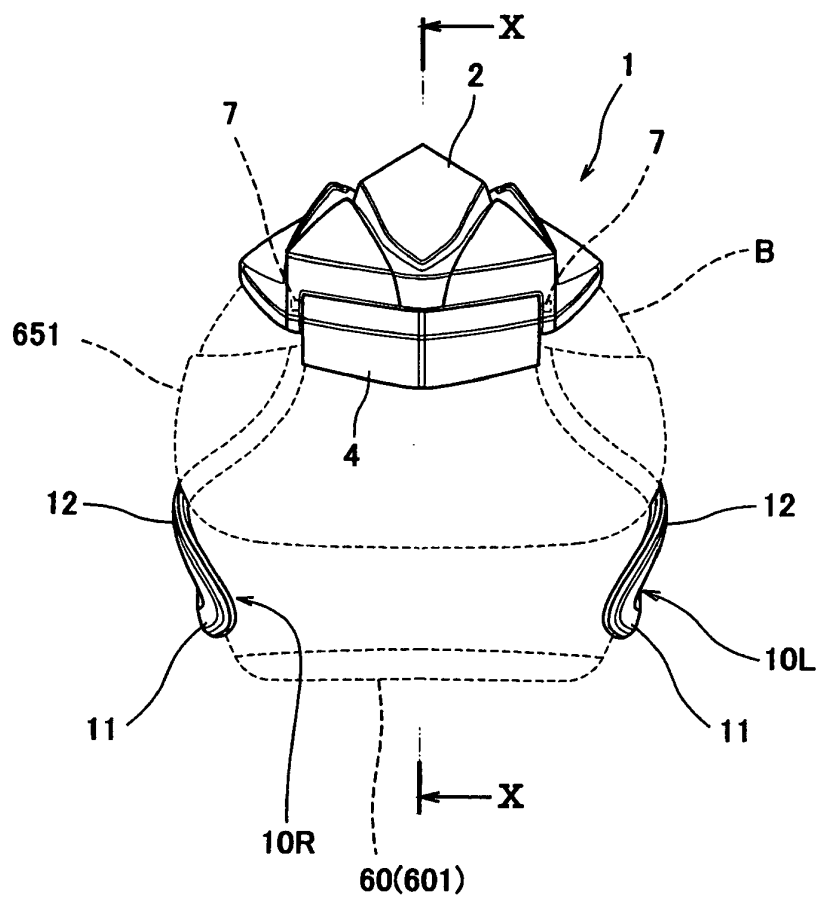


Fig. 5

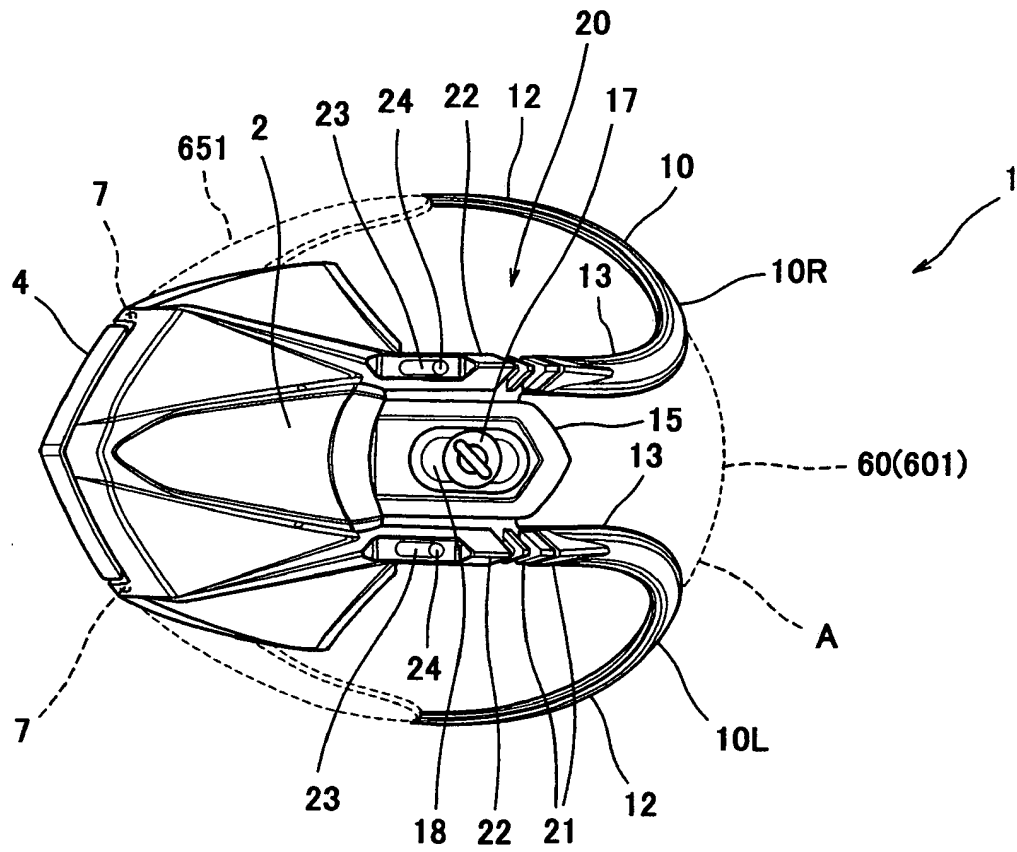


Fig. 6

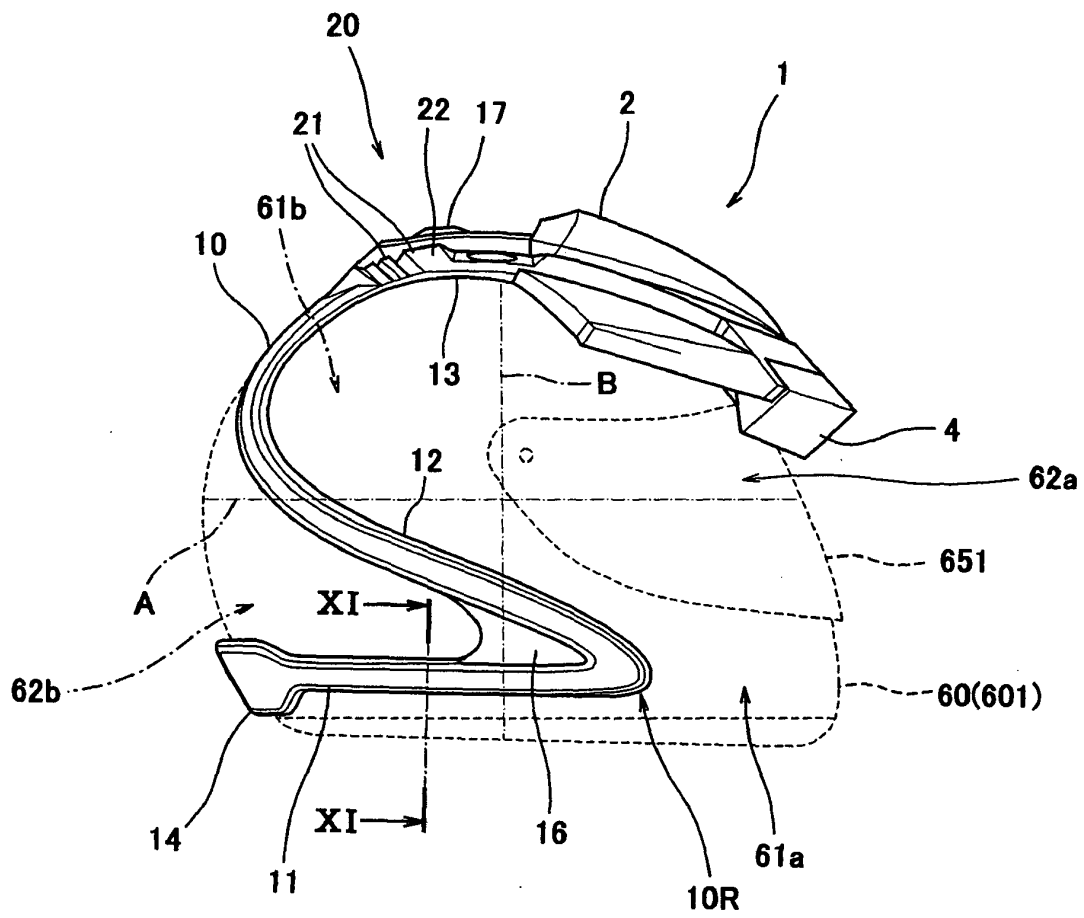


Fig. 7

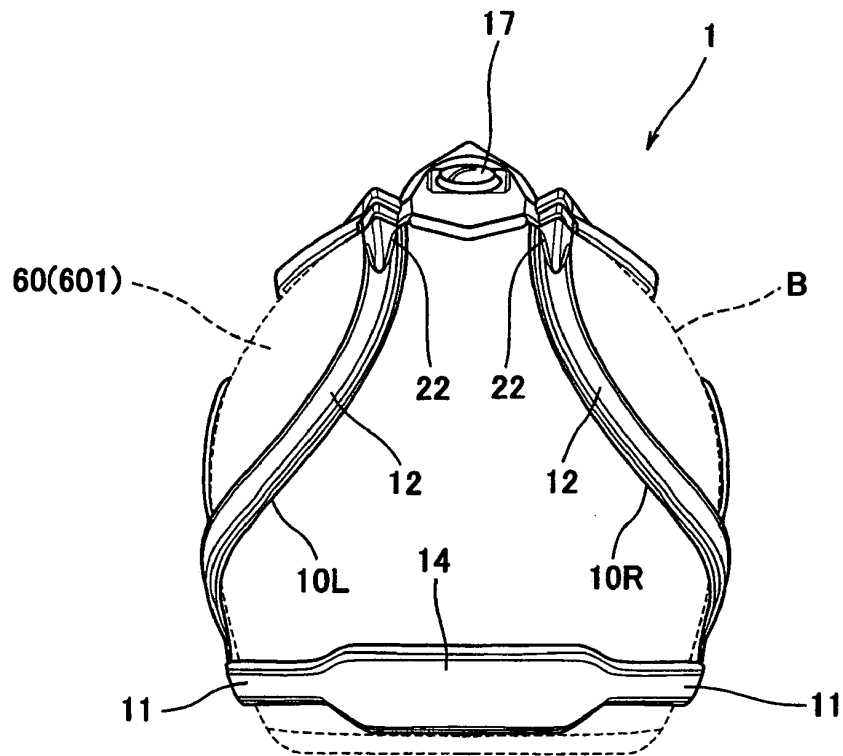


Fig. 8

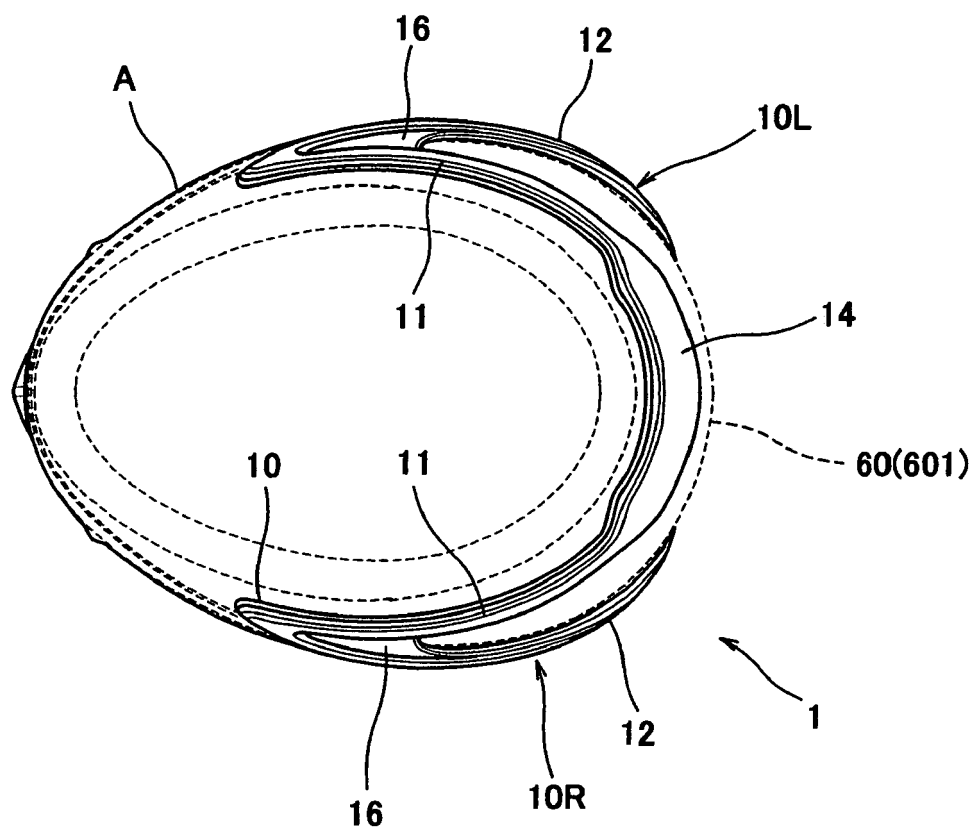


Fig. 9

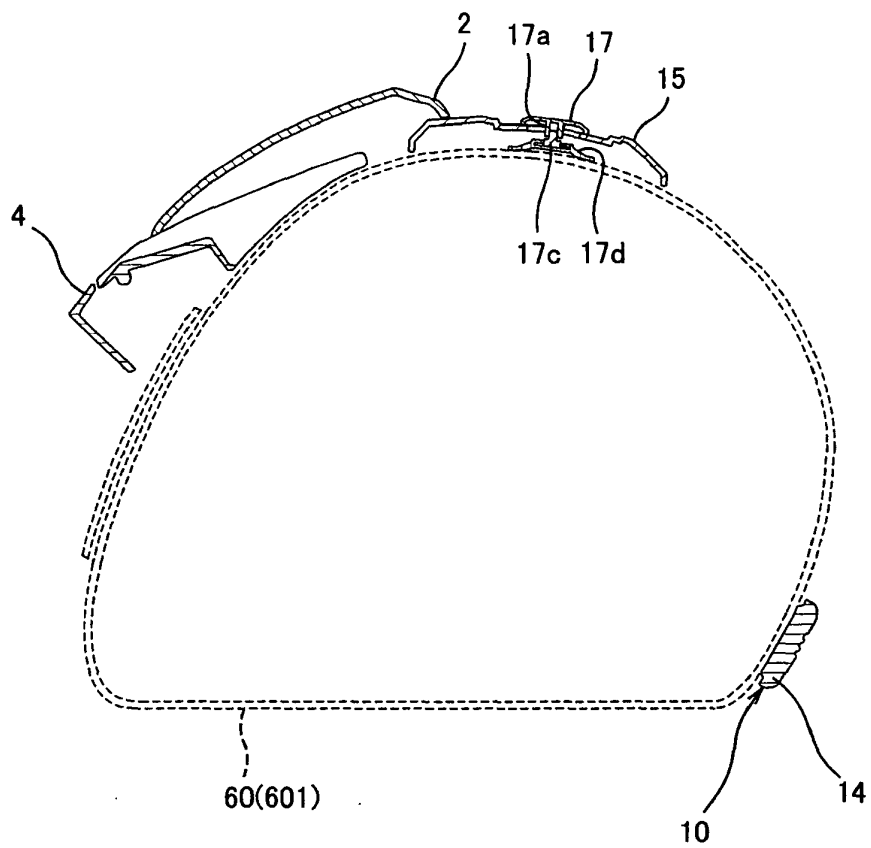


Fig. 10

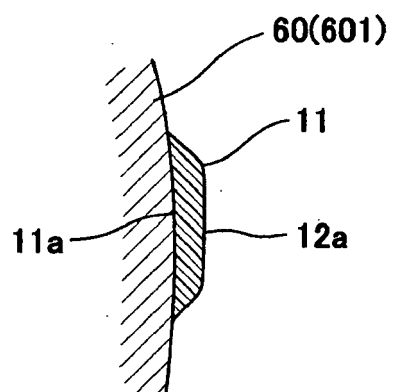


Fig. 11

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2008/001243

A. CLASSIFICATION OF SUBJECT MATTER

A42B3/04 (2006.01) i

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)

A42B3/00-7/00

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2008

Kokai Jitsuyo Shinan Koho 1971-2008 Toroku Jitsuyo Shinan Koho 1994-2008

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 2003-535226 A (Active Photonics AG., Visualisierungs- und Kommunikationssysteme), 25 November, 2003 (25.11.03), Claims 1 to 5; Fig. 6 & US 2003-0058544 A1 & EP 1107040 A1	1, 7-16 2-6
Y	JP 11-331970 A (Temco Japan Co., Ltd.), 30 November, 1999 (30.11.99), Fig. 6 & US 6456721 B1	1, 7-16
Y	JP 2002-88559 A (Honda Motor Co., Ltd.), 27 March, 2002 (27.03.02), Claim 1; Fig. 2 & US 2002-0030589 A1	7, 8



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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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

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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

30 June, 2008 (30.06.08)

Date of mailing of the international search report

08 July, 2008 (08.07.08)

Name and mailing address of the ISA/

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Authorized officer

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2008/001243

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 11-148837 A (Nippon Seiki Co., Ltd.), 02 June, 1999 (02.06.99), Claim 1; Fig. 2 (Family: none)	15, 16

Form PCT/ISA/210 (continuation of second sheet) (April 2007)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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