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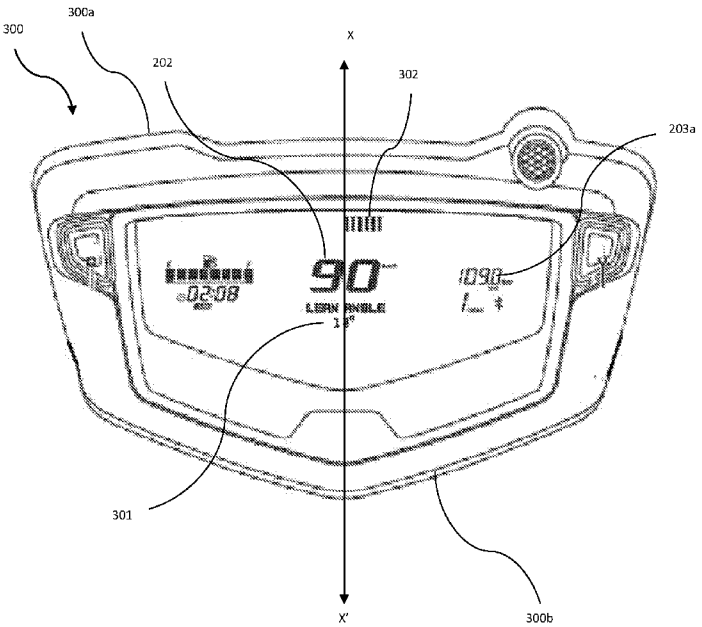


FIGURE 3

(57) Abstract: The present invention discloses about a display unit (300, 400) of a vehicle, for example an instrument cluster, comprising a first region (A) and a second region (B). The second region (B) of the display unit (300, 400) displays a lean angle (301) taken by the vehicle (100). The displayed lean angle (301) on the display unit (300, 400) proportionately shifts based on the direction of the lean of vehicle (100). Accordingly the size of the display of the lean angle (301) also shifts based on the direction of the lean of vehicle (100). Such location and size of the displayed lean angle on the display unit (300, 400) enables a rider to quickly glance at the lean angle indicated on the display unit (300, 400) while leaning the vehicle (100), without shifting his concentration from the road for an extended period of time.

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A DISPLAY UNIT

Technical Field

[0001] The present subject matter described herein generally relates to a vehicle, and particularly but not exclusively relates to a display unit of a vehicle.

BACKGROUND

[0002] Conventionally, an instrument cluster or a speedometer is a gauge that acts as a display unit of a vehicle and displays the instantaneous speed of the vehicle along with other features. Now universally fitted to motor vehicles, they started to be available as options in the early 20th century, and as standard equipment from about 1910 onwards. Early versions of speedometers were called eddy current speedometers but they were later replaced by modern electronic speedometers, because of certain disadvantages, such as they were incapable of showing the vehicle speed when the vehicle was running in reverse gear.

[0003] These modern electronic speedometers mostly include a rotation sensor mounted in the transmission that delivers a series of electronic pulses whose frequency corresponds to the average rotational speed of the driveshaft of the vehicle, and therefore the vehicle's speed is displayed, assuming the wheels have full traction. The sensor is typically a set of one or more magnets mounted on the output shaft or (in transaxles) differential crown wheel or a toothed metal disk positioned between a magnet and a magnetic field sensor. As the part turns, the magnets or teeth pass beneath the sensor, each time producing a pulse in the sensor as they affect the strength of the magnetic field it is measuring.

[0004] Alternatively, particularly in vehicles with multiplex wiring, some manufacturers use the pulses coming from the Antilock Brake System (ABS) wheel sensors which communicate vehicle speed to the instrument panel via the CAN Bus. Most modern electronic speedometers have the additional ability over the eddy current type to show the vehicle speed when moving in reverse

gear. In such vehicles, a computer converts the pulses to a speed and displays this speed on an electronically controlled, analog-style needle or a digital display. Pulse information is also used for a variety of other purposes by the Electronic Control Unit (ECU) or full-vehicle control system, e.g. triggering ABS or traction control, calculating average trip speed, or to increment the odometer in place of it being turned directly by the speedometer cable.

[0005] Another early form of electronic speedometer relies upon the interaction between a precision watch mechanism and a mechanical pulsator driven by the vehicle's wheel or transmission.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The detailed description is described with reference to an embodiment of a saddle type two wheeled vehicle along with the accompanying figures. The same numbers are used throughout the drawings to reference like features and components.

[0007] Fig. 1illustrates a left hand side view of a two wheeled vehicle, when viewed from left hand side of the rider while the rider is in riding position, in accordance with an embodiment of the present invention.

[0008] Fig. 2 illustrates a of a conventional instrument cluster of a two wheeled vehicle when viewed orthogonally to the display surface.

[0009] Fig. 3 illustrates a display surface orthogonal view of a display unit of a two wheeled vehicle, in accordance with an embodiment of the present invention.

[00010] Fig. 4 illustrates a display surface orthogonal view of a display unit of a two wheeled vehicle, in accordance with an embodiment of the present invention.

[00011] Fig. 5 a illustrates a display surface orthogonal view of a display unit of a two wheeled vehicle, in accordance with an alternate embodiment of the present

invention, when the vehicle is leaning in left hand side of the rider, when viewed from the rider's perspective when the rider is in riding position.

[00012] Fig. 5 b illustrates a display surface orthogonal view of a display unit of a two wheeled vehicle, in accordance with an alternate embodiment of the present invention when the vehicle is leaning in right hand side of the rider, when viewed from the rider's perspective when the rider is in riding position.

[00013] Fig. 6 illustrates a display surface orthogonal view of a display unit of a two wheeled vehicle, in accordance with an alternate embodiment of the present invention.

[00014] Fig. 7 illustrates a display surface orthogonal view of a display unit of a two wheeled vehicle, in accordance with an alternate embodiment of the present invention.

[00015] Fig. 8 illustrates a display surface orthogonal view of a display unit of a two wheeled vehicle, in accordance with an alternate embodiment of the present invention.

DETAILED DESCRIPTION

[00016] Latest modern vehicles particularly motorcycles come with various attractive display features on the speedometer or the instrument cluster. These display features include speed of the vehicle (meter per hour or kilometer per hour), total distance traveled, distance travelled during the latest trip, fuel available in the fuel tank, prediction of distance that can be covered with the fuel available in the tank at any particular moment of time, average fuel consumption at any particular moment of time, time, head lamp position (Full Beam or Short Beam), outside temperature, engine temperature, and tyre pressure. Some other features include a built-in odometer, built in trip meter, maximum speed recall,

low battery warning, programmable button function, lap timer and so on. These features vary from vehicle to vehicle, considering the requirements of the rider who is intended to use the vehicle, choice of manufacturer etc.. Some known arts include the lean angle display as one of the essential display feature of the instrument cluster.

[00017] In vehicles, particularly motorcycles, the rider plays major role of balancing the motorcycle against the gravity and the speed of the vehicle. There is a requirement of a precise balance in such vehicles even when the vehicle is been driven straight. However, during turning the vehicles or when a road corner is reached, the vehicle needs to ensure critical balance against speed, gravity and velocity. Therefore, leaning during turning or in corners is an essential technique which is followed by rider's all over the world, to keep the vehicle in balance.

[00018] The leaning of the vehicle by the rider to keep the vehicle in balance mostly depends upon the factors such as the angle of the corner, the velocity of the vehicle, riding surface, tyre surface condition, and the vehicle's weight. This calculation is basically done by the rider in form of a judgment on the turning moment of the vehicle, which is achieved by the rider's previous learning and experiences. The knowledge of the maximum safe lean angle of the vehicle aids in unlocking the maximum speed potential of a vehicle. The farther the rider can lean the vehicle, the higher potential corner speed can be achieved. But the maximum lean angle reached should be limited with due consideration of the safety of the rider as well. Because as soon as the rider crosses the safe range of the lean angle of the vehicle, the vehicle would trip causing severe accidents and therefore compromising the safety of the rider and the vehicle.

[00019] Therefore, riders particularly riders handling a racing motorcycle always try to figure out the maximum safe lean angle of their motorcycles, so that they are aware of the ways of increasing their riding performance while ensuring safety.

[00020] The leaning angle of the vehicles, particularly a motorcycle relatively varies according to the motorcycle type and mode of riding, which makes the maximum safe lean anglein motorcycles different for every segment of the motorcycle. For example, the maximum safe lean angle of a racing bike is much higher and different than the street sports or regular street bikes. Most street sports or regular street bikes can safely lean up to a lean angle of 35 degrees, however racing motorcycles can safely lean over 60 degrees.

[00021] Mostly, the lean angle is sensed by a lean angle sensor attached to the vehicle which senses and detects the leaning angle of the vehicle. In some known arts depending upon the data received by the lean angle sensor, if the vehicle detects surpassing of a prefixed safe margin of the lean angle, then the engine power is automatically cut down, to minimize internal mechanical hazard and to reduce the severity of the accident because of the spinning wheel and the speed of the vehicle. In other known arts, the lean angle sensor also sends angle data to the motorcycle engine control unit (ECU). The ECU in such vehicles responds to the angle data and takes necessary safety and control measures. These control measures include controlling traction control, ABS control on corners, and wheel control in lean condition, etc.

[00022] In most cases, particularly when a professional rider is riding a racing motorcycle, the professional rider requires to know the exact lean angle taken by him during a turning, so that he can rightly access performance and work upon his or her skills. Therefore, such riders opt for a motorcycle which displays a lean angle taken by them while riding the vehicle.

[00023] In some known arts, the lean angle of a vehicle is digitally displayed on a digital instrument cluster. However, the area in which the lean angle is displayed in such vehicles is usually in the bottom right most corner of the instrument cluster. Also the area of the instrument cluster utilized for the display of the lean

angle is considerably small when compared to the area of the instrument cluster utilized for the display of the speed of the vehicle.

[00024] As per the riding dynamics when the rider is taking a turn on the corners, ideally he is supposed to look in the direction in which he is riding the vehicle, this is because the body of the rider typically aligns in the direction in which the rider looks and that aids in taking swift turns by the rider. Such taking of swift turnings without any mistakes becomes crucial when the vehicle is being ridden on racing tracks by professional racers. But since the known arts provide the lean angle displayed in the corner of the instrument cluster in a considerable small space, in order to assess one's performance the rider tends to look at that corner of the instrument cluster while he is leaning with the vehicle to take the intended turn. Thus in order to note his instantaneous lean angle, the rider shifts his focus from the road to the instrument cluster. Doing so usually takes the focus of the rider away from the road for an extended period of time because of the location and the size of the font of the lean angle display. This extended shift of focus from the road to the instrument cluster can be detrimental for the rider, as while looking at the corner of the instrument cluster while observing the instantaneous lean angle taken, sometimes the body of the rider also slightly moves towards the direction in which the lean angle is displayed. Resultant to which the rider fails to align his body in the direction in which the vehicle is moving which can further lead to unbalancing of the vehicle and thus can lead to detrimental accidents. Alternatively, if the display of the angle is disposed centrally on the display unit, it may still hamper ergonomic viewing of the lean angle when the rider has leaned in one of a left and right direction. With rider changing his position of lean from one extreme to other, this makes it a moving target challenge to display the lean angle information to the rider is an ergonomic way such that it is promiscuous across the range of movement of the vehicle as well as the rider and thereby

achieve safety of the rider by displaying the required information in a manner in which the rider can process it effectively within a fraction of time.

[00025] Hence there is a need of a display unit of a vehicle which enables the rider to assess ones riding performance with ease by observing the displayed lean angle without compromising with riding safety.

[00026] The present subject matter has been devised in view of the above circumstances as well as solving other problems of the known art.

[00027] In an embodiment of the present subject matter, the present subject matter relates to a display unit of a vehicle, for example an instrument cluster, comprising a first region and a second region. The first region is closer to a boundary of the display unit and the second region is farther from the boundary of the display unit. The second region of the display unit displays a lean angle taken by the vehicle. The displayed lean angle on the display unit, proportionately shifts based on the direction of the lean of vehicle.

[00028] As per an aspect of the present embodiment, the lean angle indication is user controlled. The instrument cluster of the vehicle provides the rider the option of choosing between the display options of a second indication, for example an average speed of the vehicle and the lean angle of the vehicle. Post the rider makes a choice of enabling the display of the lean angle taken by the rider on the instrument cluster, a controller receives the input of activation of lean angle indication or lean graph and the lean angle is accordingly displayed. As per another aspect of the present embodiment a first indication, for example an engine speed data display, is displayed when the controller does not receive input of activation of lean angle indication or lean graph by rider.

[00029] As per another aspect of the present embodiment the lean angle of the vehicle is capable of being displayed in numeric form or in graph form. The space utilized for the display of the lean angle in bar or lean graph can be the topmost

portion of the instrument cluster or also can be the bottom most part of the instrument cluster. As per another aspect of the present subject matter the display of the bar or lean graph of the lean angle is indicated on the side on which the vehicle is taking the lean angle. For example, the rider can assess his riding performance by having a glance at the lean angle in a fraction of time and the information is depicted in form of bars on the right hand side of the instrument cluster, when he is taking a lean angle towards his right hand side, when viewed from a rider's perspective when rider is riding the vehicle. Similarly, the rider can assess his riding performance by having a glance at the lean angle and the information is depicted in form of bars on the left hand side of the instrument cluster, when he is taking a lean angle towards his left hand side, when viewed from a rider's perspective when rider is riding the vehicle.

[00030] As per another aspect of the present embodiment, when the rider is riding the vehicle in either left or right direction within a predetermined range, the lean angle is displayed near the centre of the display unit along a vertical axis. For example, the vehicle has a lean angle within a predetermined range of 15 degrees on either right or left side of the vehicle, the lean angle is displayed near the centre of the display In situations where the vehicle leans beyond the predetermined range towards the right hand side of the vehicle, the display of the lean angle dynamically shifts towards the right hand side of the vehicle proportionally based on direction of the lean of the vehicle. Similarly in situations where the vehicle leans beyond the predetermined range towards the left hand side of the vehicle, the display of the lean angle dynamically shifts towards the left hand side of the vehicle proportionally based on direction of the lean of the vehicle.

[00031] As per another aspect of the present embodiment, the font size of the lean angle display increases proportionately based on the lean of the vehicle. The

proportionate increase in the font size aids in combating the problem of the poor visibility of the lean angle taken by the rider while leaning the vehicle.

[00032] As per another embodiment of the present subject matter, the display unit of a vehicle, multiplexes the lean angle data display with a first indication, for example an engine speed data display.

[00033] As per another embodiment of the present subject matter the instrument cluster of the vehicle is capable of storing maximum lean angle taken by the rider during or post completion of a ride and display logged data to the user on demand.

[00034] As per another embodiment of the present subject matter the instrument cluster of the vehicle is capable of storing last lean angle taken by the rider during or post completion of a ride.

[00035] As per another embodiment of the present subject matter the instrument cluster of the vehicle includes a range of predefined color codes, which depict the status of the lean angle taken by the rider. For example, the instrument cluster displays green color when the lean angle taken by the rider is within a predetermined range; the instrument cluster displays yellow color when the lean angle taken by the rider is about to cross the predetermined range; and the instrument cluster displays red color when the lean angle taken by the rider is beyond the predetermined range and calls for retracting thereby ensuring safety limits and enabling to achieve safe ride by the rider. These predetermined ranges can be customized according to the type of the vehicle being ridden, or according to the maximum safe possible lean angle that can be taken by the rider, or according to the level of experience of the rider himself.

[00036] As per another embodiment of the present subject matter the lean graph or bar form of lean angle depiction and digital depiction of lean angle can be displayed together on an instrument cluster.

[00037] As per another embodiment of the present subject matter the instrument cluster of the vehicle can be a circular instrument cluster.

[00038] As per another embodiment of the present subject matter the lean angle can be displayed in an analogue instrument cluster using a separate needle.

[00039] As per another embodiment of the present subject matter whenever the vehicle leans more than a predefined lean angle, for example, more than 60 degrees of lean angle, a vehicle warning system is activated to caution the rider and potentially minimize the harm that may be caused to the vehicle or the rider owing to an impending accident.

[00040] As per another embodiment of the present subject matter position of the lean graph on display unit is customizable by a rider.

[00041] As per another efficacy of the present subject matter, , the display of the lean angle taken by the rider on the instrument cluster in accordance to the direction in which the vehicle is leaning, it enables the rider to quickly glance at the speedometer while taking the lean angle, without having to shift his concentration from the road for an extended period of time.

[00042] As per another efficacy of the present subject matter, , the display of the lean angle is read by the rider on the instrument cluster in lean graph or bar form of lean angle depiction and the digital form of lean angle depiction which gives a prominent visual indication of the instantaneous lean angle and further reduces the time which the rider requires to quickly glance at the speedometer while taking the lean angle, without having to shift his concentration from the road for an extended period of time.

[00043] As per another efficacy of the present subject matter the lean angle display as suggested by the prior discussed embodiments aids in proving comfort to the rider when he requires to assess his performance by noting the lean angle taken by him as well as enhances the aesthetics of the instrument cluster because of the different display techniques disclosed.

[00044] As per another efficacy of the present subject matter the lean angle display as disclosed in the embodiments uses fewer microcontroller pins in the instrument cluster thus reducing overall cost of the instrument cluster.

[00045] Exemplary embodiments detailing features regarding the aforesaid and other advantages of the present subject matter will be described hereunder with reference to the accompanying drawings. Various aspects of different embodiments of the present invention will become discernible from the following description set out hereunder. Rather, the following description provides a convenient illustration for implementing exemplary embodiments of the invention. It should be noted that the description and figures merely illustrate principles of the present subject matter. Various arrangements may be devised that, although not explicitly described or shown herein, encompass the principles of the present subject matter. Moreover, all statements herein reciting principles, aspects, and examples of the present subject matter, as well as specific examples thereof, are intended to encompass equivalents thereof. Further, it is to be noted that terms “upper”, “down”, “right”, “left”, “front”, “forward”, “rearward”, “downward”, “upward”, “top”, “bottom”, “exterior”, “interior” and like terms are used herein based on the illustrated state or in a standing state of the two wheeled vehicle with a driver riding thereon. Furthermore, arrows wherever provided in the top right corner of figure(s) in the drawings depicts direction with respect to the vehicle, wherein an arrow F denotes front direction, an arrow R indicates rear direction, an arrow Up denotes upward direction, an arrow Dw denotes downward direction, an arrow RH denotes right side, and an arrow LH denotes left side. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting.

[00046] Fig. 1 illustrates a left hand side view of a two wheeled vehicle 100, when viewed from left hand side of the rider while the rider is in riding position, in accordance with an embodiment of the present invention. The two wheeled

vehicle 100 includes a main frame (not shown) to support different parts of the two wheeled vehicle 100. The main frame includes a head tube (not shown) at its front end. The head tube supports a steering shaft (not shown) rotatably in a certain range. In an upper portion of the head tube, a handlebar 109 is rotatably integrally connected to the steering shaft (not shown). The handlebar 109 is used to steer the two wheeled vehicle 100 and is connected to a front wheel 104 through the steering shaft (not shown) and a front fork assembly 106. An upper portion of the front wheel 104 is covered by a front fender 116 which prevents mud and water from getting deflected towards the steering shaft. Further, the front fork assembly 106 is supported on the front fender 116 by means of a brace fender (not shown).

[00047] In a front portion of the body frame a fuel tank 117 is arranged immediately behind the handlebar 109 and is disposed over a first power source, for example an engine 119. A seat assembly 110 is placed behind the fuel tank 117. The seat assembly 110 includes a front rider seating portion 111a and pillion rider seating portion 111b. The pillion rider seating portion 111b is placed on the rear part of the main frame, where the rear part of main frame is covered by the tail cover assembly 103.

[00048] For the safety of the rider and in conformance with the traffic rules, a headlamp unit 112 and a turn signal lamp unit (not shown) are provided in the front portion of the two wheeled vehicle 100. On the rear portion of the two wheeled vehicle 100 a tail lamp 113 and a turn signal lamp unit 118 is provided on the rear portion of the tail cover assembly 103.

[00049] Suspension systems are provided for comfortable steering of the two wheeled vehicle 100 on the road. The front fork assembly 106, which forms the front suspension system, serves as rigidity component just like the main frame. The front fork assembly 106 is clamped to the head tube (not shown) through an upper bracket (not shown) and a lower bracket (not shown) and is capable of being moved to the left and right. Further, a rear suspension system 115, which is

a hydraulic damped arrangement, is connected to the main frame. The rear suspension system 115 comprises of at least one rear suspension (not shown) preferably disposed centrally in the longitudinal mid plane of the two wheeled vehicle 100. However, in a two wheeled vehicle 100 with two rear suspensions, the same may be disposed on the left side and the right side respectively of said two wheeled vehicle 100.

[00050] The first power source, for example the engine 119 is mounted to a front lower portion of the main frame by means of an engine mounting bracket (not shown). The engine 119 is equipped with an exhaust system that includes an exhaust pipe (not shown) connected to the engine 119 and a muffler (not shown) connected to the exhaust pipe. The muffler extends rearwards along the right side of the rear wheel 105.

[00051] Further, a swing arm 107 extending rearwards is swingably connected to a lower rear portion of the main frame. The rear wheel 105 is rotatably supported at a rear end of the swing arm 107. Power from the engine 119 is transmitted to the rear wheel 105 through a power drive mechanism, such as a drive chain, so as to drive and rotate the rear wheel 105.

[00052] A rider footrest (not shown) is mounted on by means of add-on mounting structure which is mounted on the main frame. A rear fender 114 for covering an upper side of the rear wheel 105 is mounted to a rear portion of main frame to prevent mud and water splashed by the rotating rear wheel 105 from entering the muffler, the engine 119 and other parts disposed close by. In the present embodiment since the distance between the rear wheel 105 and the rear fender 114 is large, a second rear fender 102 is provided just above the rear wheel 105.

[00053] To enhance the overall aesthetics of the two wheeled vehicle 100 and to prevent undesired foreign particles from entering parts of the two wheeled vehicle 100, a plurality of rear covers (not shown) is attached to a rear portion of the main frame.

[00054] Area below the seat assembly110 and the fuel tank 117 of the two wheeled vehicle 100 is covered on both sides by a cover frame assembly 101. The cover frame assembly 101 is further connected to main frame and the tail cover assembly 103.

[00055] Fig. 2 illustrates a view of a conventional instrument cluster 200 of a two wheeled vehicle 100 (shown in Fig. 1) when viewed orthogonally to the display surface. In case of conventional instrument clusters 200, when the instrument cluster 200 is turned ON by means of starting the vehicle 100, the instrument cluster 200 displays a number of information depending upon the type of the vehicle 100. These information include a coolant temperature indication 201, an instantaneous speed indication 202, a RPM bar indication 203, a RPM indication 203a, a Bluetooth connectivity indication 204, a first speed indication 205 or an average speed indication, a gear indication, a neutral gear indication light 206a, a time indication 207, a fuel level indication 208, etc. The placement of these indications may vary from vehicle to vehicle depending upon the features provided with the vehicle 100.

[00056] As per the illustrated figure of a conventional instrument cluster 200, the instantaneous speed indication202 is indicated substantially in the center of the instrument cluster 200, the average speed indication 205 is displayed below the instantaneous speed indication202. The neutral gear indication light 206a, the gear indication206, the Bluetooth connectivity indication204, the RPM indication203a and the RPM bar indication203 are displayed on the right hand side of the instrument cluster 200, when viewed from a rider's perspective when the rider is in riding position. The fuel level indication208, the time indication207 and the coolant temperature indication201 are displayed on the left hand side of the instrument cluster 200, when viewed from a rider's perspective when the rider is in riding position.

[00057] In such conventional instrument clusters 200, usually a lean angle indication (not shown) is digitally displayed on the right hand side top corner of the vehicle

100in place of revolution per minute (RPM) indication. This information is displayed when the rider leans the vehicle 100 while taking a turn, or while cornering. This display of the lean angle is conventionally always on the right hand side top corner of the vehicle 100 irrespective of the direction in which the rider is leaning the vehicle 100.

[00058] Fig. 3 illustrates a display surface orthogonal view of a display unit 300 of a two wheeled vehicle 100 (shown in Fig. 1), in accordance with an embodiment of the present invention. As per the present embodiment, the present subject matter relates to a display unit 300 for example an instrument cluster, comprising a first region A (shown in Fig 5a) and a second region B (shown in Fig. 5a). The first region A is closer to a boundary C (shown in Fig. 5a) of the display unit 300 and the second region B is farther from the boundary of the display unit 300. The second region B of the display unit 300 displays a lean angle 301 made by the vehicle 100. The displayed lean angle 301 on the display unit 300, proportionately shifts laterally to the left or right side based on the direction of the lean of vehicle 100.The display unit300 of the vehicle 100 provides the rider the option to make a choice between the display options of a first indication 205, for example the average speed indication (shown in Fig. 2) of the vehicle 100 and the lean angle indication 301 of the vehicle 100. Post the rider makes a choice of enabling the display of the lean angle indication 301 instead of the first indication 205 (shown in Fig. 2), a controller (not shown) receives the input of activation of lean angle 301 digitally or lean graph 302 and the lean angle 301 or lean angle graph 302 is accordingly displayed.

[00059] The lean angle 301 of the vehicle 100 is capable of being displayed digitally or in graph form. The space utilized for the display of the lean angle in bar or lean graph 302 can be near the topmost portion 300a of the display unit 300 or also can be near the bottom most part 300b of the display unit 300. The display of the bar or lean graph 302 of the lean angle 301 is indicated on the side on which the

vehicle is taking the lean angle 301. The lean graph 302 is displayed on the right hand side as shown in this embodiment. For example, the rider can assess ones riding performance by having a glance at the lean angle 301 depicted in form of bars on the right hand side of the display unit 300, when he is taking a lean angle 301 towards his right hand side, when viewed from a rider's perspective when rider is riding the vehicle 100. Similarly, the rider can assess ones riding performance by having a glance at the lean angle 301 depicted in form of bars on the left hand side of the display unit 300, when he is taking a lean angle 301 towards his left hand side, when viewed from a rider's perspective when rider is riding the vehicle 100.

[00060] When the rider is riding the vehicle 100 in either left or right lean direction within a predetermined lean angle range, for example within 15 degrees on either side of the vehicle 100, then the lean angle 301 is displayed near the centre of the display unit 300 along an axis X-X'.

[00061] The present illustration indicates the situation in which the vehicle 100 leans in right direction within the predetermined range, and the vehicle 100 makes a lean angle 301 of 12 degrees on right side of the vehicle 100, when the vehicle is viewed from the rider's perspective when the rider is in riding position. The position of the lean angle 301 is displayed on the central region of the instrument cluster 300 below the 202, within a second region B (shown in Fig. 5a). In the present illustration along with the digital numeric indication of the lean angle indication 301, a lean graph 302 is indicated near the upper most part 300a of the instrument cluster 300 and substantially near a central axis X-X'. This lean graph 302 in the present illustration is generated when the lean angle 301 made by the vehicle 100 is within a predetermined range and the vehicle 100 is leaning towards one of a right hand side and left hand side of the rider. The lean angle graph 302 in this illustration is displayed slightly towards the right hand side of

the instrument cluster 300 from the center of the display unit300, which is the right hand side of the axis X-X'.

[00062] This proposed display of the lean angle 301 enables a prominent and promiscuous visual display of the lean angle taken by the rider when the rider slightly bends the vehicle 100 towards his right hand side by taking a quick glance in a fraction of time. The proposed display of the lean angle 301 reduces dangerous shift in the rider's concentration from the road to the instrument cluster while driving for an extended period of time.

[00063] Fig. 4 illustrates a display surface orthogonal view of a display unit 300 of a two wheeled vehicle 100 (shown in Fig. 1), in accordance with another embodiment of the present invention. The present illustration indicates the situation in which the vehicle 100 leans in left direction within the predetermined range, and the vehicle 100 makes a lean angle within a predetermined range, for example 12 degrees on the left side of the vehicle 100, when the vehicle 100 is viewed from the rider's perspective when the rider is in riding position. The position of the lean angle indication is displayed on the central region of the display unit 300 below the instantaneous speed indication 202, within a second region B (shown in Fig. 5a). In the present illustration along with the digital indication of the lean angle 301, a lean graph 302 is indicated near the upper most part 300a of the display unit 300 substantially near a central axis X-X', just above the first plane A. This lean graph 302 in the present illustration is generated when the lean angle 301 made by the vehicle 100 is within a predetermined range and the vehicle 100 is leaning towards the left hand side of the rider. The lean angle graph 302 in this illustration is displayed slightly towards the left hand side of the display unit 300 from the center of the display unit 300, which is left hand side of the axis X-X'.

[00064] This proposed display of the lean angle indication 301 enables a prominent visual display of the lean angle taken by the rider when the rider slightly bends the vehicle 100 towards his left hand side. The proposed display of the lean angle

indication 301 reduces dangerous and undesirable shift in the rider's concentration from the road to the display unit 300 while driving for an extended period of time.

[00065] Fig. 5 a illustrates a display surface orthogonal view of a display unit 300 of a two wheeled vehicle 100 (shown in Fig. 1), in accordance with an alternate embodiment of the present invention, when the vehicle 100 is leaning in left hand side of the rider, when viewed from the rider's perspective when the rider is in riding position. Similar to what discussed in the prior embodiments, in situations where the vehicle 100 leans beyond the predetermined range towards the left hand side of the vehicle 100, when viewed from the rider's perspective when the rider is in riding position, the display of the lean angle 301 shifts towards the left hand side of the vehicle proportionally based on direction of the lean of the vehicle 100. The size of the lean angle 301 display increases proportionately based on the lean of the vehicle 100 in the left direction thereby augmenting the promiscuity as well as demanding smaller fraction of time of rider's attention to convey the information safely. Accordingly in another embodiment, the lean graph 302 (not shown) is displayed towards the left hand side of the display unit 300.

[00066] The present figure also illustrates a first region A, a second region B and a boundary C of the display unit 300. The first region A is closer to the boundary C and the second region B is farther from the boundary C of the display unit 300. The lean angle 301 display and the lean graph 302 (shown in Fig. 3) are both displayed in the first region A.

[00067] Fig. 5b illustrates a display surface orthogonal view of a display unit 300 of a two wheeled vehicle 100 (shown in Fig. 1), in accordance with an alternate embodiment of the present invention when the vehicle 100 is leaning in right hand side of the rider, when viewed from the rider's perspective when the rider is in riding position. Similar to what discussed in the prior embodiments, in situations where the vehicle 100 leans beyond the predetermined range towards the right hand side of the vehicle 100, when viewed from the rider's perspective

when the rider is in riding position, the display of the lean angle 301 shifts towards the right hand side of the vehicle 100 proportionally based on direction of the lean of the vehicle. The size of the lean angle 301 display increases proportionately based on the lean of the vehicle 100 in the right hand side direction thereby augmenting the promiscuity as well as demanding smaller fraction of time of rider's attention to convey the information safely. Accordingly, the lean graph 302 (shown in Fig.3) is displayed towards the right hand side of the display unit 300.

[00068] The present figure also illustrates a first region A, a second region B and a boundary C of the display unit 300. The first region A is closer to the boundary C and the second region B is farther from the boundary C of the display unit 300. The lean angle 301 display and the lean graph 302 (shown in Fig. 3) is both displayed in the second region B.As per an embodiment, the display unit is configured to dynamically shift towards left or right, the display of the lean angle based on the lean angle of the vehicle towards that side. As per an additional embodiment, the size of the graphical display increases proportionately to the lean angle. As per another embodiment, the backlit color of the display unit changes color to indicate and or caution the rider of approaching safety limit of the lean angle.

[00069] Fig. 6 illustrates a display surface orthogonal view of a display unit 300 of a two wheeled vehicle 100 (shown in Fig. 1), in accordance with an alternate embodiment of the present invention. The display unit 300 illustrated in the present figure illustrates the embodiment according to which the lean graph 302 is displayed near the bottom most part 300b of the display unit 300, in a manner similar to depiction of the lean graph 302 as discussed in Fig. 2 and Fig. 3.

[00070] Fig. 7 illustrates a display surface orthogonal view of a display unit 400 of a two wheeled vehicle 100 (shown in Fig. 1), in accordance with an alternate embodiment of the present invention. The display unit 400 illustrated in the

present figure illustrates a circular display unit 400, which depicts the lean angle 301 and the lean graph 302 as discussed in Fig. 3 to Fig. 6.

[00071] Fig. 8 illustrates a display surface orthogonal view of a display unit 300 of a two wheeled vehicle 100 (shown in Fig. 1), in accordance with an alternate embodiment of the present invention. The present illustration shows that the lean angle 301 and a first indication 205 are capable of being displayed together on a display unit 300.

[00072] As per an alternate embodiment of the present subject matter the lean angle 301 is capable of being displayed in an analogue instrument cluster (not shown) using a separate needle (not shown).

[00073] Many modifications and variations of the present subject matter are possible in the light of above disclosure. Therefore, within the scope of claims of the present subject matter, the present disclosure may be practiced other than as specifically described.

LIST OF REFERENCE NUMERALS

100: vehicle

101: Cover frame assembly

102: Second rear fender

103: Tail cover assembly

104: Front wheel

105: Rear wheel

106: Front fork assembly

107: Swing arm

109: Handle bar

110: Seat

111a: Rider seat

111b: Pillion seat

112: Headlamp unit

113: Tail lamp

114: Rear fender

115: Rear suspension system

116: Front fender

117: Fuel tank

118: Turn signal lamp

119: Engine

200: Conventional display unit or instrument cluster

201: Coolant temperature indication

202: instantaneous speed indication

203: RPM bar indication

203a: RPM indication

204: Bluetooth connectivity indication

205: First indication206: Gear indication

206a: Neutral gear indication light

207: Time indication

208: Fuel indication

300: Display unit or instrument cluster

300a: Upper most part

300b: Bottom most part

301: Lean angle indication

302: Lean angle bar indication

400: Display unit or instrument cluster

A: First region

B: Second region

C: Boundary of the display unit

X-X': Central axis

I/We Claim:

1. A display unit (300, 400) of a vehicle (100), comprising:

   a first region (A); and

   a second region (B);

   wherein,

   a display of a lean angle (301) of said vehicle (100) is confined to said second region (B) of said display unit (300, 400), and wherein said display of said lean angle (301) proportionately shifts laterally within said second region (B) of said display unit (300, 400) based on said lean angle (301) of said vehicle (100).

2. The display unit (300, 400) of a vehicle (100) as claimed in claim 1, wherein said first region (A) is closer to a boundary (C) of said display unit (300, 400) than said second region (B).

3. The display unit (300, 400) of a vehicle (100) as claimed in claim 1, wherein said second region (B) is farther from a boundary (C) of said display unit (300, 400) than said first region (A).

4. The display unit (300, 400) of a vehicle (100) as claimed in claim 1, wherein said display of a lean angle (301) of said vehicle (100) is substantially close to central plane (XX') when lean angle of said vehicle (100) is within a predetermined range.

5. The display unit (300, 400) of a vehicle (100) as claimed in claim 1, wherein said display of a lean angle (301) of said vehicle (100) dynamically shifts laterally when the lean angle of said vehicle (100) is beyond a predetermined range.

6. The display unit (300, 400) of a vehicle (100) as claimed in claim 1, wherein display of said lean angle (301) is user controlled.

7. The display unit (300, 400) of a vehicle (100) as claimed in claim 1, wherein displayed said lean angle (301) of said vehicle (100) is displayed digitally.

8. The display unit (300, 400) of a vehicle (100) as claimed in claim 7, wherein said display unit (300, 400) displays said lean angle (301) in an analogue display unit using a needle mechanism.
9. The display unit (300, 400) of a vehicle (100) as claimed in claim 1, wherein said display of said lean angle (301) of said vehicle (100) is displayed by means of a line graph (302).
10. The display unit (300, 400) of a vehicle (100) as claimed in claim 1, wherein displayed said lean angle (301) of said vehicle (100) is displayable in both digitally and in a line graph form (302) together on said display unit (300, 400).
11. The display unit (300, 400) of a vehicle (100) as claimed in claim 1, wherein displayed said lean angle (301) of said vehicle (100) is displayed in form of predefined color codes.
12. The display unit (300, 400) of a vehicle (100) as claimed in claim 9, wherein said line graph (302) is displayed in proximity of an uppermost part (300a) of said display unit (300, 400) of said display unit (300, 400).
13. The display unit (300, 400) of a vehicle (100) as claimed in claim 9, wherein said line graph (302) is displayed in proximity of a bottommost part (300b) of said display unit (300, 400).
14. The display unit (300, 400) of a vehicle (100) as claimed in claim 1, wherein said displayed said lean angle (301) of said vehicle (100) is displayed simultaneously as a lean angle (301) indication (302) and a line graph (302) on said display unit (300, 400).
15. The display unit (300, 400) of a vehicle (100) as claimed in claim 1, wherein said display unit (300, 400) displays a maximum lean angle (301) taken by said vehicle (100).
16. The display unit (300, 400) of a vehicle (100) as claimed in claim 1, wherein said display unit (300, 400) displays last lean angle (301) taken by said vehicle (100).

17. The display unit (300, 400) of a vehicle (100) as claimed in claim 1, wherein said display unit (300, 400) displays a warning beyond a predetermined lean angle (301).

18. The display unit (300, 400) of a vehicle (100) as claimed in claim 1, wherein said lean angle (301) is displayed upon a controller receiving input of activation of lean angle (301) or line graph (302) by a user; and a first indication (205) is displayed when said controller does not receive input of activation of lean angle (301) or lean graph (302) by said user.

19. The display unit (300, 400) of a vehicle (100) as claimed in claim 1, wherein said display unit (300, 400) of said vehicle (100), multiplexes the display of said lean angle (301) with a first indication (205).

20. The display unit (300, 400) of a vehicle (100) as claimed in claim 1, wherein size of display of said lean angle (301) increases proportionately to the lean of said vehicle (100).

21. The display unit (300, 400) of a vehicle (100) as claimed in claim 9, wherein size of display of said line angle (302) increases proportionately to the lean of said vehicle (100).

22. The display unit (300, 400) of a vehicle (100) as claimed in claim 1, wherein the backlit color of said display unit (300, 400) changes color to indicate and caution the rider of approaching safety limit of the lean angle of said vehicle (100).

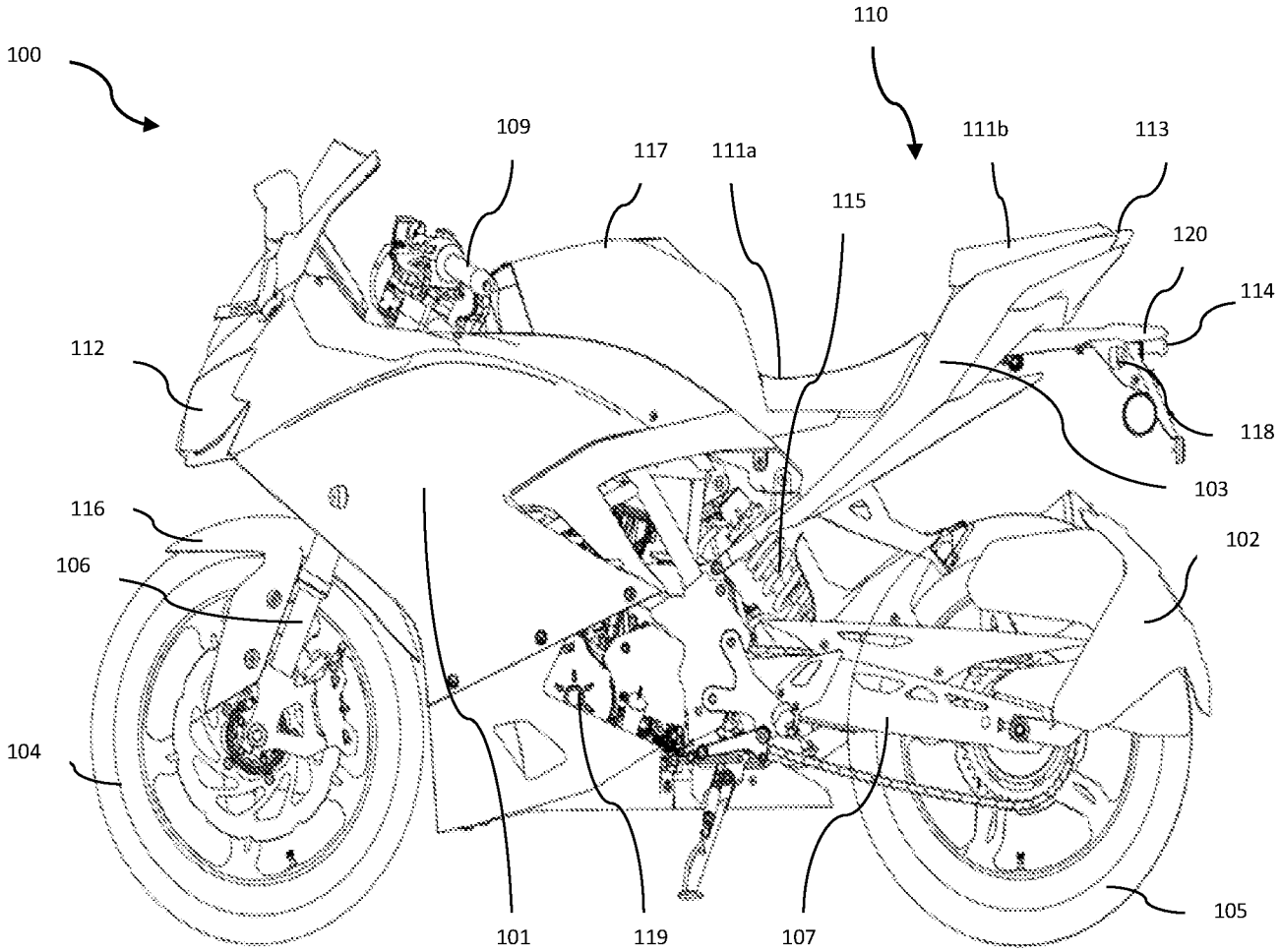

100
110
109
117
111a
115
111b
113
120
114
112
118
103
116
102
106
104
101
119
107
105

FIGURE 1

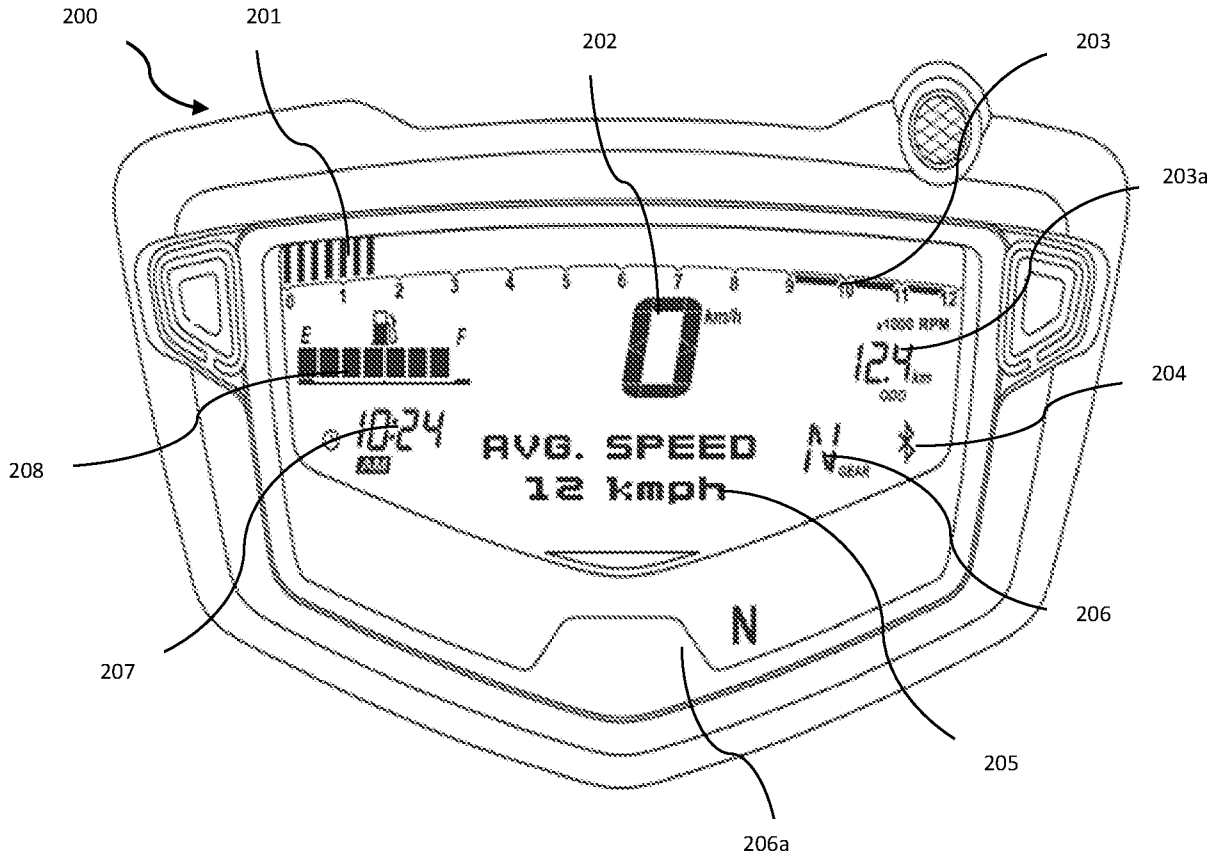

200
201
202
203
203a
204
208
206
207
205
206a
AVG. SPEED
12 kmph
N

FIGURE 2

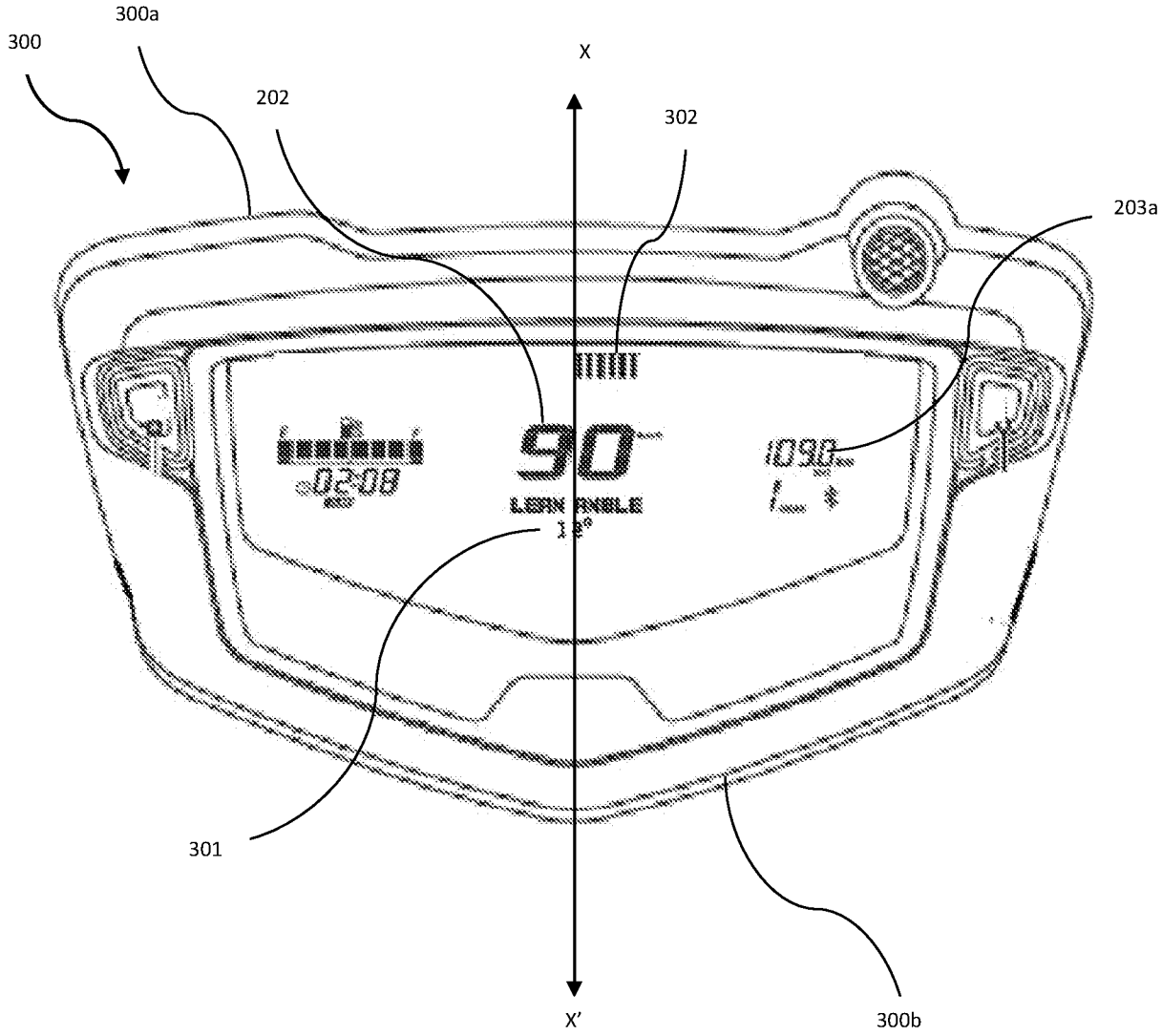


FIGURE 3

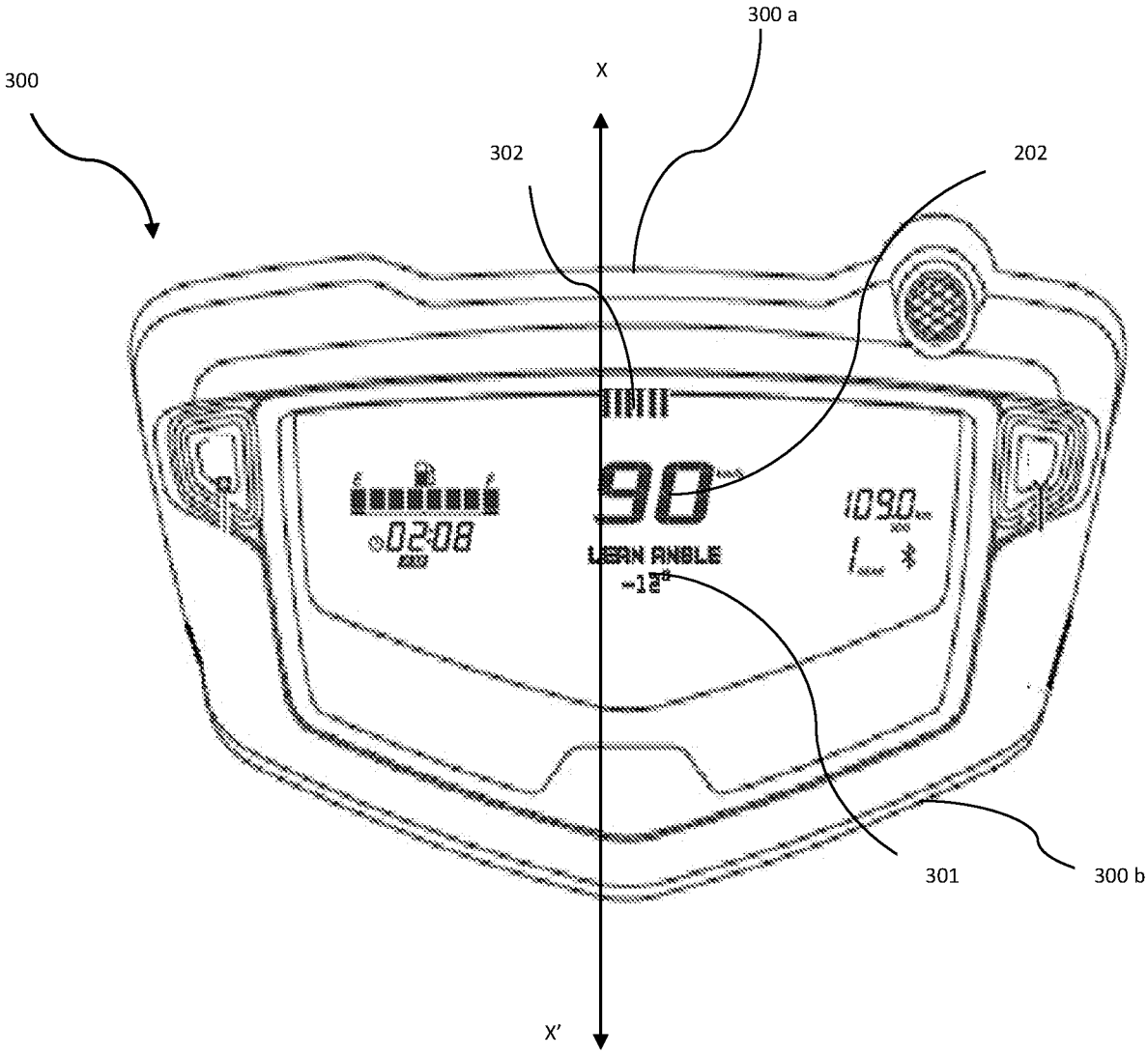


FIGURE 4

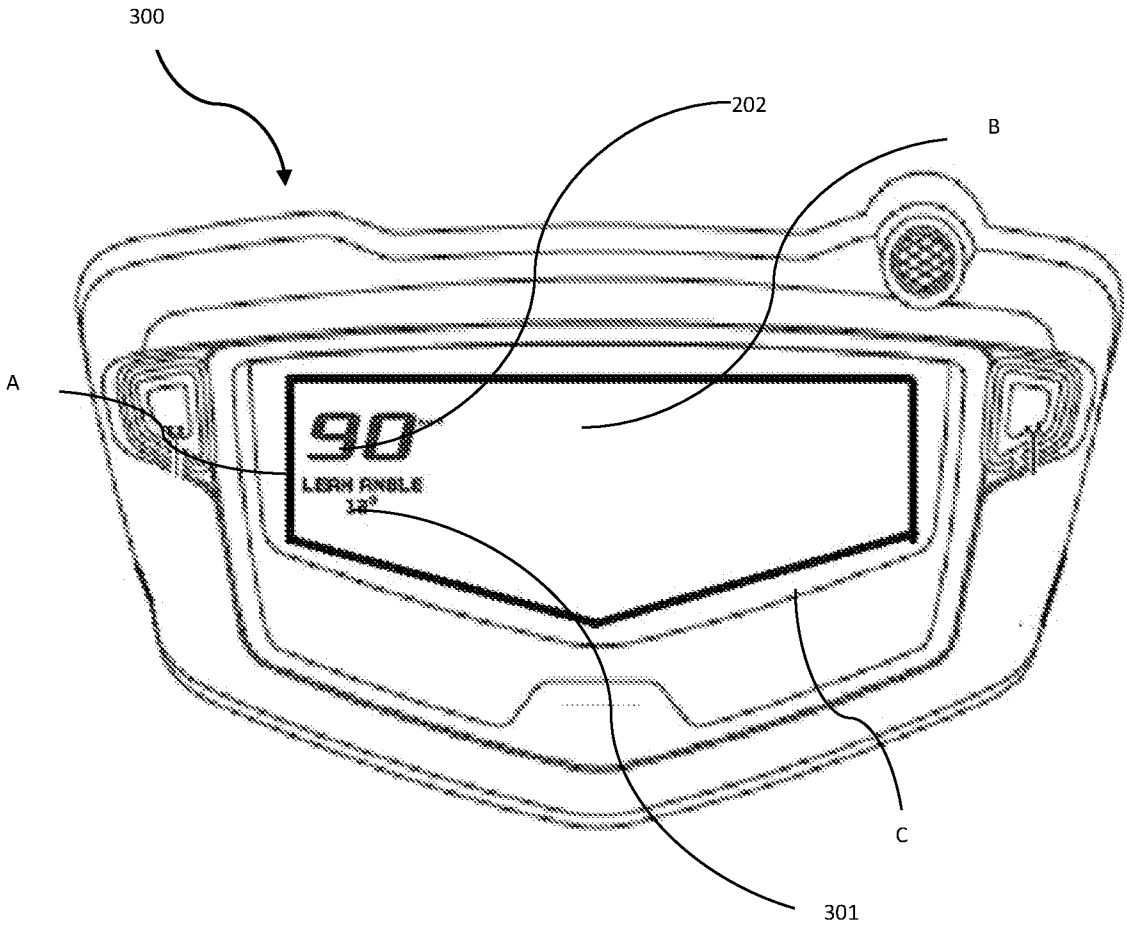


FIGURE 5a

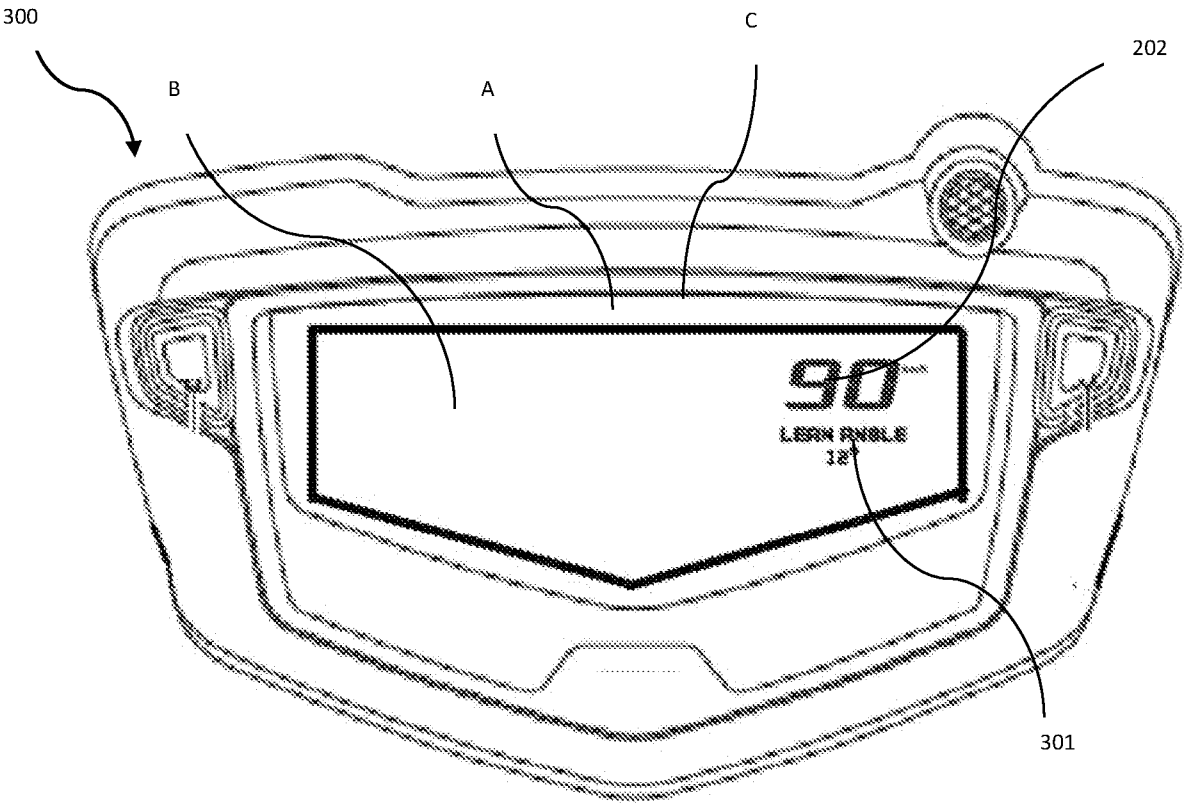


FIGURE 5b

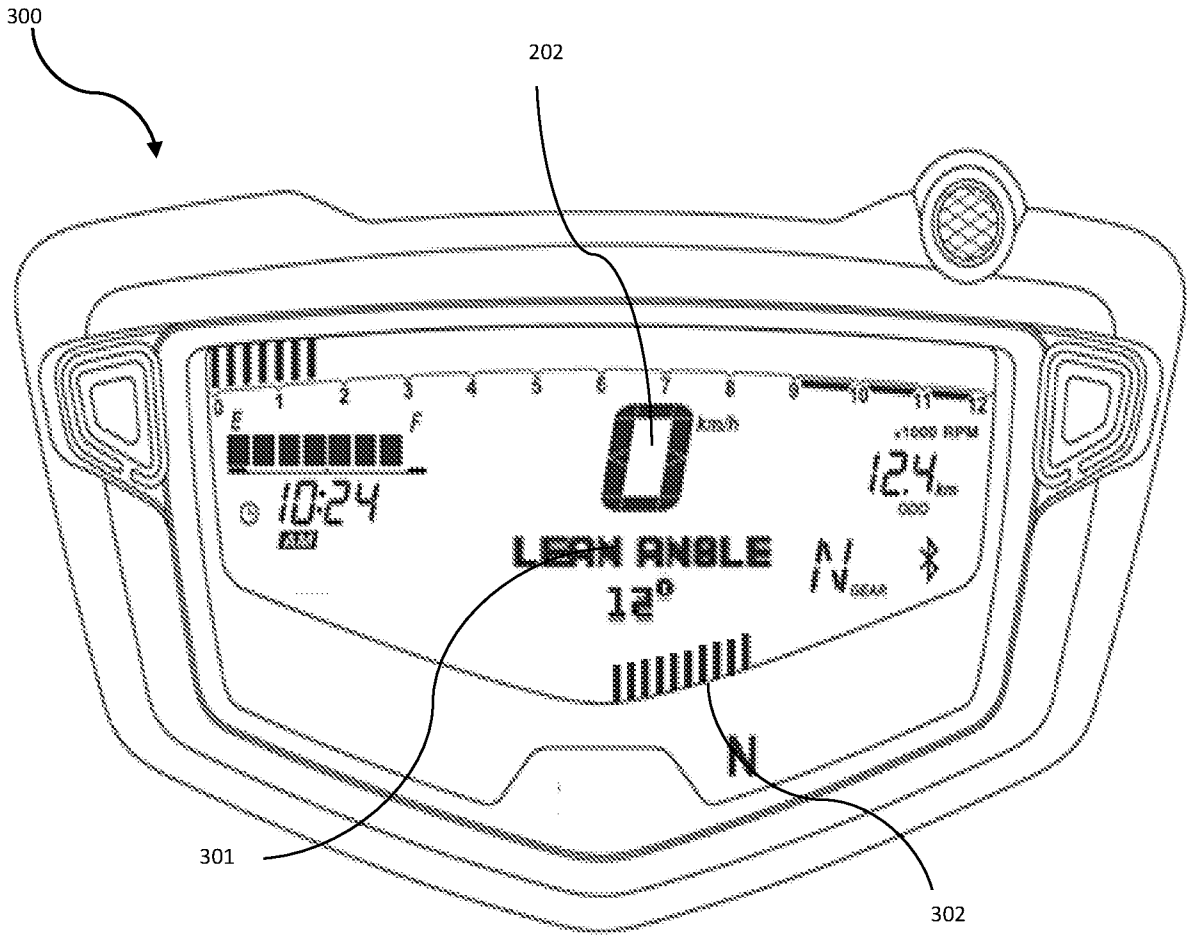


FIGURE 6

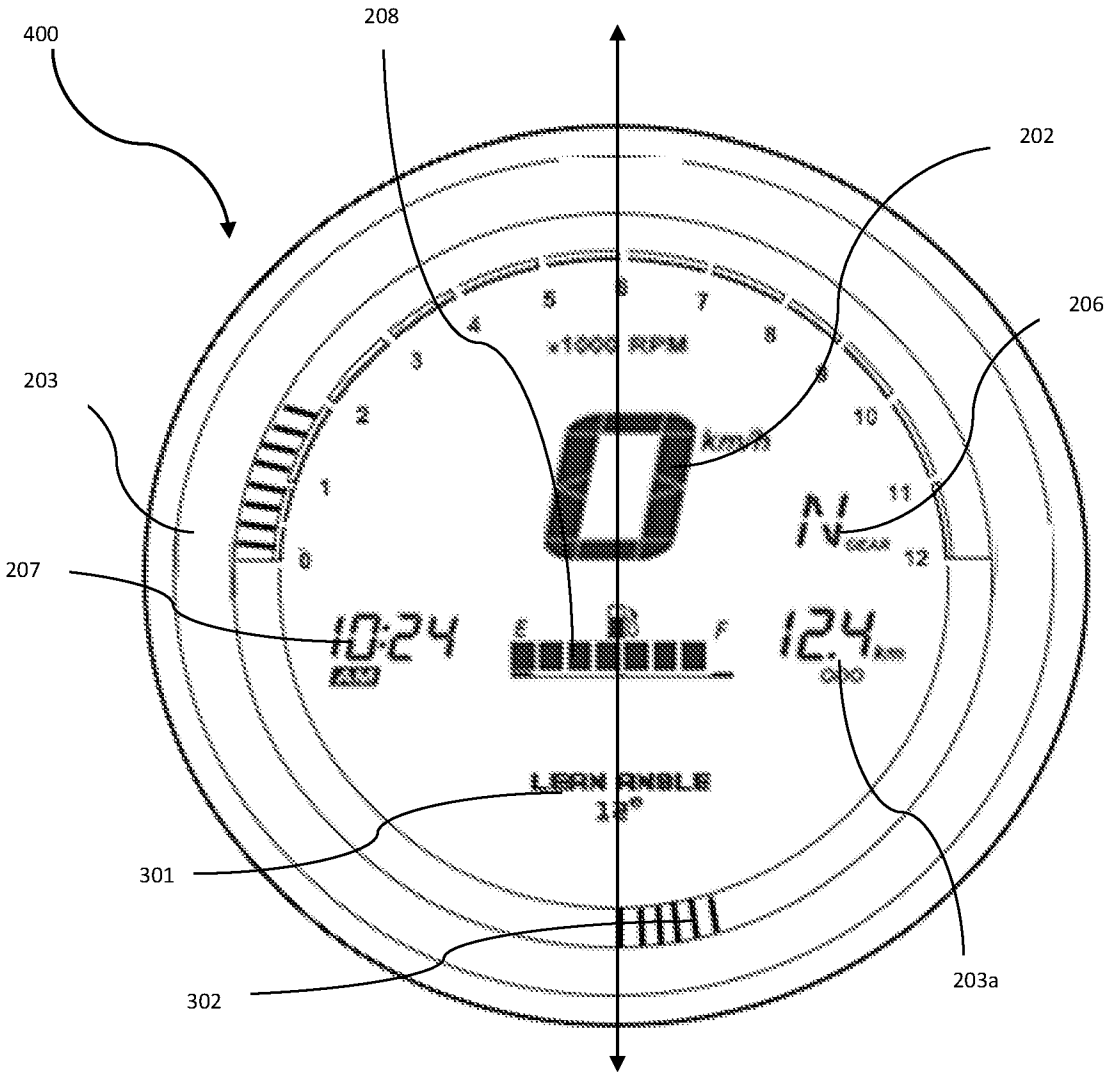


FIGURE 7

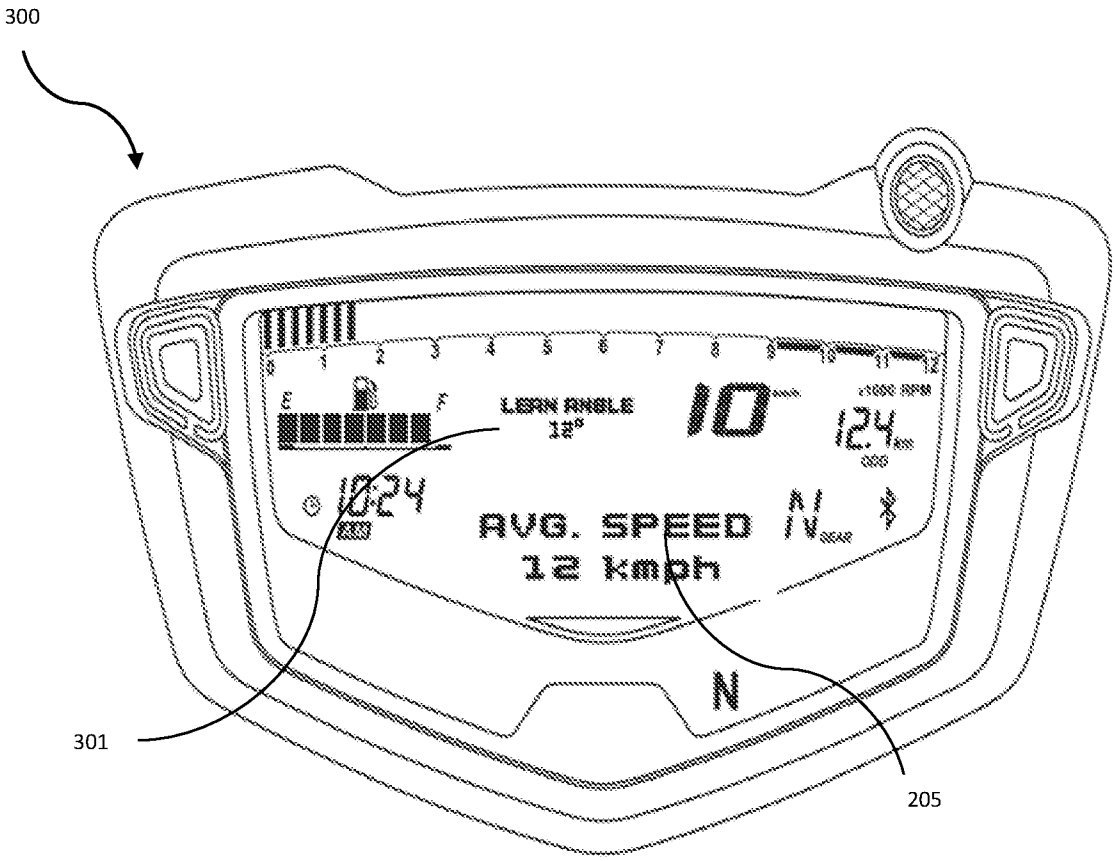


FIGURE 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN2020/050940

A. CLASSIFICATION OF SUBJECT MATTER
G09F19/00,G09G3/00,B60K37/02,B60K35/00 Version=2021.01

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G09F, G09G, B60K

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 practicable, search terms used)

DATABASES: TotalPatent One, IPO Internal Database
KEYWORDS: Vehicle, display, lean angle, move

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP2019038495A (TOYOTA MOTOR CORP) 14 MARCH 2019 (14-03-2019) ABSTRACT, PARA [0001], [0010], [0037], [0038]; FIGURES 6, 13A, 13B; CLAIM 1	1 - 22
Y	JP2013060128A (SUZUKI MOTOR CORP) 04 APRIL 2013 (04-04-2013) ABSTRACT, PARA [0003], [0018], [0030], [0035], [0036], [0040]; CLAIM 3	1 -22

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
04-03-2021	04-03-2021
Name and mailing address of the ISA/ Indian Patent Office Plot No.32, Sector 14,Dwarka,New Delhi-110075 Facsimile No.	Authorized officer Pankaj Singh Rana Telephone No. +91-1125300200