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(54) **Title**: SYNCHRONIZED BRAKING SYSTEM FOR TWO-WHEELED VEHICLES

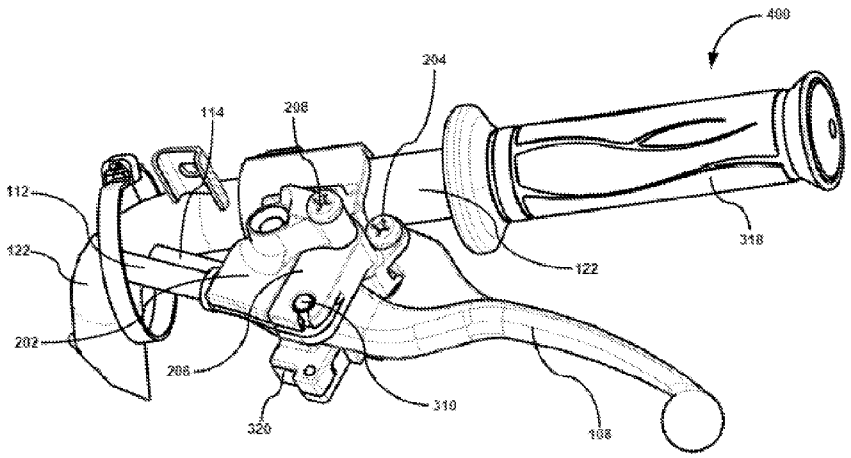

FIG. 4 (a)

(57) **Abstract**: The present subject matter discloses a synchronized braking system (100) for a two-wheeled vehicle (105). The synchronized braking system (100) disclosed herein includes a front wheel brake lever (106) coupled to a front wheel brake (102) by a front wheel brake cable (116), and a rear control lever (108) capable of synchronously transmitting brake actuating forces to both real wheel brake (104) and the front wheel brake (102). The rear control lever (108) is movably pivoted and operatively connected to at least one of a rear brake cable (114) and a synchronized brake cable (112). The rear control lever (108) directly actuates the at least one of the connected rear brake cable (114) and the synchronized brake cable (112). The other cable (112, 114) is actuated by reaction of the movably pivoted rear control hand lever (108).

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SYNCHRONIZED BRAKING SYSTEM FOR TWO-WHEELED VEHICLES

TECHNICAL FIELD

[0001] The present subject matter, in general, relates to a braking system, and, in particular relates, to a synchronized braking system of a two-wheeled vehicle.

BACKGROUND

[0002] In the last few decades, two-wheeler automobile industry has shown a remarkable growth and development, in terms of technology as well as sales. Due to consistent advancement in technology, two-wheeled vehicles, such as bicycles, motorcycles, scooters and light-weight scooters, have succeeded in maintaining their popularity among different sections of society. Different sections of society, based on their requirement, utilize the two-wheeled vehicles for various purposes, such as a recreational activity, a means of transportation, and for sports activities. As a result, it becomes pertinent for the two-wheeler automobile industry to constantly develop and modify the components of the two-wheeled vehicles to suit requirements of different riders.

[0003] In accordance with the same ideology, various types of braking systems have been developed for facilitating braking functionalities in the two-wheeled vehicles. Conventionally, braking systems that allows simultaneous actuation of a front brake and a rear brake by application of a single brake lever have gained widespread popularity across the globe.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] The detailed description is described with reference to the accompanying figures. In the figures, the left-most digit(s) of a reference number identifies the figure in which the reference number first appears. The same numbers are used throughout the drawings to reference like features and components.

[0005] FIG. 1 (a) illustrates a layout of a braking system of a two-wheeled vehicle, in accordance with an embodiment of the present subject matter.

[0006] FIG. 1 (b) illustrates a two-wheeled vehicle depicting the braking system, in accordance with the embodiment depicted in Fig. 1 (a) of the present subject matter.

[0007] FIG. 2 (a) illustrates a synchnronized bracking system (SBS) mechanism for the two-wheeled vehicle, in accordance with an embodiment of the present subject matter.

[0008] FIG. 2 (b) illustrates the synchnronized bracking system (SBS) mechanism for the two-wheeled vehicle, in accordance with another embodiment of the present subject matter.

[0009] FIG. 2 (c) illustrates the synchnronized bracking system (SBS) mechanism for the two-wheeled vehicle, in accordance with yet another embodiment of the present subject matter.

[00010] FIG. 3 (a) illustrates a SBS assembly, in accordance with a preferred embodiment of the present subject matter.

[00011] FIG. 3 (b) an exploded view of the SBS assembly of Fig. 3 (a), in accordance with a preferred embodiment of the present subject matter..

[00012] FIG. 4 (a) illustrates a top perspective view of the SBS assembly, in accordance with a preffered embodiment of the present subject matter.

[00013] FIG. 4 (b) illustrates another top perspective view of the SBS assembly shown in Fig. 4 (a) of the present subject matter.

[00014] Fig. 4 (c) illustrates a section bottom perspective view of the SBS assembly shown in Fig. 4 (a) of the present subject matter.

DETAILED DESCRIPTION

[00015] The subject matter described herein relates to a synchronized braking system for a two-wheeled vehicle, according to an embodiment of the present subject matter.

[00016] Conventionally, two-wheeled vehicles are provided with a braking system for slowing or stopping the vehicle. The braking system, usually, includes at least one brake assembly, such as a front wheel brake assembly and a rear wheel brake assembly for a front wheel and a rear wheel, respectively. Such brake

assemblies may include, but are not limited to a cam lever, a hinge pin, and a pair of brake shoes. Further, each of the front wheel brake assembly and the rear wheel brake assembly is connected to a brake lever for actuation. For example, the brake lever may be coupled to a pair of brake shoes for applying friction to each wheel of the two-wheeled vehicle, as and when required. The brake lever can be connected to the brake assembly in a variety of ways. For example, the brake lever can be connected to the brake assembly by means of a cable. In such a case, one end of the cable may be secured to the brake assembly, and the other end of the cable may be secured to the brake lever. Consequently, actuation of the brake lever may result in actuation of the brake assembly and subsequently, the brake may be applied.

[00017] Generally, the front wheel and the rear wheel are provided with separate braking systems. Conventional two-wheeler braking systems usually include either hand-operated brakes for both the wheels or include a combination of hand-operated and foot-operated brakes. In the latter case, generally, the front wheel brakes are hand-operated, and include a front wheel brake lever mounted on a handle of the two-wheeled vehicle for actuation, whereas the rear wheel brakes can be foot-operated by a rear wheel brake lever provided near a foot-rest of the rider.

[00018] During operation of the brakes, usually, riders apply the rear wheel brake alone. Such a practice stems from the fact that actuating both the brake levers at the same time may be inconvenient for the rider. In addition, when the front wheel brake is applied, less weight on the front wheel and weight transfer towards the front wheel cause the front wheel to brake abruptly, and may result in a sudden jerk to the vehicle. The sudden jerk may affect the ride quality and may disturb the balance and stability of the vehicle leading to an accident. However, on the other hand, the braking force applied for braking the rear wheel may have to be limited, to prevent skidding of the vehicle. As a result, the deceleration experienced by the vehicle may also be limited and subsequently, the stopping distance of the vehicle may be significantly large.

[00019] Conventionally, in order to address the above-mentioned concerns, braking systems that allow simultaneous actuation of a front brake and a rear

brake by application of a single brake lever have been developed. Such braking system is capable of uniting the braking operation of both the front wheel brake and the rear wheel brake with the help of a single brake lever, for example the rear wheel brake lever. Accordingly, upon actuation of the single brake lever, such a braking system may allow application of braking force to the front wheel as well as the rear wheel of the vehicle. Therefore, the front wheel brake and the rear wheel brake can be simultaneously applied by actuating one brake lever, for example, the rear wheel brake lever. In addition to being convenient for the rider, such braking systems may ensure that the deceleration of the vehicle can be increased and subsequently, the stopping distance may be reduced. Further, as would be understood, in two-wheeled vehicles with such braking systems, a front wheel brake lever may also be provided to independently operate the front wheel brake.

[00020] Further, in such conventional braking systems, a cable from each of the front wheel brake lever and the rear wheel brake lever may be connected to the front wheel brake assembly. In one example, a cable connects the rear wheel brake lever to the front wheel brake assembly. Similarly, another cable connects a front wheel brake lever to the front wheel brake assembly. Further, the front wheel brake assembly may include a cam lever and each hinge pin for supporting each of the cables. Therefore, the first cable and the second cable may be coupled to the front wheel brake assembly through the cam lever, and may maintain a contact with the corresponding hinge pin.

[00021] In the conventional braking systems, upon actuation of the combined brake lever, the braking force is distributed to the front wheel brake and the rear wheel brake. However, even in such scenarios, due to lesser weight on the front wheel brake than that on the rear wheel brake, the braking force experienced by the front wheel brake may be substantially more than the rear wheel brake causing instability of the vehicle. Such situations may also result the vehicle to nose dive, i.e., experience a jerk in the forward direction. Under such circumstances, the rider, for example a novice rider, may experience discomfort while riding. In addition, various components, such as front fork suspension assembly and the

wheel, may experience severe loads forces leading to excess wear and tear, and increasing the cost of maintenance of the vehicle.

[00022] Further, during operation of such braking systems, when the rider actuates the combined wheel brake lever, the first cable is pulled to actuate the cam lever of the front wheel brake assembly. However, in such a situation, the second cable may remain stationary with reference to the first cable and the cam lever. As a result, the portion of the cam lever may slide over the hinge pin in contact with the second cable.

[00023] In addition, the conventional braking systems employ a large number of components and linkages to connect the combined brake lever to both the rear wheel brake assembly and the front wheel brake assembly. Consequently, weight of such braking systems may be substantially high. Further, such heavy and complex braking systems with the large number of components may require greater maintenance, and skilled labor. Such a situation may add to the maintenance cost of the vehicle. In addition, due to lack of space on the vehicle, providing a parking brake arrangement may also become difficult. Accordingly, the conventional braking systems may suffer from lack of overall braking effectiveness and high costs.

[00024] Conventionally, such braking systems are provided to improve braking efficiency while actuating rear control lever alone over standard brake system that has independent control for both the brakes. Generally, such known braking systems are based on a concept in which the rear control hand lever is pivoted on to a lever holder directly receives both front and rear brake control cables (inner), while the corresponding outer brake control cables are abutted on the lever holder.

[00025] Generally, in prior art braking systems that allow simultaneous actuation of a front brake and a rear brake by application of a single brake lever, the rear control hand lever that is pivoted on the lever holder is directly connected to both front and rear brake control cables (inner). The sheaths (outer cables) of both the cables are supported by the lever holder as fixed abutment. Generally, such braking systems are simpler and involve less number of parts. However, these systems lack reliability in terms of safety and performance as it is often difficult to set or maintain equal free-play between front and rear brakes in these

systems. Such systems work based only on displacement control and distribute the traction force between the front and rear brake control cables indeterminately.

[00026] Such prior art braking systems also includes rear control hand lever pivoted on the lever holder that is connected to both front and rear brake control cables (inner) through an additional lever. Such an additional lever that is used to connect the rear control hand lever to the brake cables are often referred to as equalizer, balancing element, or pulley and like. Further, even in such systems, the sheath (outer cables) of the front and rear brake control cables are supported by the lever holder or any part thereof as fixed abutment. Though these systems address the issues relating to reliability, the equalizer that is added to adjust difference in free-play between front and rear brake systems by its pivotal action tends to increase the complexity of the braking system and often require large space and increased number of parts. Moreover, safety becomes significant while using rear control lever alone on slippery surfaces and in curves. These prior art systems provide certain amount of delay required for controlling front wheel brake while actuating rear control lever, on account of safety. Furthermore, in such prior art systems there is always a compromise between safety and ease of operation. Hence, the challenge in such prior art braking systems is to achieve trade-off between safety and ease of operation.

[00027] Further, the existing braking systems in which the rear hand lever is pivotally mounted to the lever holder or the handle bar the input force required to be provided by the rider on the hand lever is substantially high. Furthermore, the reaction at the pivot support of rear hand lever is often left unutilized. Thus, in existing braking systems having fixed pivot position of the hand lever that requires delay in front brake increases the need for higher input forces at the hand lever. This affects the hand lever feel and performance. Moreover, when the hand lever is pivoted to the lever holder, brake cables (front and rear) are directly abutted to the lever holder and there is no delay, higher forces are often applied to the front brake. Thus, causing safety related problems, more particularly, in slippery conditions, and in curves.

[00028] The synchronized braking system (SBS) of the present subject matter is provided to overcome the above stated problems of the conventional braking

systems known in the prior art. For example, the SBS of the present subject matter provides a mechanism that includes a rear control hand lever that is movably pivoted instead of being fixedly pivoted to the lever holder. Further, the additional cable of the SBS is actuated by means of pivot reaction of the movably pivoted hand lever. In one embodiment of the present invention, the hand lever is movably pivoted to a reaction relay member such that the reaction at the hand lever pivot is utilized to actuate the front brake cable. Further, in the present system, the rear brake cable is actuated when the hand lever is applied. According to an aspect of the present subject matter, a simpler, compact and reliable SBS is provided, which enables application of traction forces on rear and front brake control cables with a predetermined ratio, irrespective of free-play difference between the two brake systems. Further, the SBS of the present subject matter utilizes fewer parts.

[00029] In an aspect of the present subject matter, the rear control lever is operatively connected to a brake control cable in a known manner for operating one of brake systems fitted on front and rear wheels of a vehicle. For example, the rear control lever is pivoted on a movable support instead of lever holder. The rear control lever and additional brake control cable, which is used for operating the other braking system are operatively connected by means of the movable pivot support. The lever holder that is rigidly connected to the handle bar is used as an abutment for the first and additional brake control cables. They are arranged to allow the traction of both the brake control cables while actuating the rear control lever. Further, the reaction of the rear control lever on the movable pivot support is utilized for the traction of the additional brake control cable, for example, the front brake control cable.

[00030] Further, in another aspect of the present subject matter, the work done on the rear control lever is distributed between the first (for e.g., rear) and the additional (for e.g., front) brake control cables through the work done by the traction of the rear control lever and the work done by the pivot reaction of the rear control lever respectively. For example, the SBS assembly of the present subject matter simultaneously distributes both force and displacement (stroke) as a result of work done on the rear control lever. Such a simultaneous distribution of both force and displacement is advantageous than distributing the traction force

alone from the rear control lever directly or by means of an additional equalizer lever.

[00031] Further, in an embodiment, the same effort as applied in a standard brake system in which independent controls, for example, each hand or foot operated lever is connected to corresponding front/rear brake cable is used for the tractions of both the brake control cables connected to the rear control lever. Hence, the distribution of both force and displacement (stroke) between the brake control cables are optimized by additionally using the reaction of the rear control lever on the pivot support. The optimized ratios enable improving both lever actuation feel and performance even with a higher delay required in braking front wheel for safety purpose.

[00032] The SBS assembly of the present subject matter requires only additional stroke (travel) rather than extra effort for actuating the rear control lever to compensate the traction of the additional brake control cable. Thus, in the SBS assembly of the present subject matter, any delay provided in braking front wheel does not impact the ease of operation of the rear control lever. Hence, the SBS assembly of the present subject matter provides enhanced operational ease as the effort required for actuating the rear control lever is maintained substantially similar as in the case of standard brake system. For instance, during the delay condition, both lever-actuation feel and performance are enhanced.

[00033] Further, the rear control lever of the present subject matter is operatively connected between the rear and the front brake control cables. Each of these brake control cables is operatively connected to the respective brake system mounted on each of rear and front wheels of the two-wheeled vehicle in a known manner. In one embodiment, the first brake control cable, for e.g., the rear brake control cable is operatively connected to the rear control lever at its traction end, and the sheath of which is supported by the lever holder as an abutment and rigidly mounted on the handle bar of the two-wheeled vehicle. Similarly, the additional brake control cable, for e.g., the front brake control cable is also operatively connected to the lever holder, and the sheath of which is supported by the rear control lever at another pivot end as a movable abutment. They are arranged to allow the traction of both the brake control cables. The traction of the

first brake control cable is caused by means of the traction of the rear control lever while actuating the rear control lever. Further, the rear control lever causes the traction of the additional brake control cable by means of reaction of its pivot (another) end. The first brake control cable is disposed in a direction at its end connected to the rear control lever or the lever holder, such that the traction of the rear control lever enables to cause the traction of the first brake control cable.

[00034] Further, in one embodiment, the additional brake control cable is also disposed in a direction at its end connected to the pivot end of the rear control lever or the lever holder, in such a way that the pivot (another) end of the rear control lever enables to cause the traction of the additional brake control cable while actuating the rear control lever. Preferably, the additional brake control cable is disposed along the direction of the reaction of the rear control lever at its pivot end while actuating the rear control lever. Thus, the transmission efficiency from the rear control lever to the additional brake control cable is largely enhanced.

[00035] In an alternative embodiment, the reaction-relay member is mounted with its pivotal axis substantially parallel or transverse to the pivotal axis of the rear control hand lever. Further, in another alternative embodiment, a rear control foot pedal that is mounted to a frame of the two-wheeled vehicle replaces the rear control hand lever. The SBS described in the present subject matter is simpler and involves less number of parts. Moreover, the simple SBS assembly enables the front handle bar assembly of the two-wheeled vehicle to become more compact. Further, the SBS of the present subject matter is reliable and optimally applies the actuation forces to both the front and the rear brake control cables with a predetermined ratio irrespective of free-play difference between the front and rear brake systems.

[00036] These and other advantages of the present subject matter would be described in greater detail in conjunction with the figures in the following description.

[00037] FIG. 1 (a) illustrates a layout of a braking system 100 of a two-wheeled vehicle, in accordance with an embodiment of the present subject matter. The system 100 includes a front wheel brake 102 and a rear wheel brake 104. Further,

a front wheel brake lever 106 may be actuated to apply the front wheel brake 102. Similarly, a rider may actuate a rear control hand lever 108 for applying the front wheel brake 102 as well as the rear wheel brake 104. In one implementation, the front wheel brake lever 106 and the rear control hand lever 108 may be disposed on a right-hand side and a left-hand side of a handle bar 110 of the vehicle, respectively. In another implementation, instead of providing the rear control hand lever 108 on the handle bar 110, a foot pedal (not shown) can serve as the integrated brake actuating member to apply the front wheel brake 102 as well as the rear wheel brake 104. In a further implementation, instead of the independently provided front wheel brake lever 106, the braking system 100 may include a rear wheel brake lever (not shown) to independently apply the rear wheel brake 104. Therefore, in such an implementation, the braking system 100 may include the rear wheel brake lever to independently apply the rear wheel brake 104, and the front wheel brake lever 106 may act as the integrated brake actuating member for applying the front wheel brake 102 as well as the rear wheel brake 104.

[00038] Further, the synchronized brake cable 112 and the independent front brake cable 116 may be connected to a front wheel brake assembly (not shown) of the front wheel brake 102. The front wheel brake assembly may include a cam lever 124 (shown in Fig. 1 (b)), and an end (not shown) of each of the synchronized brake cable 112 and the independent front brake cable 116. In one implementation, a force suppressing apparatus (not shown) may also be provided to support the synchronized brake cable 112 and the independent front brake cable 116 for improving safety.

[00039] FIG. 1 (b) illustrates a two-wheeled vehicle 105 depicting the braking system 100, in accordance with the embodiment depicted in Fig. 1 (a) of the present subject matter. In an embodiment, the vehicle 105 includes a handle bar assembly 122 that is enclosed on both sides by a headlamp housing 120. The headlamp housing 120 also contains SBS assembly (not shown) that includes the rear control hand lever 108 used for synchronously actuating both the front wheel brake 102 and the rear wheel brake 104. In one embodiment, a synchronized brake cable 112 and a rear brake cable 114 are functionally coupled to the rear control

hand lever 108 such that the actuation of the rear control hand lever 108 causes a corresponding simultaneous actuation of the front wheel brake 102 and the rear wheel brake 104 in no particular order. In one embodiment, the synchronized brake cable 112 and a front brake cable 116, the other end of which is coupled to the front brake lever 106, are connected to a cam lever 124 of the front wheel brake 102. In an embodiment, when the front brake lever 106 is actuated, the front wheel brake 102 is independently controlled by means of the front brake cable 116. Similarly, the actuation of the rear control brake lever 108 also causes actuation of the front wheel brake 102 independent of the front brake lever 106 actuation. Further, the actuation of the rear control brake lever 108 also causes a corresponding actuation of the rear wheel brake 104.

[00040] FIG. 2 (a) illustrates a synchnronized bracking system (SBS) mechanism for the two-wheeled vehicle, in accordance with an embodiment of the present subject matter. In an embodiment, a SBS mechanism 200-1 as illustrated in Fig. 2 (a) includes a rear control lever 108 having a first end receiving a first brake control cable 114 and a second end that receives an additional brake control cable 112. In an embodiment, the first brake control cable 114 has a sheath and an inner cable. The sheath of the first brake control cable 114 is abutted against an abutment surface 230 of a lever holder 202, while the inner cable of the first brake control cable 114 is hinged at a traction point 304 provided on the first end of the rear control lever 108. The sheath of the additional brake control cable 112 is abutted against an outer surface of the second end of the rear control lever 108, while the inner cable of the additional brake control cable 112 is held at a hinge joint 310 provided on the lever holder 202. In an embodiment, the lever holder 202 is fixedly disposed on a handle bar 122 of the two-wheeled vehicle in such a manner that the rear control lever 108 is disposed substantially closer to a handgrip 318 provided on the handle bar 122. In an embodiment, the actuation of the rear control lever 108 by the rider causes traction of the inner cable of the first brake control cable 114 causing the actuation of the first brake control cable 114, which in turn causes the reaction of the movably pivoted second end of the rear control lever 108 such that the second end of the rear control lever 108 pushes the sheath of the additional brake control cable 112. Thus, the reaction of the movably

held second end of the rear control lever 108 causes the actuation of the additional brake control cable 112. In an embodiment, a rear surface 232 of the second end 204 of the rear control lever 108 is disposed substantially abutting against the surface of the lever holder 202 housing the hinge joint 310. This ensures any freeplay whatsoever that may occur due to the movably held rear control lever 108 at its second end is substantially eliminated.

[00041] The surface 204 of the pivot (another) end of the rear control lever 108 is used as a movable abutment for the sheath of the additional brake control cable 112. Inner cable of the additional brake control cable 112 is operatively connected to the lever holder 202 through its hinge 310. The hinge 310 and the movable abutment 204 are disposed in a line that is parallel to the direction of the reaction of the rear control lever at its pivot end and substantially perpendicular to the movable abutment surface 204 while actuating the rear control lever 108. The end of the rear control lever 108 at the same side of the traction point 304 is abutted on the lever holder 202 at other (opposite) side of the abutment 230. During non-operating condition, the first brake control cable 114 which is under preload of self-return system(s) of corresponding brake system holds the rear control lever 108 at its traction end 304 against the surface of the lever holder 202, which is other side of the abutment 230. Similarly, under preload of self-return system(s) of other corresponding brake system the sheath of the additional brake control cable 112 and the hinge 310 of the lever holder 202 also then clamp the rear control lever 108, respectively at the movable abutment 204 and other opposite surface. Hence, the rear control lever 108, however not being pivotally supported directly by the lever holder 202 or any fixed part, is now held in position without having any rattling or shaking issue induced by vehicle and road vibrations during non-operating condition of the rear control lever 108.

[00042] During operation, the rear control lever 108 causes the traction of the first brake control cable 114 by means of its traction end 304, in a known manner, while it is actuated. Simultaneously it also causes the traction of the additional brake control cable 112 through actuating the sheath of the additional brake control cable 112 by means of its reaction at its movable abutment 204 or pivot end. This reaction is induced to balance the couple generated by both actuation

effort and the reaction of the traction of the rear control lever 108. Hence, the traction forces between these first and additional brake control cables 114 and 112 are always balanced with a predetermined ratio for moment-balancing. However, even if there is any difference in free play between the front and rear brake systems, the traction forces are simultaneously applied on the first and additional brake control cables 114 and 112 for braking on corresponding wheels only after the end of free play of both brake systems whichever is later. Thus, the SBS mechanism of the present subject matter is reliable to apply braking on both the front and rear wheels with a predetermined ratio. Any delay provided in braking front wheel for safety, suppresses the traction of one of the first and additional brake control cables 114 and 112, whichever is connected to the front brake system. However, the traction of the other brake control cable is not affected. Hence, both feel and performance even at less effort are better than the prior arts, and same as the standard brake system.

[00043] FIG. 2 (b) illustrates the synchnronized bracking system (SBS) mechanism for the two-wheeled vehicle, in accordance with another embodiment of the present subject matter. In an embodiment, the SBS mechanism 200-2 as illustrated in Fig. 2 (b) includes the rear control lever 108 that includes a first end and a second end, for example, the pivot end 204 as described in Fig. 2 (a). In this embodiment, the pivot end 204 of the rear control lever 108 is slidably supported in lateral (vertical) direction by the lever holder 202 on both top and bottom surfaces. For that, the lever holder 202 is provided with a recess or slot in which the pivot end 204 of the rear control lever 108 is slidably supported against vertical load on the rear control lever 108. Hence, the lever holder 202 allows only required degree of freedom for the rear control lever 108 to actuate. Thus, even though the pivot end 204 of the rear control lever 108 is not substantially closer to the hinge joint 310 provided in the lever holder 202, the lateral (vertical) play of the pivot end 204 of the rear control lever 108 is prevented due to the recess provided in the lever holder 202 and lateral support of recess.

[00044] FIG. 2 (c) illustrates the synchnronized bracking system (SBS) mechanism for the two-wheeled vehicle, in accordance with yet another embodiment of the present subject matter. In an embodiment, the SBS mechanism

200-3 includes the rear control lever 108 whose first end receives inner cable of the first brake control cable 114, while the second end, for example, the pivot end 204 is pivoted to a reaction relay member 206 that is pivotably supported by the lever holder 202 about a pivot joint 208. In an embodiment, the sheath of the first brake control cable 114 is abutted against the abutment surface 230 of the lever holder 202. In one embodiment, the sheath of the additional brake control cable 112 is also abutted against the abutment surface 230 of the lever holder 202. The inner cable of the additional brake control cable 112 is operatively connected to the reaction relay member 206 through a hinge joint 310. In an embodiment, the actuation of the rear control lever 108 causes the traction of the inner cable of the first brake control cable 114 that actuates the first brake control cable 114. Simultaneously, the traction of the inner cable of the first brake control cable 114 causes the reaction of the pivot end 204 of the rear control lever 108 that induces the reaction relay member 206 to pivotally move about the pivot joint 208, which further causes the traction of the hinge joint 310 leading to actuation of the additional brake control cable 112.

[00045] In an embodiment, the pivot reaction-relay member 206, which is pivotally supported by the lever holder 202 at a hinge 208 helps in movably supporting the rear control lever 108 at the pivot end 204 against any vertical load. The additional brake control cable 112 is operatively connected to the pivot reaction-relay member 206 at its other end opposite to the location of the pivot end 204. For example, the inner cable of the additional brake control cable 112 is operatively connected to the pivot-reaction relay member 206 through the hinge-joint 310. The sheath of the additional brake control cable 112 is supported by the fixed abutment 230 on the lever holder 202 to enable the traction of the additional brake control cable 112. In one embodiment, a recess is provided on the lever holder 202 to accommodate the pivot-reaction relay member 206 between the rear control lever 108 and the lever holder 202. Further, in one embodiment, all the three parts, i.e., the rear control lever 108, the lever holder 202 and the reaction relay member 206 lies in a single plane.

[00046] In another embodiment, in order to reduce the size of the SBS mechanism 200-3 in longitudinal direction, the hinge joint 310 of the pivot-

reaction relay member 206 is disposed vertically above the traction point 304 of the rear control lever 108. For example, the hinge joint 208 of the pivot reaction relay member 206 is also vertically disposed at a position between the planes passing through the pivot end 204 and the hinge joint 310 in such a manner that the moment of the reaction of the rear control lever 108 and the reaction of the traction of the additional brake cable 112 on the pivot reaction relay member 206 remains balanced.

[00047] FIG. 3 (a) illustrates a handle bar assembly 300 of a two-wheeled vehicle with a SBS assembly 400, in accordance with an embodiment of the present subject matter. In an embodiment, the rear control lever 108 of the SBS assembly 400 is pivotally mounted on the reaction relay member 206, which is in turn pivotally supported by the lever holder 202. In an embodiment, the first brake control cable 114 and the additional brake control cable 112 is fixedly abutted against the abutment surface 230 [refer Fig. 4 (c)]of the lever holder 202.

[00048] FIG. 3 (b) illustrates an exploded view of the handle bar assembly 300 including the SBS assembly 400 of Fig. 3 (a), in accordance with an embodiment of the present subject matter. In an embodiment, the SBS assembly 400 includes the rear control lever 108 having a first end that is provided to receive the inner cable 308 of the first brake control cable 114. The rear control lever 108 has a second end, for example, the pivot end 204 [refer Fig. 2 (c)] that is movably pivoted to the reaction relay member 206. For example, the pivot end 204 of the rear control lever 108 includes a hole 330 that is movably held inside a recess 328 of the reaction relay member 206 by means of at least one fastening element 326. In an embodiment, the reaction relay member 206 is pivotally supported by the lever holder 202. For example, a hole 342 of the reaction relay member 206 is pivotally held between a pair of recesses 340 on the lever holder 202 by means of another fastening element 350. In an embodiment, the additional brake control cable 112 includes an inner cable 306 whose hinge pin 346 is pivotally supported at a hinge pin recess 348 provided on the reaction relay member 206 for the hinge joint 310 shown in Figs. 2 (c), 4 (a) to 4 (c). In an embodiment, the inner cable 306 passes through the lever holder 202, while the sheath of the additional brake control cable 112 is fixedly abutted against the abutment surface 230 [refer Fig. 4

(c)] of the lever holder 202. In one embodiment, the sheath of the first brake control cable 114 is also fixedly abutted against the abutment surface 230 of the lever holder 202, while the inner cable 308 also passes through the lever holder 202 and allows the hinge pin 322 to be hinged at the traction point 304 provided at the first end of the rear control lever 108. In one embodiment, a stop lamp controller 320 is mounted at a bottom side of the lever holder 202 by means of yet another fastening element in a known manner. In an embodiment, the lever holder 202 is mounted on the handle bar 122 of the two-wheeled vehicle by means of a plurality of fastening elements 336 and 338, and a bottom clamp (not shown) in a known manner.

[00049] FIG. 4 (a) illustrates a top perspective view of the SBS assembly 400, in accordance with an embodiment of the present subject matter when viewed from front side. FIG. 4 (b) illustrates another top perspective view of the SBS assembly 400 shown in Fig. 4 (a) of the present subject matter. Fig. 4 (c) illustrates a sectional bottom perspective view of the SBS assembly 400 shown in Fig. 4 (a) of the present subject matter.

[00050] In this embodiment, the rear control lever 108 is pivotally supported by the pivot reaction relay member 206 at the pivot end 204. The reaction relay member 206 is in turn pivotally supported by the lever holder 202 at its pivot joint 208. Moreover, the lever holder 202 is rigidly mounted on the handle bar 122 of two wheeled vehicle and on free end of which, the hand grip 318 is mounted for holding the handle bar in a known manner. For instance, the first brake control cable 114 and the additional brake control cable 112 are operatively connected to the traction point 304 of the rear control lever 108 and to the reaction relay member 206 at its other end respectively. In an embodiment, the inner cable 308 of the first brake control cable 114 is operatively connected to the rear control lever 108 through its hinge pin 322 located in a recess 324 provided on the rear control lever 108 at its traction point 304 for the traction of the additional brake control cable 114. Similarly, the inner cable 306 [refer Fig. 3 (b)] of the additional brake control cable 112 is operatively connected to the reaction relay member 206 at the hinge joint 310 by means of its hinge pin 346 located in a recess 348 that is provided on the reaction relay member 206 at an end opposite to the side at which

the rear control lever 108 is pivoted at the recess 328. For instance, during non-operating condition, under preload of self-return systems of corresponding brake system, the inner cable 308 of the first brake control cable 114 holds the rear control lever 108 against the lever holder 202 by means of the hinge pin 322 and the sheath of the first brake control cable 114. Similarly, under preload of self-return systems of corresponding brake system, the inner cable 306 of the additional brake control cable 112 holds the reaction relay member 206 at the hinge joint 310 against the lever holder 202 by means of the hinge pin 346 located in recess 348 and the sheath of the additional brake control cable 112. In one embodiment, under the preload, the surface of the reaction relay member 206 is rested over the surface of the lever holder 202. Similarly, the traction end of the rear control lever 108 is rested over the same surface of the lever holder 202 under the preload.

[00051] Further, in one embodiment, the rear control lever 108 is pivotally supported on the reaction relay member 206 at pivot end 204 by means of the fastening element 326 located in holes 328 of the reaction relay member 206 and the hole 330 of the rear control lever 108. The fastening element 326 is secured on the holes 328 and 330 by means of a nut or a lock nut 332 or circlip, or split pin and the like in a known manner. The pivot end 204 of the rear control lever 108 is disposed in a space provided by top and bottom tongs of the reaction relay member 206 in order to pivotally support the rear control lever 108. The holes 328 are provided on both the top and bottom tongs of the reaction relay member 206 for securing the pivot pin or fastener. Similarly, a lock nut 332 is used at the bottom side of the bottom tong of the reaction relay member 206 to secure the fastener 326 in the holes 328 and 330. The reaction relay member 206 is pivotally supported on the lever holder 202 at 208 by means of another fastening element 350 located in holes 340 provided on both top and bottom flanges of the lever holder 202 and in hole 342 provided on the reaction relay member 206. Further, a lock nut 344 or circlip, or split pin and the like is used to secure the fastener 350 in the holes 340 and 342.

[00052] In an embodiment, the inner cable 306 of the additional brake control cable 112 is traversing through a slot provided on the reaction relay member 206

and across the axis of the hinge pin recess 348. Similarly, a radial slot is provided on one of the top and bottom tongs of the reaction relay member 206 to access the recess 348 by the inner cable 306 of the additional brake control cable 112 during assembly and dismantling. In an embodiment, a pair of holes are provided on the lever holder 202 across the abutment surface 230 such that the sheath of the additional brake control cable 112 and first brake control cable 114 are firmly located inside the holes and supported against the fixed abutment 230. Similarly, a pair of slots are provided on the lever holder 202 to access the holes by the inner cable 306 of the additional brake control cable 112 and the inner cable 308 of the first brake control cable 114 respectively during assembly and dismantling. Thus, the SBS assembly 400 of the present subject matter enables ease of assembly and dismantling of the brake control cables 114 and 112.

[00053] In an embodiment, a hole (not shown) is provided on the lever holder 202 on its top portion to mount a rear view mirror by means of fastener in a known manner. The hole can also be provided with threads for directly fasten the rear view mirror. Further, a lug (not shown) is provided on the lever holder 202 at its rear side to hold a bottom clamp. Similarly, a hole is provided on the lever holder 202 at its front portion through which a fastener 336 is secured the bottom clamp against the bottom surface of the lever holder 202 by means of a lock nut 338 in a known manner. The lever holder 202 is rigidly mounted on to the handle bar 122 by means of a recess provided at the bottom side of the rear portion of the lever holder 202. Further, the lever holder 202 is axially secured to the handle bar 122 by means of at least a pip or lug provided on the bottom recess and corresponding recess or hole or slot provided on the handle bar 122 in any known manner.

[00054] Further, a stop lamp controller 320 is mounted at the bottom side of the lever holder 202 in any known manner in such a way that a trigger of the stop lamp controller 320 is controllable by means of a lug 352 provided on the bottom side of the rear control lever 108 in any known manner. A recess is provided at the bottom surface of the lever holder 202 to which the stop lamp controller 320 is secured against any rotation by mean of pip located inside the recess.

[00055] Further, in one embodiment, during the non-operating condition, both the rear control lever 108 and the reaction relay member 206 are held in position by means of the preload, without having any rattling or shaking issue even induced by vehicle and road vibrations. While actuating the rear control lever 108, it enables the traction of the first brake control cable 114 by means of hinge pin 322 and inner cable 308. Simultaneously, the reaction of the rear control lever 108 also enables the traction of the additional brake control cable 112 upon the reaction relay member 206 in turn on the inner cable 306 of the additional brake control cable 112.

[00056] Although the subject matter has been described in considerable detail with reference to certain embodiments thereof, other embodiments are possible. Rather, the features are disclosed as embodiments of the braking system 100 and the SBS assembly 400.

We claim:

1. A synchronized braking system (100) for a two-wheeled vehicle (105), the synchronized braking system (100) comprising:

a front wheel brake (102) capable of applying braking forces to a front wheel of the two-wheeled vehicle (105);

a rear wheel brake (104) capable of applying braking forces to a rear wheel of the two-wheeled vehicle (105);

a front wheel brake lever (106) mounted to a handlebar (110) of said vehicle (105), said front wheel brake lever (106) coupled to said front wheel brake (102) by a front wheel brake cable (116); and

a rear control lever (108) capable of synchronously transmitting brake actuating forces to both said real wheel brake (104) and said front wheel brake (102), wherein said rear control lever (108) is movably pivoted and operatively connected to at least one of a rear brake cable (114) and a synchronized brake cable (112), said rear control lever (108) directly actuates the at least one of the connected rear brake cable (114) and the synchronized brake cable (112), and wherein at least the other cable (112, 114) is actuated by reaction of said movably pivoted rear control hand lever (108).

2. The synchronized braking system (100) as claimed in claim 1, wherein said rear control lever (108) includes a first end coupled to an inner rear brake cable (308) of said rear brake cable (114),and a second end (204) movably pivoted and operatively connected to said synchronized brake cable (112) through an inner cable (306).

3. The synchronized braking system (100) as claimed in claim 2, wherein the rear control lever (108), when actuated, causes traction of the inner rear brake cable (308) of the rear brake cable (114) causing the actuation of the rear brake cable (114), said rear brake cable (114) when actuated causes the reaction of the

movably pivoted second end of the rear control lever (108), which pushes the sheath of the synchronized brake cable (112).

4. The synchronized braking system (100) as claimed in claim 2, wherein the second end (204) of the rear control lever (108) includes a rear surface (232) that is disposed substantially abutting against a first surface of a lever holder (202) housing a hinge joint (310) to eliminate freeplay caused at the second end of the movably pivoted rear control lever (108).

5. The synchronized braking system (100) as claimed in claim 1, wherein the lever holder (202) is provided with a recess (328) in which the second end (204) of the rear control lever (108) is slidably supported against vertical load on the rear control lever (108), and wherein the lever holder (202) allows only required degree of freedom for the rear control lever (108) to actuate.

6. The synchronized braking system (100) as claimed in claim 2, wherein the second end (204) of the rear control lever (108) is pivoted to a reaction relay member (206) that is pivotably supported by the lever holder (202) about a pivot joint (208), and wherein a outer sheath of the synchronized brake cable (112) is abutted against an abutment surface (230) of the lever holder (202), said inner cable (306) of the synchronized brake cable (112) is hingedly connected to the reaction relay member (206) at a SBS cable inner hinge (310).

7. The synchronized braking system (100) as claimed in claim 1, wherein the actuation of the rear control lever (108) causes the traction of the inner cable of the first brake control cable (114) that actuates the rear brake cable (114), and wherein the traction of the inner rear brake cable (308) causes the reaction of the pivot end (204) of the rear control lever (108) that induces the reaction relay member (206) to pivotally move about the pivot joint (208), which further causes the traction of the hinge joint (310) leading to actuation of the synchronized brake cable (112).

8. The synchronized braking system (100) as claimed in claim 4, wherein the rear brake cable (114) is under preload of self-return system(s) of corresponding brake system holds the rear control lever (108) at its traction end (304) against the surface of the lever holder (202) during non-operating condition, and wherein the sheath of the synchronized brake cable (112) and the hinge (310) of the lever holder (202), under the preload of self-return system(s) of the brake system, clamp the rear control lever (108) at the movable abutment (204) to movably pivot the rear control lever (108) during non-operating condition.

9. The synchronized braking system (100) as claimed in claim 2, wherein the second end (204) of the rear control lever (108) is movably pivoted to the reaction relay member (206) by means of a hole (330) provided on the second end (204), said hole (330) is movably disposed within a recess (328) of the reaction relay member (206) by means of at least one fastening element (326), said reaction relay member (206) is pivotally supported by the lever holder (202) by means of a hole (342) of the reaction relay member (206) that is pivotally held between a pair of recesses (340) on the lever holder (202) by means of another fastening element (350), and wherein the inner cable (306) of the synchronized brake cable (112) has a hinge pin (346) pivotally supported at a hinge pin recess (348) of the reaction relay member (206) to form the hinge joint (310).

10. A two-wheeled vehicle (105) comprising a synchronized braking system (100) as claimed in any one of the preceding claims.

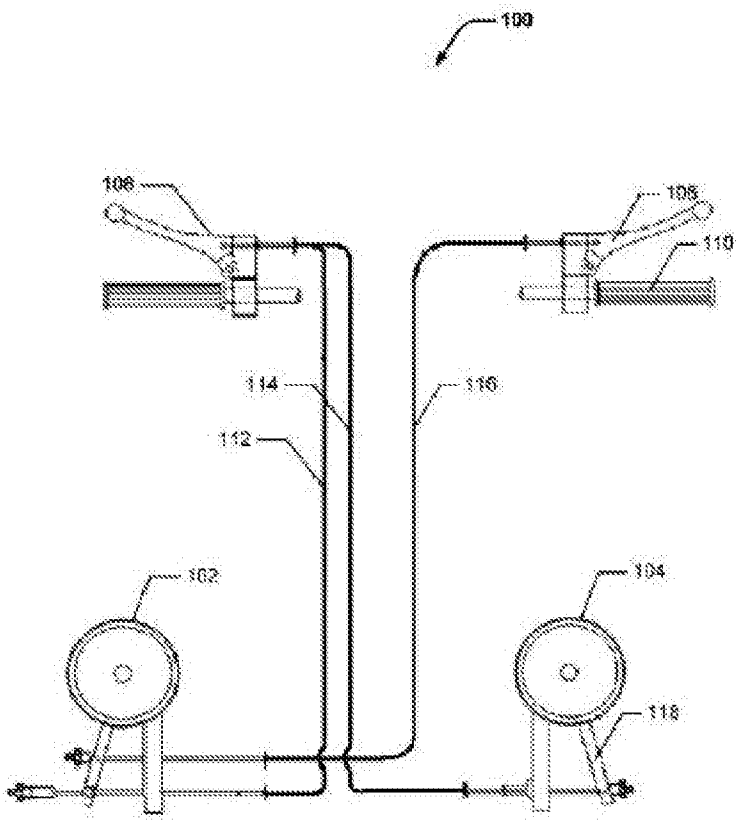


FIG. 1 (a)

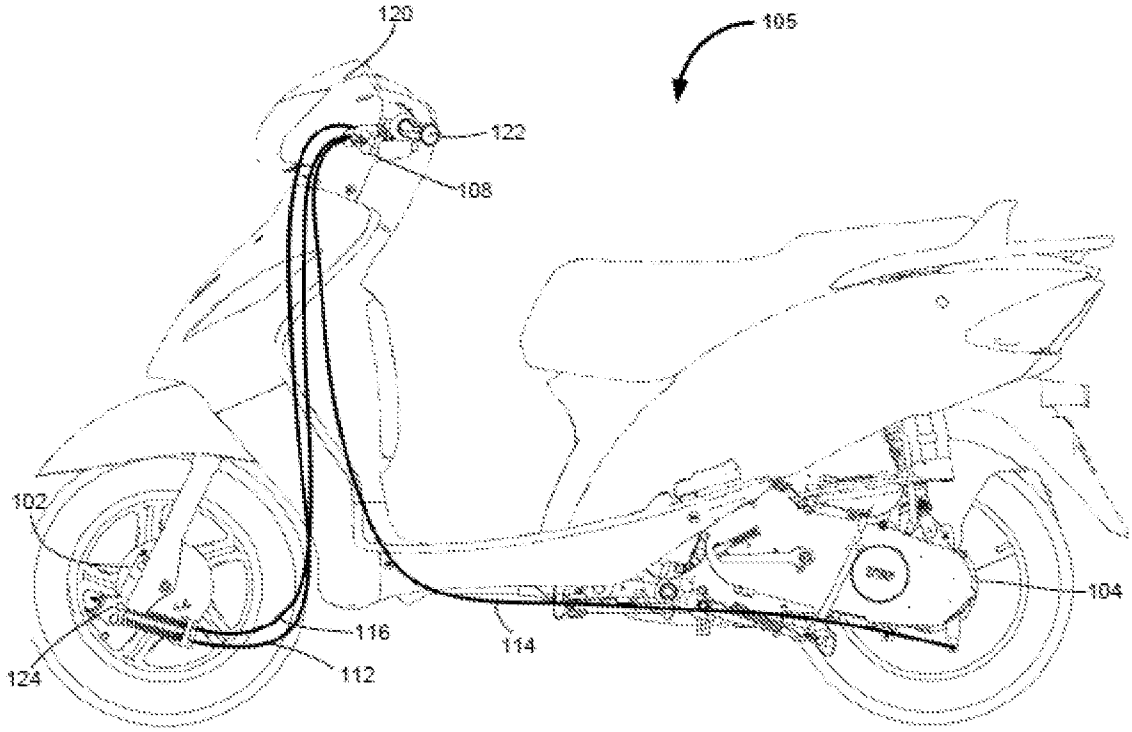


FIG. 1 (b)

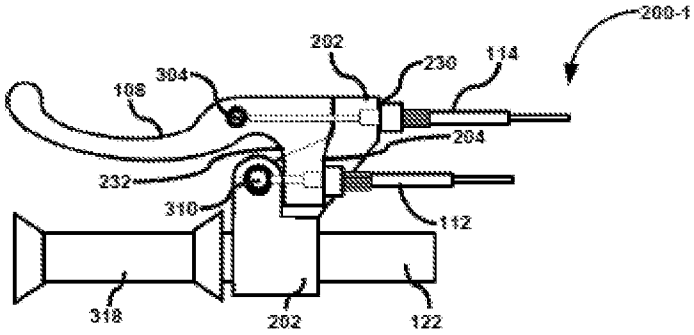
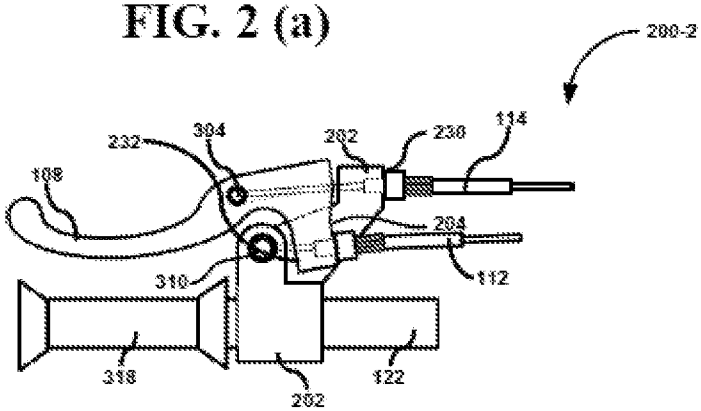

200-1
302
230
114
304
108
204
232
310
112
318
202
122

FIG. 2 (a)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318
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122

FIG. 2 (b)

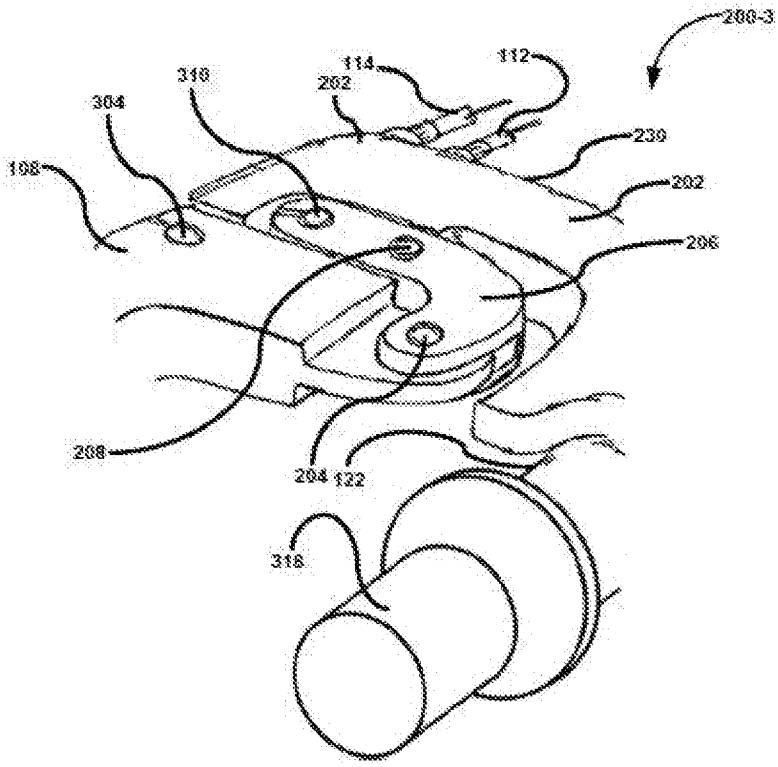


FIG. 2 (c)

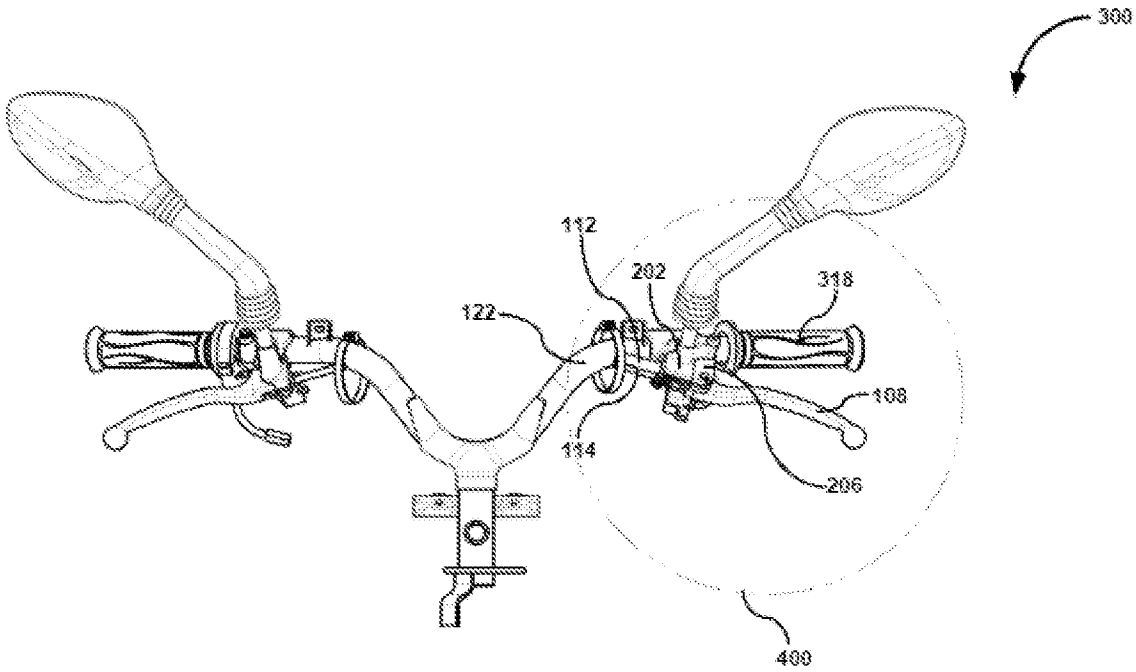
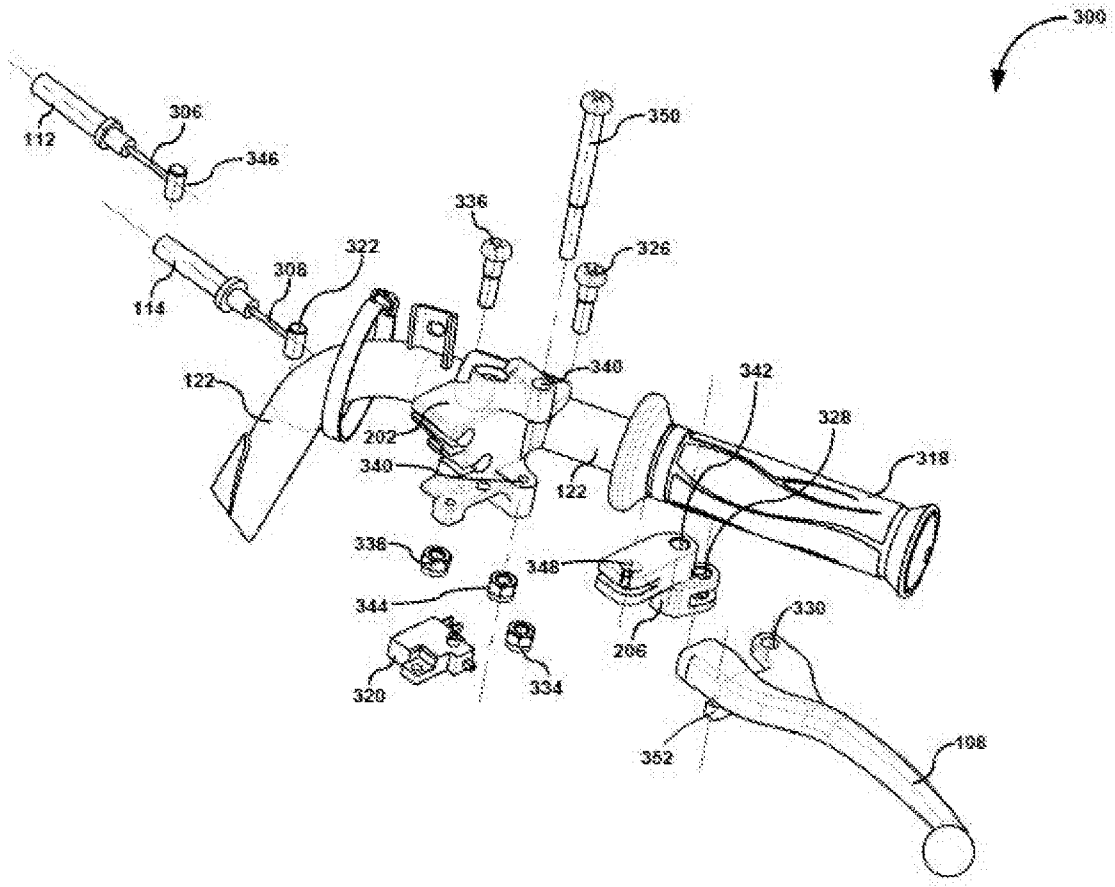


FIG. 3 (a)


300
112
306
346
350
336
326
322
308
114
340
342
122
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202
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348
344
330
206
320
334
352
108

FIG. 3 (b)

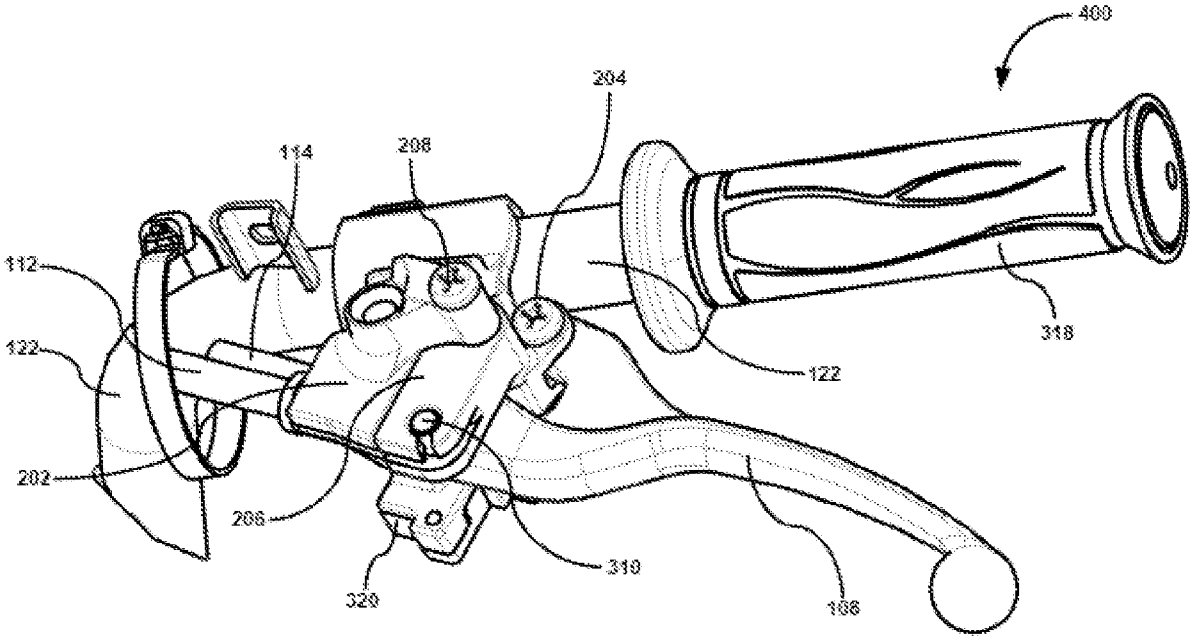

FIG. 4 (a)

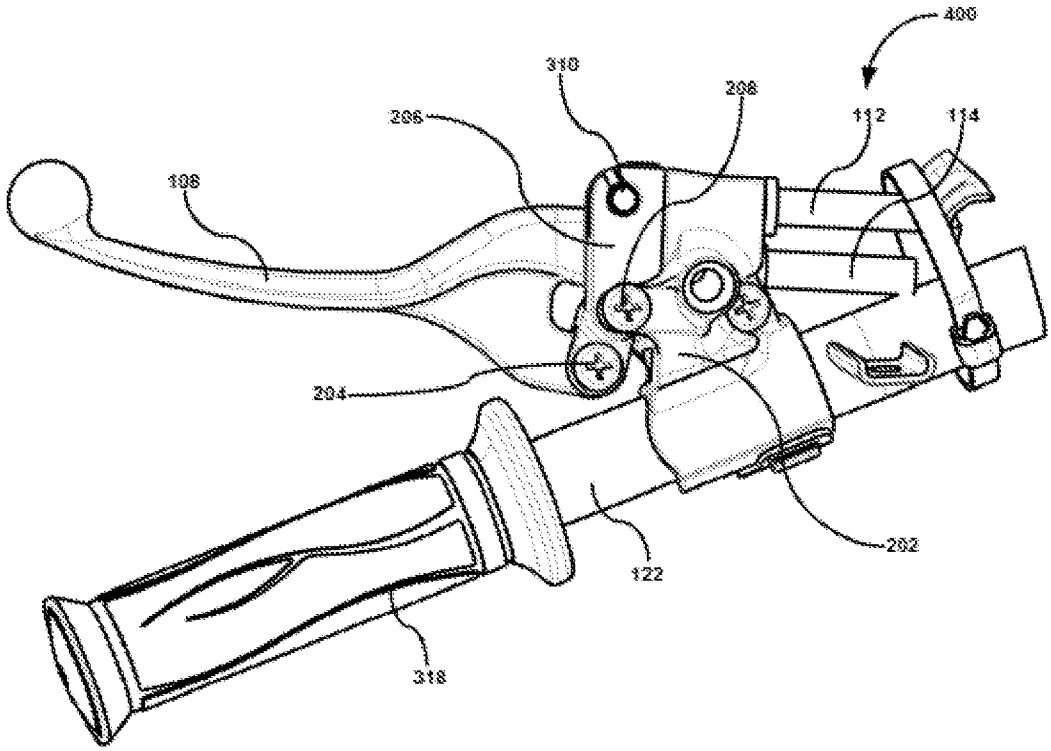

FIG. 4 (b)

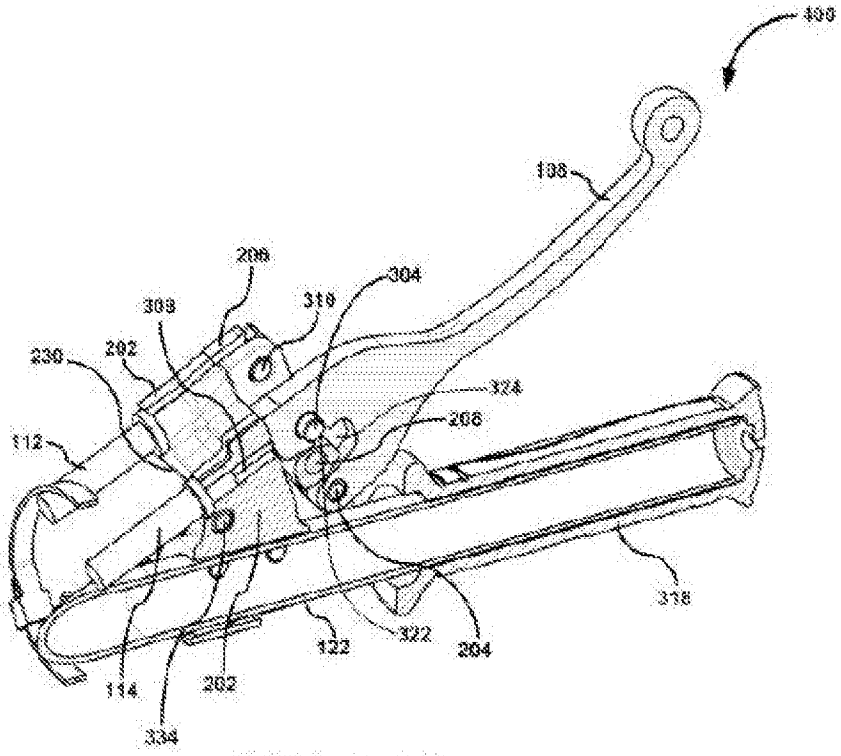
400
138
206
304
308
310
230
202
324
208
112
318
122
322
204
114
202
334

FIG. 4 (e)

INTERNATIONAL SEARCH REPORT

International application No
PCT/IN2016/050010

A. CLASSIFICATION OF SUBJECT MATTER
INV. B62L3/08
ADD.

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)
B62L

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)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	WO 2008/122120 A1 (UNIV GUELPH [CA]; RUNCIMAN JOHN R [CA]; WALLACE MICHA [CA]; BELL KATHI) 16 October 2008 (2008-10-16) page 9, line 8 - line 25; figures 1,4	1-5,7,10
X	US 4 267 746 A (PRUETT EARL M) 19 May 1981 (1981-05-19) column 4, line 10 - line 60	1-5,10
X	US 6 298 744 B1 (HUANG HAN-CHEN [TW]) 9 October 2001 (2001-10-09) column 4, line 25 - line 55; figure 3	1-5,7,8, 10

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 May 2016	03/06/2016

Name and mailing address of the ISA/	Authorized officer
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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/IN2016/050010

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IN2016/050010

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		JP H0516867 A	26-01-1993