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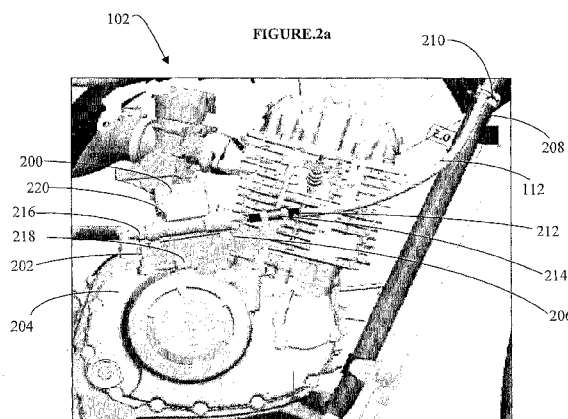
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(54) Title: CLUTCH ACTUATION ASSEMBLY FOR TWO-WHEELED VEHICLES



(57) Abstract: A clutch actuation assembly (102) for a two-wheeled vehicle (100) is described. The clutch actuation assembly includes a cable assembly (104) connected to a hydraulic assembly through an arm lever (106). The hydraulic assembly includes a master cylinder (200), a slave cylinder (302), and a pair of conduits (202) and (312) hydraulically connecting the master cylinder 200 and the slave cylinder (302). The cable assembly (104) includes a clutch lever (110), and a clutch cable (108). The arm lever (106) connects the clutch cable (108) to a first piston of the master cylinder (200). The connection is made in such a way that, when the clutch lever (110) is actuated by the rider, the hydraulic assembly gets actuated through the cable assembly (104) and the arm lever (106). The hydraulic clutch actuation assembly in turn actuates a clutch assembly (300).

CLUTCH ACTUATION ASSEMBLY FOR TWO-WHEELED VEHICLES

TECHNICAL FIELD

The subject matter described herein, in general, relates to a clutch actuation assembly and in particular, relates to a clutch actuation assembly for two wheeled vehicles.

BACKGROUND

Typically, a clutch assembly is provided between a power source, such as an engine or a motor, of a vehicle and a transmission system of the vehicle to provide a smooth shift between gears and to facilitate transfer of power from the power source to the transmission system. The clutch assembly generally includes clutch plates, a clutch release pin, a clutch shaft, and clutch springs. The clutch assembly can be actuated by a clutch actuation assembly, for example, a cable clutch actuation assembly or a hydraulic clutch actuation assembly.

The cable clutch actuation assembly includes a clutch lever and a clutch cable. When a driver of the vehicle manually imparts a force on the clutch lever, the clutch cable gets drawn. The clutch cable actuates the clutch assembly by separating the clutch plates from each other, which results in disengagement of the clutch assembly. Accordingly, when the rider releases the clutch lever, the clutch springs bring the clutch plates back to their normal position, thereby re-engaging the clutch assembly. In the engaged state, the clutch assembly facilitates the transfer of power from the power source to the transmission whereas, in the disengaged state, the clutch assembly facilitates gear shifting.

In vehicles having a high torque output, a high frictional force is required to maintain engagement of the clutch. This high frictional force is generated by combining clutch plates, having a high coefficient of friction and large contact areas, with relatively high stiffness clutch springs. The high stiffness clutch springs are used for applying a necessary load on the clutch plates. Due to high friction and high load, a large manual force is required to actuate the clutch assembly and to separate the clutch plates.

The force required to disengage the clutch increases with the separation of clutch plates due to increasing relative compression or extension of the clutch springs. The manual force required also increases as the size of the clutch plates increases, for example due to use of engines with high power output. However, the force that can be applied by the rider is limited. Additionally, the clutch cable has parasitic drag, is prone to degradation especially when exposed to high load applications, and its operation requires frequent adjustment of wear.

Therefore, usually, for high torque/high power output, a hydraulic clutch actuation assembly is used. The hydraulic clutch actuation assembly includes a manual clutch lever, a master cylinder, a slave cylinder, and an expandable hose adapted to transfer hydraulic fluid between the master and slave cylinders. When the clutch lever is retracted, the fluid inside the two cylinders gets pressurized and acts upon the clutch plates, thereby disengaging the engine from the transmission. As a result, better leverage ratio, and better clutch lever feel are obtained, but by making the overall assembly more expensive than the cable clutch actuation assembly. Additionally, the response of the hydraulic clutch gets affected because of the use of expandable hose and resultant transmission losses.

SUMMARY

The subject matter described herein is directed to a clutch actuation assembly for two-wheeled vehicles.

According to one embodiment, the clutch actuation assembly includes a cable clutch actuation assembly, an arm lever, and a hydraulic clutch actuation assembly. The cable clutch actuation assembly includes a clutch lever, and a clutch cable. The hydraulic clutch actuation assembly includes a master cylinder enclosing a first piston, a slave cylinder enclosing a second piston, and a pair of conduits connecting the master cylinder to the slave cylinder. Further, the clutch cable is connected to the master cylinder through the arm lever to provide axial motion to the first piston.

In operation, the cable clutch actuation assembly can be actuated by retracting the clutch lever. As a result, the clutch cable gets pulled. The clutch cable in turn pulls the arm lever, which further moves the first piston inside the master cylinder. The movement of the first piston provides motion to the second piston within the slave cylinder. Such motion is facilitated

through the hydraulic pressure within the conduits connecting the master cylinder to the slave cylinder. The movement of the second piston is transferred to clutch plates of a clutch assembly by means of a clutch actuating member, thus disengaging the clutch assembly.

The integrated use of the cable clutch actuation assembly and the hydraulic clutch actuation assembly ensures reduced force on the clutch cable and reduced force required to operate the clutch assembly. Additionally, a higher leverage ratio is achieved by providing three leverages, i.e., at the clutch lever, the arm lever, and the hydraulic master cylinder, thus combining both the typical mechanical and hydraulic advantages, and having an additional mechanical advantage due to the arm lever. The clutch actuation assembly of the present subject matter is compact, efficient, and economical. Moreover, manual force required to shift gears is low, thus reducing driver fatigue.

These and other features, aspects, and advantages of the present subject matter will be better understood with reference to the following description and appended claims. This summary is provided to introduce a selection of concepts in a simplified form. This summary is not intended to identify key features or essential features of the claimed subject matter, nor it is intended to be used to limit the scope of the claimed subject matter.

BRIEF DESCRIPTION OF DRAWINGS

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.

Fig. 1a illustrates a side view of a two-wheeled vehicle depicting an exemplary clutch actuation assembly.

Fig. 1b illustrates a top view of the two-wheeled vehicle of Fig. 1a depicting the exemplary clutch actuation assembly.

Fig. 2a illustrates an exemplary arrangement of a master cylinder in the clutch actuation assembly.

Fig. 2b illustrates the isometric view of the master cylinder and the arm lever in the clutch actuation assembly, in accordance with one embodiment of the present subject matter.

Fig. 2c illustrates another isometric view of the master cylinder and the arm lever in the clutch actuation assembly, in accordance with one embodiment of the present subject matter.

Fig. 3 illustrates a sectional view of an engine housing as viewed from a rear side of the two-wheeled vehicle.

Fig. 4 illustrates another sectional view of the engine housing as viewed from a rear side of the two-wheeled vehicle.

DETAILED DESCRIPTION

The subject matter disclosed herein relates to a clutch actuation assembly for a two-wheeled vehicle. For example and by no way limiting the scope of the subject matter, the two-wheeled vehicle is a motorcycle. The present subject matter integrates cable and hydraulic clutch actuation assemblies in order to provide a compact, efficient and a low cost clutch actuation assembly.

According to one embodiment, the clutch actuation assembly includes a cable clutch actuation assembly, an arm lever, and a hydraulic clutch actuation assembly. The cable clutch actuation assembly is actuated by retraction of a clutch lever provided on a handlebar of the motorcycle. To shift gears, a rider of the motorcycle retracts the clutch lever towards the handlebar. The retraction of the clutch lever actuates the cable clutch assembly that includes a clutch cable, and a cable sheath to cover the clutch cable. The clutch cable connects the clutch lever to the arm lever such that when the clutch is retracted, the clutch cable gets pulled in the direction of the clutch lever. The clutch cable in turn pulls the arm lever, thus transferring the motion of the clutch lever to the arm lever.

The arm lever further actuates the hydraulic clutch actuation assembly. The hydraulic clutch actuation assembly includes a main or master cylinder mounted on a bracket, a slave cylinder, and a pair of conduits connecting the master and the slave cylinder. The master cylinder includes a first piston and the slave cylinder includes a second piston. The first piston is connected to the arm lever such that the arm lever transfers motion of the clutch cable to the first piston and moves the first piston. The movement of the first piston increases fluid pressure inside the pair of conduits between the master cylinder and the slave cylinder. The pressure is transmitted to the second piston inside the slave cylinder through the conduits.

The movement of the second piston actuates a clutch assembly of the motorcycle. In one embodiment, the clutch assembly includes clutch plates, a pair of springs, a clutch actuating member, a clutch bearing for supporting the clutch actuating member, and a spherical ball for transferring the motion of the second piston to the clutch actuating member. The clutch actuating member is pushed by the spherical ball to separate the clutch plates in the clutch assembly, thereby ensuring disengagement of the clutch assembly.

As the clutch assembly is in a disengaged state, the rider can make the required shift in the gears. Once the required gear ratio is achieved, the rider can release the clutch lever, thus releasing the tension in the clutch cable. Accordingly, the clutch cable and in turn the arm lever are released, thereby returning to a normal condition. This reduces the hydraulic pressure in the master cylinder and the slave cylinder. Due to pressure release, the clutch actuating member and the spherical ball get pushed towards the second piston by the action of the pair of springs present near the clutch plates. This brings the clutch plates together, thereby re-engaging the clutch assembly.

Fig. 1a illustrates a side view of a motorcycle **100**, depicting an implementation of a clutch actuation assembly **102**.

Fig. 1b illustrates a top view of the motorcycle **100** depicting various components of the clutch actuation assembly **102**. The clutch actuation assembly **102** includes a cable clutch actuation assembly **104** hereinafter referred to as cable assembly **104**, a hydraulic clutch actuation assembly (not shown in the figure) hereinafter referred to as hydraulic assembly respectively, and an arm lever **106**.

The cable assembly **104** includes a clutch cable **108** and a clutch lever **110**. A cable sheath **112** covers the clutch cable **108**. The cable sheath **112** protects the clutch cable **108** from any damage due to outside environment. The clutch lever **110** is provided on a handlebar **114** of the motorcycle **100**, adjacent to a handle grip **116**, for actuating the cable assembly **104** of the motorcycle **100**. The clutch cable **108** transmits motion from the clutch lever **110** to the arm lever **106**.

In operation, the clutch lever **110** is retracted towards the handle grip **116** by a rider of the motorcycle **100**, for example to shift gears. The retraction of the clutch lever **110** facilitates the transmission of motion from the clutch lever **110** to a clutch assembly (not shown in **Figs. 1a** and **1b**) through the cable assembly **104**, the arm lever **106** and the hydraulic assembly. The clutch lever also helps in force multiplication by transferring a small force applied by the rider into a relatively larger force at the arm lever as a result of known principles of leverage.

Though the current description has been provided with reference to a push-type clutch actuation, it will be easily understood by a person skilled in the art that the disclosed embodiments can be used for pull-type clutch actuation by suitably orienting the arm lever **106**.

Fig. 2a illustrates an exemplary arrangement of a master cylinder **200** in the clutch actuation assembly **102**. As mentioned above, the clutch actuation assembly **102** includes the hydraulic assembly, the cable assembly **104**, and the arm lever **106**. The hydraulic assembly includes the master cylinder **200**, a slave cylinder (explained in detail later with reference to **Fig. 3**), and a pair of conduits such as a first conduit **202** and a second conduit (not shown in **Fig. 2a**) connecting the master cylinder **200** to the slave cylinder. In one embodiment, the slave cylinder is housed within an engine housing **204**. Additionally, the master cylinder **200** is mounted on a bracket **206** and encloses a first piston (not shown in **Fig. 2a**).

In one embodiment, the first piston is capable of sliding within the master cylinder **200** and is set in motion by the clutch lever **110** through the cable assembly **104** and the arm lever **106**. The clutch cable **108** and the arm lever **106** connect the clutch lever **110** to the first piston. In said embodiment, the arm lever **106** is mounted on the master cylinder housing and is hinged to the first piston at one end and to the clutch cable **108** at the other end. Further, the cable assembly **104** is guided on a frame **208** of the motorcycle **100** using a clip guide **210**. Also, the cable assembly **104** includes a threaded end **212** mounted on the bracket **206** by means of a first fastener **214**. The first fastener **214** may be a nut, a screw, a bolt or any other fastener known in the art.

In said embodiment, one end of the first conduit **202** is connected to the output of the master cylinder **200** by a fastening means such as a second fastener **216**. The other end of the

first conduit **202** is connected to the second conduit disposed in the engine housing **204**. The second conduit can be connected to the first conduit **202** by another fastening means such as a third fastener **218**. The second fastener **216** and the third fastener **218** may be a nut, a screw, a bolt or any other fastener known in the art. In one embodiment, the second and third fasteners **216** and **218** are benjo bolts..

A hydraulic fluid is present within and between the master cylinder **200** and the slave cylinder. In one embodiment, the hydraulic fluid used between the master cylinder **200** and the slave cylinder is high viscosity oil. For example, the hydraulic fluid used may be an engine oil so that any intermixing between the engine oil and the hydraulic fluid does not affect the functioning of the engine.

In one implementation, upon actuation of the clutch lever **110**, the clutch cable **108** gets pulled towards the clutch lever **110**, which in turn pulls the arm lever **106**. The arm lever **106** transfers the motion of the clutch cable **108** to the first piston such that the first piston moves inside the master cylinder **200**. The movement of the first piston creates pressure inside the master cylinder **200** containing the hydraulic fluid.

The quantity of the hydraulic fluid in the hydraulic assembly, i.e. the master cylinder **200**, the slave cylinder and the two conduits, is maintained such that a motion of the first piston results in a motion of a second piston (not shown in **Fig. 2**) provided inside the slave cylinder. For this purpose, a fluid level sensor **220** is provided to periodically check a predetermined level of the hydraulic fluid in the cylinders and the conduits.

The transfer of motion from the first piston in the master cylinder **200** to the second piston in the slave cylinder is possible due to the movement of the hydraulic fluid from the master cylinder **200** to the slave cylinder through the pair of conduits. The pressure applied on the first piston is transmitted unchanged to the second piston. Since the force exerted is equal to a product of pressure and area of the piston, a small force exerted on the first piston is capable of providing a large force at the second piston (with a relatively larger area than the first piston). Such a force multiplication in the hydraulic assembly helps in disengaging a clutch assembly from an engine.

Figs. 2b and Fig. 2c illustrate isometric views of the exemplary arrangement of the master cylinder **200** and the arm lever **106**. In one implementation, the arm lever **106** is operably connected to the master cylinder **200**. The arm lever **106** actuates the first piston disposed in the master cylinder **200**. The first piston, in turn, actuates the second piston disposed in the slave cylinder as discussed in the explanation of **Fig 2a**.

In one embodiment, the engine housing **204** has the bracket **206** mounted on it. Further, the master cylinder **200** is mounted on the bracket **206** and the arm lever **106** is mounted in a housing of the master cylinder **200**. The bracket **206** can be a sheet metal bracket and is also capable of receiving the clutch cable **108** through the cable guide **222**.

As discussed above, the clutch cable **108** is connected to the clutch lever **110** on one end and the arm lever **106** at the other end. This other end is shown as an effort end **224** of the arm lever **106** in the figure **2c**. The first piston of the master cylinder is operably connected to a load end **226** of the arm lever **106**. The arm lever **106** is pivoted about a fulcrum pin **228** provided as fulcrum between the effort end **224** and the load end **226** of the arm lever **106**. Further, the second fastener **216** connects the first end **230** of the first conduit **202** to the output of the master cylinder **200** while the third fastener **218** connects the second end **232** of the first conduit **202** to the second conduit (within the engine housing **204**).

In operation, when the rider of the motorcycle retracts the clutch lever in order to disengage a clutch assembly from an engine, the clutch cable **108** gets pulled towards the clutch lever **110**. The clutch cable **108**, which is connected to the arm lever **106**, actuates the arm lever **106**. To actuate the first piston of the master cylinder **200**, force is applied at the effort end **224** of the arm lever **106**. Since the effort end **224**, in comparison to the load end **226**, is placed farther from the fulcrum pin **228**, a mechanical advantage is obtained. With this a multiplied force is obtained at the load end **226** of the arm lever **106**. This multiplied force, due to the arm lever **106**, is capable of actuating the first piston of the master cylinder **200**. The mechanical advantage (MA) of a lever can be represented as:

$$MA = \frac{F_2}{F_1} = \frac{D_1}{D_2} \quad \dots(1)$$

$$\text{thus, } F_2 = \frac{F_1 \times D_1}{D_2} \quad \dots(2)$$

where F_1 is the force applied at the effort end;

F_2 is the force obtained at the load end;

D_1 is the distance from the effort end to the fulcrum pin; and

D_2 is the distance from the load end to the fulcrum pin.

Therefore, when D_1 is greater than D_2 , the force F_2 obtained at the load end is greater than the applied force F_1 and hence, a force multiplication is achieved.

Fig. 3 illustrates a first sectional view of the engine housing **204** as viewed from a rear side of the motorcycle **100**, when seen through the path of the hydraulic fluid from the master cylinder **200** to the slave cylinder. **Fig. 3** shows the clutch assembly **300** and the slave cylinder **302** of the hydraulic assembly connected to each other, according to an embodiment of the present subject matter. In said embodiment, the clutch assembly **300** is a multi-plate clutch assembly. The clutch assembly **300** includes a plurality of inside plates **304-1** and outside plates **304-2**, which can be collectively referred to as clutch plates **304**, and a pair of springs **306** and **308**. The pair of springs **306** and **308** is provided to keep the clutch plates **304** of the clutch assembly **300** in an engaged state with a flywheel of an engine(not shown in the figure). In one embodiment, the springs **306** and **308** are compression springs and are attached to the outside plates **304-2**.

As shown in **Fig. 3**, the slave cylinder **302** is housed within the engine housing **204** and includes a second piston **310**, wherein the second piston **310** is capable of reciprocating inside the slave cylinder **302**. The slave cylinder **302** is hydraulically connected to the master cylinder **200** through the first conduit **202** and a second conduit **312**. Due to this, when the first piston within the master cylinder **200** is displaced by the arm lever **106**, the hydraulic fluid between the master cylinder **200** and the slave cylinder **302** transfers pressure to the second piston **310**, thereby transferring motion as well.

Fig. 4 illustrates a second sectional view of the engine housing **204** as viewed from the rear side of the motorcycle **100**, when seen through the centre of the second piston **310**. As

explained in the illustration of **Fig. 3**, the second piston **310** is connected to a second conduit **312**. On actuation of the master cylinder **200**, the displacement of hydraulic fluid between the master cylinder **200** and the slave cylinder **302** leads to an axial motion of the second piston **310**. **Fig. 4** further depicts a clutch actuating member **400** for transferring the axial motion from the second piston **310** to the clutch assembly **300**. In one embodiment, the clutch actuating member **400** is a pin. One end of the clutch actuating member **400** is disposed in the clutch assembly **300** and the other end is guided in the second piston **310** disposed within the slave cylinder **302**. The clutch actuating member **400** is further supported by a clutch bearing **402**. The clutch bearing **402** is seated inside the clutch assembly **300** and facilitates transfer of axial motion from the second piston **310** to the clutch assembly **300** in a frictionless manner.

The second piston **310** transfers the axial motion to the clutch actuating member **400** through a spherical ball **404**. A pair of O-rings **406** is provided on the periphery of the second piston **310** to prevent any leakage of the hydraulic fluid from the other side of the second piston **310** inside the slave cylinder **302**.

Based on all the illustrations including **Fig. 4**, the overall working of the clutch actuation assembly **102** of the motorcycle **100** can be understood as follows. While riding a two-wheeler, a rider presses the clutch lever **104** to disengage the clutch assembly **300**, which is normally in an engaged condition, from an engine for example, to change gears, to start or to stop the motorcycle. When the clutch lever **110** is pressed, the clutch cable **108** gets pulled towards the clutch lever **110** and in turn pulls the arm lever **106**, thereby transferring the motion of the clutch lever to the arm lever **106**. The arm lever **106** then moves the first piston of the master cylinder **200**. This results in an increase in the hydraulic pressure inside the master cylinder **200**, due to which the fluid inside the first conduit **202** and the second conduit **312** is pushed.

The pressurized fluid further pushes the second piston **310** inside the slave cylinder **302** towards the clutch actuating member **400**. The second piston **310** moves axially and contacts the clutch actuating member **400** through the spherical ball **404**, thus pushing the clutch actuating member **400** in a forward direction. The forward movement of the clutch actuating member **400** compresses the pair of springs **306** and **308**. The compressed springs **306** and **308**

pushes the outside plates **304-2** away from the inside plates **304-1**, thus separating the clutch plates **304** of the clutch assembly **300** and disengaging the clutch assembly **300**. At this point of time, the rider can change the gears and increase or decrease the speed of the motorcycle **100**.

As can be understood, by using the hydraulic assembly described above, unidirectional transfer of force can be achieved from the slave cylinder to the pin clutch release. However, it will be understood that the design of the hydraulic system can be suitably altered to use a pull type clutch assembly as well.

The rider can then release the clutch lever **110** to let the motorcycle operate in normal condition. As the clutch lever **110** is now released, the tension in the clutch cable **108** gets released and the clutch cable **108** returns to its normal condition, i.e., a no tension state. Due to the release of tension in the clutch cable **108**, the arm lever **106** too comes back to its original position, thus causing the first piston to also return to its normal position. Also, the hydraulic pressure inside the master cylinder **200** gets released and the fluid starts flowing towards the master cylinder **200**.

This reverse flow of the fluid releases the pressure on the second piston **310** in the slave cylinder **302**, and therefore the pressure on the clutch bearing **402**, the clutch actuating member **400**, and the pair of springs **306** and **308**, which were at a compressed stage, is also released. As a result, the compressed springs **306** and **308** return to their normal relaxed condition, thereby moving the clutch actuating member **400** and the clutch bearing **402** towards the second piston **310** and pushing the second piston **310** back to its original position. This causes the clutch plates **304**, and therefore the clutch assembly **300**, to come back to their normal engaged state.

The previously described versions of the subject matter and its equivalent thereof have many advantages, including those which are described below. The combined use of the cable assembly **104** and the hydraulic assembly ensures reduction in the force acting on the clutch cable **108**. Further, due to three leverages, i.e., the clutch lever **110**, the arm lever **106**, and the hydraulic assembly, the force required to operate the clutch assembly **300** is very low as the mechanical advantage is multiplied with the hydraulic advantage. Additionally, as the force on

the clutch cable **108** is low, it does not degrade as fast as clutch cables in conventional cable clutch actuation assemblies do, and minimum maintenance is required for the clutch cable **108**.

Further, the clutch actuation assembly **102** provides immediate response, unchanged clutch lever feel, and eliminates the need to adjust the manual force required for actuating the clutch lever. In comparison to typical hydraulic clutch actuation assemblies, the response time is less as the usage of hose is minimized or even eliminated. For vehicles having high torque output, the clutch actuation assembly **102** provides high clutch spring force and correspondingly high clutch disengagement force due to its high lever ratio. Also, manually imparted force to the clutch lever **110** in a disengaged position is low, which reduces fatigue experienced by the rider.

Moreover, the clutch actuation assembly **102** of the present subject matter is compact, efficient, and economical. Further, the clutch actuation assembly **102** as described herein can be retrofitted on current two wheelers, thereby providing benefits of the integrated clutch actuation to conventional two wheelers as well.

While certain features of the claimed subject matter have been illustrated and described herein, many modifications, substitutions, changes, and equivalents will now occur to those skilled in the art. It is, therefore, to be understood that the appended claims are intended to cover all such modifications and changes that fall within the true spirit of the claimed subject matter.

I/We Claim:

1. A clutch actuation assembly (102) for a two-wheeled vehicle (100), the clutch actuation assembly (102) comprising:
 - a clutch cable assembly (104), said clutch cable assembly including
 - a clutch lever (110); and
 - a clutch cable (108) connected to the clutch lever (110);
 - characterized in that,
 - an arm lever (106) is operably coupled to the clutch lever (110) such that the clutch lever (110) actuates the arm lever (106) through the clutch cable (108); and
 - a hydraulic assembly is operably coupled to the arm lever (106), wherein the arm lever (106) actuates the hydraulic assembly.
2. The clutch actuation assembly (102) as claimed in claim 1, wherein the hydraulic assembly is operably connected to a clutch assembly (300).
3. The clutch actuation assembly (102) as claimed in claim 1, wherein the hydraulic assembly comprises a master cylinder (200), a slave cylinder (302), and a pair of conduits (202 and 312) hydraulically connecting the master cylinder (200) to the slave cylinder (302).
4. The clutch actuation assembly (102) as claimed in claim 3, wherein the master cylinder (200) is mounted on an engine housing (204) using a bracket (206).
5. The clutch actuation assembly (102) as claimed in claim 3, wherein the slave cylinder (302) is housed in an engine housing (204).
6. The clutch actuation assembly (102) as claimed in claim 3, wherein the master cylinder (200) comprises a first piston and the slave cylinder (302) comprises a second piston (310).
7. The clutch actuation assembly (102) as claimed in claim 6, wherein the arm lever (106) connects the clutch cable (108) with the first piston.
8. The clutch actuation assembly (102) as claimed in claim 6, wherein the arm lever (106) is hinged to the clutch cable (108) and the first piston.
9. The clutch actuation assembly (102) as claimed in claim 2, wherein the clutch assembly (300) is a multi-plate clutch assembly.
10. The clutch actuation assembly (102) as claimed in claim 2, wherein the clutch assembly (300) comprises a plurality of clutch plates (304), a pair of springs (306 and 308), a clutch

actuating member (400), a clutch bearing (402) for supporting said clutch actuating member (400), a spherical ball (404), and a pair of O-rings (406).

11. The clutch actuation assembly (102) as claimed in claim 10, wherein the pair of springs (306 and 308) is a pair of compression springs.

12. A method for actuating a clutch assembly (300) for a two-wheeled vehicle (100), said method comprising:

applying an actuation force on a cable assembly (104);

transferring the actuation force from the cable assembly (104) to a hydraulic assembly through an arm lever (106); and

actuating a clutch assembly (300) through the hydraulic assembly.

13. The method as claimed in claim 12, wherein applying an actuation force on a cable assembly (104) comprises pulling a clutch cable (108) of the cable assembly (104).

14. The method as claimed in claim 12, wherein applying an actuation force on a cable assembly (104) comprises actuating a first piston of the hydraulic assembly.

15. The method as claimed in claim 12, wherein actuating a clutch assembly (300) comprises disengaging the clutch assembly (300).

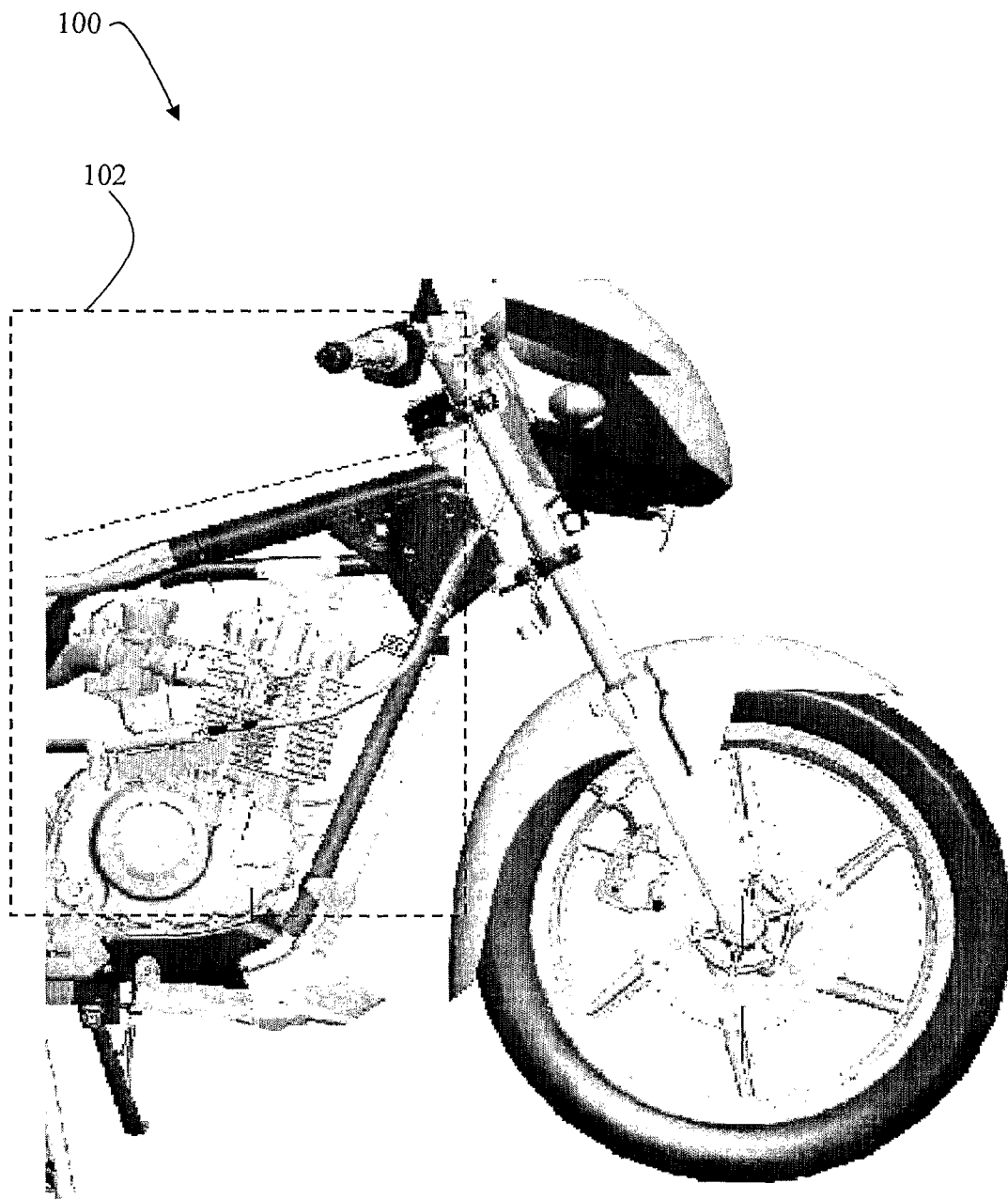
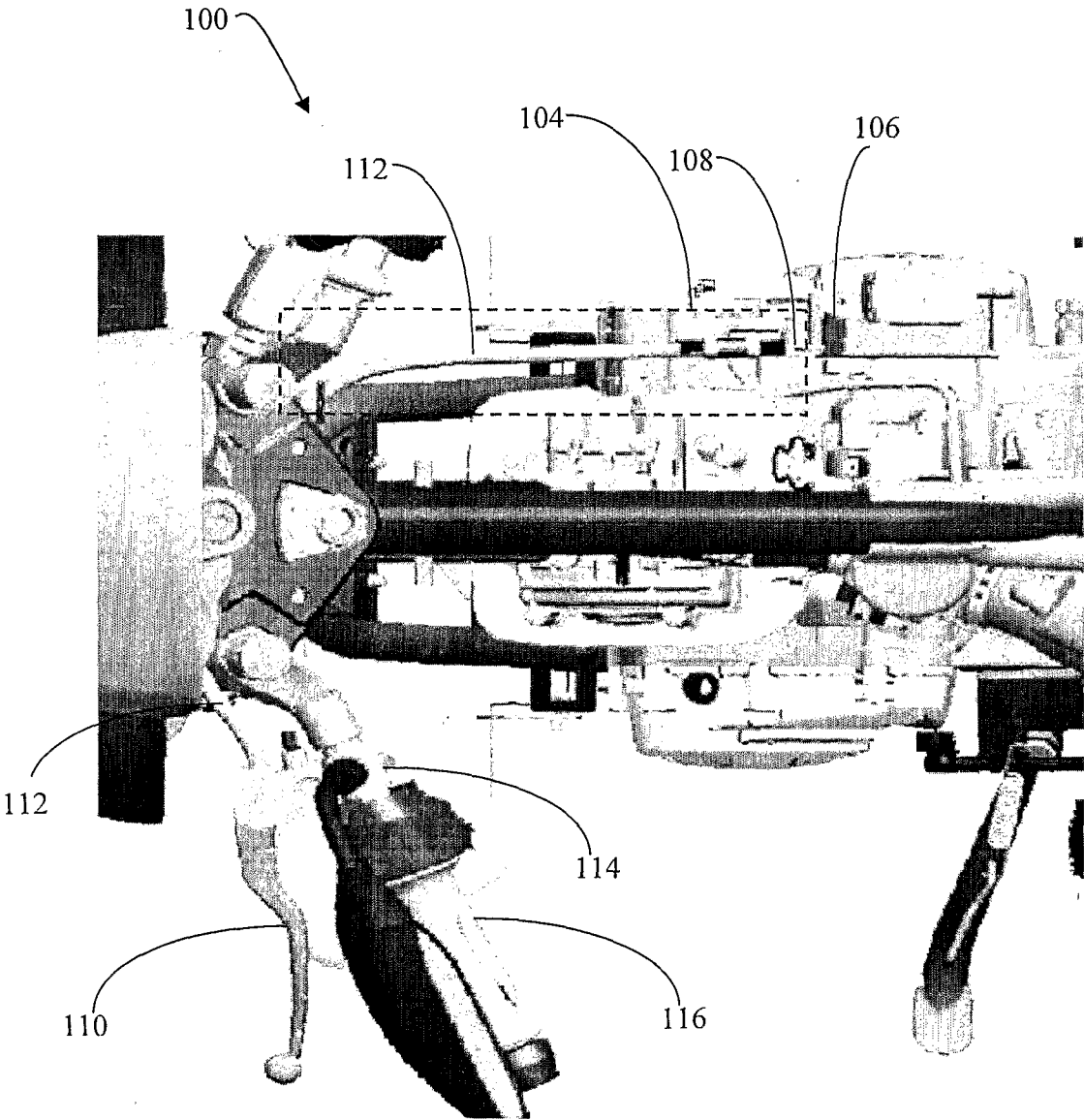


FIGURE.1a



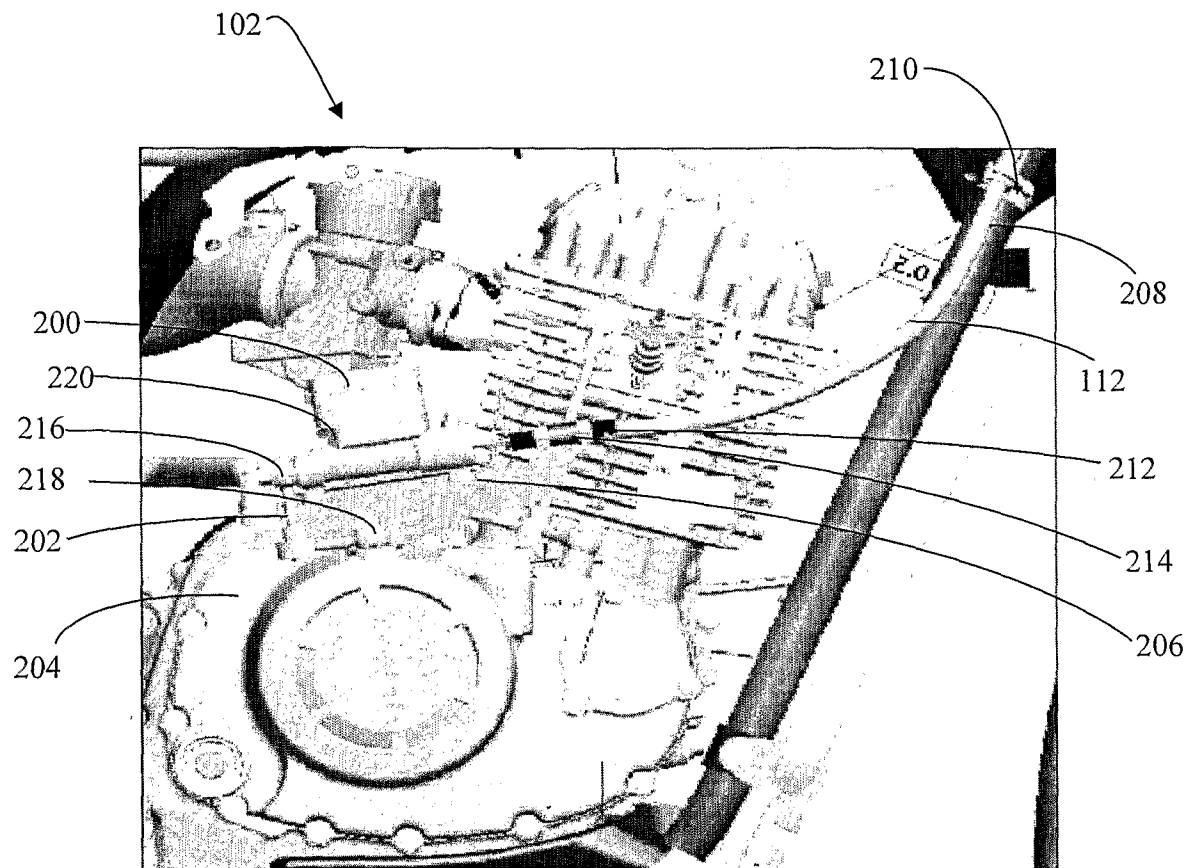


FIGURE.2a

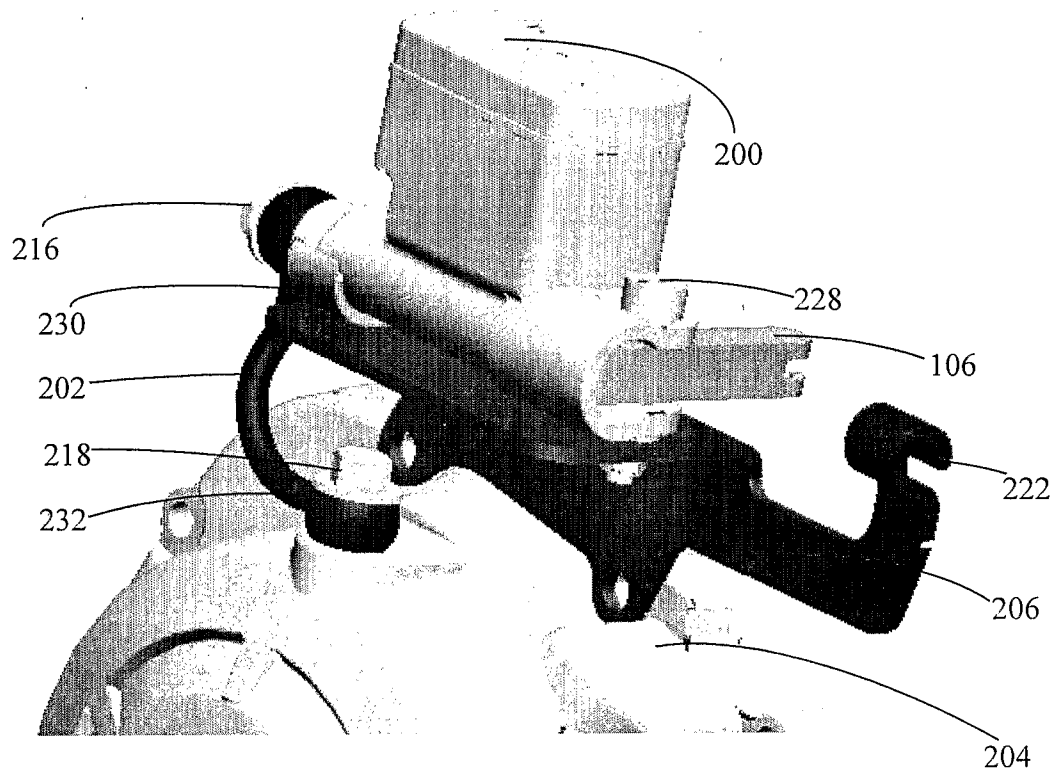


FIGURE.2b

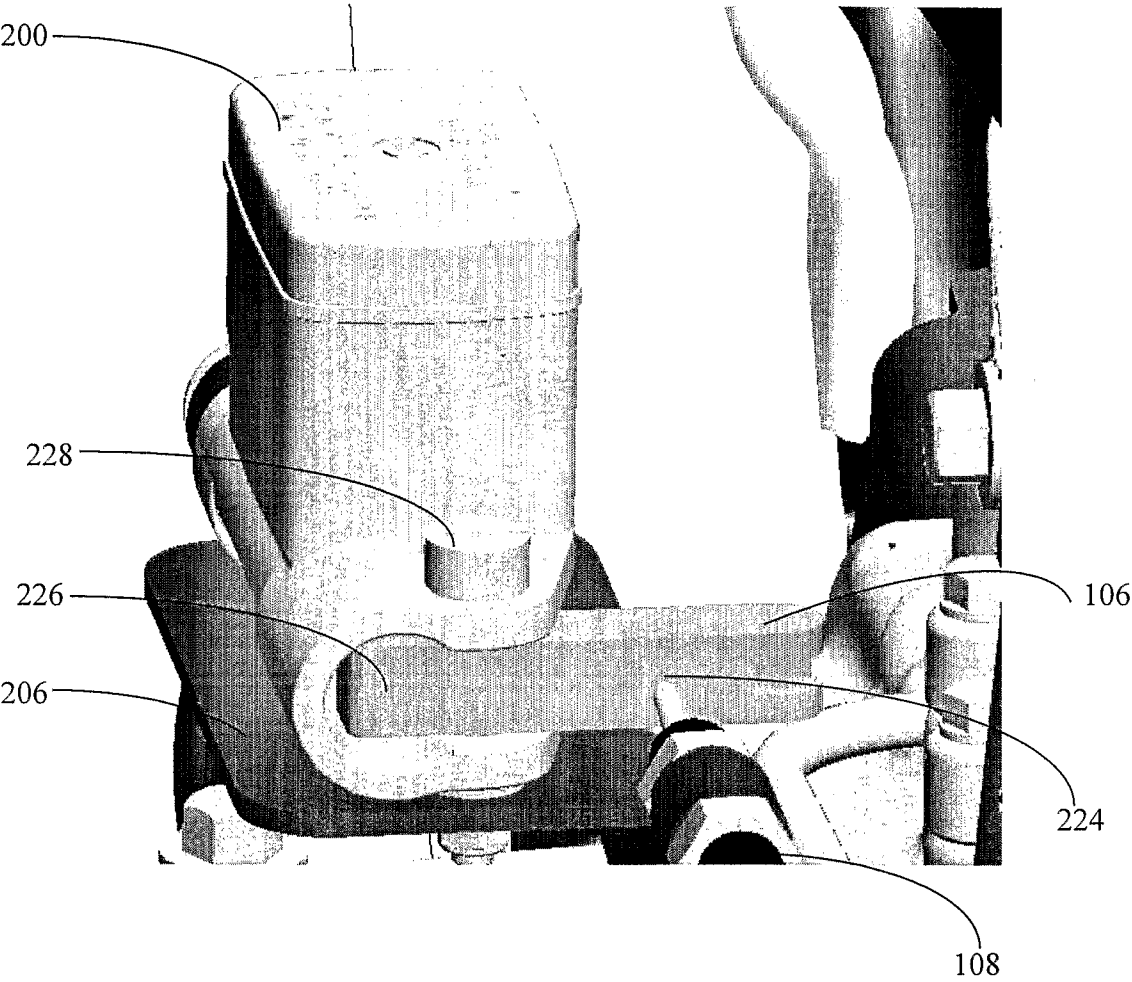


FIGURE.2c

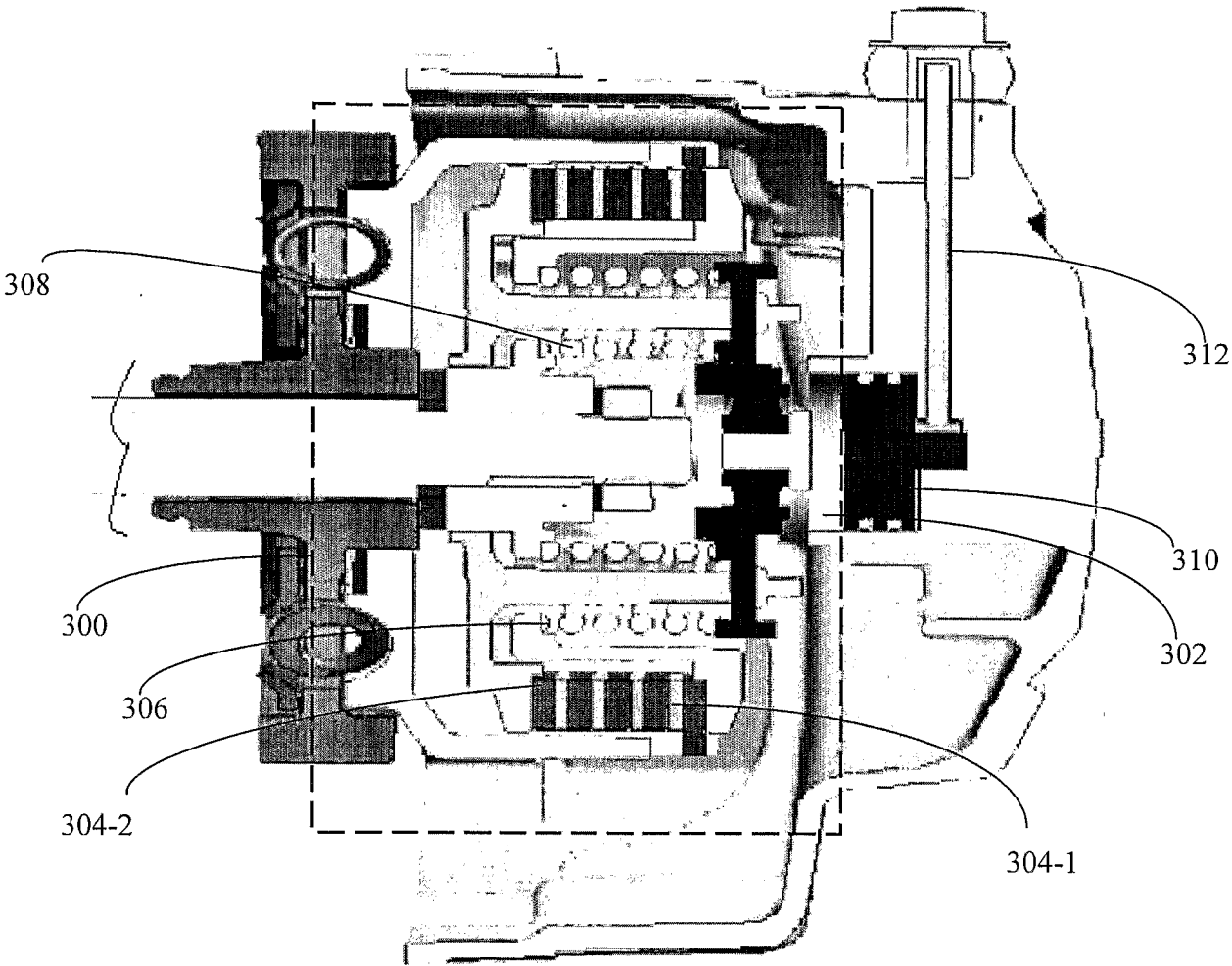


FIGURE.3

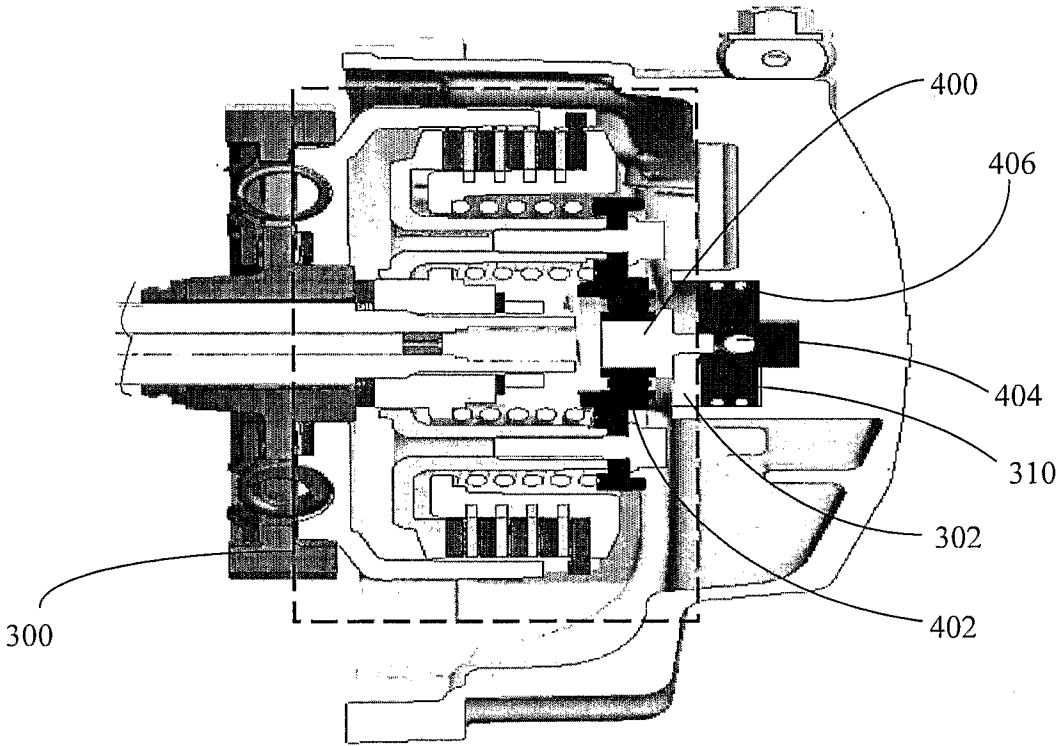


FIGURE.4

INTERNATIONAL SEARCH REPORT

International application No

PCT/IN2009/000422

A. CLASSIFICATION OF SUBJECT MATTER

INV. F16D13/52 F16D25/08 F16D48/04

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)

F16D

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 669 623 A1 (YAMAHA MOTOR CO LTD [JP]) 14 June 2006 (2006-06-14)	1-9, 12-15
Y	paragraph [0022] paragraph [0020] figures 1-7	10-11
Y	----- US 4 565 269 A (KAWASAKI HIROSHI [JP] ET AL) 21 January 1986 (1986-01-21)	10-11
A	figure 2	1-3, 5-6, 9, 15
A	----- US 6 227 342 B1 (ARMBRUSTER FREDERICK K [US] ET AL) 8 May 2001 (2001-05-08)	1, 4, 12-13

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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* & * document member of the same patent family

Date of the actual completion of the international search

24 November 2009

Date of mailing of the international search report

01/12/2009

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IN2009/000422

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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