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Matsunaga

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(54) **MULTIPLE-DISC FRICTION CLUTCH**

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F16D 13/52 (2006.01)
F16D 13/70 (2006.01)

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CPC F16D 13/52–2013/565; F16D 23/12–2023/123
See application file for complete search history.

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(57) **ABSTRACT**

A multiple-disc friction clutch has a clutch center including a first and second clutch centers. The first clutch center is axially supported by a main shaft in a relatively non-rotatable manner. The second clutch center is supported by the first clutch center in a relatively rotatable manner and holds a clutching part between a pressure plate and the second clutch center. The first and second clutch centers have a torque limiter mechanism and a torque limiter-disabling mechanism therebetween. The torque limiter mechanism transmits power between the first and second clutch centers and reduces clutch torque by acting on the pressure plate due to relative rotation between the first and second clutch centers. The torque limiter-disabling mechanism inhibits operation of a torque limiter of the torque limiter mechanism by preventing the relative rotation when power is transmitted from the first clutch center to the second clutch center in an acceleration direction.

5 Claims, 7 Drawing Sheets

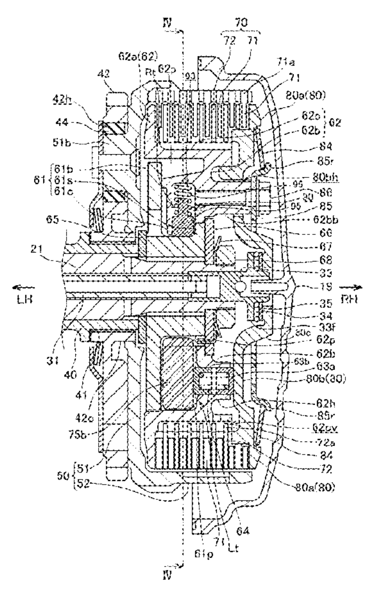


FIG. 1

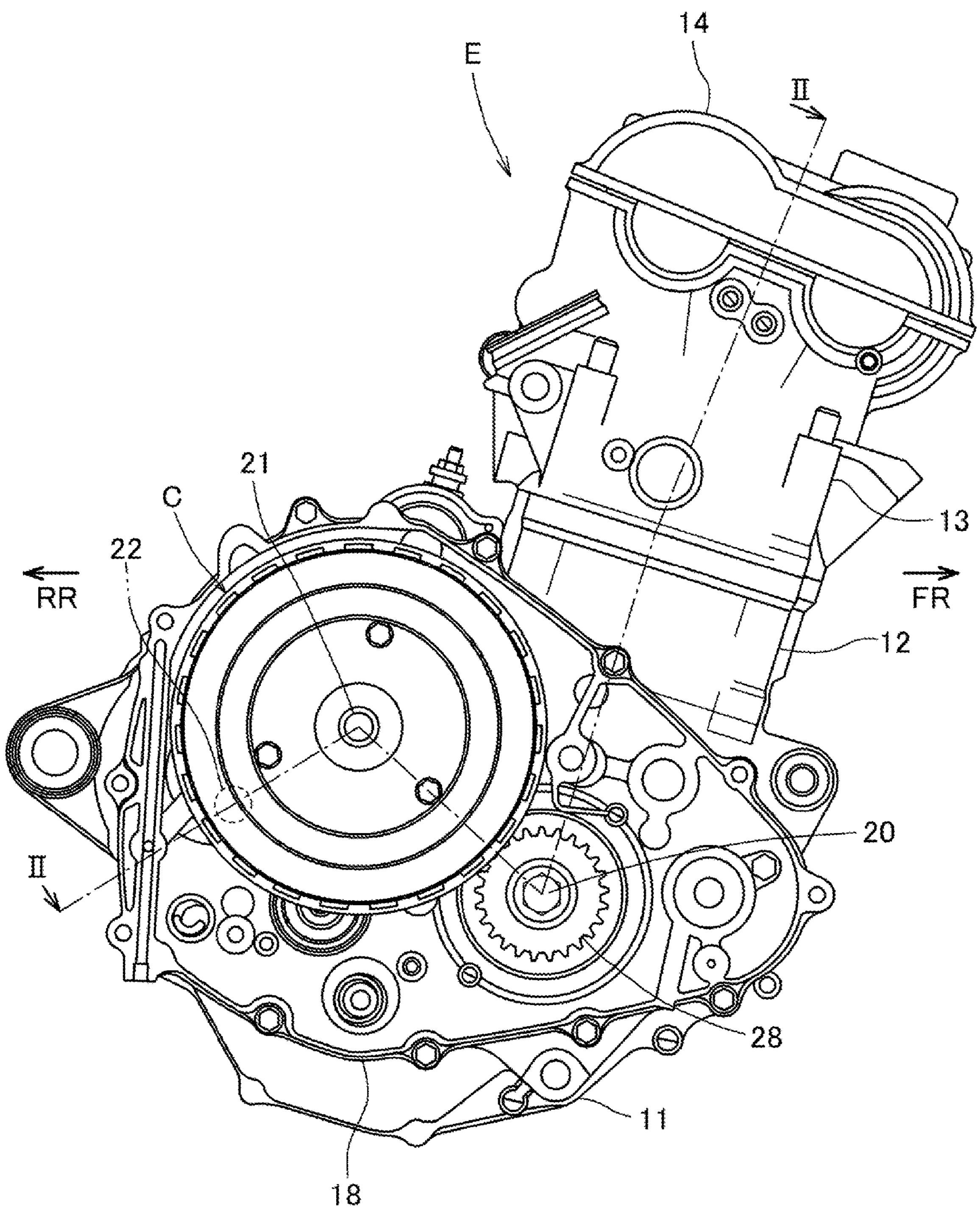
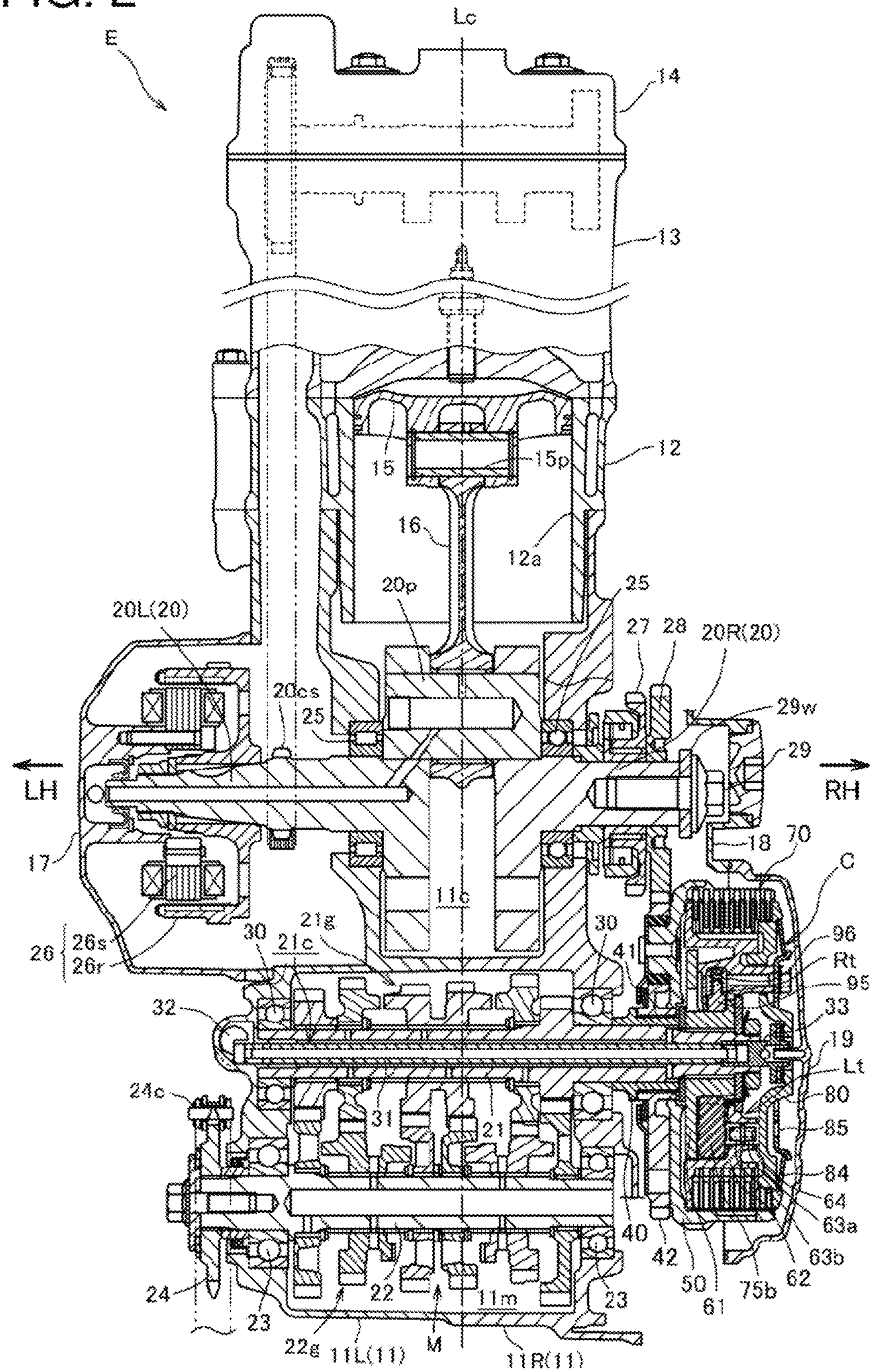


FIG. 2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14
13
12
15
15p
16
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20p
25
20L(20)
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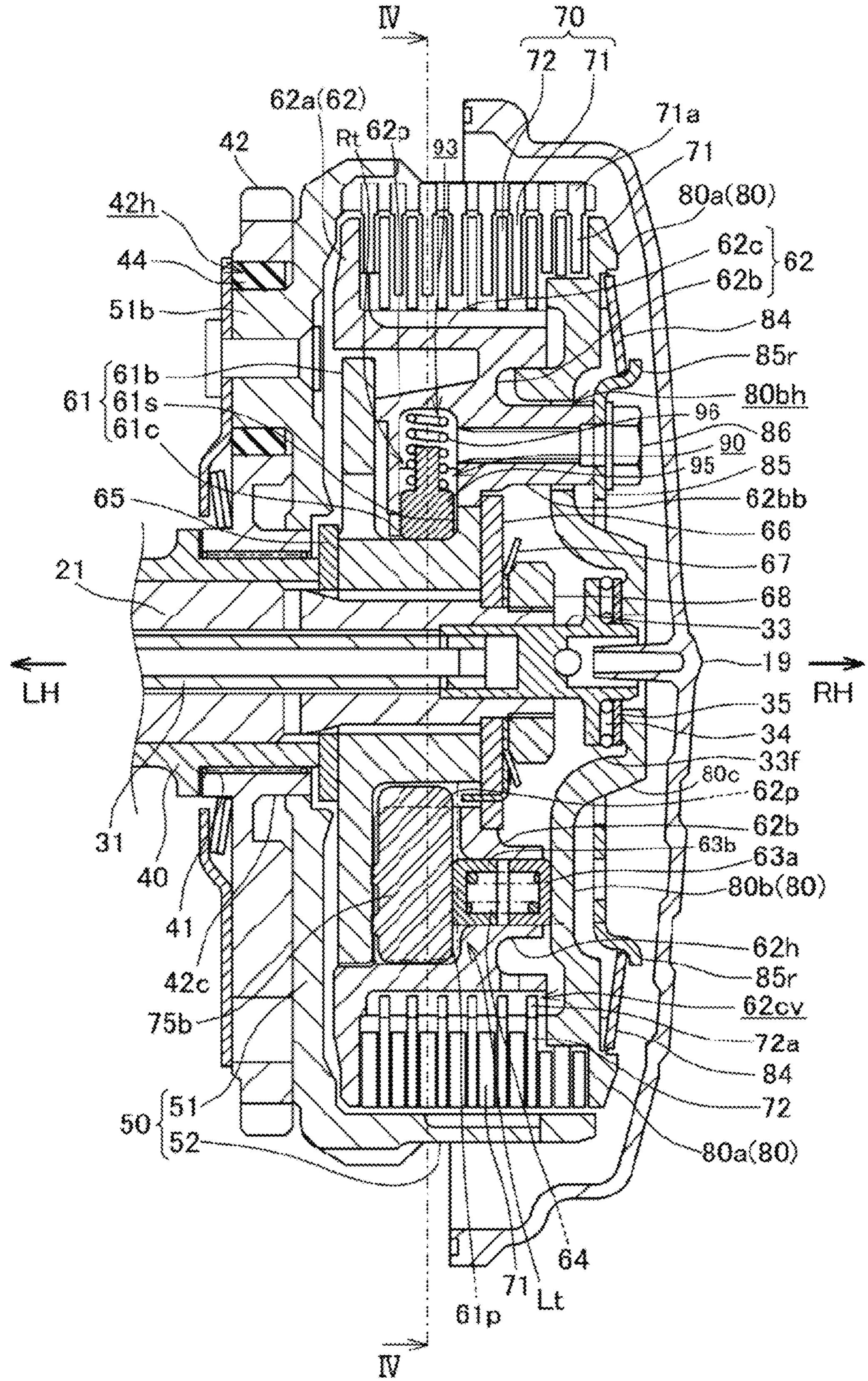
20R(20)
20cs
25
29w
29
LH
RH
17
18
70
C
11c
26
26s
26r
21g
30
21c
30
41
96
Rt
95
32
33
19
Lt
24c
31
21
80
85
84
64
63a
40
42
63b
50
62
61
75b
24
23
22
11m
23
23
22g
11L(11)
M
11R(11)

FIG. 3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70
72
71
62a(62)
Rt
62p
93
71a
71
42
42h
80a(80)
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62b
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51b
84
85r
61
61b
61s
61c
80bh
96
86
90
95
85
65
62bb
66
67
21
68
33
LH
19
RH
35
34
33f
80c
62p
62b
31
40
63b
63a
80b(80)
41
42c
62h
85r
62cv
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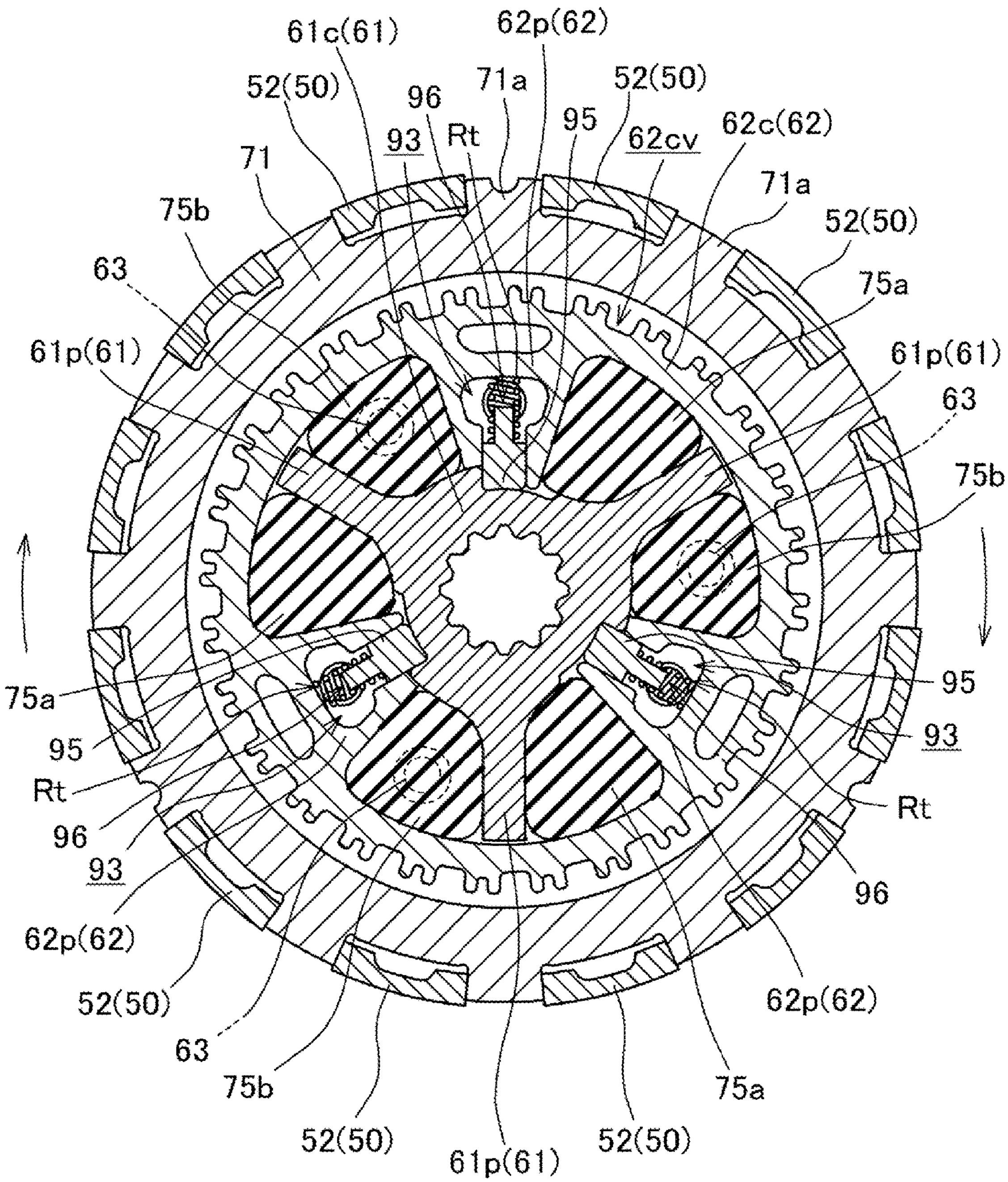
72a
84
50
51
52
72
80a(80)
64
71
Lt
61p
IV

FIG. 4



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62p(62)
52(50)
71a
52(50)
96
95
93
Rt
62cv
62c(62)
71
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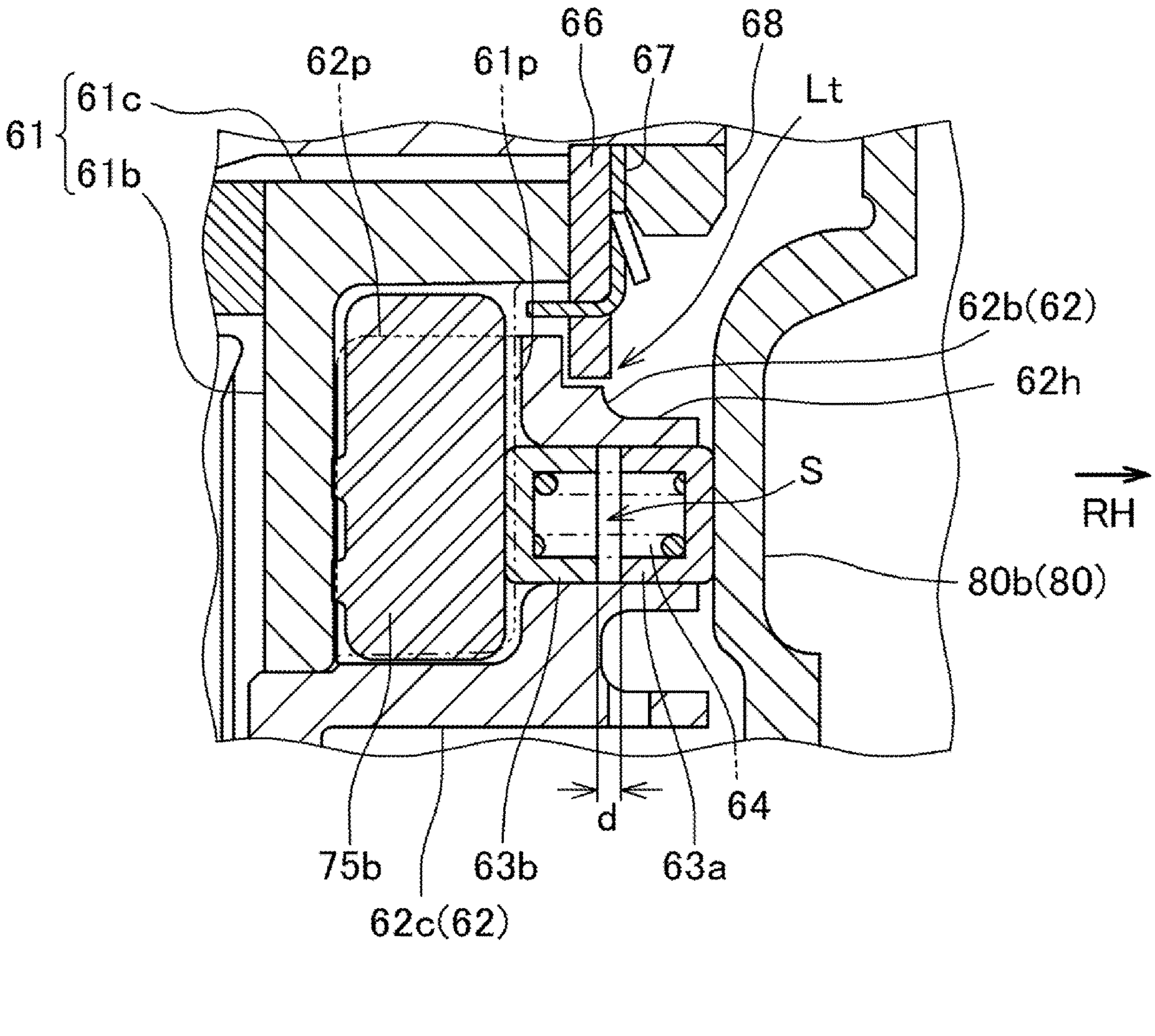
75b
52(50)
63
75a
61p(61)
61p(61)
63
75b
75a
95
95
93
Rt
Rt
96
96
93
62p(62)
52(50)
62p(62)
63
75b
75a
52(50)
61p(61)
52(50)

FIG. 5



61
61c
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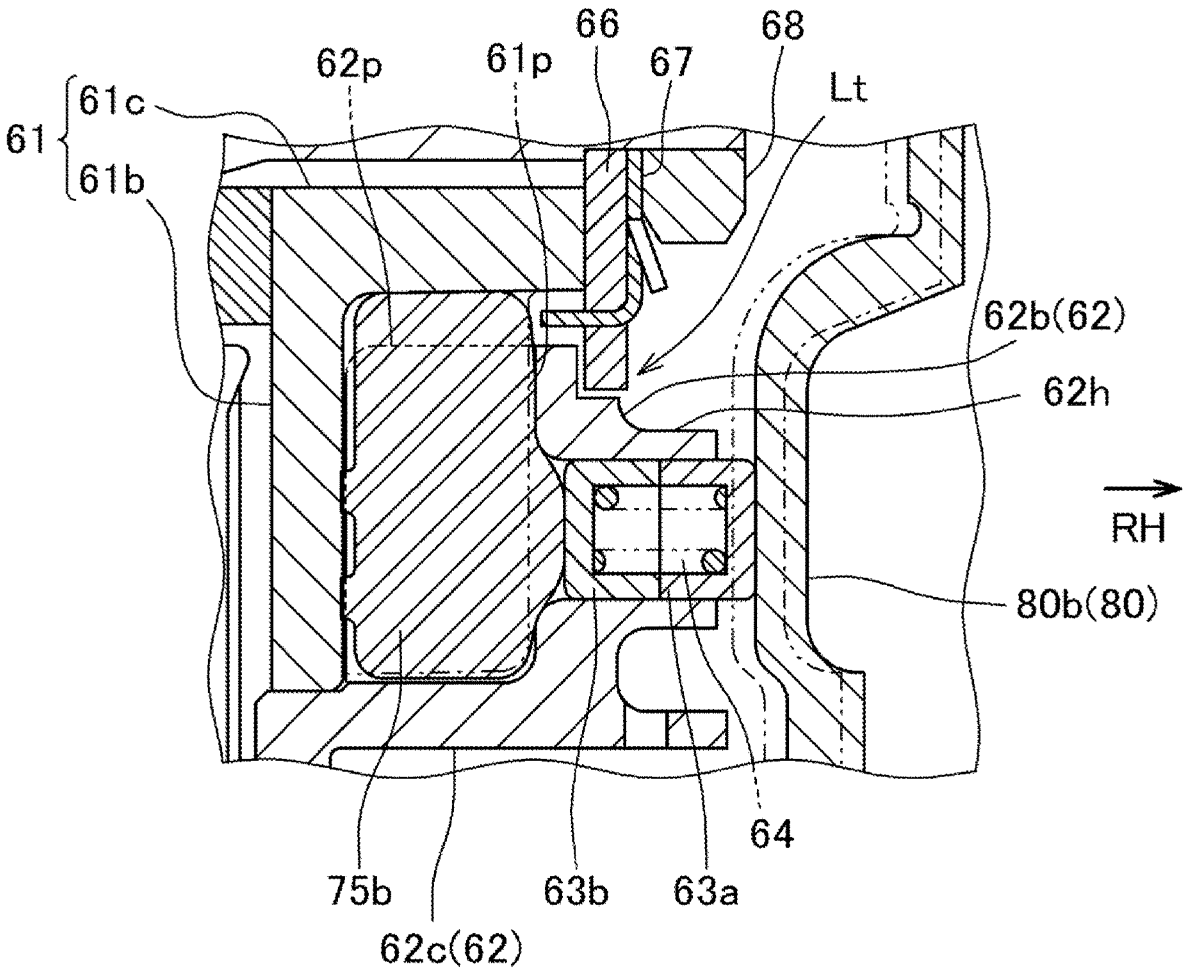
62p
61p
66
67
68
Lt
62b(62)
62h
S
RH
80b(80)
d
64
75b
63b
63a
62c(62)

FIG. 6



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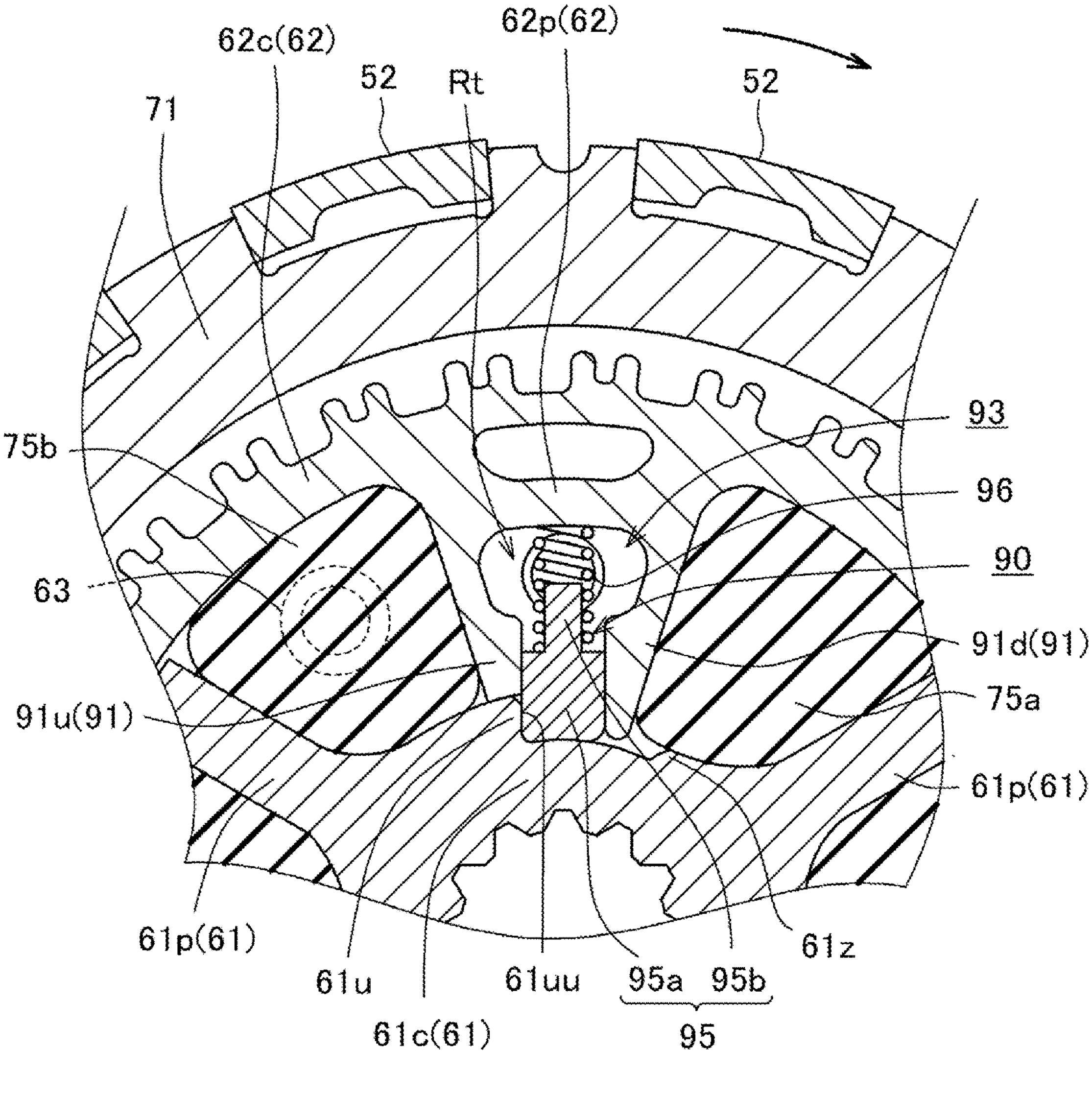
61c
61b
62p
61p
66
67
68
Lt
62b(62)
62h
RH
80b(80)
64
75b
63b
63a
62c(62)

FIG. 7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Rt
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96
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61p(61)
61p(61)
61z
61u
61uu
95a
95b
61c(61)
95

MULTIPLE-DISC FRICTION CLUTCH

BACKGROUND

1. Technical Field

The present invention relates to a multiple-disc friction clutch.

2. Description of the Background

Motorcycles receive an increased load at the rear wheel when the engine brake is activated by shifting down.

Particularly in driving in a race or the like, strong engine brake tends to be actuated when rapid deceleration is performed by shifting down quickly. In view of this, in order to reduce a load applied to a rear wheel due to engine braking, a multiple-disc friction clutch is provided with a back torque limiter mechanism for reducing clutch torque that is transmitted from the rear wheel.

An internal combustion engine may be started by a kick-start or a push-start in which a clutch is engaged after a vehicle body is pushed forward. In such a situation, the back torque limiter mechanism undesirably operates to reduce torque that is transmitted to the internal combustion engine, whereby the internal combustion engine is not smoothly started.

There is an example of a multiple-disc friction clutch that copes with this phenomenon (e.g., Patent literature 1). This multiple-disc friction clutch has a torque limiter-releasing mechanism that releases a torque limiter of a back torque limiter mechanism when a clutch output shaft is stopped or is operated in a low-rotation range of not greater than an idling speed.

CITATION LIST

Patent Literature

Patent literature 1: Japanese Patent No. 3699303

BRIEF SUMMARY

The friction clutch that is disclosed in Patent literature 1 is a multiple-disc friction clutch having a clutching part that includes a plurality of plates for transmitting and shutting off torque. The clutching part is interposed between a clutch drum (clutch housing), which is coupled to a clutch input side, and a clutch hub (clutch center), which is coupled to a clutch output side. The clutch hub is composed of a first hub body, which is directly coupled to a clutch output shaft, and a second hub body, which is supported by the first hub body in a relatively rotatable manner. A cam mechanism is structured between the first hub body and the second hub body. The friction clutch is provided with a back torque limiter mechanism that reduces clutch capacity of the clutching part (degree of torque to be transmitted) by the action of the cam mechanism. When a rotation speed of the first hub body exceeds that of the second hub body, the cam mechanism operates by relative rotation between the first hub body and the second hub body, and it axially moves the second hub body to push a pressure plate.

The friction clutch is also provided with a torque limiter-releasing mechanism that releases a torque limiter of the back torque limiter mechanism by disabling relative rotation between the first hub body and the second hub body when the clutch output shaft is stopped or is operated in a low-rotation range.

The disclosed torque limiter-releasing mechanism has a steel ball that is contained in a guide groove formed over between the first hub body and the second hub body. The steel ball can be moved against an elastic force of a coil spring by a centrifugal force. When the clutch output shaft is stopped or is operated in a low-rotation range, the steel ball is moved by the elastic force of the coil spring and locks to both of the first hub body and the second hub body to disable relative rotation therebetween.

This torque limiter-releasing mechanism releases the torque limiter of the back torque limiter mechanism to disable relative rotation between the first hub body and the second hub body when the clutch output shaft is stopped or is operated in a low-rotation range during stop or low-speed driving of a motorcycle. Thus, a push-start and a kick-start can be smoothly performed.

In the torque limiter-releasing mechanism disclosed in Patent literature 1, when the clutch output shaft is stopped or is operated in a low-rotation range, the steel ball locks to both of the first hub body and the second hub body to disable relative rotation therebetween. In more detail, the steel ball inhibits the first hub body and the second hub body from rotating relatively when back torque is transmitted from the first hub body on the clutch output shaft side to the second hub body and also when power is transmitted from the second hub body to the first hub body in a reverse manner.

When the clutch output shaft is stopped or is operated in a low-rotation range, a great acceleration may be applied in the state in which the torque limiter-releasing mechanism releases the torque limiter of the back torque limiter mechanism, that is, in the state in which the steel ball locks to both of the first hub body and the second hub body to disable relative rotation therebetween. In this case, stress concentrates on parts at which the steel ball of the torque limiter-releasing mechanism locks to the first hub body and the second hub body, and therefore, the parts are required to have high strength.

For example, in a race such as a motocross race, an accelerator or a rear brake may be operated to control the attitude by a gyro effect of a vehicle during jumping.

Specifically, at the start of jumping, since the vehicle speed is still high, the steel ball is moved in a centrifugal direction against the biasing force by a centrifugal force, and it releases locking of the first hub body and the second hub body. Then, when a rear brake is used by gripping a clutch during jumping, the clutch output shaft is stopped, and the steel ball is moved toward a rotation axis center by the biasing force. Thus, the steel ball locks to both of the first hub body and the second hub body to disable relative rotation therebetween.

Under these conditions, the clutch may be engaged, and the vehicle body may land on the ground. In this case, a very high acceleration is applied to the second hub body due to a high number of revolutions at the time of engaging the clutch, whereby stress concentrates on the parts at which the steel ball locks to the first hub body and the second hub body.

The present invention has been achieved in view of these circumstances, and an object of the present invention is to provide a multiple-disc friction clutch having a torque limiter mechanism that includes a torque limiter configured to not operate so as to prevent stress from concentrating on a part of the torque limiter mechanism, when back torque or acceleration is applied in a state in which a clutch output shaft is stopped or is operated in a low-rotation range.

In order to achieve the above object, the present invention provides a multiple-disc friction clutch including a clutch housing, clutch centers, a clutching part, a pressure plate, and a biasing member. The clutch housing is axially supported by a clutch output shaft in a rotatable manner and is configured to receive drive torque from an internal combustion engine. The clutch centers are coupled to the clutch output shaft. The clutching part includes a plurality of plate members that are configured to transmit and shut off torque between the clutch housing and the clutch centers. The pressure plate is configured to press the clutching part against the clutch center. The biasing member biases the pressure plate in a direction of pressing the clutching part. The clutch centers include a first clutch center and a second clutch center. The first clutch center is axially supported by the clutch output shaft in a relatively non-rotatable manner. The second clutch center is supported by the first clutch center in a relatively rotatable manner and holds the clutching part between the pressure plate and the second clutch center. The first clutch center and the second clutch center have a torque limiter mechanism and a torque limiter-disabling mechanism therebetween. The torque limiter mechanism is configured to transmit power between the first clutch center and the second clutch center and to reduce clutch torque by acting on the pressure plate due to relative rotation between the first clutch center and the second clutch center. The torque limiter-disabling mechanism is configured to inhibit operation of a torque limiter of the torque limiter mechanism by preventing relative rotation between the first clutch center and the second clutch center when power is transmitted from the first clutch center to the second clutch center in an acceleration direction.

In this structure, the first clutch center and the second clutch center have the torque limiter mechanism and the torque limiter-disabling mechanism therebetween. The torque limiter mechanism is configured to transmit power between the first clutch center and the second clutch center and to reduce clutch torque by acting on the pressure plate due to relative rotation between the first clutch center and the second clutch center when torque for transmitting power from the first clutch center to the second clutch center acts. The torque limiter-disabling mechanism is configured to inhibit operation of the torque limiter of the torque limiter mechanism by preventing relative rotation between the first clutch center and the second clutch center when power is transmitted from the first clutch center to the second clutch center in an acceleration direction.

When power is transmitted from the first clutch center to the second clutch center in an acceleration direction in the state in which the clutch output shaft is stopped or is operated in a low-rotation range, the torque limiter-disabling mechanism inhibits operation of the torque limiter mechanism by preventing relative rotation between the first clutch center and the second clutch center. Thus, it is possible to perform a push-start or a kick-start.

When power is transmitted from the second clutch center to the first clutch center in an acceleration direction, the torque limiter-disabling mechanism prevents the torque limiter from operating and does not inhibit relative rotation between the first clutch center and the second clutch center, irrespective of the number of rotations of the clutch output shaft. This structure enables avoiding stress from concentrating on a part of the torque limiter mechanism even when a great acceleration is applied to the second clutch center.

In one preferred embodiment of the present invention, the torque limiter-disabling mechanism may include a locking pin that is provided to the second clutch center. In this case, the locking pin is movably inserted in an insertion hole that is radially oriented, and the locking pin is biased in a rotation center direction by a pin-biasing member. When power is transmitted from the first clutch center to the second clutch center in a state in which the locking pin is protruded from the insertion hole toward a rotation axis center by a biasing force of the pin-biasing member, a locking part that is formed to the first clutch center locks to the locking pin that is protruded from the insertion hole, to prevent relative rotation between the first clutch center and the second clutch center.

In this structure, the locking pin is provided to the second clutch center. The locking pin is movably inserted in the insertion hole that is radially oriented, and the locking pin is biased in the rotation center direction by the pin-biasing member. The locking pin is protruded from the insertion hole toward the rotation axis center by the biasing force of the pin-biasing member when the clutch output shaft is stopped or is operated in a low-rotation range. On the other hand, the locking pin is moved in a centrifugal direction by a centrifugal force and retracts in the insertion hole when the clutch output shaft is operated in other rotation ranges. Thus, the structure is simple.

In the torque limiter-disabling mechanism, when the clutch output shaft is stopped or is operated in a low-rotation range, at the time power is transmitted from the first clutch center to the second clutch center in a state in which the locking pin is protruded from the insertion hole toward the rotation axis center by the biasing force of the pin-biasing member, the locking part that is formed to the first clutch center locks to the locking pin that is protruded from the insertion hole, to prevent relative rotation between the first clutch center and the second clutch center. As a result, the torque limiter of the torque limiter mechanism is prevented from operating, and a push-start or a kick-start can be performed.

In the torque limiter-disabling mechanism, when power is transmitted from the second clutch center to the first clutch center in an acceleration direction, the first clutch center does not lock to the locking pin, and relative rotation between the first clutch center and the second clutch center is not inhibited, irrespective of the number of rotations of the clutch output shaft. This structure enables avoiding stress from concentrating on a part to which the locking pin of the torque limiter-disabling mechanism locks, even when a great acceleration is applied to the second clutch center.

In one preferred embodiment of the present invention, the torque limiter mechanism may include elastic members that are interposed between the first clutch center and the second clutch center. The elastic members are configured to be compressed and deformed by relative rotation between the first clutch center and the second clutch center so as to transmit power. One of the elastic members is configured to be compressed and deformed when power is transmitted from the first clutch center to the second clutch center. The second clutch center has a side wall that faces the pressure plate and also has an opening part that penetrates axially, at a position facing the one elastic member of the side wall. Push rods are inserted and fitted in the opening part and are configured to be axially moved by compression deformation of the one elastic member so as to push the pressure plate.

In this structure, the elastic members are interposed between the first clutch center and the second clutch center. The elastic members are configured to be compressed and deformed by relative rotation between the first clutch center and the second clutch center so as to transmit power. The one elastic member is configured to be compressed and deformed only when power is transmitted from the first clutch center to the second clutch center. The second clutch center has the side wall that faces the pressure plate and also has the opening part that penetrates axially, at the position facing the one elastic member of the side wall. The push rods are inserted and fitted in the opening part and are configured to be axially moved by compression deformation of the one elastic member so as to push the pressure plate. This structure enables reducing clutch capacity at the time a great deceleration is applied.

In one preferred embodiment of the present invention, the first clutch center may be provided with a stopper part. The stopper part is configured to, when power is transmitted from the second clutch center to the first clutch center in an acceleration direction, stop relative rotation between the first clutch center and the second clutch center, which is performed via compression deformation of the elastic member between the second clutch center and the first clutch center, by making the second clutch center and the first clutch center come into contact with each other in response to the second clutch center and the first clutch center having a predetermined positional relationship as the relative rotation continues.

In this structure, when power is transmitted from the second clutch center to the first clutch center, the stopper part stops the relative rotation, which is performed via compression deformation of the elastic member between the second clutch center and the first clutch center, by making the second clutch center and the first clutch center come into contact with each other in response to the second clutch center and the first clutch center having a predetermined positional relationship as the relative rotation continues. With this structure, as the relative rotation continues, power is directly transmitted from the second clutch center to the first clutch center without using the elastic member, whereby responsiveness is improved.

In the present invention, the multiple-disc friction clutch having a torque limiter function is provided with the torque limiter-disabling mechanism that inhibits relative rotation between the first clutch center and the second clutch center when power is transmitted from the first clutch center to the second clutch center in an acceleration direction. Thus, it is possible to start an internal combustion engine by a push-start or the like.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a partially omitted side view of the whole internal combustion engine according to one embodiment of the present invention, from which a right case cover is removed.

FIG. **2** is a cross-sectional development view of the internal combustion engine as seen from an arrow direction of a line II-II in FIG. **1**.

FIG. **3** is a sectional view of a multiple-disc friction clutch of the embodiment.

FIG. **4** is a sectional view of the multiple-disc friction clutch as seen from an arrow direction of a line IV-IV in FIG. **3**.

FIG. **5** is a partial sectional view showing a torque limiter mechanism of the multiple-disc friction clutch.

FIG. **6** is a partial sectional view showing the torque limiter mechanism of the multiple-disc friction clutch in another state.

FIG. **7** is a partial sectional view showing a torque limiter-disabling mechanism of the multiple-disc friction clutch.

DETAILED DESCRIPTION

Hereinafter, one embodiment according to the present invention will be described with reference to FIGS. **1** to **7**.

FIG. **1** is a right side view of an internal combustion engine "E" of one embodiment using the present invention, from which a case cover is removed. FIG. **2** is a cross-sectional development view of the internal combustion engine "E" (cross-sectional development view as seen from an arrow direction of a line II-II in FIG. **1**).

The internal combustion engine "E" is a single-cylinder four-stroke internal combustion engine to be mounted on a motorcycle.

In the description of this specification, the front-rear and the right-left directions follow the normal standard in which an advancing direction of a motorcycle **1** of this embodiment is a front direction. In the drawings, the reference signs "FR," "RR," "LH," and "RH" denote a front direction, a rear direction, a left-hand direction, and a right-hand direction, respectively.

A crankcase **11** is directed in a right-left vehicle-width direction of the motorcycle **1** and axially supports a crankshaft **20**. The crankcase **11** forms a crank chamber **11***c*, in which the crankshaft **20** is disposed, and it also forms a transmission chamber **11***m* that houses a transmission "M," behind the crank chamber **11***c*.

The internal combustion engine "E" has an engine body above the crank chamber **11***c* of the crankcase **11**. The engine body includes a cylinder block **12**, a cylinder head **13**, and a cylinder head cover **14**. The cylinder block **12** has one cylinder **12***a*. The cylinder head **13** is fastened to the top of the cylinder block **12** by stud bolts via a gasket. The cylinder head cover **14** is joined to the top of the cylinder head **13**.

The cylinder block **12**, the cylinder head **13**, and the cylinder head cover **14** that are stacked on the crankcase **11** extend upward from the crankcase **11**, in the state of being slightly tilted forward.

In the transmission chamber **11***m* of the crankcase **11**, a main shaft **21** and a countershaft **22** of the transmission "M" are disposed while being directed in a right-left horizontal direction in parallel to the crankshaft **20**.

The crankcase **11** is divided at a plane including a cylinder axis Lc and being orthogonal to the crankshaft **20**, into two right and left parts, that is, a pair of right crankcase **11**R and left crankcase **11**L, and they are joined in a state in which respective mating surfaces are fitted together.

The right and left crankcases **11**R and **11**L in a combined state form a circular opening above the crank chamber **11***c*. A lower part of the cylinder **12***a* of the cylinder block **12** is inserted into the circular opening, and a piston **15** is slidably fitted in a cylinder bore of the cylinder **12***a* in a reciprocatable manner.

The piston **15** and the crankshaft **20** are connected by a connecting rod **16** that is axially supported at a smaller end by a piston pin **15***p* of the piston **15** and at a larger end by a crank pin **20***p* of the crankshaft **20**, whereby a crank mechanism is structured.

A left shaft body **20**L that protrudes to the left side from a left main bearing **25** of the crankshaft **20** penetrates through a chain chamber and then further penetrates through an opening of a left side wall of the left crankcase **11**L. The left shaft body **20**L is formed with a drive cam chain sprocket **20***cs* at a part corresponding to the chain chamber and is fitted with an outer rotor **26***r* of an AC generator **26** at a left end.

A left side cover **17** closes the opening of the left side wall of the left crankcase **11**L and covers the AC generator **26** while supporting an inner stator **26***s* of the AC generator **26**.

On the other hand, a right shaft body **20**R of the crankshaft **20** protrudes to the right side from a right main bearing **25** of the right crankcase **11**R. A starter driven gear **27** and a primary drive gear **28** are fitted to the right shaft body **20**R in this order from the main bearing **25** and are fixed by a flange bolt **29** via a washer **29***w*.

The transmission "M," which is disposed in the transmission chamber **11***m* behind the crank chamber **11***c*, includes a group of main gears **21***g*, a group of counter gears **22***g*, and a gear shift mechanism (not shown) of a shift drum and a shift fork operated by a gear shift control mechanism. The main gears **21***g* and the counter gears **22***g* are axially supported by the main shaft **21** and the countershaft **22**, respectively.

The main shaft **21** is positioned obliquely above and rearward of the crankshaft **20** and is axially supported by the right and left crankcases **11**R and **11**L via bearings **30** and **30** in a rotatable manner. The main shaft **21** is provided with a multiple-disc friction clutch "C" at a part protruding to the right side from the right bearing **30**.

The countershaft **22** is positioned obliquely above and rearward of the crankshaft **20** and is axially supported by the right and left crankcases **11**R and **11**L via bearings **23** and **23** in a rotatable manner. The countershaft **22** penetrates to the left side of the left bearing **23** and protrudes to the outside to function as an output shaft, and it is fitted with a drive chain sprocket **24** at a protruding left end.

A drive chain **24***c* is wound around the drive chain sprocket **24** and is also wound around a driven chain sprocket (not shown) on a rear wheel side, whereby power is transmitted to the rear wheel.

A right case cover **18** covers a right side surface of the right crankcase **11**R and opens at the multiple-disc friction clutch "C." A clutch cover **19** covers a right side of the multiple-disc friction clutch "C" to close this opening.

The main shaft **21** is formed with a shaft hole **21***c* at the shaft center, and a clutch operation rod **31** is inserted into the shaft hole **21***c*.

The clutch operation rod **31** is slidably supported by right and left reduced-diameter parts of the shaft hole **21***c* and is moved to the right side in the axial direction by operation of a clutch cam **32** that acts on a left end.

In addition, the shaft hole **21***c* is supplied with oil that is ejected from a scavenge pump.

With reference to FIGS. **2** and **3**, a sleeve member **40** is fitted onto the main shaft **21** in contact with an inner race of the right bearing **30** from a right side, and it axially supports a primary driven gear **42** via a needle bearing **41** in a rotatable manner.

The primary driven gear **42** meshes with the primary drive gear **28**, which is fitted to the crankshaft **20**.

A clutch housing **50** of the multiple-disc friction clutch "C" has a housing side wall **51** that is axially supported by the main shaft **21** in a rotatable manner, and a plurality of engaging protrusion pieces **52** protrude to the right side in the axial direction from an outer circumferential edge of the housing side wall **51**.

The plurality of engaging protrusion pieces **52** are arranged at intervals in the circumferential direction.

This housing side wall **51** of the clutch housing **50** is axially supported by a center cylindrical boss **42***c* of the primary driven gear **42** while being in contact with a disc part of the primary driven gear **42**.

A damper rubber **44** is press-fitted and held by an outer circumference of a holding boss **51***b* that protrudes on an outer surface of the housing side wall **51**. The damper rubber **44** is inserted into a circular hole **42***h* that is formed in the disc part of the primary driven gear **42**, so as to absorb rapid variations in torque between the primary driven gear **42** and the clutch housing **50**.

Thus, rotation of the crankshaft **20** is transmitted to rotation of the clutch housing **50** of the multiple-disc friction clutch "C" via meshing between the primary drive gear **28** and the primary driven gear **42** and via the damper rubber **44**.

The multiple-disc friction clutch "C" includes a clutch center that has a first clutch center **61** and a second clutch center **62**. The first clutch center **61** is spline-fitted to a right end part of the main shaft **21**, which is a clutch output shaft. The second clutch center **62** is supported by the first clutch center **61** in a relatively rotatable manner.

With reference to FIGS. **3** and **4**, the first clutch center **61** has a clutch-center side wall **61***b*, a clutch-center cylindrical boss **61***c*, and three pressing partition walls **61***p*. The clutch-center side wall **61***b* has a hollow disc shape and faces an inner surface of the housing side wall **51**. The clutch-center cylindrical boss **61***c* cylindrically extends from an inner circumferential edge of the clutch-center side wall **61***b* to a side (right side) opposite to the housing side wall **51**. The pressing partition walls **61***p* extend to the right side from the clutch-center side wall **61***b* as well as extend radially outward from the clutch-center cylindrical boss **61***c*.

The three pressing partition walls **61***p* extend at equal intervals in the circumferential direction and partition a right space of the clutch-center side wall **61***b* into three fan-shaped spaces (refer to FIG. **4**).

Spline grooves are formed in an inner circumferential surface of the clutch-center cylindrical boss **61***c*.

In addition, a support protrusion **61***s* radially protrudes at each of three positions between the three pressing partition walls **61***p*, at a right end of the clutch-center cylindrical boss **61***c*.

The three support protrusions **61***s* have the same protrusion length and have tips at equal distances from a center axis.

This first clutch center **61** is spline-fitted and is axially supported by the right end part of the main shaft **21** in a relatively non-rotatable manner while being held between washers **65** and **66**.

The first clutch center **61** is fitted to the main shaft **21** by screwing and fastening a nut **68** to a right end of the main shaft **21** via a lock washer **67**.

On the other hand, the second clutch center **62** has a clutch-center cylindrical part **62***c* with an inner diameter slightly greater than an outer diameter of the clutch-center side wall **61***b* of the first clutch center **61**. A right end part of the clutch-center cylindrical part **62***c* radially inwardly extends to form a clutch-center inner side wall **62***b* having a hollow disc shape, at a position facing the clutch-center side wall **61***b* of the first clutch center **61**. A left end part of the clutch-center cylindrical part **62***c* radially outwardly extends to form a clutch-center outer side wall **62***a* having a hollow disc shape, at an outer circumference of the clutch-center side wall **61***b* of the first clutch center **61**.

The plurality of engaging protrusion pieces **52**, which are arranged in the circumferential direction of the clutch housing **50**, are positioned on a concentric circle separated outward from the clutch-center cylindrical part **62**c of the second clutch center **62** by a predetermined distance.

That is, an annular space is formed between the clutch-center cylindrical part **62**c and the plurality of engaging protrusion pieces **52** that concentrically overlap each other, and the clutch-center outer side wall **62**a is positioned on a left side in this annular space.

A plurality of groove lines **62**cv are formed in the circumferential direction so as to be directed in the axial direction, in an outer circumferential surface of the clutch-center cylindrical part **62**c of the second clutch center **62**.

A plurality of friction plates **71** and a plurality of clutch plates **72** are alternately inserted and fitted in the annular space between the clutch-center cylindrical part **62**c and the plurality of engaging protrusion pieces **52** that concentrically overlap each other, whereby they constitute a clutching part **70**.

The friction plate **71** has a plurality of outer circumferential protrusions **71**a that are formed on an outer circumferential edge. The outer circumferential protrusions **71**a are fitted into spaces between the plurality of engaging protrusion pieces **52** of the clutch housing **50**, in an axially slidable manner (refer to FIGS. **3** and **4**). Thus, the friction plate **71** rotates together with the clutch housing **50**.

On the other hand, the clutch plate **72** has a plurality of inner circumferential protrusions **72**a that are formed on an inner circumferential edge. The inner circumferential protrusions **72**a slidably engage with the plurality of groove lines **62**cv, which are formed in the circumferential direction so as to be directed in the axial direction in the outer circumferential surface of the clutch-center cylindrical part **62**c of the second clutch center **62** (refer to FIG. **3**). Thus, the clutch plate **72** rotates together with the second clutch center **62**.

The clutch-center inner side wall **62**b of the second clutch center **62** faces the clutch-center side wall **61**b of the first clutch center **61** and has three pressing partition parts **62**p that extend to the left side from the clutch-center inner side wall **62**b as well as extend radially inward from the clutch-center cylindrical part **62**c.

The three pressing partition parts **62**p extend at equal intervals in the circumferential direction and partition a left space of the clutch-center inner side wall **62**b into three fan-shaped spaces (refer to FIG. **4**).

As shown in FIG. **4**, there is an annular space between the clutch-center side wall **61**b of the first clutch center **61** and the clutch-center inner side wall **62**b of the second clutch center **62**, which face each other, and between the clutch-center cylindrical boss **61**c and the clutch-center cylindrical part **62**c, which concentrically overlap each other. This annular space is approximately equally partitioned into six spaces by the three pressing partition walls **61**p of the first clutch center **61** and the three pressing partition parts **62**p of the second clutch center **62**, which are alternately disposed in the circumferential direction, and rubber dampers **75**a and **75**b are interposed in these six spaces.

Thus, as shown in FIG. **4**, each of the rubber dampers **75**a and **75**b is held between the pressing partition wall **61**p of the first clutch center **61** and the pressing partition part **62**p of the second clutch center **62** and has a fan shape, in an axial view.

With reference to FIG. **4**, the rotation direction of the multiple-disc friction clutch "C" is as shown by the arrows.

The rubber dampers **75**a and **75**b are alternately disposed in the circumferential direction. Among them, in terms of the rotation direction shown by the arrows, each of three rubber dampers **75**a is held between the pressing partition part **62**p of the second clutch center **62** on the upstream side and the pressing partition wall **61**p of the first clutch center **61** on the downstream side, whereas each of three rubber dampers **75**b is held between the pressing partition wall **61**p of the first clutch center **61** on the upstream side and the pressing partition part **62**p of the second clutch center **62** on the downstream side.

As shown in FIG. **3**, the second clutch center **62** is supported in a relatively rotatable manner in a state in which inner circumferential surfaces of the three pressing partition parts **62**p are in sliding contact with outer circumferential surfaces of the three support protrusions **61**s of the first clutch center **61**.

In addition, with reference to FIG. **3**, the inner circumferential surface of the pressing partition part **62**p, which is in sliding contact with the outer circumferential surface of the support protrusion **61**s of the first clutch center **61**, is positioned on the radially inside and on the left side of an outer circumferential surface of the washer **66** having a larger diameter than the inner circumferential surface of the pressing partition part **62**p, whereby the second clutch center **62** is limited in movement to the right side. Moreover, a left end surface of the pressing partition part **62**p is in contact with the clutch-center side wall **61**b of the first clutch center **61**, whereby the second clutch center **62** is also limited in movement to the left side.

A cylindrical bolt attaching boss **62**bb having a bolt hole is formed at each of three parts having respective pressing partition parts **62**p of the clutch-center inner side wall **62**b of the second clutch center **62**, in such a manner as to protrude to the right side. Each of the three pressing partition parts **62**p is provided with a torque limiter-disabling mechanism Rt (described later).

Moreover, the clutch-center inner side wall **62**b of the second clutch center **62** is formed with a cylindrical opening part **62**h that penetrates in the axial direction, at each of parts facing the three rubber dampers **75**b, which are each held between the pressing partition wall **61**p of the first clutch center **61** on the upstream side and the pressing partition part **62**p of the second clutch center **62** on the downstream side, among the six interposed rubber dampers **75**a and **75**b.

A first push rod **63**a for pushing a pressure plate **80** and a second push rod **63**b for being in pressure contact with the rubber damper **75**b are axially movably inserted and fitted in the cylindrical opening part **62**h, which is formed to the clutch-center inner side wall **62**b of the second clutch center **62**.

The first push rod **63**a and the second push rod **63**b each have a bottomed cylindrical shape, and they are inserted and fitted in the cylindrical opening part **62**h while openings thereof face each other. A coil spring **64** is compressed and interposed between the first push rod **63**a and the second push rod **63**b.

The first push rod **63**a and the second push rod **63**b are inserted and fitted in each of the three cylindrical opening parts **62**h, which are at equal intervals in the circumferential direction of the clutch-center inner side wall **62**b of the second clutch center **62**.

The clutch-center outer side wall **62**a of this second clutch center **62** faces the clutching part **70**, in which the plurality of friction plates **71** and the plurality of clutch plates **72** are alternately inserted and fitted, and a pressure plate **80** and this clutch-center outer side wall **62**a hold the clutching part **70** therebetween while the pressure plate **80** presses the clutching part **70**.

The pressure plate **80** has a disc shape, and an outer circumferential side wall **80**a presses the plurality of alternately stacked friction plates **71** and clutch plates **72**, against the clutch-center outer side wall **62***a*, from a right side.

The center of the pressure plate **80** is expanded to the right side to form a center boss **80***c*, and the pressure plate **80** continues to the outer circumferential side wall **80***a* via an inner circumferential side wall **80***b* that radially extends from the center boss **80***c*.

With reference to FIG. **3**, a cap member **33** covers an end (right end) of the clutch operation rod **31** and protrudes from a shaft end of the main shaft **21** to form a flange **33***f*. This flange **33***f* faces an annular side plate **35** that is abutted on the center boss **80***c* of the pressure plate **80**, whereby the flange **33***f* and the annular side plate **35** hold a thrust bearing **34** therebetween.

The inner circumferential side wall **80***b* of the pressure plate **80** faces the clutch-center inner side wall **62***b* of the second clutch center **62** and is formed with a circular hole **80***bh* for passing each of the three bolt attaching bosses **62***bb*, which are formed so as to protrude to the right side from the clutch-center inner side wall **62***b*.

A set plate **85** is abutted to a right end surface of each of the three bolt attaching bosses **62***bb* that penetrate to protrude from the inner circumferential side wall **80***b* of the pressure plate **80**, and a bolt **86** is tightened to each of the three bolt attaching bosses **62***bb*.

The set plate **85** is provided with an opening from which the center boss **80***c* of the pressure plate **80** protrudes to the right side.

In addition, the number of the bolts can be changed as appropriate and may be six or another number instead of three.

A disc spring **84** is compressed and interposed between a spring receiving part **85***r* that is bent at an outer circumferential edge of the set plate **85**, and a back surface (right side surface) of the outer circumferential side wall **80***a* of the pressure plate **80**.

Thus, the pressure plate **80** is biased axially inward (to the left side) by the spring force of the disc spring **84**, and the outer circumferential side wall **80***a* of the pressure plate **80** and the clutch-center outer side wall **62***a* press and hold the alternately stacked friction plates **71** and clutch plates **72** therebetween. Under these conditions, rotation of the clutch housing **50** is transmitted to the second clutch center **62** via the friction plates **71** and the clutch plates **72** that are in pressure contact with each other, that is, the clutch is engaged.

In response to the clutch operation rod **31** moved to the right side by the action of the clutch cam **32**, the pressure plate **80** is pushed to the right side via the cap member **33** and the thrust bearing **34** and is moved to the right side against the biasing force of the disc spring **84**. Then, the friction plates **71** and the clutch plates **72** in the state of being pressed and held between the pressure plate **80** and the clutch-center outer side wall **62***a* are released. Under these conditions, rotation of the clutch housing **50** is not transmitted to the second clutch center **62**, that is, the clutch is disengaged.

The clutch may be a hydraulic pressure type.

With reference to FIG. **4**, when rotation of the clutch housing **50** is transmitted to the second clutch center **62** in the state in which the clutch is engaged, rotation of the second clutch center **62** makes the pressing partition part **62***p* of the second clutch center **62** on the upstream side approach the pressing partition wall **61***p* of the first clutch center **61** on the downstream side to press and hold the rubber damper **75***a*. Thus, rotation of the second clutch center **62** is transmitted to rotation of the first clutch center **61** via the rubber damper **75***a* that is held in a pressed state, whereby power is transmitted.

On the other hand, in the state in which the clutch is engaged, when rotation of the main shaft **21** is transmitted to the first clutch center **61**, that is, when back torque acts, rotation of the first clutch center **61** makes the pressing partition wall **61***p* of the first clutch center **61** on the upstream side approach the second clutch center **62** on the downstream side to press and hold the rubber damper **75***b*. Thus, rotation of the first clutch center **61** is transmitted to rotation of the second clutch center **62** via the rubber damper **75***b* that is held in a pressed state, whereby power is transmitted.

In this manner, power is transmitted between the first clutch center **61** and the second clutch center **62** via the rubber dampers **75***a* and **75***b*. Nevertheless, elastic deformation of the rubber dampers **75***a* and **75***b* causes a very little delay in response, which hardly affects operability. The responsiveness is able to be adjusted by a filling rate of the dampers.

In addition, vibrations due to relative rotation between the first clutch center **61** and the second clutch center **62** are reduced by damping forces of the rubber dampers **75***a* and **75***b*.

The rubber damper **75***b* may not be held in a pressed state, and it may not be compressed and deformed. In this state, as shown in FIG. **5**, in accordance with biasing of the coil spring **64**, the first push rod **63***a* contacts and pushes the pressure plate **80**, whereas the second push rod **63***b* is in pressure contact with the rubber damper **75***b*. Thus, the first push rod **63***a* and the second push rod **63***b* are spaced in a contactable manner by the coil spring **64** that is interposed therebetween in a compressed state, and a gap "S" with a distance "d" is formed therebetween.

Upon being held in a pressed state, the rubber damper **75***b* is compressed and deformed to expand to the cylindrical opening part **62***h*, as shown in FIG. **6**. The rubber damper **75***b* then pushes the second push rod **63***b* against the biasing force of the coil spring **64** to eliminate the gap "S" and brings the second push rod **63***b* into contact with the first push rod **63***a*.

In response to action of a great back torque, the second push rod **63***b* comes into contact with the first push rod **63***a* and then further moves to the right side together with the first push rod **63***a* and the pressure plate **80**.

Movement to the right side of the pressure plate **80** loosens the friction plates **71** and the clutch plates **72** in the state of being pressed and held between the pressure plate **80** and the clutch-center outer side wall **62***a*, resulting in a reduction in clutch capacity.

With this structure, at the time a great torque acts due to engine braking or the like, it is possible to reduce clutch capacity and prevent rapid braking from acting on a tire (torque limiter mechanism).

With reference to FIG. **4**, the first and second push rods **63***a* and **63***b* are inserted and fitted in each of the three cylindrical opening parts **62***h*, which are provided at equal intervals in the circumferential direction of the clutch-center inner side wall **62***b* of the second clutch center **62**. In this structure, in response to protrusion of the three sets of the first and second push rods **63***a* and **63***b*, which are disposed at equal intervals in the circumferential direction (shown by the imaginary lines in FIG. **4**), forces of the first and second push rods **63***a* and **63***b* for pushing back the pressure plate **80** against the biasing force of the disc spring **84** are uniformly applied to the pressure plate **80** and thereby smoothly moves the pressure plate **80**.

As shown in FIG. **5**, due to biasing of the coil spring **64**, the first push rod **63***a* contacts and pushes the pressure plate **80**, whereas the second push rod **63***b* is in pressure contact with the rubber damper **75***b*. In this structure, it is possible to adjust operation responsiveness of the pressure plate **80** relative to compression deformation of the rubber damper **75***b*.

In this manner, the first clutch center **61** and the second clutch center **62** transmit power therebetween via the rubber dampers **75***a* and **75***b* and are provided with a torque limiter mechanism Lt that operates as follows. When a great back torque is applied, the rubber damper **75***b* is held in a pressed state, and it is thereby compressed and deformed. Then, the rubber damper **75***b* moves the first push rod **63***a* together with the second push rod **63***b* to push the pressure plate **80** to the right side, resulting in a reduction in clutch capacity.

As shown in FIG. **5**, the gap "S" is provided between the first push rod **63***a* and the second push rod **63***b*. The gap "S" between the first push rod **63***a* and the second push rod **63***b* absorbs movement thereof, which is based on compression deformation of the rubber damper **75***b*. With this structure, even when rapid relative rotation between the first clutch center **61** and the second clutch center **62** is repeated while variations in torque are great during deceleration, clutch capacity can be reduced without causing vibratory movement of the pressure plate **80**.

As a result, it is possible to reduce vibrations of a clutch lever due to vibrations of the pressure plate, when the torque limiter operates.

The torque limiter mechanism Lt of the multiple-disc friction clutch of the above-described embodiment can be easily adjusted in clutch capacity by exchanging the rubber damper for an elastic member being different in modulus of elasticity, dimensions, and shape, or by exchanging the push rod for one having a different length.

As the force for pushing the pressure plate **80** to the right side of the first push rod **63***a* is decreased, the biasing force for biasing the pressure plate **80** to the left side of the disc spring **84** exceeds it, whereby clutch capacity is quickly returned to the original level.

The multiple-disc friction clutch "C" is provided with a torque limiter-disabling mechanism Rt for the torque limiter mechanism Lt. The torque limiter-disabling mechanism Rt disables the torque limiter of the torque limiter mechanism Lt when the main shaft **21** is stopped or is operated in a low-rotation range of not greater than an idling speed.

With reference to FIGS. **3**, **4**, and **7**, the torque limiter-disabling mechanism Rt is provided so as to radially face both of the pressing partition part **62***p* of the second clutch center **62** and the clutch-center cylindrical boss **61***c* between two pressing partition walls **61***p* of the first clutch center **61**.

With reference to FIG. **7**, an insertion hole **90** is formed by radially perforating the center of the pressing partition part **62***p*, which extends radially inward from the clutch-center cylindrical part **62***c* of the second clutch center **62**.

The insertion hole **90** penetrates from an inner circumferential surface on a radially inside to a radially inner hollow **93** of the pressing partition part **62***p*.

A locking pin **95** is radially movably inserted and fitted in the insertion hole **90** of the pressing partition part **62***p*.

The locking pin **95** has such a shape that a reduced-diameter part **95***b* protrudes from a columnar pin body **95***a*, and the pin body **95***a* is inserted and fitted in the insertion hole **90** in the state in which the reduced-diameter part **95***b* faces the hollow **93**.

Thus, the pin body **95***a* of the locking pin **95** is able to project from and retract in the insertion hole **90**.

A coil spring **96** that is supported by the reduced-diameter part **95***b* is interposed between the pin body **95***a* of the locking pin **95** and a wall surface on an outer circumferential side of the hollow **93**. The coil spring **96** biases the locking pin **95** to the radially inside.

A circumferential wall **91** defines the insertion hole **90** of the pressing partition part **62***p* in the inside thereof and has an upstream circumferential wall part **91***u* on an upstream side and a downstream circumferential wall part **91***d* on a downstream side in the rotation direction of the second clutch center **62**. The upstream circumferential wall part **91***u* and the downstream circumferential wall part **91***d* differ from each other in the radial length, and specifically, the downstream circumferential wall part **91***d* is longer than the upstream circumferential wall part **91***u*.

On the other hand, the clutch-center cylindrical boss **61***c* of the first clutch center **61**, which the circumferential wall **91** of the pressing partition part **62***p* faces on a radially inside, is formed with a locking part **61***u* that protrudes radially outward. FIG. **7** shows a relative positional relationship between the first clutch center **61** and the second clutch center **62** when the main shaft **21**, which is a clutch output shaft, is stopped. Under these conditions, the locking part **61***u* protrudes to face and approach the upstream circumferential wall part **91***u*, which is one constituting the circumferential wall **91** and being shorter than the downstream circumferential wall part **91***d*.

In this manner, the torque limiter-disabling mechanism Rt is structured so as to radially face both of the pressing partition part **62***p* of the second clutch center **62** and the clutch-center cylindrical boss **61***c* of the first clutch center **61**. The torque limiter-disabling mechanisms Rt are provided at three positions in the circumferential direction.

As shown in FIG. **7**, the locking part **61***u*, which protrudes toward the upstream circumferential wall part **91***u*, has a smooth sloped surface on an upstream side, but it is cut out on a downstream side so as to have a downstream circumferential surface **61***uu* that has the same shape as an inner circumferential surface of the upstream circumferential wall part **91***u*.

The locking pin **95**, which is inserted and fitted in the insertion hole **90** formed in the pressing partition part **62***p* of the second clutch center **62**, is biased by the coil spring **96** and protrudes radially inward. In this state, the pin body **95***a* is in contact with an outer circumferential surface of the clutch-center cylindrical boss **61***c* of the first clutch center **61**. A downstream outer circumferential surface of the pin body **95***a* is in contact with only an inner circumferential surface of the downstream circumferential wall part **91***d* of the insertion hole **90** of the second clutch center **62**. On the other hand, an upstream outer circumferential surface of the pin body **95***a* is in contact with both of an inner circumferential surface of the upstream circumferential wall part **91***u* of the insertion hole **90** of the second clutch center **62** and the downstream circumferential surface **61***uu* of the locking part **61***u* of the first clutch center **61**, at the same time.

In this manner, when the main shaft (clutch output shaft) **21** is stopped, the first clutch center **61** and the second clutch center **62** have a relative positional relationship shown in FIG. **7**, in the state in which the locking pin **95** is biased by the coil spring **96** and protrudes from the insertion hole **90** of the second clutch center **62** to the radially inside (toward the rotation axis center).

Operation of this structure when the main shaft (clutch output shaft) **21** is stopped, is described below with reference to FIG. **7**. At the time power is transmitted from the second clutch center **62** to the first clutch center **61**, the first clutch center **61** does not lock to the locking pin **95** that protrudes. Conversely, at the time power is transmitted from the first clutch center **61** to the second clutch center **62**, the locking part **61***u* of the first clutch center **61** locks to the locking pin **95** that protrudes from the insertion hole **90** and inhibits relative rotation between the first clutch center **61** and the second clutch center **62**.

Similarly, when the main shaft (clutch output shaft) **21** rotates at low speed of not greater than an idling speed, although the locking pin **95** moves to a centrifugal side against the biasing force of the coil spring **96** due to a centrifugal force, the movement amount is small, and the locking part **61***u*, which is formed to the first clutch center **61**, still locks to the locking pin **95**. Thus, at the time power is transmitted from the first clutch center **61** to the second clutch center **62**, relative rotation therebetween is inhibited.

In more detail, when the main shaft (clutch output shaft) **21** is stopped or is operated in a low-rotation range, at the time power is transmitted from the first clutch center **61** on the clutch output shaft side to the second clutch center **62** (e.g., at the time of performing a push-start), the locking part **61***u* of the first clutch center **61** locks to the locking pin **95** that protrudes from the insertion hole **90** of the second clutch center **62**. Thus, relative rotation between the first clutch center **61** and the second clutch center **62** is inhibited. As a result, at the time power is transmitted from the first clutch center **61** to the second clutch center **62**, reduction in clutch capacity due to relative rotation therebetween in the torque limiter mechanism Lt is prevented, whereby the torque limiter of the torque limiter mechanism Lt does not operate.

When the main shaft (clutch output shaft) **21** is stopped or is operated in a low-rotation range, the torque limiter-disabling mechanism Rt prevents the torque limiter of the torque limiter mechanism Lt from operating and inhibits relative rotation between the first clutch center **61** and the second clutch center **62**, resulting in avoiding a reduction in clutch capacity. This enables smoothly starting an internal combustion engine by a kick-start or a push-start.

In the torque limiter-disabling mechanism Rt, when the main shaft (clutch output shaft) **21** is stopped or is operated in a low-rotation range, at the time power is transmitted from the second clutch center **62** to the first clutch center **61**, the first clutch center **61** does not lock to the locking pin **95** that protrudes, and relative rotation between the first clutch center **61** and the second clutch center **62** is not inhibited. Under these conditions, even when a great acceleration is applied to the second clutch center **62** while the main shaft (clutch output shaft) **21** is stopped or is operated in a low-rotation range, the first clutch center **61** does not lock to the locking pin **95** that protrudes, whereby it is possible to prevent stress from concentrating on a part of the torque limiter-disabling mechanism Rt.

Moreover, when the main shaft (clutch output shaft) **21** is stopped or is operated in a low-rotation range, the great acceleration acting on the second clutch center **62** is able to be absorbed by compression deformation of the rubber damper **75***a*, and stress can be dispersed. Thus, constituent members are not required to have high strength, and a complicated structure for dispersing stress is not necessary, whereby it is possible to manufacture a multiple-disc friction clutch having a simple structure and being light in weight, at low cost.

In contrast, when the main shaft (clutch output shaft) **21** comes to rotate in a rotation range exceeding an idling speed, which is higher than the low-rotation range, the locking pin **95** greatly moves to the centrifugal side against the biasing force of the coil spring **96** due to a centrifugal force, and it retracts in the insertion hole **90** of the pressing partition part **62***p* of the second clutch center **62**. In this state, relative rotation can be performed in accordance with power from either one of the first clutch center **61** and the second clutch center **62**, and power is transmitted via the rubber dampers **75***a* and **75***b*.

When the main shaft (clutch output shaft) **21** is operated in a rotation range higher than a low-rotation range, the locking pin **95** retracts in the insertion hole **90** of the second clutch center **62** due to a centrifugal force. Under these conditions, the torque limiter-disabling mechanism Rt prevents the torque limiter from operating, and therefore, the torque limiter mechanism Lt operates to reduce clutch capacity when an excessive torque is applied to the first clutch center **61**.

With reference to FIG. **7**, which shows the relative positional relationship between the first clutch center **61** and the second clutch center **62** during stop of the main shaft (clutch output shaft) **21**, the multiple-disc friction clutch has a stopper part **61***z*. The stopper part **61***z* is formed by protruding the outer circumferential surface of the clutch-center cylindrical boss **61***c*, in the vicinity of an upstream root of the pressing partition wall **61***p* of the first clutch center **61** on the downstream side of the pressing partition part **62***p* of the second clutch center **62**.

The distance from the center of the main shaft **21** of the stopper part **61***z* of the first clutch center **61** is greater than that of the downstream circumferential wall part **91***d* of the circumferential wall **91**, which defines the insertion hole **90** in the inside of the pressing partition part **62***p* of the second clutch center **62**.

This structure operates as follows when a great acceleration is applied to the second clutch center **62** in the state shown in FIG. **7**, which shows the relative positional relationship between the first clutch center **61** and the second clutch center **62** during stop of the main shaft (clutch output shaft) **21**. The pressing partition part **62***p* of the second clutch center **62** approaches the pressing partition wall **61***p* of the first clutch center **61** to compress and deform the rubber damper **75***a*. As relative rotation continues, the downstream circumferential wall part **91***d* of the pressing partition part **62***p* of the second clutch center **62** comes into contact with the stopper part **61***z* of the first clutch center **61** to stop the relative rotation. Under these conditions, power can be directly transmitted from the second clutch center **62** to the first clutch center **61** without using the rubber damper **75***a*. With this structure, it is possible to set responsiveness variously by changing the type of the rubber damper.

Although the multiple-disc friction clutch of the one embodiment of the present invention is described above, embodiments of the present invention are not limited to the foregoing embodiment and also include those implemented in various forms within the gist of the present invention.

The present invention can also be used in a torque limiter mechanism as follows. Specifically, for example, a cam mechanism is structured between the first clutch center and the second clutch center. When back torque is applied, the cam mechanism operates by relative rotation between the first clutch center and the second clutch center, and it axially moves the second clutch center to push the pressure plate, resulting in disengagement of frictional connection of the clutching part.

REFERENCE SIGNS LIST

E . . . internal combustion engine
M . . . transmission
C . . . multiple-disc friction clutch
Lt . . . torque limiter mechanism
Rt . . . torque limiter-disabling mechanism
1 . . . motorcycle
20 . . . crankshaft
21 . . . main shaft (clutch output shaft)
22 . . . countershaft
28 . . . primary drive gear
30 . . . bearing
31 . . . clutch operation rod
32 . . . clutch cam
33 . . . cap member
33*f* . . . flange
34 . . . thrust bearing
35 . . . annular side plate
40 . . . sleeve member
41 . . . needle bearing
42 . . . primary driven gear
50 . . . clutch housing
51 . . . housing side wall
52 . . . engaging protrusion piece
61 . . . first clutch center
61*b* . . . clutch-center side wall
61*c* . . . clutch-center cylindrical boss
61*p* . . . pressing partition wall
61*s* . . . support protrusion
61*u* . . . locking part
61*z* . . . stopper part
62 . . . second clutch center
62*a* . . . clutch-center outer side wall
62*b* . . . clutch-center inner side wall
62*c* . . . clutch-center cylindrical part
62*p* . . . pressing partition part
62*bb* . . . bolt attaching boss
62*h* . . . cylindrical opening part
63*a* . . . first push rod
63*b* . . . second push rod
64 . . . coil spring
65 . . . washer
66 . . . washer
67 . . . lock washer
68 . . . nut
70 . . . clutching part
71 . . . friction plate (plate member)
72 . . . clutch plate (plate member)
75*a* . . . rubber damper
75*b* . . . rubber damper
80 . . . pressure plate
80*a* . . . outer circumferential side wall
80*b* . . . inner circumferential side wall
80*bh* . . . circular hole
80*c* . . . center boss
84 . . . disc spring
85 . . . set plate
86 . . . bolt
90 . . . insertion hole
91 . . . circumferential wall
91*u* . . . upstream circumferential wall part
91*d* . . . downstream circumferential wall part
93 . . . hollow
95 . . . locking pin
96 . . . coil spring

What is claimed is:

1. A multiple-disc friction clutch comprising:

a clutch housing being axially supported by a clutch output shaft in a rotatable manner and being configured to receive drive torque from an internal combustion engine;

clutch centers being coupled to the clutch output shaft;

a clutching part including a plurality of plate members that are configured to transmit and shut off torque between the clutch housing and the clutch centers;

a pressure plate being configured to press the clutching part against one of the clutch centers; and

a biasing member biasing the pressure plate in a direction of pressing the clutching part, the clutch centers including a first clutch center and a second clutch center, the first clutch center being axially supported by the clutch output shaft in a relatively non-rotatable manner, the second clutch center being supported by the first clutch center in a relatively rotatable manner and holding the clutching part between the pressure plate and the second clutch center,

the first clutch center and the second clutch center having a torque limiter mechanism and a torque limiter-disabling mechanism therebetween,

the torque limiter mechanism includes elastic members that are interposed between the first clutch center and the second clutch center, the elastic members are configured to be compressed and deformed by relative rotation between the first clutch center and the second clutch center so as to transmit power between the first clutch center and the second clutch center and to reduce clutch torque by acting on the pressure plate due to relative rotation between the first clutch center and the second clutch center,

the torque limiter-disabling mechanism includes a locking pin that is provided to the second clutch center and being configured to inhibit operation of a torque limiter of the torque limiter mechanism by preventing relative rotation between the first clutch center and the second clutch center when power is transmitted from the first clutch center to the second clutch center in an acceleration direction.

2. The multiple-disc friction clutch according to claim **1**, wherein

the locking pin is movably inserted in an insertion hole that is radially oriented, the locking pin is biased in a rotation center direction by a pin-biasing member, and

when power is transmitted from the first clutch center to the second clutch center in a state in which the locking pin is protruded from the insertion hole toward a rotation axis center by a biasing force of the pin-biasing member, a locking part that is formed to the first clutch center locks to the locking pin that is protruded from the insertion hole, to prevent relative rotation between the first clutch center and the second clutch center.

3. The multiple-disc friction clutch according to claim **2**, wherein

the elastic members are configured to be compressed and deformed when power is transmitted from the first clutch center to the second clutch center,

the second clutch center has a side wall that faces the pressure plate and also has an opening part that penetrates axially, at a position facing the elastic members of the side wall, and

push rods are inserted and fitted in the opening part and are configured to be axially moved by compression deformation of the elastic members so as to push the pressure plate.

4. The multiple-disc friction clutch according to claim 1, wherein

the elastic member is members are configured to be compressed and deformed when power is transmitted from the first clutch center to the second clutch center,

the second clutch center has a side wall that faces the pressure plate and also has an opening part that penetrates axially, at a position facing the elastic members of the side wall, and

push rods are inserted and fitted in the opening part and are configured to be axially moved by compression deformation of the elastic members so as to push the pressure plate.

5. The multiple-disc friction clutch according to claim 4, wherein the first clutch center is provided with a stopper part, the stopper part is configured to, when power is transmitted from the second clutch center to the first clutch center, stop relative rotation between the first clutch center and the second clutch center, which is performed via compression deformation of the elastic members between the second clutch center and the first clutch center, by making the second clutch center and the first clutch center come into contact with each other in response to the second clutch center and the first clutch center having a predetermined positional relationship as the relative rotation continues.

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