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Inventor(s)	JOHNSON; Kyle D. et al.

SPRING DEFLECTING SHIFT FORK

Abstract

A shift fork assembly comprising: a clutch collar; a shift actuator collar positioned side by side to the clutch collar; a dowel inserted through the clutch collar and the shift actuator collar; and a C-shaped spring positioned over a first portion of the clutch collar and a second portion of the shift actuator collar, and the dowel being concentric to the C-shaped spring.

Inventors: **JOHNSON; Kyle D. (Toledo, OH), RATHAKRISHNAN; Sakthikumar (Perrysburg, OH), MANDERY; Nathan D. (Perrysburg, OH)**

Applicant: **Dana Heavy Vehicle Systems Group, LLC** (Maumee, OH)

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Background/Summary

TECHNICAL FIELD
[0001] Shift fork for use in a transmission.
BACKGROUND AND SUMMARY
[0002] Vehicles, such as electrified vehicles, may have a transmission to switch gears of different

ratios that produce different output torques and rotational speeds with the same input torque. The transmission may include clutch assemblies comprising clutches, such as synchronizers or dog clutches. The clutch assemblies may be actuated to selectively couple complementary gears via at least an actuator and a shifting/shift implement. Each of the clutch assemblies may be physically coupled to a shift fork. The shift fork may shiftingly couple a complementary clutch assembly to the shifting implement, such that actuation of the shifting implement may translate the shift fork and components of the clutch assembly in approximately the same direction the shifting implement is actuated. The shifting of a shift fork in a first direction may engage the clutch assembly, so an engaging component and an engagement component may rotationally couple, and rotational elements complementary to the engaging component and engagement component may rotationally couple. For example, the clutch assembly may engage and rotationally couple a first rotational element to a second rotational element, such as a shaft to a gear of a gearset. For an example, the shifting implement may be a shifting/shift rod. For another example, the shifting implement may be a shifting/shift screw.

[0003] Rigid shift forks may transfer resistive forces from a clutch assembly to a shifting implement and actuator. Likewise, certain clutches, such as dog clutches, may be prone to transferring higher quantities of resistive forces to other clutches during engagement. When engaging the clutch assembly at high speeds or at higher torques, the resistive forces transferred to the shifting implement and actuator may be greater than a threshold force. Resistive forces that are greater than the threshold force may result in degradation to the shifting implement and actuator, including acute or chronic degradation, such as permanent degradation. Resistive forces that are greater than the threshold force may result in misalignments of components included by the actuator assembly and the shift fork relative to the actuator assembly.

[0004] The inventors herein have recognized these and other issues with such systems and have come up with a way to at least partially solve them. As developed in one example, is a shift fork assembly comprising: a clutch collar; a shift actuator collar positioned side by side to the clutch collar; a dowel inserted through the clutch collar and the shift actuator collar; and a C-shaped spring positioned over a first portion of the clutch collar and a second portion of the shift actuator collar, and the dowel being concentric to the C-shaped spring.

[0005] The shift fork assembly may function as a rotational shift fork that has been separated. Separating the shift fork assembly into a first structure and a second structure, for example, may allow for a first structure to rotate independently of the second structure and vice versa. The independent rotation may reduce or prevent a force, such as torque, applied to the first structure from transferring to the second structure and vice versa. For example, the first clutch may be a dog clutch collar and the second structure may be a shift actuator collar, where the dog clutch collar is physically coupled to a dog of a dog clutch and the shift actuator collar is coupled to the shift actuator such as to be shifted therein. The separation of the dog clutch collar and shift actuator collar may allow the shift actuator and dog clutch to be separated, such that the dog clutch may be engaged via shift actuator and no torque may be transferred between the two. The two structures of the shift fork assembly may be constrained, such as to rotate about a common axis. A “C” shaped spring or other spring may connect, be positioned about, and be in surface sharing contact with the first structure and the second structure. When fit to the first structure and second structure, the spring may apply a counter torque or another counter force via a spring force to the resistance torque or other resistance forces transferred to the first structures. Likewise, the spring may couple the first structure and second structure allowing the shift fork assembly to shift as a 1-piece shift fork. However, the first structure and second structure may move to change the shape of the spring elastically, via expansion and compression, if a force greater than a threshold is provided. For example, the shift fork assembly may be blocked. Resistive forces caused by the blocking of the shift fork may elastically deform the spring and/or the position of the first structure from the second structure or vice versa. The elastic shape change and the counter torque of the spring and the

independent rotation of the second structure from the first structure may reduce degradation to components. The second structure may rotate and the spring may absorb and counter the resistive forces transferred from the first structure without degrading other components until the shift fork assembly is no longer blocked from movement by dog teeth. This device may allow for a simpler actuator design. Linear shift forks may use springs to pre-load in a first direction or a second direction, where the first direction may be opposite to the second direction. The “C”-shaped spring or other spring design about the first and second structure allows a compact solution that is pre-loaded in both directions.
[0006] It should be understood that the summary above is provided to introduce in simplified form a selection of concepts that are further described in the detailed description. It is not meant to identify key or essential features of the claimed subject matter, the scope of which is defined uniquely by the claims that follow the detailed description. Furthermore, the claimed subject matter is not limited to implementations that solve any disadvantages noted above or in any part of this disclosure.

Description

BRIEF DESCRIPTION OF THE FIGURES
[0007] FIG. **1** shows an example schematic of a vehicle which may include the transmission of the present disclosure.
[0008] FIG. **2** shows an example schematic of a gear assembly of the transmission which may include clutches and shift forks of the present disclosure.
[0009] FIG. **3** shows a first view that is a first side view of a shift fork assembly.
[0010] FIG. **4** shows a second view that is a second side view of the shift fork assembly and the angles of rotation for components of the shift fork assembly.
[0011] FIG. **5**A shows a third view that is a third side view of the shift fork assembly, showing a spring is coupled to the shift fork assembly.
[0012] FIG. **5**B shows a fourth view of the shift fork assembly, where the spring is not coupled to the shift fork assembly.
[0013] FIG. **6** shows a fifth view that is a first side view of the spring.
[0014] FIG. **7** shows a sixth view that is a second side view of the spring.
[0015] FIG. **8** shows a seventh view that is a first side view of an assembly that includes an actuator assembly, a clutch assembly, and the shift fork assembly.
[0016] FIG. **9** shows an eighth view that is a sectional view of the assembly with a shaft and a plurality of gears.
[0017] FIG. **10** shows a ninth view that is a side view of the actuator assembly.
DETAILED DESCRIPTION
[0018] The following description relates to a shift fork assembly that includes a first structure and a second structure. The shift fork assembly may be used in a transmission of a vehicle, such as an electrified vehicle, such as an all-electric vehicle (EV) or a hybrid vehicle with multiple inputs of torque. When shifted, the shift fork assembly may shift between gear sets and ratios of output speed for the transmission. Both the first structure and the second structure may be shifted to the same position by a shift actuator, such that the shift fork assembly may act as a shift fork. The shift fork assembly may include a rotational shift fork and/or be a rotational shift fork assembly for a first example. The first structure may be a structure that physically and/or shiftingly couples to a component of a clutch or clutch assembly, such as a clutch collar. The second structure may be a component that physically and/or shiftingly couples to an actuator or an actuator assembly, where the second structure may physically or shiftingly couple to a component of the actuator assembly shifted via the actuator. The second structure may therein be an actuator collar, such as a shift

actuator collar. As the shift fork assembly is actuated, components of a clutch may be actuated to rotate or slide with the friction torque assembly. For example, an engaging component may be shifting coupled to the first structure, such that the engaging component may shifted with the first structure.

[0019] The first structure and second structure may be separated by a gap and an interface. The interface may have a clearance allowing for the rotation of the second structure from the first structure or vice versa. The first structures and second structure may be centered about a common axis. A dowel may be inserted through the first structure and second structure, such as through a first sleeve of the first structure and a second sleeve of the second structure. The first and second sleeves may include a first fit and a second fit that may receive the dowel. The dowel may be centered on the common axis, such that the first structure and second structure may pivot about the dowel. A spring may be positioned about portions of the first structure and the second structure, and across the interface. The spring may be "C" shaped and may be referred to as C-shaped spring. The C-shaped spring may be loaded externally to the assembly. The C-shaped spring may be positioned about the first sleeve and the second sleeve. The C-shaped spring may limit the rotation of the components to an angle of a first maximum and an angle of a second maximum. The first maximum angle may be in a first direction from a common line perpendicular to the common axis. The second angle may be a second direction from a common line perpendicular to the common axis. The common line may divide the first structure and second structures approximately symmetrically. When the first and second structures are symmetrically divided by the common line, the first structure may be aligned with the second structure and vice versa.

[0020] For an example, the first structure may be a coupled to the engaging component in the manner described above via a plurality coupling, such as engagements, such as shift pads. The couplings may be in surface sharing contact with a component of the engaging component, such as a sleeve. Likewise, the couplings may be fastened to the shift fork assembly via a fastening component. When fastened, the couplings may physically couple the shift fork assembly, and the couplings may shiftingly couple the shift fork assembly to an engaging component. The couplings may fasten to the first component. As a clutch collar, the first component may couple to an engaging component of a clutch or clutch assembly, such as a dog. When coupled to a dog, the first structure may be a dog clutch collar. As a clutch collar, the second structure may be or have features positioned about a clutch. The second structure may comprise a plurality of arms, such as at least two arms. The arms may be positioned about an engaging component of a clutch. Each of the sleeve couplings may be fastened to an arm of the first structure.

[0021] The second structure may be coupled to the actuator assembly via a plurality of fasteners. For example, the second structure may physically couple to a shaft and a connector of the actuator assembly via the fasteners. The second structures may comprise a plurality of arms, such as at least two arms. The arms may be positioned about components of the actuator assembly. Each of the fasteners may be fastened to an arm of the second structure, such as at a lobe or another feature of the arm.

[0022] FIG. **1** shows an example schematic of a vehicle which may include the transmission of the present disclosure. FIG. **2** shows an example schematic of a gear assembly of the transmission which may include clutches and shift forks of the present disclosure. FIG. **3** shows a first view that is a first side view of a shift fork assembly. The shift fork assembly of FIG. **3** may be a shift fork assembly of the present disclosure, where the shift fork assembly includes two separate structures that may rotate independently of one another. A first structure may be a clutch collar and a second structure may be an actuator collar. A spring may be positioned about the first structure and second structure. FIG. **4** shows as second view that is a second side view of the shift fork assembly and the angles of rotation for components of the shift fork assembly. The angles of rotation of FIG. **4** may be the angle of rotation of the second structure about a dowel relative to the first structure. FIG. **5**A shows a third view that is a third side view of the shift fork assembly, showing a spring is coupled to the shift fork assembly. FIG. **5**B shows a fourth view of the shift fork assembly, where the spring is not coupled to the shift fork assembly. FIGS. **5**A-**5**B show dimensions of the second structure.

[0023] FIG. **6** shows a fifth view that is a first side view of the spring. FIG. **7** shows a sixth view that is a second side view of the spring. In FIGS. **6-7** the spring is shown separate from other components of the shift fork assembly of FIGS. **3-5**A. The spring is a C-shaped spring and may be the spring shown in FIGS. **3-5**A. FIG. **8** shows a seventh view that is a first side view of an assembly that includes an actuator assembly, a clutch assembly, and the shift fork assembly. In FIG. **8** the actuator assembly may be coupled to the shift fork assembly via the second structure. In FIG. **8** the clutch assembly may be coupled to the shift fork assembly via the first structure. FIG. **9** shows an eighth view that is a sectional view of the assembly with a shaft and a plurality of gears. The shaft may selectively couple to at least one of the gears via the clutch assembly. FIG. **10** shows a ninth view that is a side view of the actuator assembly.

[0024] It is also to be understood that the specific assemblies and systems illustrated in the attached drawings, and described in the following specification are exemplary embodiments of the inventive concepts defined herein. For purposes of discussion, the drawings are described collectively. Thus, like elements may be commonly referred to herein with like reference numerals and may not be re-introduced.

[0025] FIGS. **1-2** shows schematics of an example configuration with relative positioning of the various components. FIGS. **3-8** show example configurations with approximate position. FIGS. **3-8** are shown approximately to scale; though other relative dimensions may be used. As used herein, the terms "approximately" is construed to mean plus or minus five percent of the range unless otherwise specified.

[0026] Further, FIGS. **1-8** show example configurations with relative positioning of the various components. If shown directly contacting each other, or directly coupled, then such elements may be referred to as directly contacting or directly coupled, respectively, at least in one example. Similarly, elements shown contiguous or adjacent to one another may be contiguous or adjacent to each other, respectively, at least in one example. As an example, components laying in face-sharing contact with each other may be referred to as in face-sharing contact. As another example, elements positioned apart from each other with only a space there-between and no other components may be referred to as such, in at least one example. As yet another example, elements shown above/below one another, at opposite sides to one another, or to the left/right of one another may be referred to as such, relative to one another. Further, as shown in the figures, a topmost element or point of element may be referred to as a "top" of the component and a bottommost element or point of the element may be referred to as a "bottom" of the component, in at least one example. As used herein, top/bottom, upper/lower, above/below, may be relative to a vertical axis of the figures and used to describe positioning of elements of the figures relative to one another. As such, elements shown above other elements are positioned vertically above the other elements, in one example. As yet another example, shapes of the elements depicted within the figures may be referred to as having those shapes (e.g., such as being circular, straight, planar, curved, rounded, chamfered, angled, or the like). Further, elements shown intersecting one another may be referred to as intersecting elements or intersecting one another, in at least one example. Further still, an element shown within another element or shown outside of another element may be referred as such, in one example. Moreover, the components may be described as they relate to reference axes included in the drawings.

[0027] Features described as axial may be approximately parallel with an axis referenced unless otherwise specified. Features described as counter-axial may be approximately perpendicular to the axis referenced unless otherwise specified. Features described as radial may circumferentially surround or extend outward from an axis, such as the axis referenced, or a component or feature described prior as being radial to a referenced axis, unless otherwise specified.

[0028] Features described as longitudinal may be approximately parallel with an axis that is longitudinal. A lateral axis may be normal to the longitudinal axis. Features described as lateral may be approximately parallel with the lateral axis and normal to the longitudinal axis.

[0029] Turning now to FIG. **1**, a vehicle **100** is shown comprising a powertrain **101** and a drivetrain **103**. The vehicle **100** may have a front end **132** and a rear end **134**, located on opposite sides of vehicle **100**. Features of the vehicle **100** referred to as being located near the front may be closest to the front end **132** compared to the rear end **134**. Features of the vehicle **100** referred to as being located near the rear may be closest to the rear end **134** compared to the front end **132**. The powertrain **101** comprises a prime mover **106** and a transmission **108**. The prime mover **106** may be an internal combustion engine (ICE) or an electric machine, for example, and is operated to provide rotary power to the transmission **108**. Electric machines may include electric motors and electric motor/generators. The transmission **108** may be any type of transmission, such as a manual transmission, an automatic transmission, or a continuously variable transmission.

[0030] The transmission **108** receives the rotary power produced by the prime mover **106** as an input and outputs rotary power to the drivetrain **103** in accordance with a selected gear or setting. Additionally, there may be other movers in the vehicle besides prime mover **106**, such as if vehicle **100** is a hybrid. If the prime mover **106** is an ICE there may be at least a second mover with an input to the transmission **108**, wherein the second mover may be an electric machine such as an electric motor. In one example, if there are a single or plurality of second movers in addition to the prime mover **106**, the vehicle **100** may be a hybrid vehicle, wherein there are multiple torque inputs to the transmission **108**.

[0031] The vehicle **100** may have a longitudinal axis **130**. The powertrain **101** and drivetrain **103** may have a length parallel with the longitudinal axis **130**.

[0032] The prime mover **106** may be powered via energy from an energy storage device **105**. In one example, the energy storage device **105** is a battery configured to store electrical energy. An inverter **107** may be arranged between the energy storage device **105** and the prime mover **106** and configured to adjust direct current (DC) to alternating current (AC). The inverter **107** may include a variety of components and circuitry with thermal demands that effect an efficiency of the inverter.

[0033] The vehicle **100** may be a commercial vehicle, light, medium, or heavy duty vehicle, a passenger vehicle, an off-highway vehicle, and/or sport utility vehicle. Additionally or alternatively, the vehicle **100** and/or one or more of its components may be in industrial, locomotive, military, agricultural, and/or aerospace applications. In one example, the vehicle **100** is an all-electric vehicle or a vehicle with all-electric modes of operation, such as a plug-in hybrid vehicle. As such, the prime mover **106** is an electric machine. In one example, the prime mover **106** is an electric motor/generator.

[0034] In some examples, such as shown in FIG. **1**, the drivetrain **103** includes a first axle assembly **102** and a second axle assembly **112**. The first axle assembly **102** may be configured to drive a first set of wheels **104**, and the second axle assembly **112** may be configured to drive a second set of wheels **114**. In one example, the first axle assembly **102** is arranged near a front of the vehicle **100** and thereby comprises a front axle, and the second axle assembly **112** is arranged near a rear of the vehicle **100** and thereby comprises a rear axle. The drivetrain **103** is shown in a four-wheel drive configuration, although other configurations are possible. For example, the drivetrain **103** may include a rear-wheel drive, a front-wheel drive, or an all-wheel drive configuration. Further, the drivetrain **103** may include one or more tandem axle assemblies. As such, the drivetrain **103** may have other configurations without departing from the scope of this disclosure, and the configuration shown in FIG. **1** is provided for illustration, not limitation. Further, the vehicle **100** may include additional wheels that are not coupled to the drivetrain **103**.

[0035] In some four-wheel drive configurations, such as shown in FIG. **1**, the drivetrain **103** includes a transfer case **110** configured to receive rotary power output by the transmission **108**. A first driveshaft **113** is drivingly coupled to a first output **111** of the transfer case **110**, while a second driveshaft **122** is drivingly coupled to a second output **121** of the transfer case **110**. The first driveshaft **113** (e.g., a front driveshaft) transmits rotary power from the transfer case **110** to a first differential **116** of the first axle assembly **102** to drive the first set of wheels **104**, while the second driveshaft **122** (e.g., a rear driveshaft) transmits the rotary power from the transfer case **110** to a second differential **126** of the second axle assembly **112** to drive the second set of wheels **114**. For example, the first differential **116** is drivingly coupled to a first set of axle shafts **118** coupled to the first set of wheels **104**, and the second differential **126** is drivingly coupled to a second set of axle shafts **128** coupled to the second set of wheels **114**. It may be appreciated that each of the first set of axle shafts **118** and the second set of axle shafts **128** may be positioned in a housing. The first driveshaft **113** and second driveshaft **122** may be positioned to extend in parallel with the longitudinal axis **130**. For an example of a configuration of vehicle **100**, the second driveshaft **122** may be centered about the longitudinal axis **130**.

[0036] The first differential **116** may supply a FWD in some capacity to vehicle **100**, as part of rotary power transferred via the first driveshaft **113**. Likewise, the second differential **126** may supply a RWD to vehicle **100**, as part of the rotary power transferred via the second driveshaft **122**. The first differential **116** and the second differential **126** may supply a FWD and RWD, respectively, as part of an AWD mode for vehicle **100**.

[0037] Adjustment of the drivetrain **103** between the various modes as well as control of operations within each mode may be executed based on a vehicle control system **154**, including a controller **156**. Controller **156** may be a microcomputer, including elements such as a microprocessor unit, input/output ports, an electronic storage medium for executable programs and calibration values, e.g., a read-only memory chip, random access memory, keep alive memory, and a data bus. The storage medium can be programmed with computer readable data representing instructions executable by a processor for performing the methods described below as well as other variants that are anticipated but not specifically listed. In one example, controller **156** may be a powertrain control module (PCM).

[0038] Controller **156** may receive various signals from sensors **158** coupled to various regions of vehicle **100**. For example, the sensors **158** may include sensors at the prime mover **106** or another mover to measure mover speed and mover temperature, a pedal position sensor to detect a depression of an operator-actuated pedal, such as an accelerator pedal or a brake pedal, speed sensors at the first and second set of wheels **104**, **114**, etc. Vehicle acceleration is directly proportional to accelerator pedal position, for example, degree of depression. Upon receiving the signals from the various sensors **158** of FIG. **1**, controller **156** processes the received signals, and employs various actuators **160** of vehicle **100** to adjust drive train operations based on the received signals and instructions stored on the memory of controller **156**. For example, controller **156** may receive an indication of depression of the brake pedal, signaling a desire for decreased vehicle speed. In response, the controller **156** may command operations, such as shifting gear modes of the transmission **108**. Alternatively, the gear modes of the transmission **108** may be shifted manually, such as if the transmission **108** is a manual transmission.

[0039] In some examples, additionally or alternatively, the vehicle **100** may be a hybrid vehicle including both an engine, such as an ICE, and an electric machine each configured to supply power to one or more of the first axle assembly **102** and the second axle assembly **112**. For example, one or both of the first axle assembly **102** and the second axle assembly **112** may be driven via power originating from the engine in a first operating mode where the electric machine is not operated to provide power (e.g., an engine-only mode), via power originating from the electric machine in a second operating mode where the engine is not operated to provide power (e.g., an electric-only mode), and via power originating from both the engine and the electric machine in a third operating mode (e.g., an electric assist mode). As another example, one or both of the first axle assembly **102** and the second axle assembly **112** may be an electric axle assembly configured to be driven by an integrated electric machine.

[0040] In some embodiments, additionally or alternatively, the transmission **108** may be a first transmission, further comprising a second transmission arranged on the second set of axle shafts **128**. Herein, the transmission **108** may be interchangeably referred to as a gearbox.

[0041] Turning to FIG. **2**, a schematic **200** of the transmission **108** and gear enclosure **203** is illustrated with reference to FIG. **1** is shown. The gear enclosure **203** may be enclosed by and be comprised of a housing of the transmission **108**. In one example, the gear enclosure **203** contains a gear assembly **202**. The gearbox (e.g., the transmission **108**) may be a multi-stage reduction gearbox with the gear assembly **202** acting as a system of a plurality of reduction sets. The gear assembly **202** may be formed of at least two reduction sets that may reduce the rotational speed (e.g., rotation per minute (RPM)) and increase the torque. The reduction sets may be referred to herein as stages. The stages may be gearsets. There may be a first stage **204** and second stage **206**. The first stage **204** and second stage **206** may comprise gears, such as fixed gears.

[0042] As an example, the enclosure **203** of the transmission **108** may contain a first shaft **208**, a second shaft **210**, and a third shaft **212**. The first stage **204** may be supported by the first shaft **208** and the second shaft **210**. The second stage **206** may be supported by the first shaft **208** and the third shaft **212**. The first shaft **208** may act as an input to the first stage **204** and second stage **206**. The second shaft **210** may act as an output for the first stage **204**. The third shaft **212** may act as an output for the second stage **206**. The first stage **204** may drivingly couple the first shaft **208** to the second shaft **210**. The second stage **206** may drivingly couple first shaft **208** to the third shaft **212**. The first shaft **208** may be centered on a first axis **216**. The second shaft **210** may be centered on a second axis **218**. The third shaft **212** may be centered on a third axis **220**. The first axis **216**, second axis **218**, and third axis **220** may be parallel with one another. The first stage **204** may traverse the first axis **216** to the second axis **218**. The second stage **206** may traverse the first axis **216** to the third axis **220**. The first shaft **208** may drivingly couple a first input shaft to gear assembly **202**. For the example shown in schematic **200**, the first input shaft may be an output shaft **214** of the prime mover **106**. The output shaft **214** may be referred to herein as the prime mover output shaft **214**. For this example, the prime mover **106** may be a first electric machine, such as a first electric motor. Shafts and other components that may be drivingly coupled but not directly contacting may be represented by dotted lines **219**.

[0043] However, other configurations of the gearbox are possible. For example, the first input shaft may be a shaft drivingly coupled to output shaft **214** or the output of another reduction set. Additionally, for other configurations, there may be only a single shaft, such as second shaft **210**, that may be selectively and drivingly coupled to the first shaft **208** via reduction ratios. For example, the first stage **204** and second stage **206** may selectively and drivingly couple the first shaft **208** to the second shaft **210**.

[0044] The second shaft **210** and third shaft **212** may be drivingly coupled to a first output shaft. For the example shown in schematic **200**, the first output shaft may be a drive shaft, such as the second driveshaft **122**. However, other configurations of the gear assembly **202** and enclosure **203** are possible. For example, the first output shaft may be a shaft drivingly coupled to a drive shaft, such as the second driveshaft **122**, or to another reduction set. Additionally, for other examples, the second shaft **210** and/or third shaft **212** may be drivingly coupled to separate output shafts. For example, the second shaft **210** may be drivingly coupled a first output shaft, such as the first driveshaft **113** of FIG. **3**. For this example, the third shaft **212** may be drivingly coupled to a second output shaft, such as the second driveshaft **122**. Additionally, for other examples, the second shaft **210** and/or third shaft **212** may be output shafts.

[0045] An actuator **222** may be used to selectively and drivingly couple the first stage **204** or second stage **206** to the first shaft **208**. The actuator **222** may be drivingly coupled to a shifting implement **224**. The actuator **222** may be mounted to the transmission **108** or a component of the transmission **108**, such as the walls and surfaces of the enclosure **203**. For one example, the actuator may be mounted via fastening by a plurality of fasteners, such as screws. For another example, the actuator may be fit to a recess or void of surfaces and material of the transmission

108. The actuator **222** may be one of the actuators **160** of FIG. **1**.

[0046] As an example, the actuator **222** may advance the shifting implement **224** along a fourth axis **226**, such as via translation. The actuator **222** may advance the shifting implement **224** via a screwing motion, spinning the shifting implement **224** about the fourth axis **226**. When translated in a first direction, such as toward the front end **132**, the shifting implement **224** may drivingly couple the first stage **204** to the first shaft **208**. When translated in a second direction, such as toward the rear end **134**, the shifting implement **224** may drivingly couple the second stage **206** to the first shaft **208**. The shifting implement **224** may be guided by the housing of the transmission **108** and/or enclosure **203**. For an example, the actuator **222** may be a shift lever.

[0047] As another example, the actuator **222** may be a rotational shifting actuator. As a rotational shifting actuator the actuator **222** may pivot the shifting implement **224** about the fourth axis **226**. The actuator **222** may pivot the shifting implement **224** via a screwing motion, spinning the shifting implement **224** about the fourth axis **226**. When pivoted in a first direction, such as toward the first axis **216**, the shifting implement **224** may drivingly couple the first stage **204** to the first axis **216**. When pivoted in a second direction, such as away from the first axis **216**, the shifting implement **224** may couple the second stage **206** to the first shaft **208**.

[0048] The enclosure **203** may form a sump **228** for work fluid **230**. The work fluid **230** may be a lubricant, such as oil. The gears of the first stage **204** and second stage **206** may be lubricated by the work fluid **230** via splashing. The sump **228** may be located below the assembly **202**, such that work fluid **230** may be returned to the sump **228** via the force of gravity **260** and lowest gear of the first stage **204** and second stage **206** may dip into sump **228**. Dipping of a gear into the sump **228** may coat the teeth and other components with work fluid **230**. When coated with work fluid **230**, a gear of the first stage **204** and a gear in second stage **206** may carry and coat the teeth of other gears in mesh, therein lubricating the other gears of the first stage **204** and second stage **206**. The splashing of lubricant from the gears may coat other components of the assembly **202**, such as portions of the first shaft **208**, second shaft **210**, and third shaft **212**. After lubricating the gears of the first stage **204** and second stage **206**, work fluid **230** may be returned to the sump **228** via splashing and dripping. However, it is to be appreciated, that the method of lubrication of gears of the first stage **204** and the second stage **206** may be non-limiting. For example, additionally or alternatively, gears of the first stage **204** and the second stage **206** may be lubricated via spraying. It is also to be appreciated, that the positioning of the gears the first stage **204** and the second stage **206** relative to the direction of gravity **260** and the sump **228** may be non-limiting. For another example, there may be no gears of the first stage **204** or second stage **206** that dip into the sump **228**. Likewise, for this or another example the gears of the first stage **204** and second stage **206** may be level such as to not have a gear above or below with respect to the direction of gravity **260**.

[0049] The first stage **204** and second stage **206** may be formed of a plurality of gears. Both the first stage **204** and second stage **206** may each be formed from at least two gears. For an example, the first stage **204** may be formed of a first gear **232** and a second gear **234**. For this example, the second stage **206** may be formed of a third gear **236** and a fourth gear **238**.

[0050] There may be a plurality of arms and engagements used by the shifting implement **224** and actuator **222** to drivingly couple reduction sets. There may be at least one arm and two engagements drivingly coupled to the shifting implement **224** to select reduction sets. The number of arms and engagements drivingly coupled to the shifting implement **224** may be dependent on the number of sets to engage. The first stage **204** may be drivingly coupled to the first shaft **208** via a first engaging component **240** and first coupling **244**. Likewise, the second stage **206** may be drivingly coupled to the first shaft **208** via a second engaging component **242** and second coupling **246**. The first engaging component **240** and second engaging component **242** may be drivingly coupled to the shifting implement **224** via a first arm **248** and second arm **250**, respectively. The first arm **248** and the second arm **250** may each include a plurality of components and structures that may be coupled such as to function as an arm.

[0051] The first coupling **244** and second coupling **246** may be drivingly coupled to the first gear **232** and second gear **234**, respectively. The first engaging component **240** and the first coupling **244** may form a clutch. The second engaging component **242** and the second coupling **246** may form a clutch. In examples where the clutches are dog clutches, the first engaging component **240** and the second engaging component **242** may each be or include dog gears.
[0052] Schematic **200** shows a single shifting implement, shifting implement **224**, that may be shifted by the actuator **222**. The shifting implement **224** may physical couple to and actuate the first arm **248** and the second arm **250**. For an example, the shifting implement **224** may be screw, e.g., a shift screw, and the actuator **222** may be a motor. As a shift screw, the shifting implement **224** may be a ball screw. However, it is to be appreciated that the shifting implement **224** may include other types of shifting implements besides screws, and the shifting implement **224** may be a shifting/shift rod or a shaft. It is to be appreciated that the schematic **200** is non-limiting and there may be a plurality of shifting implements and actuators. For example, there may be a plurality of shifting implements shifted by actuator **222**. For another example, there may be a plurality of shifting implements wherein each shifting implement is shifted by an actuator specifically coupled to each shifting implement. For these examples, each shifting implement may be specific to an arm, such as the first or second arm **248**, **250**, that may be used to actuate engagements, such as the first or second engaging component **240**, **242**, respectively.
[0053] The first arm **248** may include a first collar **252** and a second collar **254**. The second arm **250** may include a third collar **256** and a fourth collar **258**. The first collar **252** and third collar **256** may each be or include clutch collars, such as dog clutch collars, where the first collar **252** and third collar **256** may shiftingly couple to components of a clutch, such as engaging components. The first collar **252** may shiftingly couple to the first engaging component **240**. The third collar **256** may shiftingly couple to the second engaging component **242**. The second collar **254** and fourth collar **258** may be actuator collars that may shiftingly couple to the shift actuator **222**. The second collar **254** and fourth collar **258** may each be physically coupled to a component shifted, pivoted, or rotated by the actuator **222**, such as the shifting implement **224**.
[0054] A set of reference axes **301** are provided for comparison between views shown in FIGS. **3-7**. The reference axes **301** indicate a y-axis, an x-axis, and a z-axis. In one example, the z-axis may be parallel with a direction of gravity and the x-y plane may be parallel with a horizontal plane a shift fork assembly **320** may rest upon. When referencing direction, positive may refer to in the direction of the arrow of the y-axis, x-axis, and z-axis and negative may refer to in the opposite direction of the arrow of the y-axis, x-axis, and z-axis. A filled circle may represent an arrow and axis facing toward, or positive to, a view. An unfilled circle may represent an arrow and an axis facing away, or negative to, a view.
[0055] Turning to FIG. **3**, it shows a first view **300** of a shift fork assembly **320**. The first view **300** is a first side view of the shift fork assembly **320**.
[0056] The first view **300** shows the shift fork assembly **320** positioned about a first axis **306** and a second axis **307**. The shift fork assembly **320** may have a first side **308** and a second side **310**. The first side **308** is opposite to the second side **310**. The first and second axes **306**, **307** may be longitudinal axes. The first and second axes **306**, **307** may be shift axes that the structures included by the shift fork assembly **320** may shift in a first direction or second direction. The first direction is opposite to the second direction, and both the first and second directions are parallel with the first and second axes **306**, **307**.
[0057] The shift fork assembly **320** may also be positioned about a third axis **312**, a fourth axis **314**, and a fifth axis **316**. The third axis **312**, the fourth axis **314**, and the fifth axis **316** may be parallel. The third axis **312**, the fourth axis **314**, and the fifth axis **316** may be lateral axes. Components and features of the shift fork assembly **320** may be centered about the third axis **312**, fourth axis **314**, and/or fifth axis **316**.
[0058] The shift fork assembly **320** is an assembly of structures that may collectively function as a

shift fork. The shift fork assembly **320** may be a configuration of the first arm **248** or second arm **250** of FIG. **2**. The shift fork assembly **320** includes a first structure **322** and a second structure **324**. The first structure **322** and second structure **324** may be two parts, a first part and a second part respectively, where each of the parts are separated. The first structure **322** and second structure **324** may be positioned side by side. The first structure **322** may be separated from the second structure **324** at a first gap **359** a second gap **360**. The volumes of the first gap **359** and second gap **360** may be continuous. The distance of the first gap **359** may vary, such as to have different distance between the first structure **322** and second structure **324** at different positions vertically. The distance of the second gap **360** between the first and second structures **322**, **324** may be approximately constant. The second gap **360** may be alternatively referred to and described as an interface, due to how the surface of the second gap **360** may be level and parallel if placed in surface sharing contact. The first structure **322** and second structure **324** may be rotationally coupled and assembled into the shift fork assembly **320** via a spring **326** and a dowel **328**. As separate parts, the first structure **322** and second structure **324** may move separate from one another. For example, the second structure **324** may rotate to different positions from the first structure **322**, about a common axis shared by the first structure **322** and second structure **324**. The common axis may be the third axis **312** of the shift fork assembly **320**. The first structure **322** and the second structure **324** may both rotate about the third axis **312** independently of one another. The dowel **328** may be a dowel rod. The dowel **328** may be centered about the third axis **312** when fit to the first structure **322** and second structure **324**, such that the centerline of the dowel **328** is collinear with the third axis **312**. The spring **326** may be positioned about the third axis **312** and about portions of the first structure **322** and second structure **324**.

[0059] The first structure **322** may be a collar that couples to components of a complementary clutch assembly, such as a clutch collar. The first collar **252** and/or third collar **256** of FIG. **2** may each be the first structure **322**. Likewise, the second structure **324** may be a collar that couples to components of an actuator assembly and therein may be an actuator collar, such as a shift actuator collar. The second collar **254** and/or fourth collar **258** may each be the second structure **324**.

[0060] The shift fork assembly **320** may comprise a substantially arched-shaped or half-circular member. For example, the first structure **322** may include a first arch **330** comprising a first arm **332** and a second arm **334**. The first arm **332** may comprise a first mounting component **336**. The second arm **334** may comprise a second mounting component **338**. The first mounting component **336** may be rigidly coupled to and continuous with the first structure **322** via the first arm **332**. Similarly, the second mounting component **338** may be rigidly coupled to and continuous with the first structure **322** via the second arm **334**. The first mounting component **336** and second mounting component **338** may be centered about the fourth axis **314**. Components of a clutch assembly may physical couple to the first mounting component **336** and second mounting component **338**. The first structure **322** includes a first surface **342**. Portions of the first surface **342** may be normal to the first axis **306**. The first surface **342** may be continuous with the first arch **330**, the first arm **332**, and the second arm **334**. The first surface **342** may be contiguous with other surfaces of the first structure **322** via smooth curves and bevels.

[0061] The first structure **322** may also include features such as a body **340** and a first sleeve **344** that extend in outward directions, such as radial directions, from the first arch **330**. A portion of the body **340** may be cylindrical in shape. The body **340** may be a cantilever that may be used as a support or a coupling feature for the first structure **322** and the shift fork assembly **320** as part of a greater assembly. The body **340** may have a fit, where the fit may receive a dowel, such as a dowel rod or a dowel pin. The first structure **322** may pivot about the dowel received by the body **340**. The dowel received by the body **340** is a separate dowel from dowel **328**. The body **340** may also be an ejector feature for the first structure **322**. The first sleeve **344** may be a first cantilever and may extend from the first arm **332** with a first platform **345**. The platform **345** may be located below the first sleeve **344**, and the platform **345** may extend in an outward direction from the first arm **332** with the first sleeve **344**. The platform **345** may have a plurality of surfaces continuous with surfaces of the first sleeve **344**. The first sleeve **344** may have an opening, such as a hole, and a passage fit to the dowel **328**. The hole or passage of first sleeve **344** complementary to the dowel **328** may be referred to herein as a fit. The first sleeve **344** may be located about the third axis **312**. The first sleeve **344** may be centered about the third axis **312**, such that the fit of the first sleeve **344** may receive the dowel **328** and be approximately centered about the third axis **312**.

[0062] The first structure **322** may also include additional features that extend from the first and second mounting components **336**, **338**. For example, the second mounting component **338** may have coupling component **348** extending outward from a surface of the second mounting component **338**. The coupling component **348** may be an appendage and a coupling location, such as a mount, for a target of a position sensor, or another attachment that a target of a position sensor may physically couple to. The coupling component **348** may extend in downward in vertical direction from the bottom of the second mounting component **338**, such as with respect to the z axis of the reference axes **301**. The coupling component **348** may be an approximately rectangular shaped body, such as a rectangular prism. The coupling component **348** may have a plurality of beveled edges and corners, smoothing the geometric shape of the coupling component **348**.

[0063] The second structure **324** may include a second arch **351**. The second structure **324** may include a second sleeve **346** that is contiguous with the second arch **351** via an offset arm **350**. The offset arm **350** may be positioned below the second sleeve **346** and to the side of the second arch **351**. The offset arm **350** may have a plurality of surfaces that are continuous with surfaces of the second arch **351**. The offset arm **350** may have at least a surface continuous with the second sleeve **346**, such as a surface facing the second gap **360**. The second sleeve **346** may have an opening, such as a hole, and a passage fit to the dowel **328**. The hole or passage of the second sleeve **346** complementary to the dowel **328** may be referred to herein as a fit. The offset arm **350** may have a plurality of surfaces that are contiguous with the second arch **351** and the second sleeve **346**. The offset arm **350** may extend downward in a vertical direction from the second sleeve **346**.

[0064] The second sleeve **346** may receive the dowel **328**. The second sleeve **346** may be centered about the third axis **312**, such that the fit of the second sleeve **346** may receive the dowel **328** and be approximately centered about the third axis **312**. The first sleeve **344** and second sleeve **346** may be aligned when their respective fits are centered about the third axis **312**. The dowel **328** may extend through the first sleeve **344** and through the second sleeve **346**. The spring **326** may be positioned about and be in surface sharing contact with the first sleeve **344** and second sleeve **346**.

[0065] The second arch **351** may comprise a first appendage **356** and a second appendage **358**. The first appendage **356** and a second appendage **358** may each curve at an angle from and are approximately continuous with the curvature of the second arch **351**. The first and second appendages **356**, **358** may be arms. The offset arm **350** may rigidly couple or comprise the second appendage **358**. Surfaces of the second arch **351** may be continuous with the first and second appendages **356**, **358**. Surfaces of the offset arm **350** may be contiguous with the first and second appendages **356**, **358**. The first appendage **356** may comprise a third mounting component **352**. The second appendage **358** may comprise a fourth mounting component **354**. The third mounting component **352** may be rigidly coupled to the second structure **324** via the first appendage **356**. The fourth mounting component **354** may be rigidly coupled to the second structure **324** via the second appendage **358** and the offset arm **350**. The second structure **324** may include a clevis, where the clevis includes the first appendage **356**, second appendage **358**, third mounting component **352**, and fourth mounting component **354**. The first appendage **356** and the second appendage **358** may be located about the second axis **307**. The first appendage **356**, and the second appendage **358** may be positioned about a shifting implement, such as shifting implement **224**, or another component of an actuator assembly. The third mounting component **352** and the fourth mounting component **354** may be located about the fifth axis **316**. The third mounting component **352** and the fourth mounting component **354** may be centered about the fifth axis **316**. The third mounting component

352 and fourth mounting component **354** may each be or include a mount for components of an actuator assembly to physically couple thereto.

[0066] The first gap **359** and second gap **360** may be positioned between the first structure **322** and the second structure **324**. The second gap **360** may be continuous and merge with the volume of the first gap **359**. The second gap **360** may extend vertically from the first gap **359** to the first sleeve **344** and second sleeve **346**. The second gap **360** may be positioned the first sleeve **344** and the second sleeve **346**, such as when the first sleeve **344** and second sleeve **346** are aligned about the third axis **312**. The second gap **360** may also be between the platform **345** and portions of the offset arm **350**. The first gap **359** may be positioned between the second appendage **358** and portions of the first arm **332**. The first gap **359** may be positioned between the fourth mounting component **354** and the first mounting component **336**.

[0067] The first structure **322** of the shift fork assembly **320** may shiftingly couple to an engaging component of a clutch or clutch assembly, such as the first engaging component **240** or the second engaging component **242** of FIG. **2**. For example, a component included by an engaging component, such as a sleeve, may be physically coupled to the first mounting component **336** and/or second mounting component **338**. Components may be physically coupled via fastening through fasteners to the first mounting component **336** and/or second mounting component **338**. For example, the first mounting component **336** may have a first passage **362** and the second mounting component **338** may have a second passage **364**. The first passage **362** and second passage **364** may be complementary to a plurality of fasteners, such as to receive the fasteners. The first passage **362** and second passage **364** may have fastening features, such as threading, that may be complementary to a fastener. The first passage **362** and second passage **364** may be centered about the fourth axis **314**. The first passage **362** and second passage **364** may be through passages that extend through the material of the first mounting component **336** and second mounting component **338**, respectively. The first passage **362** and second passage **364** may be holes, such as through holes, for the first mounting component **336** and second mounting component **338** respectively.

[0068] The second passage **364** may extend from a face **372** to another face or surface on the opposite side of the second mounting component **338**. The second mounting component **338** may include the face **372**. The face **372** may be contiguous with the second passage **364**. The face or surface opposite to face **372** may be on the second side **310**. A face with the same dimensions and shape to face **372** may be mirrored on the first mounting component **336** opposite the first axis **306**. The face **372** may be approximately flat and normal to the fourth axis **314**. A first notch **374** may be positioned between the first arm **332** and first mounting component **336**. A second notch **376** may be positioned between the second arm **334** and second mounting component **338**. The first notch **374** and second notch **376** may be above the first mounting component **336** and second mounting component **338**, respectively.

[0069] The fourth passage **368** may extend from a surface **378** to a surface, such as a face, on the opposite side of the fourth mounting component **354**. The fourth mounting component **354** includes surface **378**. The surface **378** may be contiguous with the fourth passage **368**. A surface with the same dimensions and shape to the surface **378** may be mirrored on the third mounting component **352** opposite the second axis **307**.

[0070] The second structure **324** of shift fork assembly **320**, may shiftingly couple to a shifting implement, such as shifting implement **224**. For example, a shifting implement or a connector to a shifting implement may be physically coupled to the third mounting component **352** and/or the fourth mounting component **354**. Alternatively, a connector or another component of a shift actuator assembly that may be shifted by a shift actuator may physically couple to the third mounting component **352** and/or the fourth mounting component **354**. Components may be physically coupled via fastening through fasteners to the third mounting component **352** and/or the fourth mounting component **354**. For example, the third mounting component **352** may have a third passage **366** and the fourth mounting component **354** may have a fourth passage **368**. The third passage **366** and the fourth passage **368** may be complementary to a plurality of couplings, such as to receive the couplings. The couplings complementary to the third passage **366** and the third mounting component **352** may couple the second structure **324** to an actuator assembly, such that the actuator assembly may move the second structure **324**, such as via rotation. Additionally, couplings complementary to the fourth passage **368** and fourth mounting component **354** may couple the second structure to the actuator assembly, such that the actuator assembly may move the second structure **324**, such as via rotation. The third passage **366** and fourth passage **368** may have inner surfaces with a low coefficient of friction. For example, the third and fourth passages **366**, **368** may be smooth bore. The third passage **366** and fourth passage **368** may be centered about fifth axis **316**, such as if the third mounting component **352** and fourth mounting component **354** are centered about the fifth axis **316**. The third passage **366** and fourth passage **368** may be through passages that extend through the material of the first mounting component **336** and second mounting component **338**, respectively. The third passage **366** and the fourth passage **368** may be holes, such as through holes, for the first mounting component **336** and the second mounting component **338**, respectively. The low coefficient of friction of the surfaces of the third passage **366** and/or the fourth passage **368** may allow the second structure **324** to pivot around the fifth axis **316**, such as to pivot about a dowel component or a coupling component received via the third passage **366** and/or fourth passage **368**, respectively.

[0071] For the example in view **300**, the first structure **322** may be arranged such that the first arch **330** is positioned at the top and the first mounting component **336** and the second mounting component **338** are positioned near the bottom with respect to the z-axis of the reference axes **301**. Likewise, the second structure **324** may be arranged so the second arch **351** and the offset arm **350** are nearest to the top, while the third mounting component **352** and the fourth mounting component **354** are nearest to the bottom, with respect to the z-axis of the reference axes **301**. However, it is to be appreciated that the positioning of the first structure **322** and second structure **324** relative to the z-axis are non-limiting, such that the first structure **322** and second structure **324** may be positioned relative to the reference axes **301** to couple a clutch assembly and an actuator assembly, respectively. For example, the first structure **322** may be arranged such that the first arch **330** is positioned near the bottom, and the first mounting component **336** and the second mounting component **338** are positioned near the top, with respect to the z-axis of the reference axes **301**. Likewise, the second structure **324** may be arranged so the second arch **351** and the offset arm **350** are nearest to the bottom, while the third mounting component **352** and the fourth mounting component **354** are nearest to the top, with respect to the z-axis of the reference axes **301**.

[0072] An example of the first structure **322** and the second structure **324** coupled to components of a clutch assembly and an actuator assembly, respectively, is shown in FIG. **8**.

[0073] Turning to FIG. **4**, it shows a second view **400** of the shift fork assembly **320**. The second view **400** is a second side view of the shift fork assembly **320**. The second view **400** is a lateral view, normal to the third axis **312** and fourth axis **314**. The second view **400** shows the shift fork assembly **320** from the first side **308** of FIG. **3**.

[0074] The second view **400**, shows the second structure **324** may be rotated about the dowel **328** such as to pivot in a first direction **412** or a second direction **414**. Additionally or alternatively, the first structure **322** may be rotated about the dowel such as to pivot in the first direction **412** or second direction **414**. The first direction **412** and second direction **414** may be angular directions, such as a first angular direction and a second angular direction, respectively. The first direction **412** and second direction **414** are opposite to each other across a line **410**, e.g., a line A-A. The line **410** may be a center for alignment. The first structure **322** and second structure **324** may be centered on and divided approximately symmetrically by the line **410**, such as to be aligned. The second structure **324** may be pivoted in the second direction **414** to be placed in the position shown in the second view **400**.

[0075] In addition to the third axis **312** and fourth axis **314**, the second view **400** shows a sixth axis **422**. The sixth axis **422** may be offset from but parallel to the fifth axis **316** of FIG. **3**. The second structure **324** may in a position to be aligned with the sixth axis **422**, such that the third passage **366** may be approximately centered about the sixth axis **422**. By extension, the third mounting component **352** may be about the sixth axis **422**, such as to be centered about the sixth axis. Likewise, the fourth mounting component **354** and fourth passage **368** may be about the sixth axis **422**, such as to be centered about the sixth axis **422**.

[0076] The shift fork assembly **320** may have a second surface **442** and a third surface **440**. The second surface **442** may be a surface of the first structure **322**, and more specifically the second surface **442** may be a surface of the first arch **330**. The second surface **442** may be on the opposite side of the first arch **330** from the first surface **342**. The second sleeve **346** may include the third surface **440**. The third surface **440** may be an outer surface about the second sleeve **346**. The third surface **440** may be curved about second sleeve **346** and the third axis **312**. The third surface **440** may be cylindrical in shape. The spring **326** may be positioned about the second sleeve **346** such as to have surface sharing contact with the third surface **440**. The second sleeve **346** may include a first fit **450**. The first fit **450** is an opening, such as a hole, and a passage, that may receive the dowel **328**. The first fit **450** may include an inner surface of the second sleeve **346**. The inner surface of the second sleeve **346** and first fit **450** may be smooth with a low coefficient of friction, such that the second sleeve **346** may pivot. The dowel **328** may be centered on the third axis **312** such as to be concentric to the first fit **450** and to the spring **326**. The first fit **450** may be the second fit of the second sleeve **346** described with respect to FIG. **3** above.

[0077] The spring **326** may have an outer surface **446** and an inner surface **448**. The spring may have a third gap **444**, such as a C-gap. The spring **326** may be a partial cylinder with the third gap **444**. As a C-gap, the third gap **444** may give the spring **326** a C-like shape, and therein the spring **326** may be a C-shaped spring. The outer surface **446** and inner surface **448** may be curved, and may curve about the second sleeve **346**. The inner surface **448** may abut and have surface sharing contact with the third surface **440**. The outer surface **446** may not be continuous about the entirety of spring **326**, and the outer surface **446** may terminate at opposite ends of the third gap **444**. Likewise, the inner surface **448** may not be continuous about the entirety of spring **326**, and the inner surface **448** may terminate at opposite ends of the third gap **444**.

[0078] The dimensions of the third gap **444** and the mechanical properties of the spring **326** may define the angle at which the second structure **324** may pivot in the first direction **412** or second direction **414** from the first line **410**. Additionally or alternatively, the dimensions of the third gap **444** and the mechanical properties of the spring **326** may define the angle at which the first structure **322** may pivot in the first direction **412** or second direction **414** from the first line **410**. For example, the second structure **324** may pivot from the first line **410** in the first direction **412** at a first angle **451**. Likewise, the second structure **324** may pivot from the first line **410** in the second direction **414** at a second angle **452**. For this or another example, the first structure **322** may pivot from the first line **410** in the first direction **412** at the first angle **451**. Likewise, first structure **322** may pivot from the first line **410** in the second direction **414** at the second angle **452**.

[0079] The first angle **451** and second angle **452** may be a first maximum angle and a second maximum angle, respectively, allowed by the spring **326** for the first structure **322** and/or second structure **324** to pivot from the first line **410**. The second structure **324** and/or first structure **322** may stop rotating and may be prevented from pivoting to a greater angle than the first angle **451**. At the first angle **451**, the second structure **324** and/or first structure **322** may have face sharing contact with the spring **326**. At the first angle **451**, a counter force from the spring **326** may become equal and opposite the force applied from the second structure **324** and/or first structure **322**. Likewise, the second structure **324** and/or first structure **322** may stop rotating and may be prevented from pivoting to a greater angle than the second angle **452**. At the second angle **452**, the second structure **324** and/or first structure **322** may have face sharing contact with the spring **326**.

At the second angle **452**, a counter force from the spring **326** may become equal and opposite the force applied from the second structure **324** and/or first structure **322**. Until the counter force, e.g., a spring force, of the spring **326** is equal to an applied force, such as from the shift fork assembly **320**, the spring **326** may elastically change shape and dimensions.

[0080] The spring **326** may have a clearance **454**, where the clearance **454** is the distance of the third gap **444**. The spring **326** may be of a first diameter **456** and a second diameter **458**. The second structure **324** may have a width **464**. The first diameter **456** may be an outer diameter and the second diameter **458** may be an inner diameter. The second sleeve **346** may have a third diameter **460** and a fourth diameter **462**. The third diameter **460** may be an outer diameter and the fourth diameter **462** may be an inner diameter for the second sleeve **346**. The fourth diameter **462** may also be the diameter of the first fit **450**. The fourth diameter **462** may be greater than the diameter of the dowel **328**, such that the second structure may be allowed to pivot about the dowel **328**. The width **464** is a distance less than the clearance **454**. The width **464** may be a maximum width for the second structure **324** for features not included as part of the third mounting component **352**, fourth mounting component **354**, or the second sleeve **346**. For example, the width **464** may be a maximum distance for first appendage **356**. The width **464** may also be a maximum width for the second arch **351**, the offset arm **350**, and the second appendage **358** of FIG. **3**. The width **464** may allow the second structure **324** to pivot to positions between the third gap **444**. Likewise, other features of the first structure **322**, such as the platform **345** of FIG. **3**, may be of the width **464** or other widths having a distance less than the clearance **454**. The width **464** or the aforementioned other widths may allow first structure **322** to pivot to positions between the third gap **444**.

[0081] The third mounting component **352** may include a second face **468**. The second face **468** may be positioned about the third passage **366**. The second face **468** may be contiguous with the other surfaces of the third mounting component **352** and the first appendage **356** via a plurality of curved surfaces, edges, and bevels. The second face **468** may be continuous with the other surfaces of the third mounting component **352** and the first appendage **356** via a plurality of curved surfaces, edges, and bevels.

[0082] For an example of an embodiment, the spring **326** allows for the first angle **451** to be 12.6 degrees from the first line **410**. An actuator assembly coupled to the second structure **324** may be pivoted a first maximum distance at the first angle **451**. For example, the actuator assembly and a complementary actuator may pivot a distance of 53.78 millimeters (mm). Additionally, first structure **322** or second structure **324** may be pivoted at other angles in the first direction **412** that are less than the first angle **451**. The other angles may include an angle when the first structure **322** or second structure **324** are in surface sharing contact is made with an edge of the third gap **444** but no elastic change to the dimensions and shape of spring **326** occurs. For this example, the first structure **322** or second structure **324** may be pivoted maximum angle, such as 12 degrees, from the first line **410** in the first direction **412** without causing elastic change in shape to the spring **326**.

[0083] For this or another example of an embodiment of the spring **326**, the spring **326** allows for the second angle **452** to be 12.6 degrees from the first line **410**. An actuator assembly coupled to the second structure **324** may be pivoted a second maximum distance at the second angle **452**. For example, the actuator assembly and a complementary actuator may be pivoted a distance of 53.78 mm. Additionally, first structure **322** or second structure **324** may be pivoted at other angles in the second direction **414** that are less than the second angle **452**. The other angles may include an angle when the first structure **322** or second structure **324** are surface sharing contact is made with an edge of the third gap **444** but no elastic change to the dimensions and shape of spring **326** occurs. For this example, the first structure **322** or second structure **324** may be pivoted maximum angle, such as 12 degrees, from the first line **410** in the second direction **414** without causing elastic change in shape to the spring **326**.

[0084] Forces transferred the spring **326** may be kept below a threshold, such as to prevent plastic changes in dimension and shape of the spring **326**.

[0085] The spring **326** may comprise of a material of a high tensile strength and that has appropriate range of pressures where shape and dimensional change may be elastic. For example, the spring **326** may comprise a variant of spring steel, such as 6150 spring steel. The shape and dimensions of the spring **326** may change elastically above a first threshold of force. The change in shape and dimensions of the spring **326** may be elastic below a second threshold of force. Above the second threshold of force the spring **326** a first form of acute or chronic degradation may occur, wherein plastic shape change of the spring **326** may occur. The spring **326** may change shape and dimensions plastically between the second threshold of force and a third threshold of force. The third threshold of force may be a maximum, above which a second form of acute and permanent degradation may occur. For an example, the first threshold of force may be 24.2 newton meters (Nm) from a momentum arm, such as the first structure **322** or second structure **324**, or 1686 Newtons (N) from a force (e.g., a gap force) directly to a surface of the third gap **444**. For an example embodiment, the spring **326** may be subject to forces greater than the second threshold of force at pressures greater than or equal to yield strength, where the yield strength is at von Mises Stress and/or a max principle stress of the spring **326**. For an example embodiment, the spring **326** may have the von Mises Stress of 983 megapascals (MPa) and a max principle stress of 1,100 MPa. For an example embodiment, the spring **326** may be subject to a force above the third threshold of force at pressures greater than or equal to an ultimate tensile strength of the spring **326**. The spring **326** may have an ultimate tensile strength of 2342.8 MPA.

[0086] The spring **326** may change shape and dimensions elastically. The dimensions of the spring **326** including the clearance **454**, the first diameter **456**, and the second diameter **458** may be variable. For example, the first diameter **456** may increase or decrease in distance depending on force or lack thereof applied to the spring **326**. For example, when the first structure **322** or second structure **324** are positioned at the first angle **451**, the clearance **454**, the first diameter **456**, and the second diameter **458** may be at greater distances than when the first structure **322** and second structure **324** are positioned to be aligned with the line **410**. As another example, when the first structure **322** or second structure **324** are positioned at the second angle **452**, the clearance **454**, the first diameter **456**, and the second diameter **458** may be greater distances than when the first structure **322** and second structure **324** are positioned to be aligned with the line **410**. When first structure **322** or second structure **324** are positioned to be aligned with the line **410**, the clearance **454**, the first diameter **456**, and the second diameter **458** may each be at a first threshold of distance. Each of the aforementioned first thresholds of distances are minimum values of distance. When first structure **322** or second structure **324** are positioned at the first angle **451** or the second angle **452**, the clearance **454**, the first diameter **456**, and the second diameter **458** may each be at a second threshold of distance. Each of the aforementioned second thresholds of distances are maximum values of distance.

[0087] For an example of an embodiment of the spring **326**, the first diameter **456** may be a maximum distance at or below the second threshold of force, such as a distance of 35.4 mm. The first diameter **456** may be a minimum distance below the first threshold of force when no elastic shape or dimensional change occurs. For this or another example of an embodiment of the spring **326**, the second diameter **458** may be a maximum distance at or below the second threshold of force, such as at a distance of 28.5 mm. The second diameter **458** may be a minimum distance below the first threshold of force when no elastic shape or dimensional change occurs. For this or another example of an embodiment of the spring **326**, the clearance **454** may be a minimum distance below the first threshold of force, such as a distance of 12 mm. The application of force above the first threshold of force may apply a distance of deflection to expand the third gap **444** and increase the distance of the clearance **454**. The clearance **454** may expand by a maximum deflection, where the maximum deflection is a deflection distance at a threshold of force less than the second threshold of force. A maximum deflection for the clearance **454** may be a distance of

3.23 mm.

[0088] Turning now to FIGS. **5**A-**5**B, their features and components may be described collectively herein. FIG. **5**A and FIG. **5**B show a third view **500** and fourth view **580**, respectively, of the shift fork assembly **320**. The third view **500** and fourth view **580** are longitudinal views, normal to the second axis **307**. The third view **500** and fourth view **580** may be partially transparent views, showing features such as a second fit **530** and the first fit **450** of the first sleeve **344** and second sleeve **346**, respectively. The third view **500** and fourth view **580** may be positioned at approximately the same visual reference. The third view **500** shows the shift fork assembly **320** with the spring **326** coupled to the shift fork assembly **320**, such that the spring **326** is coupled to and about the first and second sleeves **344**, **346**. The fourth view **580** shows the shift fork assembly **320** without the spring **326**.

[0089] The third view **500** and fourth view **580** show the offset arm **350** and the platform **345** have a third face **516** and a fourth face **518**, respectively. The third face **516** may be continuous with portions of the arch **351**, the first appendage **356**, and the second appendage **358**. The third face **516** may be contiguous with the fourth mounting component **354**. The fourth view **580** shows the third face **516** may be contiguous with surfaces of the second sleeve **346**, such as the third surface **440**. The fourth face **518** may be contiguous with the first arm **332**. The fourth face **518** may be contiguous with surfaces of the first sleeve **344**. The third face **516** may make surface sharing contact with the spring **326**, such as when the second structure **324** is pivoted to the first angle **451** of FIG. **4**. The fourth face **518** may make surface sharing contact with the spring **326**, such as when the first structure **322** is pivoted to the first angle **451** of FIG. **4**.

[0090] The first sleeve **344** may include a fourth surface **528**. The fourth face **518** may be contiguous with the fourth surface **528**. The fourth surface **528** may be an outer surface about the first sleeve **344**. The fourth surface **528** may be curved about the first sleeve **344** and the third axis **312**. The fourth surface **528** may be cylindrical in shape. The spring **326** may be positioned about the first sleeve **344** such as to have surface sharing contact with the fourth surface **528**. The second sleeve **346** may have a neck **532**. The neck **532** may be positioned between the fourth surface **528** and the first arch **330**, such as along and with respect to the third axis **312**. The neck **532** may be narrower in dimensions than the fourth surface **528**. The neck **532** may depress into the second sleeve **346** from the fourth surface **528** and the first arch **330**. The neck **532** may be continuous with the fourth face **518**, the fourth surface **528**, and the first arch **330**.

[0091] The first sleeve **344** may include a second fit **530**. The second fit **530** may receive the dowel **328**. The second fit **530** may include an inner surface of the second sleeve **346**. The inner surface of the second sleeve and second fit **530** may be smooth with a low coefficient of friction, such that the dowel **328** may move freely and/or the first sleeve **344** may pivot. The second fit **530** may be the first fit of the first sleeve **344** described with respect to FIG. **3** above. The first fit **450** may be a sliding fit and the second fit **530** may be a press fit. As a sliding fit the first fit **450**, and by extension the second sleeve **346** and second structure **324**, may slide about the dowel **328** and along the third axis **312**. The first fit **450** may be a first length **552** and the second fit **530** may be a second length **554**. The spring **326** may be a third length **556**. The first length **552** may extend through and be the length of the second sleeve **346**, making the first fit **450** a through passage, such as a through hole. The second length **554** may extend from the second gap **360** and through a portion of the material of the first arch **330** and the first arm **332**. Both the first fit **450** and the second fit **530** may receive the dowel, such as when the first fit **450** and second fit **530** are aligned. The first fit **450** and second fit **530** may be aligned when the centerlines of the first fit **450** and second fit **530** are approximately collinear. The first fit **450** and second fit **530** may be aligned when both are positioned approximately radially about the third axis **312**. When the spring **326** is coupled to the first sleeve **344** and second sleeve **346**, the third length **556** may be approximately parallel with the first and second lengths **552**, **554**. For an example embodiment of the spring **326**, the third length **556** may be 28 mm.

[0092] The third view **500** and fourth view **580** may show additional dimensions of the shift fork assembly **320**. The third mounting component **352** and the fourth mounting component **354** may be separated by a distance **538**. The curve **355** of the second arch **351** may be a first radius **540**. The distance **538** may be greater than the diameter and/or width of a plurality components of an actuator assembly. The distance **538** may be greater than the diameter and/or width of a component or a plurality of components that may couple to the third mounting component **352** and/or fourth mounting component **354**. The first radius **540** may be great enough of a distance such that the curve **355** may be positioned about the component or the plurality of components of the actuator assembly.

[0093] The first gap **359** comprises a second clearance **542** between the first structure **322** and second structure **324**. The second gap **360** comprises a third clearance **544** between the first structure **322** and second structure **324**. The fourth view **580** of FIG. 5B shows the second gap **360** may be a distance **582**, where the distance **582** may extend from the first gap **359** to the top of the second sleeve **346**. The second clearance **542** may be variable such as to change distance. For example, the second clearance **542** may be an approximately constant distance until reaching a first curve **546** of the first platform **345** and a second curve **548** of the offset arm **350**. The second clearance **542** may decrease in distance above the start of the first curve **546** and second curve **548**. The second clearance **542** may decrease between the first curve **546** and second curve **548** until decreasing to the distance of the third clearance **544** at the start of the second gap **360**. The third clearance **544** may be approximately constant from the first gap **359** terminates and to the top of the second sleeve **346** where the second gap **360** terminates. The third clearance **544** may therein be approximately constant at different points along distance **582**.

[0094] The second gap **360** and the third clearance **544** may be formed between a first surface **562** of the platform **345** and a second surface **564** of the offset arm **350**. The first surface **562** and second surface **564** may be parallel. The first surface **562** and second surface **564** may be flat. The first surface **562** and second surface **564** may be normal to the third axis **312**. The first surface **562** may be contiguous with the first curve **546**. The second surface **564** may be contiguous with the second curve **548**.

[0095] For an example embodiment of the second structure **324**, a branch **570** may connect the arch **351** to the first appendage **356**. Surfaces of the arch **351** may be contiguous with the first appendage **356** via the branch **570**. The second structure **324** may have a first lobe **572** and second lobe **574**. The first lobe **572** may be positioned between the arch **351** and the first appendage **356**. The first lobe **572** may be contiguous with and extend from the arch **351**, the first appendage **356**, and the branch **570**. A third notch **576** may be between the first lobe **572** and the third mounting component **352**. The third notch **576** may be below the first lobe **572** and above the third mounting component **352**. The second lobe **574** may be positioned between the arch **351** and the second appendage **358**. The first lobe **572** may be contiguous with and extend from the arch **351**, the second appendage **358**, and the offset arm **350**. A fourth notch **578** may be between the second lobe **574** and the fourth mounting component **354**. The fourth notch **578** may be below the second lobe **574** and above the fourth mounting component **354**. The first and second lobes **572**, **574** may extend in an inward direction toward the second axis **307** from the material of the second structure **324**. The first and second lobes **572**, **574** may mechanically support the first and second arms **332**, **334**, respectively, providing increased tensile and compressive strength to the first structure **322**. The first and second lobes **572**, **574** may collect lubricant, such as oil. If the first structure **322** is oriented such that the first **336** and second **338** are lower than the arch **330** with respect to gravity, the first and second lobes **572**, **574** may distribute the lubricant to a component, such as a component of an actuator assembly, coupled to the second structure **324**. The first and second lobes **572**, **574** may distribute the lubricant to the actuator assembly coupled to the second structure **324** via the third mounting component **352** and fourth mounting component **354**, where the arch **351** and the first and second lobes **572**, **574** may be located about components of the actuator assembly.

[0096] Turning to FIG. **6**, it shows a fifth view **600** of the spring **326**. The fifth view **600** is a first side view of the spring **326**. The fifth view **600** is also a first isolated view of the spring **326**, showing the spring **326** isolated from the other components and features of the shift fork assembly **320**.

[0097] The spring **326** may be centered about an axis **606**. The axis **606** may be parallel or collinear with the third axis **312** of FIG. **3**. The axis **606** may also be the third axis **312**. The spring **326** may be divided into approximately symmetrical halves by a plane **608**. The area of the plane **608** may be parallel with the axis **606**. The plane **608** may be centered on the axis **606**. The plane **608** may divide the spring **326** into a first side **612** and a second side **614**.

[0098] In addition to the outer surface **446** and inner surface **448**, the spring **326** may include a third surface **622**. The third surface **622** may extend about the axis **606** and may terminate at edges and surfaces of the third gap **444**. The third surface **622** may have a C like shape. The third surface **622** may be defined and shaped by a first edge **624** and a second edge **626**. The third surface **622** may be contiguous with the outer surface **446** via the first edge **624**. The third surface **622** may be contiguous with the inner surface **448** via the second edge **626**. The first edge **624** and second edge **626** may be curved. The first edge **624** may curve with the curvature of the outer surface **446**. The second edge **626** may curve with the curvature of the inner surface **448**. The spring **326** may include a surface of approximately same dimensions and shape as the third surface **622**, where the surface that may be mirrored opposite the third surface **622** across the outer surface **446** and inner surface **448**. For example, a third edge **628** may mirror the first edge **624**, where the third edge **628** may be opposite the first edge **624** across the outer surface **446**. Likewise, a fourth edge **630** may mirror the second edge **626**, where the fourth edge **630** may be opposite the second edge **626** across the inner surface **448**.

[0099] The spring **326** may include an elastic region **632** comprising greater expansion and tension relative to other regions of the spring **326**. Opposite to the elastic region **632** from the inner surface **448** and across the material of the spring **326**, a region on the outer surface **446** may experience greater expansion and compression relative to the other regions of the spring **326**. In other words, a greater degree of bending and other shape change may occur for the spring **326** due to and within the elastic region **632**. Likewise, a greater degree of bending and other shape change may occur at the region on the outer surface **446** that is opposite the elastic region **632** through the material of the spring **326**. The elastic region **632** is represented schematically with respect to the other components and features of the spring **326**. The elastic region **632** may be opposite the axis **606** from the third gap **444**.

[0100] The third gap **444** may be between a fourth surface **642** and a fifth surface (see fifth surface **744** in FIG. **7**). The clearance **454** may extend from the fourth surface **642** to the fifth surface. The fourth surface **642** may be approximately rectangular in shape and may be defined by a plurality of sides in the form of a fifth edge **644**, a sixth edge **646**, a seventh edge **648**, and an eighth edge **650**. The fourth surface **642** may be contiguous with the third surface **622** via the fifth edge **644**. The third surface **622** and fourth surface **642** may each terminate at the fifth edge **644**. The fourth surface **642** may be contiguous with the outer surface **446** via the sixth edge **646**. The outer surface **446** and the fourth surface **642** may each terminate at the sixth edge **646**. The fourth surface **642** may be contiguous with a surface mirroring the third surface **622** via the seventh edge **648**. The fourth surface **642** may terminate at the seventh edge **648**. The fourth surface **642** may be contiguous with the inner surface **448** via the eighth edge **650**. The inner surface **448** and the fourth surface **642** may terminate at the eighth edge **650**.

[0101] The fourth surface **642** and fifth surface may be symmetrical to one another. The fifth surface may have approximately the same dimensions and shape as the fourth surface **642**, where the fifth surface may be mirrored to the fourth surface **642** opposite the plane **608**. The features, such as the edges, of the fourth surface **642** may be mirrored on the fifth surface. For example, a ninth edge **654** may mirror the fifth edge **644**. Likewise, the tenth edge **656** may mirror the sixth edge **646**.

[0102] The spring **326** may contract in a first direction **666** and/or a second direction **668** at the third gap **444**. The spring **326** may expand in a third direction **676** and/or a fourth direction **678** at the third gap **444**. The first direction **666** and third direction **676** may be approximately normal to the fourth surface **642**. The second direction **668** and the fourth direction **678** may be approximately normal to the fifth surface **744**. The first direction **666**, second direction **668**, third direction **676**, and fourth direction **678** may be represented schematically as arrows. The expansion of the third gap **444** may increase the clearance **454**. Likewise, the expansion of the third gap **444** may expand the first diameter **456** and the second diameter **458**.

[0103] For example, a first force may be applied normal to the fourth surface **642** in the third direction **676**. The first force may be greater than a force of the first threshold, where the first threshold is a threshold of force above which the spring may experience elastic shape change. The first threshold of force is described above with the description of FIG. **4**. The application of the first force in the third direction **676** may expand the third gap **444** in the third direction **676**, increasing the distance of the clearance **454**. If the first force is removed or the first force is reduced to a force less than the first threshold, the third gap **444** may contract in the first direction **666**, decreasing the distance of the clearance **454**. The first force may be transferred from a component of the shift fork assembly **320**, such as the second structure **324**, of FIG. **3**.

[0104] For another example, a second force may be applied normal to the fifth surface **744** in the fourth direction **678**. The second force may be greater than a force of the first threshold. The application of the second force in the fourth direction **678** may expand the third gap **444** in the fourth direction **678**, increasing the distance of the clearance **454**. If the second force is removed or reduced to a force less than the first threshold, the third gap **444** may contract in the second direction **668**, decreasing the distance of the clearance **454**. The second force may be transferred from a component of the shift fork assembly **320**, such as the second structure **324**, of FIG. **3**.

[0105] Turning to FIG. **7**, it shows a sixth view **700** of the spring **326** isolated from the other components and features of the shift fork assembly **320**. The sixth view **700** is a second side view of the spring **326**.

[0106] The sixth view **700** shows the spring **326** and the third gap **444** are expanded from an unexpanded state. When the spring **326** is in an unexpanded state, (e.g., when no force is applied to features of the spring **326**), the clearance **454** may be a first dimension **722**. The first dimension **722** may be a minimum clearance for the third gap **444**. In a few examples, the first dimension **722** may be approximately 12 mm. When the spring **326** is in an expanded state, the clearance **454** may be less than or equal to a second dimension **724**. The second dimension **724** may be a maximum clearance for the third gap **444**. The first dimension **722** and second dimension **724** are represented schematically as double arrowed lines with complementary perpendicular lines representing the termination points of the distance.

[0107] The clearance **454** of the third gap **444** may be expanded greater than the first dimension **722** via a first force **738**. The first force **738** may be a force greater than the first threshold of force to cause elastic shape change to at the third gap **444**. The first force **738** may be normal to the fourth surface **642**. The first force **738** is represented schematically as a line with an arrow. The first force **738** may be transferred to the fourth surface **642** from a component of the shift fork assembly **320**, such as the second structure **324**, of FIG. **3**.

[0108] The sixth view **700** also shows the fifth surface **744**. The fifth surface **744** may share the same dimensions as the fourth surface **642**. The fifth surface **744** may mirror the fourth surface **642** opposite the plane **608**.

[0109] Turning to FIG. **8**, it shows a seventh view **800** of an assembly **810**. The seventh view **800** is a first sectional view of the assembly **810**. The assembly **810** may be part of a larger gear shifting assembly. A line **808** is shown and may divide the assembly **810**. A plane taken on the line **808** may be parallel with the fourth axis **314** and the fifth axis **316**. A sectional view may be taken on the line

808, such as in FIG. **9** below. The assembly **810** may be housed in a housing **814**. The housing **814** may be a housing of a transmission or a gearbox, such as the transmission **108** of FIG. **1**. Alternatively, the housing **814** may be a component or feature of the housing of the transmission or the gearbox. The assembly **810** may include a clutch assembly **816** and an actuator assembly **820**. The clutch assembly **816** includes a clutch. The clutch assembly **816** may be centered about the first axis **306** (see FIG. **3**). The first structure **322** may be positioned about clutch assembly **816**. The first arch **330** and the first mounting component **336**, and the first arm **332**, the second arm **334**, and the second mounting component **338** of FIG. **3**, may be positioned about the clutch assembly **816**. The clutch assembly **816** may be coupled to the first structure **322** via the first mounting component **336** and the second mounting component **338**. The clutch assembly **816** may be part of a dog clutch assembly, where the clutch may be a dog clutch, including a dog gear as an engaging component. The actuator assembly **820** may be positioned about the second axis **307**. The actuator assembly **820** may be centered about the second axis **307**. The actuator assembly **820** may include a shift actuator, such as the actuator **222**. The actuator assembly **820** may shiftingly couple to the shift fork assembly **320** via physically coupling to the second structure **324**. The actuator assembly **820** may be shiftingly coupled to the second structure **324** via the third mounting component **352** and the fourth mounting component **354**. The housing **814** may include a cover **822**. The cover **822** may be positioned about a portions of the second structure **324**, such as a portion of the second sleeve **346**. The cover **822** may be positioned below portions of the second structure **324**, such as the second arch **351**.

[0110] The clutch assembly **816** may shiftingly couple to the first mounting component **336** and second mounting component **338** via at least a coupling, such as a first coupling **832**. Couplings, such as the first coupling **832**, may be a coupling or coupling device that may shiftingly couple the clutch assembly **816** to structures such as the shift fork assembly **320**. The first coupling **832** may shiftingly couple the clutch assembly **816** to the first mounting component **336**. The first coupling **832** may be fastened to the first mounting component **336**. The first coupling **832** is an engagement device, such as a pad. For example, couplings, such the first coupling **832**, that shiftingly couples the first structure **322** to the clutch assembly **816** may be shift pads. The clutch assembly **816** may include a sleeve **834**. The sleeve **834** may be centered about the first axis **306**. The first coupling **832** may be positioned between the first mounting component **336** and a sleeve **834**. The first coupling **832** may be fastened to and be received by the first mounting component **336**, such as via the first passage **362**. The first coupling **832** may have an appendage **838**. The appendage **838** may be complementary and fit to the first passage **362**. The appendage **838** and the first passage **362** may have a plurality of smooth surfaces with a low coefficient of friction, where for an example the appendage **838** may be a peg and the first passage **362** may be smooth bore. The smooth surfaces of the appendage **838** and the first passage **362** may allow for the first mounting component **336** to pivot about the appendage **838**. The appendage **838** may be fastened to the first mounting component **336** via the first passage **362**. The first coupling **832** may have surface sharing contact with features of the sleeve **834**. The surfaces of sleeve **834** in surface sharing contact with the first coupling **832** may comprise a first area of contact. The sleeve engagement region may comprise the first area of contact. When in surface sharing contact with the sleeve **834**, the first coupling **832** may couple the sleeve **834** to the first structure **322**, such that the clutch assembly **816** may be actuated with the shift fork assembly **320**.

[0111] Additionally, there may be a second coupling that may shiftingly couple the clutch assembly **816** to the first structure **322**. For an example of an embodiment, the clutch assembly **816** may be coupled to the first structure **322** via at least a pair of couplings, such as couplings that may be fastened to the first and second mounting components **336**, **338**. The second coupling may be fastened to and be received by the second mounting component **338**, such as via the second passage **364** of FIG. **3**. For example, the second coupling may have an appendage that may be complementary and fit to the second passage **364**. The appendage of the second coupling and the second passage **364** may have a plurality of smooth surfaces with a low coefficient of friction, where for an example the appendage of the second coupling may be a peg and the second passage **364** may be smooth bore. The smooth surfaces of the appendage of the second coupling and the second passage **364** may allow for second mounting component **338** to pivot about the second appendage. When in surface sharing contact with the sleeve **834**, the second coupling may couple the sleeve **834** to the first structure **322**, such that the clutch assembly **816** may be actuated with the shift fork assembly **320**. The second coupling may be symmetrical to the first coupling **832**.

[0112] The actuator assembly **820** is sectioned by view **800**. The actuator assembly **820** may include a first actuator housing **842** and a sleeve **844**. The actuator housing **842** may be positioned about the sleeve **844**, such as to be partially around or encircling the sleeve **844**. For example, the actuator housing **842** may have portions that may curve around and be positioned radially about the sleeve **844**. The actuator housing **842** may comprise a ductile and lighter material, such as aluminum. The sleeve **844** may move linearly with the rotation of the shift implement **846** (e.g., lead screw). A cam shaft coupled to the sleeve **844** may rotate. The actuator assembly **820** may also include a shift implement **846**. The shift implement **846** is sectioned by view **800**. The actuator assembly **820** may include a coupling **848** that may physically couple to the shift implement **846**. The sleeve **844** may be positioned about the coupling **848**, such as to be around and/or encircle the coupling **848**. The coupling **848** may be positioned about shift implement **846**, such as be around and/or encircle the shift implement **846**. The shift implement **846** may be the shifting implement **224**. As an example the shift implement **846** may be a screw, such as a ball screw. The coupling **848** may be a nut, such as a ball screw nut. A plate **840** may physically couple the actuator housing **842**. The plate **840** may physically couple to an extension **849** of the actuator housing **842**. The plate **840** may be positioned between the actuator housing **842** and the sleeve **844**, such as to be in a location radially between the actuator housing **842** and sleeve **844**. The plate **840** may be positioned between the actuator housing **842** and the shift implement **846**. The plate **840** may comprise a material of a higher tensile strength than the actuator housing **842**, such as steel. The plate **840** may mechanically support the actuator housing **842**, including the extension **849**, such as when physically coupled to the actuator housing **842**. When plate **840** is physically coupled to the actuator housing **842**, the plate **840** may reduce wear and other forms of mechanical degradation to the actuator housing **842**. Components of the actuator assembly **820** may be coupled, such as physically and/or shiftingly coupled, via a plurality of fasteners, such as a first fastener **850**. The first fastener **850** may fasten the plate **840** to the actuator housing **842**. For an example embodiment, the first fastener **850** may fasten the plate **840** to the extension **849**. The actuator assembly **820** may shiftingly couple to the second structure **324** via a third coupling **852** and a fourth coupling **854**. The sleeve **844** may physically couple to the third mounting component **352**, such as via fastening by the third coupling **852**. The sleeve **844** may physically couple to the fourth mounting component **354**, such as via fastening by the fourth coupling **854**. The third and fourth couplings **852**, **854** may physically couple to the sleeve **844**. The third and fourth couplings **852**, **854** may be fastened to the third passage **366** and fourth passage **368** of FIG. **3**, respectively. The third coupling **852** and the fourth coupling **854** may be symmetrical and the same type of coupling, such that the third coupling **852** and the fourth coupling **854** may be used interchangeably. The third coupling **852** and the fourth coupling **854** may be followers for the sleeve **844**, where the third coupling **852** and the fourth coupling **854** may slide or roll within a groove patterned or molded from the sleeve **844**.

[0113] The third coupling **852** may have a second appendage **856**. The fourth coupling **854** may have a third appendage **858**. The second appendage **856** may be fit to and received by the third passage **366**. The third appendage **858** may be fit to and received by the fourth passage **368**. The second and third appendages **856**, **858** may extend through the third and fourth passages **366**, **368**, respectively. The second and third appendages **856**, **858** may have smooth outer surfaces with a low coefficient of frictions, such as for example where the second and third appendages **856**, **858** may be pegs. Likewise, the third passage **366** and fourth passage **368** may have smooth inner surfaces, such as for example where the third passage **366** and fourth passage **368** were smooth bore. The smooth surfaces of the second appendage **856** and the third passage **366** may allow for the third mounting component **352** to pivot about the second appendage **856**. Likewise, the smooth surfaces of the third appendage **858** and the fourth passage **368** may allow for the fourth mounting component **354** to pivot about the third appendage **858**. Features such as a clip **860** may fasten the third coupling **852** to the third mounting component **352**. The clip **860** may be a retainer ring (e.g., circlip) such as an E clip. The clip **860** may allow the third coupling **852** to spin about the fifth axis **316**. The clip **860** may prevent movement, such as sliding, of the third coupling **852** in a direction parallel with the fifth axis **316**. The clip **860** may be positioned about and fastened to the second appendage **856** while pressing against the third mounting component **352**. Another clip may fasten the fourth coupling **854** to the fourth mounting component **354**. For example, the another clip may be positioned about and fastened to the third appendage **858** while pressing against the fourth mounting component **354**. The another clip may be a retainer ring, such as an E clip, and may be symmetrical with the clip **860**.

[0114] Turning to FIG. **9**, it shows an eighth view **900** of the assembly **810**. The eighth view **900** is a sectional view of the assembly **810** that may be taken on the line **808** of FIG. **8**. The eighth view **900** shows an exterior **910**. The exterior **910** may represent a volume, such as packing space, about the assembly **810** and housing **814**.

[0115] The eighth view **900** shows a shaft **912** positioned about an axis **906**, such as to be centered around the axis **906**. The axis **906** may be parallel with the first axis **306** of FIG. **3**. The axis **906** may be collinear with or the first axis **306**. The housing **814** may include a wall **914**. The wall **914** may be partially cylindrical in shape and curve around the axis **906**. The wall **914** is around and include a perimeter surface of a cavity **916**. The wall **914** may include a plurality of passages **920**. The passages **920** may extend in a direction parallel with the axis **906** through the wall **914**. The cavity **916** may house the shift fork assembly **320**, the clutch assembly **816**, and the shaft **912**. The clutch assembly **816** may include a hub **926**. The sleeve **834** may be positioned about the hub **926**, such as radially about the hub **926**. The sleeve **834** be complementary to the hub **926**, such as to mesh with the hub **926**. The sleeve **834** and hub **926** may mesh via complementary features, such as via teeth of the sleeve **834** and teeth of the hub **926**. Both the sleeve **834** and hub **926** may be centered about the axis **906**. The clutch assembly **816** may include a plurality of dog teeth **930**. The dog teeth **930** may selectively couple sleeve **834** and hub **926** to a complementary rotational element of the clutch assembly **816**, where the sleeve **834** and hub **926** may rotationally couple to the complementary component. The cavity **916** may also house a first gear **932**, a second gear **934**, and a third gear **936**.

[0116] The first gear **932** may be positioned about the shaft **912**, such as to be encircled by or be positioned radially about the shaft **912**. The first gear **932** may rotationally couple to the shaft **912**. The first gear **932** may be a target gear, where the clutch assembly **816** may selectively couple to the first gear **932**. The clutch assembly **816** may selectively couple to the first gear **932** via the sleeve **834**. For example, the first gear **932** may rotationally couple to the shaft **912** via selective coupling between the first gear **932** and clutch assembly **816**. The clutch assembly **816** may rotationally and physically couple to the shaft **912** via the hub **926**. The sleeve **834** may selectively and rotationally couple to the first gear **932** via an engagement feature. The engagement feature may be complementary to the sleeve **834**, such as to mesh and selectively couple to the sleeve **834**. The engagement feature may rotationally couple to the first gear **932**, such as via physically coupling to the first gear **932**. The engagement feature may be or include an engagement ring or an engagement collar.

[0117] The first gear **932** may mesh with a second gear **934**, and the second gear **934** may mesh with a third gear **936**. When meshed, the first gear **932** may drivingly couple the second gear **934**, such that rotational energy may be transferred between the first gear **932** and second gear **934**. The first gear **932** may drive or be driven by the second gear **934**. When meshed, the second gear **934** may drivingly couple the third gear **936**, such that rotational energy may be transferred the second gear **934** and third gear **936**. The second gear **934** may drive or be driven by the third gear **936**. The rotational energy transferred between the first gear **932**, second gear **934**, and third gear **936** may be torque. The first gear **932**, second gear **934**, and the third gear **936** may be a part of a gear set when meshed.

[0118] The cover **822** may include a third fit **942**. The third fit **942** may receive the dowel **328** and a first insert **944**. The first insert **944** may be cylindrical in shape and hollow, where the cylindrical walls encircle the hollow portion. The first insert **944** may be positioned about the dowel **328**, such as to encircle the dowel **328**. The first insert **944** may be positioned radially between the third fit **942** and the dowel **328**. The first insert **944** may be a bearing or a race that may support and provide the dowel **328** a smooth surface to rotate within the third fit **942**.

[0119] The wall **914** may include a fourth fit **952**, and the body **340** may include a fifth fit **954**. The fourth fit **952** may receive a second insert **956**. The fifth fit **954** may receive a third insert **960** and the second insert **956**. The third insert **960** may be positioned about a dowel section **958** of the second insert **956**, such as to encircle the dowel section **958**. The third insert **960** may be positioned radially between the fifth fit **954** and the dowel section **958**. The third insert **960** may be a bearing or a race that may mechanically support the dowel section **958**. The dowel section **958** may be a dowel, such as a dowel pin or a dowel rod. The second insert **956** may be fixed to the housing **814** via the fourth fit **952**. The second insert **956** may be removable from fourth fit **952** from the exterior **910**. The third insert **960** may have a smooth inner surface, such that fifth fit **954** and third insert **960** may rotate about the dowel section **958**. The first structure **322** and the third insert **960** may pivot about the dowel section.

[0120] The assembly **810** may have a second coupling **962**. The second coupling **962** may shiftingly couple the clutch assembly **816** to the second mounting component **338**. The second coupling **962** may be fastened to the second mounting component **338**. The second coupling **962** is an engagement device, such as a pad. The second coupling **962** may be positioned between the second mounting component **338** and a sleeve **834**. The second coupling **962** may be fastened to the second mounting component **338**, such as via the second passage **364**. The second coupling **962** may have a second appendage **968**. The second appendage **968** may be complementary such as to fit to the second passage **364**. The second appendage **968** may be fastened to the second mounting component **338** via the second passage **364**. The second coupling **962** may have surface sharing contact with features of the sleeve **834**. The surfaces of sleeve **834** in surface sharing contact with the second coupling **962** may comprise a second area of contact. The sleeve engagement region may comprise the second area of contact. When in surface sharing contact with the sleeve **834**, the second coupling **962** may couple the sleeve **834** to the first structure **322**, such that the clutch assembly **816** may be actuated with the shift fork assembly **320**.

[0121] The second coupling **962** may have the same dimensions as the first coupling **832**. The second coupling **962** may be positioned to mirror the first coupling **832** on the opposite side of the axis **906**.

[0122] An appendage **972** may physically couple to the coupling component **348**, such as to be fixed to the coupling component **348**. The appendage **972** may be a mount or a fastener for target. A position sensor may track the target physically coupled to the appendage **972**. A target tracked by the position sensor may be used to record or estimate the position of the first structure **322**.

[0123] It is to be appreciated that the first and second axes **306**, **307**, and the components, feature, and systems centered about the first and second axes **306**, **307**, may not be parallel with the y-axis of the reference axes **301**. Likewise, it is to be appreciated that the third axis **312**, the fourth axis **314**, and the fifth axis **316**, and the components and systems centered about the aforementioned axes, may not be parallel with the x-axis of the reference axes **301**. For an example, the first and second axis **306**, **307** are may not be parallel with the y-axis of the reference axes **301**. The third axis **312**, the fourth axis **314**, and the fifth axis **316** may not be parallel with the x-axis of the reference axes **301**. The first axis **306**, the second axis **307**, the third axis **312**, the fourth axis **314**, and the fifth axis **316** are not parallel or horizontal with respect to the z-axis of the reference axes and the direction of gravity, such that the first axis **306**, the second axis **307**, the third axis **312**, the fourth axis **314**, and the fifth axis **316** are diagonal with respect to the z-axis of the reference axes **301** and the direction of gravity. Therefore, component, features, and systems centered on the first axis **306**, the second axis **307**, the third axis **312**, the fourth axis **314**, and/or the fifth axis **316** may not be centered on or be parallel with any of the axes of the reference axes **301**. Likewise, component, features, and systems centered on the first axis **306**, the second axis **307**, the third axis **312**, the fourth axis **314**, and/or the fifth axis **316** and may be diagonal with respect to the z-axis of the reference axes **301** and the direction of gravity.

[0124] Turning to FIG. **10**, it shows a ninth view **1000** of the actuator assembly **820**. The ninth view **1000** is a side view of the actuator assembly **820**. The ninth view **1000** shows the actuator assembly **820** separated from other components and features of the assembly **810** of FIG. **8**. The actuator assembly **820** may be positioned about the axis **1010**, where the actuator assembly **820** may be centered around the axis **1010**. The axis **1010** may be a shift axis for the shift implement **846** to be shifted along. The axis **1010** may also be a rotational axis for the shift implement **846** to spin about. The axis **1010** may be parallel with the second axis **307** of FIG. **3**. The axis **1010** may be collinear with or may be the second axis **307**.

[0125] The actuator assembly **820** may have an actuator **1020**. The actuator **1020** may drive the shift implement **846** in a first direction **1022** or a second direction **1024** along axis **1010**. The first direction **1022** may be opposite to the second direction **1024**, and the first direction **1022** and second direction **1024** may be parallel with the axis **1010**. The first direction **1022** and second direction **1024** may be represented schematically as arrows with relative positioning. For an example, the shift implement **846** may be screw, e.g., a shift screw. The actuator **1020** may be a motor. The actuator **1020** may be screw actuator, such as a ball screw actuator. The shift implement **846** may have a cover **1032**, such as a cap. The cover **1032** may encircle and enclose a portion of the shift implement **846**. The cover **1032** may prevent degradation of the shift implement **846**, such as from abutting other features of the assembly **810**.

[0126] The ninth view **1000** shows there may be a plurality of the first fasteners **850**, where the first fasteners may fasten the plate **840** to the actuator housing **842**. The actuator housing **842** may include a collar **1042**. The collar **1042** may be connected to the extension **849** via an arm **1040**. The collar **1042** may be positioned about the shift implement **846**, such as to encircle and be positioned radially about the shift implement **846**.

[0127] The collar **1042** may be between the cover **1032** and the sleeve **844** along the axis **1010**. The cover **1032** may be in the first direction **1022** from the collar **1042** and the arm **1040**. The sleeve **844** may be in the second direction **1024** from the collar **1042** and the arm **1040**. When advancing in the first direction **1022**, the sleeve **844** may abut the collar **1042**. The collar **1042** may stop the sleeve **844** from moving in the first direction **1022** past the collar **1042**.

[0128] The coupling **848** may include a base **1044**. The base **1044** may abut a surface of the sleeve **844**, where the surface may be normal to the axis **1010**, such as when sleeve **844** encircles the axis **1010**.

[0129] The collar **1042** may include a groove **1054**. The groove **1054** may be patterned to have an L like shape (e.g., an L-shaped groove). A coupling that may couple the collar **1042** to second structure **324** of FIG. **3**, such as the third coupling **852** or the fourth coupling **854** of FIG. **8**, may be fit to the groove **1054**. The couplings that may couple the collar **1042** to the second structure may be followers of the groove **1054**. For example, the third coupling **852** and/or the fourth coupling **854** may be followers for the groove **1054**. A groove symmetrical with the groove **1054**, may mirror and be opposite the axis **1010** from the groove **1054**. Likewise, a groove of a different pattern from groove **1054**, may be opposite the axis **1010** from the groove **1054**. The groove **1054** and the opposite groove may receive couplings that are on opposite arms of the second structure **324**. For example, the groove **1054** may receive and fit a portion of the fourth coupling **854**, while the groove opposite groove **1054** may receive and fit a portion of the third coupling **852**. The portion of the couplings fit to the groove **1054** may be a bearing component, such as a dowel component. The bearing component may be fit to the groove **1054**, such that the bearing component of the fastener may rotate within and be shifted by the pattern of the groove **1054**. The shifting of the collar **1042** may shift the bearing component and complementary fastener with the pattern of the groove **1054**. Therein components complementary to the fasteners, such as the second structure **324**, may be shifted and pivoted by the groove **1054**. The second structure **324** may be pivoted and shifted via the groove **1054** to engage and disengage the shift fork assembly **320** to different positions.

[0130] In this way, a shift fork assembly may engage an engaging component of a clutch and prevent the transfer of force to an actuator assembly. The actuator assembly may shift the shift fork to engage a clutch. The shift fork assembly may include a clutch collar and a shift actuator collar positioned side by side. The clutch collar may couple to one or more engaging components of the clutch. The shift actuator collar may couple to components of the actuator assembly so as to be shifted by the actuator assembly. The clutch collar and the shift actuator collar may be positioned about a dowel centered on a common axis. Likewise, a spring may be positioned about the clutch collar and the shift actuator collar. The clutch collar and the shift actuator collar may rotate independently of one another from torque-driven forces. In some examples, the shift actuator collar may pivot independently of the clutch collar about a common axis. In other examples, both the shift actuator collar and the clutch collar are capable of independent rotation of one another about the common axis. The spring may provide a counter force to forces through the shift fork assembly and may also change shape and dimensions elastically with force. The spring, and independent pivoting of the shift actuator collar from the clutch collar, may prevent rotation forces from being transferred to the actuator assembly. In this way, the disclosed shift fork assembly may reduce acute and chronic degradation to the shifting implement and actuator of the actuator assembly, and reduce service time resulting from degradation and misalignment.

[0131] While various embodiments have been described above, it should be understood that they have been presented by way of example, and not limitation. It will be apparent to persons skilled in the relevant arts that the disclosed subject matter may be embodied in other specific forms without departing from the spirit of the subject matter. The embodiments described above are therefore to be considered in all respects as illustrative, not restrictive. As such, the configurations and routines disclosed herein are exemplary in nature, and that these specific examples are not to be considered in a limiting sense, because numerous variations are possible. For example, the above technology can be applied to powertrains that include different types of propulsion sources including different types of prime movers, internal combustion engines, and/or transmissions. The subject matter of the present disclosure includes all novel and non-obvious combinations and sub-combinations of the various systems and configurations, and other features, functions, and/or properties disclosed herein.

[0132] Note that the example control and estimation routines included herein can be used with various engine, electric machine, transmission, and/or vehicle system configurations. The control methods and routines disclosed herein may be stored as executable instructions in non-transitory memory and may be carried out by the control system including the controller in combination with the various sensors, actuators, and other engine hardware. The specific routines described herein may represent one or more of any number of processing strategies such as event-driven, interrupt-driven, multi-tasking, multi-threading, and the like. As such, various actions, operations, and/or functions illustrated may be performed in the sequence illustrated, in parallel, or in some cases omitted. Likewise, the order of processing is not necessarily required to achieve the features and advantages of the example embodiments described herein, but is provided for ease of illustration

and description. One or more of the illustrated actions, operations, and/or functions may be repeatedly performed depending on the particular strategy being used. Further, the described actions, operations, and/or functions may graphically represent code to be programmed into non-transitory memory of the computer readable storage medium in the engine control system, where the described actions are carried out by executing the instructions in a system including the various engine hardware components in combination with the electronic controller.
[0133] It will be appreciated that the configurations and routines disclosed herein are exemplary in nature, and that these specific embodiments are not to be considered in a limiting sense, because numerous variations are possible. For example, the above technology can be applied to V-6, I-4, I-6, V-12, opposed 4, and other engine types. Moreover, unless explicitly stated to the contrary, the terms “first,” “second,” “third,” and the like are not intended to denote any order, position, quantity, or importance, but rather are used merely as labels to distinguish one element from another. The subject matter of the present disclosure includes all novel and non-obvious combinations and sub-combinations of the various systems and configurations, and other features, functions, and/or properties disclosed herein.
[0134] The following claims particularly point out certain combinations and sub-combinations regarded as novel and non-obvious. These claims may refer to “an” element or “a first” element or the equivalent thereof. Such claims should be understood to include incorporation of one or more such elements, neither requiring nor excluding two or more such elements. Other combinations and sub-combinations of the disclosed features, functions, elements, and/or properties may be claimed through amendment of the present claims or through presentation of new claims in this or a related application. Such claims, whether broader, narrower, equal, or different in scope to the original claims, also are regarded as included within the subject matter of the present disclosure.

Claims

1. A shift fork assembly comprising: a clutch collar; a shift actuator collar positioned side by side to the clutch collar; a dowel inserted through the clutch collar and the shift actuator collar; and a C-shaped spring positioned over a first portion of the clutch collar and a second portion of the shift actuator collar, and the dowel being concentric to the C-shaped spring.
2. The shift fork assembly of claim 1, where the shift fork assembly is a rotational shift fork assembly, such that the shift actuator collar rotates independently of the clutch collar.
3. The shift fork assembly of claim 2, where the clutch collar is coupled to a clutch assembly.
4. The shift fork assembly of claim 3, where the clutch collar is a dog clutch collar and the clutch assembly is a dog clutch assembly.
5. The shift fork assembly of claim 3, where the clutch assembly includes an engaging component, where the clutch collar is coupled to the engaging component via at least a mount of the clutch collar and a coupling, where the coupling is fastened to the clutch collar via the mount, where shifting the clutch collar shifts the engaging component to a position.
6. The shift fork assembly of claim 5, where the shift actuator collar is coupled to an actuator assembly, such that shifting the actuator assembly shifts the shift actuator collar and the shift fork assembly.
7. The shift fork assembly of claim 6, where the shift actuator collar has a first maximum angle, where the shift actuator collar is rotated to the first maximum angle in a first angular direction from being parallel with the clutch collar.
8. The shift fork assembly of claim 7, where the shift actuator collar has a second maximum angle, where the shift actuator collar is rotated to the second maximum angle in a second angular direction from being parallel with the clutch collar, where the second angular direction is opposite the first angular direction.
9. The shift fork assembly of claim 8, where the first maximum angle and the second maximum

angle are defined by a gap of the C-shaped spring, where the shift actuator collar stops rotating at the first maximum angle from surface sharing contact with a first edge of the gap, where the shift actuator collar stops rotating at the second maximum angle from surface sharing contact with a second edge of the gap.

10. The shift fork assembly of claim 9, where the C-shaped spring is positioned about a first sleeve of the clutch collar and a second sleeve of the shift actuator collar.

11. The shift fork assembly of claim 10, where the first sleeve is the first portion and the second sleeve is the second portion, where the dowel is received by a first complementary fit of the first sleeve and a second complementary fit of the second sleeve, where the first complementary fit and the second complementary fit are centered about a common axis.

12. The shift fork assembly of claim 11, where the clutch collar is positioned about a first axis and the shift actuator collar is positioned about a second axis, where the clutch assembly is centered about the first axis when coupled to the clutch collar, where the actuator assembly is centered about the second axis when coupled to the shift actuator collar.

13. A transmission comprising: a plurality of gear sets; and a shift fork assembly configured to shift between gear sets of the transmission, the shift fork assembly including a shift actuator, a first structure, and a second structure that rotate independently of each other, the first structure and the second structure configured to be shifted to a same position by the shift actuator, the first structure coupleable to a component of a clutch and the second structure physically coupleable to the shift actuator, wherein the first structure and the second structure are separated by a first gap and a second gap, the second gap being a clearance allowing for rotation of the second structure independently from the first structure, the first structure and the second structure centered about a common axis.

14. The transmission of claim 13, further comprising a dowel positioned through the first structure and second structure.

15. The transmission of claim 14, wherein the dowel is positioned through a first sleeve of the first structure and a second sleeve of the second structure.

16. The transmission of claim 15, wherein the dowel is centered on the common axis of the first structure and second structure, such that the first structure and second structure pivot about the dowel.

17. The transmission of claim 16, further comprising a spring positioned about portions of the first structure and second structure, and across the first gap.

18. The transmission of claim 17, wherein the spring is C-shaped, the C-shaped spring positioned about the first sleeve and the second sleeve to limit rotation.

19. The transmission of claim 13, wherein the first structure is a clutch collar.

20. The transmission of claim 13, wherein the second structure is an actuator collar.