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(54) SWITCHING ROCKER ARM FOR INTERNAL EXHAUST GAS RECIRCULATION WITH SIMPLE LATCH CONTROL

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(73) Proprietor: **Eaton Corporation**
Cleveland, OH 44122 (US)

(72) Inventors:
- **VANCE, Matthew**
  Kalamazoo, MI 49009 (US)
- **ALAGARSAMY, Guruprasath**
  Tamil Nadu (IN)

(74) Representative: **Schwan Schorer & Partner mbB**
Patentanwälte
Bauerstrasse 22
80796 München (DE)

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Description

FIELD

[0001] The present disclosure relates generally to switching roller finger followers or rocker arms in internal combustion engines.

BACKGROUND

[0002] Variable valve actuation (WA) technologies have been introduced and documented. One WA device may be a variable valve lift (WL) system, a cylinder deactivation (CDA) system such as that described in U.S. Patent 8,215,275 entitled "Single Lobe Deactivating Rocker Arm". Such mechanisms are developed to improve performance, fuel economy, and/or reduce emissions of the engine. Several types of the WA rocker arm assemblies include an inner rocker arm within an outer rocker arm that are biased together with torsion springs.

[0003] Switching rocker arms allow for control of valve actuation by alternating between latched and unlatched states. A latch, when in a latched position causes both the inner and outer rocker arms to move as a single unit. When unlatched, the rocker arms are allowed to move independent of each other. In some circumstances, these arms can engage different cam lobes, such as low-lift lobes, high-lift lobes, and no-lift lobes. Mechanisms are required for switching rocker arm modes in a manner suited for operation of internal combustion engines.
The background description provided herein is for the purpose of generally presenting the context of the disclosure.

[0004] DE 103 10 219 A1 relates to a switching rocker arm wherein that end of the inner arm which is pivotally secured to one end of the outer arm is operably associated with an engine valve and wherein the other end of the outer arm is located between the hubs provided at the inner arm for carrying the lost motion torsion springs and the end of the inner arm operably associated with the engine valve. US 2011/0226209 A1 relates to a switching rocker arm wherein the hubs carrying the lost motion torsion springs also act to pivotally secure one end of the inner arm to the outer arm, which end of the inner arm is associated with the lash adjuster.

SUMMARY

[0005] The invention relates to a switching rocker arm as defined in claim 1.

[0006] According to additional features, the switching rocker arm further comprises slider pads configured on the outer arm. The roller and the bearing cooperate to accommodate a main lift and the slider pads are configured to accommodate a secondary lift. The latch and the first and second torsion springs are positioned at the inner arm first end. The inner arm further includes a socked arranged at the inner arm first end and a valve pad positioned at the inner arm second end. A pivot axle can rotatably couple the inner arm and the outer arm. The outer arm second end extends generally above the pivot axle in a direction generally opposite the valve pad. The socket is configured to receive a ball plunger end of a dual feed hydraulic lash adjuster.

[0007] According to other features, the inner arm further comprises a rear stopper that is configured to selectively engage the outer arm. The first and second ends of both of the first and second lost motion springs are free from engagement with the outer arm first end. The first and second lost motion torsion springs have respective coil portions that are mounted on the respective first and second hubs. The first and second leg retaining tabs are each generally in the shape of a hook having a respective extension. The first leg of the first lost motion spring is positioned between the first outer side arm and the extension of the first leg retaining tab. The second leg of the second lost motion spring is positioned between the second outer side arm and the extension of the second leg retaining tab.

[0008] A switching rocker arm constructed in accordance to another example of the present disclosure includes an outer arm, an inner arm, a latch, a roller and bearing, a first and second lost motion torsion spring and a pivot axle. The inner arm is pivotally secured to the outer arm and has a latch bore. The inner arm has a first inner side arm, a second inner side arm, an inner arm first end having a socket and an inner arm second end having a valve pad, the inner arm first end has a first finger, a second finger, a first hub and a second hub. The latch is slidably connected to the inner arm at the latch bore and is configured to selectively extend to engage the outer arm. The roller and bearing are configured on the inner arm. The first and second lost motion torsion spring are mounted on respective first and second hubs and are configured to bias the inner arm. The first and second lost motion torsion springs can each have a first leg and a second leg. The first leg of the first lost motion spring engages the second leg retaining tab. The second leg of the first lost motion spring engages the second finger. The first leg of the second lost motion spring engages the first leg retaining tab. The second leg of the second lost motion torsion spring engages the first finger. The pivot axle rotatably couples the inner arm and the outer arm. The outer arm second end extends generally above the pivot axle in a direction generally opposite the valve pad.

[0009] According to other features, the first and second fingers of the inner arm and the first and second leg retaining tabs are all positioned intermediate (i) the first and second hubs and (ii) the bearing. Slider pads are configured on the outer arm. The roller and the bearing cooperate to accommodate a main lift. The slider pads are configured to accommodate a secondary lift. The latch and the first and second torsion springs are positioned at the inner arm first end. The socket is configured to receive a ball plunger end of a dual feed hydraulic lash

adjuster. The inner arm further comprises a rear stopper that is configured to selectively engage the outer arm. The first and second ends of both of the first and second lost motion torsion springs are free from engagement with the outer arm first end.

[0010] According to still other features, the first and second lost motion torsion springs have respective coil portions that are mounted on the respective first and second hubs. The first and second leg retaining tabs are each generally in the shape of a hook having a respective extension. The first leg of the lost motion spring is positioned between the first outer side arm and the extension of the first leg retaining tab. The second leg of the second lost motion spring is positioned between the second outer side arm and the extension of the second leg retaining tab.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The present disclosure will become more fully understood from the detailed description and the accompanying drawings, wherein:

FIG. 1 is a top perspective view of an exemplary switching rocker arm constructed in accordance to one example of the present disclosure;
FIG. 2 is a bottom perspective view of the switching rocker arm of FIG. 1;
FIG. 3 is an exploded view of the switching rocker arm of FIG. 1;
FIG. 4 is a side view of the switching rocker arm of FIG. 1;
FIG. 5 is a top view of the switching rocker arm of FIG. 1;
FIG. 6 is a first end view of the switching rocker arm of FIG. 1;
FIG. 7 is a second end view of the switching rocker arm of FIG. 1;
FIG. 8 is a sectional view taken along lines 8-8 of FIG. 5; and
FIG. 9 is a sectional view taken along lines 9-9 of FIG. 5;

DETAILED DESCRIPTION

[0012] With reference to FIGS. 1-9, an exemplary switching rocker arm assembly constructed in accordance to one example of the present disclosure is shown and generally identified at reference 10. The switching rocker arm assembly 10 can be a compact cam-driven single-lobe cylinder deactivation (CDA-1L) switching rocker arm installed on a piston-driven internal combustion engine, and actuated with the combination of a duel-feed hydraulic lash adjusters (DFHLA) 12 (FIG. 8) and oil control valves (OCV). The switching rocker arm assembly 10 can be engaged by a single lobe cam. The switching rocker arm assembly 10 can include an inner arm 22 and an outer arm 24. The inner arm 22 generally comprises a first inner side arm 22a, a second inner side arm 22b, an inner arm first end 22c and an inner arm second end 22d. The outer arm 24 generally comprises a first outer side arm 24a, a second outer side arm 24b, an outer arm first end 24c and an outer arm second end 24d. The outer arm 24 further defines a latch bore 25 (FIG. 8).

[0013] As will become appreciated from the following discussion, the inner arm 22 and the outer arm 24 can be locked together, causing an engine valve to open and allowing the cylinder to operate as it would in a standard valvetrain. As further shown in FIG. 8, the inner arm 22 can have a valve pad 26 arranged at the inner arm second end 22d and configured to engage a valve 27. The inner arm 22 can further include a socket 28 arranged at the inner arm first end 24c and configured to receive a ball plunger end 29 of the DFHLA 12. The socket 28 and ball plunger end 29 can allow rotational freedom of movement in all directions. This can permit side and possibly asymmetrical loading of the ball plunger end in certain operating modes.

[0014] The DFHLA 12 has two oil ports. A lower oil port provides lash compensation and is fed engine oil similar to a standard HLA. An upper oil port, referred as the switching pressure port, provides the conduit between controlled oil pressure from the OCV and a latch assembly 32. The latch assembly 32 includes a latch pin 34 and a biasing member 36. When the latch pin 34 is engaged (extended outwardly along the latch bore 25), the inner arm 22 and the outer arm 24 operate together like a standard rocker arm to open the engine valve. The inner arm 22 includes a rear stopper 38 generally arranged at the inner arm first end 22c that is configured to engage the outer arm 24. In the no-lift (unlatched) position, the inner arm 22 and the outer arm 24 can move independently to enable cylinder deactivation. Additional description of the operation of the DFHLA 12 may be found in commonly owned United States Patent No. 8,915,225.

[0015] A first and second lost motion torsion spring 40 and 42 are incorporated to bias the position of the inner arm 22 so that it always maintains continuous contact with the camshaft lobe. With particular reference to FIG. 3, the first torsion spring 40 has a first leg 40a, a second leg 40b and a coil portion 40c. The second torsion spring 42 has a first leg 42a, a second leg 42b and a coil portion 42c. The outer arm 24 has a first leg retaining tab 44a and a second leg retaining tab 44b. The first and second leg retaining tabs 44a, 44b are each generally in the shape of a hook having a respective extension 44c and 44d. The inner arm 22 has a first finger 46a and a second finger 46b. The first leg 40a of the first torsion spring 40 engages the second leg retaining tab 44b while the second leg 40b of the first torsion spring engages the second finger 46b. The first leg 42a of the second torsion spring 42 engages the first leg retaining tab 44a while the second leg 42b of the second torsion spring engages the first finger 46a. Specifically, the first leg 40a is positioned between the first outer side arm 24a and the extension

44c while the second leg 40b is positioned between the second outer side arm 24b and the extension 44d. The inner arm first end 22c includes hubs 48a and 48b that receive the respective coil portions 40c and 42c.

[0016] The inner arm 22 and the outer arm 24 are both mounted to a pivot axle 50. The pivot axle 50 can be located adjacent to a first end 52 of the rocker arm assembly 10, which secures the inner arm 22 to the outer arm 24 while also allowing a rotational degree of freedom pivoting about the pivot axle 50 when the rocker arm assembly 10 is in a deactivated state. The latch assembly 32 that selectively couples the inner and outer arms 22 and 24 is arranged on an opposite second end 54 of the rocker arm assembly 10. In addition to the illustrated example having a separate pivot axle 50 mounted to the outer arm 24 and the inner arm 22, the pivot axle 50 may be integral to the outer arm 24 or to the inner arm 22. The rocker arm assembly 10 can include a bearing 60 having a roller 62 that is mounted between the first and second inner side arms 22a and 22b on a bearing axle 64 that, during normal operation of the rocker arm assembly 10 serves to transfer energy from a rotating cam to the rocker arm assembly 10.

[0017] The configuration of the switching rocker arm assembly 10 provides a compact design. In this regard, the first and second fingers 46a and 46b of the inner arm 22 as well as the first and second leg retaining tabs 44a and 44b are positioned intermediate the hubs 48a, 48b and the bearing 60 (as best shown in FIG. 5). Moreover, the latch assembly 32 and the first and second torsion springs 40, 42 are all located at the same end (inner arm first end 22c) of the inner rocker arm 22. In addition, the outer arm second end 24d extends generally above the pivot axle 50 in a direction generally opposite the valve pad rather than in front of the inner arm second end 22d providing further packaging advantages.

[0018] The switching rocker arm assembly 10 enables the variability in valve lift by inducing lost motion for one lift profile while transmitting the secondary lift profile to the valve or vice versa. Generally, the latching pin or connecting mechanism is tightly controlled to minimize the effect of the clearance on to the valve lift. However, depending on the application and purpose of the secondary valve lift, not all designs need to be tightly controlled. In one such application, where latch clearance to the interfacing arm is not having a wider pronounced effect on the valve. A design that could achieve this configuration has optimal requirements in the manufacturing process. There are also benefits in terms of compactness, cost and better kinematic performance with further optimization of the rocker arm parameters layout.

[0019] The rocker arm assembly 10 achieves the main valve lift in the roller 60 and the secondary valve lift in slider pads 80a and 80b due to the application duty cycle. A normally unlatched design is employed to selectively use the secondary valve lift when required per the engine duty cycle. The inner arm 22 houses the bearing 60 and roller 62 while the outer arm 24 encompasses the slider pads 80a and 80b in the cam interface area. The pivot axle 50 connects both the inner and outer arms 22, 24 and is placed over the top of the engine valve. The inner arm 22 is mounted over the hydraulic lash adjuster 12 and interfaces with a ball socket area of the lash adjuster 12 in a tangential contact (FIG. 8).

[0020] The latch pin assembly 32 is positioned at the second end 54 of the rocker arm assembly 10 at the inner arm first end 22c extending outward, away from the rocker arm assembly 10 for latching. In this regard, the latch pin assembly 32 is arranged on a common side as the springs 40 and 42. The configuration provides an improved packaging layout over prior art configurations. The rocker arm assembly 10 includes a compact design for improved kinematics. The rocker arm assembly 10 provides reduced mass over valve for improved dynamics. The main rocker event is over roller design for optimized friction. The overall rocker arm packaging is optimized specifically for a given engine.

Claims

1. A switching rocker arm (10) comprising:

an outer arm (24) having a first outer side arm (24a), a second outer side arm (24b), an outer arm first end (24c) and an outer arm second end (24d), the first outer side arm having a first leg retaining tab (44a), the second outer side arm having a second leg retaining tab (44b);

an inner arm (22) pivotally secured to the outer arm and having a latch bore (25), the inner arm having a first inner side arm (22a), a second inner side arm (22b), an inner arm first end (22c) and an inner arm second end (22d), the inner arm second end pivotally secured to the outer arm and configured to be operably associated with an engine valve (27), the inner arm first end having a first finger (46a), a second finger (46b), a first hub (48a) and a second hub (48b);

a latch (32) slidably connected to the inner arm first end at the latch bore and configured to selectively extend to engage the outer arm first end, the first and second hubs positioned intermediate the outer arm first end and the inner arm second end;

a roller (62) and bearing (60) configured on the inner arm;

a first and second lost motion torsion spring (40, 42) mounted on the respective first and second hubs and configured to bias the inner arm, the first and second lost motion torsion springs each having a first leg (40a, 42a) and a second leg (40b, 42b), wherein (i) the first leg of the first lost motion spring engages the second leg retaining tab and the second leg of the first lost motion spring engages the second finger, and (ii) the

first leg of the second lost motion spring engages the first leg retaining tab and the second leg of the second lost motion torsion spring engages the first finger; and
wherein the first and second fingers of the inner arm and the first and second leg retaining tabs are all positioned intermediate (i) the first and second hubs and (ii) the bearing.

2. The switching rocker arm of claim 1, further comprising slider pads (80a, 80b) configured on the outer arm (24), wherein the roller (62) and bearing (60) cooperate to accommodate a main lift and the slider pads are configured to accommodate a secondary lift.

3. The switching rocker arm of claim 1 wherein the latch (32) and the first and second torsion springs (40, 42) are positioned at the inner arm first end (22c).

4. The switching rocker arm of claim 3 wherein the inner arm (22) further includes a socket (28) arranged at the inner arm first end (22c) and a valve pad (26) positioned at the inner arm second end (22d).

5. The switching rocker arm of claim 4, further comprising a pivot axle (50) that rotatably couples the inner arm (22) and the outer arm (24), wherein the outer arm second end (24d) extends generally above the pivot axle in a direction generally opposite the valve pad (26).

6. The switching rocker arm of claim 5 wherein the socket (28) is configured to receive a ball plunger end (29) of a dual feed hydraulic lash adjuster (12).

7. The switching rocker arm of claim 1 wherein the inner arm (22) further comprises a rear stopper (38) that is configured to selectively engage the outer arm (24).

8. The switching rocker arm of claim 1 wherein the first and second ends of both of the first and second lost motion torsion springs (40, 42) are free from engagement with the outer arm first end (24c).

9. The switching rocker arm of claim 1 wherein the first and second lost motion torsion springs (40, 42) have respective coil portions (40c, 42c) that are mounted on the respective first and second hubs (48a, 48b).

10. The switching rocker arm of claim 1 wherein the first and second leg retaining tabs (44a, 44b) are each generally in the shape of a hook having a respective extension (44c, 44d).

11. The switching rocker arm of claim 10 wherein the first leg (40a) of the first lost motion spring (40) is positioned between the first outer side arm (24a) and the extension (44c) of the first leg retaining tab (44a) while the second leg (42b) of the second lost motion spring (42) is positioned between the second outer side arm (24b) and the extension (44d) of the second leg retaining tab (44b).

Patentansprüche

1. Schaltkipphebel (10) mit:

einem Außenarm (24) mit einem ersten Außenseitenarm (24a), einem zweiten Außenseitenarm (24b), einem ersten Außenarmende (24c) und einem zweiten Außenarmende (24d), wobei der erste Außenseitenarm einen ersten Schenkelhaltevorsprung (44a) und der zweiten Außenseitenarm einen zweiten Schenkelhaltevorsprung (44b) aufweist;
einem Innenarm (22), der schwenkbar an dem Außenarm befestigt ist und eine Verriegelungsbohrung (25) aufweist, wobei der Innenarm einen ersten Innenseitenarm (22a), einen zweiten Innenseitenarm (22b), ein erstes Innenarmende (22c) und ein zweites Innenarmende (22d) aufweist, wobei das zweite Innenarmende schwenkbar an dem Außenarm befestigt ist und ausgebildet ist, um in Wirkverbindung mit einem Motorventil (27) assoziiert zu sein, wobei das erste Innenarmende einen ersten Finger (46a), einen zweiten Finger (46b), eine erste Nabe (48a) und eine zweite Nabe (48b) aufweist;
einer Verriegelung (32), die gleitend mit dem ersten Innenarmende an der Verriegelungsbohrung verbunden ist und ausgebildet ist, um sich selektiv zu erstrecken, um mit dem ersten Außenarmende in Eingriff zu treten, wobei die erste Nabe und die zweite Nabe zwischen dem ersten Außenarmende und dem zweiten Innenarmende angeordnet sind;
einer Rolle (62) und einem Lager (60), das auf dem Innenarm konfiguriert ist;
einer ersten und einer zweiten Totgangtorsionsfeder (40, 42), die auf der ersten bzw. zweiten Nabe montiert sind und ausgebildet sind, um den Innenarm vorzuspannen, wobei die erste und zweite Totgangtorsionsfeder jeweils einen ersten Schenkel (40a, 42a) und einen zweiten Schenkel (40b, 42b) aufweisen, wobei (i) der erste Schenkel der ersten Totgangfeder mit dem zweiten Schenkelhaltevorsprung in Eingriff steht und der zweite Schenkel der ersten Totgangfeder mit dem zweiten Finger in Eingriff steht, und wobei (ii) der erste Schenkel der zweiten Totgangfeder mit dem ersten Schenkelhaltevorsprung in Eingriff steht und der zweite Schenkel der zweiten Totgangtorsionsfeder mit

dem ersten Finger in Eingriff steht; und
wobei der erste und zweite Finger des Innenarms und der erste und zweite Schenkelhaltevorsprung jeweils zwischen (i) der ersten und zweiten Nabe und (ii) dem Lager angeordnet sind.

2. Schaltkipphebel gemäß Anspruch 1, ferner versehen mit auf dem Außenarm (24) konfigurierten Gleitflächen (80a, 80b), wobei die Rolle (62) und das Lager (60) zusammenwirken, um einen Haupthub zu implementieren und die Gleitflächen ausgebildet sind, um einen Sekundärhub zu implementieren.

3. Schaltkipphebel gemäß Anspruch 1, wobei die Verriegelung (32) und die erste und zweite Torsionsfeder (40, 42) auf dem ersten Innenarmende (22c) angeordnet sind.

4. Schaltkipphebel gemäß Anspruch 3, wobei der Innenarm (22) ferner eine an dem ersten Innenarmende (22c) angeordnete Buchse (28) und eine an dem zweiten Innenarmende (22d) angeordnete Ventilfläche (26) aufweist.

5. Schaltkipphebel gemäß Anspruch 4, ferner versehen mit einer Schwenkachse (50), welche den Innenarm (22) und den Außenarm (24) drehbar koppelt, wobei das zweite Außenarmende (24d) sich im Wesentlichen oberhalb der Schwenkachse in einer Richtung im Wesentlichen entgegengesetzt zu der Ventilfläche (26) erstreckt.

6. Schaltkipphebel gemäß Anspruch 5, wobei die Buchse (28) ausgebildet ist, um ein Kugelkolbenende (29) einer Doppelzufuhr-Hydraulikspiel-Einstellvorrichtung (12) aufzunehmen.

7. Schaltkipphebel gemäß Anspruch 1, wobei der Innenarm (22) ferner einen hinteren Anschlag (38) aufweist, der ausgebildet ist, um mit dem Außenarm (24) selektiv in Eingriff zu treten.

8. Schaltkipphebel gemäß Anspruch 1, wobei die ersten und zweiten Enden sowohl der ersten als auch der zweiten Totgangtorsionsfeder (40, 42) nicht in Eingriff mit dem ersten Außenarmende (24c) stehen.

9. Schaltkipphebel gemäß Anspruch 1, wobei die erste und zweite Totgangtorsionsfeder (40, 42) entsprechende Spulenabschnitte (40c, 42c) aufweisen, die auf einer der jeweiligen ersten und zweiten Nabe (48a, 48b) montiert sind.

10. Schaltkipphebel gemäß Anspruch 1, wobei der erste und zweite Schenkelhaltevorsprung (44a, 44b) jeweils im Wesentlichen in der Form eines Hakens mit einer entsprechenden Verlängerung (44c, 44d) ausgebildet ist.

11. Schaltkipphebel gemäß Anspruch 10, wobei der erste Schenkel (40a) der ersten Totgangfeder (40) zwischen dem ersten Außenseitenarm (24a) und der Verlängerung (44c) des ersten Schenkelhaltevorsprungs (44a) ausgebildet ist, während der zweite Schenkel (44b) der zweiten Totgangfeder (42) zwischen dem zweiten Außenseitenarm (24b) und der Verlängerung (44d) des zweiten Schenkelhaltevorsprungs (44b) angeordnet ist.

Revendications

1. Culbuteur de commutation (10) comprenant :

un bras externe (24) ayant un premier bras latéral externe (24a), un second bras latéral externe (24b), une première extrémité de bras externe (24c) et une seconde extrémité de bras externe (24d), le premier bras latéral externe ayant une première languette de retenue de patte (44a), le second bras latéral externe ayant une seconde languette de retenue de patte (44b) ;
un bras interne (22) fixé de manière pivotante sur le bras externe et ayant un alésage de verrou (25), le bras interne ayant un premier bras latéral interne (22a), un second bras latéral interne (22b), une première extrémité de bras interne (22c) et une seconde extrémité de bras interne (22d), la seconde extrémité de bras interne étant fixée de manière pivotante sur le bras externe et configurée pour être associée de manière opérationnelle avec une soupape de moteur (27), la première extrémité de bras interne ayant un premier doigt (46a), un second doigt (46b), un premier moyeu (48a) et un second moyeu (48b) ;
un verrou (32) raccordé de manière coulissante à la première extrémité de bras interne au niveau de l'alésage de verrou et configuré pour s'étendre sélectivement afin de mettre en prise la première extrémité de bras externe, les premier et second moyeux étant positionnés entre la première extrémité de bras externe et la seconde extrémité de bras interne ;
un rouleau (62) et un palier (60) configurés sur le bras interne ;
un premier et un second ressort de torsion de déplacement à vide (40, 42) monté sur les premier et second moyeux respectifs et configurés pour solliciter le bras interne, les premier et second ressorts de torsion de déplacement à vide ayant chacun une première patte (40a, 42a) et une seconde patte (40b, 42b), dans lequel (i) la première patte du premier ressort de déplace-

ment à vide met en prise la seconde languette de retenue de patte et la seconde patte du premier ressort de déplacement à vide met en prise le second doigt, et (ii) la première patte du second ressort de déplacement à vide met en prise la première languette de retenue de patte et la seconde patte du second ressort de torsion de déplacement à vide met en prise le premier doigt ; et

dans lequel les premier et second doigts du bras interne et les première et seconde languettes de retenue de patte sont tous positionnés entre (i) les premier et second moyeux et (ii) le palier.

2. Culbuteur de commutation selon la revendication 1, comprenant en outre des patins coulissants (80a, 80b) configurés sur le bras externe (24), dans lequel le rouleau (62) et le palier (60) coopèrent pour accepter un levage principal et les patins coulissants sont configurés pour accepter un levage secondaire.

3. Culbuteur de commutation selon la revendication 1, dans lequel le verrou (32) et les premier et second ressorts de torsion (40, 42) sont positionnés au niveau de la première extrémité de bras interne (22c).

4. Culbuteur de commutation selon la revendication 3, dans lequel le bras interne (22) comprend en outre une douille (28) agencée au niveau de la première extrémité de bras interne (22c) et un patin de soupape (26) positionné au niveau de la seconde extrémité de bras interne (22d).

5. Culbuteur de commutation selon la revendication 4, comprenant en outre un essieu de pivot (50) qui couple en rotation le bras interne (22) et le bras externe (24), dans lequel la seconde extrémité de bras externe (24d) s'étend généralement au-dessus de l'essieu de pivot dans une direction généralement opposée au patin de soupape (26).

6. Culbuteur de commutation selon la revendication 5, dans lequel la douille (28) est configurée pour recevoir une extrémité de piston plongeur à bille (29) d'un rattrapeur de jeu hydraulique à double alimentation (12).

7. Culbuteur de commutation selon la revendication 1, dans lequel le bras interne (22) comprend en outre une butée arrière (38) qui est configurée pour mettre sélectivement en prise le bras externe (24).

8. Culbuteur de commutation selon la revendication 1, dans lequel les première et seconde extrémités des premier et second ressorts de torsion de déplacement à vide (40, 42) sont dépourvues de mise en prise avec la première extrémité de bras externe (24c).

9. Culbuteur de commutation selon la revendication 1, dans lequel les premier et second ressorts de torsion de déplacement à vide (40, 42) ont des parties hélicoïdales (40c, 42c) respectives qui sont montées sur les premier et second moyeux (48a, 48b) respectifs.

10. Culbuteur de commutation selon la revendication 1, dans lequel les première et seconde languettes de retenue de patte (44a, 44b) sont chacune généralement de la forme d'un crochet ayant une extension (44c, 44d) respective.

11. Culbuteur de commutation selon la revendication 10, dans lequel la première patte (40a) du premier ressort de déplacement à vide (40) est positionnée entre le premier bras latéral externe (24a) et l'extension (44c) de la première languette de retenue de patte (44a) alors que la seconde patte (42b) du second ressort de déplacement à vide (42) est positionnée entre le second bras latéral externe (24b) et l'extension (44d) de la second languette de retenue de patte (44b).

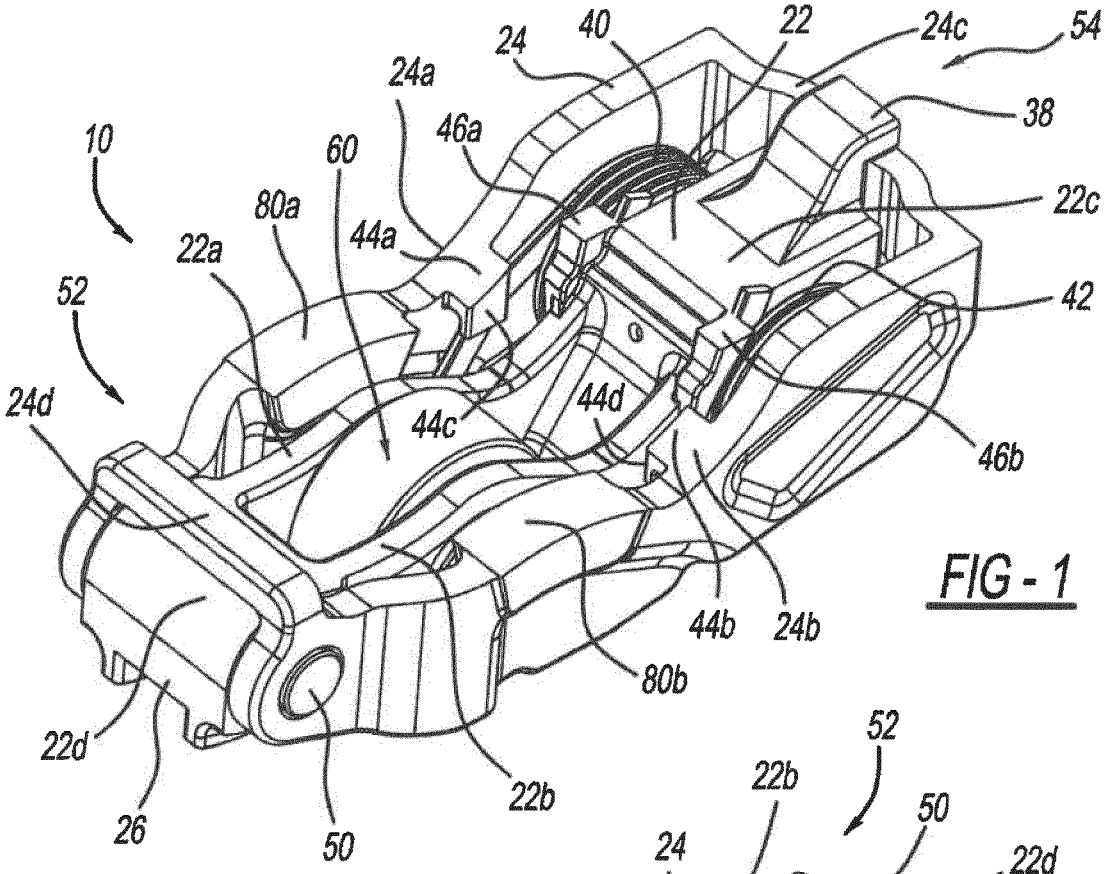
10
52
24d
22a
80a
60
24
40
22
24c
54
24a
46a
38
44a
22c
42
44c
44d
46b
44b
24b
80b
22d
26
50
22b

FIG - 1

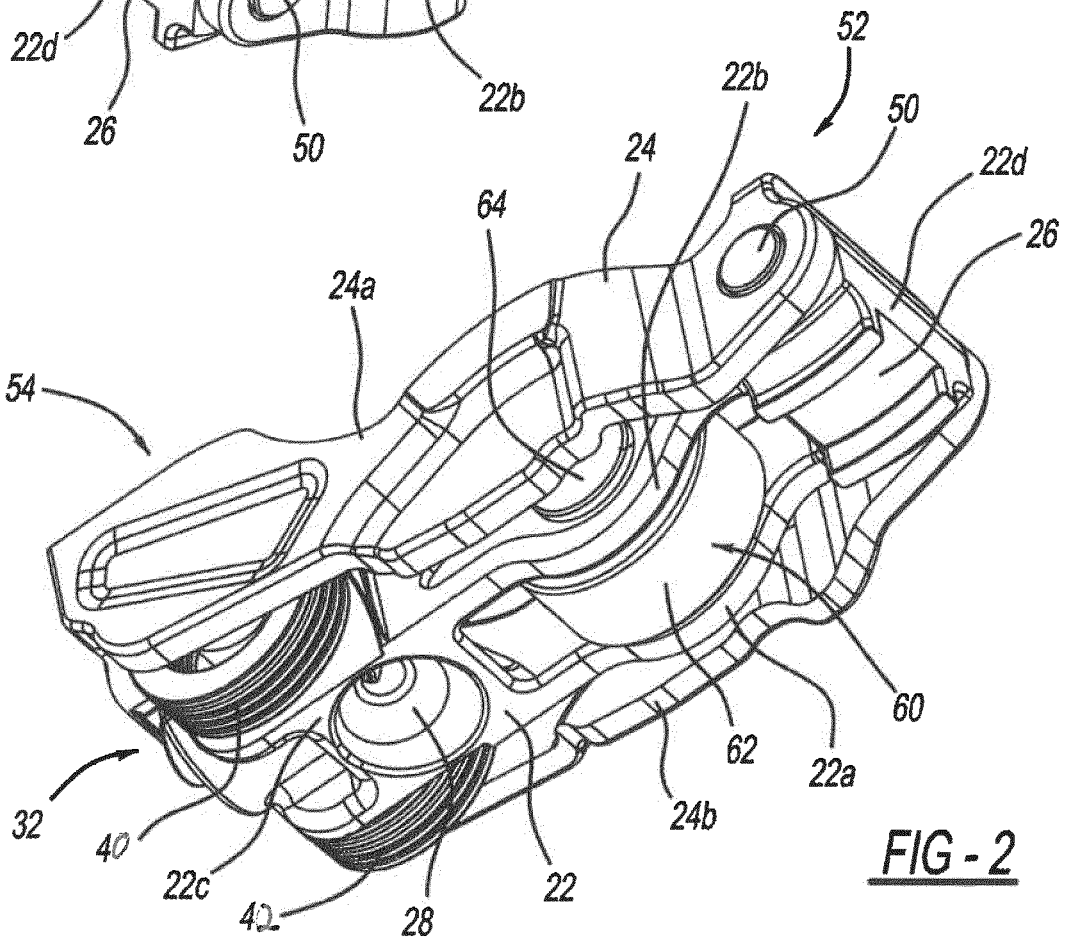
52
22b
50
22d
24
64
26
24a
54
60
62
22a
24b
32
40
22c
42
28
22

FIG - 2

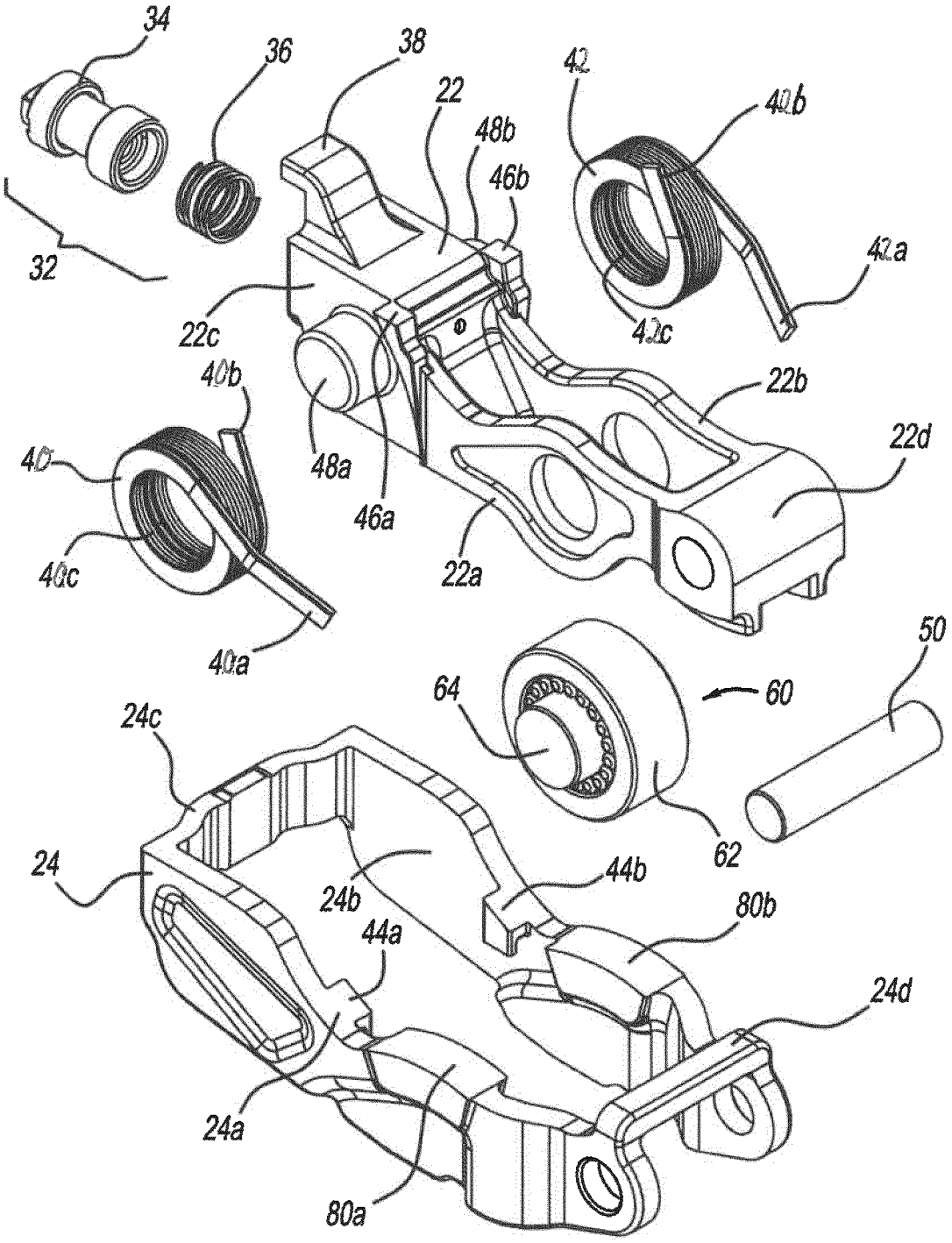
34
36
38
22
42
40b
48b
46b
32
42a
22c
42c
40b
22b
40
22d
48a
46a
40c
22a
40a
50
64
60
24c
62
24
44b
24b
80b
44a
24d
24a
80a

FIG - 3

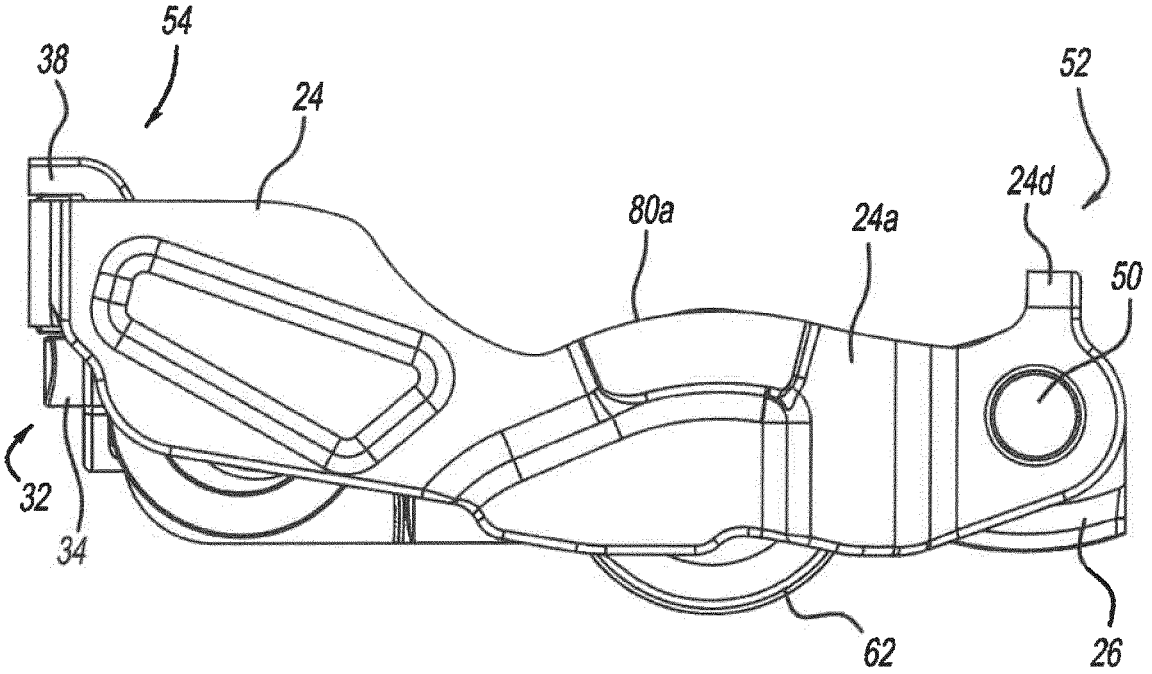
54
38
24
52
24d
80a
24a
50
32
34
62
26

FIG - 4

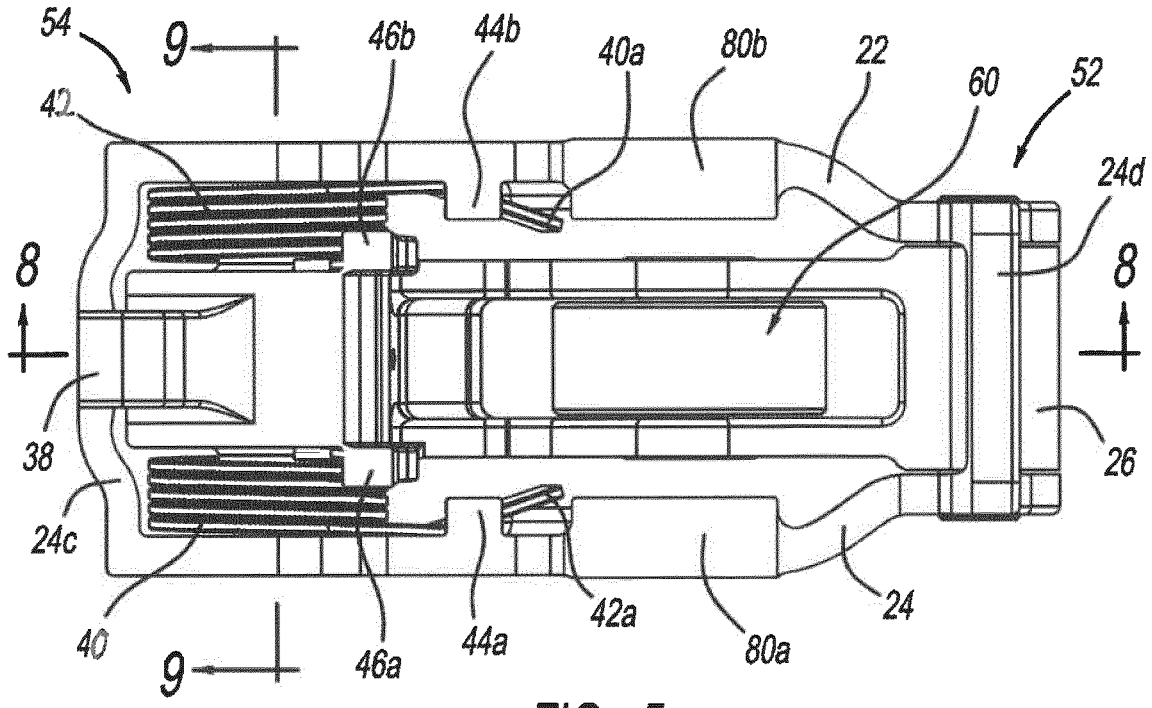
54
9
46b
44b
40a
80b
22
60
52
42
24d
8
8
38
26
24c
24
40
42a
44a
46a
80a
9

FIG - 5

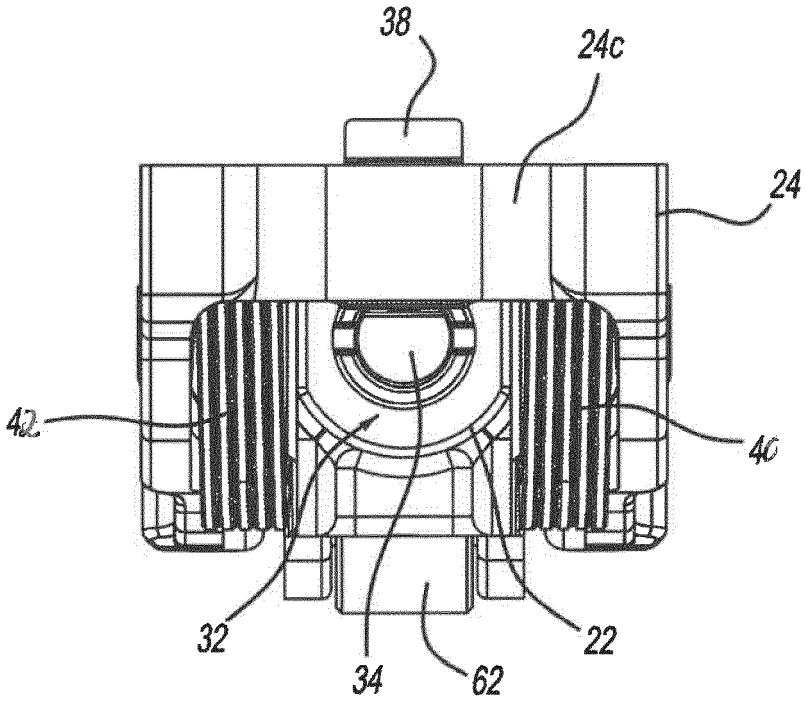

FIG - 6

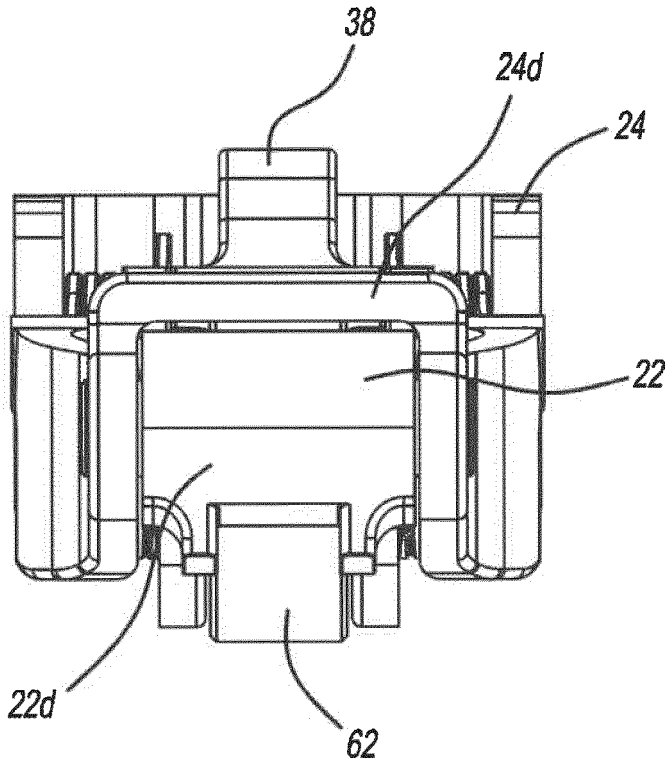

FIG - 7

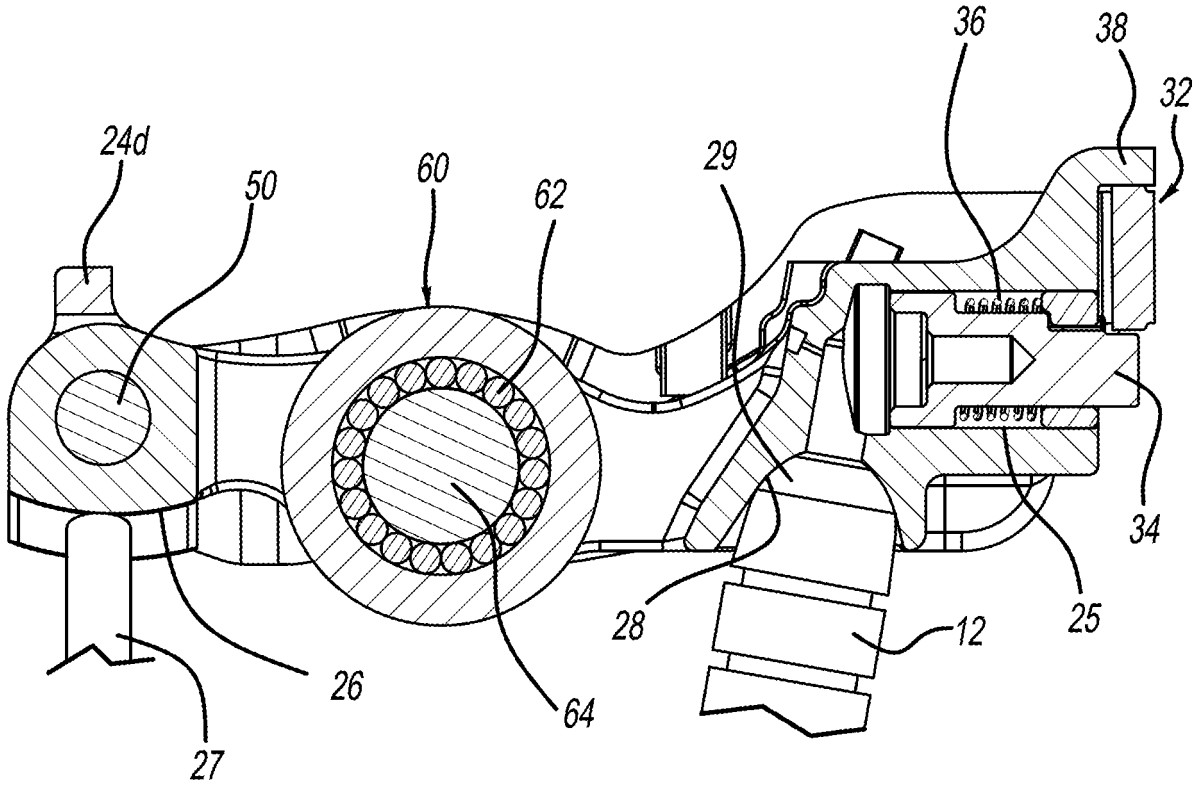

FIG - 8

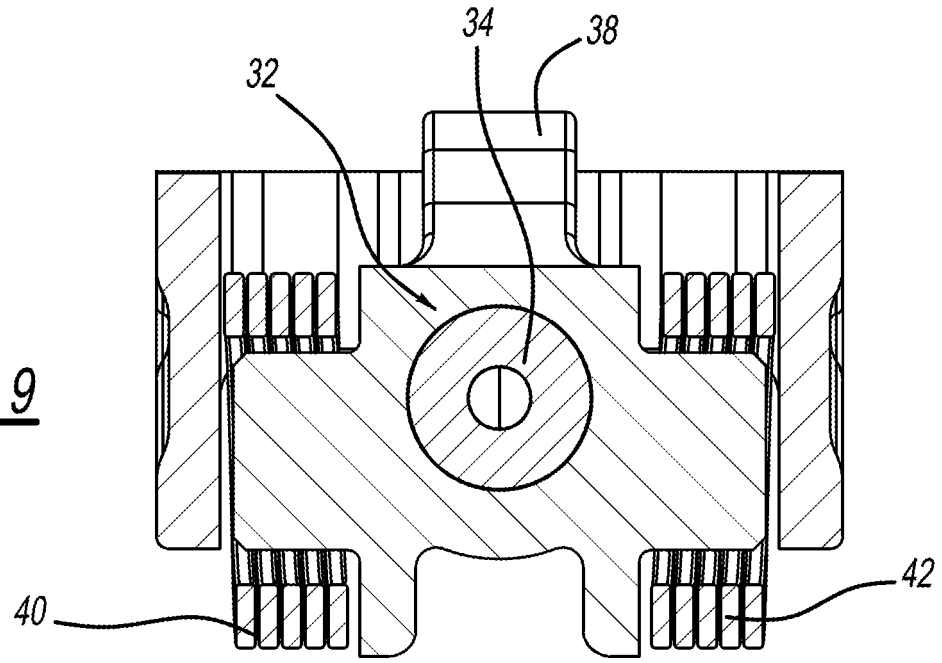

FIG - 9

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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