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**Hendriksma**

(54) **SWITCHABLE ROCKER ARM**

(76) Inventor: **Nick J. Hendriksma**, Grand Rapids, MI (US)

Correspondence Address:
**DELPHI TECHNOLOGIES, INC.**
**M/C 480-410-202, PO BOX 5052**
**TROY, MI 48007 (US)**

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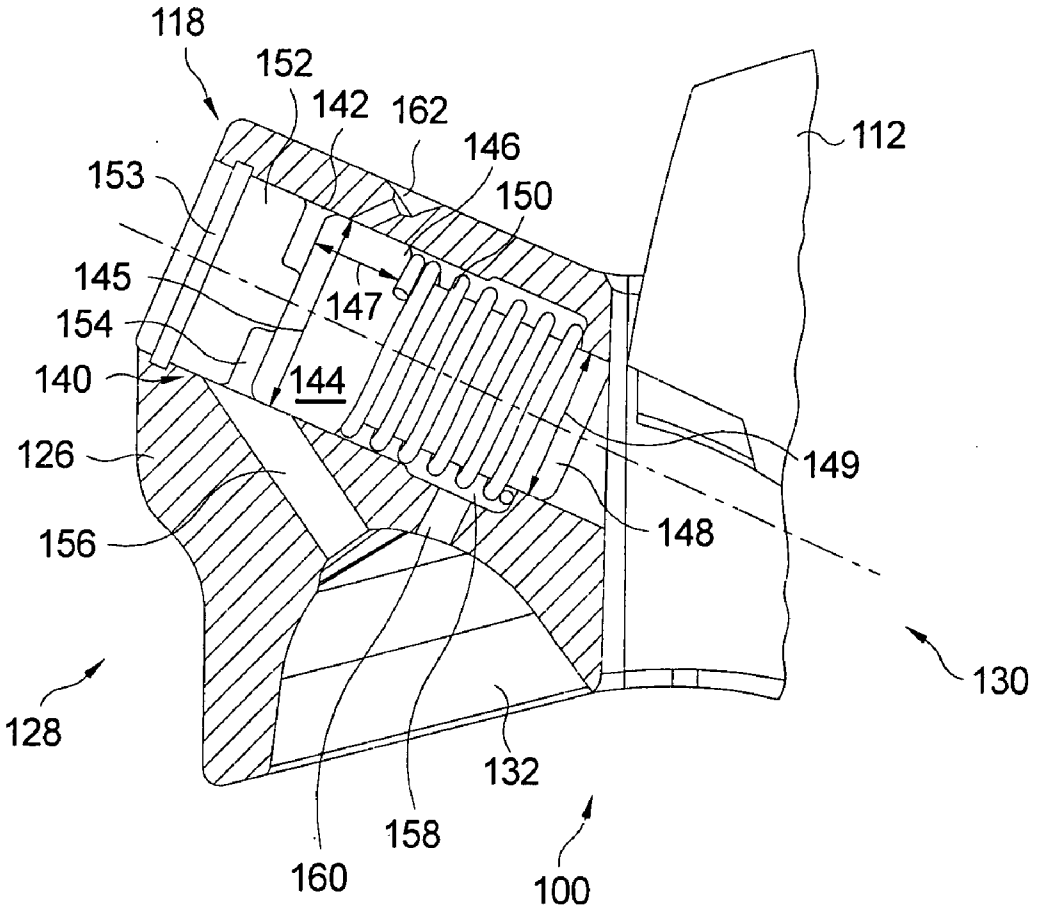
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(57) **ABSTRACT**

A latching mechanism for variably activating an engine valve in an internal combustion engine includes a rocker arm body having a bore and a socket. A first passage leads from the socket to a first hydraulic chamber formed above a lock pin head. A second passage leads from the socket to a second hydraulic chamber formed below the lock pin head. Since both the first and the second hydraulic chamber receive pressurized oil, it is the diameter of the pin shank that determines the hydraulic force needed to axially move the locking pin to an extended position and into a locking engagement with a slider member. In an alternate embodiment of the invention the first passage connecting the first hydraulic chamber with the socket is eliminated and instead the locking pin is modified to permit flow between second hydraulic chamber and first hydraulic chamber.



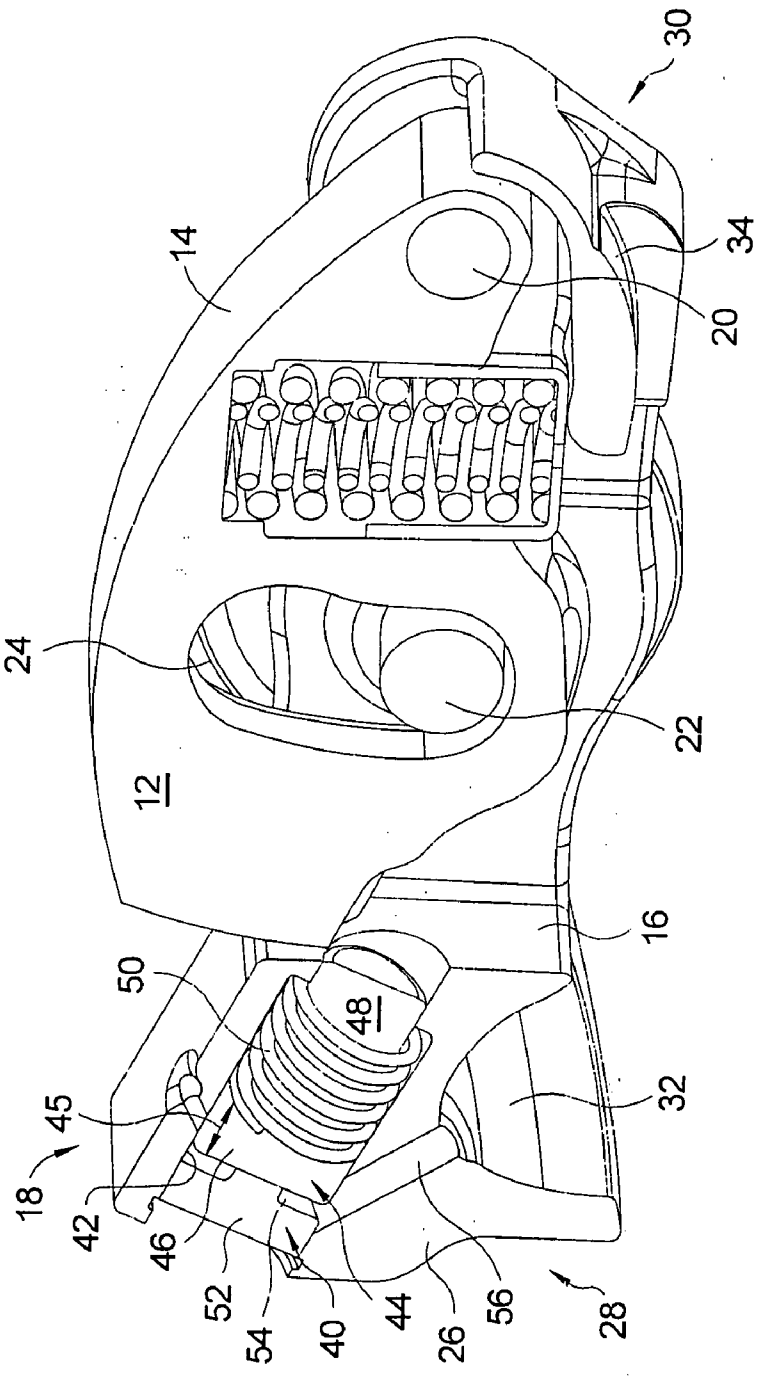



FIG. 1.
(PRIOR ART)

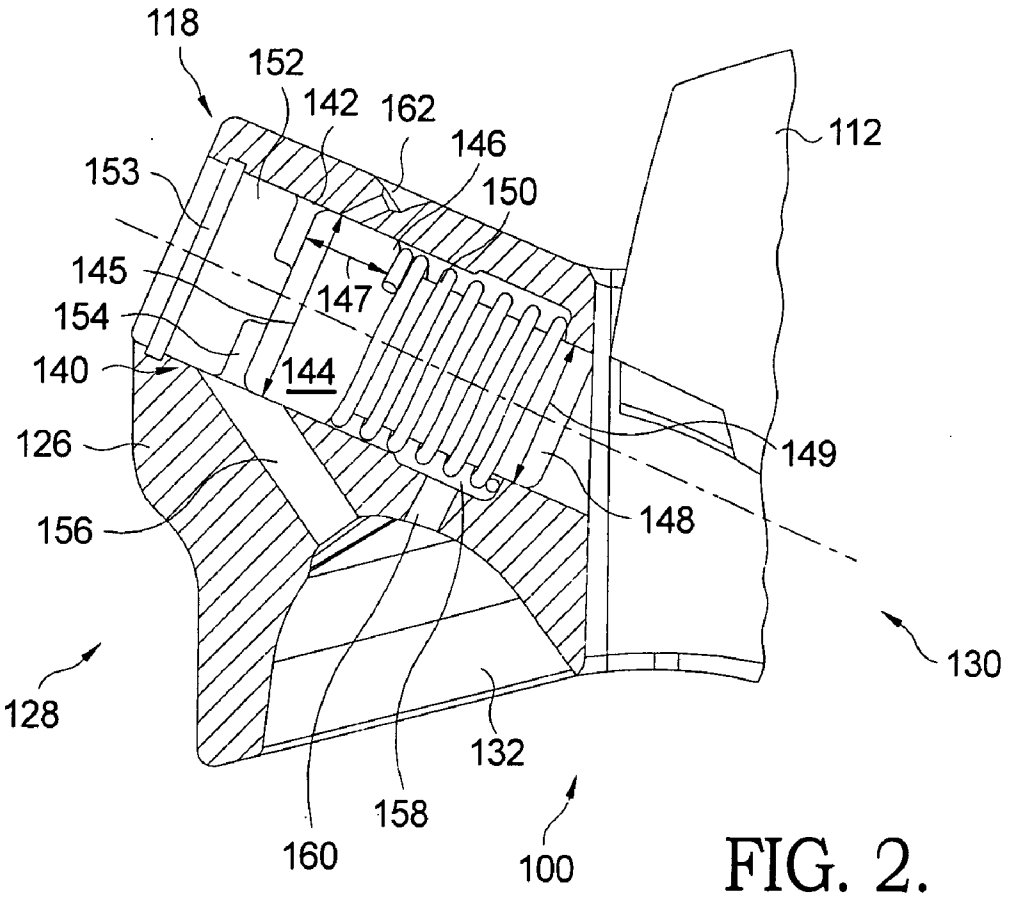

118
152
142
162
146
150
153
112
145
147
154
140
144
126
149
148
156
130
128
132
158
160
100

FIG. 2.

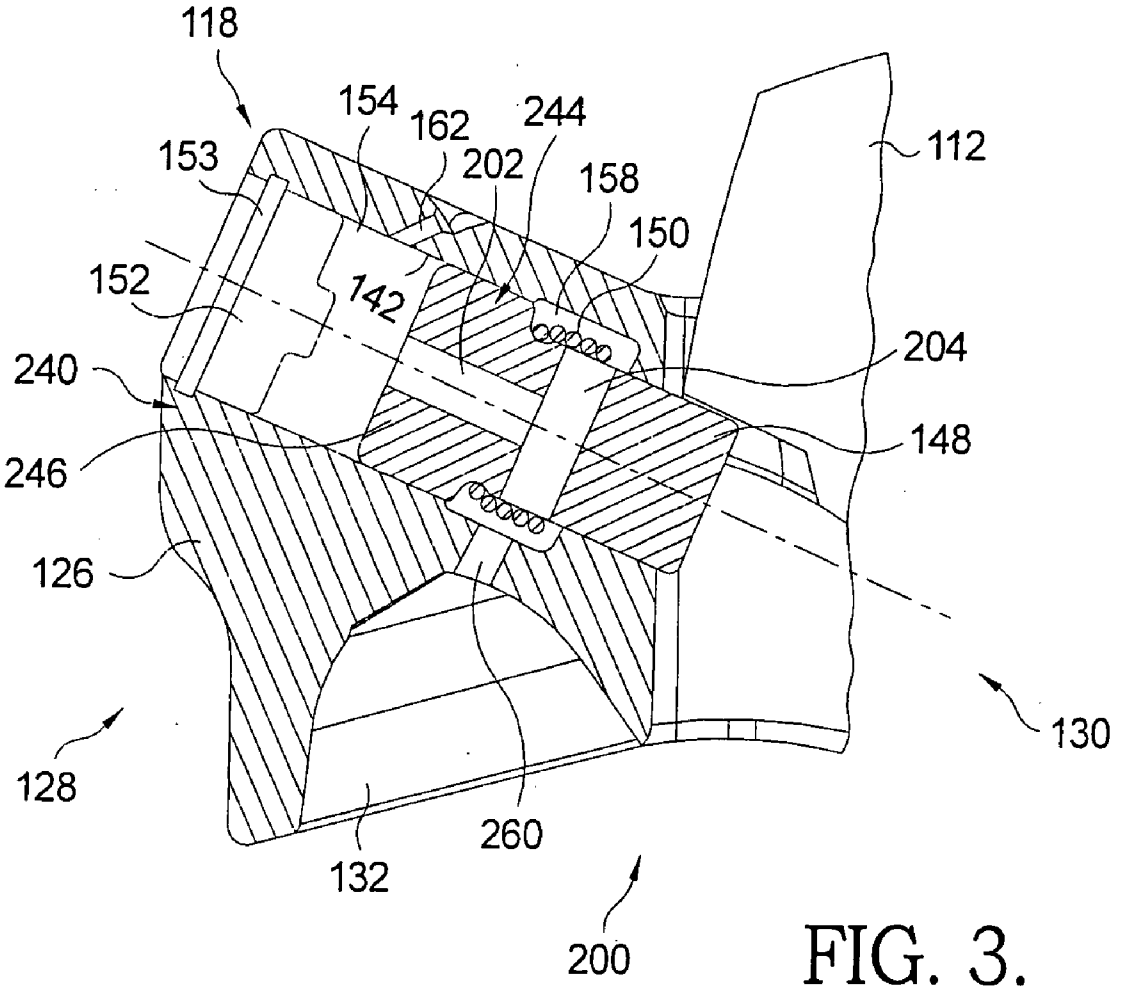

118
154
162
244
153
202
158
112
150
152
142
204
240
148
246
126
130
128
260
132
200

FIG. 3.

# SWITCHABLE ROCKER ARM

## TECHNICAL FIELD

**[0001]** The present invention relates to mechanisms for altering the actuation of valves in internal combustion engines; more particularly, to finger follower type rocker arm assemblies capable of changing between high and low or no valve lifts; and most particularly, to an improved oil circuit for a latching mechanism for a two-step finger follower type rocker arm assembly.

## BACKGROUND OF THE INVENTION

**[0002]** Variable valve activation (VVA) mechanisms for internal combustion engines are well known. It is known to be desirable to lower the lift, or even to provide no lift at all, of one or more valves of a multiple-cylinder engine, during periods of light engine load. Such deactivation or cam profile switching can substantially improve fuel efficiency.

**[0003]** Various approaches are known in the prior art for changing the lift of valves in a running engine. One known approach is to provide a latching mechanism in the hydraulic lash adjuster (HLA) pivot end of a rocker arm cam follower, opposite from the valve-actuating end, which locks and unlocks the valve actuator portion from the follower body. The cam follower mechanism is latchable by a hydraulically actuated lock pin whose motion typically is governed in a latching direction by application of pressurized engine oil received from the HLA and in an unlatching direction by a return spring. The lock pin is disposed as a piston in a smooth bore of the follower body and is retained therein by a plug pressed into the end of the bore. The typically cylindrical plug serves to seal the prior art smooth bore, thus forming a hydraulic chamber between itself and an end of the lock pin.

**[0004]** Typically, a two-step roller finger follower (RFF) allows the engine valves to be operated with two different cam profiles, one when the locking pin disengages (unlocks) a high lift follower (low lift mode) and the other when the locking pin is engaged (locked) to the high lift follower (high lift mode). When the HLA oil pressure is low, the return spring moves the locking pin to a retracted position and the locking pin is disengaged from the high lift follower or other valve actuator. When HLA oil pressure is increased, the hydraulic force of the oil pressure in the hydraulic chamber overcomes the spring force and the locking pin moves to an extended position engaging with the high-lift follower or other valve actuator. However, this prior art oil circulation arrangement suffers from several shortcomings.

**[0005]** First, the major diameter of the lock pin, for example, the head diameter if the lock pin includes a head and a shank, determines the magnitude of the hydraulic force generated by the oil pressure in the hydraulic chamber, which may be determined as oil pressure times pin head area, and the total volume of fluid displaced as the pin moves. The lock pin response depends, therefore, on the capacity of the system to flow the required volume of oil. Problems may occur when moving the lock pin from an extended position to a retracted position with cold oil due to the high viscosity of the oil and, thus, a lower flow rate through the HLA, at lower temperatures and at relatively low pressure. A smaller major diameter of the lock pin would reduce the required flow capacity but reduction in size is constrained by the contact stress between the lock pin and the saddle of the high lift follower.

**[0006]** Second, the tolerances on the diameter of the lock pin head and surrounding bore must be controlled to manage the leakage through the clearance. Consequently, manufacturing costs are increased. The axial length of the lock pin head also influences the leakage. While a longer axial length of the lock pin head would reduce the leakage, a shorter length is beneficial for packaging both the return spring and the rocker arm in the cylinder head. However, tight clearances between the lock pin head and the bore combined with shorter pin head length increases the risk of jamming the lock pin head in the bore.

**[0007]** Third, the return spring cavity is typically vented such that clearance between the diameter of the pin shank (minor diameter) and bore is not required to seal against oil leakage. However, tolerances on the minor diameter size cannot be increased, as the diameter must be controlled for reasons of mechanical lash.

**[0008]** Fourth, a passage connecting the bore with the HLA intersects the bore of some prior art two-step finger follower type rocker arm assemblies at an angle, which may limit the hole size of the passage. The lock pin head and retention plug can in some applications partially block the passage and, thus, the flow area. Further, the angled hole may be difficult to drill and may be prone to burrs in critical areas.

**[0009]** What is needed in the art is an improved latching mechanism for a two-step finger follower type rocker arm assembly that more effectively moves the lock pin from a retracted position to an extended position, that eliminates the currently required tight clearances between lock pin head and bore, and that concurs with return spring and rocker arm packaging requirements.

**[0010]** It is a principal object of the present invention to provide a two-step rocker arm assembly having faster response characteristics under cold oil conditions among members of a manufactured population of two-step finger follower type rocker arm assemblies.

**[0011]** It is a further object of the invention to provide an improved oil circuit for a latching mechanism for a two-step finger follower type rocker arm assembly.

**[0012]** It is a still further object of the present invention to provide a lock pin mechanism that reduces the net volume of oil displaced by the lock pin and reduces the required return spring force for equivalent switch pressure.

## SUMMARY OF THE INVENTION

**[0013]** Briefly described, a rocker arm body includes a first and a second oil passage connecting a lock pin bore with a variable oil pressure source, such as a socket for a hydraulic lash adjuster (HLA). The first oil passage leads from the HLA socket to a hydraulic chamber formed by a lock pin head and a retention plug sealing the lock pin bore. The second oil passage leads from the HLA socket to a return spring cavity. Adding the second oil passage will not increase the number of machining operations compared to the known prior art, since at the same time a venting hole typically machined into the follower body can be eliminated. Therefore, oil flow between the HLA and the return spring cavity and between the HLA and the hydraulic chamber above the lock pin head is enabled. Furthermore, leakage between the lock pin head and the wall of the lock pin head is advantageous rather than detrimental as in prior art. Due to the oil circuit in accordance with the invention, the minor diameter of the lock pin, which may be the diameter of the lock pin shaft, now determines the hydraulic force generated by oil pressure and the net volume of oil

displaced by the lock pin motion. Compared to prior art lock pin mechanisms, up to 40% less oil needs to be displaced as the pin translates between the extended and retracted positions. Consequently, the viscous flow losses are reduced and switching response is improved, especially with cold oil. Since a smaller hydraulic force is needed to move the lock pin compared to prior art oil circulation, the required return spring force for equivalent switch pressure is reduced compared to prior art, which enables a superior return spring design, such as having a lower rate and/or shorter length.

**[0014]** Furthermore, with the introduction of the second oil passage that allows oil to flow to both sides of the lock pin head in accordance with the invention, oil leakage past the lock pin head is no longer a concern and, therefore, related tolerances can be relaxed compared to known prior art latching assemblies and the axial length of the pin head can be reduced. The shorter axial length of the lock pin head combined with larger allowable clearances between the lock pin head and the wall of the lock pin bore alleviates the lock pin head jamming concern of the prior art and reduces the chance of the lock pin head partially blocking the original passage where the passage breaks into the lock pin bore.

**[0015]** In an alternate embodiment in accordance with the invention, the first oil passage connecting the HLA socket with the hydraulic chamber above the lock pin head is completely eliminated and the lock pin is modified to permit oil flow between the return spring cavity and hydraulic chamber as well as from the HLA socket to and from the return spring cavity. Eliminating the original oil passage connecting the HLA socket with the hydraulic chamber is advantageous, since the typically angled flow passage is difficult to manufacture and may have potential for burrs in critical regions of the passage.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0016]** These and other features and advantages of the invention will be more fully understood and appreciated from the following description of certain exemplary embodiments of the invention taken together with the accompanying drawings, in which:

**[0017]** FIG. **1** is a cutaway isometric view of a prior art two-step roller finger follower;

**[0018]** FIG. **2** is a cross-sectional side view of a first latching mechanism of a two-step finger follower rocker arm assembly in accordance with the present invention, showing a first embodiment of an oil circuit; and

**[0019]** FIG. **3** is across-sectional side view of a second latching mechanism of a two-step finger follower rocker arm assembly in accordance with the present invention, showing an alternative embodiment of an oil circuit.

**[0020]** Corresponding reference characters indicate corresponding parts throughout the several views. The exemplification set out herein illustrates one preferred embodiment of the invention, in one form, and such exemplification is not to be construed as limiting the scope of the invention in any manner.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

**[0021]** The advantages and benefits afforded to a two-step roller finger follower (RFF) in accordance with the invention may be better appreciated by first considering a prior art two-step roller finger follower. Such a two-step RFF is suitable for use in a variable valve activation system of an internal combustion engine.

**[0022]** Referring to FIG. **1**, the view shown represents a section cutaway along a vertical symmetry plane for description purpose such that only one-half of a prior art two-step roller finger follower (RFF) **10** is present. Thus, where appropriate, the described elements should be considered as having matching counterparts (not shown) in the full RFF. A high-lift follower **12** including a cam-follower surface **14** is disposed in a central opening **16** in a rocker arm **18**. High-lift follower **12** pivots within opening **16** about a pivot shaft **20**. A roller shaft **22** mounted in rocker arm **18** supports a roller **24** for following a low-lift lobe of an engine camshaft (not shown).

**[0023]** Rocker arm **18** includes a body **26** having a first end **28** and a second end **30**. A socket **32** is included at first end **28** for pivotably mounting RFF **10** on a hydraulic lash adjuster (HLA) (not shown). A pad **34** is included at second end **30** for actuating a valve stem (not shown). A latching mechanism **40** disposed in body **26** of rocker arm **18** at the first end **28** thereof selectively latches high-lift follower **12** in position to actuate the valve stem in response to the high-lift cam lobe base circle and eccentric, or selectively unlatches high-lift follower **12** to follow the high-lift cam lobe base circle and eccentric in lost motion.

**[0024]** Latching mechanism **40** includes a stepped bore **42**, preferably cylindrical, in body **26**. Latching mechanism further includes a piston **44** defining a locking pin having a head portion **46** and a shank portion **48**. Head portion **46** of piston **44** may be biased outwards in bore **42** by a return spring **50** (retracted position) or shank portion **48** may be extend toward high-lift follower **12**. Bore **42** is closed by a plug **52** forming a hydraulic chamber **54** that is in communication via passage **56** with socket **32**.

**[0025]** Pressurized oil is supplied to chamber **54** in known fashion from the hydraulic lash adjuster (not shown) upon command from an engine control module to cause piston **44** to become hydraulically biased toward high-lift follower **12**. The diameter of head portion **46** of piston **44** determines the magnitude of the hydraulic force (oil pressure times area of head portion **46**) available to overcome the spring force and also the total volume of fluid displaced as the piston **44** moves. When such biasing occurs and overcomes the counter-bias of return spring **50**, shank portion **48** extends from bore **42** towards high-lift follower **12** and locks high-lift follower **12** in position. Oil leaking past head portion **46** of piston **44** is vented from return spring cavity **58** via a vent hole (not shown) included in body **26** in the cutaway section.

**[0026]** When the engine control module determines, in known fashion from various engine operating parameters, that high-lift follower **12** should be unlocked, a reduced oil pressure is supplied to chamber **54**, allowing return spring **50** to bias piston **44** away from high-lift follower **12**, and high-lift follower **12** is again free to pivotally slide in central opening **16**. As long as the lower oil pressure is supplied to chamber **54**, latching mechanism **40** remains disengaged from high-lift follower **12**. To minimize oil leakage from hydraulic chamber **54** into a return spring cavity **58** past head portion **46** of piston **44**, the clearance between the diameter of head portion **46** and bore **42** must be carefully controlled with appropriate tolerances. Leakage through the clearance between head portion **46** and bore **42** may be controlled by designing head portion **46** of piston **44** to have a longer axial length **45**, but axial length **45** is constrained by the packaging requirements for

return spring **50**. Too tight clearances between head portion **46** and bore **42** combined with too short axial head length may cause jamming of head portion **46** in bore **42**. All of these relationships are known in the RFF prior art and need not to be further elaborated here.

**[0027]** Referring now to FIG. **2**, a two-step finger follower rocker arm assembly **100** in accordance with a first embodiment of the invention includes a rocker arm **118** having a body **126** that extends from a first end **128** to a second end **130**. A socket **132** integrated in body **126** and positioned proximate to first end **128** receives the head of a hydraulic lash adjuster (HLA) (not shown) for pivotably mounting rocker arm assembly **100** in an engine. Socket **132** may receive any variable oil pressure source. A latching mechanism **140** is provided for engaging and locking a cam-actuated slider member **112**, such as high-lift follower **12** shown in FIG. **1**, at its most outward extreme of motion.

**[0028]** Latching mechanism **140** includes a stepped bore **142**, preferably cylindrical, and integrated in body **126** proximate to the first end **128**. Bore **142** is closed by a plug **152** that is secured by a retaining clip **153**. Latching mechanism **140** further includes a locking pin **144** that includes a pin head **146** having a first diameter **147** and a pin shank **148** having a smaller second diameter **149**. Locking pin **144** is operated as a piston and is axially positioned within bore **142** such that pin head **146** faces plug **152**. Plug **152** seals bore **142** and functions as a stop for locking pin **144**. Pin shank **148** receives a return spring **150**. Locking pin **144** is biased outwards in bore **142** by return spring **150**.

**[0029]** A first hydraulic chamber **154** that is in communication via a first passage **156** with socket **132** is formed between plug **152** and pin head **146**, and therefore above pin head **146**. A second hydraulic chamber **158** that is in communication via a second passage **160** with socket **132** is formed by the cavity housing return spring **150** and is positioned below pin head **146**. Body **126** further includes a spray hole **162** that is in communication with first hydraulic chamber **154**.

**[0030]** In operation, upon command from an engine control module pressurized oil is supplied via first passage **156** to first hydraulic chamber **154** in known fashion from the hydraulic lash adjuster (HLA, not shown) inserted in socket **132** and simultaneously discharged from second hydraulic chamber **158** via second passage **160**. It may further be possible to supply pressurized oil to second hydraulic chamber **158** via second passage **160** and to simultaneously discharge oil from first hydraulic chamber **154** via first passage **156**. In any case, first hydraulic chamber **154** and second hydraulic chamber **158** contain oil at substantially the same pressure. The oil pressure in first hydraulic chamber **154** and second hydraulic chamber **158** causes locking pin **144** to become hydraulically biased towards cam-actuated slider member **112** due to the force produced by the pressure acting on the cross-sectional area of the pin shank diameter **149**. When such biasing occurs and overcomes the counter-bias force of return spring **150**, the end of pin shank **148** positioned opposite from pin head **146** is urged axially into a locking engagement with slider member **112**. Locking pin **144** is now in extended position (shown in FIG. **3**), since a portion of pin shank **148** axially extends bore **142** towards slider member **112**. If this operation is applied to RFF **10** shown in FIG. **1**, RFF **10** is operated in high-lift mode. Oil may further exit from first hydraulic chamber **154** through spray hole **162** when locking pin **144** is in extended position, since pin head **144** is not blocking spray hole **162** in the extended position.

**[0031]** By designing two-step finger follower rocker arm assembly **100** to include a first passage **156** and a second passage **160**, oil is present in first hydraulic chamber **154** positioned above pin head **146** and in second hydraulic chamber **158** positioned below pin head **146** concurrently. The minor diameter of locking pin **144**, which is the second diameter **149** of pin shank **148**, determines the hydraulic force generated by the oil pressure available to move locking pin **144** to the extended position and the net volume of oil displaced by the motion of locking pin **144**. The hydraulic force can be calculated from oil pressure times cross-sectional area of pin shank **148**. With the benefit of the counter-force exerted on locking pin **144** by second passage **160**, if the area of pin shank **148** is about 40% smaller than the area of pin head **146**, the net force exerted by is the oil pressure against return spring **150** would be 40% less than the force that would be exerted against the return spring without the benefit of second passage **160**. Thus, a smaller return spring **150** would be needed than return spring **50**. Further, if the area of pin shank **148** is about 40% smaller than the area of pin head **146**, then 40% less oil is displaced for the same pin travel compared to prior art rocker arm **18** that includes only passage **56**, as shown in FIG. **1**. Having to displace a smaller net volume of oil to move locking pin **144** into extended position is beneficial for faster switching response of two-step finger follower rocker arm assembly **100**, especially during operation with cold oil.

**[0032]** When the engine control module determines, in known fashion from various engine operating parameters, that a retracted position of locking spring **144** and, thus, disengagement from slider member **112**, is desired, a reduced oil pressure is supplied to first hydraulic chamber **154** and to second hydraulic chamber **158**, allowing return spring **150** to again bias lock pin **144** away from slider member **112**. While moving towards plug **152**, locking pin **144** pushes oil contained in first hydraulic chamber **154** out through first passage **156** back to the HLA inserted in socket **132**. Simultaneously, oil enters second hydraulic chamber **158** through second passage **160**. As long as the reduced oil pressure is maintained in first chamber **154** and second chamber **158**, latching mechanism **140** remains in retracted position (shown in FIG. **2**) disengaged from slider member **112**. If this operation is applied to RFF **10** shown in FIG. **1**, RFF **10** is operated in low-lift mode.

**[0033]** Since two-step finger follower rocker arm assembly **100**, as illustrated in FIG. **2** in accordance with the invention, enables the presence of oil in both the first chamber **154** and the second chamber **158** and, thus, above and below pin head **146**, oil leakage through the clearance between bore **142** and pin head **146** is allowed. Consequently, tolerances between bore **142** and pin head **146** can be relaxed and axial length **145** of pin head **144** can be reduced compared to prior art latching mechanism **40** shown in FIG. **1**. A shorter axial length **145** of pin head **144** combined with larger allowable clearances between bore **142** and pin head **146** eliminates the concern of jamming of pin head **144** of the prior art latching mechanism **40** (FIG. **1**). The clearance between pin shank **148** and bore **142** below return spring **150** and, therefore, below second hydraulic chamber **158** must be controlled to minimize oil leakage from second hydraulic chamber **158**. If needed, the land length in this area could be increased. By designing latching mechanism **140** such that oil may enter and exit first

chamber **154** through first passage **156** and second chamber **158** through second passage **160** concurrently, the vent hole incorporated in body **26** of prior art rocker arm **18** can be eliminated.

**[0034]** Referring now to FIG. **3**, a two-step finger follower rocker arm assembly **200** in accordance with an alternative embodiment of the invention includes an alternative latching mechanism **240** provided for engaging and locking a cam-actuated slider member **112**, such as high-lift follower **12** shown in FIG. **1**, at its most outward point of motion. Latching mechanism **240** differs from latching mechanism **140** shown in FIG. **2** by eliminating first passage **156** connecting first hydraulic chamber **154** with HLA socket **132** and by modifying locking pin **144** to permit flow between second hydraulic chamber **158** and first hydraulic chamber **154**. In a currently preferred embodiment, latching mechanism **240** includes a locking pin **244** that has an internal oil passage, which communicates chamber **158** with chamber **154**.

**[0035]** As shown in FIG. **3**, locking pin **244** may include an axial hole **202** extending through pin head **246** and intersecting with a cross hole **204** extending through pin shank **148**. Alternatively, slots or grooves (not shown) could be implemented on the outside diameter of pin head **246** to provide an oil passage between second hydraulic chamber **158** and first hydraulic chamber **154**. Second hydraulic chamber **158** is in communication with socket **132** via a passage **260**.

**[0036]** In operation, upon command from an engine control module, pressurized oil is supplied via passage **260** to second hydraulic chamber **158** in known fashion from the hydraulic lash adjuster (HLA, not shown) inserted in socket **132**. The pressurized oil entering second hydraulic chamber **158** also flows into first hydraulic chamber **154** through cross hole **204** and axial hole **202** integrated in locking pin **244**. The pressurized oil entering first hydraulic chamber **154** and second hydraulic chamber **158** causes locking pin **244** to become hydraulically biased towards cam-actuated slider member **112**. When such biasing occurs and overcomes the counter-bias of return spring **150**, the end of pin shank **148** positioned opposite from pin head **246** is urged axially into a locking engagement with slider member **112**. Locking pin **244** is now in extended position (shown in FIG. **3**), since a portion of pin shank **148** axially extends from bore **142** towards slider member **112**. If this operation is applied to RFF **10** shown in FIG. **1**, RFF **10** is operated in high-lift mode.

**[0037]** When the engine control module determines, in known fashion from various engine operating parameters, that a retracted position of locking spring **244** and, thus, disengagement from slider member **112**, is desired, a reduced oil pressure is supplied to second hydraulic chamber **158** and to first chamber **154** through cross hole **204** and axial hole **202**, allowing return spring **150** to again bias lock pin **244** away from slider member **112**. While moving locking pin **244** towards plug **152**, oil contained in first hydraulic chamber **154** flows out of first hydraulic chamber **154** through axial hole **202** and cross hole **204** into second hydraulic chamber **158** and from second hydraulic chamber **158** through passage **260** to socket **132**. The oil flowing out of passage **260** into socket **132** is received by a hydraulic lash adjuster (HLA, not shown). As long as the reduced oil pressure is maintained in second chamber **158**, latching mechanism **240** remains in retracted position (shown in FIG. **2**) disengaged from slider member **112**. If this operation is applied to RFF **10** shown in FIG. **1**, RFF **10** is operated in low-lift mode.

**[0038]** The hydraulic force generated by the oil pressure and the net volume of oil displacement by motion of locking pin **244** are the same as described above in connection with FIG. **2**. Designing two-step finger follower rocker arm assembly **200** without first passage **156** that must be angled to provide connection from socket **132** to first hydraulic chamber **154** lowers manufacturing costs of assembly **200** by avoiding difficult machining operation. Machining operations to create passage **260** are simpler than machining operation to create passage **156**, since passage **260** is shorter and only slightly angled if at all due to the location of socket **132** relative to second hydraulic chamber **158**.

**[0039]** While the invention has been described as relating to a two-step rocker arm assembly, it is understood that it can relate to a deactivating rocker arm assembly whereby, instead of a lower valve lift, no valve lift is applied. Furthermore, while the invention has been described in connection with a two-step RFF **10**, it may be applicable for other cylinder activation operations.

**[0040]** While the invention has been described by reference to various specific embodiments, it should be understood that numerous changes may be made within the spirit and scope of the inventive concepts described. Accordingly, it is intended that the invention not be limited to the described embodiments, but will have full scope defined by the language of the following claims.

What is claimed is:

**1**. A latching mechanism for variably activating an engine valve in an internal combustion engine, comprising:
- a body including a bore and a variable oil pressure source;
- a locking pin including a pin head axially disposed in said bore;
- a first hydraulic chamber formed above said pin head;
- a second hydraulic chamber formed below said pin head;
- a first passage connecting said first hydraulic chamber with said variable oil pressure source; and
- a second passage connecting said second hydraulic chamber with said variable oil pressure source.

**2**. The latching mechanism of claim **1**, wherein said locking pin further includes a pin shank that extends from said pin head towards said second hydraulic chamber, and wherein said pin shank has a smaller diameter than said pin head.

**3**. The latching mechanism of claim **2**, further comprising a return spring received by said pin shank, wherein said locking pin is biased in said bore by said return spring.

**4**. The latching mechanism of claim **1**, further comprising a plug disposed in said bore, wherein said plug seals said bore and restricts movement of said locking pin.

**5**. The latching mechanism of claim **1**, wherein said variable oil pressure source receives a hydraulic lash adjuster, wherein said first hydraulic chamber receives pressurized oil from said hydraulic lash adjuster via said first passage while said second hydraulic chamber discharges oil via said second passage concurrently, or wherein said second hydraulic chamber receives pressurized oil from said hydraulic lash adjuster via said second passage while said first hydraulic chamber discharges oil via said first passage concurrently.

**6**. The latching mechanism of claim **1**, wherein a hydraulic force of pressurized oil received by said first hydraulic chamber and said second hydraulic chamber overcomes a counter-bias force of said return spring and biases said locking pin to an extended position, where a portion of said locking pin positioned opposite from said pin head axially extends beyond said bore.

7. The latching mechanism of claim 6, wherein said hydraulic force axially urges said locking pin into a locking engagement with a slider member activating said engine valve.

8. The latching mechanism of claim 6, wherein said diameter of said pin shank determines said hydraulic force that overcomes said counter-bias force of said return spring and a net volume of oil displaced by motion of said locking pin.

9. The latching mechanism of claim 1, wherein oil enters and exits said first hydraulic chamber via said first passage, wherein oil enters and exits said second hydraulic chamber via said second passage, and wherein compressed oil leaks through a clearance between said pin head and said bore.

10. The latching mechanism of claim 1, wherein a cavity housing a return spring forms said second hydraulic chamber.

11. A latching mechanism for variably activating an engine valve in an internal combustion engine, comprising:

a body including a bore and a variable oil pressure source;

a locking pin axially disposed in said bore, said locking pin including a pin head, a pin shank, and an oil passage;

a first hydraulic chamber formed above said pin head;

a second hydraulic chamber formed below said pin head; and

a passage connecting said second hydraulic chamber with said variable oil pressure source;

wherein said oil passage of said locking pin connect said second hydraulic chamber with said first hydraulic chamber.

12. The latching mechanism of claim 11, wherein said oil passage of said locking pin includes an axial hole extending through said pin head and intersecting with a cross hole extending through said pin shank.

13. The latching mechanism of claim 11, wherein said oil passage of said locking pin includes slots or grooves disposed on an outside diameter of said pin head.

14. The latching mechanism of claim 11, wherein pressurized oil is supplied to said second hydraulic chamber from said variable oil pressure source via said passage, and wherein said pressurized oil is supplied from said second hydraulic chamber to said first hydraulic chamber via said oil passage of said locking pin.

15. The latching mechanism of claim 11, wherein oil flows from said first hydraulic chamber into said second hydraulic chamber via said oil passage of said locking pin, and wherein said oil flows from said second hydraulic chamber into said socket via said passage.

16. The latching mechanism of claim 11, wherein pressurized oil supplied to said second hydraulic chamber via said passage and supplied to said first hydraulic chamber via said oil passage of said locking pin creates a hydraulic force that overcomes the force of a return spring and urges said locking pin axially into a locking engagement with a slider member for activating said engine valve.

17. A two-step finger follower rocker arm assembly for variably activating an engine valve in an internal combustion engine, comprising:

a rocker arm body having a bore;

a locking pin axially disposed in said bore;

a first hydraulic chamber formed in said bore, wherein oil flows into and out of said first hydraulic chamber via a first passage; and

a second hydraulic chamber formed in said bore, wherein oil flows into and out of said second hydraulic chamber via a second passage;

wherein pressurized oil supplied to said first hydraulic chamber and said second hydraulic chamber moves said locking pin to an extended position for selectively latching a slider member to said body to provide a first rocker assembly mode having a first valve lift capability; and

wherein a return spring moves said locking pin to a retracted position for unlatching said slider member from said body to provide a second rocker assembly mode having a second valve lift capability.

18. The rocker arm assembly of claim 17, wherein said first passage connects said first hydraulic chamber with a variable oil pressure source.

19. The rocker arm assembly of claim 18, wherein said variable oil pressure source receives a hydraulic lash adjuster.

20. The rocker arm assembly of claim 17, wherein said first passage is an oil passage integrated in said locking pin, and wherein said oil passage connects said first hydraulic chamber with said second hydraulic chamber.

21. The rocker arm assembly of claim 18, wherein said second passage connects said second hydraulic chamber with the variable oil pressure source.

22. The rocker arm assembly of claim 17, wherein said locking pin includes a pin head and a pin shank having a smaller diameter than said pin head, wherein said pressurized oil generates a hydraulic force, and wherein said diameter of said pin shank determines the hydraulic force needed to move said locking pin to said extended position.

23. A method for providing a hydraulic force to a latching mechanism of a rocker arm assembly for variably activating an engine valve in an internal combustion engine, comprising the steps of:

axially disposing a locking pin having a pin shank and a pin head in a bore of a rocker arm body;

supplying pressurized oil via a first passage to a first hydraulic chamber;

discharging pressurized oil via a second passage from a second hydraulic chamber, and

determining a hydraulic force needed to overcome a counter force and to move said locking pin to an position where a portion of said pin shank extends from said bore based on a diameter of said pin shank, wherein said diameter of said pin shank is smaller than the diameter of said pin head.

24. The method of claim 23, further including the steps of:

integrating said first passage into said locking pin to form an internal passage;

connecting said second hydraulic chamber with a variable oil pressure source via said second passage; and

providing communication between said second hydraulic chamber and said first hydraulic chamber via said locking pin oil passage.

25. The method of claim 23, further including the steps of:

connecting said first hydraulic chamber with a variable oil pressure source via said first passage, and

connecting said second hydraulic chamber with said variable oil pressure source via said second passage.

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