Sept. 17, 1968 R. C. RONZI 3,401,677

INTEGRAL LASH ADJUSTER

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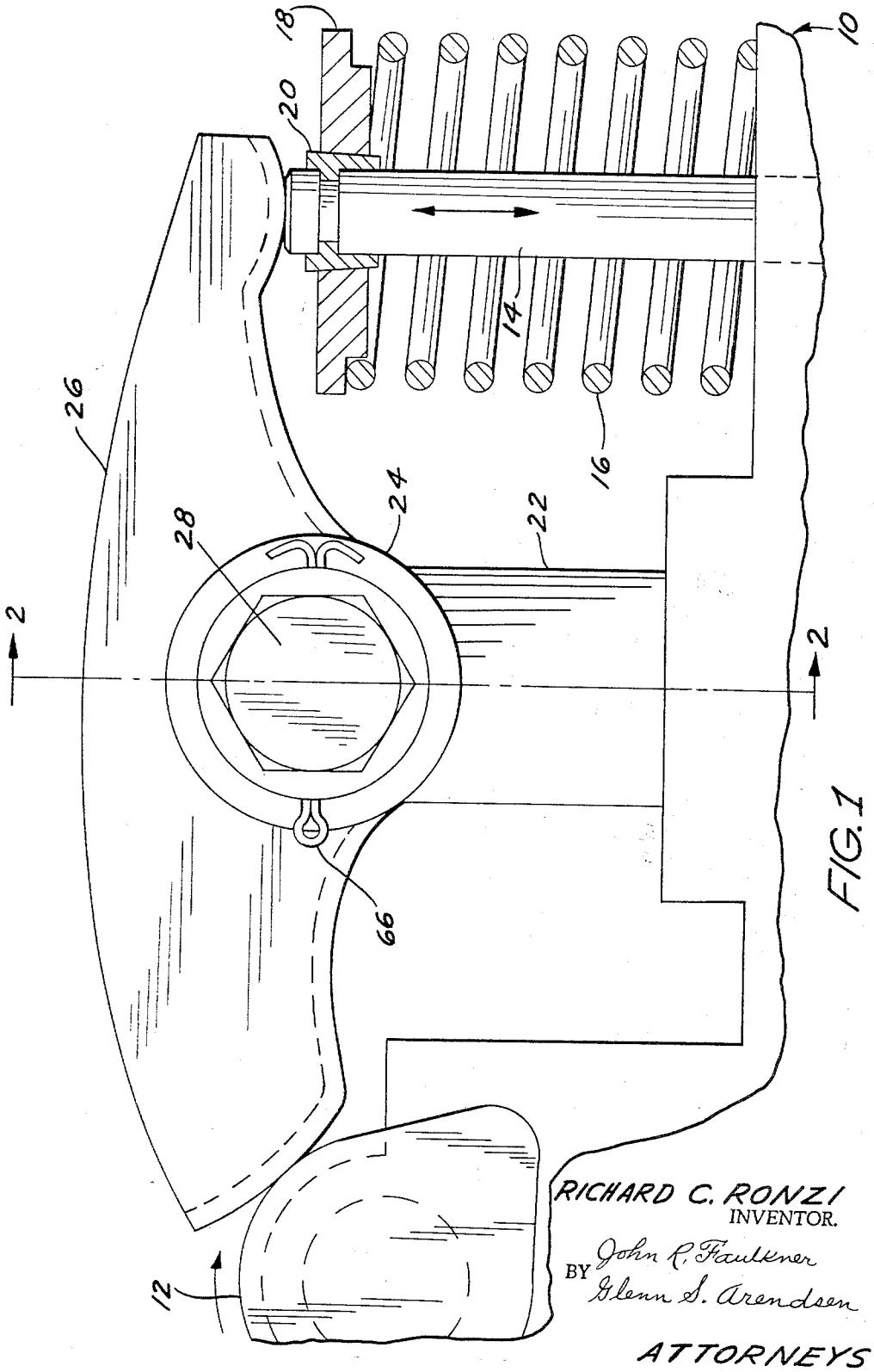


FIG. 1

RICHARD C. RONZI
INVENTOR.

BY John R. Faulkner
Glenn S. Arendsen

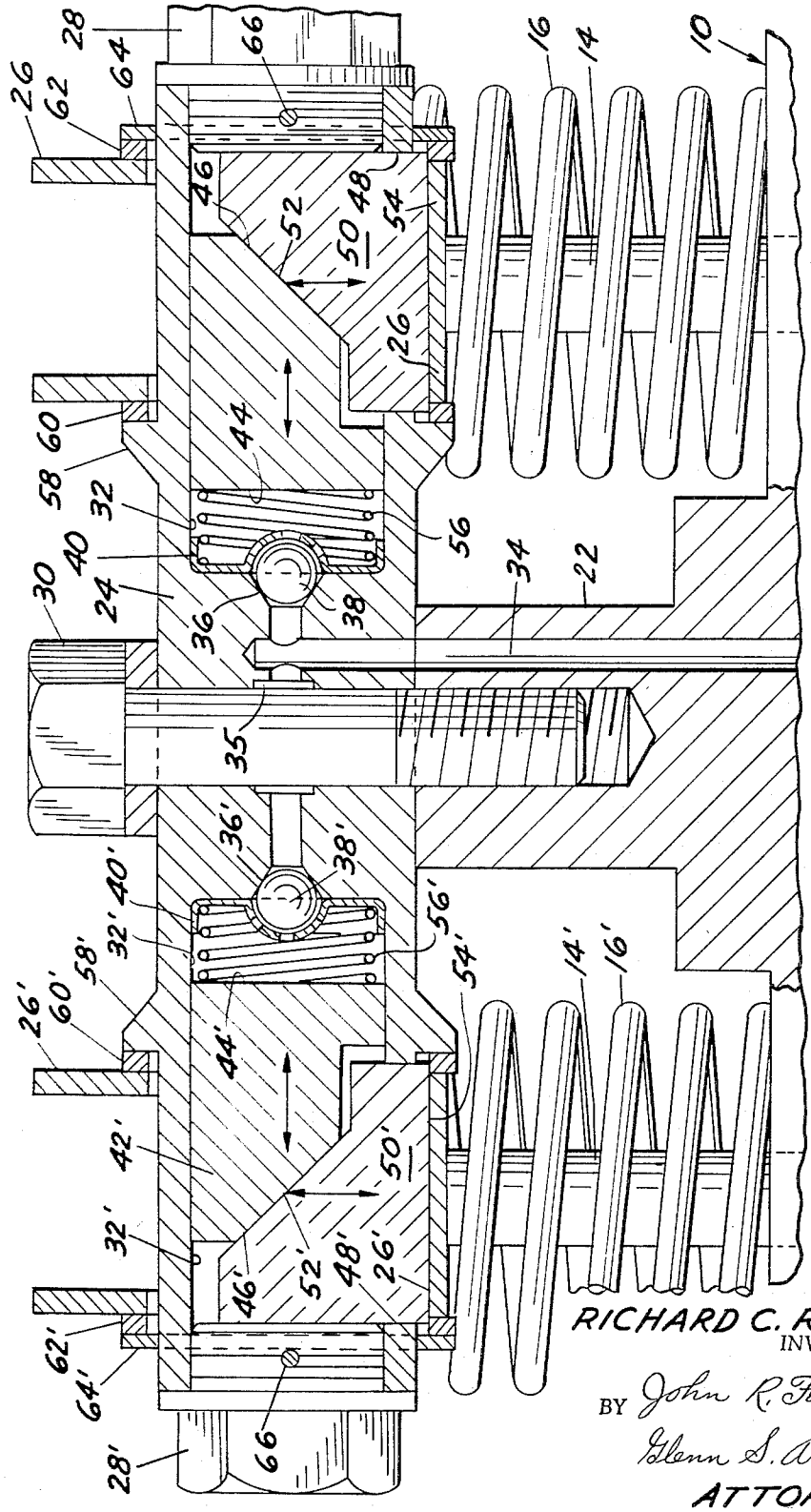
ATTORNEYS

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FIG. 2



RICHARD C. RONZI
INVENTOR.

BY John R. Faulkner
Glenn S. Arendsen
ATTORNEYS

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INTEGRAL LASH ADJUSTER

Richard C. Ronzi, Southfield, Mich., assignor to Ford Motor Company, Dearborn, Mich., a corporation of Delaware

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ABSTRACT OF THE DISCLOSURE

A hydraulic lash adjuster is built into the support shaft for the rocker arm of a reciprocating engine valve train. A chamber is formed in the support shaft and connected to the engine oil supply. Mounted in the chamber is a piston subject to oil pressure on one side and having an inclined surface on the other side. The inclined surface bears on a correspondingly inclined surface of a member projecting down through an opening in the wall of the shaft, and this member bears on the lower inside surface of the bore in the rocker arm. Engine oil pressure positions the piston, the piston acts through the inclined surfaces to position the member projecting through the opening in the shaft wall, and the member in turn positions the rocker arm to eliminate lash existing in the valve train.

Summary of the invention

Commercialized reciprocating engines having overhead camshafts and overhead valves generally have not had hydraulic lash adjusters associated with the valve trains because of space limitations. The hydraulic lash adjuster usually proposed for such valve trains were modified versions of the lash adjuster used in engines having the camshaft in the engine block. Typically, these adjusters were mounted above the rocker arm where they were anchored to the rocker arm mounting stud or a reaction bar fixed with respect to the engine head. Obviously, such constructions increased engine size considerably. Furthermore, passages or external tubing were necessary to conduct engine oil under pressure to the adjuster, thereby increasing component and assembly costs.

This invention provides a lash adjuster integral with a support shaft that acts on the rocker arm and can be used to eliminate lash in any mechanism for converting rotational motion of the camshaft into reciprocating motion of a reciprocating member without substanitally increasing package size. The adjuster preferably is hydraulically operated and is particularly useful in the valve train of reciprocating engines having an overhead camshaft and overhead valves because of the crucial space limitations therein. In a mechanism for converting rotating motion of the camshaft into reciprocating motion of a reciprocating member by means of a rocker arm, the hydraulic lash adjuster of this invention comprises a support shaft for the rocker arm containing a chamber for hydraulic fluid and having an opening in a wall, an inlet for admitting hydraulic fluid to the chamber, a piston mounted in the chamber between the inlet and the opening, and a member located in the opening for movement at an angle to the axis of the support shaft. Both the piston and the member have a surface angled relative to the axis of the support shaft and these surfaces are in sliding contact with each other. The rocker arm is located on the support shaft in contact with the member so the position of the member determines the radial location of the rocker arm relative to the support shaft.

Passages communicate engine oil under pressure to the chamber, and a check valve positioned conveniently in the mouth of the passage prevents oil from flowing out of the chamber when loads are applied from the rocker arm via the wedging action of the member located in the opening to the piston. The oil trapped in the chamber retards the collapse of the adjuster so the motion of the camshaft is translated through the rocker arm to operate the valve. When the loads on the rocker arm are reduced, oil flows into or out of the chamber to compensate for lash changes.

Brief description of the drawings

FIGURE 1 is a side view of an engine head having an overhead camshaft and an overhead valve showing a support shaft containing the lash adjuster of this invention located between the camshaft and the valve stem. FIGURE 2 is a sectional view taken along line 2—2 of FIGURE 1 showing the structural relationship of the components making up the lash adjuster.

Detailed description

Referring to FIGURE 1, the engine head is represented generally by the numeral **10**. A camshaft **12** is rotatably mounted on one side of the head and a reciprocating poppet type valve having a valve stem **14** is mounted on the other side. A conventional valve spring **16** is mounted concentrically around valve stem **14** and bears on a retainer **18** that is locked to the valve stem by a locking means **20**.

Located between the camshaft and the valve is a support post **22**. Post **22** carries a support shaft **24** for the rocker arm **26**. The end of the support shaft **24** is closed by a plug **28**.

Turning to FIGURE 2, shaft **24** is fastened to post **22** by a bolt **30** passing through the approximate center of the shaft. Chambers **32** and **32'** are formed in each end of shaft **24** and the inner ends of the chambers communicate with a passage **34** connected to the pressure side of the engine oil pump (not shown). An annular groove **35** conducts oil around bolt **30**. The openings of passage **34** into chambers **32** and **32'** are flared as at **36** and **36'** and ball checks **38** and **38'** are located in the respective flared portions, which form valve seats therefor. Retainers **40** and **40'** fit into the inner ends of chambers **32** and **32'** to hold the ball checks in the immediate area of the flared portions.

Pistons **42** and **42'** are located slidably in the respective chamber. Each piston has an inner surface **44** and **44'** exposed to oil pressure and a surface **46** and **46'** angled relative to the axis of shaft **24** at the opposite side. Openings **48** and **48'** are formed in the wall of shaft **24** that faces engine head **10** outboard of the respective piston and a follower member **50**, **50'** fits slidably in the respective opening. The inner surfaces **52** and **52'** of followers members **50** and **50'** also are angled relative to the axis of support shaft **24** with the angles thereof corresponding to the angles of surfaces **46** and **46'**. Surface **52** slidably contacts surface **46** and surface **52'** slidably contacts surface **46'**. The lower surfaces **54** and **54'** of members **50** and **50'** are located a short distance outside of support shaft **24**.

A compressive spring **56** is located between surface **44** and retainer **40** and a compressive spring **56'** is located between surface **44'** and retainer **40'**. Plug **28** and a corresponding plug **28'** close the ends of respective chambers **32** and **32'**. Outwardly facing abutments **58** and **58'** are formed on the exterior surfaces of shaft **24** near the central portion thereof. Washers **60** and **60'** are positioned against the respective abutment and rocker arm **26** and its corresponding rocker arm **26'** are positioned against the respective washer. The bores in rocker arms **26** and **26'** are slightly larger than the outside diameter of shaft **24** and the lower inner surface of each bore bears against respective surface **54** and **54'**. Outboard of the rocker arms is another washer **62**, **62'** which is held in place by a retainer **64**, **64'**. The retainers in turn are held in position by cotter pins **66**, **66'** that pass through appropriate holes in the shaft wall and plug.

Operation

Rotation of camshaft **12** acts trough rocker arms **26** and **26'** to produce reciprocating motion of the valves associated with valve stem **14** and its corresponding stem **14'** in the conventional manner, with the rocker arms pivoting about shaft **24**. Because of manufacturing tolerances, thermal expansion, etc., some looseness or lash exists between the camshaft, rocker arms and valve stems. Ordinarily, the lash is less than several thousandths of an inch but even this small amount is sufficient to cause noisiness and excessive wear and interfere with engine operation.

The lash adjuster eliminates the lash in the following manner. When the valve is closed, that is, when the nose of the camshaft is out of touch with the rocker arm, engine oil under pressure in passage **34** unseats ball checks **38** and **38'** and enters chambers **32** and **32'** through appropriate openings in retainers **40** and **40'**. The oil exerts hydraulic pressure against surfaces **44** and **44'**, thereby urging pistons **42** and **42'** axially outward. Pistons **42** and **42'** in turn act through surfaces **46** and **46'** to urge members **50** and **50'** radially downward. Members **50** and **50'** act on the loaded sides, which in this case are the lower portions, of rocker arms **26** and **26'** to urge the rocker arms downward and thereby close the gap existing in the valve train. In accordance with conventional lash adjuster operation, the hydraulic pressure is insufficient to overcome the force of the valve springs.

When the nose of the camshaft rotates into contact with rocker arm **26**, rocker arm **26** pivots about the shaft to begin the reciprocating motion of the valve. The increased force on the rocker arm urges the rocker arm upward and is transmitted back through member **50**, surfaces **52** and **46** to piston **42**. Piston **42** increases the pressure in chamber **32** and the increased pressure seats ball check **38** to prevent oil from flowing out of the chamber and thereby collapsing the adjuster. Continued rotation of the camshaft acts through the rocker arm to reciprocate the valve.

Sufficient clearance exists between piston **42**, member **50** and chamber **32** to permit leakage of small amounts of oil out of chamber **32**. This leakage prevents the adjuster from becoming overadjusted which would prevent the valve **14** from seating when the nose of the camshaft is out of touch with the rocker arm. Additionally, the leakage provides lubricating oil to areas having relative motion such as surfaces **46**, **52**, and **54**. After the valve has opened and closed, engine oil under pressure again is metered into chamber **32** to compensate for the leakage and for any increases in lash. A similar mode of operation adjusts rocker arm **26'** for any lash existing in that valve train.

A passage can be formed in piston **42** to positively conduct lubricating oil from chamber **32** to surfaces **46** and **52**. Any resilient or adjustable means can be used in place of the hydraulic fluid to position the piston. Relative motion between rocker arm **26** and member **50** can be eliminated and surfaces **46** and **52** can be made plano-convex and plano-concave, respectively, so the rocking motion of the rocker arm produces relative motion at surfaces **46** and **52** instead of at surface **54**. Surfaces **46** and **52** preferably are inclined about 45° relative to the axis of shaft **24** but other angles can be used to optimize the lash adjuster to particular valve train characteristics. Thus, angles less than 45° decrease the proportion of the hydraulic force transmitted to the rocker arm while angles greater than 45° increase the proportion. Note that the opposite is true for collapsing forces transmitted back through member **50** from the rocker arm.

Thus this invention provides a lash adjuster for an overhead camshaft engine that does not require significant increases in engine size. The adjuster can be used to take up the looseness of any pivoting member mounted on a support shaft, or it can be used to hold a member mounted on the support shaft in contact with another element with a resilient force.

What is claimed is:

1. In a mechanism for converting rotating motion of a camshaft into reciprocating motion of a reciprocating member by means of a rocker arm, a hydraulic lash adjuster comprising

a support shaft for the rocker arm, said support shaft containing a chamber for hydraulic fluid and having an opening in a wall,

inlet means for admitting hydraulic fluid to said chamber,

a piston mounted in said chamber between said inlet means and said opening, said piston having a surface angled relative to the axis of the support shaft, and

a member located in said opening for movement at an angle to the axis of the support shaft, said member having a surface angled relative to said axis in contact with the angled surface of the piston so the position of said member in said opening is determined by the pressure of the hydraulic fluid on the piston, said rocker arm being located on said support shaft in contact with said member so the position of said member determines the location of said rocker arm.

2. The mechanism of claim **1** in which the reciprocating member is a poppet type valve of a reciprocating internal combustion engine.

3. The mechanism of claim **2** in which the camshaft is an overhead camshaft and the valve is an overhead valve.

4. The mechanism of claim **3** in which the support shaft is fastened to the engine head at the approximate center of the support shaft, and the support shaft contains one of said chambers on each side of the fastening.

5. The mechanism of claim **4** comprising passage means for supplying engine lubricating oil under pressure to said chambers.

6. The mechanism of claim **1** in which the support shaft is fastened to the engine at the approximate center of the support shaft, and the support shaft contains one of said chambers on each side of the fastening.

7. A lash adjuster comprising a support shaft having a chamber therein,

a first member mounted in said chamber for movement along the axis of the support shaft,

means for positioning said first member,

a second member mounted in wedging contact with said first member, said second member being movable at an angle to the axis of the support shaft, and

a pivoting member mounted on said support shaft and contacted by said second member so any looseness in the mounting of the pivoting member is taken up by movement of the first member.

8. The lash adjuster of claim **7** in which the second member projects through an opening in the side of the support shaft facing the loaded side of the pivoted member.

9. The lash adjuster of claim **8** in which hydraulic means are used to position the first member.

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AL LAWRENCE SMITH, *Primary Examiner.*