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[54] TAPPET FOR OVERHEAD CAMSHAFT ENGINE

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[51] **Int. Cl.**.....**F01l 1/16,** F01l 1/24

[58] **Field of Search** 123/90.27, 90.48, 90.51, 90.55, 123/90.58, 90.59, 90.57

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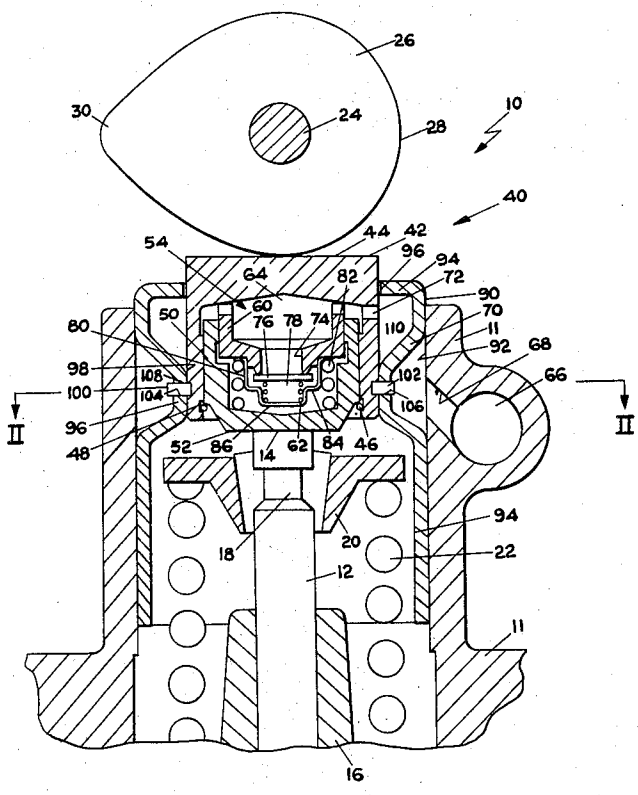
[57] **ABSTRACT**

A hydraulic valve lifter assembly is interposed directly between a spring biased valve stem and cam, the valve lifter assembly comprising a plunger slidably mounted within a valve lifter body forming a pressurized chamber the body and plunger movable axially within a cylinder head guide. A tubular shaped intermediate member is secured to the valve lifter body by a spring clip, the sides of the member being in slidable engagement with the guide and fitting over the end portion of the valve stem and associated spring. A constricted portion of the tubular member engages the valve body and is detachably connected thereto by the spring clip.

21 Claims, 3 Drawing Figures



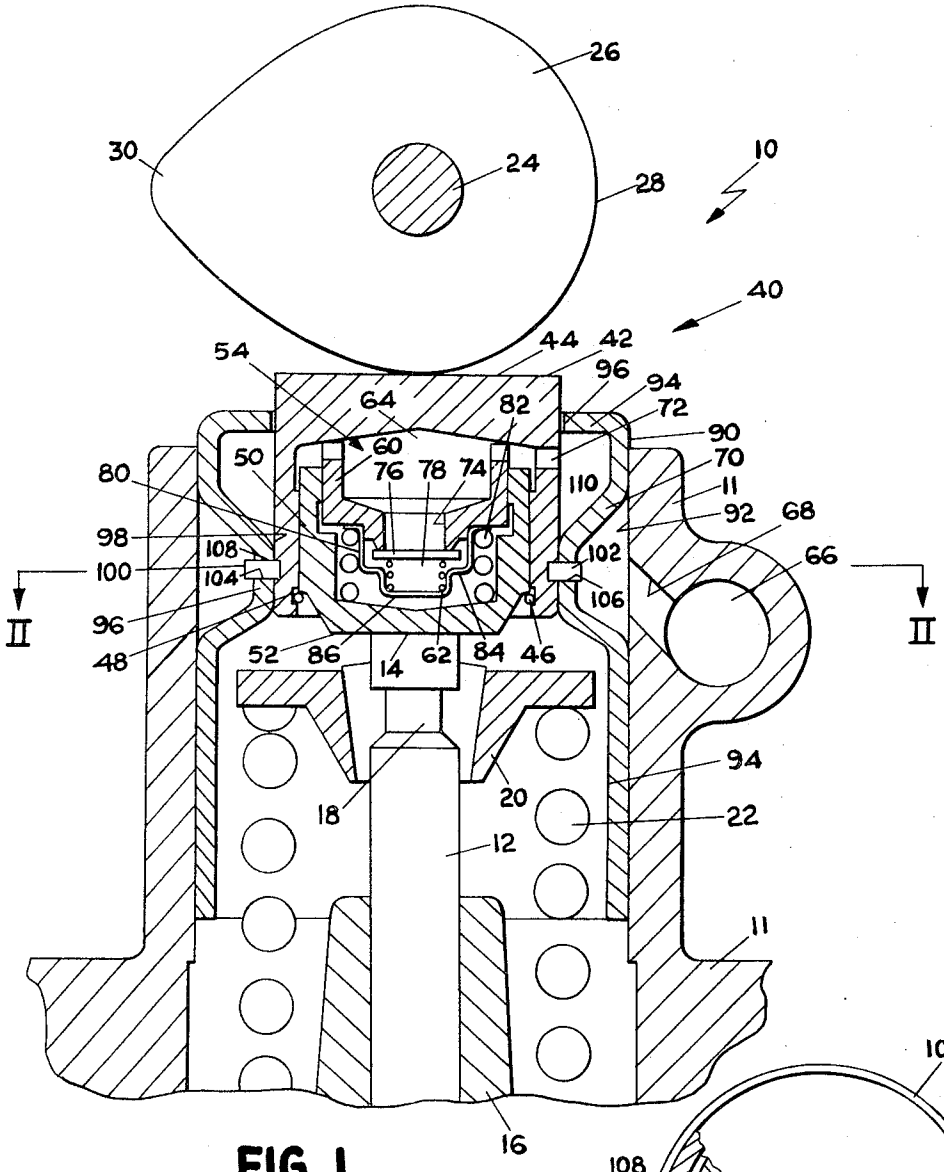


FIG. 1

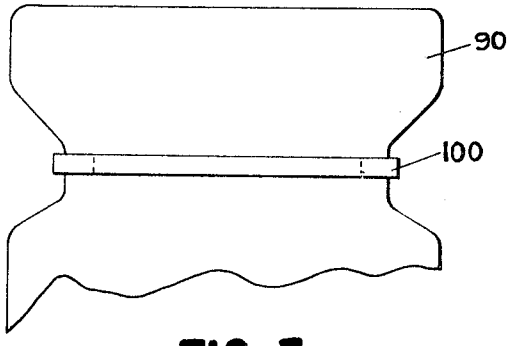


FIG. 3

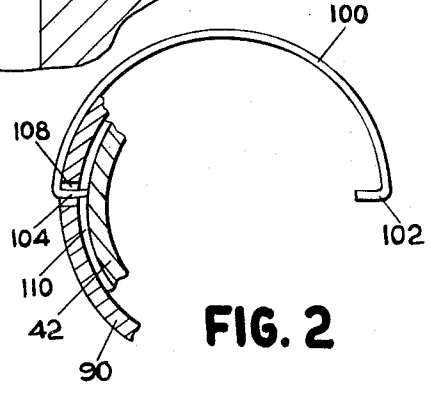


FIG. 2

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TAPPET FOR OVERHEAD CAMSHAFT ENGINE

BACKGROUND OF INVENTION

Internal combustion engines with the cam shaft mounted "overhead" or on the cylinder head, are gaining industry-wide favor because of the greater efficiency obtained with them. There are however several drawbacks encountered with this type of engine in which an inverted cup type tappet is located between the cam shaft and the end of the valve stem which remain unsolved. One significant problem is the difficulty in making lash adjustments. Yet another is the large size and consequent high cost of the tappet, which must be large enough in diameter to fit over and outside of the engine valve spring. The high cost is due to the high quality material needed for the surfaces that contact the cam shaft and valve stem. Heretofore, the entire valve lifter body has been formed of this high quality, high cost material. Thus, a primary object of this invention is to make a tappet that provides a low cost hydraulic lash adjuster which eliminates a significant amount of the heretofore required high quality material.

SUMMARY OF INVENTION

For achievement of these and other object, this invention is comprised of a valve lifter assembly having a plunger slidably mounted within the lifter body for reciprocal movement therewith, the valve lifter body being mounted for axial movement within a cylinder head guide but spaced therefrom to provide a significantly smaller lifter body in diameter thereby eliminating the heretofore required high cost lifter body required to fit over and enclose a portion of the valve stem and associated spring. To accomplish this, an intermediate tubular shaped member of low cost material is detachably connected to the valve lifter body by a spring clip means. The tubular member has sides engageable with the guide for guiding movement therebetween and a pair of open ends, one fitting over the valve lifter body, the other encapsulating the upper end of the valve stem and associated spring. A portion of the tubular member is constricted for engagement with the valve lifter body and includes means permitting the insertion of the spring clip to join the tubular member to the valve lifter.

In accordance with this invention, the above-described combination permits a concentration of high quality material only at the important stress points. That is, the high quality material is limited to the hydraulic tappet structure and points of contact between the cam and stem. The intermediate tubular member permits a significant reduction in the amount of high quality material necessary to meet these requirements.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a transverse sectional view of an hydraulic valve lifter assembly arranged according to this invention;

FIG. 2 is a fragmentary sectional view taken along line II—II of FIG. 1; and

FIG. 3 is a partial side elevational view of the hydraulic valve lifter assembly of FIG. 1

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings in detail, FIG. 1 shows an engine assembly **10** including a conventional internal combustion engine having a plurality of cylinders and pistons (not shown) therein to drive a crank shaft (not shown) for power output. The engine includes a cylinder head **11** of conventional construction, having intake and exhaust engine valves **12** for each cylinder, and extending through the head so that the tip **14** of the valve stem protrudes from and above the engine cylinder head.

The valve stem rides within the bore provided in the cylinder head and within extended guide bushing **16**. It includes a reduced diameter neck **18** around which a generally disc shaped keeper **20** is fitted to retain compression spring **22** between it and the cylinder head. Mounted in the overhead position above the valves and cylinder head is the overhead

cam shaft **24** which includes a plurality of spaced cams **26**, one for each valve, and each having a base circle **28** and an operating camming lobe **30** in conventional fashion.

Tappet **40** is comprised of a valve lifter body **42** comprising a cup-shaped cylinder member whose closed end **44** is in abutting engagement with cam **26**. Nestled within valve lifter body **42** is an upwardly extending generally cup-shaped lash adjuster body **50** whose closed lower end **52** rests on the upper end **14** of the valve stem.

The lifter body and lash adjuster body are slidable relative to each other to provide the tappet adjustment. A retainer ring **46** is mounted in an annular groove **48** on the interior surface of lifter body **42** for retaining the adjuster body within the lifter.

Valve lifter body **42** and adjuster **50** are inverted with respect to each other and define a chamber **54** segregated by a plunger **60**. Plunger **60** segregates chamber **54** into a fluid pressure chamber **62** formed within the interior of adjuster member **50** below plunger **60** and a reservoir **64** formed within the interior portion of valve lifter body **42** above the adjuster member **50** and plunger **60**. Pressure chamber **62** is supplied with engine oil via an oil gallery **66** open to a branch port **68** in communication with reservoir **64** through ports **70** and **72**. A plunger passageway **74** permits flow of the engine oil from reservoir **64** to pressure chamber **62** the flow being controlled by a check valve **76** permitting flow of the engine oil in one direction, that is, from the reservoir to the chamber while preventing return flow therethrough.

Check valve **76** is biased into a closed position by spring **78**, spring **78** being held in compression against valve **76** by a cage **80** held in place against the lower portion of plunger **60** by a spring **82**, the spring constant of which considerably exceeds that of spring **78**. Valve **76** is also biased toward its closed position when the pressure in chamber **62** exceeds that in the reservoir. Spring **78** and cage **80** limit the opening travel of valve **76** to the amount necessary to accommodate replenishment of pressure chamber **62** with oil which normally escapes therefrom during "leakdown." Leakdown will occur during cam induced opening movements of the engine valve causing oil to leak between the sliding surfaces of the plunger **60** and cup-shaped adjuster **50**. Cage **80** has a stepped cross section wherein movement of valve **76** is estopped past abutment **84** on the cage.

During each engine valve opening, cam lobe **30** provides downward movement of the valve lifter body **42** tending to force the plunger further into the interior of lash adjuster **50**. The resulting pressure rise in chamber **62** causes valve **76** to seat preventing reverse flow of the oil through the plunger passageway **74**. It is this pressure which provides proper lash adjustment and the only movement of oil out of chamber **62** is leakage between the mating surfaces of the plunger and lash adjuster. With continued downward movement, the lash adjuster is likewise moved downwardly under the thrust of the trapped oil in chamber **62** forcing the engine valve to open against its spring **22**. On the return stroke, the closed end **44** of valve lifter body **42** is urged against the cam under the baising force of engine valve spring **22** as the cam rotates through its base circle portion **28**. This reduces the oil pressure in chamber **62**, although engine oil pressure is still present, which with the bias provided by spring **82** urges the plunger back up towards the closed end of lifter body **42**, while maintaining abutment of the closed end **52** of lash adjuster **50** against the stem tip **14**. The relative movement so provided permits valve **76** to be unseated thereby allowing flow of replenishment oil to chamber **62** as necessary to completely fill it preparatory to the lift operating cycle. The magnitude of relative movement between valve lifter **42** and lash adjuster **50** will vary according to the expansion and contraction of the various parts as a result of wear and tear, or temperature gradients in the engine.

It will be appreciated that valve lifter body **42**, lash adjuster **50** and plunger **60** are all comprised of a high quality, high cost material due to the requisite machining tolerances and

sliding movements relative thereto resulting from the constant oscillations required. Also, the parts are of a size that can be run on currently used machinery for high volume manufacturing of hydraulic tappets for push rod type engines. In prior proposals, the cost of these materials were prohibitive or at least deterrent to an overhead valve lifter since the valve lifter body **42** in prior proposals fit over and partially enclosed the end portion of stem spring **22** and associated keeper **20**. This requirement is eliminated by the embodiment shown in FIG. **1** and as a result thereof, it is no longer required to encapsulate a portion of the valve stem and spring with the valve lifter body resulting in a significant reduction in the diameter of the valve lifter body (as shown in FIG. **1** to be substantially less than the spring diameter) and overall length thereof.

This is accomplished by an intermediate guide member **90** connected to and positioned intermediate the valve lifter body **42** and cylinder head **11**. That portion of cylinder head **11** extending upwards around the tappet includes a cylindrical bore **92** which acts as a guide for the adjusting movement of the tappet. Intermediate member **90** is generally sleeve-like and preferably tubular in shape providing a sliding fit in bore **92**, the bore and guide **90** being concentric with the valve stem. The guide extends downward over the end portion of the stem spring **22** and associated keeper **20** to provide lateral support for the valve lifter body to relieve the lifter body, adjuster and plunger of all side thrusts as would otherwise be induced from the cam.

Preferably, guide member **90** is comprised of a generally cylindrical side **94** and extends substantially from the closed end portion **44** of the valve lifter body downwards over the uppermost portion of spring **22** terminating approximately in the vicinity of guide bushing **16**. The upper end **95** of guide member **90** is turned inwardly to form a flange whose inner end **96** forms a snug fit with the valve lifter body. Spaced axially downward therefrom, is a constricted portion **96**, the depth of which is equal to the distance between the valve lifter body and bore **92**. The interior surface **98** of constricted portion **96** forms an annular surface which is in snug contact with valve lifter body **42** and in combination with flange **94** provides a positive annular grip of the valve lifter body at two spaced locus of points.

Referring to FIGS. **2** and **3** a generally C-shaped spring clip **100** interlocks guide member **90** to the valve lifter body. The ends of the clip are formed into a pair of radially extending ears **102** and **104** which are inserted through the guide member body into the valve lifter body. This is accomplished by providing a pair of diametrically opposed openings **106** and **108** through the interior surface **98** of the guide member to permit insertion of the ears. In addition, the valve lifter body includes an annular groove **110** likewise for receipt of ears **102** and **104**. Thus, with the ears extending approximately equal in length to the depth of the openings and ears, the guide member is detachably secured to the valve lifter body by the spring clip. A port **70** is provided through the guide member to permit the passage of oil from gallery **66** through branch **68** on into reservoir **64** through port **72**.

It will be appreciated that while the spring clip provides a snug and facile interlock between the guide member and valve lifter body, any air entering the system is vented out of the guide member at the point wherein the flange **94** abuts against the valve lifter body. This prevents any undesirable pressure build-up in the system.

Preferably, guide member **90** is comprised of sheet metal rolled to the shape shown from tubing. This could be steel tubing which would preferably be carbo-nitrided or aluminum. If aluminum is used, it might be necessary to apply one of the surface hardening processes to prevent excessive wear on the outer surface engagement with bore **92**. This type of shaped tubing is significantly inexpensive compared to the high quality material required in the lifter body itself and therefore provides significant savings on a per part basis. Realizing the quantity of tappets used in the automotive industry alone, these savings become extremely advantageous.

Although but one embodiment has been shown and described in detail, it will be obvious to those having ordinary skill in this art that the details of construction of this particular embodiment may be modified in a great many ways without departing from the unique concepts presented. It is therefore intended that the invention is limited only by the scope of the appended claims rather than by particular details of construction shown, except as specifically stated in the claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In an engine having an overhead cam valve lifter assembly comprising, in combination:
- a cam means;
- a tappet guide means;
- a spring biased valve stem;
- a valve lifter body having a closed end engageable with said cam means;
- a plunger slidably mounted in said lifter body for reciprocating movement therebetween, said plunger engaging said stem;
- the improvement comprising:
  - said valve lifter body spaced radially from said guide means;
  - an intermediate member connected to said lifter body and slidable within said guide means to provide axial movement of said lifter body within said guide means; and
  - connector means for connecting said intermediate member to said lifter body.

2. The combination according to claim **1** wherein said connector means detachably mounts said intermediate member to said lifter body.

3. The combination according to claim **2** wherein said connector is comprised of a spring clip.

4. The combination according to claim **1** wherein said intermediate member is generally tubular in shape and includes sides in slidable engagement with said guide means and open ends, one of said ends fitting around said valve lifter body, the other end fitting over said spring biased valve stem and associated spring.

5. The combination according to claim **4** wherein said means detachably mounts said intermediate member to said lifter body.

6. The combination according to claim **5** wherein said means is comprised of a spring clip.

7. The combination according to claim **4** wherein said intermediate member includes a constricted portion engaged with said valve lifter body.

8. The combination according to claim **7** wherein said means is comprised of a spring clip detachably mounting said intermediate member to said lifter body.

9. The combination according to claim **7** wherein a portion of the sides of said tubular member are depressed inwardly to form said constricted portion, said constricted portion including a pair of apertures therethrough, said valve lifter body including a recessed opening in alignment with said apertures, said means comprising a generally C-shaped spring clip having an inturned ear on each end thereof said ears being inserted into said apertures and openings to detachably join said intermediate member to said valve lifter body.

10. The combination according to claim **9** wherein said valve lifter body opening comprises a groove around the periphery of said body.

11. The combination according to claim **9** wherein said one of said open ends of said intermediate member is turned inwardly to provide a flange in snug engagement with said valve lifter body spaced axially from said constricted portion.

12. An improved hydraulic valve lifter assembly for an overhead cam shaft engine having a cam shaft with cams spaced therealong, and a tappet guide means for guiding a tappet comprising:
- a valve lifter body having a closed end provided for engagement with a cam of an overhead cam shaft;

a plunger body slidably mounted in said lifter body for reciprocal movement and adapted for engagement with a valve stem;

a sleeve-like member secured to and extending about the periphery of said lifter body and adapted for sliding movement in a tappet guide means to provide support for and axial movement of said lifter body in said tappet guide means.

13. The improvement according to claim **12** wherein said sleeve-like member includes sides spaced from said valve lifter body for sliding engagement with said tappet guide means.

14. The improvement according to claim **13** wherein said sleeve-like member includes a constricted portion engaged with said valve lifter body.

15. The improvement according to claim **14** wherein said sleeve-like member includes connector mean detachably securing said sleeve-like member to said valve lifter body.

16. The improvement according to claim **15** wherein a portion of the sides of said sleeve-like member are depressed inwardly to form said constricted portion, said constricted portion including a pair of apertures therethrough said valve lifter body including a recessed opening in alignment with said apertures, said connector means comprising a generally C-shaped spring clip having an inturned ear on each end thereof said ears being inserted into said apertures and openings to detachably join said sleeve-like member to said valve lifter body.

17. A tappet guiding member comprising a tubular element having a top, bottom and sides; said top having an opening adapted to receive cam engaged self adjusting valve lifter body, said bottom having an opening for receiving a valve stem and valve spring; and means for securing said guiding member to a cam engaged self adjusting valve lifter body received within said opening.

18. The tappet guiding member according to claim **17** wherein the sides of said tubular element are spaced from said valve lifter body for sliding engaged with a tappet guide means to provide support for and movement of said valve lifter body in said tappet guide.

19 The tappet guiding member according to claim **18** where a portion of the sides of said member intermediate said top and bottom is depressed to form a constricted portion for engagement with said valve lifter body.

20. The tappet guiding member according to claim **19** wherein the top of said tubular element is turned inwardly to provide a flange in snug engagement with said valve lifter body, said flange being spaced axially with respect to said tubular element and valve lifter body from said constricted portion to provide positive support for said valve lifter body.

21. The tappet guiding member according to claim **19** wherein said means for securing said guiding member to a valve lifter body is comprised of a generally C-shaped spring having an inturned ear on each end thereof; said constricted portion including a pair of apertures therethrough; said valve lifter body including recessed opening in alignment with said apertures; and said inturned ears on said C-shaped spring clip being removably inserted into said apertures to detachably join said tubular member to said valve lifter body.

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