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HYDRAULIC SPACER

Filed March 13, 1959

FIG. 1

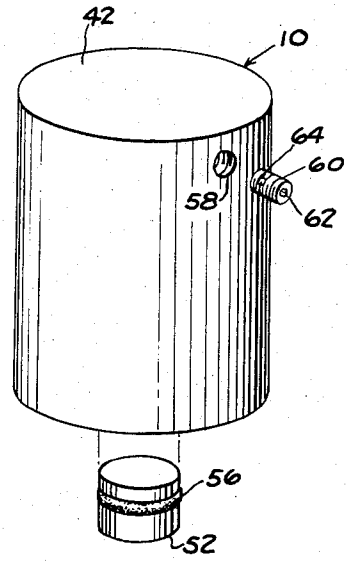
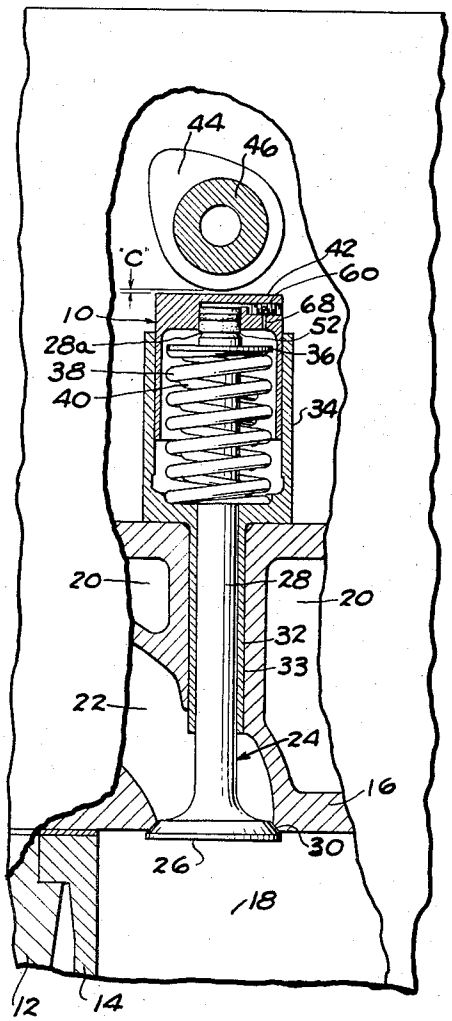


FIG. 2



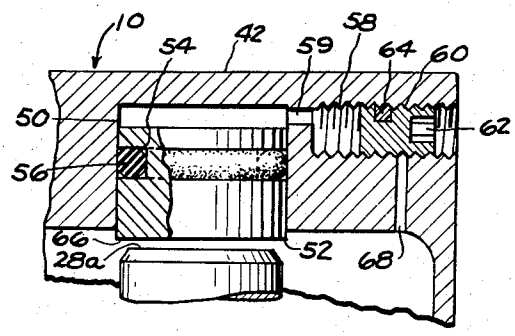


FIG. 3

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HYDRAULIC SPACER

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7 Claims. (Cl. 123—90)

The present invention relates to hydraulic spacers and more particularly to a manually adjustable hydraulic spacer incorporated in a valve tappet assembly for an internal combustion engine.

In internal combustion engines employing poppet valves it is always important to maintain a designed clearance in the valve actuating mechanism. Such clearance is usually located between the cam lobe and the cam follower. If the clearance is too small, the valve may not close under all operating conditions or, alternatively, if it is too great there may be excess wear on the cam follower because the cam lobe does not strike it at the proper angle.

Various means have been suggested and employed to allow adjustment in dimension so as to permit maintenance of the specified clearance after engine parts have become worn through use. The present invention discloses a device of simple construction for varying the thickness of a valve tappet which has many advantages over the prior art and is particularly adapted to large engines having overhead cams acting directly above the poppet valve assembly. It is to be understood, however, that it is equally adaptable in valve applications of other types and configurations.

It is an object of the present invention to provide an adjustable valve tappet spacer capable of accurately maintaining a specified clearance between the cam and cam follower of a poppet valve engine.

It is still another object of the present invention to provide an adjustable hydraulic tappet spacer which contains an hydraulic fluid that may be displaced to control the thickness of the head of the tappet body.

These and further objects of the present invention will become apparent from the following discussions and the accompanying drawings in which:

Figure 1 is a perspective view of a tappet body incorporating the manually adjustable hydraulic spacer of the present invention;

Figure 2 is an elevational view, partly in section, of a portion of an engine incorporating the spacer of Figure 1; and

Figure 3 is an elevational view in section of the manually adjustable hydraulic spacer.

Referring now to the drawings wherein like reference numerals define like parts, in Figure 1 a cup-shaped valve tappet body **10** is disclosed which incorporates the adjustable hydraulic spacer mechanism in its preferred form. Figure 2 discloses a portion of a poppet valve internal combustion engine having a cylinder block **12** and a cylinder liner **14** secured therein. The liner **14** and a cylinder head **16** combine to define a combustion chamber **18**. Reciprocally mounted within the cylinder liner **14** is a piston, not shown, which receives and transmits the combustion forces for doing useful work. The cylinder head **16** is a cored casting having cooling water passages **20** and intake and exhaust gas passages. In Figure 2 only the intake passage **22** is shown; however, the exhaust gas passage is of similar construction.

The intake passage **22** is sealed from the combustion chamber **18** by a poppet valve **24** having a valve head **26** and a valve stem portion **28**. The valve head **26** is adapted to have a sealing contact with a valve seat **30** formed at the mouth of the intake passage **22**. The valve stem **28** is reciprocally received within a sleeve member **32** which functions as a liner or bearing surface for the sliding valve stem **28**.

The sleeve **32** is received within a vertical bore **33** formed in the cylinder head **16** and has an upstanding cup member **34** integrally formed on the upper end of the sleeve **32**. The upper end of the valve stem **28** has a collar-like spring retainer **36** detachably affixed thereto. There is provided a pair of coaxial valve springs **38** and **40** interposed between the spring retainer **36** and the inner floor of the cup member **34**. Telescopingly received within cup member **34** is the tappet body **10**. Tappet body **10** is of an inverted cup shape and fits over the upper end of the valve stem **28***a*.

Tappet body **10** constitutes a cam follower and its upper surface **42** receives the sliding face of an eccentric cam lobe **44** carried by a camshaft **46**. As is well known, the rotation of the camshaft **46** is coordinated with the movement of the piston so that the cam lobe **44** will bear against surface **42** to drive the poppet valve **24** downwardly at the desired moment in the cycle. This action will unseat the valve head **26** and permit the reception of combustion supporting air through passage **22** into combustion chamber **18**.

In order to maintain perfect combustion it is necessary that the valve head **26** be seated at all times other than when it is intended that combustion supporting air be admitted to the combustion chamber **18**. It is for this reason that a clearance *c* is provided between the minimum radius of the cam **44** and the upper surface **42** of the tappet body **10** when valve **24** is fully seated. This clearance will ordinarily be in the order of .005 to .015 inch.

Due to manufacturing tolerances and wear encountered during the operation of an engine, it is necessary from time to time to make adjustments in the working parts so as to obtain a constant clearance *c*. Such adjustment is permitted by the present invention.

In Figure 3 details are shown of the construction of the tappet body **10** wherein a vertical cylinder bore **50** is provided and has slidably disposed therein a piston member **52**. Piston **52** has a circumferential groove **54** for the reception of a flexible sealing element **56** disclosed in the drawing as being preferably of the O-ring type. Ring **56** assures a sealing contact between the piston **52** and the cylinder **50**. There is also provided in the head of the tappet body **10** a horizontal bore **58** which is communicatively connected with the cylinder **50** by means of an orifice **59**. The wall of bore **58** is threaded to receive a plug **60**. The plug **60** is characterized by a tool-receiving socket **62** in its outer end and a flexible sealing member **64** disposed somewhere along its periphery.

An incompressible fluid is trapped in the chambers defined by the bores **50**, **58** and between piston **52** and plug **60**. Sealing elements **56** and **64** prevent the passage of fluid beyond the piston **52** or plug **60** respectively. It is thus apparent that as the plug **60** is threaded in or out, hydraulic fluid will be forced through the orifice **59** and into or out of the cylinder **50** and consequentially piston **52** will correspondingly be forced into or out of the cylinder **50**. It is thus obvious from the foregoing structure that the dimension of the valve body between the upper face **42** and the lower face **66** of piston **52** can be controlled by the lateral positioning of plug **60**. Because the plug **60** is smaller than the piston **52**, greater axial movement of the plug **60** will be required for a corresponding

shift of the piston **52**, permitting an accurate adjustment of that dimension.

A bleed passage **68** is provided in the tappet body **10** so that the chambers of bores **50** and **58** may be filled with hydraulic fluid, the piston **52** inserted in position, and then plug **60** screwed into the bore **58**. As the plug **60** is threaded into position excess fluid will be forced out through the bleed passage **68** until the plug **60** is well received within the bore **58** and the sealing element **64** has passed the mouth of passage **68**. This activity thus assembles the tappet body **10** for installation into the engine. Referring to Figure 2, it is seen that when properly located face **66** of piston **52** bears against the end **28***a* of valve stem **28**.

When the tappet **10** is located in the valve assembly as seen in Figure 2, a feeler gauge corresponding to the dimension *c* in thickness is interposed between the cam **44** and the tappet face **42**. A tool is then inserted in socket **62** and the plug **60** is adjusted horizontally causing a vertical adjustment of the piston **52**. When the horizontal adjustment of plug **60** is achieved which gives the desired clearance *c* as indicated by the feeler gauge, then the valve assembly is ready for operation.

Because the fluid trapped between the piston **52** and plug **60** is of constant volume, clearance *c* will be maintained until wearing of the valve head **26**, valve seat **30**, tappet face **42**, or of the cam **44** has occurred. Such wearing will change the clearance, and it will then be necessary to again adjust the spacer to maintain the desired clearance *c*. This further adjustment is achieved by merely screwing the plug **60** in or out until the clearance *c* is again realized.

The foregoing constitutes the preferred form of the present invention. Variations will occur to those skilled in the art which will fall within the scope and spirit of the following claims.

I claim:

1. A valve tappet spacer having a blind hole therein, a piston slidably received within said hole, a second hole intersecting said first mentioned hole in the region of said hole normally between the blind end thereof and said piston and having a plug threadably received therein, and hydraulic fluid disposed in said holes and trapped between said piston and said plug.

2. A valve tappet spacer assembly having a cup shaped cam follower, said follower having a head portion with a blind hole therein, a piston slidably received within said hole, a second hole intersecting said first mentioned hole in the region of said first hole normally between the blind end thereof and said piston and having a plug threadably received therein, and hydraulic fluid disposed in said holes and trapped between said piston and said plug.

3. In an internal combustion engine having cam actuated poppet valves a cup shaped cam follower, said follower having a head portion with a longitudinal blind hole opening toward the inside of said cup shaped cam follower, a piston slidably received within said hole, a transverse hole communicating with said first hole in the region normally between the blind end thereof and said piston, a plug threadably received within said second hole, and hydraulic fluid disposed in said holes and trapped by said plug and said piston.

4. In a valve tappet assembly an adjustable thickness device comprising an element having a blind longitudinal bore and a piston slidably received within said bore, a second bore communicatively connected to said first mentioned bore in the region normally between the blind end of said bore and said piston and having a plug member threadably received therein so as to define a sealed chamber between said piston and said plug.

5. In an internal combustion engine having cam actuated poppet valves comprising serially disposed cam and poppet valves a cam follower and adjustable spacer device interposed between said cam and said valve, said device having a longitudinal bore directed away from said cam, a piston slidably received within said bore, a second bore in said follower communicating with said first mentioned bore in the region normally between the closed end thereof and said piston, a plug threadably received within said second bore, and hydraulic fluid disposed in said bores and trapped between said plug and said piston.

6. In a valve tappet assembly an adjustable thickness device comprising an element having a blind longitudinal bore and a piston slidably received within said bore, a second bore communicatively connected to said first mentioned bore in the region normally between the closed end of said first bore and said piston and transverse thereto, said second bore being of substantially lesser diameter than said first mentioned bore, and a plug member threadably received within said second bore so as to define a sealed chamber between said piston and said plug.

7. A hydraulic spacer for placement between a tapper element and a tap receiving element, which comprises: a piston member; a piston receiving member having a piston chamber open at one end and closed at the opposite end with said piston member being slideably disposed therein and normally spaced from said closed end and an auxiliary, hydraulic fluid chamber with an interconnecting passageway therefrom to said piston chamber in the region thereof normally between said piston member and said closed end of said piston chamber, one of said piston member and piston receiving member being adapted to be in combination with one of said elements; and adjustment means for adjusting the hydraulic fluid capacity of said auxiliary chamber.

References Cited in the file of this patent

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