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Cornell

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[54] **HYDRAULIC TAPPET WITH SWIVELABLY MOUNTED PUSHROD**

[72] Inventor: **Richard D. Cornell,** Muskegon, Mich.

[73] Assignee: **Johnson Products, Inc.,** Muskegon, Mich.

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[52] **U.S. Cl.**.....**123/90.27,** 123/90.35, 123/90.61

[51] **Int. Cl.**.....**F01l 1/14,** F01m 9/10

[58] **Field of Search** .....123/90.48, 90.27, 90.39, 90.41, 123/90.42, 90.46, 90.55, 90.61, 90.63, 59 A; 74/519, 559

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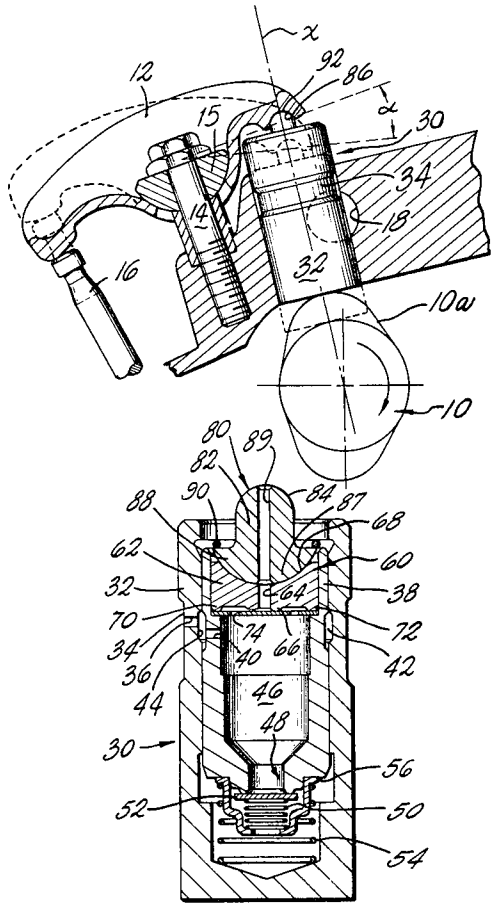
Primary Examiner—Al Lawrence Smith

Attorney—Price, Heneveld, Huizenga & Cooper

[57] **ABSTRACT**

A hydraulic tappet in an overhead cam engine characterized by a rocker arm seat swivelably mounted in the tappet and with respect to the rocker arm so as to compensate for the axial misalignment of the rocker arm during the reciprocation of the tappet.

4 Claims, 2 Drawing Figures



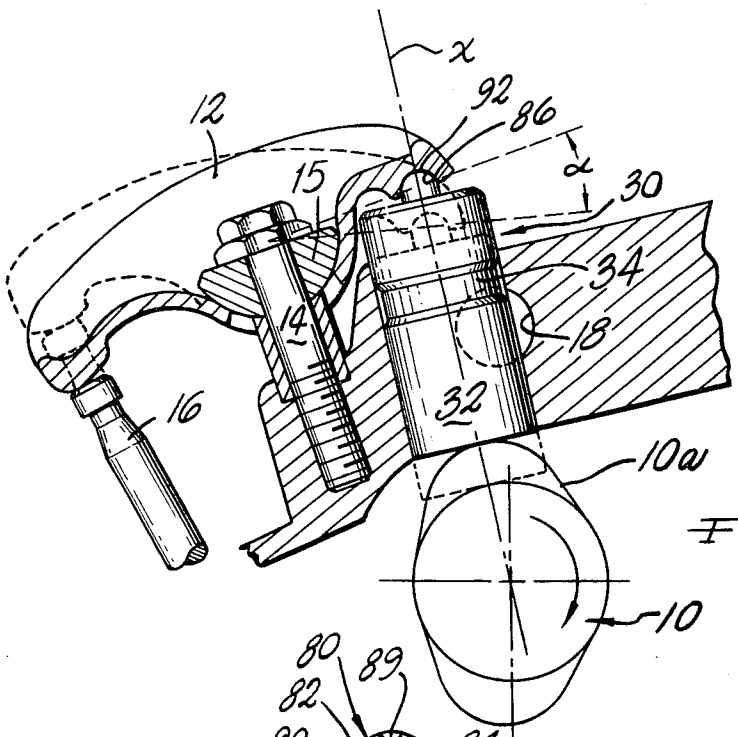


FIG. 1

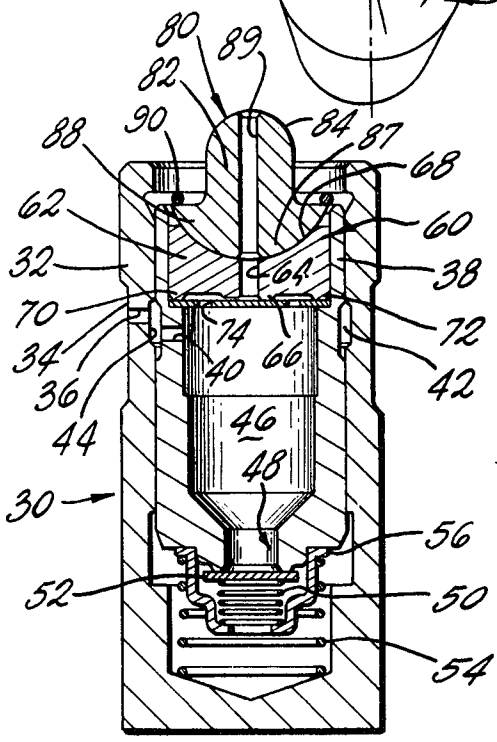


FIG. 2

INVENTOR
RICHARD D. CORNELL

BY
Price, Heneveld, Huizenga & Cooper
ATTORNEYS

HYDRAULIC TAPPET WITH SWIVELABLY MOUNTED PUSHROD

BACKGROUND OF THE INVENTION

Hydraulic tappets have been utilized predominantly with engines other than overhead cam engines which in most instances have featured lash adjusters. The difficulty in utilizing hydraulic tappets with an overhead cam engine is that the rocker arm is located a relatively short distance from the cam shaft. As a result, the space available between the cam and the rocker arm is so limited as to prevent the use of a normal length push rod. Further, the rocker arm is mounted for pivotal movement so that the push rod socket adapted to receive the tappet push rod moves along an arcuate path. At the same time, the tappet is mounted for reciprocation. As a result, to my knowledge to the present day there has been no success in developing any type of arrangement whereby the arcuate moving push rod socket will accommodate the push rod of a reciprocating hydraulic tappet. In other words, there has been no means for compensating the difference in movement between the arcuate movement of the rocker arm and the reciprocating movement of the hydraulic tappet.

SUMMARY OF THE INVENTION

In accordance with my invention, I have provided a means whereby a hydraulic tappet can be utilized in overhead cam engines. I provide a tappet with the usual components including the tappet body having a bore with an open end, a plunger mounted for reciprocal movement within the bore of the body, a push rod seat mounted on the plunger adjacent the open end of the body, and a push rod of reduced length which is swivelably associated with the push rod seat at one end and at the other end has means adapted for swivel association with the push rod socket of the rocker arm. These swivel connections provide means for compensating for the axial misalignment of the tappet with respect to the push rod socket in the different positions of the rocker arm along its arcuate path.

It will therefore be evident that my invention provides a tappet which can be utilized by an overhead cam engine in such a fashion that the tappet connection between the rocker arm and the tappet accommodates the rocking action of the rocker arm.

It will also be evident that I have provided a hydraulic tappet which has all the attributes of tappets used on engines other than overhead cam engines including the ability to take up the lash and also supply oil to the rocker arm by means of the hydraulic tappet.

It will be seen that I have provided a tappet whereby the oil is supplied by the tappet rather than by other means as has heretofore been required for overhead cam engines.

Further, an object of this invention is to make possible the use of hydraulic tappets in overhead cam engines without experiencing difficulties in misalignment between the tappet and the rocker arm, such difficulties heretofore having created serious problems which practically eliminated the possibility of using hydraulic tappets with overhead cam engines.

Still other objects of this invention are to provide such a hydraulic tappet in which conventional components, such as those disclosed in previous patents referred to in this application, can be utilized with only minimum changes in such components as will be evidenced from the following description.

Other objects and advantages will become apparent upon reference to the following drawings and detailed discussions.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary sectional view illustrating the engine valve train assembly utilizing the invention; and

FIG. 2 is a side elevational, cross sectional view of the hydraulic tappet constructed in accordance with the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

This invention concerns a hydraulic tappet for use in combination with an overhead cam engine. As shown in FIG. 1, the valve train for such an engine conventionally features cam shaft **10** having a cam **10***a* positioned in the immediate vicinity of the rocker arm **12** which is pivotally mounted on a post **14** by means of the rocker arm support **15**. A tappet **30** is provide to actuate the rocker arm so as to actuate engine valve stem **16**. The tappet **30** is conventionally provided with oil under pressure by a galley passageway **18** which is common to each tappet for each valve. The tappet **30** is so arranged (not specifically shown) so that the oil in galley **18** in certain positions of the tappet flows through passageway **36** (FIG. **2**) of the tappet body and thence through the passageway **42** of the tappet plunger into a reservoir **46** from whence it flows in a metering fashion, as will be hereinafter explained, through push rod seat opening **64** and push rod passage **89** to the rocker arm.

The hydraulic tappet **30** comprises a tappet body **32** having a surface which is recessed at **34** to accommodate oil delivered by the passageway **18**, the oil passing into the tappet body via orifice **36**. A plunger **38** is reciprocatingly positioned within the tappet body **32**, the plunger **38** being conventionally provided with a second orifice **40** and a recessed surface **42** which cooperates with an internal annular groove **44** on the tappet body **32** and the orifices **36** and **40** to pass oil into the interior cavity **46** of the plunger **38** as herebefore disclosed.

The plunger is also conventionally provided with an open upper end and a generally closed lower end except for a coaxial passageway **48** governed by a check valve assembly comprising a spring **50** and plate **52**. Another coil spring **54** urges a retainer cap **56** and therefore the plunger **38** toward the open end of the hollow tappet body **32** in a conventional fashion.

At the upper end of plunger **38** is provided a rocker arm seat assembly **80** including the push rod seat **62** and the push rod **82**, both of which have the passageways **64** and **89**, respectively, for passage of oil to the rocker arm **12** from the reservoir **46**. Between the reservoir **46** and passageway **64** is the metering means **60** of the hydraulic tappet which as shown is similar to that disclosed in U.S. Pat. No. Re. 25,974. This particular metering means includes a specially designed nose portion **66** of the push rod seat **62** and an annular ridge **70** seated upon a metering disc **72** which has apertures **74** therein for allowing oil to pass from the reservoir **46** to the passageway **64**. This configuration of the push rod seat **46** in conjunction with the disc **72** controls the flow of oil into the passage **64** in a manner identical with the control set forth in the aforesaid reissue patent. However, it will be apparent that other push rod seat designs are usable provided they accommodate the push rod **82** as described hereafter.

In accordance with another aspect of the invention, a push rod **82** is slidably mounted upon the surface **68** so as to provide a pivotal connection between tappet **30** and the rocker arm **12**. Specifically, the surface **68** of the push rod seat **62** is spherically shaped to accommodate the spherical end **87** of the push rod **82**. The opposite end **84** of the push rod is provided with a spherical surface which as shown has a radius of curvature considerably less than that of the surface for the end **82**, the end **84** being designed to fit into the socket **86** of the rocker arm **12**. In addition to its large radius of curvature, the end **87** is characterized by flanges **88** which project out almost to the width of the push rod seat **62** so as to engage, prior to the assembly of the tappet, a retainer ring **90** which is permanently confined within the tappet. The retainer ring serves to prevent separation of the rocker arm seat **80** from the metering socket **62** before assembly.

An important characteristic of the rocker arm seat **80** is its short length combined with the pivotal action of the push rod. The length of seat **80** is considerably shorter or smaller than the length of the remainder of the tappet **30** which allows the tappet **30** to fit into the very confined space between the cam

10 and the rocker arm 12 while at the same time permitting the necessary swivel-like movement which accommodates the arc prescribed by the rocker arm.

OPERATION

It will be readily appreciated that the operation of the rocker arm seat 80 is as follows. When the tappet 30 is pushed upwardly by the cam 10 to the position as shown in solid lines, the rocker arm seat 80 forces the rocker arm to rock to the position shown in solid lines in FIG. 1. At this point, the center point 92 of the socket 86 of the rocker arm 12 has departed from the axis of the tappet 30 by a small amount due to the rocking of the arm 12 through the angle "alpha". This small amount requires that the push rod 82 swivel or pivot by sliding on the surface 68 to accommodate the temporary misalignment of the point 92 with the axis of the tappet. At the same time, spherical end 84 swivels within the spherical surface 86 of the rocker arm.

Any back lash in the valve train is taken up by the hydraulic tappet in a well-known fashion. That is, the oil pressure in reservoir 46, supplied from galley 18 through passages 36 and 40, extends the plunger 38, if required, by passing through valve plate 52 into the chamber below the plunger thus applying a force thereto to extend the plunger 38 so as to hold the push rod 82 in constant contact with the rocker arm. On the other hand, the plunger can be distended by passing the oil contained in the chamber below plunger 38 around the plunger in the space between the plunger 38 and body 32 and back to reservoir 46, such action occurring when sufficient force is supplied to the end of push rod 82 due to heat expansion or the like of the valve train.

In any event some of the soil in reservoir 46 is fed to the rocker arm by flowing through disc apertures 74, the metered passageway formed by nose 66, then through passages 64 and 89 to the rocker arm.

It should be obvious from the above description that I have conceived of a hydraulic tappet construction for an overhead cam engine which has all the attributes required for smooth operation. The tappet permits the arc movement of the rocker arm and the reciprocating movement of the tappet despite the short distance therebetween. The tappet provides the necessary automatic hydraulic adjustments of other hydraulic tappets and provides a means for supplying oil through the tappet to the rocker arm.

Although the invention has been disclosed in connection with a preferred embodiment, it is not intended that it be limited thereto. Rather, it is intended that the invention cover all arrangements, equivalents, and alternate embodiments which may be included within the scope of the following claims.

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

1. A tappet for use with an overhead cam engine having a rocker arm with a push rod socket adapted for movement along an arcuate path comprising: a tappet body having a bore with an open end; a plunger mounted for reciprocal sliding movement in the bore of said body; a push rod seat mounted on said plunger adjacent the open end of said body; and a push rod of reduced length swivelably associated with the push rod seat at one end and at the other end having means adapted for swivel association with the push rod socket of said rocker arm; said swivel associations providing means for compensating for the axial misalignment of the tappet with respect to the push rod socket in different positions thereof along said arcuate path, said push rod being spherical in shape on each end and the end adjacent the push rod seat being larger than the opposite end adjacent said rocker arm.

2. The combination of claim 1 in which the end adjacent the push rod seat has a radius larger than the radius of the end adjacent the rocker arm.

3. In combination with an overhead cam engine having a rocker arm pivotally mounted whereby its push rod socket moves along an arcuate path; a tappet comprising a tappet body having a bore with an open end; a plunger mounted for reciprocal sliding movement in the bore of said body; a push rod seat mounted on said plunger adjacent the open end of said body; and a push rod of reduced length swivelably associated with the push rod seat at one end and at the other end having means adapted for swivel association with the push rod socket of said rocker arm; said swivel associations providing means for compensating for the axial misalignment of the tappet with respect to the push rod socket in different positions thereof along said arcuate path, said push rod being spherical in shape on each end and the end adjacent the push rod seat being larger than the opposite end adjacent said rocker arm.

4. The combination of claim 3 in which the end adjacent the push rod seat has a radius larger than the radius of the end adjacent the rocker arm.

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