A valve train actuating device for an internal combustion engine including a lever-type cam follower and a hydraulic support element for supporting the cam follower is provided. The hydraulic support element includes at least one piston guided in a housing (1), the piston having at least one reservoir (3) for pressure medium for a hydraulic valve lash adjustment. The piston cooperates on a supporting head (2) projecting out of the housing (1) with a supporting region (4) of the cam follower, and a pressure medium inlet is configured on the supporting head (2) and on the supporting region (4) for supplying pressure medium to the reservoir (3).
Fig. 1
VALVE TRAIN ACTUATING DEVICE FOR AN INTERNAL COMBUSTION ENGINE

INCORPORATION BY REFERENCE


FIELD OF THE INVENTION

[0002] The invention concerns a valve train actuating device for an internal combustion engine.

[0003] Hydraulic support elements for cam followers in valve trains are usually supplied with pressurized oil from the engine oil pump of the internal combustion engine through a gallery. A hydraulic support element for a switchable finger lever of a valve train of an internal combustion engine is shown in DE 10 2008 038 792 A1. In this case, a pressure piston is guided in a bore of a pot-shaped housing on which the finger lever is supported with an end region on a head protruding out of the housing. Two reservoirs for the pressure medium for a hydraulic valve lash adjustment are configured in the interior of the pressure piston. The pressure medium supply to the reservoirs in the piston is effected through the oil pump of the internal combustion engine. For this purpose, oil supply channels and/or openings are required in the cylinder head of the internal combustion engine and on the housing of the support element, and these can only be realized through use of complex and expensive means. In addition, this leads to an additional requirement of energy for the oil pump. In case the support element is to be installed in an inclined position of the support element relative to the horizontal line, there exists the danger of the pressure medium leaking out of the pressure medium supply openings of the housing. Further, this also necessitates provision of a pressure relief opening on the housing in order to avoid a pumping-up of the support element with hydraulic medium during operation.

SUMMARY

[0004] The object of the invention is therefore to simplify and make more cost-effective the pressure medium supply to the hydraulic support element in a valve train actuating device of the previously cited type. This object is achieved with one or more features of the invention.

[0005] For pressure medium supply to the reservoir in the piston of the hydraulic support element, the invention provides configuring a pressure medium inlet on the supporting head of the piston and on the supporting region of the cam follower. In this way, complex and expensive constructional measures for pressure medium supply on the cylinder head of the internal combustion engine and on the housing of the support element are avoided. Under the action of gravitational force, the pressure medium can flow via the pressure medium inlet on the supporting head in a simple manner into the reservoir of the piston so that a pump is not required for the pressure medium supply. Further, because no through-openings for the pressure medium supply are required on the housing of the support element, a leakage of pressure medium out of the support element in an installation position that is inclined relative to the horizontal line can be prevented.

[0006] According to a particularly simple embodiment of the invention, the pressure medium inlet is configured in the form of two through-bore that correspond to each other and are situated respectively, on the supporting region of the cam follower and on the supporting head of the piston.

[0007] It is advantageous to make the diameter of the through-bore on the supporting region of the cam follower larger than the diameter of the through-bore on the supporting head of the piston. In this way, in a simple manner, an at least intermittent overlap of the through-bore on the supporting region of the cam follower and on the supporting head of the piston is guaranteed during the pivotal movements of the cam follower.

[0008] It is further advantageous if the outer side of the supporting region of the cam follower facing away from the supporting head comprises in the region of the through-bore of the pressure medium inlet, a means for collecting pressure medium and routing this pressure medium into the through-bore. In this way, the oil, particularly in the form of spray oil, existing in the region of the cylinder head under operational conditions and emanating from the engine or lubricant oil circulation of the internal combustion engine can be utilized for the pressure medium supply.

[0009] For collecting the pressure medium and routing it into the through-bore on the supporting region of the cam follower, it is possible to use at least one baffle plate that is connected to the supporting region of the cam follower.

[0010] Advantageously, the baffle plate is funnel-shaped or configured with a V-shaped cross-sectional profile.

[0011] For realizing a simple fixing, the baffle plate can be configured as a sheet metal clip that surrounds the supporting region of the cam follower at least partially.

[0012] For this purpose, it is possible to configure the baffle plate in one piece with a retaining element for fixing the supporting head of the piston on the supporting region of the cam follower.

[0013] In one preferred embodiment of the invention, the piston comprises two piston parts that are arranged coaxially to each other, behind each other in the housing. In this embodiment, the piston protrudes with an upper piston part out of the housing on the supporting head. This embodiment enables an internal pressure medium return within the support element between the reservoir and the high pressure chamber on the lower piston part. This results in very short sinking times of the piston during the cam lift phase.

[0014] Starting from an end of the piston upper part facing away from the supporting head, it is possible to arrange coaxially within the reservoir of the upper piston part, a bushing that extends through the reservoir into the supporting head. If the installation position of the support element is inclined relative to the horizontal line, the bushing prevents a leakage of the pressure medium out of the piston upper part.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Further features of the invention result from the following description and from the appended drawings in which a number of examples of embodiment of the invention are shown in simple illustrations.

[0016] FIG. 1 shows a section of a valve train actuating device according to the invention for an internal combustion engine, in a first example of embodiment.

[0017] FIG. 2 shows a section of a valve train actuating device according to the invention for an internal combustion engine, in a second example of embodiment.

[0018] FIG. 3 shows a section of a valve train actuating device according to the invention for an internal combustion engine, in a third example of embodiment.
FIG. 4 shows a section of a valve train actuating device according to the invention for an internal combustion engine, in a fourth example of embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The valve train actuating device according to a first example of embodiment illustrated in FIG. 1 shows a lever-type cam follower of a valve train, not further shown, of an internal combustion engine, and a hydraulic support element for supporting the cam follower. The hydraulic support element comprises a pot-shaped housing 1 in which a cylindrical piston is guided. The piston protrudes with a supporting head 2 out of the housing 1. The lever-type cam follower is pivotally supported through a supporting region at the supporting head 2. A reservoir 3 for pressure medium for realizing a hydraulic valve lash adjustment is configured in the interior of the piston.

The piston is made in two parts i.e., a piston upper part and a piston lower part, the piston upper part comprising the supporting head 2. The piston upper part and the piston lower part are arranged coaxially behind each other in the housing 1. The end of the piston upper part facing away from the supporting head 2 is situated on the piston lower part which, in turn, is supported through a re-setting spring on the closed bottom of the housing 1. The reservoir 3 is configured in the interior of the piston upper part and the piston lower part. A non-return valve is arranged on the piston lower part and connects the reservoir 3 to a high pressure chamber for pressure medium for the hydraulic valve lash adjustment, said high pressure chamber being situated in the housing 1 and defined at a front end by the piston lower part.

The cam follower is configured as a finger lever and is pivotally supported at one end section on a semi-spherical supporting region 4 on the supporting head 2 of the piston. The support element is fixedly arranged with its housing 1 in a bore on the cylinder head, not shown, of the internal combustion engine. At its end section facing away from the supporting region 4, the finger lever cooperates with a gas exchange valve of the internal combustion engine.

Starting from its front side end, the supporting head 2 of the piston comprises a central axial through-bore 5 that corresponds on one side to a through-bore 6 on the supporting region 4 and communicates on the other side with the reservoir 3 in the interior of the piston. The through-bore 5, 6 form a pressure medium inlet to the pressure medium supply of the reservoir in the piston. Here, it is possible for the oil existing under operational conditions in the form of spray in the region of the cylinder head or dripping from adjacent components out of the engine circulation or the lubricating oil circulation of the internal combustion engine to settle on the outer side of the supporting region 4 facing away from the supporting head 2 and to flow under the action of gravitational force through the through-bore 6 and the corresponding through-bore 5 into the reservoir 3 in the piston. In this way, the oil already situated in the cylinder head region of the internal combustion engine for a pressure medium supply to the support element is utilized, so that a pressure medium supply through the oil pump of the internal combustion engine is not required. It is, however, also imaginable for the pressure medium inlet to be connected to the pressure medium supply of the internal combustion engine, for example, through tubes.

By reason of the configuration of the pressure medium supply on the supporting head 2 of the piston, through-openings to the pressure medium supply on the housing 1 of the support element are avoided. Thus, the support element, when mounted in an installation position at an installation angle of approximately 30° relative to the horizontal line, is protected from a leakage of pressure medium through the housing 1.

The inner diameter of the through-bore 6 on the supporting region 4 is approximately twice as large as the inner diameter of the through-bore 5 on the supporting head 2 of the piston. In this way, it is guaranteed that during a pivoting of the finger lever during operation, the through-bore 5, 6 are in constant overlap with each other at least partially and thus guarantee a flow of pressure medium into the reservoir 3. Alternatively, the through-bore 5, 6 can also be configured such as to overlap each other only temporarily during operation.

The internal pressure medium return between the high pressure chamber and the reservoir takes place through a leak gap 7 between the outer peripheral wall of the piston lower part and the inner peripheral wall of the housing 1 and through a plurality of radially extending bead-like depressions 8 on the upper front end of the piston lower part facing the piston upper part. The depressions 8 connect the leak gap 7 to the reservoir 3 in the piston lower part. The edge of the upper front end of the piston lower part comprises a continuous annular bevel on which the pressure medium flowing in the leak gap can collect. A further pressure medium return is enabled through an annular return groove 9 configured on the outer peripheral wall of the piston upper part, said return groove 9 communicating via a through-bore 10 with the reservoir 3 in the piston upper part. It is also imaginable to provide a plurality of such return grooves comprising one or more through-bore 4 on the piston upper part.

FIG. 2 shows a hydraulic support element for a finger lever in a second example of embodiment. In this embodiment, the piston is made in one part. This leads to a reduction of the axial design length of the support element. The internal pressure medium return between the reservoir 3 and the high pressure chamber takes place in this case through a leak gap situated between the outer peripheral wall of the piston and the inner peripheral wall of the housing 1, and between the outer peripheral wall of the piston and the return groove 9 and the through-bore 10 on the piston.

In a third example of embodiment, FIG. 3 shows a hydraulic support element arranged in an installation position inclined relative to the horizontal line and comprising a two piece piston, for use in a V-type engine. Starting from the end of the piston upper part facing away from the supporting head 2 of the piston upper part is arranged in the reservoir 3, a bushing 11 that extends into the region of the supporting head 2. In this way, in an inclined installation position, the bushing 11 prevents the pressure medium from flowing out through the through-bore 10 in the piston upper part.

In the fourth example of embodiment shown in FIG. 4, a collector in the form of a collecting and baffling element 12 is arranged in the region of the through-bore 6, on the outer side of the supporting region 4 of the cam follower turned away from the supporting head 2. These collecting and baffling means 12 serve to collect the oil present under operational conditions in the region of the cylinder head and route this oil into the through-bore 6 on the supporting region 4 of the cam follower. The oil level of oil collected is indicated in
the figure through an interrupted line. The collecting and baffling element 12 in this case is configured as a funnel-shaped baffle plate configured on the outer side of the supporting region 4 turned away from the supporting head 2. The oil level of oil collected on the baffle plate is indicated in the figure through an interrupted line. A through-opening 13 is arranged on the bottom of the funnel and corresponds on the outer side of the supporting region 4 to the through-bore 6.

[0030] The baffle plate forms a sheet metal clip that surrounds the supporting region 4 on the end of the cam follower. On its side facing the supporting head 2, the clip comprises an opening at which the clip partially surrounds the supporting head 2 of the piston on a constriction, so that the piston is retained on the semi-spherical supporting region if the cam follower. In this way, the baffle plate forms at the same time a retaining clamp for the support element, said retaining clamp serving in particular as a transportation safety device.

LIST OF REFERENCE NUMERALS

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<td>Through-opening</td>
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</table>

1. A valve train actuating device for an internal combustion engine comprising a lever-type cam follower and a hydraulic support element for supporting the cam follower, said hydraulic support element comprising at least one piston guided in a housing, said piston comprising at least one reservoir for pressure medium for a hydraulic valve lash adjustment, and said piston cooperating on a supporting head projecting out of the housing with a supporting region of the cam follower, and a pressure medium inlet is configured on the supporting head and on the supporting region for supplying pressure medium to the reservoir.

2. The valve train actuating device according to claim 1, wherein the pressure medium inlet is formed by two corresponding through-holes on the supporting region of the cam follower and on the supporting head of the piston.

3. The valve train actuating device according to claim 2, wherein a diameter of the through-bore on the supporting region of the cam follower is larger than a diameter of the through-bore on the supporting head of the piston.

4. The valve train actuating device according to claim 1, wherein a collector for collecting pressure medium and for routing the pressure medium into the through-bore is arranged in a region of the through-bore on an outer side of the supporting region of the cam follower turned away from the supporting head.

5. The valve train actuating device according to claim 4, wherein the collector comprise at least one baffle plate that is connected to the supporting region of the cam follower.

6. The valve train actuating device according to claim 5, wherein the baffle plate is configured with a funnel-like shape or with a V-shaped cross-sectional profile.

7. The valve train actuating device according to claim 5, wherein the baffle plate is configured as a sheet metal clip that surrounds the supporting region of the cam follower at least partially.

8. The valve train actuating device according to claim 5, wherein the baffle plate is configured in one piece with a retaining element for fixing the supporting head of the piston on the supporting region of the cam follower.

9. The valve train actuating device according to claim 1, wherein the piston comprises two piston parts arranged coaxially to each other and behind each other in the housing, said piston protruding with a piston upper part out of the housing on the supporting head and the reservoir is arranged in an interior of the two piston parts.

10. The valve train actuating device according to claim 9, wherein, starting from an end of the piston upper part facing away from the supporting head of piston upper part is arranged coaxially in the reservoir of the piston upper part, a bushing that extends into the supporting head.