United States Patent [19]

Zink

[11] **3,861,365**

[45] **Jan. 21, 1975**

[54] **MECHANISM FOR ADJUSTING AND MAINTAINING THE VALVE PLAY IN INTERNAL COMBUSTION ENGINES, ESPECIALLY IN MOTOR VEHICLE INTERNAL COMBUSTION ENGINES**

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[22] Filed: **Dec. 8, 1972**

[21] Appl. No.: **313,278**

[30] **Foreign Application Priority Data**

Dec. 8, 1971 Germany 2160774

[52] **U.S. Cl.** **123/90.43,** 123/90.36, 123/90.46, 123/90.55, 123/90.57

[51] **Int. Cl.** **F01l 1/18,** F01l 1/20

[58] **Field of Search** 123/90.43, 90.46, 90.55, 123/90.57, 90.36

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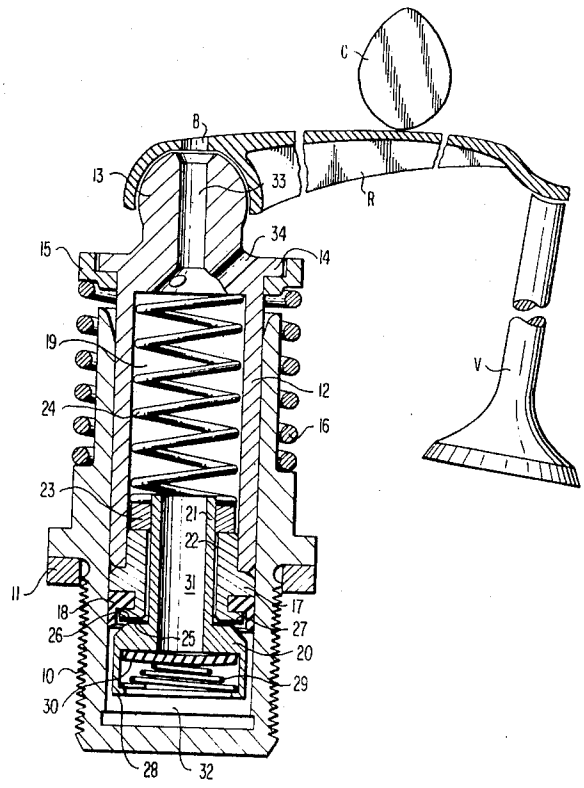
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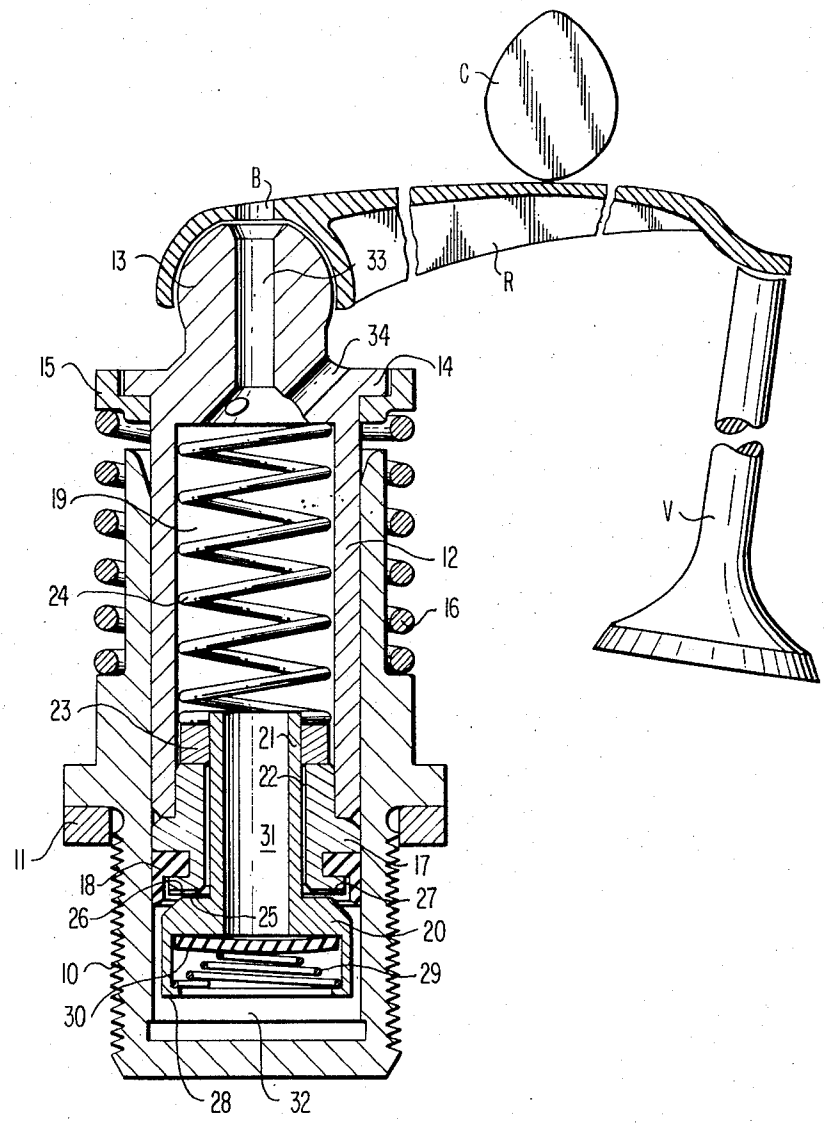
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[57] **ABSTRACT**

A device for the adjustment and maintenance of the valve clearance in internal combustion engines, especially in motor vehicle internal combustion engines, in which a rocker arm actuated by a cam rests with its one end on the valve stem and with its other end on an abutment that is constructed in the manner of a piston sliding within an oil-filled cylinder and equipped with a check valve; the oil filling is maintained by external feed and the piston structure includes a first piston which supports the rocker arm and which receives within an axial bore a second piston which is axially movable with respect to the first piston by the amount of the predetermined valve clearance; the second piston is also provided with an axial bore for establishing a communication between the pressure space disposed underneath the second piston and a reservoir space disposed on the inside of the first piston, which is closed by a check valve.

38 Claims, 1 Drawing Figure




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MECHANISM FOR ADJUSTING AND MAINTAINING THE VALVE PLAY IN INTERNAL COMBUSTION ENGINES, ESPECIALLY IN MOTOR VEHICLE INTERNAL COMBUSTION ENGINES

The present invention relates to a device for the adjustment and maintenance of the valve play or valve clearance in internal combustion engines, especially in motor vehicle internal combustion engines, whereby a rocker arm actuated by the cam rests with one end thereof on the valve stem and with its other end on an abutment which is constructed in the manner of a piston sliding within an oil-filled cylinder and provided with a check valve, and whereby the oil filling is maintained by feed from the outside.

Devices of the aforementioned type are known as such in the prior art. The present invention is concerned with the task to improve these known devices. In particular, it is to be achieved by the present invention that the valve play or valve clearance remains constant in every case and that a cold starting is possible without noise. Also, the present invention aims at an independence from the oil viscosity.

The underlying problems are solved in accordance with the present invention in the devices of the aforementioned type in that a first piston supporting the rocker arm receives within an axial bore a second piston which is axially movable with respect to the first piston by the amount of the predetermined valve play or clearance, and which includes an axial bore for the connection between pressure space and reservoir space, which communication is closed by the check valve.

It is possible by the mechanism of the present invention to predetermine accurately the valve play and to keep the same necessarily and unconditionally at this value. The device according to the present invention obviates servicing of the control elements so that an improper adjustment of the valve can no longer occur. The starting during cold-start takes place quietly and the device of the present invention is always operationally ready by reason of the oil reserve present therein. Also with oil of different viscosity, the predetermined valve play remains preserved.

In one embodiment of the present invention, the first piston consists of a guide cylinder and of a ring member whereby the guide cylinder receives or forms at the outwardly facing end the ball head for the support of the rocker arm and whereby the annular member is secured at the guide cylinder at the other end thereof, which annular member, in its turn, carries a seal with respect to the housing. It is thereby known to cause such a piston to abut constantly against the rocker arm by a spring force. To that end, the present invention additionally proposes that an annular disk Z-shaped in cross section serves as spring abutment at the guide cylinder which simultaneously forms an abutment or stop at the housing for limiting the maximum piston travel or piston path.

It is additionally proposed by the present invention that the second piston is constructed pot-shaped, and extends with a central body or shaft through the annular member or portion of the first piston and that a ring is securely mounted over the shaft or body end whereby at the second piston the axial spacing between the ring and piston body is larger corresponding to the predetermined valve play or clearance than the axial

width of the annular member in the first piston. Determinative therefore is the area ratio of the first to the second piston. It is thereby deemed particularly appropriate if, according to a further feature of the present invention the piston bottom at the second piston or the end surface of the annular member or portion facing the same at the first piston be provided with grooves arranged in a star-like or spider-like manner. It is prevented in this manner that the piston and annular member stick to one another, so to speak of. Of course, it is also within the scope of the present invention if the same control groove arrangement is present also or exclusively between the ring at the second piston and the upper surface of the annular member at the first piston.

According to a still further feature of the present invention, a predetermined slight clearance or play is present between the body or shaft of the second piston and its receiving bore within the annular member or portion of the first piston. Very slight oil quantities or air pockets flow in this manner strongly throttled but continuously from the pressure space disposed below the first piston into the reservoir space arranged in the guide cylinder. As a result of this constant circulation, the pressure space is reliably kept free of air pockets.

According to the present invention, the pot-shaped portion of the second piston is drawn-in at the outer edge and serves thus as abutment for the conical spring of the check valve. Furthermore, a compression spring is arranged in the guide cylinder of the first piston which seeks to displace the second piston constantly in the direction away from the ball head.

Also, in the present invention, an axial bore is arranged in the ball head which corresponds to a corresponding bore in the socket of the abutting rocker arm. According to the present invention, one or several inclined bores which terminate freely toward the outside may be arranged below the ball head within the bottom of the guide cylinder.

Accordingly, it is an object of the present invention to provide a mechanism for adjusting and maintaining the valve clearance in internal combustion engines which avoids by simple means the aforementioned shortcomings and drawbacks encountered in the prior art.

Another object of the present invention resides in a device for adjusting and maintaining the valve clearance in internal combustion engines which exhibits improved operating characteristics by extraordinarily simple means.

A further object of the present invention resides in a device for adjusting and maintaining the valve play in internal combustion engines in which the valve clearance remains constant under all circumstances and which also enables a noiseless cold-starting.

Still another object of the present invention resides in a device for adjusting the maintaining the valve play in internal combustion engines, especially in motor vehicle internal combustion engines, which assures an independence from the oil viscosity used with the device.

Another object of the present invention resides in a device of the type described above which renders superfluous the servicing thereof and thus eliminates the possibility of an incorrect adjustment of the valve during such servicing.

A further object of the present invention resides in a valve clearance adjusting device which is operationally ready at all times.

Still a further object of the present invention resides in a device of the aforementioned type which utilizes relatively few parts, yet prevents the possibility of improper operation by simple means.

These and further objects, features and advantages of the present invention will become more apparent from the following description when taken in connection with the accompanying drawing which shows, for purposes of illustration only, one embodiment in accordance with the present invention, and wherein:

The single FIGURE is a longitudinal cross-sectional view through a device for adjusting and maintaining the valve play in internal combustion engines in accordance with the present invention.

Referring now to the single figure of the drawing, the entire abutment for the rocker arm according to the present invention is screwed-in with a housing **10** into the cylinder head or the corresponding part of the internal combustion engine in a customary manner. A washer **11** thereby offers the possibility to change the basic adjustment of the entire mechanism with respect to the cam shaft and the valve actuation in its height. A guide cylinder **12** is sealingly arranged in the housing **10,** which carries at the outer, i.e., upper end the ball head **13,** on which rests the rocker arm R with one end. A Z-shaped ring disk **15** is arranged at the upper flange **14** of the guide cylinder **12** which serves, on the one hand, as abutment for the spring **16** and, on the other, as abutment for the limitation of the maximum travel of the guide cylinder **12.** The spring **16** holds the guide cylinder **12** and therewith the ball head **13** in constant abutment at the rocker arm.

At its lower end, the guide cylinder **12** is securely connected with an annular member or portion **17** which is constructed piston-like and which carries a seal **18** with respect to the housing **10.** A reservoir space **19** is formed on the inside of the guide cylinder **12** which is filled at least to a large extent with oil.

The first piston of the entire device which is constituted by the guide cylinder **12** and the annular member **17,** is movable as a whole with respect to the housing **10.** A second piston **20** is coordinated to this first piston, which is constructed pot-shaped and which extends with its body or shaft **21** through the annular portion **17** in a bore **22.** A ring **23** is secured on the shaft or body **21** inside of the reservoir space **19** and more particularly in such a manner that the entire second piston **20** is able to move axially with respect to the annular member **17,** i.e., therefore with respect to the first piston by the predetermined valve play or clearance of, for example, 0.2 mm. Furthermore, a spring **24** is arranged in the reservoir space **19** which is supported, on the one hand, at the ring **23,** and on the other, at the guide cylinder **12** and which constantly seeks to displace the piston **20** in the downward direction as viewed in the drawing. A play or clearance of about 0.2 mm. is therefore present in this position between the bottom **25** and the lower end surface **26** of the annular member or portion **17.** It should be pointed out that star-like grooves **27** are machined or cut either into the end face **26** or into the bottom **25** or into both surfaces, which assure a free oil-passage and thus prevent that the two parts stick to or adhere at one another, so to speak of. It should be additionally mentioned that the body of shaft **21** has a very slight predetermined clearance or play in the receiving bore **22** so that a strongly throttled, very slight flow can also take place at this location.

The lower outer edge **28** of the pot-shaped second piston **20** is flanged-in inwardly and serves for the support of a conical spring **29** for the check valve disk **20.** The latter closes an axial bore **31** of relative large cross section, which extends centrally through the second piston **20** and its body or shaft **21,** and which connects the reservoir space **19** with the pressure space **32** underneath the second piston **20.**

If the valve V is actuated from the position illustrated in the drawing by rotation of cam C, i.e., if a pressure is applied by the rocker arm against the first piston in the downward direction, then the first piston moves downwardly only to such an extend until the clearance or play predetermined between the same and the second piston **20** is used up. The second piston **20** thereby deflects slightly in the upward direction for the purpose of volume compensation or equalization. If the clearance or play is used up, then pressure is being built up in the pressure space **32** which prevents a further downward movement of the first piston.

If the ball head **13** is again relieved, then the spring **16** forces the first piston, i.e., the guide cylinder **12** and the annular member **17** again upwardly and the spring **24** again forces the second piston **20** downwardly. A volume equalization or compensation between the pressure space **32** and the reservoir space **19** can thereby take place by way of the longitudinal bore **31** and the check valve **30** opening in that case.

During the starting of the engine in the cold condition, possibly one valve at one cylinder may be open, i.e., at this valve the first piston is then under constant pressure. It has moved under this pressure downwardly for such length of time until the ring **15** abuts at the housing **10.** This is possible because the oil flows over out of the pressure space **32** by way of the axial play between the body or shaft **21** and the bore **22** into the reservoir space. If the engine is now started, then the valve closes and the first piston **12** is relieved. The spring **16** now displaces the same again in the upward direction by the full travel or distance whereby the oil flows back out of the reservoir space **19** through the large longitudinal bore **31** into the pressure space **32.** Subsequently thereto, the operating cycle as described above can commence again.

The oil in the reservoir space **19** is replenished by spray oil in the cylinder head which can enter through a longitudinal bore **33** in the ball head **13**--to which is coordinated a corresponding bore B in the rocker arm R. Further inclined bores **34** underneath the ball head **13** serve the same purpose.

While I have shown and described only one embodiment in accordance with the present invention, it is understood that the same is not limited thereto but is susceptible of numerous changes and modifications as are known to those skilled in the art, and I therefore do not wish to be limited to the details shown and described herein but intend to cover all such changes and modifications as are encompassed by the scope of the appended claims.

What I claim:

1. A device for adjusting and maintaining the valve play in internal combustion engines, especially in motor vehicle internal combustion engines, in which a cam-actuated rocker arm rests with one end on a valve shaft and with its other end on an abutment which is

constructed in the manner of a piston sliding within an oil-filled cylinder forming a housing and provided with a check valve means, and in which the oil supply is maintained by a supply from the outside, characterized in that the piston includes a first piston means adapted to support the rocker arm and provided with an axial bore for accommodating therein a second piston means, said second piston means being movable relative to the first piston means by the amount of the predetermined valve clearance, said second piston means being provided with an axial bore for the connection between a pressure space and a reservoir space formed on the inside of the oil-filled cylinder, said last-mentioned axial bore being closed by the check valve means, said first piston means being constantly forced against the rocker arm by a spring force, characterized in that a ring disk of substantially Z-shaped cross-section serves as spring abutment at a guide cylinder of the first piston means, said ring disk simultaneously forming an abutment at the housing for limiting the maximum piston travel.

2. A device according to claim **1,** characterized in that the first piston means includes a guide cylinder and an annular portion, and in that the guide cylinder includes at the outwardly facing end thereof a ball head for the support of the rocker arm and at the other end thereof the annular portion which in its turn carries a seal means with respect to the housing.

3. A device according to claim **2,** characterized in that the second piston means is constructed pot-shaped and extends with a central piston body thereof through the annular portion of the first piston means, and in that a ring means is provided at the body end of the second piston means, whereby the axial spacing between the ring means and the piston body at the second piston means is larger corresponding to the predetermined valve clearance than the axial width of the annular portion in the first piston means.

4. A device according to claim **3,** wherein said ring means is securely mounted to the end of the piston body.

5. A device according to claim **3,** characterized in that the piston bottom at the second piston means is provided with star-like groove means.

6. A device according to claim **5,** characterized in that the end face of the annular portion at the first piston means facing the second piston means is provided with star-like groove means.

7. A device according to claim **3,** characterized in that the end face of the annular portion at the first piston means facing the second piston means is provided with star-like groove means.

8. A device according to claim **3,** characterized in that at least one of the piston bottom of the second piston means and the end face of the annular portions of the first means facing the second piston means is provided with groove-like means.

9. A device according to claim **8,** characterized in that a predetermined slight clearance exists between the body of the second piston means and its receiving bore in the annular portion of the first piston means.

10. A device according to claim **9,** characterized in that the potshaped portion of the second piston means is drawn-in at the outer end thereof and thus serves as abutment for a conical spring of the check valve means.

11. A device according to claim **10,** characterized in that a compression spring is arranged in the guide cylinder of the first piston means which seeks to displace the second piston means constantly in the direction away from the ball head.

12. A device according to claim **11,** characterized in that an axial bore is arranged in the ball head which corresponds to a corresponding bore in the socket of the abutting rocker arm.

13. A device according to claim **12,** characterized in that at least one inclined bore means is provided underneath the ball head in the bottom of the guide cylinder means, said bore means terminating freely in the outward direction.

14. A device according to claim **13,** characterized in that several inclined bore means are provided.

15. A device for adjusting and maintaining the valve play in internal combustion engines, especially in motor vehicle internal combustion engines, in which a cam-actuated rocker arm rests with one end on a valve shaft and with its other end on an abutment which is constructed in the manner of a piston sliding within an oil-filled cylinder forming a housing and provided with a check valve means, and in which the oil supply is maintained by a supply from the outside, characterized in that the piston includes a first piston means adapted to support the rocker arm and provided with an axial bore for accommodating therein a second piston means, said second piston means being movable relative to the first piston means by the amount of the predetermined valve clearance, said second piston means being provided with an axial bore for the connection between a pressure space and a reservoir space formed on the inside of the oil-filled cylinder, said last-mentioned axial bore being closed by the check valve means, and characterized in that the second piston means is constructed pot-shaped and extends with a central piston body thereof through an annular portion of the first piston means, and in that a ring means is provided at the body end of the second piston means, whereby the axial spacing between the ring means and the piston body at the second piston means is larger corresponding to the predetermined valve clearance than the axial width of the annular portion in the first piston means.

16. A device according to claim **15,** characterized in that a predetermined slight clearance exists between the body of the second piston means and its receiving bore in the annular portion of the first piston means.

17. A device according to claim **15,** characterized in that the pot-shaped portion of the second piston means is drawn-in at the outer end thereof and thus serves as abutment for a conical spring of the check valve means.

18. A device for adjusting and maintaining the valve play in internal combustion engines, especially in motor vehicle internal combustion engines, in which a cam-actuated rocker arm rests with one end on a valve shaft and with its other end on an abutment which is constructed in the manner of a piston sliding within an oil-filled cylinder forming a housing and provided with a check valve means, and in which the oil supply is maintained by a supply from the outside, characterized in that the piston includes a first piston means adapted to support the rocker arm and provided with an axial bore for accommodating therein a second piston means, said second piston means being movable relative to the first piston means by the amount of the predetermined valve clearance, said second piston means being provided with an axial bore for the connection

between a pressure space and a reservoir space formed on the inside of the oil-filled cylinder, said last-mentioned axial bore being closed by the check valve means, wherein said second piston means includes a bottom in facing relationship to an abutment surface of said first piston, wherein stop means are provided for normally maintaining the bottom of said second piston spaced from said abutment surface of said first piston by said amount of the predetermined valve clearance, and characterized in that the piston bottom at the second piston means is provided with star-like groove means.

19. A device for adjusting and maintaining the valve play in internal combustion engines, especially in motor vehicle internal combustion engines, in which a cam-actuated rocker arm rests with one end on a valve shaft and with its other end on an abutment which is constructed in the manner of a piston sliding within an oil-filled cylinder forming a housing and provided with a check valve means, and in which the oil supply is maintained by a supply from the outside, characterized in that the piston includes a first piston means adapted to support the rocker arm and provided with an axial bore for accommodating therein a second piston means, said second piston means being movable relative to the first piston means by the amount of the predetermined valve clearance, said second piston means being provided with an axial bore for the connection between a pressure space and a reservoir space formed on the inside of the oil-filled cylinder, said last-mentioned axial bore being closed by the check valve means, wherein said second piston means includes a bottom in facing relationship to an end face on an annular portion of the first piston means, wherein stop means are provided for normally maintaining the bottom of said second piston means spaced from said end face of the annular portion of the first piston means by said amount of the predetermined valve clearance, and characterized in that at least one of the piston bottom of the second piston means and the end face of the annular portion of the first piston means facing the second piston means is provided with groove-like means.

20. A device according to claim **19,** characterized in that the first piston means includes a guide cylinder and an annular portion, and in that the guide cylinder includes at the outwardly facing end thereof a ball head for the support of the rocker arm and at the other end thereof the annular portion which in its turn carries a seal means with respect to the housing.

21. A device according to claim **20,** characterized in that the annular portion is secured to said other end of the guide cylinder.

22. A device according to claim **20,** characterized in that the guide cylinder forms the ball head.

23. A device according to claim **20,** characterized in that the ball head is mounted at said one end of the guide cylinder.

24. A device according to claim **20,** characterized in that a compression spring is arranged in the guide cylinder of the first piston means which seeks to displace the second piston means constantly in the direction away from the ball head.

25. A device for adjusting and maintaining the valve play in internal combustion engines, especially in motor vehicle internal combustion engines, in which a cam-actuated rocker arm rests with one end on a valve shaft and with its other end on an abutment which is constructed in the manner of a piston sliding within an oil-filled cylinder forming a housing and provided with a check valve means, and in which the oil supply is maintained by a supply from the outside, characterized in that the piston includes a first piston means adapted to support the rocker arm and provided with an axial bore for accommodating therein a second piston means, said second piston means being movable relative to the first piston means by the amount of the predetermined valve clearance, said second piston means being provided with an axial bore for the connection between a pressure space and a reservoir space formed on the inside of the oil-filled cylinder, said last-mentioned axial bore being closed by the check valve means, characterized in that the first piston means includes a guide cylinder and an annular portion, and in that the guide cylinder includes at the outwardly facing end thereof a ball head for the support of the rocker arm and at the other end thereof the annular portion which in its turn carries a seal means with respect to the housing, characterized in that an axial bore is arranged in the ball head which corresponds to a corresponding bore in the socket of the abutting rocker arm for accommodating supply of oil to said reservoir space from outside said ball head and rocker arm.

26. A device for adjusting and maintaining the valve play in internal combustion engines, especially in motor vehicle internal combustion engines, in which a cam-actuated rocker arm rests with one end on a valve shaft and with its other end on an abutment which is constructed in the manner of a piston sliding within an oil-filled cylinder forming a housing and provided with a check valve means, and in which the oil supply is maintained by a supply from the outside, characterized in that the piston includes a first piston means adapted to support the rocker arm and provided with an axial bore for accommodating therein a second piston means, said second piston means being movable relative to the first piston means by the amount of the predetermined valve clearance, said second piston means being provided with an axial bore for the connection between a pressure space and a reservoir space formed on the inside of the oil-filled cylinder, said last-mentioned axial bore being closed by the check valve means, characterized in that the first piston means includes a guide cylinder and an annular portion, and in that the guide cylinder includes at the outwardly facing end thereof a ball head for the support of the rocker arm and at the other end thereof the annular portion which in its turn carries a seal means with respect to the housing, and characterized in that at least one inclined bore means is provided underneath the ball head in the bottom of the guide cylinder means, said bore means terminating freely in the outward direction at a position spaced from said rocker arm for accommodating supply of oil to said reservoir space from outside said ball head and rocker arm.

27. A device according claim **26,** characterized in that an axial bore is arranged in the ball head which corresponds to a corresponding bore in the socket of the abutting rocker arm.

28. Valve play adjusting apparatus comprising:

a housing,

a first piston movably disposed in said housing and including rocker arm engaging means for engaging a valve rocker arm or movement therewith,

a second piston movably disposed in said housing,

a fluid reservoir space and a fluid pressure space communicating directly with respective oppositely facing pressure surfaces of said pistons such that said pistons are moved together in respective opposite direction dependent on forces exerted thereon by the rocker arm and on changes in the relative fluid pressures in said reservoir space and pressure space,

said first and second pistons being provided with respective abutment surface portions in facing relationship to one another,

and spacing means for maintaining said first and second pistons with said abutment surface portions spaced a predetermined distance from one another when the pressure difference between said reservoir space is below a certain value while permitting said first and second pistons to move toward one another until said abutment surface portions abuttingly engage one another whenever the pressure difference is sufficiently above said certain value, wherein at least one of said abutment surface portions includes groove means for accommodating leakage of fluid between said abutment surface portions when in abutting engagement with one another.

29. Apparatus according to claim **28,** wherein said first piston is slidably guided in said housing and surrounds said reservoir space, wherein said second piston is slidably guided in a part of said first piston located at one axial end of said reservoir space, wherein the end of said second piston facing away from said first piston forms part of the boundary for said pressure space, and wherein the abutment surface of said first piston is at the extreme end thereof which faces the pressure space while the abutment surface of said second piston is formed on an annular shoulder portion which has a larger cross-sectional dimension than does the portion of the second piston guided in said first piston.

30. Apparatus according to claim **29,** wherein said spacing means includes resilient means biasing said pistons away from one another and stop means limiting the maximum amount the pistons can be spaced from one another, said stop means including a ring member attached to said second piston at the end of said second piston which bounds a portion of said reservoir space.

31. Apparatus according to claim **30,** wherein said reservoir space and said pressure space are communicated with one another by a check valve and by leakage openings between the outer walls of the second piston and the inner walls of the first piston adjacent thereto.

32. Apparatus according to claim **31,** wherein a spring is interposed between said housing and said first piston for biasing said pistons in a first direction, and wherein a Z-shaped cross-section ring disk is provided at said first piston which simultaneously serves as a first abutment for said spring and a second abutment engageable with the housing for limiting maximum movement of the first piston in a second direction opposite said first direction.

33. Apparatus according to claim **29,** wherein a spring is interposed between said housing and said first piston for biasing said pistons in a first direction, and wherein a Z-shaped cross-section ring disk is provided at said first piston which simultaneously serves as a first abutment for said spring and a second abutment engageable with the housing for limiting maximum movement of the first piston in a second direction opposite said first direction.

34. Apparatus according to claim **28,** wherein said spacing means includes resilient means biasing said pistons away from one another and stop means limiting the maximum amount the pistons can be spaced from one another.

35. Apparatus according to claim **28,** wherein a spring is interposed between said housing and said first piston for biasing said pistons in a first direction, and wherein a Z-shaped cross-section ring disk is provided at said first piston which simultaneously serves as a first abutment for said spring and a second abutment engageable with the housing for limiting maximum movement of the first piston in a second direction opposite said first direction.

36. A valve adjusting apparatus comprising:

a housing,

a first piston movably disposed in said housing and including rocker arm engaging means for engaging a valve rocker arm for movement therewith,

a second piston movably disposed in said housing,

a fluid reservoir space and a fluid pressure space communicating directly with respective oppositely facing pressure surfaces of said pistons such that said pistons are moved together in respective opposite directions dependent on forces exerted thereon by the rocker arm and on changes in the relative fluid pressures in said reservoir space and pressure space,

said first and second pistons being provided with respective abutment surface portions in facing relationship to one another,

and spacing means for maintaining said first and second pistons with said abutment surface portions spaced a predetermined distance from one another when the pressure difference between said reservoir space is below a certain value while permitting said first and second pistons to move toward one another until said abutment surface portions abuttingly engage one another when the pressure difference is sufficiently above said certain value, wherein said first piston is slidably guided in said housing and surrounds said reservoir space, wherein said second piston is slidably guided in a part of said first piston located at one axial end of said reservoir space, wherein the end of said second piston facing away from said first piston forms part of the boundary for said pressure space, and wherein the abutment surface of said first piston is at the extreme end thereof which faces the pressure space while the abutment surface of said second piston is formed on an annular shoulder portion which has a larger cross-sectional dimension than does the portion of the second piston guided in said first piston.

37. Apparatus according to claim **36,** wherein a spring is interposed between said housing and said first piston for biasing said pistons in a first direction, and wherein a Z-shaped cross-section ring disk is provided at said first piston which simultaneously serves as a first abutment for said spring and a second abutment engageable with the housing for limiting maximum movement of the first piston in a second direction opposite said first direction.

38. Valve play adjusting apparatus comprising:

a housing,

a piston movably disposed in said housing and including rocker arm engaging means for engaging a valve rocker arm for movement therewith,

and a fluid reservoir space and a fluid pressure space communicating directly with respect to oppositely facing pressure surfaces of said piston such that said piston is moved in respective opposite directions in dependence on the forces exerted thereon by the rocker arm and on changes in the relative fluid pressures in said reservoir space and pressure space,

wherein a spring is interposed between said housing and said first piston for biasing said pistons in a first direction, and wherein a Z-shaped cross-section rink disk is provided at said first piston which simultaneously serves as a first abutment for said spring and a second abutment engageable with the housing for limiting maximum movement of the first piston in a second direction opposite and first direction.

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