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[54] **DEVICE FOR ADJUSTING AND HOLDING THE VALVE PLAY IN INTERNAL COMBUSTION ENGINES**

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[51] **Int. Cl.** **F01l 1/14**

[58] **Field of Search** 123/90.46, 90.55, 90.56, 123/90.57, 90.58, 90.59

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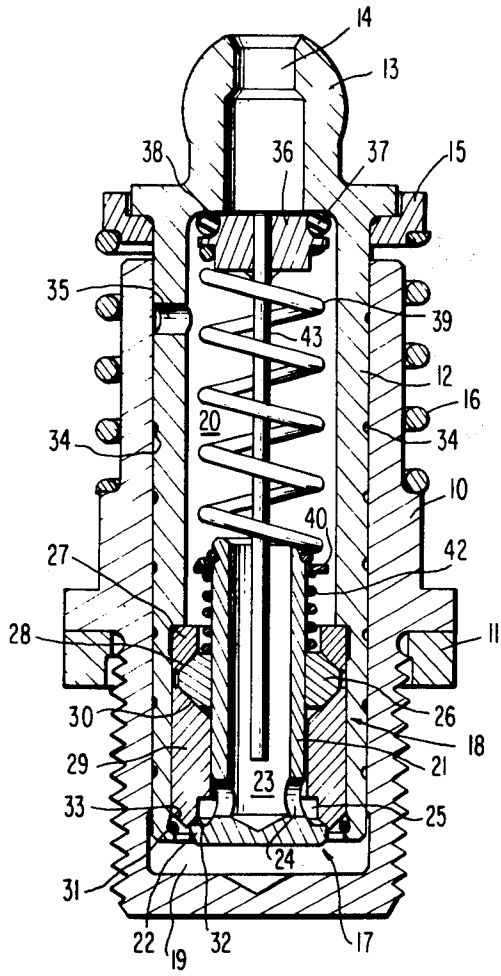
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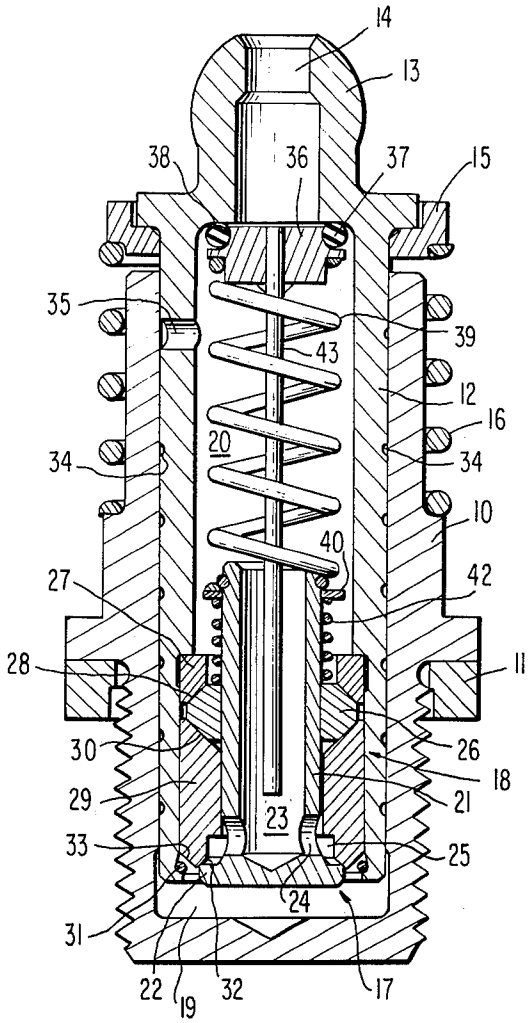
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[57] **ABSTRACT**

A device for adjusting and retaining the valve play in internal combustion engines, especially in motor vehicle internal combustion engines in which a transmission member such as a rocker arm controlled by a cam cooperates with the valve stem by way of an adjusting member, for example, in such a manner that the rocking lever arm abuts with one end on the valve stem and with the other end on an abutment operating as adjusting member which is constructed in the manner of a piston sliding within an oil-filled cylinder and equipped with a check valve; the abutment thereby is formed by a first piston which dips into the housing and which receives with its inner end a second piston that is located in the connection between the pressure space and the reservoir space; the second piston accommodates a check valve closing off this connection; the second piston is also adapted to be fixed with respect to the first piston by a clamping device which is axially movable with respect to the first piston by the predetermined valve play.

21 Claims, 1 Drawing Figure




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DEVICE FOR ADJUSTING AND HOLDING THE VALVE PLAY IN INTERNAL COMBUSTION ENGINES

The present invention relates to a device for adjusting and holding the valve play in internal combustion engines, especially in motor vehicle internal combustion engines, whereby a transmission member controlled by a cam, especially a rocker or rocker arm, cooperates with the valve shaft by way of an adjusting member, for example, in such a manner that a rocker arm rests with one end on the valve stem and with its other end on an abutment acting as adjusting member 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 in the prior art. The present invention is concerned with the task to improve these known prior art devices. In particular, it is to be achieved by means of the present invention that the valve play remains constant in every case and that a cold start is possible without noise. Also, an independence from the oil viscosity is aimed-at by the present invention. Furthermore, proper consideration should be given above all that a so-called pumping up action of the adjusting member is no longer possible.

The underlying problems are solved according to the present invention in the devices of the aforementioned type in that the first piston forming the abutment receives at the inner end immersing into the housing a second piston which is located in the connection between the pressure space and the reservoir space and which receives a check valve blocking this connection and which is adapted to be fixed with respect to the first piston by a clamping device and in that this clamping device is axially movable with respect to the first piston by the predetermined valve play or clearance.

In one embodiment according to the present invention, the clamping device consists of a slotted clip ring or locking ring on the second piston and of one sleeve on each side of this clamping ring whereby the two sleeves are arranged in the first piston and are operatively connected by means of conical end faces with the conical end surfaces of the clamping ring. The construction according to the present invention takes place in such a manner that the second piston includes at its inner end facing the pressure space a valve disk, and the sleeve arranged below the clamping ring forms with a cone surface the seat for this valve disk.

Additionally, it is proposed by the present invention that the first piston includes at its inner end facing the pressure space an abutment ring, and in that the clamping device has the predetermined axial play with respect to this abutment ring. The sleeve arranged below the clamping ring may thereby be provided appropriately at its inner end facing the pressure space with a double cone whose radially inner cone surface serves as valve seat and whose radially outer cone surface serves as counter surface for the abutment ring.

It is possible by the device according to the present invention to accurately predetermine a very definite valve play and to maintain this value in operation unconditionally. It is assured thereby that the valves in the engine can close flush in every case. The adjusting member cannot pump up at high engine rotational

speed by the clamping device according to the present invention. This clamping device thereby operates fully automatically as soon as an undesirable oil pressure builds up in the pressure space. The device according to the present invention is additionally independent of any external oil supply so that, on the one hand, no air can be introduced into the element by the same and, on the other, also no additional pressure is exerted on the cam shaft base circle.

According to a further feature of the present invention, the second piston is provided with a central bore open only toward the interior of the first piston, which central bore is operatively connected directly above the valve disk by radial apertures with the surrounding space below the clamping device. Finally, it is additionally proposed that the reservoir space is connected by a lateral bore with a groove surrounding the first piston and serving as oil collecting space. Of course, the first piston may thereby be provided with several annular or spiral grooves at its circumference. An oil loss is avoided in this manner, for the oil creeping past the first piston is thereby returned again into the reservoir space.

The first piston may include at the top a ball head as abutment for a rocker arm or the like, provided with an oil bore which, according to the proposal of the present invention, is closed off by a suction valve arranged in the reservoir space, whereby the suction valve is supported at the second piston by means of a spring on a spring plate. A further compression spring is thereby arranged according to the present invention between the clamping ring and the spring plate.

It is additionally proposed by the present invention that a rod projecting up to into the second piston is secured at the suction valve plate for pushing open the check valve. As a result thereof, the first piston can be inserted more easily into the housing so that the assembly of the entire device can be simplified. Finally, it is also proposed by the present invention that a small notch or the like is arranged in the sealing surface of the suction valve. It is achieved in this manner that no excess pressure can build up in the reservoir space. The suction valve may thereby be provided with a sealing ring which includes a small slot in its sealing surface. With another embodiment of the suction valve, this construction takes place analogously.

In the embodiments described hereinabove as well as also in the embodiment to be described more fully hereinafter, one starts with an internal combustion engine whose valves are controlled by valve rocker arms. However, the device proposed according to the present invention is not limited thereto. It may also be installed into tappets or push-rods or also into valve controls with rocker levers.

Accordingly, it is an object of the present invention to provide a device for adjusting and retaining the valve play 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 an improved device for adjusting and maintaining the valve play in internal combustion engines, by means of which the valve play can be kept constant under all circumstances, yet permits a cold start without noise.

A further object of the present invention resides in a device for adjusting and maintaining the valve play in internal combustion engines which assures indepen-

dence from the oil viscosity as well as from an external supply.

A still further object of the present invention resides in a device of the type described above in which a pumping-up action of the adjusting member is no longer possible.

Still another object of the present invention resides in a device for adjusting and holding the valve play of internal combustion engines which makes it possible to pre-determine very accurately a definite valve play and to maintain this value strictly under all operating conditions.

A further object of the present invention resides in a device for adjusting and holding the valve play of internal combustion engines, especially of motor vehicle internal combustion engines which assures that the valves close flush in every case.

A still further object of the present invention resides in a device of the type described above which eliminates the introduction of air into the element, minimizes the danger of the application of additional pressure on the camshaft base circle and precludes oil losses in operation.

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 according to the present invention.

Referring now to the single FIGURE of the drawing, the entire abutment according to the present invention for the valve rocker together with a housing **10** is screwed into the cylinder head or into the respective part of the internal combustion engine in a conventional manner, as shown in the drawing. A shim plate or washer **11** thereby offers the possibility to change in height the basic adjustment of the entire device with respect to the cam shaft and the valve actuating mechanism. A first piston **12** is arranged sealingly in the housing **10** which carries at its upper end a ball head **13**, on which abuts the valve rocker (not shown). An oil bore **14** in the ball head **13** serves for receiving the dripping or splash oil which is sprayed in from the outside. A Z-shaped annular disk **15** is arranged at the upper flange of the first piston **12** which, on the one hand, serves as abutment for the spring **16** and, on the other, forms an abutment for limiting the maximum travel of the first piston **12.** The spring **16** retains the ball head **13** and therewith the first piston **12** in constant abutment at the valve rocker.

At its lower end, the first piston **12** accommodates a check valve generally designated by reference numeral **17** and a clamping device generally designated by reference numeral **18.** The check valve **17** is thereby disposed in the connection between the pressure space **19** and the reservoir space **20** disposed on the inside of the first piston **12.** The check valve **17** is formed by a second piston **21** which includes a valve plate or valve disk **22** at its end facing in the direction toward the pressure space **19.** The second piston **21** has a central dead-end bore **23** which is open in the direction toward the reservoir space **20.** Radial openings **24** connect this dead-end bore **23** with the space **25** disposed directly above the valve disk **22.**

The clamping device **18** consists of a slotted clamping ring or clip ring **26** which is arranged on the second piston **21** and whose outer contour is constructed conically V-shaped. A sleeve **27** is disposed above this clamping ring **26** which cooperates by means of a conical end face **28** with the clamping ring **26.** Analogously a sleeve **29** is also disposed underneath the clamping ring **26** which also cooperates by means of a conical end face **30** with the clamping ring **26.** The entire clamping device **18** is retained in the first piston **12** by a ring **31** and more particularly in such a manner that with respect to this ring **31** the clamping device **18** is able to move by the predetermined valve play, for example, by about 0.1 to about 0.2 mm. The arrangement is thereby made in such a manner that the sleeve **29** is of double conical construction at its end facing the pressure space **19** whereby the radially inner cone surface **32** serves as seating surface for the valve plate **22** and the radially outer cone surface **33** as counter-surface for the abutment ring **31.**

The first piston **12** is provided along its outer circumference with several circumferential oil grooves **34** whereby the upper oil groove is connected with the reservoir space **20** by a cross bore **35.** As a result thereof, the oil leaking out of the pressure space **19** between the housing **10** and the first piston **12** cannot escape toward the outside but again collects in the reservoir space **20.** This reservoir space **20** is closed off in the upward direction with respect to the bore **14** by a suction valve **36** whose sealing ring **37** has a small notch **38** in order that under no circumstances an excess pressure can form in the reservoir space **20.** The suction valve **36** is supported by a spring **39** on a spring plate **40** at the second piston **21.** A further compression spring **42** is disposed between this spring plate **40** and the clamping ring **26.** The suction valve **36** is provided with a rod **43** which extends up to into the second piston **21** to a point just barely above the valve plate **22.** With the aid of this rod **43,** the check valve **17** can be pushed open during the assembly through the bore **14** so that the first piston **12** can be inserted into the oil-filled housing **10.**

If the valve of the internal combustion engine is actuated out of the illustrated position, i.e., if the first piston **12** receives a pressure in the downward direction by the valve rocker, then this first piston **12** deflects downwardly only so far until the play provided between clamping device **18** and piston **12** is used up. When this is the case, then pressure is being built up in the pressure space **19** which prevents a further downward movement of the first piston **12.** During the starting of the engine in cold condition, possibly a valve is open in one cylinder, i.e., at this valve the first piston **12** is then under a constant pressure. Under this pressure this valve has yielded so long until the spring plate **15** abuts at the housing **10.** The oil has thereby escaped out of the pressure space **19** through the annular gap between the first piston **12** and the housing **10** in the upward direction and has flown over into the reservoir space **20** through the bore **35.** If the cam shaft now rotates, then the first piston **12** is again forced upwardly by the spring **16** whereby the check valve **17** opens and the corresponding oil quantity is again sucked back into the pressure space **19** out of the reservoir space **20** and even out of the bore **14.**

In order that the first piston **12** does not rise (is pumped up) at high engine rotational speeds, the clamping device **18** is provided. More particularly, if an

excess pressure remains in the pressure space **19** also when the valve rocker abuts at the cam shaft base circle, then the second piston **21** is clamped fast in the first piston **12** by this clamping device **18**, i.e., the excess pressure valve **17** cannot open and the oil supply out of the reservoir space **20** does not occur. This oil replacement occurs again only in actuality when the pressure has been decreased in the pressure space **19** as a result of the unavoidable leakage oil losses. The check valve **17** then again operates normally.

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 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 is:

1. A valve play adjusting and maintaining device, in which a transmission means controlled by a cam cooperates by way of an adjusting means with a valve stem in such a manner that the transmission means rests with its one end on an abutment operable as adjusting means, characterized by a first piston means forming said abutment, a housing receiving said first piston means, said first piston means receiving at its inner end which immerses into said housing, a second piston means, said second piston means being disposed in the connection between a pressure space means and a reservoir space means operatively connected with each other, a second piston means accommodating a check valve means operable to close off said connection, said second piston means being fixable with respect to said first piston means by a clamping means which is axially movable with respect to the first piston means by a predetermined valve play.

2. A device according to claim **1**, characterized in that the oil filling is maintained by supply from the outside.

3. A device according to claim **1**, characterized in that the transmission means is a valve rocker member.

4. A device according to claim **1**, characterized in that the clamping means consists of a slotted clamping ring having conical end surfaces and disposed on the second piston means and of one sleeve means on each side of the clamping ring, said sleeve means being arranged in the first piston means and having conical end surfaces cooperating with the conical end surfaces of the clamping ring.

5. A device according to claim **4**, characterized in that the second piston means includes at its inner end facing the pressure space means, a valve disk, the sleeve means arranged underneath the clamping ring forming with a cone surface thereof the seat for the valve disk.

6. A device according to claim **5**, characterized in that the first piston means includes at its inner end facing the pressure space means an abutment ring and in that the clamping means has the predetermined axial play with respect to said abutment ring.

7. A device according to claim **6**, characterized in that the sleeve means arranged below the clamping ring includes at its end facing the pressure space means, a double conical surface, whose radially inner cone surface serves as valve seat and whose radially outer cone surface serves as counter surface for the abutment ring.

8. A device according to claim **7**, characterized in that the second piston means is provided with a central bore open only toward the inside of the first piston means, said central bore being in communication directly above the valve disk by way of radial openings with the surrounding space underneath the clamping means.

9. A device according to claim **8**, characterized in that the reservoir space means is operatively connected by way of lateral bore with a groove means surrounding the first piston means and serving as oil-collecting means.

10. A device according to claim **9**, which includes a ball head provided with an oil bore, arranged on the first piston means and serving as abutment for said transmission means, characterized in that said oil bore is closed off by a suction valve means arranged in the reservoir space means and in that said suction valve means is supported by means of a spring on a spring plate at the second piston means.

11. A device according to claim **10**, characterized in that a compression spring is arranged between the clamping ring and the spring plate.

12. A device according to claim **11**, characterized in that a rod projecting up to into the second piston means is secured at the suction valve means for pushing open the check valve means.

13. A device according to claim **12**, characterized in that a small notch is provided in the sealing surface of the suction valve means.

14. A device according to claim **13**, characterized in that the transmission means is a valve rocker member.

15. A device according to claim **4**, characterized in that the first piston means includes at its inner end facing the pressure space means an abutment ring and in that the clamping means has the predetermined axial play with respect to said abutment ring.

16. A device according to claim **15**, characterized in that the sleeve means arranged below the clamping ring includes at its end facing the pressure space means, a double conical surface, whose radially inner cone surface serves as valve seat and whose radially outer cone surface serves as counter surface for the abutment ring.

17. A device according to claim **1**, characterized in that the second piston means includes a valve disk at its end facing the pressure space and is provided with a central bore open only toward the inside of the first piston means, said central bore being in communication directly above the valve disk by way of radial openings with the surrounding space underneath the clamping means.

18. A device according to claim **1**, characterized in that the reservoir space means is operatively connected by way of lateral bore with a groove means surrounding the first piston means and serving as oil-collecting means.

19. A device according to claim **1**, which includes a ball head provided with an oil bore, arranged on the first piston means and serving as abutment for said transmission means, characterized in that said oil bore is closed off by a suction valve means arranged in the reservoir space means and in that said suction valve means is supported by means of a spring on a spring plate at the second piston means.

20. A device according to claim **19**, characterized in that a rod projecting up to into the second piston means is secured at the suction valve means for pushing open the check valve means.

21. A device according to claim **19**, characterized in that a small notch is provided in the sealing surface of the suction valve means.

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