June 3, 1930. C. E. SUMMERS ET AL 1,761,943

VALVE SPRING RETAINER

Filed Jan. 13, 1928

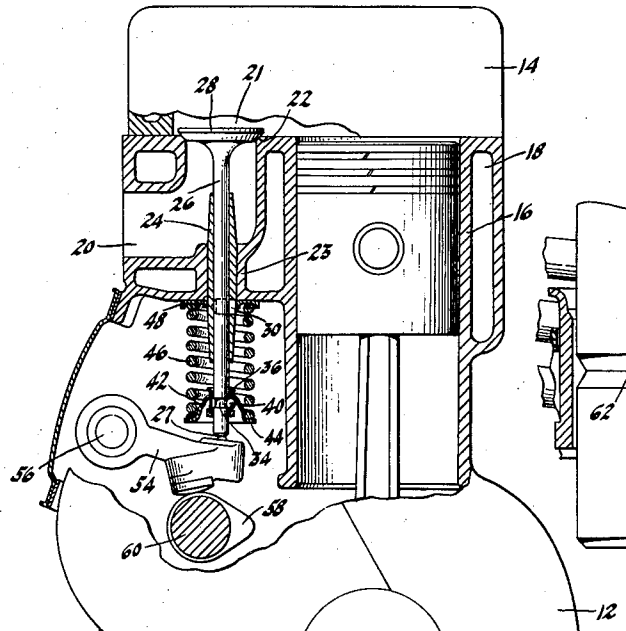


Fig. 1

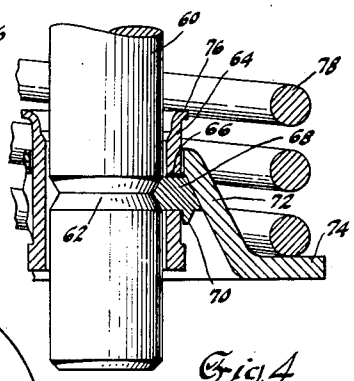


Fig. 4

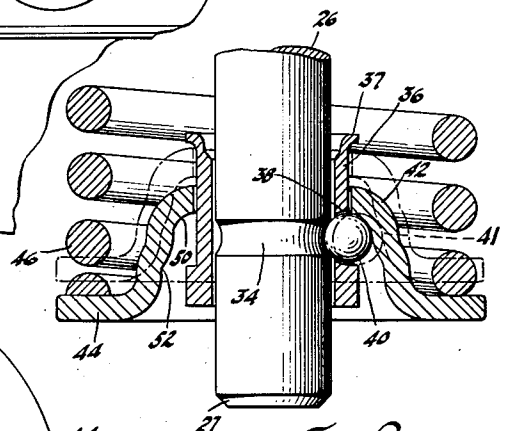


Fig. 2

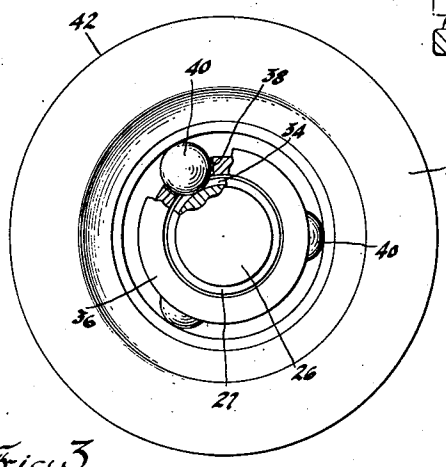


Fig. 3

Inventors

Caleb E. Summers &

George W. Lampman

By

Blackmore, Spencer & Hicks

Attorneys

Patented June 3, 1930 1,761,943

UNITED STATES PATENT OFFICE

CALEB E. SUMMERS AND GEORGE W. LAMPMAN, OF PONTIAC, MICHIGAN, ASSIGNORS TO GENERAL MOTORS RESEARCH CORPORATION, OF DETROIT, MICHIGAN, A CORPORATION OF DELAWARE

VALVE-SPRING RETAINER

Application filed January 13, 1928. Serial No. 246,508.

This invention relates to poppet valves in internal combustion engines.

The removal of a poppet valve in an internal combustion engine, for grinding or replacing, is ordinarily difficult and somewhat dangerous since the attachment and detachment of the usual valve spring retainer requires that the operator handle certain small keys, pins, wedges, etc., at the same time holding the valve compressed while working in a very limited space.

It is an object of the present invention to provide a valve spring retainer which will securely hold the valve stem under the tension of the valve spring and which may be engaged or disengaged from the valve stem by the use of a simple lifting tool, without the necessity of the operator using his hands to disengage a pin, key or usual holding element.

More specifically it is an object of the invention to provide a valve spring retainer which will function as a rigidly fixed abutment on the lower end of the valve stem for holding the lower end of the coiled valve spring and which will permit ready removal and replacement of the valve stem when lifted upward a short distance with a simple lifting tool.

Other objects and advantages of the invention will appear in the course of the following description, taken in connection with the accompanying drawing and appended claims.

In the drawing:

Figure 1 is an end view, partly in section, of an internal combustion engine embodying our invention.

Figure 2 is an enlarged vertical section through the lower portion of the valve stem, illustrating the valve spring retaining means.

Figure 3 is a bottom plan view of the structure shown in Figure 2, with parts broken away.

Figure 4 is a view similar to Figure 2, illustrating a slightly modified form of our invention.

Referring to the drawing, there is illustrated in Figure 1 an internal combustion engine comprising an oil pan 10, engine block 12 and cylinder head 14. The engine block comprises a cylinder 16, water jacket 18, and an exhaust port 20 connected with a combustion chamber 21 in the cylinder head 14 by an opening provided with the usual valve seat 22. While only one cylinder and valve operating mechanism are shown, the engine illustrated and described may include any usual number of cylinders.

Rigidly fixed in a web 23 of the engine block casting on one side of the cylinder 16 is a bearing sleeve 24 which extends vertically some distance up into the exhaust port 20. Slidable vertically in the bearing sleeve 24 is a valve stem 26 provided with a head 28 adapted to seat in the valve seat 22. Just below the web portion 23, the sleeve 24 is provided with an opening 30 for permitting the escape of any excess oil which may have worked up around the valve stem within the bearing sleeve. The valve stem is bevelled on its lower end, as at 27.

Referring now to Figures 1 and 2, the valve stem 26 is provided adjacent its lower end with a circumferentially extending groove 34. Fitting over the valve stem 26 over the groove 34 is the spring retainer which includes a sleeve 36 which has a working fit on the stem. The sleeve is formed with three circumferentially spaced openings 38, the surfaces of which converge toward a common point on the axis of the stem for centering the locking dogs which in this embodiment comprise spherical balls 40. Each ball 40 is disposed within an opening 38 and rests in the groove 34, the radius of the groove being substantially equal to that of the balls. The upper rim of sleeve 36 is flanged outward as at 37, for a purpose described below.

Fitting over the sleeve 36 and slidable vertically thereon is the retaining member which comprises a somewhat bell-shaped hood or washer 42 which is flanged outward on its lower edge, as at 44, for receiving the lower end of a coil spring 46 which surrounds the valve stem 26 between the washer 42 and the lower side of web 23. Between the upper end of spring 46 and web 23 is a washer 48 provided about its periphery with a downward extending flange for counteracting any

tendency of the upper end of the spring to spread.

On its under side the washer 42 is formed with an upper annular groove 50 shaped to conform for a certain angular distance with the surface of the balls 40. In the position illustrated in full lines in Figure 2, the balls 40 are held firmly in their respective openings and in the groove 34.

Beneath the groove 50 is a similar annular groove 52. It may be noted that groove 52 is spaced radially from the axis of the valve stem somewhat farther than the groove 50, the difference in the radial distance from the axis of the stem of the two grooves being equal to or slightly greater than the depth of groove 34.

The lower end of valve stem 26 rests on the upper surface of a tappet 54 which is pivoted at 56 to the engine block 12. The lower surface of arm 54 rests on an eccentric 58 on a cam shaft 60 supported in the engine block and driven in the usual manner. With the construction shown the tappet 54 is oscillated and the valve stem reciprocated vertically in the usual manner when the engine is running.

The removal of the valve stem is accomplished in the following manner. The forked end of a lifting tool is inserted under the washer 42 and the washer forced upward a short distance. The washer slides readily upward over the sleeve 36 until its upper edge abuts against the flange 37, this position of the washer 42 being indicated in dotted lines in Figure 2. As the washer 42 moves upward from the full line toward the dotted line position, each ball 42 moves radially outward till it rests within the lower groove 52 on the inner side of the washer 42, as indicated in dotted lines at 41 in Figure 2. Since in this position the balls 40 are no longer in the groove 34, the valve stem can be readily lifted out. The washer 42 may then be supported on the lifting tool or it may be let down to rest on the tappet 54.

In order to replace the parts in their original position, the lifting tool is used to raise the washer 42 to the position it was in when the valve stem was taken out. The valve stem is then pushed in until the groove 34 is even with or below the balls 40, and the washer let down. In order to secure engagement of the balls 40 with the groove 34 as the washer is let down it will be convenient for the lifting tool to be provided with some means, such as a spring or small finger pivoted on the lifting tool, for pressing upward on sleeve 36 as the washer 42 is let down. As the washer 42 moves downward relative to the sleeve, the upwardly converging under surface of the washer pushes the balls inward and causes them to seat in their respective apertures and in the groove 34. The lifting tool is then removed.

In the modified form of our invention disclosed in Figure 4, the valve stem 60 is provided adjacent its lower end with a circumferentially disposed V-shaped groove 62. The spring retainer includes a sleeve 64 disposed over the valve stem over this groove and provided with three circumferentially disposed openings 66 adapted to register with the groove 62. Slidable radially in each opening is a dog 68 provided with an inner face shaped to fit in the groove 62 and with an inclined outer face. The dog 68 is formed on its under side with a boss 70 positioned to contact the outer side of the sleeve 64 and counteract any tendency of the dog to twist in its opening in the sleeve.

Fitting over the sleeve 64 just above the dogs 68 is the retaining member which comprises a washer or hood 72 formed on its lower rim with a flange 74 extending outward in a plane perpendicular to the axis of the valve stem. The inner surface of the main portion of the washer is inclined at the same angle as the outer face of the dog 68. The upper rim of the sleeve 64 is flanged outward as at 76 for contacting the washer 72 as it is moved upward as described below. The flange 74 receives the lower end of the usual coiled valve spring 78.

The operation of the device is similar to that of the previously described embodiment. The forked end of a lifting tool is placed under the washer 72 and the washer lifted till its upper portion contacts the under side of the flange 76, in which position the inner surface of the main portion of the washer 72 will be spaced from the outer face of dog 68 a distance equal to or slightly greater than the depth of groove 62. The stem 60 may then be readily removed, the lower surface of groove 62 forcing the dogs 68 radially outward far enough to clear the groove, but not far enough to permit removal of the dogs 68. The washer 72 may then be supported on the lifting tool or it may be let down on the tappet.

As in the other embodiment, the parts are reassembled by lifting the washer 72 up to the position it occupied when the stem was removed. The stem, which is bevelled on its lower end, is then pushed down through its bearing and through the sleeve 64 until the groove 62 registers with the dogs 68, and the washer 72 let down. In order to secure engagement of the dogs 68 with groove 62 when the washer is let down, it is desirable that the lifting tool be provided with means for exerting a slight upward pressure on the sleeve 64 as the washer 72 is let down. As the washer 72 moves downward relative to the sleeve, the inclined inner surface of the washer pushed the dogs 68 inward for engaging with the groove 62. The lifting tool may then be removed.

In assembling either type of spring re-

tainer, the locking dogs are first placed in their respective apertures in the sleeve from the outside, it being noted that in neither embodiment can the dog pass through its aperture into the sleeve. The retaining member is then slipped into place and the flange (37 or 76) turned out to prevent removal of the retaining element. The retainer can then be handled as a unit without danger of any one of the dogs falling out.

We claim:

1. A spring retainer comprising a hollow sleeve provided with an aperture and flanged outward adjacent one end, a retaining element fitting closely about said sleeve between said aperture and flange and slidable therebetween, said retaining element being extended radially and axially over said aperture, and a locking dog in said aperture contacting the inner side of said retaining element and held in a position extending within the inner surface of said sleeve when said retaining element is nearest said aperture, and movable to clear said inner surface when said retaining element is distant from said aperture.

2. A spring retainer comprising a hollow sleeve provided with a plurality of apertures and flanged outward adjacent one end, a retaining element fitting closely about said sleeve between said apertures and flange and slidable therebetween, said retaining element being extended radially and axially over said apertures, and a locking dog in each aperture contacting the innerside of said retaining element and held in a position extending within the inner surface of said sleeve when said retaining element is nearest said apertures and movable to clear said inner surface but not removable from between said elements when said retaining element is distant from said aperture.

3. A spring retainer comprising a hollow sleeve provided with an aperture intermediate its ends and a dog in said aperture, a retaining element fitting said sleeve between said aperture and one end and slidable a limited distance therebetween, said retaining element being extended radially and axially over said aperture between the sleeve and retaining element, means for preventing the escape of said dog into said sleeve, the inner surface of said retaining element being such that the dog is held extended within said sleeve when said retaining element is closest to said aperture and movable to clear said inner surface but not to escape from said aperture when said retaining element is distant from said aperture.

4. A spring retainer comprising a hollow sleeve provided with an aperture intermediate its ends, a retaining element fitting said sleeve between said aperture and one end and slidable a limited distance therebetween, said retaining element being extended radially and axially over said aperture and being provided with two annular grooves of unequal radius and axially spaced, a locking dog within said aperture extending within the inner surface of said sleeve when in register with the smaller groove and clearing said inner surface when in register with the larger groove.

5. The combination with a poppet valve having a stem provided with a groove, and a spring adapted to yieldingly hold the valve on its seat, a quick detachable spring retainer engageable with the stem and comprising a sleeve provided with an aperture therein, a movable dog positioned in the aperture, and a retaining member serving as an abutment for said spring, said sleeve and retaining member cooperating to form a unitary assembly for the purpose of holding said dog in said aperture when the spring retainer is removed from the valve stem.

6. The combination with a poppet valve having a stem provided with a groove, and a spring adapted to yieldingly hold the valve on its seat, of a spring retainer detachably engageable with the stem and comprising a sleeve slidable on said stem and having an aperture therein, a movable dog positioned in said aperture and a retaining member serving as an abutment for said spring and adapted to force said dog into said groove under normal conditions for the purpose of preventing axial movement of said spring retainer relative to said stem, and adapted to allow removal of said spring retainer when said spring is compressed to a position out of contact with said retaining member.

7. The combination as set forth in claim 6, said sleeve, dog and retaining member forming a unitary assembly for the purpose of preventing separation of said parts when removed from the valve stem.

8. The combination as set forth in claim 6, said sleeve and retaining member being so constructed as to limit inward and outward movement of said dog in said aperture when the spring retainer is removed from the valve stem.

In testimony whereof we affix our signatures.

CALEB E. SUMMERS.
GEORGE W. LAMPMAN.