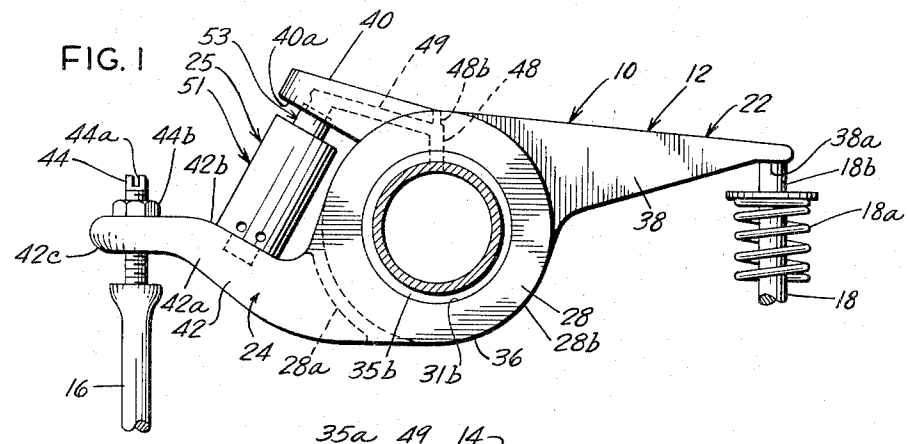
Sept. 25, 1956 W. A. SCHOONOVER 2,764,141

VALVE ACTUATING MECHANISM

Filed April 30, 1954

FIG. 1



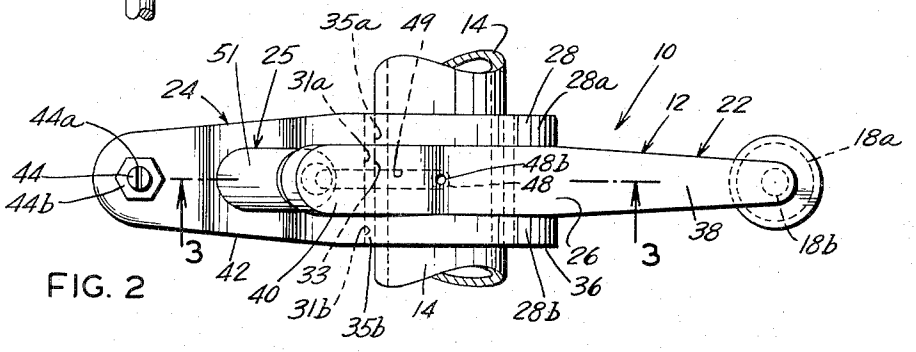


FIG. 2

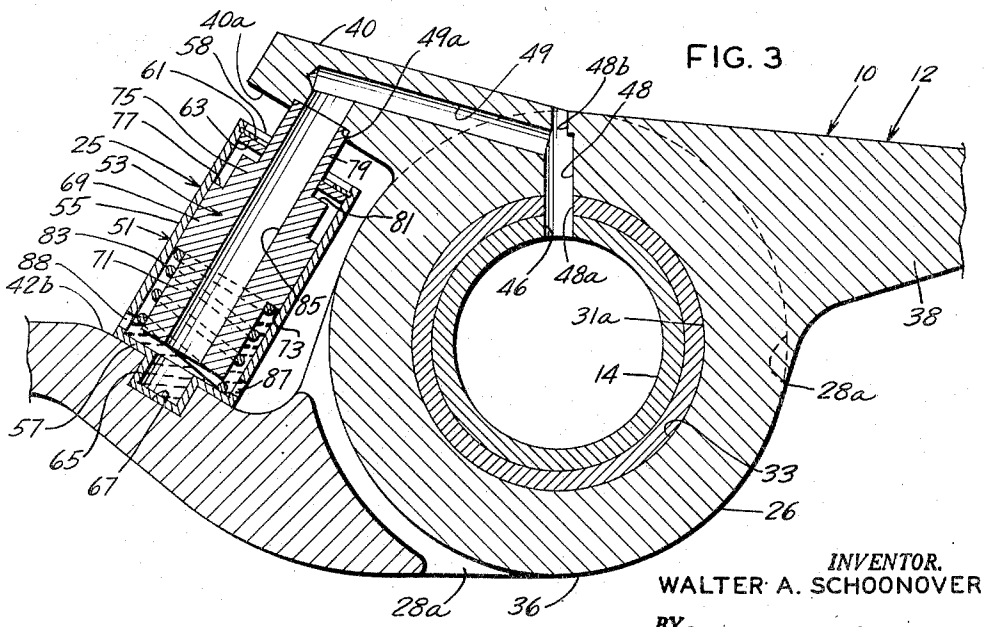


FIG. 3

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VALVE ACTUATING MECHANISM

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14 Claims. (Cl. 123—90)

This invention relates to valve actuating mechanism and more specifically to valve actuating mechanism which is particularly well adapted for use in actuating valves in overhead valve engines.

The accommodation of changing valve clearances as engine parts warm up has long been a perplexing problem for engine designers. The affording of such valve clearance has been necessary so as to insure that the valves will seat properly when they are to be in closed position. However, the affording of such clearance tends to make the operation of the valve actuating mechanism noisy. Various types of valve silencing mechanisms have been heretofore known in the art. However, these previously known mechanisms have had several inherent disadvantages which it is a primary object of my invention to overcome.

It is a primary object of my invention to afford quiet valve operation in overhead engine and the like in a novel and expeditious manner.

It is another object of my invention to minimize, in a novel and expeditious manner, the clearance which it is necessary to afford in the valve-actuating train in order to insure proper seating clearance for the valve itself.

Another object of my invention is to afford quietly operating valve actuating mechanism which is readily accessible for adjustment from the top of the engine upon merely removing the valve cover.

A further object of my invention is to afford novel valve actuating mechanism of the aforementioned type wherein adjustment of the valve clearance is simple.

Yet another object of my invention is to afford a novel valve actuating mechanism of the aforementioned type wherein the parts thereof are hydraulically cushioned in a novel and expeditious manner.

Another object of my invention is to afford a novel rocker arm which may be utilized in presently existing engines.

A further object of my invention is to provide a novel rocker arm which, in and of itself, and in a novel and expeditious manner, affords clearance for a valve to be actuated thereby.

Other and further objects to the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawing which, by way of illustration, shows a preferred embodiment of the present invention and the principles thereof and what I now consider to be the best mode in which I have contemplated applying these principles. Other embodiments of the invention embodying the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention and the purview of the appended claims.

In the drawing:

Fig. 1 is a side elevational view of valve actuating mechanism embodying the principles of my invention;

Fig. 2 is a top plan view of the valve actuating mechanism shown in Fig. 1; and

Fig. 3 is a detail sectional view taken substantially along the line 3—3 in Fig. 2.

To illustrate the preferred embodiment of my invention, a valve actuating mechanism 10, embodying the principles of my invention, is shown in the drawings. The valve actuating mechanism 10 comprises, in general a rocker arm 12 which may be mounted on a rocker shaft 14 in operative position to be actuated by a push rod 16 to thereby depress a valve 18 against the urging of a valve spring 18*a*.

Rocker shafts such as the rocker shaft 14, push rods such as the push rod 16, and valves such as the valve 18, of course, have long been known in the art and form no part of my invention except insofar as they may form a part of my novel combination.

Because of the expansion of engine parts after the engine has warmed up, as compared to the size of those parts when the engine is in a cold condition, it has long been necessary to afford clearance in the valve actuating mechanism in engines so as to insure that the valves will be permitted to completely seat when inclosed position even after the parts have expanded because of the warming up of the engines.

One of the common methods heretofore known in the art for affording such necessary valve clearance has been to adjust the valve actuating mechanism in such a manner that the necessary clearance is actually afforded between the stem of the valve to be actuated and the member, such as, for example, the rocker arm, directly actuating the valve. Such construction means that to afford an effective "valve clearance" of a certain amount such as, for example, ten thousandths of an inch, the entire amount of clearance, ten thousandths of an inch in this presumed example, must be provided between the valve and the member directly actuating it. This, of course, causes noisy operation and other undesirable operating characteristics.

Various forms of valve silencers have been previously used in the art in an attempt to rectify these undesirable conditions, but all such previous attempts to remedy the situation have had inherent disadvantages such as, for example, still requiring excessive clearance between valve actuating parts, being noisy or unreliable in operation, being complicated in construction and operation, or requiring difficult adjustment of parts hidden deep in the interior of an engine in order to adjust the valve clearance, and the like. My novel invention overcomes such disadvantages as will be apparent from the description thereof appearing hereinafter.

In the preferred form of my novel invention, as illustrated in the drawings herein, the rocker arm 12 comprises three principle parts, namely, a toe branch 22 adapted to be rotatively mounted on the rocker shaft 14, a heel branch 24 also adapted to be rotatively mounted on the rocker shaft 14, and a spacer unit 25 disposed between the toe branch 22 and the heel branch 24 and operatively coupling them together in a novel manner as will be discussed in greater detail presently.

A boss 26 and a boss 28, Fig. 2, is provided at one end of the toe branch 22 and of the heel branch 24, respectively, of the rocker arm 12 for the reception of a rocker shaft such as the rocker shaft 14 therethrough. The boss 28 on the heel branch 24 is bifurcated in form, having two legs 28*a* and 28*b*, disposed in spaced relation to each other. The legs 28*a* and 28*b* of the boss 28 are spaced from each other in such a manner as to receive the boss 26 of the toe branch 22 therebetween, Figs. 2 and 3.

The legs 28*a* and 28*b* of the boss 28 have circular shaped openings 31*a* and 31*b*, respectively, extending laterally therethrough in axial alignment with each other. The boss 26 of the toe branch 22, likewise, has an open-

ing 33 formed therein, the latter opening being of the same size and shape as the openings 31*a* and 31*b* and being disposed in axial alignment therewith when the boss 26 is disposed in operative position in the bifurcated boss 28. Bearings 35*a*, 35*b* and 36, made of suitable material such as, for example, babbitt, are mounted in the openings 31*a*, 31*b* and 33, respectively, in axial alignment with each other and when the rocker arm 12 is mounted on the rocker shaft 14, the latter is journaled in these bearings, Figs. 2 and 3.

The toe branch 22 embodies an elongated leg 38 projecting forwardly from the upper portion of the boss 26 and terminating at its forward end portion in a substantially flat lower face 38*a* adapted to engage the upper end of the shaft 18*b* of a valve such as the valve 18. A second elongated leg 40 projects rearwardly from the upper portion of the boss 26 and has a substantially flat bottom face 40*a* formed thereon.

The rocker shaft 14 is hollow in construction and during the operation of the engine in which it is mounted, oil is fed into the rocker shaft 14 under pressure. Small openings 46 are afforded in the rocker shaft 14 to afford lubrication for bearings such as the bearings 35*a*, 35*b* and 36, and other parts of the engine.

A passageway 48 is formed in the upper portion of the boss 26 of the toe branch 22, the passageway 48 opening at one end in the top of the boss 26, Figs. 2 and 3 and at the lower end at the internal surface of the bearing 36, Fig. 3. The inner end 48*a* of the passageway 48 is preferably of substantially the same size as the opening 46 in the rocker shaft 14 and is so disposed in the boss 26 and the bearing 36 that, during oscillation of the rocker arm 12 on the rocker shaft 14, the opening 48*a* is intermittently moved into and out of communication with the opening 46 so that oil is intermittently caused to spurt outwardly through the passageway 48 from the interior of the rocker shaft 14 to thereby afford lubrication for moving parts in the head of the engine. The outer end portion 48*b* of the passageway 48 is preferably of a smaller or restricted size than the inner end portion 48*a* thereof, and another passageway 49, opening at its inner end into the passageway 48 below the restricted portion 48*b* thereof, extends outwardly through the leg 40 from the passageway 48 and terminates at its outer end portion in an enlarged recess 49*a* formed in the face 40*a* of the leg 40 for a purpose which will be discussed in greater detail hereinafter.

The heel branch 24 includes an elongated leg 42 which projects rearwardly from the bottom portion of the boss 28. The leg 42 has an intermediate portion 42*a* having an upwardly disposed, substantially flat, face 42*b* which, when the toe branch 22 and the heel branch 24 are disposed in the aforementioned operative position relative to each other, is disposed in substantially parallel spaced relation to the face 40*a*. The leg 42 on the heel branch 24 also has a rear end portion 42*c* in which an adjusting screw 44 having an upwardly facing slotted head 44*a* is threadedly engaged. The adjusting screw 44 extends through the rear end 42*c* of the leg 42 in position to abuttingly engage the upper end of the valve actuating member in the engine such as, for example, the push rod 16, when the rocker arm 12 is disposed in the aforementioned operative position on the rocker shaft 14. A lock nut 44*b* is mounted on the adjusting screw 44 and may be engaged with the upper face of the rear end portion 42*c* of the leg 42 to hold the adjusting screw 44 in adjusted position.

When the toe branch 22 and the heel branch 24 are mounted in the aforementioned operative position on the rocker shaft 14, the forward face 38*a* of the leg 38 on the toe branch 22 rests on the upper face of the valve shaft 18*b*, and the lower face of the adjusting screw 44 in the rear end portion 42*c* of the leg 42 of the heel branch 24 rests on the upper face of the push rod 16. Thus, with the toe branch 22 and the heel branch 24 disposed in such positions, clockwise rotation of the toe branch 22 is limited by the valve 18, and counterclockwise rotation of the heel branch 24 is limited by the push rod 16. The spacer unit 25 is disposed between the leg 40 of the toe branch 22 and the intermediate portion 42*a* of the leg 42 of the heel branch 24 for the purpose, among others, of limiting counterclockwise rotation of the toe branch 22 and clockwise rotation of the heel branch 24 as will be discussed in greater detail presently.

The spacer unit 25, Fig. 3, comprises, in general, a cylinder 51 in which is reciprocably mounted a hollow piston 53. The cylinder 51 is of substantially circular-shaped cross-section and embodies a circular-shaped side wall 55 closed at one end by a bottom wall 57 and open at the other end 58 thereof. A snap ring 61 is mounted in a groove formed in the inner face of the upper end portion of the side wall 55 of the cylinder 51, adjacent the open end 58, to retainingly engage a washer 63 mounted in the cylinder 51. The radial center portion of the bottom wall 57 of the cylinder 51 is deformed outwardly to form a circular shaped boss 65 which is complementary in shape to, and is adapted to be received in, a recess 67 formed in the face 42*b* of the leg 42 on the heel branch 24 of the rocker arm 12.

The piston 53 embodies a central body portion 69 which is complementary in cross sectional size and shape to the interior of the side wall 55 of the cylinder 51 and is slidingly engaged with the latter in the cylinder 51. The piston 53 has a lower end portion 71 which projects downwardly from the central body portion 69 and is of uniform, reduced cross section, Fig. 3, to thereby afford a shoulder 73 in the lower face of the central body portion 69 of the piston 53. An intermediate portion 75 which is of substantially the same reduced cross sectional size as the lower end portion 71, projects upwardly from the central body portion 69 of the piston 53 to thereby afford an upwardly facing shoulder 77 on the upper end of the central body portion 69. The upper end portion 79 of the piston 53 is still further reduced in cross section and projects upwardly from the intermediate portion 75 to thereby afford an upwardly facing shoulder 81 on the intermediate portions 75. The upper end portion 79 of the piston 53 projects outwardly through the washer 63 and the snap ring 61, preferably with a sliding fit in the washer 63, and projects upwardly from the open end 58 of the cylinder 51.

The recess 67 in the face 42*b* of the leg 42 of the heel branch 24 is disposed in axial alignment with the recess 49*a* appearing in the face 40*a* of the leg 40 of the toe branch 22. The outer end of the upper end portion 79 of the piston 53 is complementary in shape to the recess 49*a* in the face 40*a* and, when the spacer unit 25 is disposed in operative position between the faces 40*a* and 42*b*, the boss 65 on the bottom 57 of the cylinder 51 is disposed in the recess 67 in the face 42*b*, and the outer end of the upper end portion 79 of the piston 53 is disposed in the recess 49*a* in the face 40*a* of the leg 40 preferably with a snug fit.

A compression coil spring 83 is mounted around the lower end portion 71 of the piston 53 and is engaged at its lower end with the inner face of the bottom wall 57 of the cylinder 51, and is engaged at its upper end with the downwardly facing shoulder 73 on the central body portion 69 of the piston 53. Thus it will be seen that the spring 83 is effective to urge the piston 53 upwardly in the cylinder 51 toward engagement of the shoulder 81 on the piston 53 with the lower face of the washer 63.

The piston 53 has an axially disposed opening 85 extending through the entire length thereof, and when the upper end of the piston 79 is disposed in the recess 49*a*, the opening 85 is disposed in communication with the adjacent end of the oil passageway 49 in the leg 40 of the toe branch 22 to thereby afford a passageway through which oil may flow from the passageway 48 into the cylinder 51 below the piston 53. Two openings 87 and

88, which are smaller in cross-section than the passageways 48, 49 and 85, are formed in the side wall 55 of the cylinder 51 adjacent to the bottom wall 57, Fig. 3. I prefer to make the openings 87 and 88 of a cross-sectional size approximately one-third that of the passageways 48, 49 or 85.

In the installation of my novel rocker arm 12 in an engine such as, for example, an engine embodying the rocker shaft 14, the valve 18, and the push rod 16, as shown in the drawings, the toe branch 22 and the heel branch 24 may be assembled in the aforementioned operative relation relative to each other, and mounted on the rocker shaft 14. The front face 38*a* of the heel portion 22 then rests on the upper face of the shaft of the valve 18, and the lower face of the adjusting screw 44 rests on the upper face of the push rod 16. The adjusting screw 44 may then be screwed upwardly through the rear end portion 42*c* of the leg 42 on the heel branch 24 to such position that the heel portion 24 is permitted to be rotated in a counterclockwise direction on the shaft 14, as viewed in Fig. 3, to such a position that the spacer unit 25 may be inserted between the faces 40*a* and 42*b* with the upper end of the piston 53 disposed in alignment with the recess 49*a* and with the boss 65 on the bottom wall 57 of the cylinder 51 disposed in alignment with the recess 67. When the spacer unit 25 is disposed in this position, the piston 53 is held by the spring 83 in its extreme outwardly projecting position in the cylinder 51, and in such position the shoulder 81 is disposed in abutting engagement with the washer 63 which, it will be remembered, is held in the cylinder 51 by the snap ring 61.

With the spacer unit 25 disposed in such position between the recesses 49*a* and 67, the adjusting screw 44 may then be turned in a direction effective to advance it downwardly toward the push rod 16 to thereby cause the heel branch 24 to rotate in a clockwise direction on the rocker shaft 14, as viewed in Fig. 3 into a position wherein the outer end of the end portion 79 of the piston 53 just seats against the inner face of the recess 49*a*, and the outer end of the boss 65 on the bottom wall 57 of the cylinder 51 just seats against the inner face of the recess 67.

When the adjusting screw 44 is adjusted to this position, it will be seen that the legs 40 and 42 of the toe branch 22 and the heel branch 24, respectively, are spaced from each other sufficiently that the front face 38*a* of the toe branch 22 is disposed in engagement with the upper face of the valve shaft 18*b*, and the lower face of the adjusting screw 44 is disposed in engagement with the upper face of the push rod 16, and the spacer unit 25 is effective to yieldingly hold the toe branch 22 and the heel branch 24 against such rotation relative to each other as would be effective to raise the adjusting screw 44 or the face 38*a* from its engagement with the push rod 16 or the valve stem 18*b*, respectively.

Also, it will be noted that the spacer unit 25 in my novel rocker arm 12 is disposed closer to the axial center of the rocker shaft 14 than is the portion of the forward face 48*a* of the toe branch 22 which is engaged with the upper face of the valve shaft 18*b*. I prefer to dispose the spacer unit 25 at a distance from the axial center of the rocker shaft 14, which is substantially one-half the distance that the axial center line of the rocker shaft 14 is disposed from the engagement of the valve shaft 18*b* with the face 38*b* on the branch 22. This I have found to be a desirable ratio between the two distances. However, it will be appreciated that this ratio between the two distances, wherein the spacer unit is disposed at a fraction of the distance from the center of rotation of the rocker arm 12 than is the engagement between the rocker arm 12 and the valve to be actuated, may be varied by those skilled in the art without departing from the purview of my invention.

With the parts of the rocker arm 12 disposed in the last mentioned position relative to the valve 18 and the push rod 16, the "clearance" for the valve 18 may now be set. To facilitate the explanation of this operation, it will be assumed that it is necessary in providing for the expansion of parts in the engine in which my novel rocker arm 12 is mounted that sufficient expansion room be afforded in the valve actuating train so that it corresponds, in effect, to the affording of ten thousandths of an inch clearance between the front face 38*a* of the toe branch 22 and the upper face of the valve shaft 18*b*. However, it will be appreciated that this is merely by way of illustration and that my device may be used for setting a "clearance" of any definite amount.

Thus, when the rocker arm 12 is disposed in the last mentioned operative position on the rocker shaft 14 with respect to the push rod 16 of the valve 18, and with the valve 18 disposed in full upwardly projecting, or closed, position, and the push rod 16 disposed in fully depressed position, the adjusting screw 44 may be turned to advance it downwardly through the rear end portion 42*c* of the leg 42 a distance sufficient to cause the heel branch 24 to rotate in a clockwise direction relative to the toe branch 22 sufficiently to cause the cylinder 51 to move upwardly relative to the piston 53, and against the urging of the spring 83, to a position wherein the lower face of the bottom end 71 of the piston 53 is disposed five thousandths of an inch from the upper face of the bottom wall 57 of the cylinder 51, or, in other words, one-half of the distance that it is desired to afford as "clearance" for the valve 18. Such a setting of a clearance between the piston 53 and the bottom wall 57 which is equal to only one-half the "clearance" desired at the top of the valve 18 is possible because the engagement of the valve 18 with the forward face 38*a* of the toe branch 22 of the rocker arm 12 is twice the distance from the center of rotation of the rocker arm 12 than is the axial center of the spacer unit 25 and, therefore, movement of the legs 40 and 42 of the rocker arm 12 at the axial center of the spacer unit 25 toward each other the distance of five thousandths of an inch affords an upward movement of the face 38*a* of the toe branch 22 of ten thousandths of an inch and, therefore, ten thousandths of an inch is, in effect, afforded for the valve 18 by the provision of five thousandths of an inch clearance between the bottom end of the piston 53 and the bottom wall 57 of the cylinder 51.

Provision for readily calibrating the amount of adjustment of the adjusting screw 44 necessary to afford the desired clearance between the piston 53 and the bottom wall 57 of the cylinder 51 may be readily provided in my novel device. Thus, for example, a spacer unit 25 wherein the outer spacing of the bottom of the piston 53 from the bottom wall 57 is ten thousandths of an inch when the shoulder 81 is disposed in abutting relation to the washer 63 may be provided. Then an adjusting screw 44 of a known number of threads to the inch may be provided such as, for example, a screw wherein a complete turn will advance the screw an amount effective to raise the cylinder 51 five thousandths of an inch on the piston 53. With such construction, where it was desired to afford five thousandths of an inch clearance between the bottom of the piston 53 and the bottom wall 57 of the cylinder 51, the adjusting screw 44 would merely be turned one complete turn to thereby advance the screw 44 five thousandths of an inch and thus reduce the clearance between the piston 53 and the bottom wall 57 from ten thousandths of an inch to five thousandths of an inch.

Even using the same spacer unit 25 and adjusting screw 44 various "clearances" for the valve 18 could be afforded. Thus, for example, if, instead of ten thousandths of an inch "clearance" at the valve 18 it was desired to afford fifteen thousandths of an inch clearance, the adjusting screw in that event, would merely be turned one-half a turn to thereby advance it sufficiently to lower the piston 53 in the cylinder 51 by twenty-five ten-thousandths of an inch and thus reduce the spacing between the piston 53 and the bottom wall 57 of the cylinder 51 to seventy-five

ten thousandths of an inch or, in other words, to one-half of the fifteen thousandths of an inch "clearance" desired at the valve 18.

Also, if a mechanic had a spacer unit 25 having a total of ten thousandths of an inch clearance between the bottom of the piston 53 and the upper face of the bottom wall 57 of the cylinder 51, when the piston 53 is disposed in fully upwardly projecting position in the cylinder 51, and it was desired to use that spacer unit in an engine requiring a substantially greater "clearance" at the valve 18 such as, for example, a clearance of thirty thousandths of an inch. With my novel invention, this may be readily provided for by removing the piston 53 from the cylinder 51 and grinding, or otherwise removing, from the bottom of the piston 53 a length of the piston 53 somewhat in excess of the necessary additional five thousandths of an inch such as, for example, an additional ten thousandths of an inch. The piston 53 may then again be mounted in operative position in the cylinder 51 and, when the shoulder 81 is disposed in engagement with the bottom face of the washer 63 the bottom of the piston 53 would then be disposed twenty thousandths of an inch above the upper face of the bottom wall 57 of the cylinder 51. By then turning the adjusting screw 44 to reduce this clearance between the piston 53 and the bottom wall 51 to fifteen thousandths of an inch, the "clearance" of thirty thousandths of an inch may be afforded at the valve 18.

During the operation of an engine embodying my novel rocker arm 12, the rocker arm 12 oscillates on the rocker shaft 14 as it is first turned clockwise by the push rod 16 to open the valve 18 against the urging of a spring 18*a*, and is then rotated in a counterclockwise direction by the valve spring 18*a* acting through the valve 18 during closing movement of the valve 18. During this oscillation of the rocker arm 12 the lower end 48*a* of the passageway 48 oscillates past the passageway 46 in the rocker shaft 14. Each time the passageway 48 moves past the passageway 46, oil under pressure is fed into the passageway 48 and part of the oil is squirted outwardly through the restricted opening 48*a*. Another part of the oil is fed from the passageway 48 through the passageway 49 and the passageway 85 into the cylinder 51 below the piston 53. Thus, during counterclockwise rotation of the rocker arm 12 when the heavier load is removed from the spacer unit 25 and the piston 53 is permitted to move upwardly in the cylinder 51 under the urging of the spring 83, oil may flow downwardly into the space between the bottom of the piston 53 and the bottom wall 57. Thereafter, during the reverse movement of the rocker arm 12 that is, when the push rod 16 presses upwardly on the adjusting screw 44 to thereby rotate the rocker arm 12 in a clockwise direction and depress the valve 18 against the urging of the relatively strong valve spring 18*b*, the squeezing effect of the arms 42 and 40 of the opposite ends of the spacer unit 25 is sufficient to press the piston 53 downwardly in the cylinder 51 against the urging of the relatively weak spring 83, and to cause the oil between the piston 53 and the bottom wall 57 to be squeezed outwardly through the openings 87 and 88, in the bottom portion of the cylinder 51. However, the openings 87 and 88 are of such reduced cross-sectional size that such outward flow of oil therethrough is relatively slow and the oil between the bottom of the piston 53 and the bottom wall 57 thus affords a cushion between the piston 53 and the bottom wall 57 which quiets the operation of the valve actuating mechanism.

The spring 83 may be of any practical desired strength less than the strength of the spring 18*a* which is sufficient to hold the piston 53 in full outwardly projecting position in the cylinder 51 when no load is applied to the spacer unit 25, but I prefer to use a spring 83 which is approximately one-third of the strength necessary to initiate movement of the valve 18 during any adjusting movement of the piston 53 in the cylinder 51.

It will be seen that not only are the moving parts of my novel valve actuating mechanism cushioned in an effective manner, but, with my novel device, a minimum relative movement of parts in the valve actuating train may be afforded while still providing, in effect, a maximum clearance for the valve to be actuated.

Also, it will be seen that with my novel device, "valve clearance" may be readily adjusted by simply removing the valve cover of an engine and turning the readily accessible adjusting screw.

In addition, it will be seen that my novel device is effective in eliminating back lash between parts in the valve actuating train because, with clearance afforded between the shoulder 81 and the washer 63, when the adjusting screw 44 is disposed in adjusted position, the spring 83 is effective to yieldingly hold the adjusting screw in engagement with the push rod 16, and to yieldingly hold the front face 38*a* of the toe branch 22 in engagement with the valve 18 during counterclockwise movement of the rocker arm 12, as viewed in Fig. 3.

From the foregoing it will be seen that I have afforded a novel and practical rocker arm which is effective in operation, and may be readily and economically produced commercially.

Furthermore, it will be seen that I have afforded a novel rocker arm which is readily adapted for installation on present engine installations and, when so installed, affords efficient, quiet, valve actuation in such an engine.

Thus, while I have illustrated and described the preferred embodiment of my invention, it is to be understood that this is capable of variation and modification, and I therefore do not wish to be limited to the precise details set forth, but desire to avail myself of such changes and alterations as fall within the purview of the following claims.

I claim:

1. Valve actuating mechanism comprising a member for pushing a valve, a second member for pushing said first mentioned member, said members being rotatable relative to each other, and means for limiting rotation of said members oppositely to each other, said means comprising two other members removably mounted between said first mentioned members and reciprocable relative to each other, each of said last mentioned members being engaged with a respective one of said first mentioned members, and means limiting reciprocation of said two members relative to each other.

2. A rocker arm for use on a rocker shaft to actuate a valve, said rocker arm comprising a toe member having a portion for pushing such a valve, said toe member having an opening therethrough for reception of such a rocker shaft therein, a heel member having a portion for engaging a pushing member, said heel member having an opening therethrough for receiving said rocker shaft therein, said toe member and said heel member being rotatable relative to each other when said latter members are mounted on said shaft, and means for rotating said portion on said toe member in a valve-pushing direction upon movement of said portion on said heel member in a direction away from such a pushing member, said means comprising a cylinder, a piston reciprocably mounted in said cylinder, and means urging said piston outwardly of said cylinder, said cylinder and said piston each having an outer end portion abuttingly engaged with a portion of a respective one of said first mentioned members between said first mentioned portions.

3. A rocker arm comprising an elongated member having a narrow end portion and an enlarged end portion, said enlarged end portion having an opening extending laterally therethrough, a second elongated

member having a narrow end portion and an enlarged end portion, said last mentioned end portion having an opening extending laterally therethrough in axial alignment with said first mentioned opening, said elongated members being rotatable along a predetermined path around the axis of said openings relative to each other, said elongated end portions projecting outwardly on opposite sides of said axis of said openings, said second elongated member having an intermediate portion between said narrow end portion of said second elongated member and said opening therethrough, said first mentioned elongated member having an outwardly projecting portion disposed in substantially parallel relation to said intermediate portion, and means for limiting movement of said intermediate portion and said outwardly projecting portion toward each other, said means comprising an elongated cylinder having one end disposed in engagement with said intermediate portion, a piston reciprocably mounted in said cylinder and projecting outwardly from the other end of the latter into engagement with said outwardly projecting portion of said first mentioned elongated member, and spring means disposed between said cylinder and said piston and urging said cylinder and said piston outwardly away from each other.

4. A rocker arm comprising an elongated member having one end portion and a second end portion, said second end portion having an opening extending laterally therethrough, a second elongated member having a third end portion and a fourth end portion, said fourth end portion having an opening extending laterally therethrough in axial alignment with said first mentioned opening, said elongated members being rotatable along a predetermined path around the axis of said openings relative to each other, said one and third end portions projecting outwardly on opposite sides of said axis of said openings, said second elongated member having an intermediate portion between said one end portion and said second end portion, said first mentioned elongated member having an outwardly projecting portion disposed in substantially parallel relation to said intermediate portion, and means for limiting movement of said intermediate portion and said outwardly projecting portion toward each other, said means comprising an elongated cylinder having one end disposed in engagement with said intermediate portion, a piston reciprocably mounted in said cylinder and projecting outwardly from the other end of the latter into engagement with said outwardly projecting portion of said first mentioned elongated member, and spring means disposed between said cylinder and said piston and urging said cylinder and said piston outwardly away from each other, said piston having a one operating position wherein said piston is disposed in spaced relation to said one end portion of said cylinder, and having another operating position wherein said cylinder is disposed in abutting engagement with said one end of said cylinder.

5. A rocker arm adapted to be installed on a rocker shaft in the valve-actuating mechanism of an overhead valve type engine between the push rod and the valve to be actuated thereby, said rocker arm comprising a heel member having an opening extending therethrough for the reception of such a rocker shaft therein, and having a portion projecting away from said opening into position to be engaged by such a push rod when said heel member is disposed in operative position on said rocker shaft, a toe member having an opening extending therethrough for the reception of said rocker shaft therein, said last mentioned opening being disposed in axial alignment with said first mentioned opening, said toe member having a portion projecting away from said second mentioned opening into position to engage such a valve when said toe member is disposed in operative position on said rocker shaft, said heel member and said toe member being reciprocable around said shaft relative to each other, and means for urging said heel member and said toe member to rotate around said shaft relative to each other toward engagement with said push rod and said valve, respectively, said means comprising a cylinder having an outer end, a piston receprocably mounted in said cylinder and having an outer end projecting outwardly of said cylinder, means in said cylinder urging said piston outwardly of said cylinder, each of said outer ends being abuttingly engaged with a respective one of said members.

6. A rocker arm adapted to be installed on a rocker shaft in the valve-actuating mechanism of an overhead valve type engine between the push rod and the valve to be actuated thereby, said rocker arm comprising a heel member having an opening extending therethrough for the reception of such a rocker shaft therein, and having a portion projecting away from said opening into position to be engaged by such a push rod when said heel member is disposed in operative position on said rocker shaft, a toe member having an opening extending therethrough for the reception of said rocker shaft therein, said last mentioned opening being disposed in axial alignment with said first mentioned opening, said toe member having a portion projecting away from said second mentioned opening into position to engage such a valve when said toe member is disposed in operative position on said rocker shaft, said toe member having a passageway extending through a portion thereof from said opening therein, said passageway being in communication with said opening in such position as to periodically receive oil from said rocker shaft, said heel member and said toe member being reciprocable around said shaft relative to each other, and means for urging said heel member and said toe member to rotate around said shaft relative to each other toward engagement with said push rod and said valve, respectively, said means comprising a cylinder having a closed end and an open end, said closed end being disposed in engagement with said heel member, an elongated piston reciprocably mounted in said cylinder, said piston having an inner end mounted in said cylinder, an outer end projecting outwardly from the open end of said cylinder, and a passageway extending longitudinally through said piston, said outer end of said piston being disposed in abutting engagement with said toe member with said passageway in said piston disposed in communication with said passageway in said toe member, said piston having one position in said cylinder wherein said inner end of said piston is disposed in spaced relation to said closed end of said cylinder, and another position wherein said inner end of said piston is disposed in abutting engagement with said closed end of said cylinder, and spring means mounted between said cylinder and said piston in position to yieldingly urge said piston away from said closed end of said cylinder.

7. A rocker arm comprising a bifurcated boss having an opening therethrough for receiving a rocker shaft therethrough, a second boss operatively mounted in said bifurcated boss and having an opening therethrough in alignment with said first mentioned opening for receiving said rocker shaft therethrough, said bosses being rotatable relative to each other on said rocker shaft when mounted thereon, an arm projecting outwardly from said second boss, a second arm projecting outwardly from said second boss in a generally opposite direction from said first mentioned arm, a third arm projecting outwardly from said bifurcated boss in a generally opposite direction to said first mentioned boss and in spaced relation to said second arm, and a spacer unit disposed between said second arm and said third arm in position to urge said bosses to rotate in opposite directions relative to each other, said spacer unit comprising two abutment members reciprocably mounted relative to each other, said members being mounted between said two last mentioned arms with one of said members disposed in abutting engage-

ment with one of said last mentioned arms and the other of said members disposed in abutting engagement with the other of said members, and resilient means connected to said members in position to urge said members toward said abutting relation to the respective ones of said arms.

8. A rocker arm comprising a toe branch having a rocker shaft opening therethrough, a heel branch having a rocker shaft opening therethrough in axial alignment with said first mentioned opening, said branches being movably mounted relative to each other for rotation around the axial center of said openings, a valve engaging portion, an actuating member engaging portion, one of said portions being disposed on one of said branches, and the other of said portions being disposed on the other of said branches, an abutting portion disposed on one of said branches, and a spacer unit mounted between said branches in position to urge said branches to rotate in opposite directions, said spacer unit comprising a cylinder having one end disposed in abutting engagement with one of said last mentioned portions, a piston mounted in said cylinder and projecting outwardly through the other end of the latter into abutting engagement with the other one of said last mentioned portions, and spring means mounted in said cylinder between said cylinder and said piston and urging said cylinder and said piston into said abutting engagement with said respective last mentioned portions.

9. A rocker arm comprising a toe branch including an end portion having a rocker shaft opening therethrough, a heel branch including a second end portion having a rocker shaft opening therethrough in axial alignment with said first mentioned opening, said branches being movably mounted relative to each other for rotation around the axial center of said openings, said toe branch including a third end portion projecting away from said first mentioned end portion and having a valve-engaging portion thereon, an abutment member projecting outwardly from said first mentioned end portion away from said third end portion, said heel branch having a fourth end portion disposed in spaced relation to said openings and to said third end portion, said fourth end portion having a portion thereon for engaging a valve-actuating member, and means for holding said last mentioned portion in engagement with such an actuating member and said valve-engaging portion in engagement with a valve member, said means comprising two abutment members movably mounted relative to each other and each disposed in operative engagement with a respective one of said branches between said valve engaging portion and said actuating member engaging portion, and means engaged with said abutment members yieldingly urging the latter into said engagement with said branches.

10. A rocker arm for use in an engine for actuating a reciprocating valve from a reciprocating actuating member, said rocker arm comprising a toe branch, a heel branch, said branches being rotatable relative to each other, said toe branch including a portion engageable with such a valve, said heel branch including a portion engageable with such an actuating member, and means for retaining said portions in such engagement with said members, said means comprising a cylinder mounted between said branches, said cylinder having a closed end disposed in abutting engagement with one of said branches between said portions, a piston reciprocably mounted in said cylinder and projecting outwardly therefrom into abutting engagement with the other of said branches between said portions, and spring means mounted in said cylinder between said closed end and said piston and urging said piston and cylinder outwardly relative to each other toward said abutting engagement with said branches.

11. A rocker arm for use in an engine for actuating a reciprocating valve from a reciprocating actuating member, said rocker arm comprising a toe branch, a heel branch, said branches being rotatable relative to each other, said toe branch including a portion engageable with such a valve, said heel branch including a portion engageable with such an actuating member, and means for retaining said portions in such engagement with said members, said means comprising a cylinder mounted between said branches, said cylinder having a closed end disposed in abutting engagement with one of said branches between said portions, a piston reciprocably mounted in said cylinder and projecting outwardly therefrom into abutting engagement with the other of said branches between said portions, and spring means mounted in said cylinder between said closed end and said piston and urging said piston and cylinder outwardly relative to each other toward said abutting engagement with said branches, means in said other branch and said piston for feeding oil into said cylinder between said closed end and said piston for resisting movement of said piston toward said closed end, and means in said cylinder for discharging oil therefrom.

12. A rocker arm for actuating valves and comprising an elongated heel branch comprising a bifurcated end portion, another end portion, an intermediate body portion interconnecting said end portions, and an adjusting screw mounted in, threadedly engaged with, and extending through said other end portion in position to engage a valve-actuating member, said bifurcated end portion comprising two legs disposed in spaced substantially parallel relation to each other, said legs having aligned openings therein for receiving a rocker shaft therethrough, an elongated toe branch comprising an end portion rotatably mounted between said legs and having an opening extending therethrough in alignment with said first mentioned openings for receiving said rocker shaft therethrough, another end portion having a face thereon for operatively engaging one end of such a valve to be actuated, and an arm projecting outwardly from said first mentioned end portion of said toe branch in substantially parallel relation to said intermediate body portion of said heel branch, and means mounted in engagement with said arm and said intermediate body portion between said adjusting screw and said valve-engaging face and urging said arm and said leg away from each other to thereby urge said heel portion and said toe portion toward actuating-member-engaging position and toward valve-engaging position, respectively.

13. A rocker arm for actuating valves and comprising an elongated heel branch comprising a bifurcated end portion, another end portion, an intermediate body portion interconnecting said end portions, and an adjusting screw mounted in, threadedly engaged with, and extending through said other end portion in position to engage a valve-actuating member, said bifurcated end portion comprising two legs disposed in spaced substantially parallel relation to each other, said legs having aligned openings therein for receiving a rocker shaft therethrough, an elongated toe branch comprising an end portion rotatably mounted between said legs and having an opening extending therethrough in alignment with said first mentioned openings for receiving said rocker shaft therethrough, another end portion having a face thereon for operatively engaging one end of such a valve to be actuated, and an arm projecting outwardly from said first mentioned end portion of said toe branch in substantially parallel relation to said intermediate body portion of said heel branch, and means for rotating said toe branch toward said valve upon movement of said adjusting screw in one direction by said actuating member, said means comprising an elongated spacer unit having two oppositely disposed end portions reciprocably mounted for movement toward and away from each other, one of said end portions of said spacer unit being disposed in abutting engagement with said arm, and the other of said end portions of said spacer unit being disposed in abutting engagement with said in-

termediate body portion, and spring means disposed between said end portions of said spacer unit and urging said last mentioned end portions away from each other.

14. A rocker arm for actuating valves and comprising an elongated heel branch comprising a bifurcated end portion, another end portion, an intermediate body portion interconnecting said end portions, and an adjusting screw mounted in, threadedly engaged with, and extending through said other end portion in position to engage a valve-actuating member, said bifurcated end portion comprising two legs disposed in spaced substantially parallel relation to each other, said legs having aligned openings therein for receiving a rocker shaft therethrough, an elongated toe branch comprising an end portion rotatably mounted between said legs and having an opening extending therethrough in alignment with said first mentioned openings for receiving said rocker shaft therethrough, another end portion having a face thereon for operatively engaging one end of such a valve to be actuated, and an arm projecting outwardly from said first mentioned end portion of said toe branch in substantially parallel relation to said intermediate body portion of said heel branch, and means for rotating said toe branch toward said valve upon movement of said adjusting screw in one direction by said actuating member, said means comprising an elongated cylinder having a closed end portion disposed in abutting engagement

with said said intermediate body portion, said cylinder having an opening in said closed end portion and having an open end portion, a piston reciprocably mounted in said cylinder and having one end projecting outwardly from said open end, said one end of said piston being disposed in abutting engagement with said arm, said first mentioned leg of said toe branch, said arm, and said piston, having a passageway therethrough for feeding oil into said cylinder between said closed end and said piston, said passageway being of greater cross-section than said opening in said cylinder, means in said open end of said cylinder for retaining said piston in said cylinder, and a compression coil spring mounted in said cylinder between said closed end portion and said piston and urging said piston toward said last mentioned means.

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