May 13, 1941. A. E. LUDWIG 2,241,821

AUTOMATICALLY ADJUSTABLE VALVE TAPPET

Filed May 29, 1940 3 Sheets-Sheet 1

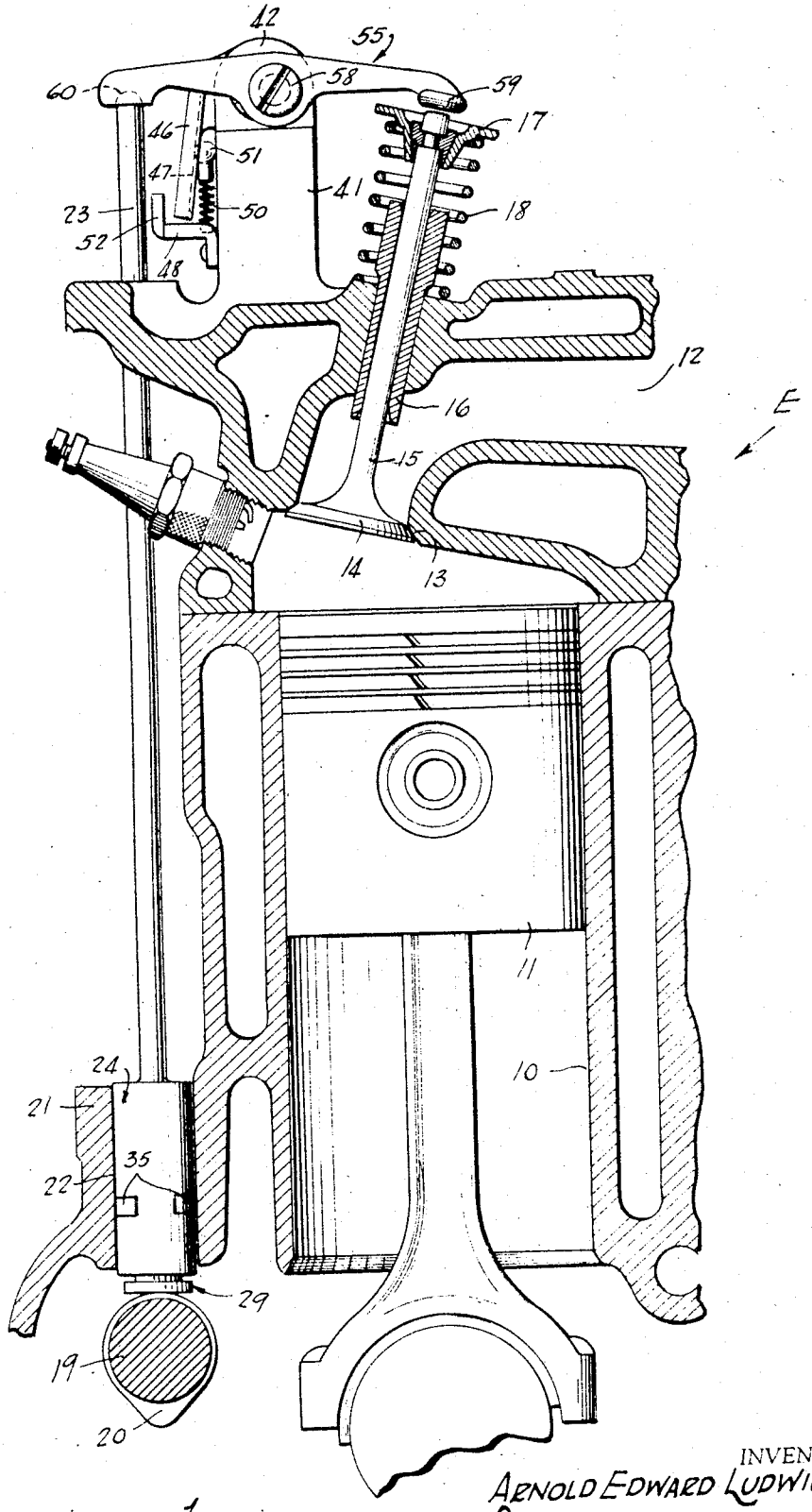


FIG. 1

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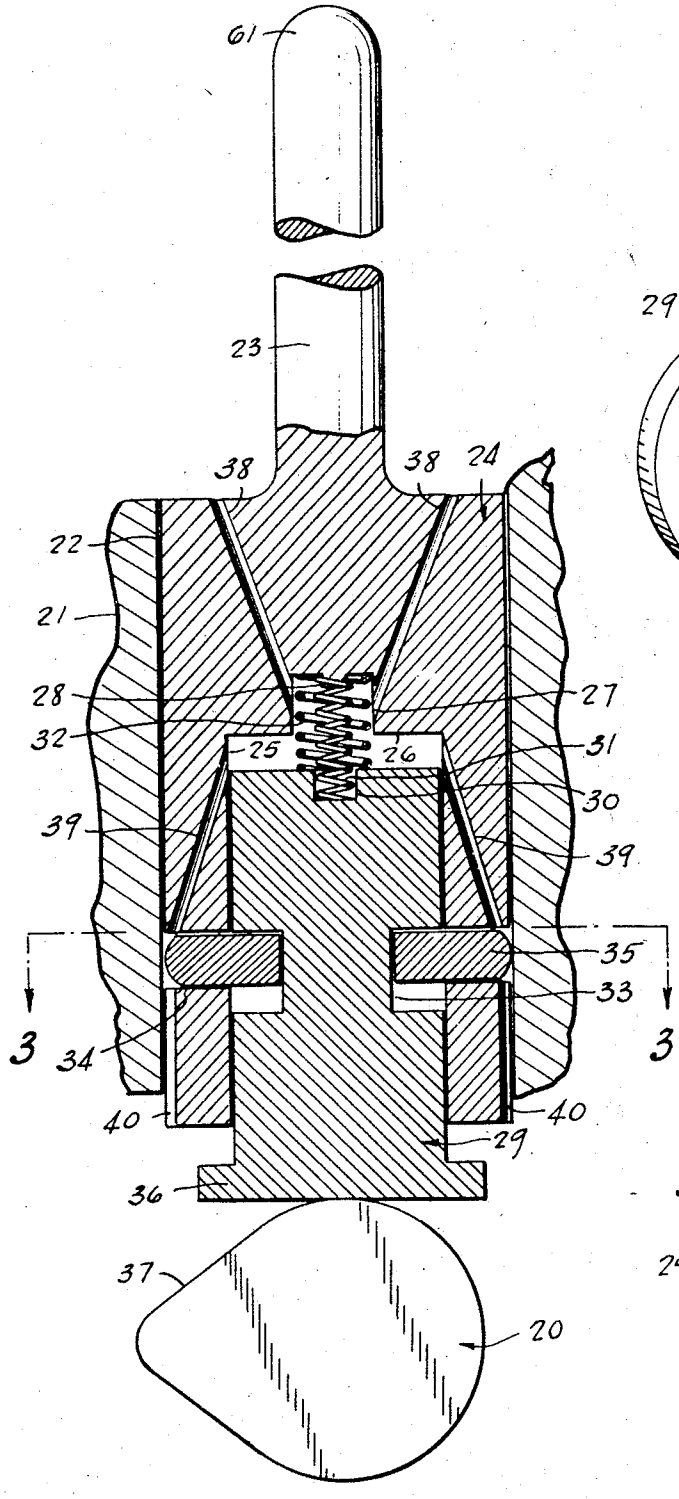


FIG. 2

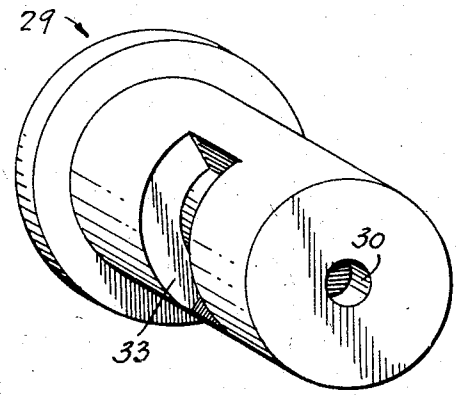


FIG. 4

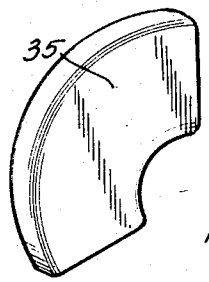


FIG. 5

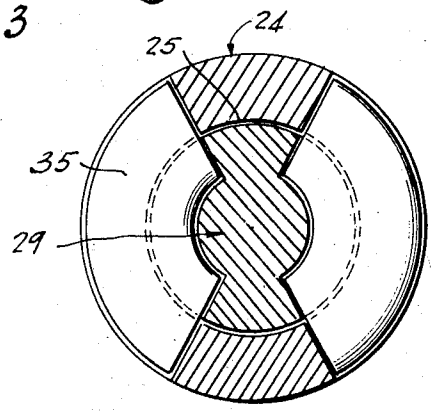


FIG. 3

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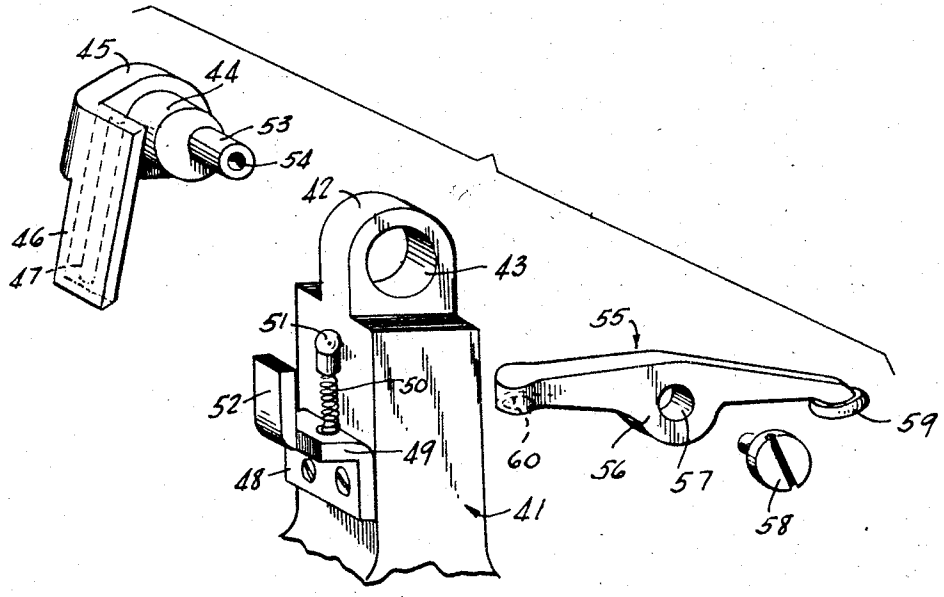


FIG. 6

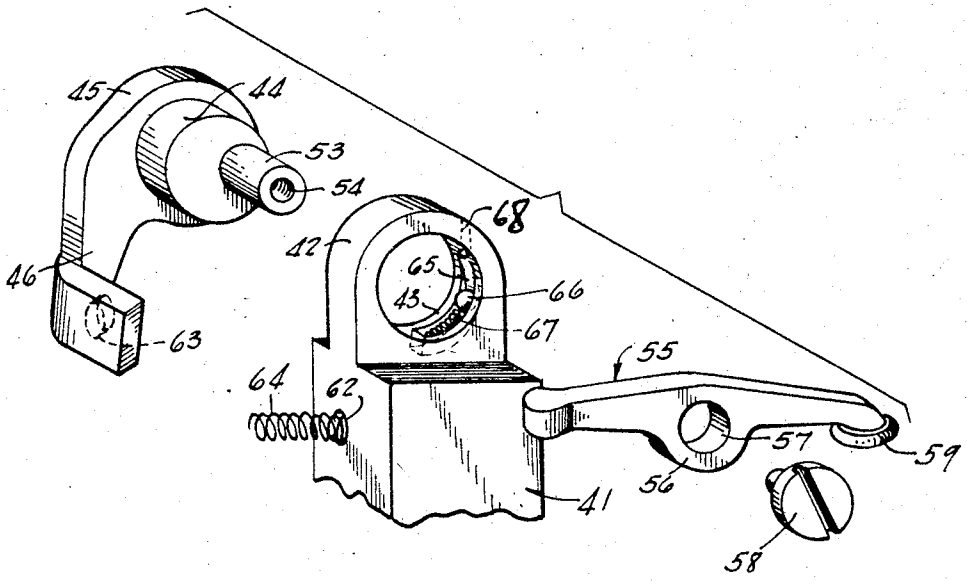


FIG. 7

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UNITED STATES PATENT OFFICE

2,241,821

AUTOMATICALLY ADJUSTABLE VALVE TAPPET

Arnold Edward Ludwig, Asbury Park, N. J.

Application May 29, 1940, Serial No. 337,745

7 Claims. (Cl. 123—90)

This invention relates to valve tappets such as are commonly employed in motor vehicles for the purpose of actuating the valves that control the flow of fuel to the cylinders of the engine.

The internal combustion engine of a modern motor vehicle ordinarily includes a plurality of cylinders into which fuel is introduced for subsequent explosion to generate the power of the engine. One or more valves is ordinarily associated with each cylinder for controlling the admission of fuel thereinto. A spring is associated with each valve for maintaining the same seated in closed position. A cam shaft is driven from the main drive shaft of the engine, and carries a plurality of cams, there being a cam for each valve. Valve tappets have been interposed between said cams and the valves for actuating the valves to open the same from the cams. In order to provide definite assurance that the valves will be fully closed at proper periods in the cycle of operation, it has been the practice to provide a clearance in the tappets, this being a well accepted theory in the automobile industry.

However, if for any of several reasons the clearance should become excessive, a noisy condition is created which is highly undesirable, and this has proven to be particularly so in the engines of the so-called overhead valve type.

In the copending application of Arnold Edward Ludwig, Serial No. 337,054, filed May 24, 1940, there is illustrated and described a tappet assembly which provides a constant clearance, and which automatically adjusts itself to any wear or other factors which ordinarily might disturb the clearance. Such tappet assembly is more particularly adapted for use in engines of the L head type in which there is a direct push from the cam to the valve to unseat the same.

The present invention is concerned primarily with engines of the overhead valve type, and has, as its foremost objective, the provision of a tappet assembly designed to be interposed between an overhead valve and a cam, and which tappet assembly is automatically adjustable to accommodate any changing conditions which ordinarily might interfere with the clearance thereof.

In an overhead valve engine each valve is normally carried by a valve stem that is maintained in an upraised position by a spring to seat the valve in sealing position. A rocker arm is pivotally mounted, and has one end in effective operating relation with respect to the end of said valve stem. A push rod or tappet has been usually associated with the other end of the rocker arm, and is interposed between said end and the respective cam on the cam shaft. Thus as the cam shaft is rotated, said push rod is raised upwardly to raise the end of the rocker arm with which it engages, whereby the other end of said rocker arm is depressed to depress the valve stem and open the valve.

In accordance with the present invention the rocker arm is mounted on a pivot pin which is eccentrically mounted on a bearing that is rotatably carried by the engine block.

An important object of the invention is the provision of means which is associated with said bearing for maintaining said end of the rocker arm in engagement with the upper end of said valve stem. When such an arrangement is employed it becomes necessary to provide for a clearance in the tappet assembly. Accordingly, another highly important object of the invention is the provision of push rod mechanism between said cam and rocker arm, and which push rod mechanism includes means for providing a clearance in the tappet assembly.

Particular objects and advantages of the invention are associated with the manner in which this clearance in the push rod assembly is obtained. Other particular objects and advantages of the invention are intimately tied up with the provision of means that are associated with the bearing on which the rocker arm is eccentrically mounted for maintaining the end of the rocker arm in engagement with the valve stem. These will in part become apparent, and in part be hereinafter stated, as the description of the invention proceeds.

The invention, therefore, comprises a tappet assembly designed to be interposed between an overhead valve and a cam for actuating the same. The tappet assembly consists of a rocker arm that is mounted on a pivot that is eccentrically carried by a bearing that is rotatably mounted on the engine block. Associated with said bearing is means for maintaining one end of the rocker arm in engagement with the valve stem of the valve. Also included as an essential part of the tappet assembly is a push rod mechanism that is interposed between the other end of the rocker arm and said cam, and which includes means for providing a clearance in the tappet assembly.

For a full and more complete understanding of the invention reference may be had to the following description and accompanying drawings, wherein—

Figure 1 is a vertical section through a portion

of an overhead valve engine including a valve tappet assembly that is designed in accordance with the precepts of this invention,

Figure 2 is an enlarged detailed view in section through the lower end of the push rod mechanism,

Figure 3 is a horizontal section in detail taken about on the plane represented by the line 3—3 of Figure 2,

Figure 4 is a detailed perspective of a part of the push rod mechanism,

Figure 5 is another detailed perspective of another part of said push rod mechanism,

Figure 6 is a view in perspective developing the rocker arm and associated pivotal mounting parts in an exploded relation, and

Figure 7 is a similar view of a modification.

Referring now to the drawings, wherein like reference characters denote corresponding parts, and first more particularly to Figure 1, the block and head of an internal combustion engine are referred to generally by the reference character E. The engine E is formed with a cylinder 10 on which operates a piston 11. A passageway from the source of fuel supply (not illustrated) to the cylinder 10 is represented at 12. Just above the cylinder 10 the walls defining the passageway 12 are formed with a conical valve seat 13. A valve 14 is of a structure complemental to the valve seat 13, and is designed to be seated therein to close the passageway 12. This valve 14 is carried by a stem 15, which is slidably received in a bearing sleeve 16 that is carried by the engine E.

The upper end of the stem 15 carries a spring bearing member 17, and an expansion coil spring 18 is interposed between said spring bearing member 17 and the engine E. This spring 18 exerts a tendency normally maintaining the valve 14 in the seated closing position depicted in Figure 1.

A cam shaft designated 19 is driven by the main drive shaft of the engine in a maner well-known in this art. A cam shown at 20 is mounted on the cam shaft 19, and is intended to actuate the valve 14 to open the same. This actuation is accomplished by the following described tappet assembly.

It will be noted from Figure 1 that the engine E is formed with a structure at 21 that provides a guide passage 22, the passage 22 being disposed immediately above the cam 20.

Referring now more particularly to Figures 2, 3, 4 and 5, a push rod mechanism is shown as comprising a push rod 23 that carries, on its lower end, a cylindrical enlargement 24 that is slidably received in the guide passage 22. This cylindrical enlargement 24 is formed with a cylindrical socket 25 that opens downwardly. The upper wall of the socket 25, which is designated 26, is formed with a depression 27, and the upper wall of the depression 27 carries a downwardly projecting central boss 28.

A cam engaging member designated 29 is of a cylindrical formation substantially complemental to the socket 25. This cam engaging member 29 is slidably received in the socket 25, and its upper end is formed with a spring receiving recess 30. An expansion coil spring 21 is fitted at one end of the recess 30, and at the other end is fitted about the boss 28. A second expansion coil spring 32 engages the upper wall of the depression 27 at one end and the upper wall of the cam engaging member 29 at the other. These springs 31 and 32 have a tendency to spread the cam engaging member 29 and the enlargement 24 on the push rod 23 apart.

The cam engaging member 29 is formed with a pair of arcuate shaped recesses 33 which are disposed substantially diametrically oppositely to one another, and the walls of the enlargement 24 about the socket 25 are formed with recesses 34 that are in alignment with the recesses 33. A pair of arcuate abutment members 35 are positioned in the recesses 34 and project into the recesses 33, as shown in Figure 2.

It will be noted that these abutment members 35 are maintained in assembled relation by the walls of the engine E that define the guide passage 22. Moreover, the abutment members 35 are smaller than the recesses 33 so that there is a certain predetermined amount of movement provided for between the cam engaging member 29 and the push rod 23.

The cam engaging member 29 carries a cam engaging head 36 that is in engagement with the cam surface 37 of the cam 20. As shown in Figure 2, the enlargement 24 may be provided with oil passages to provide for lubrication of the relatively movable parts.

A pair of passages 38 extend from the upper end of the enlargement 24 into the depression 27. Another pair of oil ducts 39 extend from the upper part of the recess 25 to the recesses 33. Additional oil ducts 40 are formed in the cylindrical outer surfaces of the enlargement 24 between the recesses 34 and the lower end thereof.

Referring now more particularly to Figures 1 and 6, a pedestal 41 is shown as upstanding from the engine E. The upper end of the pedestal 41 is reduced in thickness to provide a tongue 42 formed with a bearing opening 43. Rotatably mounted in the bearing opening 43 is a bearing member 44. This bearing member 44 is carried by an end piece 45 that also carries a downwardly extending arm 46. A groove of arcuate cross section is designated 47, and is shown in dotted lines in Figures 1 and 6. This groove is formed on the inner face of the arm 46.

A bracket designated 48 may be affixed to the pedestal 41 in any preferred manner such as by the screw fastening elements illustrated. The bracket 48 has a bottom wall 49 against which bears the lower end of a spring 50. The upper end of the spring 50 engages a ball 51 that is partially received in the groove 47, and which engages the surface of the pedestal 41. The bracket 48 also includes an upwardly extending part 52 that is spaced from the pedestal 41, and which acts as a stop for the arm 46.

A pivot pin 53 projects outwardly from the bar 44 and is disposed eccentrically with respect to the axis thereof. The free end of the pivot pin 53 is formed with a threaded socket 54, a rocker arm referred to in its entirety by the reference character 55, and a hub portion 56 formed with a bearing opening 57 which receives the pivot pin 53. A retaining screw 58 is threaded into the socket 54, and maintains the rocker arm 55 assembled on the pivot pin 53. This also serves to maintain the bearing 44 assembled in the bearing opening 43.

A rocker arm 55 carries a head 59 at one end which engages the upper end of the valve stem. The other end of the rocker arm 55 is formed with a depression 60 in which is fitted the upper end of the push rod 23 which is rounded, as shown at 61. The operation of the above-described tappet assembly may be described by noting that the springs 31 and 32 normally main-

tain the cam engaging member 29 and the push rod 23 in a relatively spread apart position. Thus the head 36 of the cam engaging member 29 is always in engagement with the cam surface 37 of the cam 20. Also, the rounded end 61 of the push rod 23 is in snug engagement with the surface of the depression 60.

Moreover, the spring 50 tends to move the ball 51 upwardly. Thus the ball 51 acts as a wedge, tending to spread the arm 47 apart from the pedestal 41. Thus there is a tendency for the bearing 44 to rotate, and due to the eccentric arrangement of the pivot pin 53 the pivotal mounting of the rocker arm 55 is moved downwardly. Thus the end 59 of the rocker arm 55 is maintained in engagement with the upper end of the valve stem 15.

When the cam 20 rotates from the position shown in Figure 1, in which it will be noted the valve 14 is in closed position, the initial movement of the cam tends to close the clearance of the tappet assembly; that is the member 29 is moved upwardly with respect to the push rod 23 just as far as is permitted by the clearance between abutment members 35 and recesses 33. When this clearance is closed, further rotation of the cam 20 causes a positive actuation of the push rod 23 to unseat the valve 14 from its seat 13.

After the cam is rotated through 180°, the spring 18 urges the end 59 of the rocker arm 55 upwardly as the valve 14 returns to its seated position. Thus the other end of the rocker arm is moved downwardly, causing the push rod mechanism to also be moved downwardly. If, after continued use of the engine, there should be any wear as between the valve stem 15 and the end 59 of the rocker arm, or should carbon deposits be built up on the conical seat 13 or valve 14, or should any other factors arise which ordinarily might disturb the relative disposition of the parts, the same will be accommodated by the automatic adjustment provided by the eccentric bearing arm 46, wedge ball 51 and spring 50.

A slightly modified form of the mechanism that is associated with the bearing for the rocker arm is depicted in Figure 7. In this form of the invention the wall of the pedestal opposite to the arm 46 is formed with a spring receiving recess 62. A similar recess is formed on the opposite face of the arm 46, such recess being shown at 63.

An expansion spring 64 has one end received in the recess 63 and the other end received in the recess 62. This spring 64 has a tendency to spread the arm 46 away from the pedestal 41 in the same manner as does the wedge ball 51.

The bearing surface 43 is formed with a pair of arcuate grooves 65 which merge in with the bearing surface 43 providing, in effect, inclined surfaces, one end of each of which merges in with the bearing surface 43. A clutch ball element 66 is positioned in each of the grooves 65, and an expansion spring 67 is associated with each clutch ball element. When the bearing member 44 is positioned within the bearing opening 43, the arcuate grooves 65 provide what are, in effect, tapered recesses, and the spring 67 normally urge the balls 66 to the smaller end of the recesses. Thus rotation in a clockwise direction, such as caused by the spring 64, is permitted. However, rotation in a reverse direction is prevented by this overrunning clutch mechanism. In order to release eccentric bearing 44 for the purpose of reverse rotation a bore 68 is provided for the insertion of a small tool to press against ball 66 to effect the release.

It will be noted that the part 52 of the bracket 48 acts as a stop limiting outward movement of the arm 46; this being true for the modification of Figure 7 as well as the form of Figure 6.

While preferred specific embodiments of the invention are hereinbefore set forth it is to be clearly understood that the invention is not to be limited to the exact constructions illustrated and described, because various modifications of these details may be provided in putting the invention into practice within the purview of the appended claims.

I claim:

1. A valve tappet assembly of the character described comprising push rod mechanism, a rocker arm having one end in operative engagement with said push rod mechanism and its other end adapted to operatively engage a valve stem, a pedestal formed with a bearing opening, a bearing member rotatable in said opening, a pivot pin eccentrically carried by said bearing member, said rocker arm being mounted on said pivot pin, an arm carried by said bearing member, a bracket carried by said pedestal, a ball element interposed between said arm and said pedestal, and an expansion spring engaging said bracket at one end and said ball at the other, said spring and ball exerting a tendency to spread said arm apart from said pedestal to rotate said bearing member.

2. A valve tappet assembly of the character described comprising push rod mechanism, a rocker arm having one end in operative engagement with said push rod mechanism and its other end adapted to operatively engage a valve stem, a pedestal formed with a bearing opening, a bearing member rotatable in said opening, a pivot pin eccentrically carried by said bearing member, said rocker arm being mounted on said pivot pin, overrunning clutch mechanism disposed between said bearing member and said pedestal whereby rotation of said bearing member in only one direction is permitted, and means associated with said bearing member tending to rotate said bearing member in the direction in which rotation is permitted.

3. A valve tappet assembly of the character described comprising push rod mechanism, a rocker arm having one end in operative engagement with said push rod mechanism and its other end adapted to operatively engage a valve stem, a pedestal formed with a bearing opening, a bearing member rotatable in said opening, a pivot pin eccentrically carried by said bearing member, said rocker arm being mounted on said pivot pin, overrunning clutch mechanism disposed between said bearing member and said pedestal whereby rotation of said bearing member in only one direction is permitted, an arm carried by said bearing member, and an expansion spring interposed between said arm and said pedestal, said spring tending to rotate said bearing member in the direction in which rotation is permitted.

4. A valve tappet assembly of the character described comprising push rod mechanism, means included in said push rod mechanism for providing a clearance in said tappet assembly, a rocker arm having one end in operative engagement with said push rod mechanism and its other end being adapted to operatively engage a valve stem, a pedestal formed with a bearing opening, a bearing member rotatably mounted

in said bearing opening, a pivot pin eccentrically carried by said bearing member, said rocker arm being mounted on said pivot pin, means for rotating said bearing member, and stop means for limiting rotation of said bearing member.

5. A valve tappet assembly of the character described comprising push rod mechanism, a rocker arm having one end in operative engagement with said push rod mechanism and its other end adapted to operatively engage a valve stem, a pedestal formed with a bearing opening, a bearing member rotatable in said opening, a pivot pin eccentrically carried by said bearing member, said rocker arm being mounted on said pivot pin, spring means associated with said bearing member tending to rotate the same, and stop means for limiting rotation of said bearing member.

6. In a valve actuating assembly including a push rod, a pivoted rocker arm supported by a pedestal, and a spring closed valve, the improvement of which comprises a bearing eccentrically supporting said pivoted rocker arm in said pedestal, a lever arm carried by said bearing and arranged with respect to said pedestal to form an intervening wedge guide, a wedge member in said guide, and means for urging said wedge member into said guide to cause said lever arm to rotate said bearing and alter the axis of oscillation of said pivoted rocker arm.

7. In a valve actuating assembly including a push rod, a pivoted rocker arm supported by a pedestal, and a spring closed valve, the improvement of which comprises a bearing eccentrically supporting said pivoted rocker arm in said pedestal, a lever arm carried by said bearing and arranged with respect to said pedestal to form an intervening wedge guide, a wedge member in said guide, means for urging said wedge member into said guide to cause said lever arm to rotate said bearing and alter the axis of oscillation of said pivoted rocker arm, and means for limiting rotation of said lever arm and bearing.

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