

Feb. 16, 1954

P. F. BERGMANN

2,669,228

ADJUSTING SCREW ASSEMBLY FOR ROCKER ARMS

Filed May 10, 1951

Fig. 2.

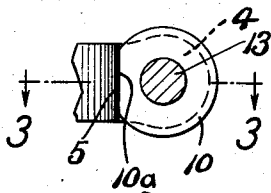


Fig. 1.

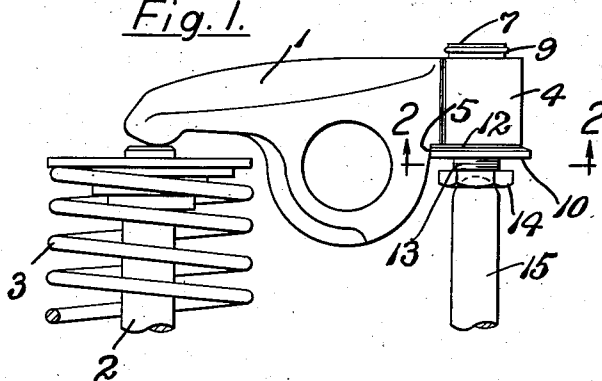


Fig. 3.

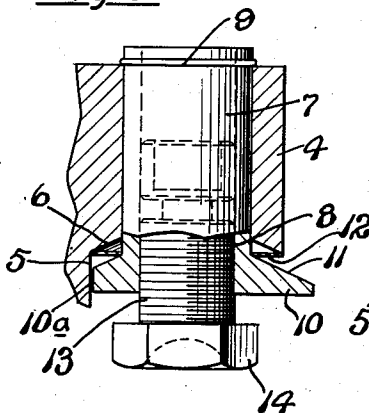


Fig. 4.

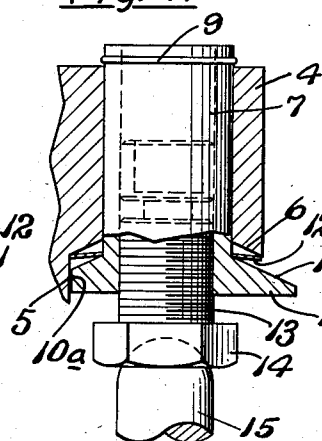


Fig. 5.

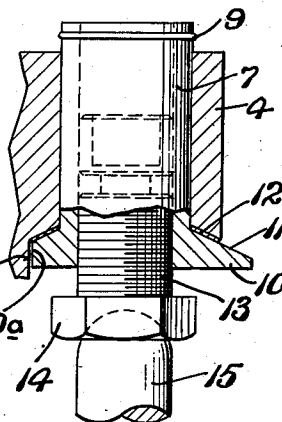


Fig. 6.

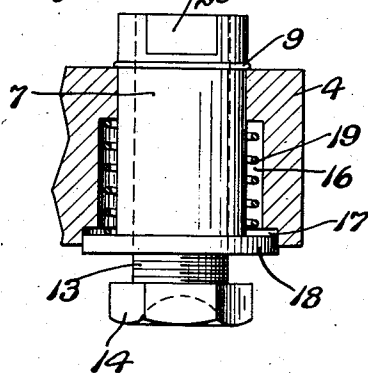
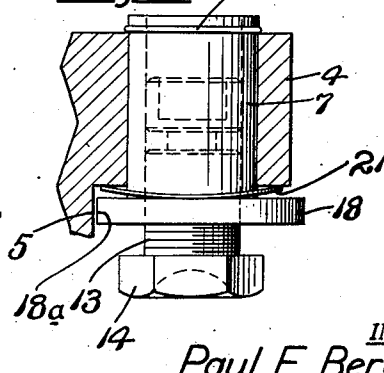


Fig. 7.



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2,669,228

ADJUSTING SCREW ASSEMBLY FOR
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Application May 10, 1951, Serial No. 225,595

3 Claims. (Cl. 123—90)

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The present invention relates to an adjusting screw assembly for rocker arms used in valve-in-head engines, that will provide quiet operation of the valve gear of such engines.

The rocker arms, one associated with each valve of an internal combustion engine, are moved for opening the valves against heavy valve springs which close the valves when free to do so. By tappet operation of a push rod disposed between one end of the rocker arm and the upper end of the tappet, the tappet being lifted by engagement at its lower end with a rotating cam on the engine camshaft, the arm is rocked. In adjusting to take up slack, wear, and the like between the various contacting surfaces of the valve train, the end of the rocker arm opposite that which engages against the stem of the valve operated thereby, has an adjusting screw threaded vertically therein against the lower end of which the upper end of the push rod bears.

A clearance space between the upper end of the valve stem and one end of the rocker arm, varying in different models or designs of engines, is maintained by the adjustment of the screw, by the use of a suitable feeler gauge of a predetermined thickness, such thickness being that of the clearance wanted. After the adjustment is complete and the gauge withdrawn, the thickness of such gauge leaves a clearance or "lash" in the whole valve train when the engine valve is closed and seated.

Such clearance space is necessary to prevent holding the valves open due to temperature changes of the parts of the engine, under various operating conditions. This clearance space is the cause of tappet noises, so called, especially present in valve-in-head engines, due to metal striking against metal between the several members of the valve train.

With my invention, the elimination of these valve train noises is accomplished. When an adjustment of the adjusting screw is made with my invention, the clearance in the valve train is all concentrated between the rocker arm screw and the upper end of the push rod by a novel structure using a spring, which in combination with the oil film retained on the parts, eliminates the metal to metal noises and prolongs the life of the parts.

It is a further object of the invention to provide a unit of which the adjusting screw is a part which may be easily and quickly assembled with a rocker arm. In the proposed structure the adjusting screw will be of the self-locking type, an example of which is shown in Patent

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No. 2,427,560, issued to Charles E. Johnson, because such self-locking screw facilitates the accurate lash adjustment that is substantially universally used in modern valve-in-head engines.

This screw can be assembled into the sleeve by the parts manufacturer, who is familiar with the assembly of such screws into tappets, and who can, therefore, be sure that the screws are assembled with the proper torque, and holding properties. When such screws are assembled into rocker arms made by the engine manufacturer, considerable trouble is experienced in maintaining the proper thread contact between the two parts because such assembly is a specialty job with which the engine manufacturer is not as experienced as the tappet manufacturer.

An understanding of the invention may be had from the following description, taken in connection with the accompanying drawing, in which,

Fig. 1 is a fragmentary elevation illustrating a rocker arm with my invention applied thereto, showing the operative position of the rocker arm with respect to the tappet actuated push rod and the valve stem of an internal combustion engine valve.

Fig. 2 is an under plan view and horizontal section, substantially on the plane of line 2—2 of Fig. 1, looking upwardly.

Fig. 3 is an enlarged vertical section substantially on the plane of line 3—3 of Fig. 2 illustrating the adjustable screw assembly of my invention applied at one end of the rocker arm, showing the relative position of the parts before the rocker arm is assembled into the engine.

Fig. 4 is a similar sectional view showing the positions of the parts, after the proper lash adjustment for the engine has been made, with the engine at substantially atmospheric temperature, and with the engine cam in position where the tappet is at its lowest position.

Fig. 5 is a similar sectional view showing the positions of the parts when the engine cam is in position to open the engine valve.

Fig. 6 is a sectional view similar to Fig. 3, showing a modified form of structure.

Fig. 7 is a sectional view similar to Fig. 3 showing still another modified form of structure.

Like reference characters refer to like parts in the different figures of the drawing.

A rocker arm 1 of conventional structure, in practice is mounted upon an axis of turning between its ends, one end portion of the rocker arm bearing against the upper end of a stem 2 of an engine valve, actuated by a heavy coiled

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compression spring 3 to close the valve when free to do so.

At the opposite end portion of the rocker arm an enlarged generally cylindrical vertical boss 4 is cast integral with the rocker arm, there being a vertical shoulder at 5 to one side of and below the lower end of said boss, provided by the adjacent downwardly extending central portion of the rocker arm through which the shaft on which it rocks passes.

With my invention, the boss 4 is vertically drilled or bored or otherwise machined to provide a vertical cylindrical opening from one end to the other of the boss. In the lower side of the boss 4 around said opening the metal is cut or machined away to provide a continuous upwardly and inwardly inclined surface 6. The angle of inclination shown in the drawings is approximately 15°, but such angle can be varied within reasonable limits without affecting the invention. The proper angle is such that the vertical side of the triangle thus formed, is a few thousandths of an inch longer than the proper lash or clearance adjustment of the engine involved. There is thus made at the lower end of the boss 4, a generally conical annular recess surrounding the vertical opening or passage through it.

A cylindrical sleeve 7 interiorly threaded, as at 8 (Fig. 3) is located in the vertical opening in the boss 4 having free up and down movement therein. At its upper end, it extends above the upper end of the boss 4 for a short distance. In such upwardly projecting end portion a continuous annular groove is made around the sleeve for the reception of a removable and replaceable snap ring 9, preferably made of spring metallic wire, which keeps the sleeve from falling out of the rocker arm while the various valve train parts are being assembled into the engine.

At the lower end of sleeve 7, integral therewith, is a generally flat head 10 having substantially the diameter of the boss 4 or greater and which, at its upper side, outwardly from the cylindrical sleeve portion 7, is formed with a downwardly and outwardly inclined conical surface 11 which is machined at substantially the same angle as the conical surface 6, lying in parallelism therewith. Before the sleeve is inserted upwardly through the boss 4 a flat thin metal ring 12 of spring or resilient material, having an exterior diameter substantially that of the exterior diameter of the boss 4, and having a central opening through which the sleeve passes, is placed over the sleeve and, upon assembly of the sleeve with the boss 4 is between the two annular surfaces 6 and 11. When unstressed (Fig. 3), the flat ring 12 is in a substantially horizontal plane. As shown in Fig. 2, the head 10 at one side has a flat 10a machined thereon to come into substantial bearing engagement against a stop, provided by the side or shoulder 5 previously described. Thus, when the sleeve is inserted upwardly through the boss 4, it is in a position such that the edge of the flat 10a is parallel to and closely adjacent such shoulder 5, thus holding the sleeve 7 against rotation about its longitudinal vertical axis.

A screw having a threaded shank 13 and a head 14 is screwed upwardly into the sleeve 7 at its lower end. Preferably, such screw is a self-locking tappet screw, well-known to those skilled in the art, having two spaced threaded sections with the threads of one section off-lead with respect to the other. When such screw is threaded into and engages with the threads 8 of the sleeve 7, a

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tight binding engagement is made such that the screw in operation, even under the vibrations present in an internal combustion engine, remains fixed in position and will not inadvertently or accidentally change its position with reference to the sleeve 7.

In practice, the self-locking screw 13—14 is assembled into sleeve 7 and this sub-assembly is then assembled into rocker arm 1, along with the spring washer 12, and snap ring 9.

In Fig. 4 can be seen the relative position of the parts of the assembly after the lash adjustment has been made and with the engine cam in its down, or valve closed position. The spring ring 12 is partially stressed so that all of the lash present in the valve train is between the inclined surface 6 on the rocker arm and the complementary surface 11 on sleeve 7. The lash is easily adjusted by compressing the spring 12 and placing a feeler gauge between the end of the valve stem 2, and the contacting surface of the rocker arm. When the lash is properly set, the feeler gauge is removed and immediately the spring 12 takes up all of the lash between the valve stem and rocker arm 21 and transfers it to the other end of the rocker arm assembly.

In the operation of my invention when used in an internal combustion engine, upon a cam lifting the tappet and moving the push rod 15 upwardly, the first effect will be to move the screw and sleeve 7 with its head 10, upwardly to stress the spring member 12, whereby its upper side will come against the inclined surface at 6, and its lower side against the lower inclined surface 11 on the head 10, as shown in Fig. 5; and thereafter rocker arm 1 on continuance of rocking opens the engine valve.

With the structure as described, the spring member 12 will keep the various parts of the valve train, valve, rocker arm, push rod, and tappet, in contact with each other at all times, by pushing sleeve 7 and adjusting screw 13—14 against the push rod, because the total length of the spring effect of spring 12 is slightly greater than the lash adjustment. The normal "rattling" of the valve train parts, sometimes referred to as tappet noise, is thus eliminated, in a cold engine as well as in a warm one.

As the parts expand due to the engine approaching the running temperature, the amount of lash compensated for by spring 12 changes, but the quieting effect remains the same.

In Fig. 6, in the modified structure shown, the vertical passage for the sleeve 7 through the boss 4 at the lower portion thereof is enlarged, providing an annular chamber 16 of relatively narrow width around the lower part of the sleeve 7. At a still lower portion, and at the lower end of the chamber 16, there is a further enlargement providing an annular recess 17 at the lower side of the boss 4 and extending upwardly therein. The head 18 at the lower end of the sleeve is not provided with the inclined upper annular surface but is horizontal. When the sleeve 7 in this structure is at its lowermost position (Fig. 6), corresponding to Fig. 3, stopped by the snap ring 9, a space a few thousandths of an inch greater than the designed lash or clearance for the engine is provided between the upper side of the head and the upper side of the enlarged recess 17. A coiled compression spring 19 around sleeve 7, bearing at its lower end against the upper side of the head 18 and at its upper end against the upper end of the annular chamber 16, normally moves the sleeve 7 and the parts

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associated therewith to such lower position. Making the lash adjustment is the same as previously described for the construction shown by Fig. 3.

Another form of construction is shown in Fig. 7. This construction is similar to that shown in Fig. 3, except that the spring washer 21, taking the place of the washer 12 instead of being flat, is offset, or dished as shown, an amount sufficient to be a few thousandths of an inch more than the normal lash adjustment of the engine. The lower end surface on boss 4, and the upper side surface of head 13 on sleeve 7 are perpendicular to the axis of sleeve 7. The head 13 is flattened at 13a at one side to engage shoulder 5 to prevent turning of sleeve 7. All other features of this construction are the same as Fig. 3.

The structure described, using the spring rings, 12 or 21, or the spring 19, eliminates many of the undesired tappet noises at engine starting and when the engine is at running temperature. The tappet assembly has other valuable results which follow, and would follow if such springs 12 or 19 were not used. The manufacturer of the assembled screw and sleeve 7 puts them together at the factory and the two are shipped assembled to the builder of the engines in which they are to be used, providing a better engagement and working operation of the screw in connection with the sleeve 7, than if an interiorly threaded opening made directly in the boss 4 vertically therein, was fabricated by the engine manufacturer who manufactures the rocker arms, and tappet screws only were made by an accessory manufacturer and shipped to the engine manufacturer to be assembled with the rocker arm, as is now very frequently done. Greater certainty of better construction and better operation is had. The engine manufacturer, with respect to the rocker arms, is merely required to drill or bore the vertical passage for the sleeve 7. This is readily done without unusually close tolerances being needed.

In the structural form shown in Fig. 6, the head 10 is of a circular form without the holding flat 10a. Accordingly, the sleeve 7 is elongated somewhat to extend farther above the snap ring 9, so that flat surfaces 20 at diametrically opposite sides of the sleeve may be made at its upper end for the application of a wrench to hold the sleeve from turning when the screw is adjusted. In the other forms, shown in Figs. 1 to 5 inclusive, and in Fig. 7 the sleeve is maintained against turning by the engagement of the flat 10a against the surface at 5, one wrench and the use of one hand only being required in adjusting the screw 13-14.

The invention is defined in the appended claims, and is to be considered comprehensive of all forms of structure coming within their scope.

I claim:

1. A tappet screw assembly adapted to be mounted upon one end of a rocker arm of an internal combustion engine and extend freely vertically therethrough comprising, a vertical sleeve, said sleeve being interiorly threaded throughout its length and having an enlarged head at its lower end adapted to come below the end portion of the rocker arm through which the sleeve is to pass, said sleeve at its upper end portion having an annular groove around it, a removable snap ring of spring material in said groove adapted to be located above the upper side of a rocker arm through which the

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sleeve is adapted to pass, with the upper side of said head located a predetermined spaced distance from the lower side of the rocker arm through which the sleeve is adapted to pass when said snap ring is at its lowermost position, a tappet screw threaded upwardly into the lower end of said sleeve, and means for holding the sleeve from rotation upon turning the screw to obtain different adjusted positions thereof.

2. In a device as described, a vertical interiorly threaded sleeve having an enlarged head at its lower end, said head at one side thereof having a portion of the periphery of the head in a vertical plane, a spring around said sleeve above the head resistingly yieldable toward said head upon pressure thereagainst at its side opposite the head, a headed screw threaded upwardly into said sleeve at the lower end thereof, said sleeve at the upper end portion thereof having an annular groove around it, and a spring split ring in said groove extending beyond the outer surface of said sleeve.

3. In a structure as described, a rocker arm adapted to be mounted to turn about a horizontal axis, disposed between its ends, one end adapted to engage the stem of a valve of an internal combustion engine to open the valve on downward movement of said end of the rocker arm, the other end of the rocker arm having a vertically disposed integral boss, said boss having a vertical passage therethrough of uniform diameter, a vertically disposed interiorly threaded sleeve passing through said boss, said sleeve at its lower end having a head located underneath at the lower side of said boss, said sleeve at its upper end portion above the upper side of said boss having an annular groove therearound, a split resilient ring surrounding the upper end of the groove and partially received therein, thereby limiting downward movement of the sleeve and head and maintaining the upper side of the head when in its lowermost position a predetermined distance from the lower side of said rocker arm boss, said lower surface of said boss having an annular surface around said sleeve inclined at an acute angle to the horizontal, and said head at its upper side having an annularly inclined surface around the sleeve, inclined at a substantially like angle to the horizontal, said inclined surfaces on the boss and head being substantially parallel to each other, a thin flat ring of spring material around the sleeve located between said head thereof and the lower end of the boss, normally occupying a horizontal position and said head at one side having a laterally extending lug engaging against an adjacent side of the rocker arm below the boss to hold the sleeve against turning about its vertical axis, and a tappet screw threaded upwardly into said sleeve having a head at its lower end.

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