

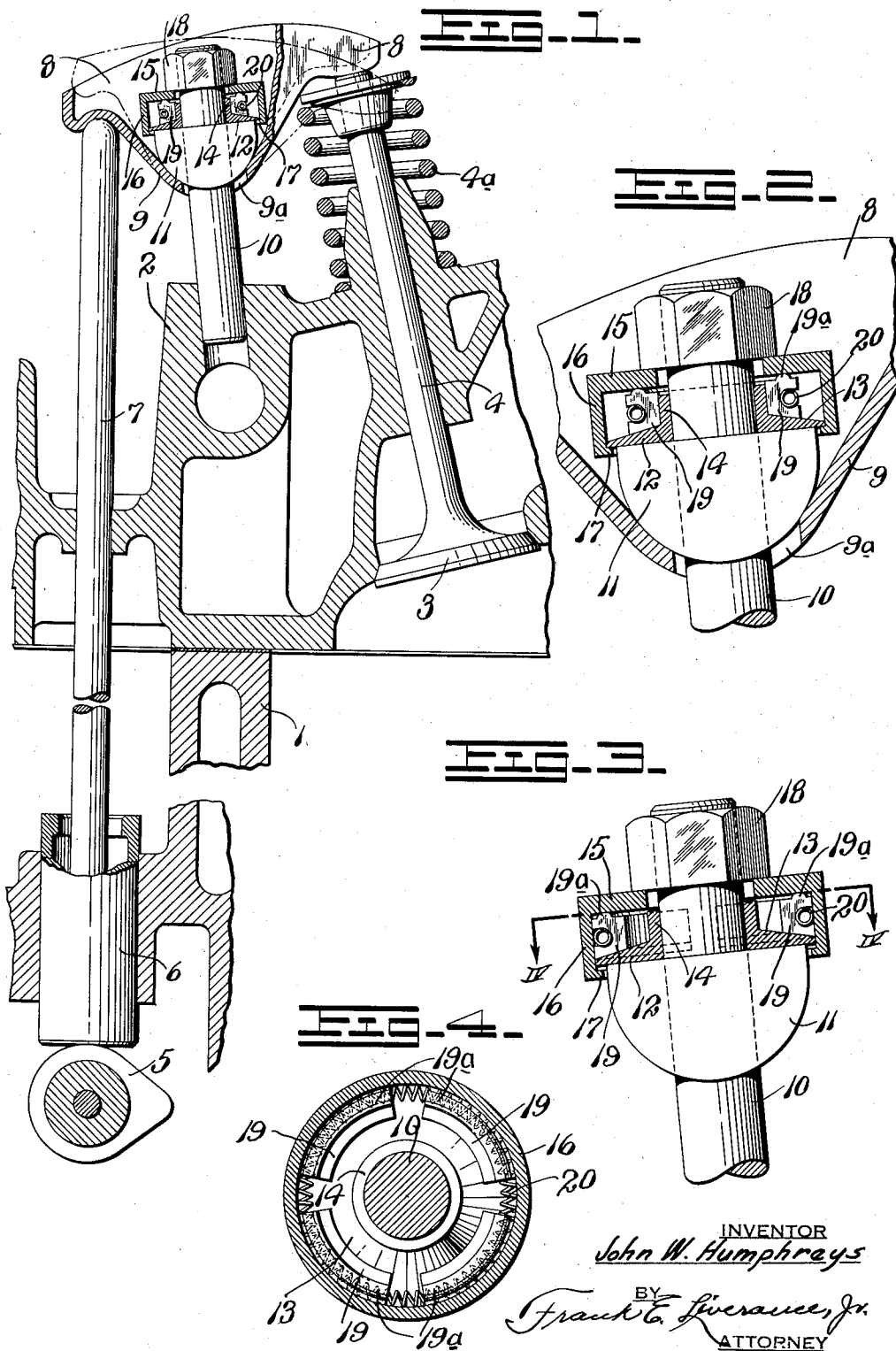
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MECHANICAL LASH REMOVAL STRUCTURE

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MECHANICAL LASH REMOVAL STRUCTURE

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8 Claims. (Cl. 123—90)

The present invention relates to a novel construction of a mechanical lash removal structure and more particularly to such structure combined with a rocker arm, a push rod and the engine valve of an internal combustion engine. This structure eliminates and removes lash which may occur when mechanical valve tappets are used for lifting engine valves.

This application is a continuation-in-part of patent application Serial No. 521,978, filed July 14, 1955, now abandoned.

Lash or loose slack is due to the fact that engine parts, including the push rod and the valve stem, elongate as the engine increases in temperature after a cold start. When the engine is cold and there is no provision for eliminating such lash, various tappet noises occur during the period that the engine is warming up. These noises are caused by loose slack in the valve train leading from a cam on a camshaft of the engine. Some slack is necessary because as the engine warms up the expansion elongation of push rods and valve stems occur. As a result if there were no slack, the valves would be held open when they should be closed, and there would be a resultant loss of power, and burning of valves.

It is a primary object and purposes of this invention to provide novel structure for eliminating lash and the tappet noises which come therefrom when the engine is cold, which structure is built in the rocker arm located between the push rod and the upper end of the engine valve stem. Such structure is readily manufactured and installed and adjustment is particularly easy, the part which is operated for such adjustment being above the engine and over the rocker arm which makes it readily accessible.

It is a further object to provide an automatically operated lash removing device of simple, economical structure and one which is sturdy and durable and requires little or no repair or maintenance.

Many other objects and purposes than those stated will appear and be understood from the following description, taken in connection with the accompanying drawings illustrating a preferred embodiment of my invention, in which drawings,

Fig. 1 is a fragmentary vertical section through a portion of an engine block and head and showing my invention embodied with a rocker arm which extends between the upper end of a push rod and of a valve stem.

Fig. 2 is a fragmentary enlarged section, the same as in Fig. 1, illustrating the automatic adjusting mechanism used with the rocker arm and the position occupied by the parts thereof when the engine is cold.

Fig. 3 is a similar section showing the automatic lash removing structure and the position which the parts occupy after the engine has become warm through operation, and

Fig. 4 is a horizontal section and plan substantially on the plane of line IV—IV of Fig. 3 looking in a downward direction.

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

In Fig. 1 a fragmentary portion of the engine block 1 is shown with the head 2 thereover closing the upper ends of the cylinders. One of the valves 3 with an upwardly extending valve stem 4 is illustrated, being mounted on the head with the valve at a port leading to an engine cylinder. A cam 5 on the camshaft rotates continuously when the engine is in operation, lifting a valve tappet 6 against which the lower end of a push rod 7 bears. Rod 7 extends upwardly to substantially the same height as the upper end of the valve stem 4. This supplies the environment in which my invention is used.

Between the spaced upper ends of push rod 7 and valve stem 4 a rocker arm of novel structure is located. It is pressed and stamped from flat metal having spaced generally vertical sides 8, integral with the bottom 9 of the form shown in Fig. 1. The bottom 9 is of generally semi-spherical contour having a slot 9a. The upper ends of the push rod 7 and the valve stem 4 bear against the end portions of the lower side 9 of the rocker arm.

A rod 10 is fixedly secured at its lower end portion to the head 2, extending upwardly therefrom and passing through the slot 9a in the bottom 9 of the rocker arm. The upper end portion of the rod 10 passes between the sides 8 of the rocker arm. Said rod 10 also passes through a bearing block 11, the under side of which is of generally semi-spherical form and bears against the upper side of the bottom 9 of said rocker arm. Thus when the rocker arm rocks back and forth it slidably bears against the under curved side of the block 11. The rod 10 passes through a cam mechanism which includes the cam sleeve 14, wedges 19, spring 20 and housing 16.

The upper side of the block 11 is flat, against which the under side of an annular flange 12 of sleeve 14 bears. Flange 12 has a downwardly and outwardly inclined upper annular side 13 extending outwardly from the central portion of the sleeve 14. The rod 10 passes upwardly through sleeve 14.

A housing of short cylindrical form has an upper flat side 15 over and spaced from the flange 12 through the center of which rod 10 passes. Integral downwardly extending sides 16 reach to and under the edge portions of the flange 12 and are turned inwardly to provide a continuous inwardly extending annular lip 17 under the outer edge portions of the flange 12. Rod 10 at its upper end above the top 15 of the housing is threaded and receives a self-locking adjusting nut 18.

Within the housing and over the downwardly and outwardly inclined upper sides 13 of the flange 12 a number of curved wedge members 19 are disposed, the lower sides of which have surfaces complementary to the upper downwardly inclined surfaces 13 of the flange 12, while at the upper sides ribs 19a bear against the under side of the housing top 15. Four are shown but the number may be varied without departing from my invention. An endless coiled tension spring 20 of circular form is around the outer sides of all of the wedge members 19 seated in grooves therein at the outer sides thereof. Such spring 20 is under tension urging the wedge members inwardly toward each other so that at innermost position, as in Fig. 2, such members abut the sleeve 14.

When an engine is cold and the push rod 7 and valve stem 4 are contracted to their shortest length, springs 20 urge the wedge members inwardly moving the sleeve 14 with the block 11 below it in a downwardly direction (Fig. 2). This moves the rocker arm in the same direction maintaining its ends in contact with the push rod and valve stem. As temperature rises during engine operation causing elongation of the push rod and valve stem, the rocker arm is lifted or bodily moved upward with re-

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spect to the relatively fixed rod 10. The force exerted by such upward movement which carries the flange 12 of sleeve 14 upward also may be resolved in part into a generally horizontal component pushing the wedge members 19 outwardly and, at an extreme, reaching the outermost position shown in Fig. 3. As soon as the engine cools and contraction starts, the wedge members are automatically urged inward by coil spring 20 toward the inner extreme position shown in Fig. 2. It is apparent that on the initial adjustment of the parts nut 18 may be turned to adjust the parts to the position shown in Fig. 2 while the engine is cold.

As engine temperature rises compensation is made by the automatic separation of the wedge members 19, the same being moved outwardly progressively as temperature and expansion increase. The spring 26 is stretched. The separation of the wedge members 19 occurs under the forces exerted by the valve spring associated with valve 3 and its stem 4 at all times when valve 3 is not completely closed, together with vibration or shock from the push rod and valve stem transmitted to the rocker arm when the engine is operated. When the engine valve 3 is completely closed the force of its spring is removed and the spring 20 will hold the wedge members 19 snugly against the flange 12 with the ribs 13 snugly against the housing top 15. When the engine is stopped and cooled with a consequent reduction in temperature, contraction occurs which releases the pressure of the push rod against the rocker arm and the wedge members 19 are drawn together. Thus under all conditions of temperature a snug engagement of the rocker arm with the upper ends of both the push rod 7 and valve stem 14 is maintained and there is no loose motion or backlash with resultant tappet noises.

In practice the outward and downward inclination of the upper side 13 of flange 12 to its lower side is approximately nine degrees. With such angle, static pressure of a push rod or valve stem or both will not provide a sufficiently strong horizontal component of the force to move the wedge members outwardly. Under the vibratory and reciprocating conditions of engine operation, such separation will occur when the force of the valve spring is applied as when a valve is opened and continues until the engine valve is closed.

The manufacturing cost of this invention is low. Installation is easy and the adjustment is especially easy because of ready access to the nut 18. With the invention as disclosed exceptionally satisfactory results have been obtained. All tappet noises at the start and during warming up of a cold engine are eliminated, as are tappet noises during operation when the engine is hot. The spring biased cam mechanism eliminates chattering usually encountered in purely spring biased anti-lash mechanisms.

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. In an internal combustion engine having a cam operated push rod and a spring valve with valve stem, the outer ends of said push rod and valve stem being spaced from each other, and a rocker arm between said push rod and valve stem bearing against the outer ends thereof at its ends, the improvement comprising: means for pivotally and outwardly and inwardly movably mounting said rocker arm between its ends, and spring biased cam means for maintaining the ends of the rocker arm against the outer ends of said push rod and valve stem under longitudinal elongation and shortening of the lengths of the push rod and valve stem caused by changing temperature conditions.

2. In an internal combustion engine having a cam operated push rod, a spring closed valve with valve stem, the outer ends of said push rod and valve stem being spaced from each other, and a rocker arm having ends bearing against the push rod and valve stem, the improve-

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ment comprising, a fixed support extending outwardly through and between the ends of the rocker arm, stop means on the outer end portion of said support, a bearing block through which said support freely passes located between the rocker arm and nut, and spring biased cam means between the stop means and said block for forcing the block against the rocker arm.

3. In an internal combustion engine having a cam operated push rod, a spring closed valve with valve stem, the outer end of said push rod and valve stem being spaced from each other, a rocker arm extending between and having its ends bearing against the push rod and valve stem, a bearing block on said rocker arm; a fixed rod extending through said rocker arm and bearing block; means located at the top of said fixed rod for variably positioning said block on said fixed rod support to take up lash; said means including a wall operatively connected to said block and inclined at an angle to the axis of said fixed rod; and spring biased cam means bearing against said wall and urging said block against said rocker arm.

4. In an internal combustion engine having a cam operated push rod and a spring closed valve with valve stem, the outer ends of said push rod and valve stem being spaced from each other, and a rocker arm between said push rod and valve stem bearing against the outer ends thereof at its ends, the improvement comprising: a fixed rod extending through said rocker arm intermediate its ends; bearing means freely slidable on said rod and seated on the outer surface of said rocker arm; and spring biased cam means urging said bearing means against said rocker arm.

5. In an internal combustion engine having a cam operated push rod and a spring closed valve with valve stem, the outer ends of said push rod and valve stem being spaced from each other, and a rocker arm between said push rod and valve stem bearing against the outer ends thereof at its ends, the improvement comprising: a fixed rod extending through said rocker arm intermediate its ends; bearing means freely slidable on said rod and seated on the outer surface of said rocker arm; spring biased cam means urging said bearing means against said rocker arm; said spring biased cam means including a cam surface inclined radially from the axis of said fixed rod; and wedge elements riding on said surfaces and spring biased in a direction substantially perpendicular to the axis of said fixed rod.

6. In structure as described having a cam operated, longitudinally movable push rod and a spring closed valve having a valve stem spaced from said push rod, adjacent outer ends of push rod and valve stem being located generally at the same height, the improvement comprising, a rocker arm against the inner side of which and at opposite ends said outer ends of the push rod and valve stem bear, a fixed post between the outer end portions of the push rod and valve stem extending through said rocker arm between the ends thereof, a bearing block against the upper end of said support and rocker arm, through which said support passes, said rocker arm being tiltable about said block for limited raising and lowering of the ends of said rocker arm, and spring biased cam means between said support and the outer side of said block for maintaining said block and rocker arm in firm contact engagement under temperature caused elongation or contraction in length of said push rod and valve stem.

7. In an internal combustion engine having a cam operated push rod, a spring closed valve with valve stem, the outer ends of said push rod and valve stem being spaced from each other, and a rocker arm extending between and having its ends against the outer ends of the push rod and valve stem, the improvement comprising, a fixed rod support passing through said rocker arm between the ends thereof, a block against the upper side of the rocker arm through which said rod support passes, a stop member on the upper end portion of said rod

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support, a housing between said nut and block through which said rod support passes, a sleeve around the rod support within said housing, an annular flange on said sleeve against the upper side of said block, said flange having a downwardly and outwardly inclined upper surface, a plurality of arc shaped wedge members in said housing bearing against the upper side of the housing and upper inclined side of said flange, and spring means normally moving said wedging members inwardly when free to do so.

8. In an internal combustion engine having a cam operated push rod and a spring closed valve with valve stem, the outer ends of said push rod and valve stem being spaced from each other, and a rocker arm between said push rod and valve stem bearing against the outer ends thereof at its ends, the improvement comprising: 15 a fixed rod extending through said rocker arm intermediate its ends; bearing means freely slidable on said rod and seated on the outer surface of said rocker arm; spring biased cam means urging said bearing means against 20 said rocker arm, said spring biased cam means includ-

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ing a bearing block and sleeve freely slidably mounted on said fixed rod; said bearing block seated on said rocker arm; said sleeve being located outwardly of said block and having an annular flange with a radially inclined surface inclined toward said rocker arm; a plurality of arc shaped wedge members bearing against said inclined surface; and a coil spring around said wedge members urging them radially inwardly toward said fixed post; and stop means bearing against said wedge 10 members on the side opposite said inclined surface whereby said wedge members in being urged radially inwardly urge the block toward said rocker arm.

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