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LASH ADJUSTING DEVICE

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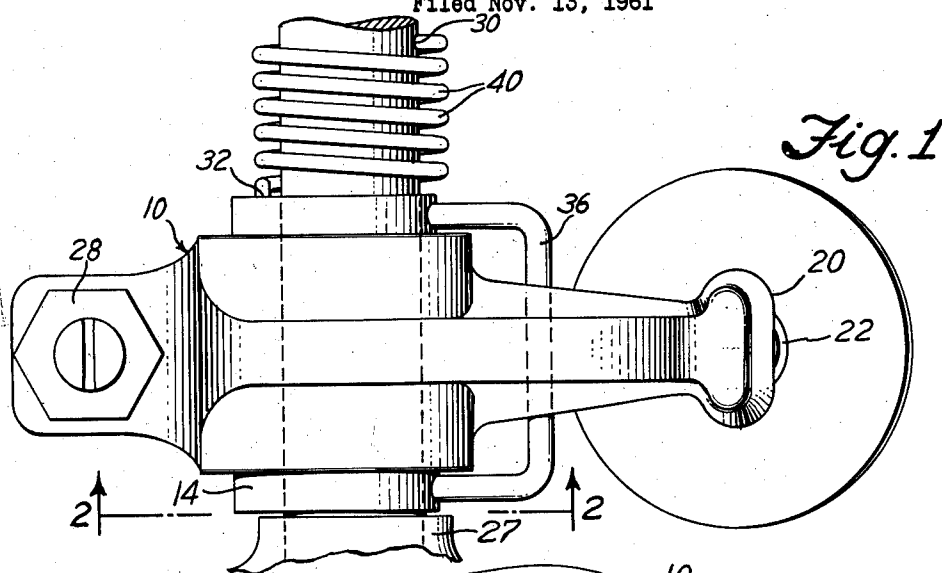


Fig. 1

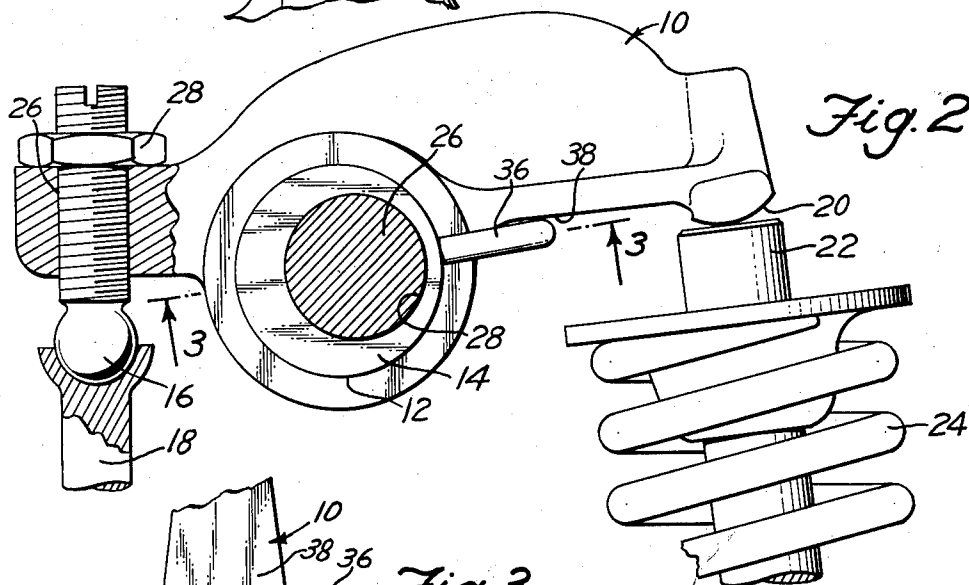


Fig. 2

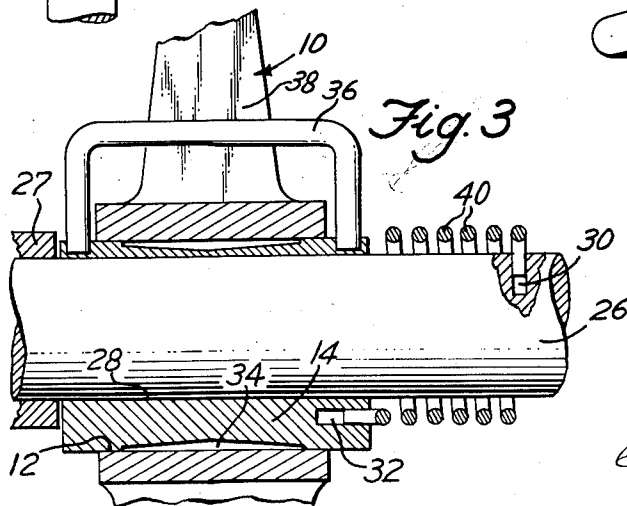


Fig. 3

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LASH ADJUSTING DEVICE

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1 Claim. (Cl. 123—90)

This invention relates to mechanical lash adjusting systems for engine valve actuating trains, and more particularly to a type of spring loaded lash adjuster wherein potential lash is deliberately introduced into the valve train by fully compulsive means which is extremely simple and rugged and which is not adversely affected by inertia conditions during engine operation.

Recent developments in the mechanical lash adjuster field for modern automotive engines have taught the desirability of providing a force-multiplying mechanism of the annular or rotary wedge variety having an inherently self-locking angle considerably below the critical friction angle. This mechanism is shifted in a direction to introduce potential lash while the valve is unseated to insure positive, firm seating of the valve; it is then biased in the opposite direction to wipe out such potential lash while the valve is seated to insure quiet operation and full lift on the following unseating stroke. Furthermore, because of the diverse operating conditions of modern automotive engines which render the niceties of critical friction requirements wholly unreliable, the means for shifting the wedge device in the direction of increased lash while the train is loaded must constitute a positive one-way drive including a fully compulsive reaction connection as well as a positive driving connection. For truly successful use in mass production high speed engines, moreover, such positive driving means must be extremely simple for both economic and maintenance reasons as well as being free from adverse influence by inertia forces which change with engine speeds.

Accordingly, it is an object of the present invention to provide a lash adjusting device including a purely one-way abutment drive arrangement for a self-locking rotary wedge which is positive in action because of compulsive driving and reaction connections and absence of compulsive driving and reaction connections and absence of critical frictional balances, is extremely simple of structure involving relatively few moving parts, and is designed to minimize adverse influences produced by changing inertia forces.

A more particular object of the present invention is to provide an adjustable mounting for a rocker arm fulcrum in a valve actuating train which comprises an eccentric sleeve rotatable by fully compulsive means about a shaft fixed on the engine to introduce an increment of potential lash on the valve opening stroke, and which is biased in the direction of decreased lash after the valve seats.

Further objects and advantages of the present invention will be apparent from the following detailed description, with reference to the accompanying drawings in which like reference characters refer to the same parts throughout the several views, and in which:

FIGURE 1 is a top view of a rocker arm and fulcrum arrangement embodying the lash adjusting elements of this invention;

FIGURE 2 is a sectional elevational view on line 2—2 of FIGURE 1 of such a rocker arm mounting; and

FIGURE 3 is a sectional view on line 3—3 of FIGURE 2 showing further details of the lash adjusting fulcrum.

Referring in more particularity to the drawings, a rocker arm 10 is fulcrumed intermediate its ends about the outer surface 12 of a horizontal sleeve 14. Means

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forming a push rod abutment 16 at one end of the rocker arm cooperate with a push rod 18 actuated by the conventional rotary cam, not shown. Means forming a valve stem abutment 20 at the other end of the rocker arm cooperate with the stem of a conventional valve 22 which is biased upwardly against its seat, not shown, by means of a valve seating spring 24. A screw thread connection 26 between the rocker arm 10 and the push rod abutment 16 serve to effect semi-permanent adjustments in the overall effective length of the valve actuating train, which adjustment may be secured by means of a lock nut 28.

The fulcrum surface 12 for the rocker arm 10 is adapted to be raised and lowered in relation to the engine by means of a pair of adjusting members comprising the sleeve 14 and a horizontal shaft 26 fixed in brackets 27 secured to the engine member. The sleeve 14 is received upon the shaft 26 by means of an eccentric aperture 28. It will be understood that, as the sleeve 14 is oscillated about the shaft 26, the fulcrum 12 will be raised or lowered in relation to the shaft 26 which is fixed on the engine. A radial hole 30 is provided in the shaft 26 to receive one end of a lash take-up spring, explained below.

The eccentric sleeve 14 has an axial dimension somewhat greater than the width of the rocker arm 10. In one axial end of the sleeve, a hole 32 is provided for receiving the other end of a lash take-up spring, explained below. A cut-away portion 34 around the mid-portion of the outer surface of the sleeve 14 is provided to insure that there is substantially more frictional contact between the inner surface 28 of the sleeve and the shaft 26 than there is between the outer surface 12 of the sleeve and the rocker arm. This provides an inherently self-locking characteristic for the force-multiplying eccentric. An abutment member comprising a U shaped radially extending actuating arm 36 integral with the sleeve 14 is provided for turning the sleeve about the shaft 26 to raise or lower the rocker arm fulcrum. A second abutment is formed by the under surface 38 of the valve stem actuating end of the rocker arm 10. As can be seen from FIGURE 2, clockwise motion of the rocker arm 10 about the fulcrum 12 will drive the abutment arm 36 downwardly in a direction which raises the rocker arm fulcrum in relation to the engine.

A coiled torsion or lash take-up spring 40 surrounding the shaft 26 has one end anchored in the hole 30 in the shaft and the other end anchored in the hole 32 in the sleeve 14. This spring creates a continual bias on the sleeve 14 in a counterclockwise direction (FIGURE 2) to lower the rocker arm fulcrum in relation to the fixed shaft 26. This spring is too weak to so rotate the sleeve while the valve train is under the load of the valve seating spring 24; however, when the valve is seated spring 40 biases the eccentric in the direction of decreased lash to lower the pivot of the rocker arm and remove all actual lash from the actuating train.

In operation, with the parts positioned as shown in the drawings, operation of the cam, not shown, forces the push rod 18 upwardly to oscillate the rocker arm 10 in a clockwise direction (FIGURE 2) about its fulcrum 12. As the abutment 38 swings against the abutment 36, and drives it downwardly in a clockwise direction, the eccentric adjusting member 14 will be shifted in the direction of increased lash, that is, the pivot fulcrum surface 12 for the rocker arm will be raised in relation to the other adjusting member (fixed shaft 26). On the valve closing stroke, when the rocker arm oscillates back in a counterclockwise direction, the abutment arm 36 will remain down in the position of increased lash because of the self-locking feature of the eccentric. The great difference in relative contact between the eccentric and the

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shaft and the eccentric and the rocker arm, as well as the proximity of the two centers for the cylindrical eccentric surfaces 28, 12, thus serve to retain potential lash in the valve train on the valve closing stroke to insure full and proper seating of the valve. At this point, because of the lash introduced on the valve opening stroke, the cam, push rod and rocker arm have a small amount of return travel remaining. Here, the lash take-up spring 40 becomes operative after the valve has seated to drive the adjusting member 14 relative to the adjusting member 26 in the direction of decreased lash (counterclockwise in FIGURE 2) to wipe out the lash in the train as fast as the receding cam contour permits. This lash take-up adjustment will swing the abutment arm 36 only part of the distance back towards the rest position of the abutment 38, under normal operating conditions. Then, on the next valve opening stroke, the abutment 38 will pick up the abutment 36 at this mid-point and drive it downwardly to the maximum point represented by the peak of cam rise, thus again introducing an increment of potential lash to insure proper valve seating.

Thus, a lash adjusting device has been disclosed which serves, by means of a single pair of positive acting abutments forming a fully compulsive driving connection and the fixed shaft forming a fully compulsive reaction connection, to shift an inherently self-locking rotary wedge through a variable distance to introduce a corresponding amount of potential lash into the train. This is done during the last portion of each valve opening stroke, such lash being retained on the valve closing stroke by the self-locking character of the wedge or force-multiplying mechanism until the valve seats, at which point the lash take-up spring operates to increase the effective length of the train as fast as the receding cam contour permits. The amount of potential lash removed by this spring during normal "warmed-up" operation will shift the force-multiplying mechanism through only part of the available lash eliminating distance, thus only a corresponding increment of potential lash will be introduced by the one-way drive abutments on the next opening stroke. Thus, the increment or amount of potential lash will vary with the lengths of the parts relative to each other and to the engine. Enough extra travel of the force-multiplying mechanism may be provided to compensate for wear of the parts.

Furthermore, the extreme simplicity of the device renders it available for mass production purposes, and the placement of the parts—particularly of the force-multiplying mechanism including its operating abutment—minimizes adverse influences caused by momentum and inertia forces during high speed engine operation.

While the above described embodiment constitutes a preferred mode of carrying out this invention, many other

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forms might be adopted within the scope of the actual invention, which is claimed as:

A lash adjusting system of the mechanical type for a valve operating train of an engine comprising in combination therewith

a rocker arm,

means on one end of the rocker arm forming a push rod connection and means on the other end thereof forming a valve stem connection,

means intermediate the ends of the rock arm forming a fulcrum,

an adjustable mounting for the fulcrum including a shaft fixed on the engine,

an eccentric associated with the fulcrum and rotatable about the shaft in one direction and return through a limited stroke to decrease and increase, respectively, the effective length of the train by a predetermined amount,

a single pair of one-way drive abutments movable toward and away from one another between spaced and engaged relationships in response to valve opening and valve closing motion of the train, respectively, one of the abutments being associated with the eccentric and the other abutment being located on the rocker arm to engage the one abutment part way through the valve opening motion of the train and thereafter compulsively rotate the eccentric in the one direction from a mid-stroke position through the distance required to reach the limit of its stroke to create a corresponding amount of potential lash in the train,

the eccentric being inherently self-locking against the force of valve train load to retain such amount of potential lash in the train during valve closing motion of the train as the abutments disengage and move away from one another,

and a lash take-up spring having insufficient force to rotate the eccentric while the train is loaded and connected to rotate the eccentric in the return direction away from its stroke limit to a mid-stroke position through the distance required to remove actual lash from the train as the load on the train is relieved by seating of the valve.

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