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SLOPING PUSH ROD ROCKER ARM MOUNTING

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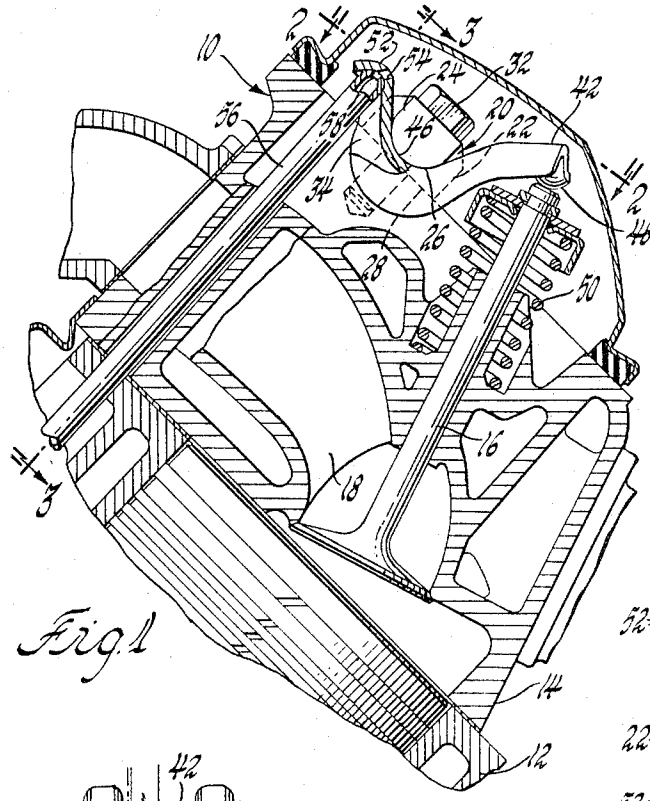


Fig. 1

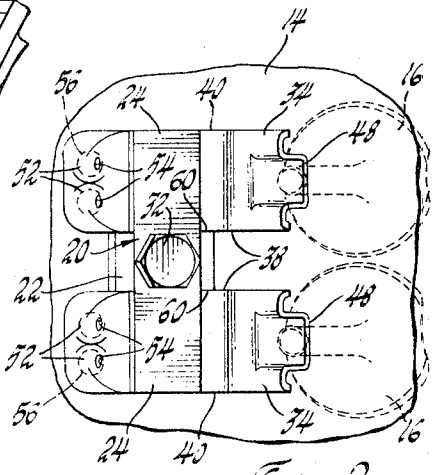


Fig. 2

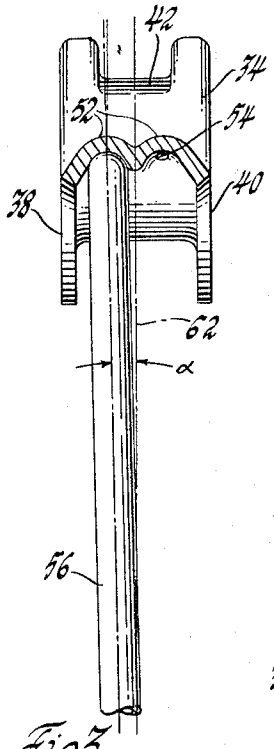


Fig. 3

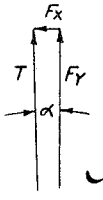


Fig. 4

Fig. 5

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SLOPING PUSH ROD ROCKER ARM MOUNTING

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This invention relates to mounting of rocker arms of the type used for operating poppet valves and the like in internal combustion engines and, more particularly, to such mountings in which the rocker arms are retained in place partly by axial components of force impressed upon the rocker arms by sloping the rocker arm actuating push rods with respect to the individual planes of action of their respective rocker arms.

The principal object of the present invention is to provide a valve actuating rocker arm arrangement in which the rocker arms are axially located in their respective planes of action by axial thrust of the valve actuating push rods caused by sloping the push rods with respect to the planes of the action of the rocker arms thereby obviating the need for conventional spring clips, snap rings, springs or other retaining means commonly used with various rocker arm arrangements.

In a specific aspect of the invention, it provides a rocker arm support arrangement having pairs of rocker arms carried on the oppositely extending arms of individual support members, each of the rocker arms including a pair of axially spaced push rod receiving portions arranged so that the rocker arms are interchangeable, the push rods being sloped inwardly at their upper ends and engaging the inner receiving portion of each rocker arm so as to urge the rocker arms inwardly against stop means thereby fixing their axial positions.

Further objects and advantages of the invention will be apparent from the following description of a preferred embodiment selected for purposes of illustration, having reference to the drawing, wherein:

FIGURE 1 is a fragmentary cross-sectional view of an internal combustion engine having a rocker arm support arrangement according to the invention;

FIGURE 2 is a fragmentary plan view taken generally along the plane indicated by line 2—2 of FIGURE 1;

FIGURE 3 is a fragmentary side view taken generally along the plane indicated by line 3—3 of FIGURE 1;

FIGURE 4 is a force diagram indicating the resolution of push rod thrust force into components viewed in the direction of FIGURE 3, and

FIGURE 5 is a pictorial view showing a rocker arm and its support.

Referring now to the drawing, numeral 10 generally indicates an internal combustion engine having a bank 12 of cylinders closed at the upper end thereof by a cylinder head 14. The cylinder head carries a plurality of valves 16 which control the flow of fluids through passages 18 connecting with the various cylinders of bank 12. It is common practice for the valves 16 to include an inlet and an outlet valve for each cylinder and the arrangement shown in the drawing is particularly intended for engines of this type although it is not necessarily limited thereto.

In the disclosed embodiment, the cylinder head 14 carries a plurality of supports 20 spaced longitudinally along the cylinder head and having one support 20 associated with the valves 16 of each cylinder in the cylinder bank.

The supports each comprise a central leg 22 having a pair of arms 24 extending oppositely from one end thereof. The arms are formed with arcuate bearing portions 26 extending along the sides facing the opposite end

28 of leg 22. An opening 30 extends longitudinally through leg 22, through which securing means, such as bolt 32, extends to retain each support 20 in place with its end face 28 secured against the cylinder head 14.

A pair of rocker arms 34 is received on the arms 24 of each support member for rocking motion thereon in individually defined planes. The rocker arms are each formed from a single sheet of metal and comprise parallel inner and outer sides 38 and 40, respectively, connected by an upper wall 42. The upper wall includes an upwardly facing arcuate bearing surface 46 intermediate the ends thereof and which is received against bearing portion 26 of the appropriate support arm to provide for the rocking action of the rocker arm.

The upper wall also includes an actuating portion 48 at one end of the rocker arm which contacts the end of the associated valve for actuating the valve in its opening direction. A coil spring 50 biases each of the valves in a closing direction and tends to rotate the associated rocker arm 36 in a counter-clockwise direction, as shown in FIGURE 1.

At its end opposite from the actuating portion, each rocker arm includes a pair of downwardly facing spherical push rod receiving portions 52, each having a lubricating opening 54 therethrough. A hollow push rod 56 actuated by a camshaft (not shown) engages, for a purpose to be later disclosed, the receiving portion 52 of each rocker arm which is adjacent its inner side as it is mounted on the associated support. Each push rod has a lubricating passage 58 in the end thereof which is adapted to be intermittently aligned with the opening 54 in the associated receiving portion of its respective rocker arm. By this means, lubricant may be fed through the hollow push rod and openings 58 and 54 to lubricate the bearing surfaces 46 and 26 of the rocker arms and support arms, respectively.

Actuation of the push rod upwardly, as shown in FIGURE 1, rotates the rocker arm 34 clockwise around an axis extending longitudinally through support arm 24 so as to open the poppet valve 16, while downward movement of the push rod permits spring 50 to move valve 16 in a closing direction rotating the rocker arm in a counterclockwise direction keeping at all times a minimum spring tension on the valve train including the push rod and rocker arm except, possibly, when the valve is completely closed.

In order to retain rocker arms 34 in their proper axial positions on support arms 24, the inner sides 38 of the rocker arms are permitted to engage sides 60 of leg 22, preventing movement of the rocker arms inwardly from their proper positions. Outward movement of the rocker arms on the support arms is prevented by the fact that push rods 56 form an angle α with the plane of rocking motion of the rocker arms 34, as indicated by line 62 of FIGURE 3.

As indicated in FIGURE 4, the upward thrust T of push rod 56 on rocker arm 34 may be resolved into a component F_y acting in the plane of rocking motion 62 and a component F_x acting perpendicular to plane 62 and parallel to the axis around which rocker arm 34 rotates. The component F_x represents the force by which rocker arm 34 is urged inwardly against side 60 of the support leg and is thereby retained in a fixed axial position on its support arm 24. This force F_x represents a fixed percentage of the thrust force T of the push rod against the rocker arm. The percentage depends upon the angle α and it varies in proportion to variations in the force T.

It should be clear that, in order to satisfactorily locate each rocker arm in its proper axial position, there should be a minimum of clearance between the push

rod and rocker arm and the rocker arm and valve since the existance of such clearance will permit the rocker arm to slide axially away from the support leg until the clearance is taken up. As a practical matter, a small amount of clearance may be tolerated as long as the position of the rocker arm is substantially maintained. Use of hydraulic valve lifters or other devices to take up valve train clearance is, of course, desirable since this holds the rocker arm in position at all times.

In the disclosed embodiment, as shown in FIGURE 3, the lower end (not shown) of push rod **56** is located substantially in plane **62** which bisects the space between the push rod receiving portions **52** of the rocker arm. This fact permits rocker arms **34** to be used interchangeably on either arm of the supports, the push rod always being placed in engagement with the inner receiving portion of the rocker arm so that the force F_x will always urge the rocker arm inwardly against its fixed stop. It would, of course, be possible to utilize rocker arms with single push rod receiving means, the only necessity being that the push rod be placed at a suitable angle with the plane of rocking motion so that a side thrust F_x is created urging the rocker arm against suitable fixed stop means.

It is to be understood that the foregoing disclosure refers to only a preferred embodiment of the invention and that it is intended to cover all changes and modifications which do not constitute departures from the spirit and scope of the invention as defined by the following claims.

I claim:

1. Valve gear for an internal combustion engine and comprising

at least one valve actuating rocker arm, each said rocker arm being mounted for rocking movement around a predetermined axis,

stop means preventing sliding movement of each said rocker arm in one direction along its axis,

resilient means yieldingly opposing rocking movement of each said rocker arm in one direction and

a push rod engaging each said rocker arm at a location spaced from its axis and opposing the force of said resilient means to rockingly actuate said rocker arm in said one direction, the direction of force of said push rod upon said rocker arm being disposed at an angle to a plane perpendicular to said axis whereby a component of said push rod force acts in a direction along said axis, said push rod force angle being the sole means to prevent movement of said rocker arm axially away from said stop means.

2. The combination of claim **1** and including support means secured to said engine and having a pair of outwardly extending arms, one of said rocker arms being mounted on each of said arms for rocking movement around predetermined axes.

3. The combination of claim **2** wherein said support arms extend in opposite directions along the same axis, said rocker arms being mounted for rocking movement around said axis, said stop means preventing sliding movement of said rocker arms inwardly on said support arms, the push rods engaging the rocker arms on each support member slanting inwardly at their ends which are in contact with said rocker arms whereby the components of push rod force along said axis urge said rocker arms inwardly against said stop means.

4. The combination of claim **3** wherein said rocker arms each include a pair of axially spaced push rod receiving portions adjacent one end thereof whereby said rocker arms may be interchangeably used on either of said support arms and said push rods engage the inner ones of said receiving portions.

5. The combination of claim **4** wherein said support arms include arcuate bearing surfaces extending along the sides thereof facing said engine, said rocker arms including arcuate bearing surfaces cooperating with said support arm bearing portions to permit rocking movement of said rocker arms on said support arms and lubricating passage means through said push rod receiving portions and adapted to communicate with passage means through said push rods to permit the delivery of lubricant to said bearing surfaces and portions.

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