Sept. 17, 1968 F. M. ROSE 3,401,678

ROCKER ARM GUIDE

Filed Nov. 29, 1966 2 Sheets-Sheet 1

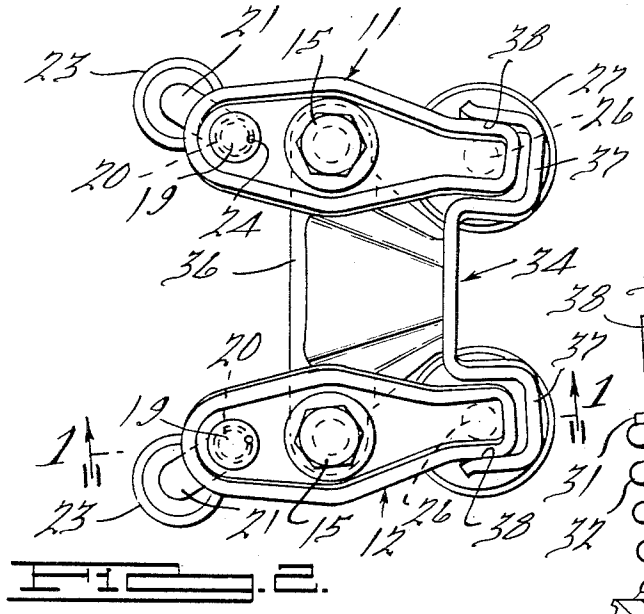

FIG. 2.

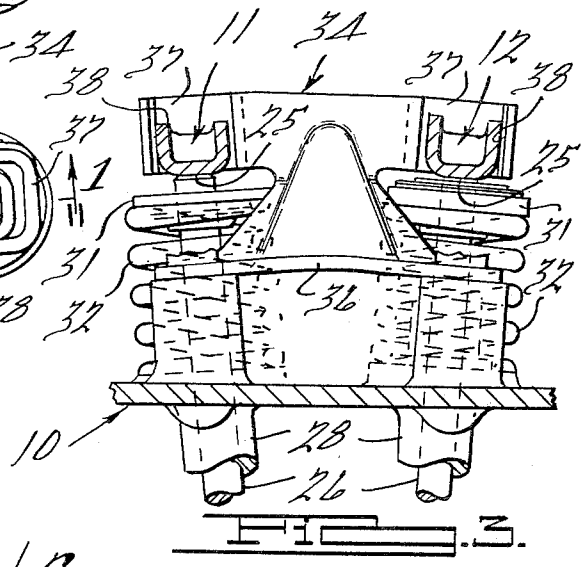

FIG. 3.

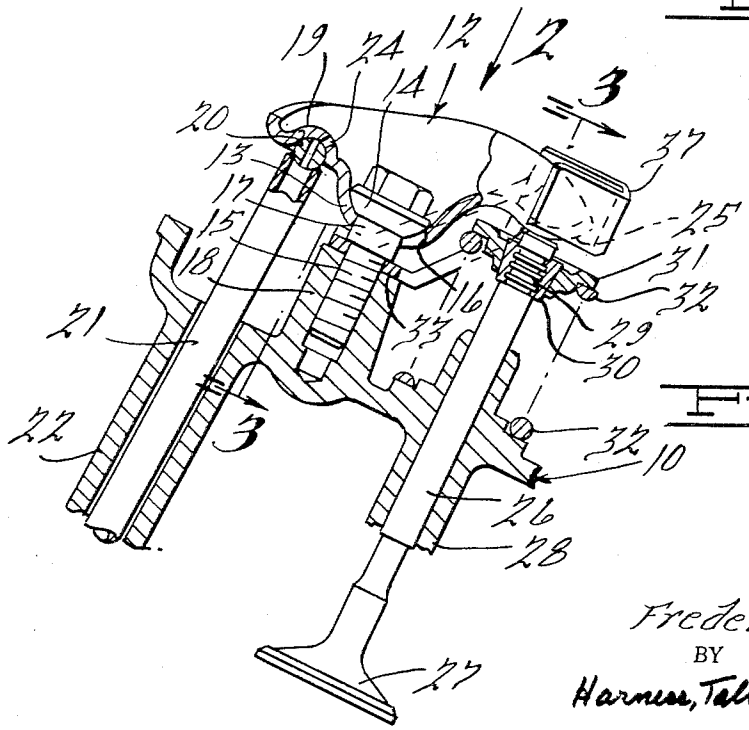

FIG. 1.

INVENTOR.
Frederick M. Rose
BY
Harness, Talburtt & Baldwin
ATTORNEYS.

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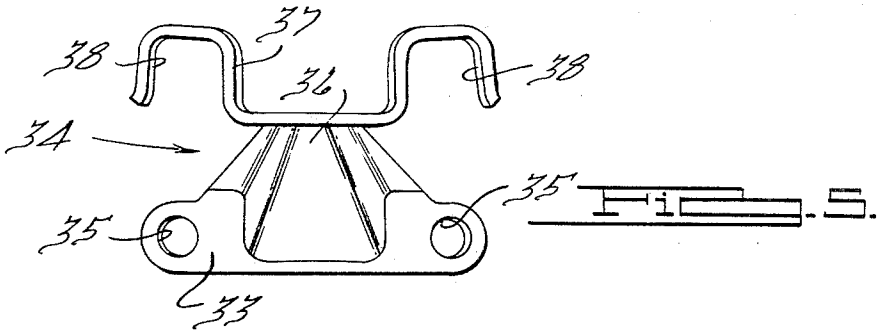

Fig. 5.

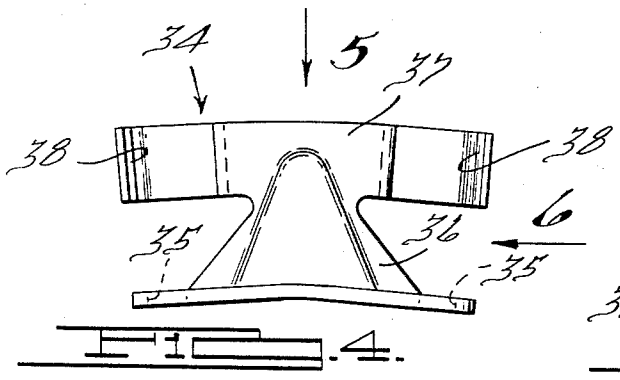

Fig. 4.

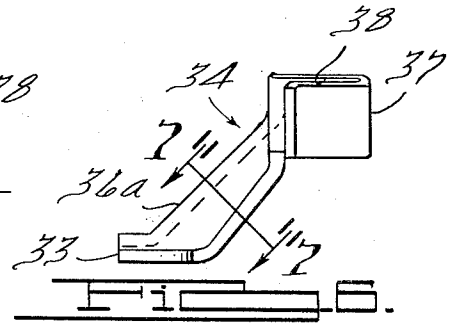

Fig. 6.

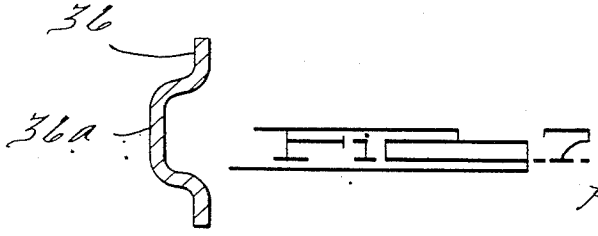

Fig. 7.

INVENTOR.
Frederick M. Rose
BY
Harness, Talbutt & Baldwin
ATTORNEYS.

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ROCKER ARM GUIDE

Frederick M. Rose, Sarasota, Fla., assignor to Chrysler Corporation, Highland Park, Mich., a corporation of Delaware

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ABSTRACT OF THE DISCLOSURE

A rocker arm installation for overhead valve engines wherein dished, stud mounted rocker arms with ball-and-socket type fulcrums are employed. The push rods associated with a pair of the rocker arms angularly engage the rocker arms to exert a force tending to rotate them in opposite directions about their respective mounting stud axes. A rocker arm guide spans the two studs, is secured to the engine head by the studs, and has flanges extending laterally in opposite directions to engage opposite sides of the two rocker arms to prevent such rotation.

This invention relates to valve operating rocker arms for a piston type automotive internal combustion engine and has for an important object the provision of an improved simplified and economically manufactured and installed rocker arm assembly, including the customary push rod actuator for the rocker arm and the latter's pivotal mounting, whereby the rocker arm is supported in predetermined alignment with the stem of the valve to be operated.

In a typical rocker arm installation for an overhead valve engine, a rocker arm is pivotally mounted between its ends on the cylinder head casting to engage at its one end an axially reciprocating push rod and at its opposite end the stem of the valve for reciprocating the latter in timed relationship with respect to the engine operation. Largely because of spatial limitation and the resultant angular relationships between the reciprocating parts involved, considerable difficulty has ben experienced in maintaining the rocker arm in the desired alignment and in providing adequate bearing surface between the rocker arm and its supporting means, such that the desired alignment is not impaired by wearing of the parts and objectionable noise and inefficient engine operation are avoided.

For example, it has long been desirable to provide a stud-mounted rocker arm wherein a stud secured to the cylinder head cooperates with an intermediate base portion of the rocker arm to effect a ball-and-socket type articulated rocker arm mounting. The push rod and valve stem engage opposite ends of the rocker arm and either the rod or stem interengages the associated end of the rocker arm to prevent its rotation about the axis of the stud to a position out of engagement with either the rod or stem. Such structures have not been entirely satisfactory, largely because of the cost of providing suitable bearing means to withstand the resulting side or transverse loading on the rod or stem, resulting again in part from the spatial or dimensional requirements of the assembly, and also because of the costly design limitations that such structures impose on the rocker arm as well as on the rod and stem.

It is accordingly another object to provide a stud mounted rocker arm assembly of the above character including a particularly inexpensive and readily assembled stamped rocker arm guide of unitary construction rigidly secured to the cylinder head by the same stud employed to mount the rocker arm. The guide comprises a base flange adapted to seat on the cylinder head and apertured for passage of the securing stud, a rigidified body extending angularly from the base flange and outwardly toward an end of the rocker arm, and a guide flange engaging a side of the rocker arm in antifriction relationship to prevent its rotation while readily enabling its pivotal reciprocation.

Another and more specific object is to provide such an assembly wherein the two rocker arms associated with the exhaust and inlet valves of a single cylinder of the engine are actuated by a pair of independently operative push rods angularly engaging the rocker arms respectively so as to exert a force tending to rotate the rocker arms in opposite directions about the axes of their respective mounting studs. The base flange of the rocker arm guide spans the two mounting studs and is secured to the cylinder head by both studs, thereby to provide a simple inexpensive nonrotatable guide. The guide flange extends laterally in opposite directions from the body of the guide and engages correspondingly opposite sides of the two rocker arms to prevent their rotation in said opposite directions.

By virtue of the foregoing structure, neither the push rod nor the valve stem is employed as the rocker arm restraint. Accordingly the push rod may be economically formed from tubuluar stock without a costly bearing surface, although the valve stem is preferably mounted slidably in a bushing in any event. By avoiding use of the valve stem as a rocker arm restraint, wear between the valve stem and its bushing is minimized, so that a shorter and more economical valve stem and also a more compact engine construction are achieved, leakage of oil and exhaust gases is minimized, and a sloppy mounting for the valve stem after a minimum operating life is avoided. Accordingly, proper valve seating and the minimizing of valve noise are accomplished throughout a comparatively long operating life for the engine. Also the angular arrangement of the push rods with respect to the rocker arms, tending to rotate the same as aforesaid, maintains the rocker arms snugly against the guide flange, thereby to prevent lost motion and rattling noises and to assure proper alignment of the rocker arms with respect to their valve stems at all times.

Other objects are to provide such as assembly wherein the two push rods for a pair of inlet and exhaust valves converge toward the associated ends of the rocker arms from the tappets which operate the push rods, thereby to exert forces on the push rod engaging ends of the rocker arms tending to rotate the same toward each other and to rotate the opposite valve stem engaging ends away from each other, and wherein the guide flange of the rocker arm guide provides a pair of restraints engaging the most laterad sides of the valve stem engaging ends of the rocker arm respectively to prevent rotation of the latter out of alignment with the valve stems.

By virtue of the foregoing, a rocker arm guide of minimum size is feasible with consequent reduction in material and cost. In the usual preferred construction, the valve

stem engaging end of the rocker arm extends farther from the pivotal stud mounting than does the push rod engaging end, so as to provide adequate valve operation with minimum tappet and push rod movement. Thus the engagement between the guide restraints and the valve stem engaging ends of the rocker arms confine the latter ends more closely than would be the case of the case if the guide restraints engaged the push rod engaging ends. In the latter case, slightly unavoidable movements of the push rod engaging ends would result in magnified movement of the valve stem engaging ends and consequent excessive wearing between the rocker arm and valve stems. In accordance with the preferred construction described and shown herein, such wear is minimized and proper valve operation is assured throughout a long engine life.

Also in consequence of the preferred structure, adequate space between the tappets at the push rod ends remote from the rocker arms is provided for the connecting rod bearings and engine cylinder. In the latter regard, the push rods are seated at their opposite ends against their associated tappet and rocker arm to allow freedom of push rod movement transversely of its axis during its axial reciprocation, as required by pivoting of the rocker arm.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

FIGURE 1 is a vertical mid-sectional view through a rocker arm and mounting embodying the present invention, taken in the direction of the arrows substantially along the line 1—1 of FIGURE 2.

FIGURE 2 is an elevational view taken in the direction of the arrow 2 of FIGURE 1, showing a pair of rocker arms for the inlet and exhaust valves.

FIGURE 3 is a sectional view taken in the direction of the arrows substantially along the broken line 3—3 of FIGURE 1.

FIGURE 4 is a view similar to FIGURE 3, but showing only the rocker arm guide removed from the assembly.

FIGURE 5 is an elevational view of FIGURE 4 taken in the direction of the arrow 5.

FIGURE 6 is an elevational view of FIGURE 4 taken in the direction of the arrow 6.

FIGURE 7 is a sectional view taken in the direction of the arrows 7—7 of FIGURE 6.

It is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

Referring to the drawings, a particular embodiment of the present invention is illustrated by way of example with a customary overhead valve type internal combustion automotive engine of conventional construction, a fragmentary portion of the cylinder head casting 10 being shown. A pair of rocker arms 11 and 12 arranged side by side, FIGURE 2, are associated with the inlet and exhaust valves respectively for one of the engine cylinders. In the present instance the two rocker arms 11, 12 and parts associated therewith as described herein are substantially mirror images of each other and operate similarly. Accordingly the comparable parts associated with the exhaust and inlet valves are both numbered the same.

Each of the rocker arms may be of conventional construction and includes a central upwardly opening spherical socket portion 13 within which is seated the ball head 14 of a stud 15, which extends through an oversize aperture 16 in the base of the socket 13 for passage of an enlarged neck or spacer 17 of the stud 15. The latter is screwed tightly into an internally threaded boss 18 of the casting 10 to pivotally secure the rocker arm to the cylinder head 10 for universal rocking or pivotal movement by virtue of the ball and socket articulation.

One end of each rocker arm is provided with a downwardly opening socket 19 engaged with the spherical ball end 20 of a tubular push rod 21. The latter extends freely through the bore of an oil return portion 22 of the casting 10 and engages a tappet 23 at its lower end by means of a ball and socket articulation similar to that illustrated at its upper end. The ball end 20 of the push rod 21 is provided with a diametrically extending oil passage which receives lubricating oil pumped upwardly through the tube 21 and discharges the oil into the socket 13 via an oil port 24 in the rocker arm. In this regard, the socket 19 is slightly out of round to provide an oil passage clearance between the oil ports in the ball 20 and socket 19 and also to provide lubrication for the ball and socket articulation 19, 20.

Oil flowing into the socket 13 via port 24 lubricates the ball and socket connection 13, 14 and overflows the opposite or valve stem engaging end of the rocker arm to lubricate its rounded underside 25 in bearing contact with the upper end of a valve stem 26 of an integral valve 27 comprising either the conventional inlet or exhaust valve for the engine cylinder. The stem 26 comprises a smooth bearing shaft portion which extends in bearing and guided relationship through the bore of a valve guide portion 28 of the casting 10. The upper end of the stem 26 is serrated at 29 for interlocking engagement with a complimentary pair of diametrically opposed dogs 30 having conically tapered outer surfaces mating with a similarly tapered inner opening of an annular spring retainer 31. This latter structure is maintained in assembled relationship by means of a valve closing spring 32 seated coaxially around the stem 26 under compression between the retainer 31 and a portion of the casting 10 at the upper end of the valve guide 28.

The spring 32 urges the valve stem engaging end 25 of the rocker arm upwardly and normally maintains the valve 27 in its closed position. Similarly the push rod 21 is maintained in contact with the push rod engaging end 19 of the rocker arm with a reacting force opposing the spring 32 to cooperate with the latter in urging the rocker arm upwardly to the upper portion of the neck 17 into engagement with the spherical mounting portion 14 of the stud 15, thereby to maintain the pivotal ball and socket relationship. The structure described thus far may be conventional.

A base flange 33 of a unitary guide 34 comprising a one-piece sheet metal stamping spans the pair of bosses 18 and is provided with a pair of apertures 35 for passage of the studs 15. The flange 33 spaces each of the enlarged necks 17 from the associated boss 18 in the manner of a washer and is secured in place by the studs 15. From the flange 33, the guide 34 extends angularly upwardly and toward the valve stem engaging portions 25 of the two rocker arms 11 and 12 as an integral body portion 36 reinforced by an integrally formed dart 36*a* and terminates in an integral guide flange 37. The latter extends laterally in opposite direction to provide a pair of U-shaped guides confining the adjacent sides respectively of the rocker arms 11 and 12. The laterad ends of the guide flange 37 comprise restraints 38 in sliding bearing engagement with the corresponding sides of the rocker arms 11 and 12.

As is apparent in FIGURE 2, the push rods 21 converge upwardly towards their ball and socket engagements with their respective rocker arms 11 and 12, and in cooperation with the springs 32 exert continuous forces tending to rotate the rocker arm 11 counterclockwise and the rocker arm 12 clockwise in FIGURE 2 about the axes of their respective studs 15. Accordingly, upon axial reciprocating movement of the push rods 21 in accordance with conventional operation of the engine, the rocker arms 11 and 12 are povital about generally horizontal axes intermediate their ends and transverse to the axes of

the studs **15** respectively so as to impart a corresponding reciprocation to the valves **27**.

By virtue of the push rods **21** extending obliquely with respect to the two principal axes of pivotal movement of the rocker arms **11** and **12**, one side only of the valve stem engaging end of each rocker arm **11** or **12** is urged at all times against the associated restraint **38**, so as to prevent lost motion therebetween and consequent noise. Adequate bearing engagement between the restraints **38** and the adjacent sidewalls of the rocker arms **11** and **12** is thus provided to minimize wear without interfering with the vertical reciprocation. Also the construction shown readily enables the extent of valve opening movement to be changed merely by changing the lift of the conventional tappet operating cam shaft.

Wearing of the sidewalls of the rocker arms **11** and **12** in contact with the restraints **38** does not effect the extent of opening movement of the valves **27**. Also the restraints **38** preferably engage the longer valve stem engaging arms of the rocker arms **11** and **12**, rather than the latter's shorter push rod engaging arms, so that the effect on the angular alignment between the bearing portions **25** and valve stem **26** about the axes of the studs **15** resulting from slight wearing of the rocker arm sidewalls in contact with the restraints **38** is not magnified. Also in accordance with the oblique arrangement of the push rods **21**, adequate space is provided between tappets **23** for the cylinder bore and connecting rod bearings, whereas the upper ends of the rods **21** are comparatively closely spaced to minimize the distance between the studs **15** and the width of the rocker arm guide **34**.

Having thus described my invention, I claim:

1. In a valve operating assembly for an automobile engine:

(a) a valve operating rocker arm,

(b) rocker mounting means for pivotally mounting said rocker arm on a fixed portion of said engine for pivotal movement about

(1) a first axis for operating said valve and about

(2) a second axis transverse to said first axis,

(c) rocker arm actuating means adapted to be operated by said engine for reciprocating said rocker arm about said first axis including

(1) reciprocating means engaging said rocker arm to exert a force thereagainst oblique to both of said axes tending to pivot said rocker arm in one direction about said second axis, and

(d) fixed guide means adapted to be secured to a fixed portion of said engine for slidably engaging said rocker arm to oppose pivoting thereof in said one direction about said second axis.

2. In the combination according to claim **1**, said actuating means including means urging said rocker arm in said one direction about said second axis into sliding engagement with said guide means at all times throughout the reciprocation of said rocker arm.

3. In the combination according to claim **1**, said mounting means including stud means for securing both said rocker arm and guide means to said fixed portion of said engine at the same location.

4. In the combination according to claim **1**, said rocker arm having a driven end and a valve operating end, said pivot axes being between said ends, said reciprocating means engaging said driven end to exert said force thereagainst, and said valve operating end having means adapted to be operably coupled with said valve for operating the same upon reciprocation of said rocker arm about said first axis, and said guide means having a restraining portion slidably engaging said rocker arm adjacent said valve operating end to block said pivoting in said one direction about said second axis.

5. In combination with an automobile engine:

(a) a valve operating rocker arm pivotal about

(1) a first pivot axis for operating a valve of said engine and pivotal about

(2) a second pivot axis transverse to said first axis,

(b) an engine operated rocker arm actuating means for reciprocating said rocker arm about said first axis including

(1) a push rod reciprocable in opposite directions oblique to both of said axes and engaging said rocker arm to urge pivoting thereof in one direction about said second axis,

(c) a fixed guide slidably engaging said rocker arm to oppose said pivoting in said one direction about said second axis, and

(d) mounting means for securing said guide and rocker arm to said fixed portion, said mounting means comprising:

(1) a stud extending coaxially with said second axis through aligned apertures in said guide and rocker arm and into said fixed portion of said engine, and also comprising

(2) portions cooperable with said rocker arm to enable pivoting thereof about both of said axes.

6. In the combination according to claim **5**, said push rod engaging said rocker arm at one end thereof, the opposite end of said rocker arm having means operably coupled with a valve of said engine for operating said valve upon reciprocation of said rocker arm about said first axis, said guide having a restraining portion slidably engaging said racker arm adjacent said opposite end to block said pivoting in said one direction about said second axis.

7. In the combination according to claim **6**, said push rod extending in its oblique direction of reciprocation into engagement with said one end of said rocker arm, and means continuously urging said rocker arm pivotally about said first axis into engagement with said push rod to effect a continuous reaction force directed in said oblique direction tending to urge pivoting of said rocker arm in said one direction about said second axis to maintain said rocker arm continuously in contact with said restraining portion throughout the reciprocating movement of said rocker arm.

8. In the combination according to claim **5**, said engine having an inlet valve and an exhaust valve, said rocker arm being associated with one of said valves to operate the same, a second rocker arm and actuating means therefor similar to the first-named rocker arm and actuating means and associated with the other of said valves to operate the same, said two rocker arms extending generally in side-by-side arrangement, said guide comprising a unitary structure having a base spanning the distance between said rocker arms and having a portion extending from said base to a pair of restraining portions slidably engaging said two rocker arms respectively to prevent the pivoting of the engaged rocker arm in its respective one direction about its respective second axis, said base having the aperture therein through which said stud passes into said fixed portion of said engine, and said mounting means also securing said second rocker arm to said fixed portion and including a second stud associated with the second rocker arm and extending coaxially with the latter's second pivot axis through aligned apertures in said base and second rocker arm and into said fixed portion of said engine similarly to the first-named stud, said base being secured by said two studs to said fixed portion at the two locations of said studs.

9. In the combination according to claim **8**, the two push rods of the two actuating means converging in the directions of their extension toward their engagements with their respective rocker arms.

10. In the combination according to claim **9**, the two push rods engaging their respective rocker arms at the same side of a line joining said two studs, each of the rocker arms having means at the opposite side of said line operably coupled with its associated valve for op-

erating the latter, and the two restraining portions slidably engaging their respective rocker arms at said opposite side of said line.

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AL LAWRENCE SMITH, *Primary Examiner.*