

March 4, 1969

J. J. ANSTETH

3,430,612

ROCKER ARM STUD GIRDLE

Filed Dec. 26, 1967

Sheet 1 of 3

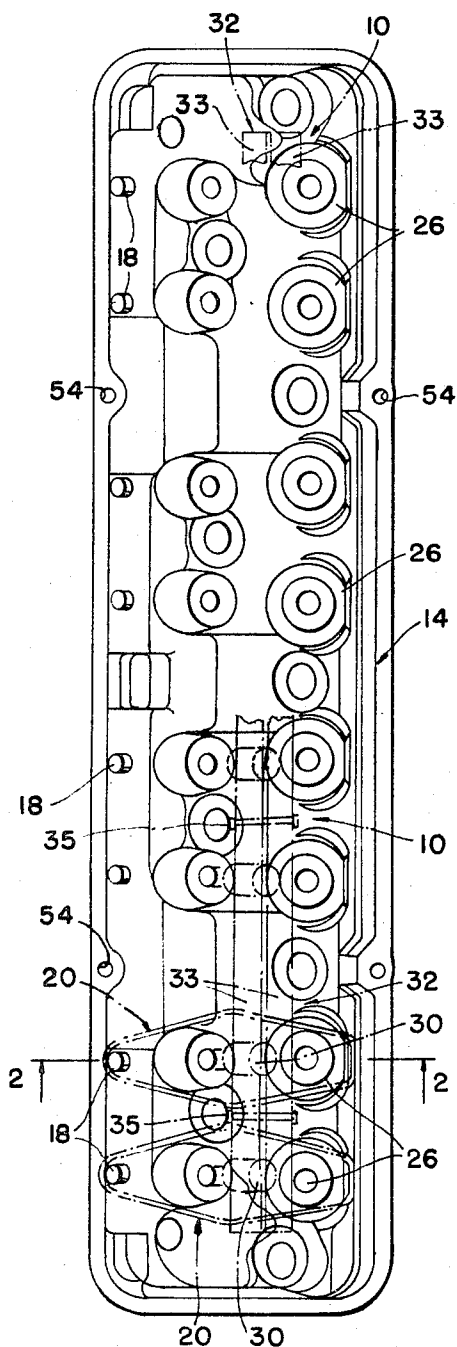


FIG. 1

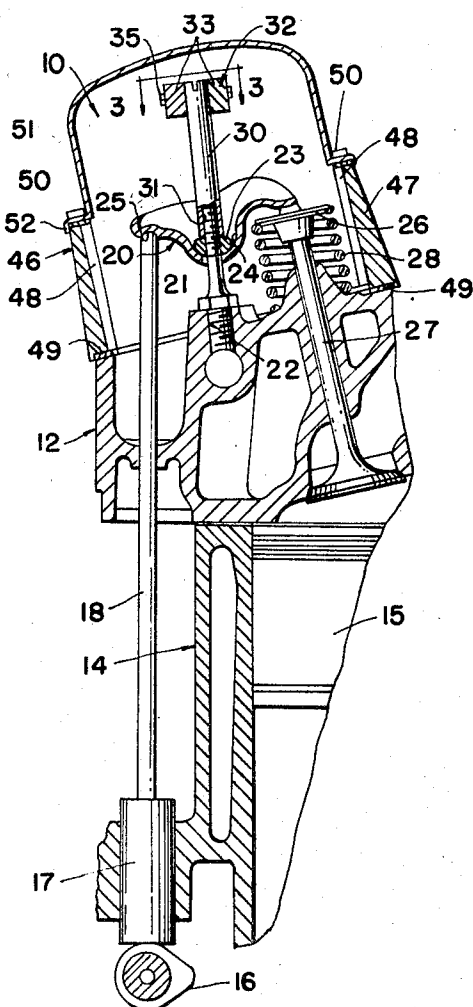


FIG. 2

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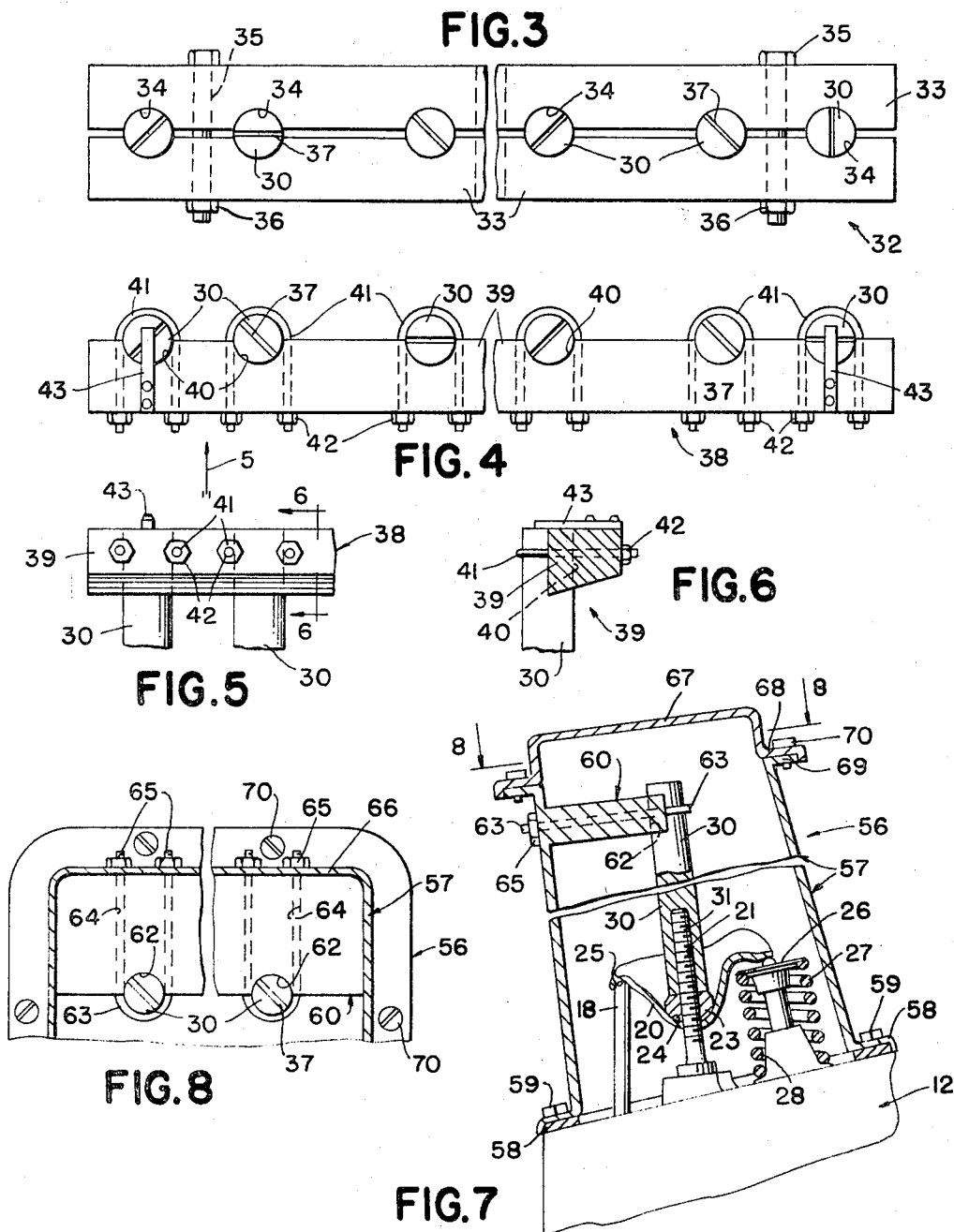
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Sheet 2 of 3



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Sheet 3 of 3

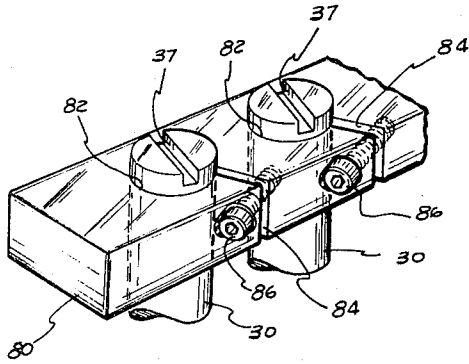


FIG. 9

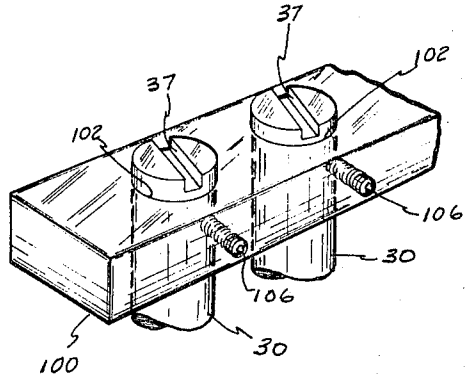


FIG. 11

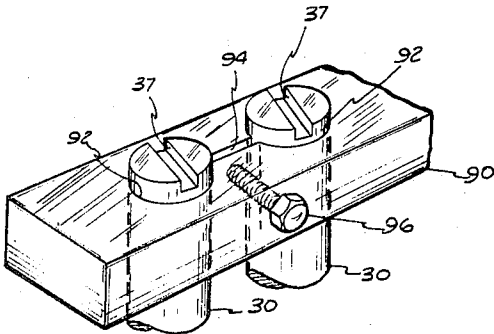


FIG. 10

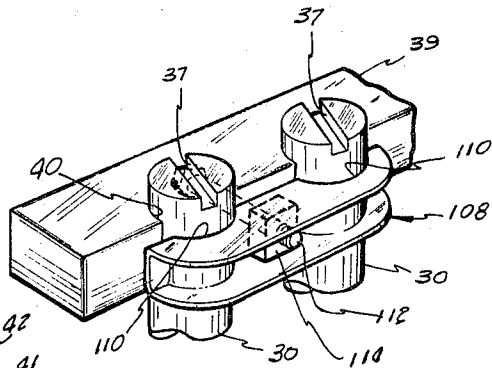


FIG. 12

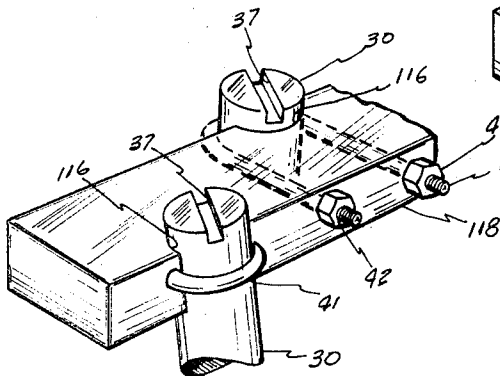


FIG. 13

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1

3,430,612

ROCKER ARM STUD GIRDLE

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Continuation-in-part of application Ser. No. 578,876,
Sept. 12, 1966. This application Dec. 26, 1967, Ser. No.
701,516

U.S. Cl. 123-90

26 Claims

Int. Cl. F011 3/24; F02b 75/20

ABSTRACT OF THE DISCLOSURE

An elongated girdle bar and a plurality of stud support
nuts are structurally assembled with the rocker arm studs
of an internal combustion engine to eliminate deflection
and vibrations in the engine valve operating components.

CROSS REFERENCE TO RELATED APPLICATIONS

This is a continuation-in-part of my patent application
Ser. No. 578,876, filed Sept. 12, 1966, and now
abandoned.

BACKGROUND OF THE INVENTION

I. Field of the invention

This invention relates to improvements in the type of
engine having pushrod operated valve rocker arms pivot-
ally carried by upstanding studs mounted on the cyl-
inder head, and more particularly to a unique rocker
arm stud girdle assembly which structurally ties together
the valve rocker arm studs of an internal combustion en-
gine, in order to eliminate causes of inefficient operation of
the engine valve operating components which are normally
produced by stud deflection and high frequency vibra-
tions, particularly in engines operating at high speeds or
over extended periods of full load at the r.p.m. of maxi-
mum torque producing valve stud stresses. Use of the
present invention eliminates the tendency of the valve studs
to pull out from the cylinder head and the stripping of the
stud threads under high pressure.

The devices herein disclosed will find application most
effectively in racing engines, marine and heavy vehicle
engines, and any high performance engines. In addition to
restraining studs against rotational and angular deflec-
tion, the present device is effective for maintaining per-
manent valve adjustment, being applicable to all engines
using solid valve lifters and to some engines using hy-
draulic valve lifters.

II. Description of the prior art

Examples of engine valve train systems having rocker
arm supporting studs with which the present invention is
intended to be structurally integrated are such as may
be seen in U.S. Patents Re. 24,035, 1,877,051, 2,811,959,
and 2,902,014. The studs of this type are generally press-
fitted or threaded into the cylinder head, and extend
through the central slots of hemispherical seats provided
medially in the rocker arms, and through hemispherical
bearings which ride on the seats and are retained by stud
nuts.

In use, as a rocker arm opens and closes the valve,
the stud on which the arm is mounted tends to flex back
and forth between the valve stem and the operating
pushrod. This deflection is generally in the plane in
which lie the valve stem and the pushrod, and usually but
not necessarily laterally with respect to the engine crank-
shaft centerline. Additional longitudinal deflection of
the stud will also occur since the pushrod is never pre-
cisely parallel to the plane in which the rocker arm stud
and valve stem lie. This deflection exists even in a static

2

condition. As a result of the above described rocker arm
stud deflections, it will be apparent that valve lift and
effective valve opening duration will be reduced.

When the engine is running, and especially at the high
r.p.m. of a racing engine, the dynamic forces involved in
valve train operation drastically increases the flexing of
the stud, resulting in erratic operation due to variations in
rocker arm ratio, valve timing and valve lash, and to loss
of valve lift and effective valve-open duration, all acting
to limit or reduce engine power output.

Stud deflection at the tip may be as great as 1/4-inch,
and this motion is transmitted through the rocker arm
to the tip of the valve stem causing severe side loading
thereof with consequent premature wear-out of the valve
guide.

In most engines, the pushrod is confined in a broached
slot in the cylinder head and its end fits into a socket pro-
vided at one end of the rocker arm, thereby locating the
rocker arm in respect to rotation about the centerline of
the rocker arm stud. When the stud flexes, it forces the
pushrod to cock in its guide and bind, causing guide and
pushrod wear and frequently bending of the pushrod,
with loss of rotational positioning of the rocker arm and
causing the valve to cease opening fully, resulting in a
condition under which the engine cannot be properly
operated and accentuating further the problems heretofore
described.

Some devices have been proposed to prevent the rocker
arm from rotating about its stud, such as those shown in
U.S. Patent No. 3,198,183 and British patent specification
No. 866,872, but these do not attack the root problem
of rocker arm stud deflection.

Constant flexing of the rocker arm stud tends to loosen
its press-fit with the cylinder head and to pull out due
to the pressures exerted by the valve spring. Corrective
measures such as driving in a new oversize stud, pinning
the stud to the cylinder head boss, or replacing it with a
screw-in type, must be taken when the studs pull out.

Another factor accentuating loss of engine performance
is the inherent resonant frequency of the valve operating
train, which at high speed produces harmonic vibrations
tending to loosen the stud and increase deflection, pro-
duce wear and at times even weld together frictionally
contacting components, and to back off the lock nut re-
taining the rocker arm and its hemispherical bearing
on the stud, necessitating frequent valve adjustments,
repair and incidental maintenance.

To my knowledge, nothing heretofore has been pro-
posed as an effective cure for the above problems.

SUMMARY OF THE INVENTION

It is a general object of the invention to correct the
aforesaid problems by providing a very simple and com-
pact unit to structurally interconnect and intersupport the
rocker arm studs, thereby restraining the studs against
deflection and dampening out the harmonic resonant
vibrations. Since in certain embodiments of the invention
the active restraining components of the unit are mounted
on the cylinder head only through the agency of the rocker
arm studs themselves, such unit may be considered free-
standing. In another form, however, the structure is in-
corporated with an adapter cover or housing having in-
tegral, built-in stud restraining means, which cover or
housing is bolted directly to the cylinder head in place
of the usual rocker arm housing.

More specifically, the invention comprises a compact,
inexpensively fabricated and readily installed girdle struc-
ture which includes an elongated girdle bar, either free-
standing or formed as an integral part of a die-cast
adapter housing, which bar is located above and in longi-
tudinal alignment with the usual line of spaced rocker
arm studs. A plurality of elongated adjustable stud sup-

3

port nuts are rigidly carried by the girdle bar and depend therefrom, each such stud support nut serving as a stud extension, being rigidly secured with maximum thread engagement on the upper threaded end of the rocker arm stud, and directly above and in downwardly abutting engagement with the usual hemispherically surfaced fulcrum bearing carried on the stud. The stud support nut thus acts as a lock against the top of the hemispherical bearing.

The additional length occasioned by the stud support nuts is accommodated, and the girdle structure is surrounded, in the free-standing version, by a rocker arm cover riser of a simplified construction, which is bolted directly to the top of the cylinder head. The usual rocker arm housing or cover is bolted down onto the top of the riser to complete the installation.

A further object of the invention in providing such a free-standing type of stud girdle structure, is to strongly discipline the studs by structurally tying them together as a unit, so that they interact mutually in supporting each other, thus nullifying vibratory and flexing effects which have heretofore posed problems of erratic valve train operation, breakage of studs, stripping of stud threads, pulling out of pressed-in studs, valve guide wear, pushrod bending, and the like. The disciplinary action is exerted positively, in the non-free-standing embodiment, by a one-piece adapter housing bolted directly to the cylinder head; and the two different versions of the girdle structure are optionally available for the conversion of racing engines of different types or manufacture.

Further in accordance with the invention, it is contemplated that the cover riser or the girdle bar housing, both of which constitute adapters to accommodate the increased height of the combined studs and support nuts, shall be of a standardized design for the respective cylinder heads to which they are applied. That is, they are standardized to the extent that the riser and the housing may be attached to the cylinder head (and the existing cylinder head cover may be attached to the riser) by the standard bolt, screw or stud receiving provisions of the cylinder head.

In addition, as the result of applying the improved girdle assembly to the cylinder head of a racing engine, the rocker arms thereof are held reliably in adjustment relative to the pushrods and valves, and the studs are protected over the normal useful life of the engine. Efforts have been made in the past to solve these problems by such approaches as enlarging the diameter of the studs, using jam nuts, roll pins and the like, altering rocker arm ratios and lubrication, substituting metals, etc., but such efforts have not been fully successful and the alterations have involved substantial extra expense with little gain.

DESCRIPTION OF THE DRAWINGS

A clear understanding of the invention may be had by reference to the accompanying drawings illustrating preferred embodiments of the invention in which like reference characters refer to like parts throughout the several views and in which:

FIGURE 1 is a top plan view indicating the manner of application of a free-standing embodiment of the girdle structure to the cylinder head of a typical 8-cylinder engine, with the cylinder head cover removed and omitting the adapter riser of the structure in the interest of clarity, and indicating the relationship of the girdle bar and the support nuts to the stud-mounted rocker arms, pushrods and valves of the engine;

FIGURE 2 is a view in transverse vertical cross section taken substantially on the line 2—2 of FIGURE 1, illustrating the assembly of the girdle structure in relation to the engine and its existing stud-fulcrumed rocker arm and valve by the usual engine cam, tappet and pushrod components;

FIGURE 3 is a fragmentary top plan view, partially broken away, as seen from the line 3—3 of FIGURE 2,

4

illustrating a girdle bar device used in the free-floating or free-standing embodiment of the invention disclosed in FIGURES 1 and 2, as structurally interconnecting the stud support nuts of the assembly.

FIGURE 4 is a top plan view, partially broken away, illustrating another free-standing embodiment of the girdle, as applied to the stud support nuts;

FIGURE 5 is a fragmentary side elevational view as seen substantially from the line 5—5 of FIGURE 4;

FIGURE 6 is a fragmentary view in transverse vertical section taken substantially on the line 6—6 of FIGURE 5;

FIGURE 7 is a fragmentary view in transverse vertical section generally corresponding to FIGURE 2, but on a somewhat enlarged scale, and showing another embodiment of the girdle bar structure, in which the bar component is cast integrally with the rocker arm housing member;

FIGURE 8 is a fragmentary view partially broken away in horizontal cross section taken substantially on the line 8—8 of FIGURE 7;

FIGURES 9, 10, 11 and 12 are fragmentary perspective views illustrating various means for securing stud support nuts to the girdle bar structure; and

FIGURE 13 is a fragmentary perspective view of a girdle bar structure arranged to structurally unite stud support nuts in engines having non-parallel studs.

Referring to FIGURES 1 and 2, a preferred free-standing rocker arm girdle assembly of the invention, as generally designated by the reference numeral 10, as illustrated as applied to one of the cylinder heads 12 of a typical V-8 racing engine. The cylinder head is mounted in the usual manner on the engine cylinder block 14. FIGURE 2 shows a piston 15 in a cylinder of the block 14, a cam 16 operating a tappet 17 slidably guided in the block 14 and actuating, through a pushrod 18 similarly guided in the cylinder head 12, a typical stamped rocker arm 20. The rocker arm 20 is of conventional construction, as is the upright hocker arm stud 21 on which the rocker arm 20 is fulcrumed. The lower end of the stud 21 is threaded as at 22 into a top boss of the cylinder head 12, with the usual fulcruming centrally-bored hemispherical bearing 23 carried on the stud and slidably engaging a complementary hemispherical seat 24 of the rocker arm 20.

A concave seat 25 on one end of the rocker arm 20 is operatively engaged by the upper end of the pushrod 18, and the opposite end of the rocker arm 20 engages the top of a pressure disc 26 carried on the upper end of the stem of the valve 27 in conventional fashion, with a compression valve spring 28 disposed between the disc 26 and the top of the cylinder head 12 to oppose the clockwise action of the rocker arm 20.

Now considering FIGURE 3 in conjunction with FIGURE 2, the free-standing rocker arm stud girdle assembly 10 of the invention is shown as comprising a plurality of vertically elongated, cylindrical stud support nuts 30, one for each stud 21. The lower end of each stud support nut 30 is drilled and internally threaded as at 31 to be adjustably screwed onto the upper threaded end of the rocker arm stud 21, and to downwardly abut the flat top of the hemispherical bearing 23, which is retained by the stud support nut 30 to ride in the rocker arm hemispherical seat 24. In this way the elongated stud support nut 30 acts as an adapter rigidly coupling the rocker arm stud with the remaining active components of the stud girdle assembly 10. It also further stabilizes the bearing 23 from above.

The elongated stud support nut 30, as thus secured to the stud 21, is clamped at its top in an elongated rigid girdle bar member 32, structural features of which are illustrated in FIGURE 3. The girdle bar member 32 comprises a pair of parallel, elongated bar elements 33 of a length somewhat in excess (as indicated in FIGURE 1) of the length of the series of spaced rocker arms 20 which

span the respective sets of pushrods 18 and valve stem pressure discs 26.

The bar elements 33 are of substantially rectangular cross section, facing one another in side by side and transversely closely spaced relation; and each bar is provided along the facing side thereof with pairs of concave seats 34 of slightly less than semi-cylindrical formation. The pairs of seats 34 have uniform and somewhat greater longitudinal spacing relative to one another, as appears in FIGURE 3, so that each seat 34, when the girdle bar member 32 is mounted on the stud support nuts 30, is in transverse alignment between a transversely aligned pushrod 18 and valve pressure disc 26 of the engine (FIGURE 1).

Clamping bolts 35 extend through aligned bores in the bar elements 33 located between each pair of seats 34, with nuts 36 secured to the bolt ends, so that the respective stud support nuts 30 may be securely and rigidly clamped to the girdle bar member 32. The upper end of each stud support nut 30 is provided with a kerf 37 to receive a screw driver for the purpose of making valve adjustments.

FIGURES 4, 5 and 6 illustrate another preferred girdle bar assembly 38 embodying the invention, and comprising a single elongated, rigid bar 39 of approximately rectangular section, and in a length equal to that of the bar member 32 of FIGURES 1-3. The bar 39 has on a side face thereof equally spaced pairs of equally spaced semi-cylindrical concave seats 40, in which the upper ends of the support nuts 30 are carried as shown.

The bar 39 is provided, directly adjacent the sides of each seat 40, with through holes to receive the arms of a U-bolt 41, and nuts 42 threaded on the end of each arm enable the U-bolt 41 to be drawn up tightly against the stud support nut 30 to lock it tightly in the seat 40 and provide substantially 360° structural engagement therewith.

In order to assist in properly locating the girdle bar assembly 38 vertically relative to the several stud support nuts 30, once same have been installed on the rocker arm studs 21, a gauge finger 43 may be secured to the top of the bar 39 to extend outwardly over each of the end-most seats 40. Thus, with the U-bolts 41 loose the bar 39 may be lowered onto the stud support nuts 30 until the fingers 43 rest thereon, whereupon the nuts 42 are tightened to secure the bar 39 rigidly to the stud support nuts 30.

When the rocker arm stud girdle assembly 10 is installed, the additional height above the rocker arms 20 is accommodated by the installation of an enclosing rocker arm cover riser structure 46 as seen in FIGURE 2, between the cylinder head 12 and the existing rocker arm cover 51.

The riser structure 46 is preferably in the form of an aluminum casting of substantially rectangular outline, including integral side and end walls 47 which are locally thickened by a plurality of internal boss formations 48. With an appropriate sealing gasket 49 interposed, the riser 46 is tightly secured to the top of cylinder head 12 by elongated screws or bolts 50; and these bolts also clamp the rocker arm cover 51 to the top of the riser walls 47, with another sealing gasket 52 interposed. Bolt holes through the bosses are located to align with the tapped holes 54 (FIGURE 1) in the cylinder head 12, and with the bolt holes of the rocker arm cover 51.

Not only does the riser 46 accommodate the girdle-increased height of the rocker arm studs, but the standardized design of the riser also enables an installation of the girdle assembly 10, including the stud support nuts and riser, to be made on rocker arm studs 21 and cylinder head 12 with extreme speed and ease, and with no structural modifications of either studs or head.

FIGURES 7 and 8 of the drawings illustrate a built-in embodiment of the girdle assembly of the invention, which has advantages over the free-standing form in certain applications. It, too, is of simple construction, and

positively anchors the stud support nuts 30, and the studs 21 to which they are secured, in a manner to eliminate the undesired high frequency vibratory and flexing action thereof at high engine speed. Inasmuch as the pushrods 18, rocker arms 20, studs 21, hemispherical bearings 23, and valve components appearing in FIGURE 7 are substantially the same as those shown in FIGURE 2, they are designated by corresponding reference numerals.

This unitary version of the rocker arm stud girdle assembly, generally designated by the reference numeral 56, substitutes structurally and functionally for the free-standing girdle bars 32 and 38 and the riser 46 of FIGURES 1-6. The present embodiment comprises a die cast aluminum adapter housing 57 of elongated rectangular outline and of sufficient height to accommodate the added length of the stud support nuts 30.

The housing 57 is laterally outwardly flanged at 58 about its bottom periphery, the flange 58 conforming in outline, and as to the pattern of its bolt holes, with the top of the cylinder head 12, so that bolts 59 of a size which previously mounted the rocker arm cover to the head may be employed to mount the housing 57.

The housing 57 is provided, at a suitable elevation, with an inwardly projecting girdle bar 60, in the form of an integral flange of substantial thickness. This flange extends, as indicated in FIGURE 8, the entire length of the housing 57 and is provided along its inner edge with a plurality of semi-cylindrical seats 62, similar to the seats 40 of the girdle bar 39 shown in FIGURE 4. The seats 62 are vertically aligned with and engage the stud support nuts 30. Elongated U-bolts 63 extend through holes 64 provided in the girdle bar 60 on both sides of the respective seats 62, and nuts 65 are secured to the U-bolts 63 outwardly of a side wall 66 of the housing 57.

The housing 57 is closed at its top by a cover 67, which is flanged at 68 to mate over a top flange 69 of the housing 57, being secured thereon by bolts or screws 70. A gasket may be interposed between the flanges if desired.

The girdle assembly 56 is readily mounted on the cylinder head 12 and presents a rigid anchor through the girdle bar 60 for the stud support nuts 30, through the agency of which the rocker arm studs 21 are disciplined in the fashion described heretofore in reference to the free-standing embodiments of the invention.

FIGURES 9-12 illustrate various other means by which the stud support nuts of the present invention may be secured to the girdle bar structure so they may be readily installed and adjusted.

In FIGURE 9, a girdle bar 80 is provided with parallel, spaced bores 82 of a diameter to closely fit the upper ends of the stud support nuts 30. Slots 84 are provided to intersect the bores 82, and set screws 86 are arranged to extend transversely across the slots 84 whereby on tightening the set screws 86 the support nuts 30 will be securely clamped against displacement or rotation with substantially 360° engagement of the support nuts 30 by the girdle bar.

In FIGURE 10, a pair of stud support nuts 30 is illustrated as carried in spaced bores 92 of a girdle bar 90. A slot 94 extends between and intersects the bores 92 as shown, with a screw 96 extending through the girdle bar 90 transversely across the slot 94, whereby on tightening the screw 96 the two stud support nuts 30 will be securely clamped against displacement or rotation.

In FIGURE 11, the stud support nuts 30 are shown as carried in bores 102 of a girdle bar 100 and held against displacement or rotation by individual set screws 106 extending through the girdle bar 100 to intersect the bores 106.

FIGURE 12 illustrates the girdle bar 39 like that of FIGURE 4 having pairs of spaced semi-cylindrical recesses 40 on one side for seating the upper ends of pairs of stud support nuts 30. Each pair is retained in place by means of a clamp member 108 provided with semi-cylindrical seats 110 spaced equally to match the

spacing of the recess seats 40 in the girdle bar 39. The clamp member 108 is secured to the girdle bar 39 by means of a bolt 112 extending through the girdle bar, and nut 114 retained against rotation within the clamp member 108, whereby on tightening the bolt 112 the pair of stud support nuts 30 are clamped against displacement or rotation with substantially 360° engagement of the stud support nuts 30 by the girdle bar 39 and clamp member 108.

FIGURE 13 illustrates a modification in which the pair of stud support nuts 30, respectively connected with studs (not shown) extending upwardly on non-parallel axes, are positioned with the upper ends of the stud support nuts 30 being seated in semi-cylindrical recesses 116 provided on opposite sides of a girdle bar 118, spaced and sloped to the precise spacing and slope of the upper portions of the stud support nuts 30 as shown. The stud support nuts 30 are retained against displacement and rotation by means of U-bolts 41 and nuts 42 like those shown in the FIGURE 4 modification.

Installations of the assemblies shown in the various embodiments of the invention are substantially the same, and are accomplished as follows:

First, the rocker arm cover of the engine to be modified with the present device is removed to expose the valve operating mechanisms, and the existing conventional rocker arm stud lock nuts are removed from the rocker arm studs 21.

Next the elongated stud support nuts 30 are screwed onto the studs 21 so that the support nut lower surfaces bear on the upper flat surfaces of the hemispherical bearings 23.

Following this, the girdle bar, its locking elements loosely installed, whether they be the U-bolts, clamps, set screws, or other devices, is emplaced on the upper ends of the stud support nuts, and the locking elements secured tightly to retain the stud nuts in place against displacement or rotation.

Next the rocker arm cover riser, if used (embodiments of FIGURES 1-6 and 9-13), is installed in place.

Then individual locking elements of the girdle bar assembly are loosened to enable the separate stud support nuts 30 to be adjusted one at a time by use of the proper tool in the kerf 37, to obtain accurate valve lash, and the locking elements are individually tightened again to lock the stud support nuts in place.

Finally, the rocker arm cover is replaced.

In the embodiment of FIGURES 7 and 8 the girdle bar is an integral part of the riser 57 and a special cover 67 replaces the conventional cover 51 which in the other modifications will be reused.

Installation of the assembly shown in FIGURE 13 will be slightly different, with only one-half of the stud support nuts 30, i.e. those on one side of the girdle bar, being installed on their studs initially, the girdle bar 118 being installed on these stud support nuts 30, after which the other stud support nuts on the other side of the girdle bar 118 are installed. In this modification, since the two sets of stud support nuts 30 are angularly inclined with respect to each other, the girdle bar assembly is automatically positioned to a selected height, whereas the girdle bar assemblies of the other modification must be clamped in place at a height on the stud support nuts which will be close to the rocker arms yet will not interfere with their normal operation.

It will be seen that in all the forms of the present invention, the rocker arm stud girdle assembly will rigidly structurally interconnect all of the rocker arm studs to eliminate stud deflection and to dampen harmonic vibrations in the valve train. The primary beneficial results in respect to engine operation include increased valve lift and duration, elimination of erratic valve train operation, elimination of pulled rocker arm studs, and reduction of valve guide wear and pushrod bending. In addition,

other beneficial results are achieved, such as the following:

The rocker arm stud girdle assembly keeps the valves adjusted indefinitely. The bottom of each support nut 30 has a large flat area which is from 50% to 100% greater than the bottom area of the conventional adjustment nut secured to the rocker arm stud 21. The present support nuts are preferably carbo-nitride hardened "lead steel," and are substantially impervious to wear. Since there are no sharp, protruding edges abutting the top of the hemispherical bearing 23, wear at this area is eliminated. Also, since the support nut is clamped into either an almost fully cylindrical seat or a semi-cylindrical seat in the girdle bar assembly, and has substantially a 360° circumferential restriction when clamped in place, it cannot turn. In fact, tests with the modifications shown in FIGURES 4-8, it was discovered that with a clamping force of only about five to seven foot pounds torque on the U-bolts of the girdle bar assembly, 150 foot pounds of torque applied to the head of the support nut did not turn it in its girdle assembly. It is expected that similar results will be found in the other modifications.

Further, the valve lash will be retained practically indefinitely since the support nut is effectively impervious to wear, cannot turn in its restrictive girdle assembly, provides maximum contact area against the rocker arm hemispherical bearing for minimum wear thereto, and while clamped into the girdle assembly prevents the rocker arm stud from pulling out. It has been found that the wear in the valve train between the cam, tappets, pushrods, rocker arms and the tips of the valve stem is negligible and usually matched by wear to the valve seats.

Another benefit of the present bar assembly is that since it is usually positioned over the pushrod ends of the rocker arms, it will deflect oil flow from the pushrods down onto the rocker arm hemispherical bearings, providing added lubrication at this most critical point. Also the support nuts act as a drip path for oil droplets which form when the engine is in a high r.p.m. condition.

Although I have shown and described several embodiments of my invention, it will be apparent to one skilled in the art to which the invention pertains that various changes and modifications may be made therein without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. A girdle bar assembly for the studs of an engine cylinder head about which the rocker arms fulcrum, comprising an elongated girdle bar spanning the longitudinally aligned engine studs, a plurality of support members secured to the engine studs, said support members being co-axial with and extending above the engine studs and means for rigidly securing the girdle bar to the portion of the support members extending above the engine studs, whereby the girdle bar assembly rigidly yokes the engine studs for mutual restraint of one another through the agency of said assembly.

2. A girdle bar assembly for studs of an engine cylinder head which are pivotally engaged by rocker arms with fulcrum elements carried on the studs, said assembly comprising an elongated girdle bar, and a plurality of elongated stud support members, one for each rocker arm stud, having means to fixedly connect the members individually and directly to the studs and in abutment with the respective fulcrum elements, said girdle bar being a unitary, free-floating member having means to fixedly connect the same directly to the respective stud support members at points spaced from said fulcrum elements, whereby the girdle bar assembly rigidly yokes the studs for mutual restraint of one another through the agency of said assembly.

3. The girdle bar assembly of claim 1, in which said girdle bar is of a rigid elongated character, comprising a pair of bars paralleling one another, at least one of which has a series of longitudinally spaced concave seats

facing the other bar and in which the respective stud support members are disposed, and means to draw said bars toward one another to clamp said stud support members tightly in the respective seats.

4. The girdle bar assembly of claim 2, in which said girdle bar is of a rigid elongated character, comprising a pair of bars paralleling one another, each bar having a series of longitudinally spaced concave seats facing the other bar and in which the respective stud support members are disposed, and means to draw said bars toward one another to clamp said stud support members tightly in the respective seats.

5. The girdle bar assembly of claim 1, in which said girdle bar is of a rigid elongated character, comprising a bar having longitudinally spaced U-shaped clamp devices in fixed relation thereto, said clamp devices drawing said stud support members tightly against the bar.

6. The girdle bar assembly of claim 2, in which said girdle bar is of a rigid elongated character, comprising a bar having a series of longitudinally spaced concave seats on a side thereof, said bar having longitudinally spaced, U-shaped clamp devices in fixed relation thereto and in transverse register with the respective seats, said clamp devices drawing said stud support members tightly into said seats.

7. The girdle bar assembly of claim 1, and further comprising an adapter riser having means to fixedly mount the same on said cylinder head in surrounding relation to the girdle bar and stud support members.

8. The girdle bar assembly of claim 2, and further comprising an adapter riser having means to fixedly mount the same on said cylinder head in surrounding relation to the girdle bar and stud support members, said riser accommodating the length of said stud support members.

9. The girdle bar assembly of claim 7, in which said adapter riser has means at opposite sides thereof to coact with standard cover mounting provisions of the cylinder head, as well as to standard mounting provisions of a mating cylinder head cover, in covering the assembly as mounted to the cylinder head.

10. The girdle bar assembly of claim 8, in which said adapter riser has means at opposite sides thereof to coact with standard cover mounting provisions of the cylinder head, as well as to standard mounting provisions of a mating cylinder head cover, in covering the assembly as mounted to the cylinder head.

11. The girdle bar assembly of claim 1, in which said girdle bar is a rigid bar member having means passing transversely therethrough to clamp said stud support members to the girdle bar.

12. The girdle bar assembly of claim 1, in which said girdle bar is in the form of an upright-walled housing having an integral bar member internally thereof at which said stud support members are rigidly secured to the housing.

13. The girdle bar assembly of claim 1, in which said girdle bar is in the form of an upright-walled housing having an integral bar member internally thereof at which said stud support members are rigidly secured to the housing, said housing having means to secure the same directly to said cylinder head.

14. The girdle bar assembly of claim 1, in which said girdle bar is in the form of an upright-walled housing having an integral bar member internally thereof at which said stud support members are rigidly secured to the housing, said bar member having seats receiving the stud support members, and means to clamp same in said seats.

15. The girdle bar assembly of claim 1, in which said girdle bar is in the form of an upright-walled housing having an integral bar member internally thereof at which said stud support members are rigidly secured to the housing, said housing having means to secure the same directly to said cylinder head, said bar member having seats receiving the stud support members, and means to clamp same in said seats.

16. In an internal combustion engine having a valve operating system of the type including rocker arms pivotally carried on threaded studs secured to the engine cylinder head, a girdle bar assembly comprising means removably secured and structurally supportably interconnecting said studs to eliminate deflection thereof and dampen harmonic vibrations of the valve operating system, said girdle bar assembly means comprises a plurality of elongated stud support nuts adjustably rigidly secured to said studs, an elongated girdle bar member extending between and engaged with said stud support nuts, and means selectively rigidly securing said girdle bar to said support nuts.

17. The assembly as defined in claim 16 and in which (a) each said stud support nut comprises an elongated cylindrical element having an internally threaded recess at one end for adjustably securing same to said stud, and (b) said girdle bar member has a plurality of circular spaced recesses aligned with and engageable with at least a portion of the cylindrical surface of the other ends of said stud support nuts.

18. The assembly as defined in claim 16 wherein the valve operating system includes flat-topped hemispherical bearings carried on said studs and engaging hemispherical seats in said rocker arms, and in which said means comprises a plurality of elongated stud support nuts each adjustably rigidly secured to a stud and provided with a smooth flat surface engaging substantially the entire flat top of said bearing.

19. The assembly as defined in claim 16 and in which (a) each said stud support nut comprises an elongated element having an internally threaded recess at one end for adjustably securing same to said stud, (b) said girdle bar member comprises a pair of parallel-arranged bar elements having facing sides provided with facing recesses complementary to and adapted to substantially peripherally engage the other ends of said stud support nuts, and (c) said securing means comprises bolts extending transversely through said bar elements and nuts on said bolts for selective clamping of said stud support nuts between said bar elements.

20. The assembly as defined in claim 16 and in which (a) each said stud support nut comprises an elongated element having an internally threaded recess at one end for adjustably securing same to said stud, (b) said girdle bar member has side recesses complementary to and adapted to substantially semi-peripherally engage one side of the other end of each stud support nut, and (c) said securing means comprises U-bolts having ends extending transversely through said girdle bar member and a medial portion complementary to and adapted to semi-peripherally engage the other side of each stud support nut whereby to effect substantially full peripheral clamping engagement of said stud support nuts.

21. The assembly as defined in claim 20 and in which said girdle bar member side recesses are disposed on opposite sides of said member and are aligned respectively with paired stud support nuts extending in angular divergence from angularly positioned studs.

22. The assembly as defined in claim 16 and in which (a) each said stud support nut comprises an elongated element having an internally threaded recess at one end for adjustably securing same to said stud, (b) said girdle bar member has side recesses complementary to and adapted to substantially semi-peripherally engage one side of the other end of each stud support nut, and (c) said securing means comprises a clamp member for each pair of stud support nuts, each clamp member having a pair of spaced side recesses complementary to and adapted to semi-peripherally engage the other

11

sides of a pair of stud support nuts, and a bolt extending transversely through said girdle bar member and through said clamp member intermediate its recesses, whereby to effect substantially full peripheral clamping engagement of each pair of said stud support nuts.

23. The assembly as defined in claim 16 and in which
- (a) each said stud support nut comprises an elongated element having an internally threaded recess at one end for adjustably securing same to said stud,
 - (b) said girdle bar member has a plurality of spaced bores axially aligned with and substantially peripherally engaged with the other ends of said stud support nuts, and
 - (c) said securing means comprises slots in said girdle bar member intersecting said bores, and set screw elements extending across said slots whereby to selectively urge said slots to close and thereby clamp said stud support nuts in said bores.

24. The assembly as defined in claim 23 and in which said slots extend outwardly from said bores to a side of said girdle bar member.

25. The assembly as defined in claim 23 and in which said slots extend between pairs of bores.

12

26. The assembly as defined in claim 16 and in which
- (a) each said stud support nut comprises an elongated element having an internally threaded recess at one end for adjustably securing same to said stud,
 - (b) said girdle bar member has a plurality of spaced bores axially aligned with and substantially peripherally engaged with the other ends of said stud support nuts, and
 - (c) said securing means comprises set screws extending laterally into said girdle bar member to intersect said bores.

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