FORM PTO-1619A
Expires 06/30/99
OMB 0651-0027

RECEIVE
JAN 30 2002

02-14-2002
101983300

RECORDATION FORM COVER SHEET
PATENTS ONLY

TO: The Commissioner of Patents and Trademarks: Please record the attached original document(s) or copy(ies).

Submission Type

1-30-02

[X] New

[ ] Resubmission (Non-Recordation)
Document ID# [ ]

[ ] Correction of PTO Error
Reel # [ ] Frame # [ ]

[ ] Corrective Document
Reel # [ ] Frame # [ ]

Conveyance Type

[X] Assignment [ ] Security Agreement

[ ] License [ ] Change of Name

[ ] Merger [ ] Other [ ]

U.S. Government
(For Use ONLY by U.S. Government Agencies)
[ ] Departmental File [ ] Secret File

Conveying Party(ies)

[ ] Mark if additional names of conveying parties attached

Name (line 1): Martin R. Zielke — Execution Date Month Day Year: 3/1/01

Name (line 2):

Second Party
Name (line 1): — Execution Date Month Day Year:

Name (line 2):

Receiving Party

[ ] Mark if additional names of receiving parties attached

Name (line 1): International Truck and Engine Corporation

[ ] If document to be recorded is an assignment and the receiving party is not domiciled in the United States, an appointment of a domestic representative is attached. *(Designation must be a separate document from Assignment.)*

Name (line 2):

Address (line 1): 4201 Winfield Rd.

Address (line 2):

Address (line 3): Warrenville (City) | IL/USA (State/Country) | 60555 (Zip Code)

Domestic Representative Name and Address

Enter for the first Receiving Party only.

Name:

Address (line 1):

Address (line 2):

Address (line 3):

Address (line 4):

02/13/2002 [illegible]
01 FC:581 [illegible]

FOR OFFICE USE ONLY

Mail documents to be recorded with required cover sheet(s) information to:
Commissioner of Patents and Trademarks, Box Assignments , Washington, D.C. 20231

Correspondent Name and Address

Area Code and Telephone Number: 630/753-2311

Name: Dennis Kelly Sullivan

Address (line 1): International Truck and Engine Corporation

Address (line 2): 4201 Winfield Rd.

Address (line 3):

Address (line 4): Warrenville, IL 60555

Pages

Enter the total number of pages of the attached conveyance document including any attachments. # 40

Application Number(s) or Patent Number(s)

☐ Mark if additional numbers attached

Enter either the Patent Application Number or the Patent Number (DO NOT ENTER BOTH numbers for the same property).

Patent Application Number(s)			Patent Number(s)		
09/768,520					

If this document is being filed together with a new Patent Application, enter the date the patent application was signed by the first named executing inventor. Month Day Year: 1/24/01

Patent Cooperation Treaty (PCT)

Enter PCT application number only if a U.S. Application Number has not been assigned.

PCT ____ PCT ____ PCT ____

PCT ____ PCT ____ PCT ____

Number of Properties

Enter the total number of properties involved. # 1

Fee Amount

Fee Amount for Properties Listed (37 CFR 3.41): $ 40

Method of Payment: Enclosed ☐ Deposit Account ☒

Deposit Account

(Enter for payment by deposit account or if additional fees can be charged to the account.)

Deposit Account Number: # 14-0603

Authorization to charge additional fees: Yes ☒ No ☐

Statement and Signature

To the best of my knowledge and belief, the foregoing information is true and correct and any attached copy is a true copy of the original document. Charges to deposit account are authorized, as indicated herein.

Cathi Majewski — Name of Person Signing

Signature

1/11/02 — Date

ASSIGNMENT

AS, Martin R. Zielke, 14203 King Road, Lockport Illinois 60441;

after referred to as ASSIGNOR) has invented certain new and useful improvements in ;NATIONAL Docket No. D-4990 entitled:

Rocker Carrier

which he is about to make application for Letters Patent in the United States, said application having a claration and Power of Attorney executed by ASSIGNOR on the _____ day of _____, 2001,

r is identified subsequent to filing in the United States Patent and Trademark Office as Serial No. 09/768,520 filed 1/24/01 ınd

WHEREAS, INTERNATIONAL TRUCK AND ENGINE CORPORATION, a corporation existing under the laws of the State of Delaware, (hereinafter referred to as INTERNATIONAL) having its principal place of business at 455 North Cityfront Plaza Drive, Chicago, Illinois 60611, is desirous of acquiring the entire right, title and interest in and to the aforesaid invention or inventions, and any Letters Patent granted hereon by the United States of America and any foreign country;

NOW THEREFORE, in consideration of the sum of One Dollar and other valuable consideration received by ASSIGNOR from INTERNATIONAL, the receipt of which is hereby acknowledged by ASSIGNOR, ASSIGNOR does hereby sell, assign, and transfer to INTERNATIONAL said invention or inventions, said application, divisional applications thereof, continuation applications thereof and any and all Letters Patent of the United States and any foreign country which may be granted therefor, and any reissue or reissues, or extension or extensions thereof, together with the right to file applications in, and to acquire Letters Patent in, all countries foreign to the United States in the name of INTERNATIONAL or as it may direct, and to claim for such foreign applications and Letters Patent the priority date of filing of the said International or United States application under the provisions of the Patent Cooperation Treaty, the International Convention for the Protection of Industrial Property or the European Patent Convention in the countries in which it applies.

ASSIGNOR hereby authorizes and requests the Commissioner of Patents and Trademarks to issue any and all Letters Patent of the United States on said invention or inventions or resulting from said application, or any division or divisions or continuations thereof to INTERNATIONAL as assignee of the entire interest.

ASSIGNOR hereby authorizes INTERNATIONAL to insert the dates of execution of said application.

ASSIGNOR does hereby covenant that he has full right to convey the entire interest herein assigned, and that he has not executed and will not execute any agreement in conflict herewith.

ASSIGNOR further covenants that he will, at any time, upon request, execute and deliver any and all papers that may be necessary or desirable to perfect the title to said invention or inventions, or any Letters Patent that may be granted therefor in any country in INTERNATIONAL, and that if INTERNATIONAL desires to secure a division, reissue, reexamination, or renewal of any such Letters Patent, that a disclaimer relating thereto should be filed, or make application for a corresponding patent in any foreign country, that he will, upon request, sign all papers, make all rightful oaths, and does all lawful acts requisite for the application for such

reexamination, or extension and the procuring thereof, or for the filing of such disclaimer or application without further compensation, but at the expense of INTERNATIONAL.

ASSIGNOR does further covenant and agrees that he will, at any time, upon request, communicate to INTERNATIONAL any facts relating to said invention or inventions and Letters Patent, or the history thereof and testify as to the same in interferences or other litigation when requested so to do.

This assignment shall inure to the benefit of INTERNATIONAL, its successors, assigns and other legal representatives and shall be binding upon ASSIGNOR, his heirs and legal representatives.

IN WITNESS WHEREOF, he has executed this instrument.

Martin R. Zielke this 1 day of MARCH, 2001
Martin R. Zielke

State of Illinois)
)ss:
County of)

On this day of , 2001, before me personally came Martin R. Zielke to me personally known, and known to me to be the individual described in and who executed the foregoing assignment, and acknowledged to me that he executed the same of his own free will and for the purposes therein set forth.

Notary Public

UR.-Nr. 212 /2001 V

I hereby certify, that the documents overleaf were signed in my presence by Mr. Martin Roger Zielke, born on 14th May 1955, business address 52072 Aachen, Suesterfeldstrasse 200, identified by passport of the United States of America.

Aachen, 1st of March 2001

Dr. Heimsoeth, administrator for the public notary Hans-Wilhelm Zinken

APOSTILLE

(Convention de La Haye du 5 octobre 1961)

1. Bundesrepublik Deutschland

2. Öffentliche Urkunde

3. unterschrieben von Dr. Heimsoeth

4. in seiner Eigenschaft als Notariatsverwalter anstelle des Notars Zinken in Aachen

sie ist versehen mit dem Stempel/Siegel des ~~xxxx~~ Notars

Bestätigt

5. in Aachen 6. am 7. März 01

7. durch den Präsidenten des Landgerichts in Aachen

8. unter Nr. 91a E - 2.263 - 2.264

9. Stempel/Siegel: DER PRÄSIDENT DES LANDGERICHTS * AACHEN *

10. Unterschrift:
In Vertretung:

(Zerbes)

ROCKER CARRIER

[0001] This patent application claims the benefit of Provisional U.S. Patent application Serial No. 60/178.161 filed on January 26, 2000.

FIELD OF THE INVENTION

[0002] This invention relates generally to cylinder heads in internal combustion engines. More particularly, this invention relates to cylinder heads having carriers for a rocker arm assembly in a diesel engine.

BACKGROUND OF THE INVENTION

[0003] Internal combustion engines have intake and exhaust valves for air to enter and exhaust to leave each cylinder. The valves connect to rocker arms, which rotate on a pivot ball to open and close the valves. Typically. there is a separate rocker arm for each valve. Push rods operate the rocker arms and extend through the engine cylinder head to connect to a camshaft, via tappets. As the camshaft rotates, the push rods actuate the rocker arms to open and close the valves. The camshaft is designed to open and close the valves in conjunction with the cycling of the piston in the cylinder.

[0004] In the prior art, a pedestal is required as an upper support for the pivot ball on the rocker arm. The pedestal is bolted to the cylinder head to complete the assembly. This design requires significant bosses in the head and a substantial pedestal to support the valve train loads. The bosses and pedestals add weight to the engine. In addition, the rocker arms and related components are assembled along with the rest of the engine. This increases the assembly time of the engine.

[0005] Accordingly, there is a need for a rocker carrier with sufficient structural support to reduce engine weight and a modular design to reduce assembly time of the engine.

SUMMARY OF THE INVENTION

[0006] The present invention provides a rocker carrier with a modular design that adapted for use with a cylinder head in an internal combustion engine. The rocker carrier comprises a body portion having a continuous peripheral wall including a front and rear wall connected between a first and second end wall, a plurality of rocker arm pedestals integrally formed on the body portion and disposed between the rear and front walls, a top surface able to cooperatively engage a valve cover, and a bottom surface able to cooperatively engage a cylinder head. The rocker arm pedestals of the rocker carrier are further made up of dual rocker arm pedestals and/or an end rocker pedestals.

[0007] The rocker carrier of the present invention can also comprise a plurality of support fins, a high pressure oil line passage integrally formed adjacent to the rear wall, a plurality of high pressure oil reservoir bosses integrally formed on the body portion and disposed between the rocker arm pedestals and the front wall, a plurality of exterior head bolt passages, a plurality of carrier bolt bosses, a plurality of glow plug passages, a plurality of electrical connector passages, and an oil drain passage, and a plurality of valve cover bolt bosses formed adjacent to the rear wall.

[0008] The rocker carrier is preferably connected to the cylinder head. A valve cover secures to the top of the rocker carrier thus enclosing the cylinder head. One of the functions of the rocker carrier is to mount the rocker arm assemblies containing the rocker arms and related parts. The rocker arm carrier also mounts a high pressure oil rail that provides high

pressure oil to thereby actuate fuel injectors. In addition, it provides a place to pass electrical wires from the engine harness to the fuel injector and glow plug under the valve cover.

[0009] The rocker carrier of the present invention reduces the bosses, pedestals, and other structural support components used for a rocker arm assembly which results in weight savings. In addition to the weight savings, the modular design permits pre-assembly of the rocker carrier thereby reducing the assembly time of the engine in the assembly plant. The rocker carrier also has funnel shaped guides in a bottom or underside surface of the rocker carrier for aligning the push rods. The rocker carrier will also allow for increased bolt stretch to produce an acceptable cylinder head to crank shaft joint.

[0010] The following drawings and description set forth additional advantages and benefits of the invention. More advantages and benefits are obvious from the description and may be learned by practice of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The present invention may be better understood when read in connection with the accompanying drawings, of which:

[0012] Figure 1 shows a perspective view of an embodiment of a rocker carrier according to the present invention;

[0013] Figure 2 shows a top view of the embodiment of the rocker carrier shown in Figure 1;

[0014] Figure 3 shows a front view of the rocker carrier shown in Figure 2;

[0015] Figure 4 shows a rear view of the rocker carrier shown in Figure 2;

[0016] Figure 5 shows a bottom view of the rocker carrier shown in Figure 2;

[0017] Figure 6 shows a cross-sectional view along a section line B-B of the rocker carrier shown in Figure 2;

[0018] Figure 7 shows a cross-sectional view along a section line A-A of the rocker carrier shown in Figure 2;

[0019] Figure 8 shows a cross-sectional view along a section line D-D of the rocker carrier shown in Figure 2;

[0020] Figure 9 shows a cross-sectional view along a section line E-E of the rocker carrier shown in Figure 2;

[0021] Figure 10 shows a cross-sectional view along a section line C-C of the rocker carrier shown in Figure 2;

[0022] Figure 11 shows a top view of a second embodiment of the rocker carrier according to the present invention;

[0023] Figure 12 shows a top perspective view of the second embodiment of the rocker carrier shown in Figure 11 with rocker arm assemblies mounted thereon; and

[0024] Figure 13 shows a top perspective view of the first embodiment of the rocker carrier shown in Figure 2 with a high pressure oil reservoir mounted thereon.

DESCRIPTION OF THE INVENTION

[0025] Figures 1 and 2 show a perspective and a top view of a first embodiment of a rocker carrier 100 according to the present invention. The rocker carrier 100 is preferably adapted for mounting on top of a cylinder head (shown in Figure 13) in an internal combustion engine comprising, e.g., a gasoline or diesel engine. The embodiment depicted in Figures 1 and 2 is preferably mounted on the cylinder head of a six-cylinder engine with V-type configuration.

Those of skill in the art will readily recognize that the rocker carrier 100 can be easily modified to cooperatively mount on an eight cylinder V-type engine (as shown in Figure 11). Moreover, the rocker carrier 100 of this embodiment can be interchangeably mounted on either cylinder head bank or side of an engine.

[0026] Figures 1 and 2 shows a rocker carrier body portion 100 that has a relatively thin and continuous peripheral wall that is made up of a front 5 and rear 10 wall connected between first 15 and second 20 opposing peripheral end walls. There is further a bottom support floor 9 that spans to connect the rear wall 10 and the back portions of the first 15 and second 20 opposing peripheral end walls. The bottom support floor 9 can serve to give the rocker carrier 100 added structural strength and as a foundation for other portions of the rocker carrier 100. The rocker carrier 100 is preferably integrally cast as single piece of aluminum material, though other suitable materials may be used instead. The unfinished rocker carrier 100 is then machined or finished as required for a particular engine application.

[0027] The rocker carrier body 100 is preferably integrally cast with a plurality of rocker arm pedestals 30, 35 and 40 disposed between the front 5 and rear 10 rocker carrier walls. The rocker arm pedestals 30, 35, and 40 will be used to mount rocker arm assemblies 1205, 1210, and 1215 (shown in Figure 12) which are used to actuate valve bridges (not shown). The location of the rocker arm pedestals 30, 35 and 49 is important because they locate and position the rocker arm assemblies 1205, 1210 and 1215. Correct location of the rocker arm pedestals 30, 35 and 40 will lead to equally distributed loads on the valve bridges (not shown) which actuate the valves. Uneven loading of the valve bridges can result in uneven loading of the valves and edge loading of the stems which leads to premature wear and reduced life of valve stems.

[0028] The rocker arm pedestals 35, 40, and 45 preferably have two configurations, though more or less configuration may be used. There is dual rocker arm pedestal 30 (of which two are shown in the rocker carrier of Figures 1 and 2) which will cooperatively support a dual fulcrum plate 1212 (shown in Figure 12) of a dual rocker arm assembly 1210. There are also shown single or end rocker arm pedestals 35 and 40 in the rocker carrier 100 which are adjacent to the first 12 and second 20 end walls. The single or end rocker carrier pedestals will preferably support a single or end fulcrum plate 1203 and 1217 (shown in Figure 12) of respective single or end rocker arm assemblies 1205 and 1215 (shown in Figure 12).

[0029] The dual rocker pedestals 30 are preferably configured to have a pair of opposing hold down bolt bosses 31 such that that the dual fulcrum plate 1212 of the dual rocker arm assembly 1210 can be attached to the rocker carrier 100 by a hold down bolt 1237 (shown in Figure 12). The first end rocker pedestal 35 is preferably configured to have a hold down bolt boss 36 opposite the first end wall 15 such that that the first end fulcrum plate 1203 of the first single rocker arm assembly 1205 can be attached to the rocker carrier 100 by a hold down bolt 1236 (shown in Figure 12).. In a similar fashion, the second end rocker pedestal 40 is preferably configured to have a hold down bolt boss 41 opposite the second end wall 20 such that the second end fulcrum plate 1217 of the second single rocker arm assembly 1215 can be attached to the rocker carrier 100 by a hold down bolt 1241 (shown in Figure 12)..

[0030] Moreover, in the preferred embodiment shown in Figures 1 and 2, the rocker arm pedestals 30, 35 and 40 are preferably configured to have interior head bolt passages 37. The interior head bolt passages 37 will further comprise a compression limiter 38 (shown in Figure 2) which will be press fit into the interior head bolt passage 37. The compression limiters 38 are

flush with the rocker arm pedestals 30, 35 and 40. The fulcrum plates, which sit on the rocker arm pedestals 30, 35, and 40 and will be situated as before, will be configured to have a fulcrum passage 1204 (shown in Figure 12) that coincides with the interior head bolt passages 37. The interior head bolt passages 37 will go all the way through the rocker carrier 100 and will coincide with a passage (not shown) in the cylinder head to a hold down bolt boss in the crank case (not shown).

[0031] The interior head bolts passages 37 are important since they allow appropriate long head bolts 1337 (shown in Figure 13), similar to an M-14 bolt, to be inserted into the fulcrum passages 1204 and the interior head bolt passages 37. The long head bolts 1337 will be fastened to the crack case to provide the clamp load on the head gasket (not shown). The head gasket should provide a good joint between the cylinder head and the crank case and is critical between the cylinder head and crank case. The long head bolts 1337 (shown in Figure 13) provide more stretch for gasket settling and other forms of permeate joint compression. The viability of the head gasket joint will be preferably controlled by the clamp load exerted on the head gasket joint through the interior cylinder head bolts 1337 in the interior head bolt passages 37 and exterior head bolt passages 85 (discussed below). Further, compression limiters 38 are preferably steel to prevent the head bolts 1337 from crushing the aluminum rocker carrier 100. In addition, the headbolt 1337 length and counterbore depth in the crankcase is preferably kept the same for all headbolts 1337. This produces a more uniform joint compression and influence on the cylinder bore distortion, thus producing an acceptable head to crankcase joint.

[0032] In an alternate embodiment, the end fulcrum plates 1203 and 1217 and the end rocker arm pedestals 35 and 40, and the dual fulcrum plates 1212 and the dual rocker arm pedestals 35

are integrally cast as part of the rocker carrier 100. This alternate integrated rocker carrier casting 100 would be cast such as to provide appropriate structure for proper valve train stiffness. Further, the alternate rocker carrier would omit the hold down bolts 1236, since the fulcrum plates 1203, 1207, 1212 are now cast as part of rocker arm pedestals 30, 35 and 40.

[0033] Figures 1 and 2 show a plurality of high pressure oil reservoir bosses 45 and 50 where a high pressure reservoir or rail 1305 (shown in Figure 13) will be mounted. Such as high pressure oil rail or reservoir 1305 would be used in an engine that uses hydraulically activated electronically controlled unit injection (HEUI) fuel systems, or hydraulic fuel systems, that requires high-pressure oil to actuate fuel injectors (not shown). In such a system, the HEUI system typically employs high pressure oil, via the high pressure oil reservoirs 1305, to act on an intensifier piston (not shown) in each fuel injector to drive down a fuel plunger and thereby eject fuel into a combustion chamber.

[0034] In this embodiment, the high pressure (HP) oil reservoir bosses 45 and 50 are preferably arranged in two sets 45 and 50. A first set of HP oil reservoir bosses 45 comprises three bosses 45 that are preferably integrally cast adjacent to the dual rocker arm pedestals 30 and to the first end pedestal 35 as part of the rocker carrier 100. The second set of HP oil reservoir bosses 50 are preferably integrally cast adjacent to the front wall 5 on the interior as part of the rocker carrier 100. The high pressure oil reservoir or rail 1305 will be appropriately bolted down on these bosses 45 and 50, as shown in Figure 13.

[0035] Figures 1 and 2 further show a plurality of exterior head bolt passages 85 integrally cast with the front wall 5 of the rocker carrier 100. The exterior head bolt passages 85 will also have a exterior compression limiter 86 which is also press fit into the interior head bolt passage 85

and flush with the top 87 of the head bolt passages 85. The exterior compression limiters 86 are preferably steel to prevent a head bolt (not shown) from crushing the aluminum rocker carrier 100. Again, appropriate head bolts, similar to an M-14 bolts, will be inserted in to the exterior head bolt passages 85 and will be bolted to the crack case to provide the clamp load to the head gasket (not shown). Further, in this embodiment the exterior head bolt passages 85 and the exterior compression limiters 86 are longer than the interior head bolt passages 37 and the interior compression limiters 38. This is due to the positioning of the fulcrum plates 1203, 1212 and 1217 (shown in Figure 12) on top of the interior head bolt passages 37. The fulcrum plates have a thickness of about 10mm, and that is the difference between the interior and exterior head bolt passages 37 and 85 and compression limiters 38 and 85.

[0036] Figures 1 and 2 further show a plurality of glow plug passages 80 cast with the front wall 5 of the rocker carrier 100. The glow plug passages 80 are preferably inclined so that the glow plugs (not shown) when installed will be physically positioned to cooperate with a corresponding combustion chamber (not shown). There are also shown top inclined faces 81 corresponding to the inclined glow plug passages 80.

[0037] Figures 1 and 2 show a plurality of rocker carrier bolt bosses 70 and 75 which will allow the rocker carrier 100 to be bolted down to the top of the cylinder head (shown in Figure 13). In this embodiment, the rocker carrier bolt bosses 70 and 75 are preferably arranged in two sets 70 and 75. A first set of rocker carrier bolt bosses 70 comprise three carrier bosses 45 that are integrally cast adjacent to the rear wall 10 of the rocker carrier 100, preferably to the interior of the rear wall 10. However those of skill in the art will recognize that other placement of the rocker carrier bolt bosses is possible, e.g., to the exterior of the rear wall 10. The second set of

rocker carrier bolt bosses 75 are integrally cast adjacent to the front wall 5 on the exterior of the rocker carrier 100, and adjacent to the glow plug passages 80. The rocker carrier 100 will be appropriately bolted down to the cylinder head via the rocker carrier bolt bosses 70 and 75, as shown in Figure 13.

[0038] Figures 1 and 2 show a plurality of push rod passages 55 and 56 which will allow push rods (not shown) to be inserted therein. The push rod passages 55 and 56 are integrally cast adjacent to the rear wall 10 of the rocker carrier 100, preferably to the interior of the rear wall 10. In this embodiment, the push rod passages 55 are preferably situated in pairs 55 and 56 such that each push rod pair can have one intake and one exhaust push rod (not shown). The intake push rod in the push rod passage pair 55 and 56 will actuate an intake rocker arm 1207 and 1211 (shown in Figure 12) which will in turn actuate intake valves (not shown) via an intake valve bridge (not shown). The exhaust push rod in the push rod passage pair 55 and 56 will actuate a corresponding exhaust rocker arm 1209 and 1219 (shown in Figure 12) which will in turn actuate exhaust valves (not shown) via an exhaust valve bridge (not shown). In the embodiment shown in Figures 1 and 2, there are three pairs of push rod passages 55 and 56 since the embodiment represent a rocker carrier that would be mounted on one cylinder head of a V-6 type engine. Those of skill in the art will readily recognize that the rocker carrier design can be easily expanded when there is a different number of cylinders, e.g., the V-8 configuration shown in Figures 11 and 12.

[0039] Figures 1 and 2 preferably show two high pressure (HP) oil line passages 60 which facilitate routing of an internal HP oil line 1310 (show in Figure 13) to the HP oil reservoir 1305 as would be used in an engine with HEUI type fuel system that requires high pressure

oil to operate fuel injectors (not shown). The high pressure oil line passages 60 are integrally cast adjacent to the rear wall 10 of the rocker carrier 100, and preferably to the interior of the rear wall 10. The two high pressure oil line passages 60 shown allow the rocker carrier 100 to be mounted on either side of an engine. This is the case since the rocker carrier 100 preferably has a symmetrical design such that it can be used both on the left and right bank of an engine with a V-type configuration. The carrier could also be formed with only one high pressure line passage 60, however, it 100 might then be limited to mounting on one side of an engine.

[0040] Figures 1 and 2 also show a plurality of structural support members, fins or ribs 6, 7 and 8 that will give the rocker carrier body 100 and the front and rear walls 5 and 10 added strength and help prevent wall vibration. The structural support members or fins 6, 7 and 8 are integrally cast in various preferred locations in the of the rocker carrier 100. A first set of support fins 8 preferably connect the rear wall 10 and the dual rocker arm pedestals 30. The fist set of support fins 8 is further attached to the rocker carrier bottom support floor 9 for added support. A second set of support fins 6 preferably connect the front wall 5 and the first set of central high pressure oil reservoir bosses 45 and 50 that are adjacent to dual rocker arm pedestals 30. There is also a third set of support fins 7 that are preferably attached to the rear set of carrier bosses 70 and the bottom support floor 9. Those of skill in the art will recognize that more or less support fins can be used with rocker carrier 100.

[0041] Figure 1 further shows a plurality of electrical connector passages 65 and an oil drain passage 67 that are preferably integrally cast with the rear wall 10 of the rocker carrier 100. The electrical connector passages 65 will allow wiring to be routed to and from appropriate locations on a fuel injector. There are shown three electrical connector passages 65 since the rocker carrier

of this embodiment is intended to be used on one side or bank of a V-6 type engine. The number of electrical connector passages 65 will vary according to the type of engine being used and the number of cylinders in the engine. In this embodiment, there is shown an oil drain passage 67 that will preferably accept drain oil from a turbocharger (not shown). Those of skill in the art will recognize that the oil drain passage 67 could be situated elsewhere on the rocker carrier 100 or somewhere other than the rocker carrier 100. Figure 1 further shows a top corner section 21 on the rocker carrier 100 that can be used to support auxiliary engine components (not shown) via tapped passages 22. Finally, Figures 1 and 2 show a plurality of valve cover bosses 27 formed around the periphery of the top surface 25 of the rocker carrier 100. The valve cover bosses 27 will allow for the connection to the rocker carrier 100 to a typical valve cover (not shown).

[0042] Figure 3 shows a front view of the rocker carrier 100 shown in Figures 1 and 2. Figure 3 shows that the top surface 25 of the rocker carrier 100 is preferably inclined. This feature of the rocker carrier 100 allows the rocker carrier to fit well into the limited space available in an engine compartment. There are also shown valve cover bosses 27 along the periphery of the top surface 25. Figure 3 partially shows the electrical connector passages 65 and the oil drain passage in the rear wall 10 of the rocker carrier 100. Last, Figure 3 shows the inclined nature of the top faces 81 of the glow plug passages 80 in the front wall 5 of the rocker carrier 100.

[0043] Figure 4 shows a rear view of the rocker carrier 100 shown in Figures 1 and 2. Figure 4 shows the rear wall 10 of the rocker carrier 100. Figure 4 shows the electrical connector passages 65 and the oil drain passage which are preferably part of the rear wall 10 of the rocker carrier 100 in this embodiment. Also, Figure 4 shows the top corner section 21 of the rocker

carrier 100 that can be used to support auxiliary engine components via tapped passages 22 (shown in Figure 1).

[0044] Figure 5 shows a bottom view of the rocker carrier 100 shown in Figures 1 and 2. Figure 5 is instructive because it shows, in a 2 dimensional view, the respective funnel configuration 550 and 560 of the underside of the push rod passages 55 and 56. The preferred funnel configuration 550 and 560 on the underside of the push rod passages 55 and 56 should make installation of the push rods (not shown) easier. Figure 5 also shows a bottom surface 505 around the periphery of the rocker carrier 100. In a preferred embodiment, the bottom surface 505 is configured to have a sealing grove 510 around the periphery of the rocker carrier 100. The sealing groove 510 will preferably accept a form gasket to assist in sealing the bottom 505 of the rocker carrier 100 to the top of a cylinder head (not shown). Figure 5 also shown a bottom view of the various configurations comprising the rocker carrier previously described in with respect to Figures 1 and 2.

[0045] Figure 6 shows a cross-sectional view along a section line B-B of the rocker carrier shown in Figure 2. Figure 6 shows a cross section of the rocker arm pedestals 30, 35 and 40 and that the respective interior head bolt passage 37 completely traverse the rocker carrier 100. There is also shown that the interior head bolt passages 37 further comprise a compression limiter 38. Figure 6 shows that the compression limiters 38 are flush with the tops 530, 535 and 540 of the rocker arm pedestals 30, 35 and 40. Figure 6 also shows the electrical connector passages 65 and the oil drain passage which are preferably part of the rear wall 10 of the rocker carrier 100 in this embodiment. Also, Figure 6 shows a cross section view of the sealing grove 510 in the bottom surface 505 of the rocker carrier 100. There is also shown a cross section of

the first 15 and second 20 opposing end walls along with valve cover bosses 27 in the top surface 25 of the rocker carrier 100.

[0046] Figure 7 shows a cross-sectional view along a section line A-A of the rocker carrier shown in Figure 2. Figure 7 shows a cross section of the exterior head bolt passages 85 in the front wall 5 of the rocker carrier 100. There is also shown that the exterior head bolt passages 85 further comprise a compression limiter 86. Figure 7 shows that the compression limiters 86 are flush with the tops 686 of the exterior head bolt passages 85. Figure 7 partially shows the electrical connector passages 65 and the oil drain passage that are preferably part of the rear wall 10 of the rocker carrier 100 in this embodiment. Again, Figure 6 shows a cross section view of the sealing grove 510 in the bottom surface 505 of the rocker carrier 100. There is also shown the valve cover bosses 27 in the top surface 25 of the rocker carrier 100.

[0047] Figure 8 shows a cross-sectional view along a section line D-D of the rocker carrier shown in Figure 2. Figure 8 shows that the push rod passage 60 is preferably adjacent to the rear wall 100 and completely traverses the rocker carrier 100 support floor 9. Figure 8 shows a support fin 7 attached to the rear wall 10. There is also shown a support fin 6 between the front wall 5 and a central high pressure oil reservoir boss 45 that is adjacent to a dual rocker arm pedestals 30. Again, Figure 8 shows a cross section view of the sealing grove 510 in the bottom surface 505 of the rocker carrier 100 (also shown in Figures 9 and 10).

[0048] Figure 9 shows a cross-sectional view along a section line E-E of the rocker carrier shown in Figure 2. In particular, Figure 9 shows a cross section of the interior and exterior rocker carrier bolt bosses 70 and 75 which will allow the rocker carrier 100 to be bolted down to the top of the cylinder head (shown in Figure 13). The interior or first set of rocker carrier

bolt bosses 70 are adjacent to the rear wall 10 and completely traverse the rocker carrier 100. The exterior or second set of rocker carrier bolt bosses 75 are adjacent to the front wall 5 on the exterior of the rocker carrier 100 and completely traverse the rocker carrier 100. Figure 9 also shows a cross section of a support fin 7 that preferably attach the interior rocker carrier bolt bosses 70 to the bottom support floor 9.

[0049] Figure 10 shows a cross-sectional view along a section line C-C of the rocker carrier shown in Figure 2. Figure 10 shows a cross section of a dual rocker arm pedestals 30 and its respective interior head bolt passage 37 that traverses the rocker carrier 100. Figure 10 also shows a cross section of an exterior head bolt passages 85 in the front wall 5 of the rocker carrier 100. No compression limiters 38 or 86 are shown in this view for either head bolt passage 37 or 85. There is also shown a support fin 6 between the front wall 5 and a central high pressure oil reservoir boss 45 that is adjacent to a dual rocker arm pedestals 30. Also shown is a support fin 8 connecting the rear wall 10 and the dual rocker arm pedestals 30.

[0050] Figure 11 shows a top view of a second embodiment of the rocker carrier 100 according to the present invention. Those of skill in the art will recognize that the embodiment illustrated by Figures 1-10 is a design than can be expanded or adapted to fit various engine applications and types. In this case, Figure 11 shows a rocker carrier 1100 that is adapted to preferably be used on one side or bank of a V-8 type engine. The rocker carrier 1100 of Figure 11 is very similar to the rocker carrier of Figures 1-10, albeit with longer front 1105 and rear 1110 walls.

[0051] Compared to Figures 1 and 2, Figure 11 shows an additional exterior head bolt passage 1185, glow plug passage 1180, exterior carrier boss 1175, and high pressure oil reservoir

boss1150 in the front wall 1105 of the rocker carrier 100. There is an additional dual rocker arm pedestal 1130 with a respective interior head bolt passages 1137 and compression limiter 1138. There is also shown an additional interior carrier boss 1170 between a pair of additional push rod passages 1155 and 1156 adjacent to the rear wall 1110 of the rocker carrier 1110. Figure 11 further shows additional structural support members or fins 1106, 1107 and 1108 that will give the rocker carrier body 1100 and the front and rear walls 1105 and 1110 added strength and help prevent wall vibration. Last, Figure 11 shows two additional valve cover bosses 1127 on the top surface 1125.

[0052] Figure 12 shows a top perspective view of the second embodiment of the rocker carrier 1100 shown in Figure 11 with rocker arm assemblies preferably mounted thereon. Figure 12 shows a plurality of rocker arm assemblies 1205, 1210 and 1217 mounted on the rocker arm pedestals 30, 1130, 35 and 40 (shown in Figures 1, 2 and 11) and attached by hold down bolts 1236, 1237 and 1241. The rocker arm assemblies 1205, 1210 and 1217 have rocker arms 1207, 1209, 1211, 1219 that will actuate valve bridges (not shown) when actuated by push rods (not shown) at appropriate times. Figure 12 shows that two types of rocker arm assemblies 1205, 1210 and 1217 are preferably used with the rocker carrier 1100, though other appropriate configuration may be used as well.

[0053] There are shown three dual rocker arm assemblies 1210 which cooperatively support a dual fulcrum plate 1212. The dual fulcrum plates 1212 will each hold an intake and exhaust rocker arm 1209 and 1211. In a preferred embodiment, the intake and exhaust rocker arms 1209 and 1211 on the dual fulcrum plates 1212 will operate valves on different engine cylinders. During intake, when the dual rocker arm assemblies 1210 operate, the intake rocker

arms 1211 will appropriately actuate corresponding intake valves (not shown) via an intake valve bridge (not shown). During exhaust, when the dual rocker arm assemblies 1210 operate, the exhaust rocker arms 1209 will appropriately actuate corresponding exhaust valves (not shown) via an exhaust valve bridge (not shown).

[0054] There is also shown a first and second end rocker arm assembly 1205 and 1215 in the rocker carrier 1100 which are adjacent to the first 15 and second 20 end walls which have a first and second end fulcrum plate 1203 and 1217. In the embodiment of Figure 12, the first end fulcrum plate 1203 will preferably hold an intake rocker arm 1207. During intake, when the first end rocker arm assembly 1205 operates, the intake rocker arm 1207 will appropriately actuate corresponding intake valves (not shown) via an intake valve bridge (not shown). The second end fulcrum plate 1217 will preferably hold an exhaust rocker arm 1219. During exhaust, when second end rocker arm assembly 1215 operates, the exhaust rocker arm 1219 will appropriately actuate corresponding exhaust valves (not shown) via an exhaust valve bridge (not shown).

[0055] Figure 12 further shows that the fulcrum plates 1203, 1212, and 1217 of the rocker arm assemblies 1205, 1210 and 1217 are preferably attached to the rocker carrier 1100 by hold down bolt 1236, 1237 and 1241, e.g. by M-8 type bolts. The bolts 1236, 1237 and 1241 improve the stiffness of the plates 1203, 1212 and 1217 by tying the plates to the rocker carrier 1100. The hold down bolts 1236, 1237 and 1241 also allow the plates to be pre-installed on the rocker carrier 1100 before the head bolts 1337(shown in Figure 13) are installed. As a result, the rocker carrier 1100 may be pre-assembled with the rocker arm assemblies 1205, 1210 and 1217 installed thus decreasing the assembly plant labor to assemble the engine.

[0056] Figure 13 shows a top perspective view of the first embodiment of the rocker carrier shown in Figures 1and 2 with a high pressure oil reservoir 1305 mounted thereon. There is also shown a high pressure oil line 1310 coming through the rocker carrier 100 via one high pressure oil line passage 1360. Another high pressure line section (not shown) would then complete a connection from the high pressure oil line 1310 in the high pressure passage 1360 and the high pressure oil reservoir 1305. There are also shown rocker arm assemblies 1205, 1210 and 1217 that are preferably attached to the rocker carrier 100 by hold down bolts 1236, 1237 and 1241, and a plurality of interior head bolts 1337.

[0057] The rocker carrier 100 enables a modular assembly of the cylinder head with the rocker carrier before installing the cylinder head with the rocker on the crankcase. The modular assembly reduces in-plant assembly costs and assembly time. In one arrangement of the modular assembly, the modular unit includes the cylinder head assembly, head installed valve train parts, fuel injectors, glow plugs, rocker arm carrier, electrical connections, and the oil rail. However, other arrangements including more or less components are possible. The modular assembly may be assembled and tested on a sub-assembly line. The cylinder head with the rocker carrier can then be installed on the crankcase using head bolts 1335 to complete the engine assembly.

[0058] The invention has been described and illustrated with respect to certain preferred embodiments by way of example only. Those skilled in that art will recognize that the preferred embodiments may be altered or amended without departing from the true spirit and scope of the invention. Therefore, the invention is not limited to the specific details,

representative devices, and illustrated examples in this description. The present invention is limited only by the following claims and equivalents.

I Claim:

1. A rocker carrier adapted for use with a cylinder head in an internal combustion engine comprising:

a body portion having a continuous peripheral wall including a front and rear wall connected between a first and second end wall;

a plurality of rocker arm pedestals integrally formed on the body portion and disposed between the rear and front walls;

a top surface able to cooperatively engage a valve cover; and

a bottom surface able to cooperatively engage a cylinder head.

2. The rocker carrier of Claim 1, wherein the rocker arm pedestals comprise a dual rocker arm pedestal or an end rocker pedestal.

3. The rocker carrier of Claim 2, wherein the rocker arm pedestals further comprise an interior head bolt passage.

4. The rocker carrier of Claim 1, wherein the rocker arm pedestal is adapted to support a rocker arm assembly.

5. The rocker carrier of Claim 4, wherein the rocker arm assembly comprises a single mount fulcrum plate or a dual mount fulcrum plate.

6. The rocker carrier of Claim 3, further comprising a plurality of exterior head bolt passages adjacent to the front wall.

7. The rocker carrier of Claim 6, wherein the plurality of exterior and interior head bolt passages further comprise a compression limiter.

8. The rocker carrier of Claim 2, further comprising a plurality of push rod passages formed adjacent to the rear wall.

9. The rocker carrier of Claim 8, wherein the push rod passages are funnel shaped on a bottom surface side.

10. The rocker carrier of Claim 2, further comprising a high pressure oil line passage.

11. The rocker carrier of Claim 10, wherein the high pressure line oil passage is adjacent to the rear wall.

12. The rocker carrier of Claim 2, further comprising a plurality of high pressure oil reservoir bosses.

13. The rocker carrier of Claim 12, wherein

at least one high pressure oil reservoir boss is adjacent to the rocker arm pedestals, and at least one high pressure oil reservoir boss is adjacent to the front wall.

14. The rocker carrier of Claim 12, further comprising a plurality of valve cover bosses formed on the top surface.

15. The rocker carrier of Claim 12, further comprising a plurality of carrier bolt bosses.

16. The rocker carrier of Claim 15, further comprising a plurality of structural support fins cooperatively connecting the rocker arm pedestals to the front and rear walls.

17. The rocker carrier of Claim 12, further comprising a plurality of glow plug passages integrally formed with the front wall.

18. The rocker carrier of Claim 17, wherein the glow plug passages have an inclined top face.

19. The rocker carrier of Claim 2, further comprising a plurality of electrical connector passages integrally formed with the rear wall.

20. The rocker carrier of Claim 19, further comprising a oil drain passage integrally formed with the rear wall.

21. The rocker carrier of Claim 15, further comprising a sealing groove around the

periphery of the bottom surface.

22. A rocker carrier adapted for use on top of a cylinder head in an internal combustion engine comprising:

a body portion having a thin continuous peripheral wall including a front and rear wall connected between a first and second end wall;

a plurality of rocker arm pedestals integrally formed on the body portion and disposed between the rear and front walls;

a high pressure oil line passage integrally formed adjacent to the rear wall;

a plurality of high pressure oil reservoir bosses integrally formed on the body portion and disposed between the rocker arm pedestals and the front wall;

a top surface able to cooperatively engage a valve cover; and

a bottom surface able to cooperatively engage a cylinder head.

23. The rocker carrier of Claim 22, wherein the rocker arm pedestals comprise a dual rocker arm pedestal or an end rocker pedestal.

24. The rocker carrier of Claim 23, wherein the front wall further comprises

a plurality of exterior head bolt passages;

a plurality of carrier bolt bosses; and

a plurality of glow plug passages.

25. The rocker carrier of Claim 23, wherein the rear wall further comprises

a plurality of electrical connector passages;

an oil drain passage; and

a plurality of valve cover bosses.

26. The rocker carrier of Claim 1, wherein the rocker carrier is comprised of cast aluminum material.

ABSTRACT

There is provided a rocker carrier for use with a cylinder head in an internal combustion engine comprising a body portion having a continuous peripheral wall including a front and rear wall connected between a first and second end wall, a plurality of rocker arm pedestals comprised of a dual or end rocker arm pedestals integrally formed on the body portion and disposed between the rear and front walls, a top surface, and a bottom surface. The rocker carrier further comprises a plurality of support fins, a high pressure oil line passage, a plurality of high pressure oil reservoir bosses, a plurality of exterior head bolt passages, a plurality of carrier bolt bosses, a plurality of glow plug passages, a plurality of electrical connector passages, and an oil drain passage, and a plurality of valve cover bolt bosses formed adjacent to the rear wall.