The integrated shaft (A) in accordance with this invention is provided with a cam lobe (5) integral with said shaft at central portion for driving the high pressure fuel injection diesel pump (15) with two symmetrical semi cylindrical stepped portions (6) at equal distance from the said cam lobe (5) for taking care for the reciprocating mass unbalance along with front driven gear which is mounted on the integrated shaft with provision of solid mass with asymmetrical placed holes in the same phase to provide a drive to the whole assembly from the front side and during mounting it is necessary to ensures that assembly rotates in the opposite direction of crank shaft. This shaft is also provided with a symmetrically flatten surface (7) at the front-end of the shaft to give a drive to oil pump (12). This integrated shaft is adopted to be mounted on cylinder block (13) and bedplate (14) assembly.
A NOVEL INTEGRATED SHAFT FOR TWIN CYLINDER INTERNAL COMBUSTION INLINE COMMON RAIL DIESEL ENGINE

FIELD OF INVENTION

This invention relates to internal combustion engine and more particularly to integrated shaft used in twin cylinder internal combustion inline common rail diesel engine for balancing the reciprocating unbalanced mass of an engine and for driving high-pressure fuel injection pump and oil pump.

BACKGROUND OF INVENTION

Conventionally balancer shaft in automotive application is used for balancing the reciprocating unbalance mass and separate drives are used for driving the oil pump and fuel injection pump.

In a two-cylinder high-pressure internal combustion diesel inline engine, for automotive applications multifold requirement from the component such as functional requirement, rigidity and compactness are necessary in order to make system less complex.

US6405702 describes the balancer shaft that has a drive member that is interposed in the timing drive and a torsional vibration damper that is interposed between this drive member and the balancer masses on the balancer shaft to avoid transmission of crankshaft vibrations to the balancer shaft without affecting the valve timing. Balancer shaft has at least offset balance masses formed thereon and is also formed with integral bearings mounted directly on opposite sides of each of the balance masses. Above said
arrangement have been provided for improving smoothness in engine operation by having a balancer shaft that is driven from the crank shaft and a pair of counter weights provided to balance certain vibration forces of the engine. This prior art teaches only balancing of unbalance mass.

OBJECT OF INVENTION

The main object of this invention is to provide an integrated shaft for twin cylinder internal combustion inline common rail diesel engine to operate with minimal vibration.

Another object of this invention is to provide an integrated shaft which is also responsible to provide drive to high-pressure diesel fuel injection pump and oil pump.

Yet another object of this invention is to provide an integrated shaft, which is simple in construction and cost effective.

STATEMENT OF INVENTION

A novel integrated shaft for twin cylinder internal combustion inline common rail diesel engine consists of at least four cylindrical surfaces integrally provided on said shaft to support on cylinder block and bed plate assembly wherein said shaft have a integral cam lobe at centre to provide drive to cylinder block mounted high-pressure diesel fuel injection pump, two symmetrical semi cylindrical stepped portions at equi-distance from the said cam lobe, a symmetrical flat surface on opposite side at the front-end of the said shaft to give a drive to oil pump and a drive gear provided at front of the said shaft.
SUMMARY OF INVENTION

The integrated shaft in accordance with this invention is provided with a cam lobe integral with said shaft at central portion for driving the high pressure fuel injection diesel pump with two symmetrical semi cylindrical stepped portions at equal distance from the said cam lobe for taking care for the reciprocating mass unbalance along with front driven gear which is mounted on the integrated shaft with provision of solid mass in the same phase by providing asymmetrically placed holes to provide a drive to the whole assembly from the front side and during mounting it is necessary to ensures that assembly rotates in the opposite direction of crank shaft. This shaft is also provided with a symmetrically flatten surface at the front-end of the shaft to give a drive to oil pump.

This integrated shaft is adopted to be mounted on cylinder block and bedplate assembly.

Therefore, the multifold output from the single shaft is the key feature of this invention.

DESCRIPTION OF THE PREFFRED EMBODIMENT

Referring now to the drawings wherein the showings are for the purpose of illustrating a preferred embodiment of the invention only, and not for the purpose of limiting the same,

Figure 1 shows isometric view of integrated shaft in accordance with this invention.
Figure 2 shows front view of integrated shaft
Figure 3 shows integrated shaft mounted with gear
Figure 4 shows drive for oil pump from integrated shaft
Figure 5 shows drive for high pressure pump from integrated shaft

Referring to figs. 1 to 5 the integrated shaft (A) is provided with a cam lobe (5) integral with said shaft at central portion and two symmetrical semi cylindrical stepped portions (6) at equal distance from the said cam lobe for the purpose of balancing the reciprocating unbalance mass during running mode. The said cam lobe (5) is provided to drive cylinder block mounted high-pressure diesel fuel injection pump (15) and there is also provided a symmetrically flatten surface (7) at the front-end of the said shaft to give a drive to oil pump (12).

The integrated shaft is provided with two integral cylindrical surfaces (2, 3) on both the side of said cam lobe (5) and two integral cylindrical surfaces (1, 4) touching to said symmetrical semi cylindrical stepped portions (6) in order to provide space to locate on cylinder block (13) and bedplate (14) assembly rigidly.

Provision (8) is made on the integrated shaft to locate the driven gear and this driven gear (10) is mounted on the said provision (8), said gear is also provided with solid mass (11) with asymmetrical holes for balancing the reciprocating unbalance mass of an engine. The whole assembly of integrated shaft gets a drive from the front side and it should be ensured that assembly rotates in the opposite direction of crank shaft and functions best for the reciprocating mass unbalance reduction.

Semi cylindrical surfaces (6) are merged with the cylindrical surfaces (1, 2, 3, and 4) with a curved profile (9) to ensure rigidity under fluctuating loads arising from the engine.

The driven gear (10) have the teeth matching with the corresponding teeth of crank gear, ensures smooth motion transmission with 1:1 ratio and also ensures the opposite phase of motion for integrated shaft with respect to crank shaft.
An integrated shaft in accordance with this invention is provided in vehicle internal combustion engine in such a way that its central axis is parallel to crankshaft axis and both the axes are located in the same horizontal plane mounted between cylinder block (13) and bedplate (14).

The integrated shaft in accordance with this invention carries out the following functions:

A] Balances the primary reciprocating masses.
B] Provides drive to high-pressure diesel fuel injection pump.
C] Provides a drive for oil pump.

The foregoing description is a specific embodiment of the present invention. It should be appreciated that this embodiment is described for purpose of illustration only, and that numerous alterations and modifications may be practiced by those skilled in the art without departing from the spirit and scope of the invention. It is intended that all such modifications and alterations be included insofar as they come within the scope of the invention as claimed or the equivalents thereof.
CLAIMS

1. A novel integrated shaft for twin cylinder internal combustion inline common rail diesel engine consists of at least four cylindrical surfaces integrally provided on said shaft to support on cylinder block and bed plate assembly wherein said shaft have a integral cam lobe at centre to provide drive to cylinder block mounted high-pressure diesel fuel injection pump, two symmetrical semi cylindrical stepped portions at equi-distance from the said cam lobe, a symmetrical flat surface on opposite side at the front-end to give a drive to oil pump and a drive gear provided at front of the said shaft.

2. The integrated shaft as claimed in claim 1 wherein said semi cylindrical stepped portions are merged with the said cylindrical surfaces with a curved profile.

3. The integrated shaft as claimed in claim 1 & 2 wherein said drive gear is provided with solid mass in the same phase of said cylindrical stepped portions by providing asymmetrically placed holes for balancing the reciprocating unbalance mass of an engine.

4. The integrated shaft as claimed in claims 1 to 3 wherein the driven gear has the teeth matching with the corresponding teeth of crank gear.

5. The integrated shaft as claimed in claims 1 to 4, where in its central axis is parallel to crankshaft axis and both the axis are located in the same horizontal plane mounted between cylinder block and bedplate.
6. The internal combustion diesel engine fitted with integrated shaft as claimed in claims 1 to 5.

7. Vehicle fitted with internal combustion diesel engine having integrated shaft as claimed in claims 1 to 6.

8. The integrated shaft substantially as herein described with reference to accompanying drawings.
**INTERNATIONAL SEARCH REPORT**

**International application No**
PCT/IN 2008/000176

**A CLASSIFICATION OF SUBJECT MATTER**

IPC*: F16F 15/26 (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

**B FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC*: F16F, F02B

**Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched**

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC; WPI; TXTnn

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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<td>DE 19928416 A1 (AUDI AG, IAV GMBH) 5 July 2001 (05.07.2001) Abstract; Figures 1 and 2</td>
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<td>A</td>
<td>US 6006715 A (IZUMI ETAL.) 28 December 1999 (28.12.1999) Abstract; Column 6, Lines 28 to 35; Figure 6</td>
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* Further documents are listed in the continuation of Box C

**Date of the actual completion of the international search**
29 July 2008 (29.07.2008)

**Date of mailing of the international search report**
28 August 2008 (28.08.2008)

**Name and mailing address of the ISA/AT**

Austrian Patent Office
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Form PCT/ISA/2 10 (second sheet) (January 2004)
Continuation of first sheet

Continuation No. II:

Observations where certain claims were found unsearchable

(Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, the international search was carried out on the basis of:

Claims Nos.: 8 because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

Independent claim 8 does not meet the requirements of Rule 6.2 (a) PCT. Claims shall not, except where absolutely necessary, rely, in respect of the technical features of the invention, on references to the description or drawings. In particular, they shall not rely on such references as: "...as herein described with reference to accompanying drawings".
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