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(74) Agents: **GOLERIA, Karuna** et al.; DEPENNING & DEPENNING, Alaknanda Building, 16 Nepean Sea Road, Mumbai 400 036, Maharashtra (IN).

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(71) Applicant (for all designated States except US): **TATA MOTORS LIMITED** [IN/IN]; Bombay House, 24 Homi Mody Street, Hutatma Chowk, Mumbai 400 001, Maharashtra (IN).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **PESHAVE, Milind, D.** [IN/IN]; Tata Motors Limited, Bombay House, 24 Homi Mody Street, Hutatma Chowk, Mumbai 400 001, Maharashtra (IN). **DHARKAR, Niraj, R.** [IN/IN]; Tata Motors Limited, Bombay House, 24 Homi Mody Street, Hutatma Chowk, Mumbai 400 001, Maharashtra (IN).

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(54) Title: A NOVEL INTEGRATED BED PLATE STRUCTURE FOR TWO CYLINDER DIRECT INJECTION HIGH PRESSURE COMMON RAIL FOUR STROKE RECIPROCATING PISTON INTERNAL COMBUSTION DIESEL ENGINE

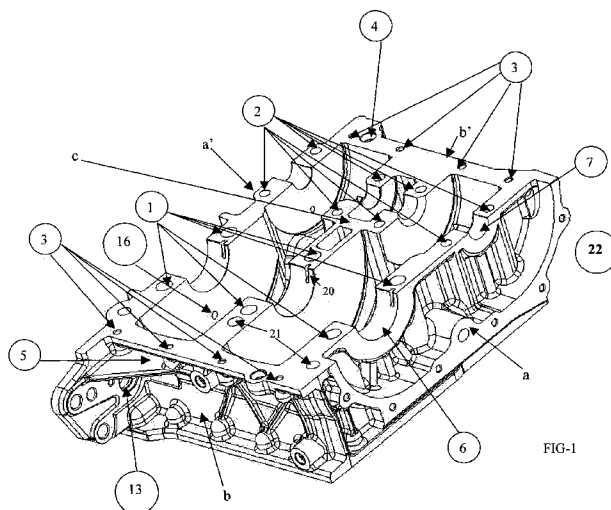


FIG-1

(57) Abstract: This invention relates to a novel integrated bedplate structure (20) for two cylinder internal combustion inline common rail diesel engine comprising; Two pairs of side walls (a, a'; b, b') forming lower side of the skirt of a cylinder block, and a bulkhead (c) partitioning the portion between said walls into two equal compartments; said compartments top are opened to receive a crankshaft and a balancershaft; mounting means (6, 7) for crankshaft and balancershaft; said compartments having solid bottom structure with openings for said crankshaft and balancershaft web clearance; means for locating an oil pump on the face of said side wall (a); an oil hole (10) located on said side wall (a) for feeding oil to said oil pump; and an oil passage fluidly connecting said oil hole and an oil strainer located at bottom of said bedplate.

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**A Novel Integrated Bed Plate Structure For Two Cylinder Direct Injection
High Pressure Common Rail Four Stroke Reciprocating Piston
Internal Combustion Diesel Engine**

FIELD OF INVENTION

This invention relates to internal combustion engine and more particularly to integrated bed plate structure used in two cylinder direct injection high pressure common rail four stroke internal combustion diesel engine to provide the effective supporting system for cylinder block, crankshaft, balancer shaft & additionally to provide other features necessary to perform the engine functions.

BACKGROUND OF THE INVENTION

In a two-cylinder inline direct injection common rail high-pressure internal combustion diesel 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. This novel integrated bed plate integrates multi functions in a compact structure. The prior art US 6926444 relates to a bearing cap for a main bearing in an internal combustion engine. The cap consisting partially of an aluminum alloy and partially of an iron alloy forming a core in the aluminum material.

OBJECT OF THE INVENTION

The main object of this invention is to provide a novel integrated bed plate structure for two cylinder direct injection high pressure common rail four stroke reciprocating

piston internal combustion diesel engine with effective supporting system for the cylinder block to enable it to remain firm and stable at different speeds and under the influence of dynamic loading.

- Another object of the invention is to provide effective support for the rotating crank shaft and balancer shafts through bearings.
- Another object of the invention is to mount the oil pump and provide passageways for the oil to be provided, with minimum pressure loss.
- Another object of this invention is to prevent the frothing in the oil sump which would obstruct the flow and deteriorate the engine performance.
- Another object of this invention is to support other parts viz. power steering pump bracket, oil strainer, dipstick, crank sensor & oil seal.
- Another object is to dampen the vibrations and avoiding the resonance phenomenon.
- Another object is to provide the passage for oil return to oil sump from the corresponding return holes of the cylinder block.
- Another object is to provide the support to the oil seal crankshaft rear & provide the supporting face to the balancer shaft cover
- Another object is to provide the provision for supporting the adapter plate jointly with holes provided on the rear face of the cylinder block.

Yet another objective is to provide a structure which is light in weight and compact in size.

BRIEF DESCRIPTION OF INVENTION

A novel integrated bed plate structure for two cylinder internal combustion inline common rail diesel engine is designed to suit the requirements of multifunction, low weight and compactness of the engine. The bedplate structure having two pairs of side walls forming lower side of the skirt of a cylinder block and a bulkhead partitioning the portion between said walls into two equal compartments. The compartment top is opened to accommodate the crankshaft and balancershaft. The bottom portion of bedplate is a solid structure provides with opening for crankshaft and balancershaft web clearance. The cylinder block mounted on the top face of the bedplate while oil sump is held from the bottom side. Adapter plate on the flywheel side of the engine holds the cylinder block and bed plate together through the bolts. The cylinder block is held firmly between bedplate and cylinder head ensures structural rigidity.

A novel integrated bed plate structure for two cylinder internal combustion inline common rail diesel engine in accordance with this invention is designed with rigid structure for supporting it on the cylinder block firmly through three types of bolts on the entire periphery mounted from the bottom side along with the dowels for correct alignment. Larger bolts are provided around the crankshaft region for better stability. The ribs located on the body of the bed plate provide stiffness to the structure. This ensures that the vibrations, caused by the linear movements of the pistons and the rotary movements of the shafts, are absorbed by the bed plate and any occurrence of resonance is avoided. Easy assembling of the crank shaft and balancer shaft along with their bearings is facilitated by the bedplate. A curved

profile for locating an oil pump is provided in the front side wall of the bedplate. An oil passage to feed the oil pump is designed with minimum pressure losses has got proper alignment with an oil strainer. The inlet of the oil passage is located on the bottom of the bed plate. The typical design of bedplate ensures the minimizing of frothing of oil in the oil sump and eliminates the requirement of baffle plate in the oil sump passage. Supporting provision of the brackets for the accessory is provided on the side walls in such a way that it ensures the uniform distribution of the load. Provision for supporting the engine speed sensor on the front face ensures the accuracy of speed sensing. Bottom face of the bedplate provided with curved profile ensures the oil sump fitment as per the engine requirement. This is mounted using the entire periphery. Oil communicating holes on the in the front & rear walls ensures excess oil, back to the oil sump. Rear portion of the block is provided with provision for fixing an adapter plate which firmly secures jointly at cylinder block & bedplate. A dipstick tube is mounted on the side face with communicating passage to oil sump. Appropriate profile cuts in the bottom of two compartments of the bedplate below the crankshaft & balancer shaft centre lines are provided to ensure the free rotation of crank webs, return of oil back to sump & reduction in weight.

The multiple objective functioning is the key feature of this invention

This novel integrated bed plate structure ensures the support to the cylinder block in the dynamic condition, support the crankshaft & balancer shaft at appropriate bearing locations, provides the face to mount the oil pump, provides the passage to oil flow with minimum pressure loss to oil pump & return oil flow line, provides the provision to mount the crank sensor, oil pan, oil strainer, dip stick, oil seal & finally provides appropriate supporting provisions for the accessory brackets & ribs to reinforce the structure .

BRIEF DESCRIPTION OF DRAWINGS

Fig 1: Isometric top view of integrated bed plate structure

Fig 2: Front view of integrated bed plate structure

Fig 3: Side view of integrated bed plate structure

Fig 4: Bottom view of integrated bed plate structure

Fig 5: Rear view of integrated bed plate structure

Fig 6: Left side view of integrated bed plate structure

Fig 7: Integrated bedplate structure mounted with oil pump

Fig 8: Integrated bedplate structure mounted with adapter plate

Fig 9: Integrated bedplate structure mounted with oil sump

Fig 10: Integrated bedplate structure mounted with cylinder block

DETAILED DESCRIPTION OF INVENTION

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

The structure of bedplate ensures that the vibrations, caused by the linear movements of the pistons and the rotary movements of the shafts, are absorbed and any occurrence of resonance is avoided.

Referring to the figures, bed plate structure (22) for two cylinder internal combustion inline common rail diesel engine in accordance with this invention includes two pairs of side walls (a, a' ; b, b') forming lower side of the skirt of a cylinder block (26) and bulk head (c) partitioning the portion between said walls into two equal compartments. The compartments top is opened to accommodate a

crankshaft and balancershaft. The compartments bottom portion provided with openings (19) for crankshaft and balancershaft web clearance. The bedplate is designed with rigid structure for supporting it on the block (26) firmly through three types of bolts (1, 2 & 3) on the entire periphery mounted from the bottom side along with the dowel holes (4) for correct alignment. Larger bolts are provided around the crankshaft region for better stability. The ribs (5) located on the body of the bed plate provide stiffness to the structure. Vibrations, caused by the linear movements of the pistons and the rotary movements of the shafts, are absorbed by this bed plate and any occurrence of resonance is avoided. Easy assembling of the crank shaft located at three bearing places(6)and balancer shaft located at four bearing places(7)along with their bearings is facilitated by the bedplate. A provision (8) for locating the half portion of oil pump (25) is provided on the front face with curved profile (9). An oil passage fluidly connecting an oil strainer located at bottom of the bedplate and an oil hole (10) located on the front side wall (a'). The oil passage to feed oil to the oil pump (25) through the oil hole (10) is designed with minimum pressure losses has got proper alignment with the passage (11) for oil strainer. The oil hole (10) is located on the front side wall (a) below the profile for oil pump. The oil strainer is located at the bottom of the bedplate and communicating to the oil hole (10) through an oil passage in the bedplate. The typical design of bedplate ensures the minimizing of frothing of oil in the oil sump (25) and eliminates the requirement of baffle plate in the oil sump passage. Supporting provision (12) of a bracket for the accessory is provided on the side face wall in such a way which ensures the uniform distribution of the load. Provision (13) for supporting the engine speed sensor on the face of front wall (a) ensures the accuracy of speed sensing. Bottom of the bedplate provided with curved profile (14) ensures the oil sump (25) fitment on the supporting bolts (15) as per the engine requirement. This is mounted using the entire periphery. Oil communicating holes (16) provided in the

front & rear walls (a,a'). Face of the rear wall (a') is provided ensures excess oil, back to the oil sump. Rear face is provided with supporting provision (17) of adapter plate (24) which firmly secures the cylinder block & bedplate. Dipstick tube (18) is mounted on the side face wall (b') with communicating passage to oil sump (25). Appropriate opening (19) in the bottom of two compartments of the bedplate along the crankshaft & balancer shaft centre line are provided on the bedplate bottom to ensure the free rotation of crank webs, return of oil back to sump & reduction in weight. Slots (20) on the circular profile of crank bearing matches with the corresponding profile in the bearing, provided to restrict the movement of bearing. Oil return holes (21) provided in the bedplate aligned with cylinder block holes and ensures return of oil back to the oil sump (25).

The multiple objective functioning is the key feature of this invention

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 bedplate structure (20) for two cylinder internal combustion inline common rail diesel engine comprising:

Two pairs of side walls (a, a'; b, b') forming lower side of the skirt of a cylinder block, and a bulkhead (c) partitioning the portion between said walls into two equal compartments;

said compartments top are opened to receive a crankshaft and a balancershaft; mounting means (6, 7) for crankshaft and balancershaft;

said compartments having solid bottom structure with openings for said crankshaft and balancershaft web clearance;

means for locating an oil pump on the face of said side wall (a);

an oil hole (10) located on said side wall (a) for feeding oil to said oil pump;

and an oil passage fluidly connecting said oil hole and an oil strainer located at bottom of said bedplate.

2. A bedplate structure as claimed in claim 1, wherein said structure having a curved profile on the face said side wall (a) for locating said oil pump.
3. A bedplate structure as claimed in claim 1, wherein said oil passage configured to align with said oil strainer and said oil hole.
4. A bedplate structure as claimed in claim 1, wherein a dipstick tube mounted on the side face wall (b') with a communicating passage therein to an oil sump;

5. A bedplate structure as claimed in claim 1, where in said structure having supporting means (12) for accessory brackets on the side face wall (b) to ensure uniform distribution of the load.
6. A bedplate structure as claimed in claim 1, wherein a engine speed sensor mounting means (13) provided on the side wall (b).
7. A bedplate structure as claimed in claim 1, where in dowel holes provided on the side walls of said bedplate for accurate aligning the bedplate with engine block.
8. A bedplate structure as claimed in claims 1, where in oil communicating holes are provided in the side walls (a, a')
9. A bedplate structure as claimed in claim 1, where in said crankshaft mounting means (6) comprises slots (20) matching with the corresponding profile in the bearing to restrict the movement of the bearing.
10. A bedplate structure as claimed in claim 1, where in oil return holes (21) provided in said bedplate aligned with cylinder block holes.
11. A bedplate structure as claimed in claim 1, where in said structure comprises ribs (5) on the body of the bedplate to provide stiffness to the structure.
12. A novel integrated bedplate structure for two cylinder internal combustion inline common rail diesel engine as herein above described with reference to the accompanying drawings.

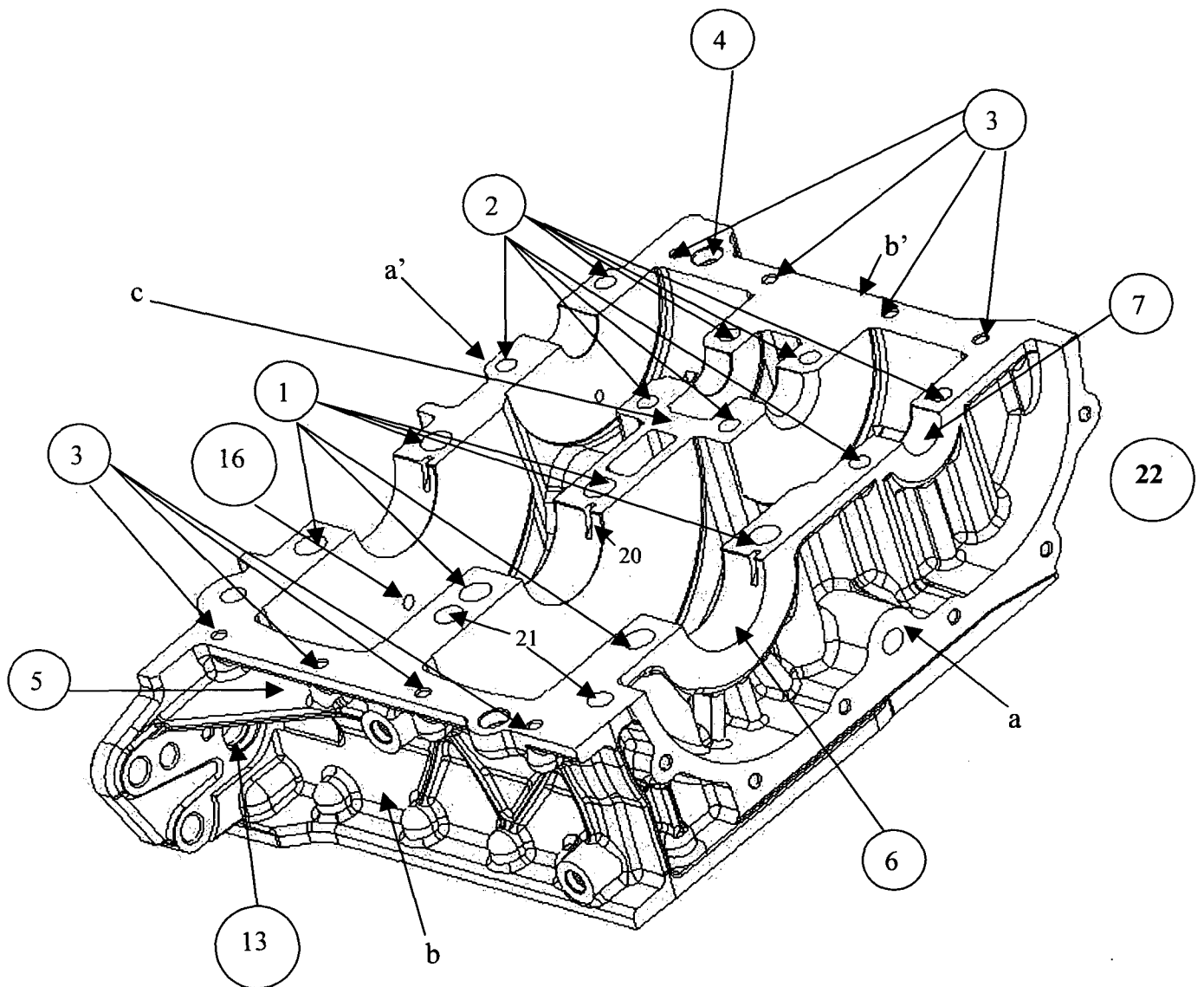
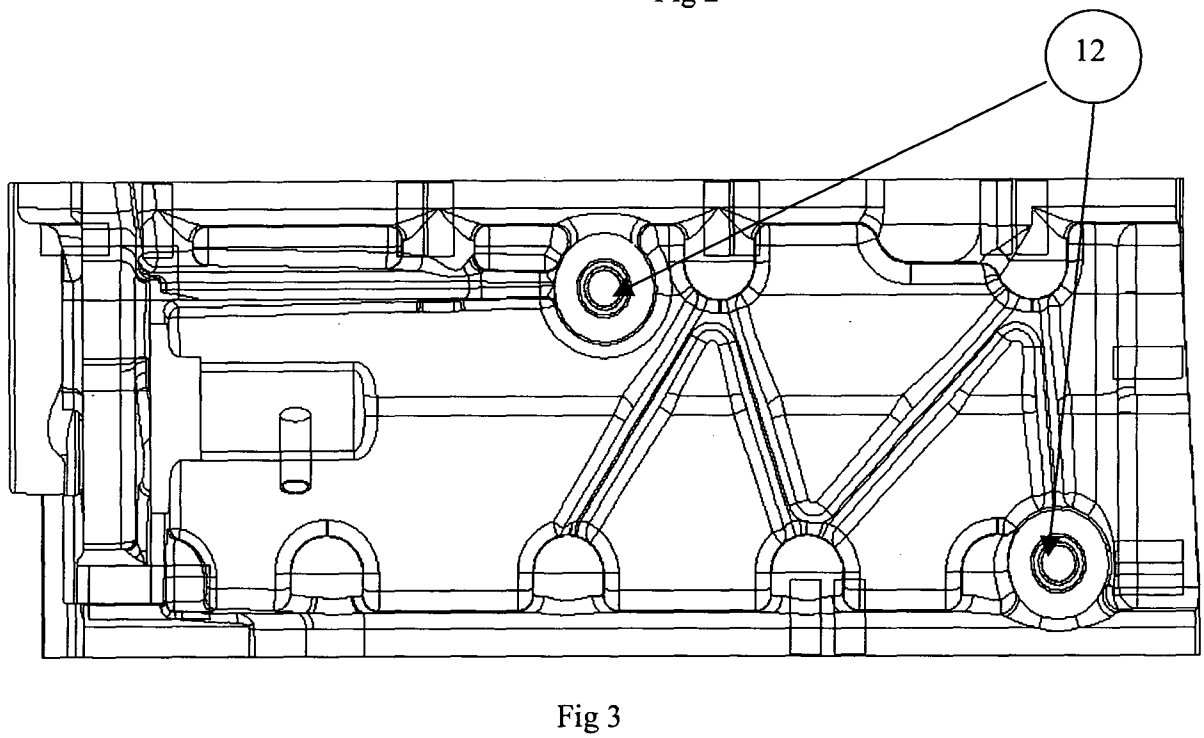
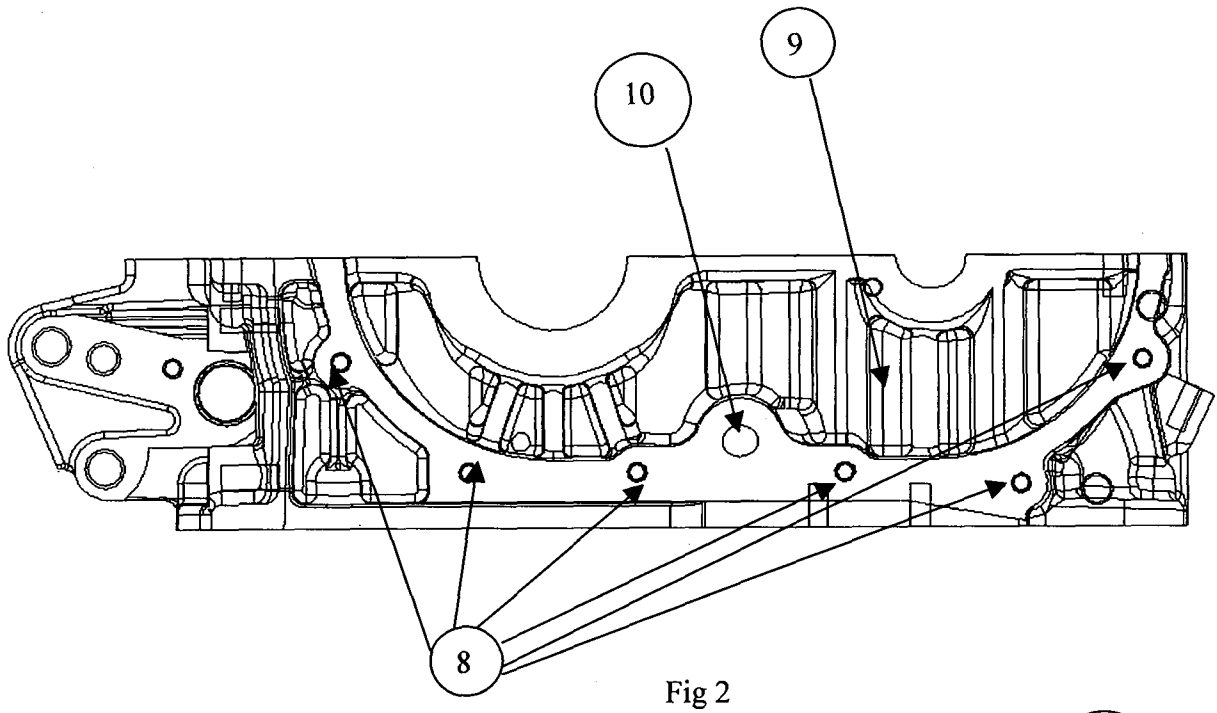


FIG-1



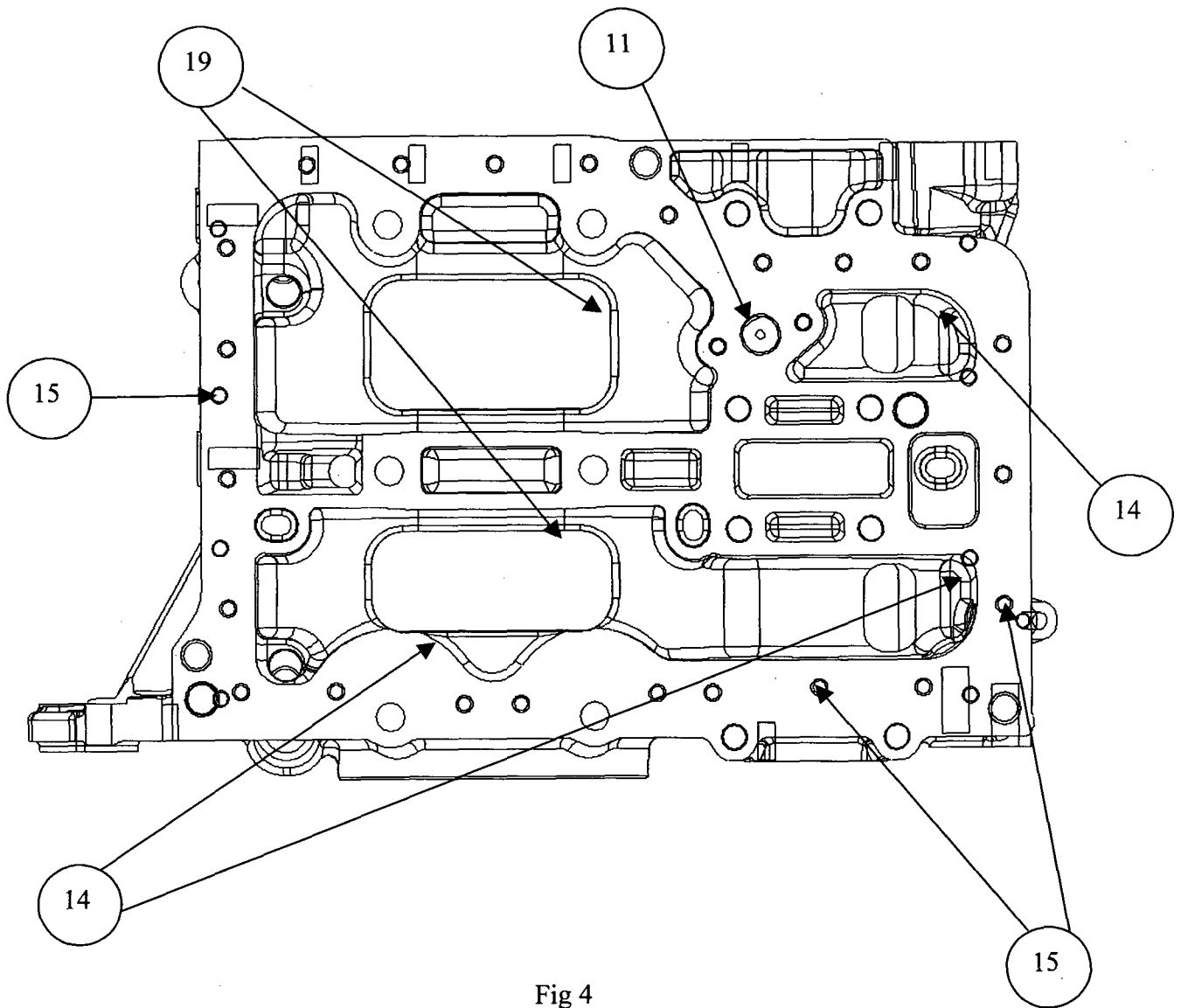


Fig 4

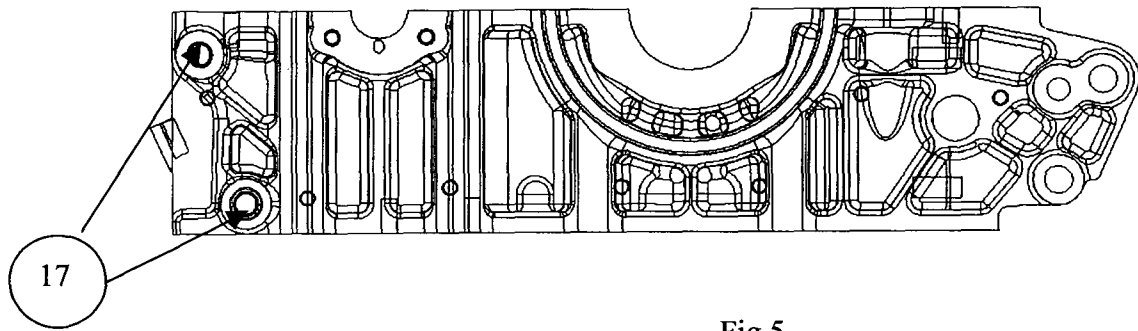


Fig 5

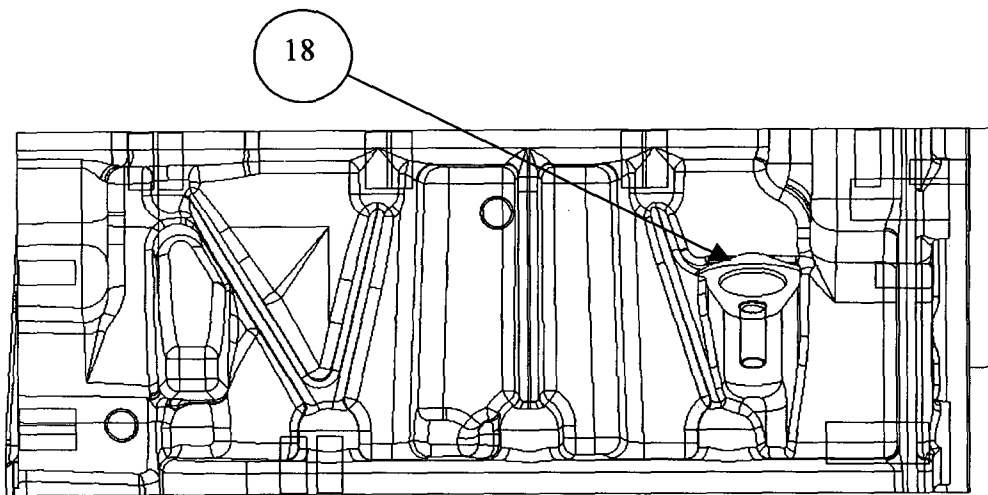


Fig 6

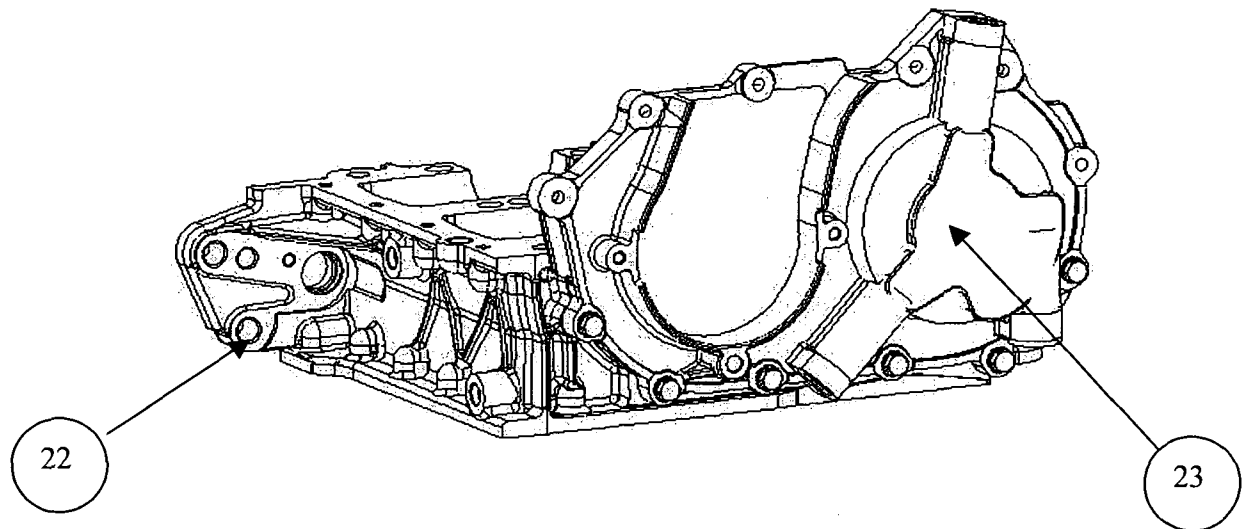


Fig 7

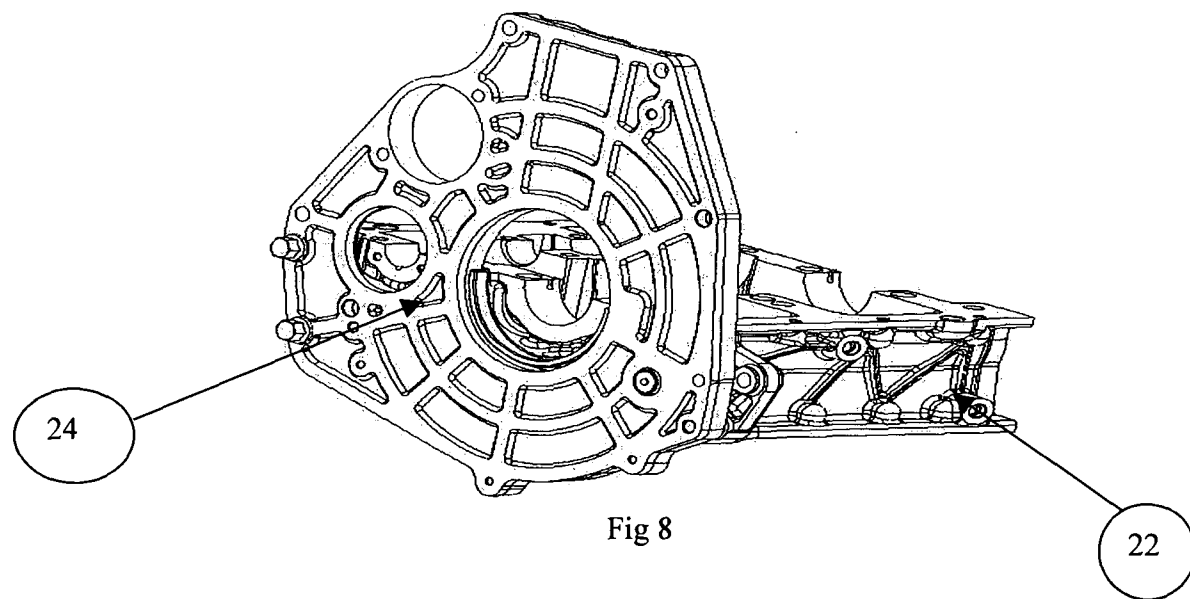


Fig 8

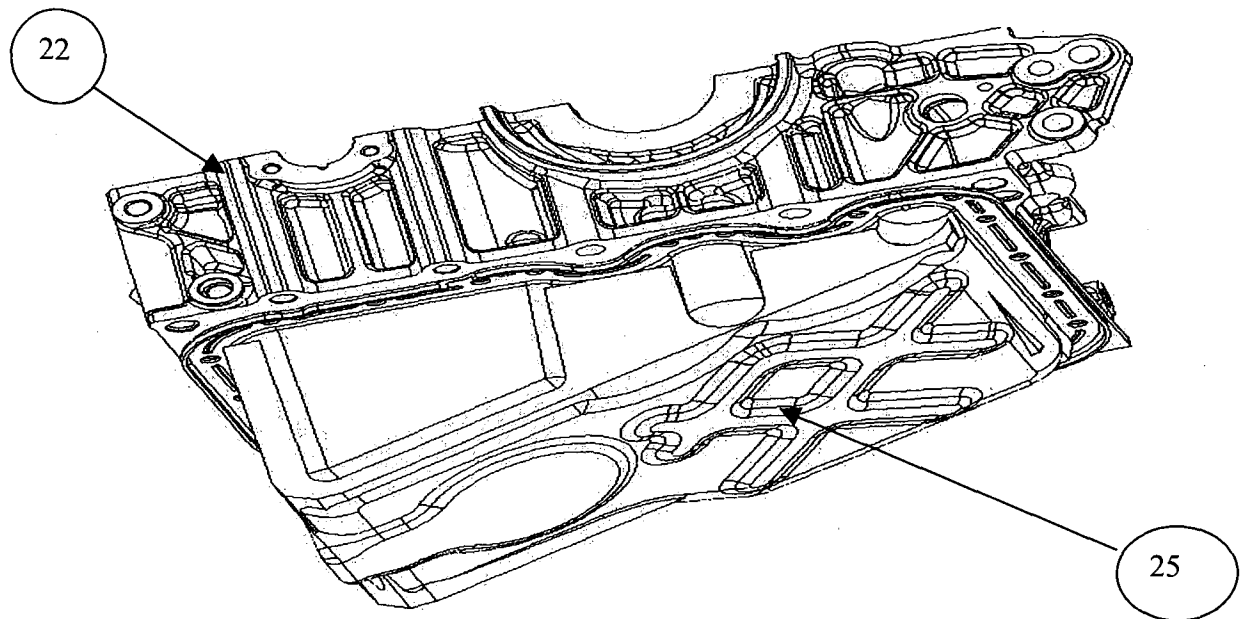


Fig 9

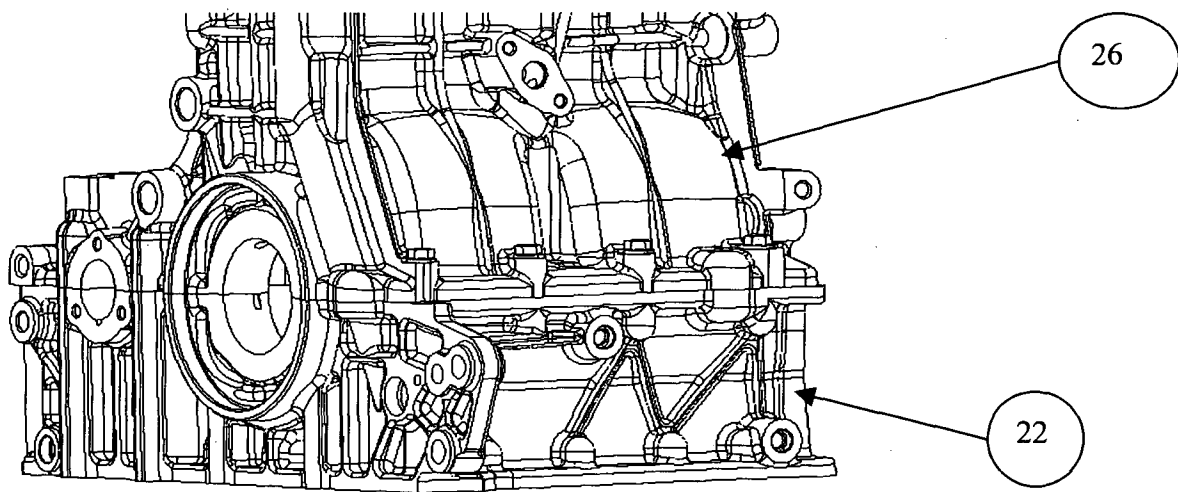


Fig 10