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(54) STRUCTURE AND METHOD FOR ASSEMBLING CYLINDER BLOCK AND CRANK CASE

(57) A simple structure and method applicable to the assembling of a cylinder block (1) and a crankcase (2) of an engine, particularly to the positioning of rear end surfaces of the cylinder block and crankcase without using dowels that would raise the assembling cost. Positioning members (7) are provided on a rear end surface (6) of at least one of the cylinder block (1) and crankcase (2). The cylinder block and the crankcase are joined with each other with a rear end surface (5) of the

other being in contact with the positioning members (7). The positioning members (7) enable the two rear end surfaces (5,6) to be coplanar relative to each other, and therefore the dowels may be dispensed with or precise machining and dimensions are not required to the dowels. As a result, the assembling cost reduction is attained.

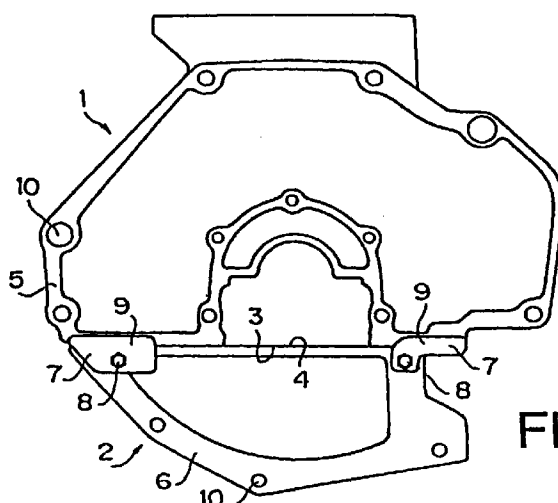


FIG. 1

EP 0 933 523 A1

Description

Technical Field

[0001] The present invention relates to a structure and method for assembling a cylinder block and crankcase of an engine.

Background Art

[0002] As illustrated in Figure 4 of the accompanying drawings, a general engine 21 has a crankcase 23 below a cylinder block 22, and rear end surfaces 24 and 25 of the crankcase and cylinder block are attached to a transmission casing 26. When the cylinder block 22 and crankcase 23 are assembled, dowels 27 projecting from the cylinder block 22 are fitted in mating dowel holes 28 formed in the crankcase 23 for relative positioning between the cylinder block and crankcase. Then, the cylinder block and crankcase are firmly joined with each other by bolts. It should be noted that the crankcase 23 may have dowels and the cylinder block 22 may have the mating holes. Further, reamer bolts or pins may be employed instead of the dowels for positioning (Japanese Utility Model Application, Laid-Open Publication No. 64-34448). Moreover, a flywheel housing may be provided in the place of the transmission casing 26. In the drawing, a reference numeral 29 designates a cylinder head and 30 an oil pan.

[0003] Incidentally, the rear end faces 24 and 25 of the cylinder block 22 and crankcase 23 form an interface to be joined with the transmission casing 26. Therefore, the rear end faces 24 and 25 should be coplanar after the cylinder block and crankcase are assembled. As illustrated in Figure 5 of the accompanying drawings, if a step or discrepancy θ is created between the rear end surfaces 24 and 25, a gap may be left between the transmission casing 26 and the cylinder block and crankcase, and bolts and flanges extending through or near the transmission casing, cylinder block and crankcase may be damaged.

[0004] In the above described and illustrated construction, the distance between the dowels 27 is $X \pm \alpha 1$ and that between the dowel holes 28 is $X \pm \alpha 2$. In particular, the distance from the rear dowel 27 to the rear end face 24 is $Y \pm \beta 1$ and that from the rear dowel hole 28 to the rear end face 25 is $Y \pm \beta 2$. The step θ is, therefore, defined as follows: $\theta = \pm (\beta 1 + \beta 2)$. In short, in order to eliminate the step θ , it is necessary to design and manufacture the locations and dimensions of the dowels 27 and dowel holes 28 accurately. This requires high accuracy in processing/machining and assembling, and it results in raised cost.

[0005] An object of the present invention is to align the rear end surfaces of the cylinder block and crankcase by a relatively simple and easy structure and method, without using the cost-raising dowels or the like.

Disclosure of the Invention

[0006] A cylinder block-crankcase assembling structure according to the present invention includes a positioning member provided on at least one of rear end surfaces of cylinder block and crankcase, and the other rear end surface is caused to contact the positioning member when joining the cylinder block with the crankcase.

10 [0007] Preferably the positioning member is a planar end plate.

[0008] Preferably the positioning member has a portion projecting beyond a contact surface between the cylinder block and crankcase.

15 [0009] Preferably the positioning member is attached by a bolt.

[0010] Preferably a pair of positioning members are provided on the rear end surface on its right and left sides.

20 [0011] Preferably the positioning member has a dust cover portion to close an opening of a transmission casing or flywheel housing.

25 [0012] Preferably the rear end surfaces of the cylinder block and crankcase define surfaces to contact the transmission casing or flywheel housing.

[0013] Preferably a second positioning projection is provided one of the contact surfaces of the cylinder block and crankcase, and a mating hole is provided on other contact surface.

30 [0014] A cylinder block-crankcase assembling method according to the present invention includes providing a positioning member on at least one of rear end surfaces of cylinder block and crankcase, and causing the other rear end surface to abut against the positioning member when assembling the cylinder block and crankcase.

35 [0015] Another cylinder block-crankcase assembling method according to the present invention includes providing a positioning member on at least one of rear end surfaces of cylinder block and crankcase, providing a second positioning projection on one of contact surfaces between the cylinder block and crankcase and a mating hole in the other contact surface to receive the projection, fitting the projection into the mating hole for rough positioning between the cylinder block and crankcase, moving the cylinder block and crankcase relative to each other until at least one of the rear end surfaces of the cylinder block and crankcase abuts the positioning member for final positioning between the cylinder block and crankcase, and then firmly uniting the cylinder block and crankcase by bolts.

40 [0016] Preferably the positioning member is a planar end plate.

[0017] Preferably the positioning member has a portion projecting beyond a contact surface between the cylinder block and crankcase.

45 [0018] Preferably the positioning member is attached by a bolt.

[0019] Preferably the positioning member is removed

after the cylinder block and crankcase are assembled.

[0020] Preferably a pair of positioning members are provided on the rear end surface on its right and left sides.

[0021] Preferably the positioning member has a dust cover portion to close an opening of a transmission casing or flywheel housing.

[0022] Preferably the rear end surfaces of the cylinder block and crankcase define surfaces to contact the transmission casing or flywheel housing.

[0023] Still another cylinder block-crankcase assembling method according to the present invention includes providing end plates, as positioning members, on a rear end surface of a crankcase on its right and left sides by bolts such that they project upward beyond a contact surface between the cylinder block and crankcase, providing a plurality of second positioning projections such as dowels on one of contact surfaces between the cylinder block and crankcase and a plurality of mating holes in the other contact surface to receive the projections, fitting the projections into the mating holes for rough positioning between the cylinder block and crankcase, moving the cylinder block and crankcase relative to each other until the rear end surface of the cylinder block abuts the end plates for final positioning between the cylinder block and crankcase, and then firmly uniting the cylinder block and crankcase by bolts.

[0024] According to the above structure and method, it is possible to align the rear end surfaces of the cylinder block and crankcase so that they become coplanar relative to each other. Therefore, unlike the conventional structure, it is unnecessary to perform a strict positioning by dowels or the like. Consequently, the dowels or the like may be dispensed with or the number of the dowels may be reduced so that cost reduction is realized.

Brief Description of the Drawings

[0025]

Figure 1 illustrates a rear view of a cylinder block and crankcase when assembled.

Figure 2 illustrates a lateral view of the cylinder block and crankcase when assembled.

Figure 3 illustrates a rear view of a cylinder block and crankcase according to another embodiment.

Figure 4 illustrates a lateral view of a cylinder block and crankcase when assembled according to the prior art.

Figure 5 is an enlarged lateral view to show misalignment between rear end surfaces.

Best Mode for Carrying Out the Invention

[0026] Now, preferred embodiments of the present invention will be described in detail in reference to the accompanying drawings.

[0027] Referring to Figures 1 and 2, illustrated is an assembling structure for a cylinder block and crankcase according to the present invention. In particular, Figure 1 is an illustration when viewed from the rear and Figure 2 is an illustration when viewed from the side. As depicted, a crankcase 2 is assembled to a bottom of the cylinder block 1. The cylinder block and crankcase contact each other at their contact surfaces or interfaces 3 and 4, and firmly united together by bolts (not shown). Like the conventional structure, a plurality of positioning projections such as dowels (not shown) are provided on one of the interfaces 3 and 4, and a plurality of mating holes such as dowel holes (not shown) to receive the projections are formed in the other interface. It should be noted that these dowels and holes are utilized for merely rough positioning, and therefore strict accuracy is not required in dimensions and locations as compared with the conventional structure.

[0028] The rear end surfaces 5 and 6 of the cylinder block and crankcase are surfaces which contact a transmission casing (not shown) or flywheel housing (not shown). These rear end surfaces 5 and 6 are precisely aligned with each other by a pair of end plates 7, which are positioning members, so that they are coplanar when the cylinder block and crankcase are assembled. In this embodiment, the two end plates 7 are provided on the left and right sides. These end plates 7 are mounted on the rear end surface 6 of the crankcase 2 by bolts 8. Each of the end plates 7 has a portion 9 projecting upward beyond the contact surface 4 of the crankcase 2. By contacting the rear end surface 5 of the cylinder block 1 against these projecting portions 9, the rear end surfaces 5 and 6 are accurately aligned. Each of the end plates 7 has a small configuration so that it does not become an obstacle when a transmission casing and/or other parts are assembled. Locations, shapes and dimensions of the end plates 7 are determined under the same principle. It should be noted that the rear end surfaces 5 and 6 have a plurality of spacedly-arranged positioning and fixing members 10 such as bolt holes, dowels and dowel holes for positioning and fixing of a transmission casing and/or other parts.

[0029] Now, an assembling method for the cylinder block 1 and crankcase 2 will be described. First, the end plates 7 are attached to the crankcase 2 by the bolts 8. Then, the rear end surface 5 of the cylinder block 1 is placed against the projecting portions 9 of the end plates 7 while the cylinder block 1 and crankcase 2 are being brought into contact with each other. During this contacting, the projections formed on the contact surface 3 or 4 fit in the mating holes formed in the other contact surface for positioning. This positioning is, however, rough positioning. Specifically, fitting tolerance between the projections and holes is loose as compared with the conventional structure so that the cylinder block 1 and crankcase 2 are able to move relative to each other horizontally in right and left as well as back and forth to a certain extent. Because of this, the cylin-

der block rear end surface 5 can contact the end plates 7, and fitting between the projections and holes does not affect the positioning by the end plates 7. After the contacting between the cylinder block and crankcase is finished, the cylinder block and crankcase are tightened and firmly united by bolts (not shown). According to this assembling process, the cylinder block and crankcase are joined with each other with their rear end surfaces 5 and 6 being coplanar.

[0030] According to the illustrated and described structure and method, as understood from the foregoing, the positioning between the rear end surfaces 5 and 6 is performed by the end plates 7 provided on one of the rear end surfaces 6, so that it is not necessary to carry out the positioning by the dowels or the like provided on the contact surfaces 3 and 4. Therefore, accuracy in dimensions and machining of the dowels and associated holes is substantially unnecessary. As a result, the dowels and mating holes may be dispensed with or the number of the dowels and associated holes may be reduced. In other words, by providing the end plates 7, the positioning of the rear end surfaces 5 and 6 is performed by a simple structure and method, without depending upon the dowels which entail high manufacturing cost. Accordingly, highly accurate machining/processing and assembling are not needed and cost reduction is realized. It is of course that no gap is left between the rear end surfaces of the cylinder block and crankcase and a transmission casing when they are assembled with each other since the rear end surfaces 5 and 6 are coplanar. Thus, damages to bolts and flanges extending between or existing near the cylinder block, crankcase and transmission casing would not occur due to such a gap.

[0031] As may be understood from the above description, the positioning members are not limited to the planar end plates 7. For example, they may be stay-like parts. The end plates 7, however, inherently have planar surfaces so that the positioning becomes easy and accurate. The structure is also simple. Therefore, it is advantageous in terms of cost reduction. It should also be noted that the positioning members may be attached onto the rear end surface 5 of the cylinder block 1, or they may be on both of the rear end surfaces 5 and 6. Further, the number and locations of the positioning members are not limited to the illustrated ones, and the positioning members may be removed after the cylinder block 1 and crankcase 2 are joined by the bolts. If the positioning members do not interfere with a crankshaft and flywheel, the positioning members may not be removed after assembling since otherwise a step of removing the positioning members would be required.

[0032] Figure 3 illustrates another embodiment of the present invention. Similar reference numerals are used to similar components in Figures 1 through 3. The right end plate 7A also includes a dust cover portion 11 to close a front opening of a transmission casing or flywheel housing. Conventionally, a separate dust cover is

mounted on the transmission casing or the like to close the front opening thereof. In the second embodiment, however, the end plate 7A also serves as the dust cover so that a separate dust cover is not needed. This reduces the number of parts and in turn a manufacturing cost.

[0033] Other modifications and changes may be made without departing from the spirit and scope of the present invention defined in the appended claims.

Industrial Applicability

[0034] The present invention is applicable to engine's cylinder block-crankcase assembling.

Claims

1. A cylinder block-crankcase assembling structure characterized in that a positioning member is provided on at least one of rear end surfaces of cylinder block and crankcase, and the other rear end surface is abutted to the positioning member when the cylinder block and crankcase are joined.
2. The cylinder block-crankcase assembling structure of claim 1, characterized in that the positioning member is a planar end plate.
3. The cylinder block-crankcase assembling structure of claim 1 or 2, characterized in that the positioning member has a portion projecting beyond a contact surface between the cylinder block and crankcase.
4. The cylinder block-crankcase assembling structure of claims 1, 2 or 3, characterized in that the positioning member is attached to the rear end surface by a bolt.
5. The cylinder block-crankcase assembling structure according to any one of claims 1 to 4, characterized in that a pair of positioning members are provided on the rear end surface on its right and left sides.
6. The cylinder block-crankcase assembling structure according to any one of claims 1 to 5, characterized in that the positioning member has a dust cover portion to close an opening of a transmission casing or flywheel housing.
7. The cylinder block-crankcase assembling structure according to any one of claims 1 to 6, characterized in that the rear end surfaces of the cylinder block and crankcase are surfaces to contact a transmission casing or flywheel housing.
8. The cylinder block-crankcase assembling structure according to any one of claims 1 to 7, characterized in that a projection is provided on one of contact

surfaces between the cylinder block and crankcase and a hole is provided on the other contact surface to receive the projection for positioning between the cylinder block and crankcase.

9. A cylinder block-crankcase assembling method characterized in that a positioning member is provided on at least one of rear end surfaces of cylinder block and crankcase, and the other rear end surface is abutted to the positioning member when the cylinder block and crankcase are joined.

10. A cylinder block-crankcase assembling method characterized in that a positioning member is provided on at least one of rear end surfaces of cylinder block and crankcase, a projection is provided on one of contact surfaces between the cylinder block and crankcase and a mating hole is provided on the other contact surface to receive the projection for rough positioning between the cylinder block and crankcase, the cylinder block and crankcase are joined by fitting the projection into the mating hole, the cylinder block and crankcase are moved relative to each other until at least one of the rear end surfaces of the cylinder block and crankcase abuts against the positioning member for final positioning between the cylinder block and crankcase, and the cylinder block and crankcase are firmly united by bolts.

11. The cylinder block-crankcase assembling method of claim 9 or 10, characterized in that the positioning member is a planar end plate.

12. The cylinder block-crankcase assembling method of claim 9, 10 or 11, characterized in that the positioning member has a portion projecting beyond a contact surface between the cylinder block and crankcase.

13. The cylinder block-crankcase assembling method according to any one of claims 9 to 12, characterized in that the positioning member is attached to the rear end surface by a bolt.

14. The cylinder block-crankcase assembling method according to any one of claims 9 to 13, characterized in that the positioning member is removed after assembling of the cylinder block and crankcase is finished.

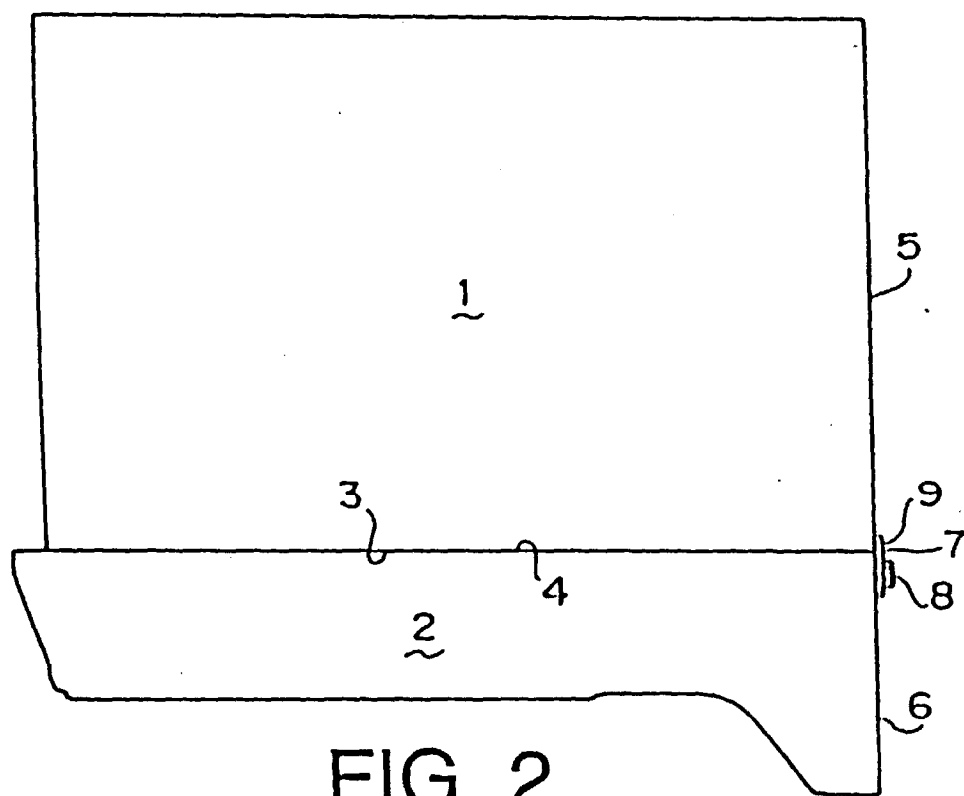
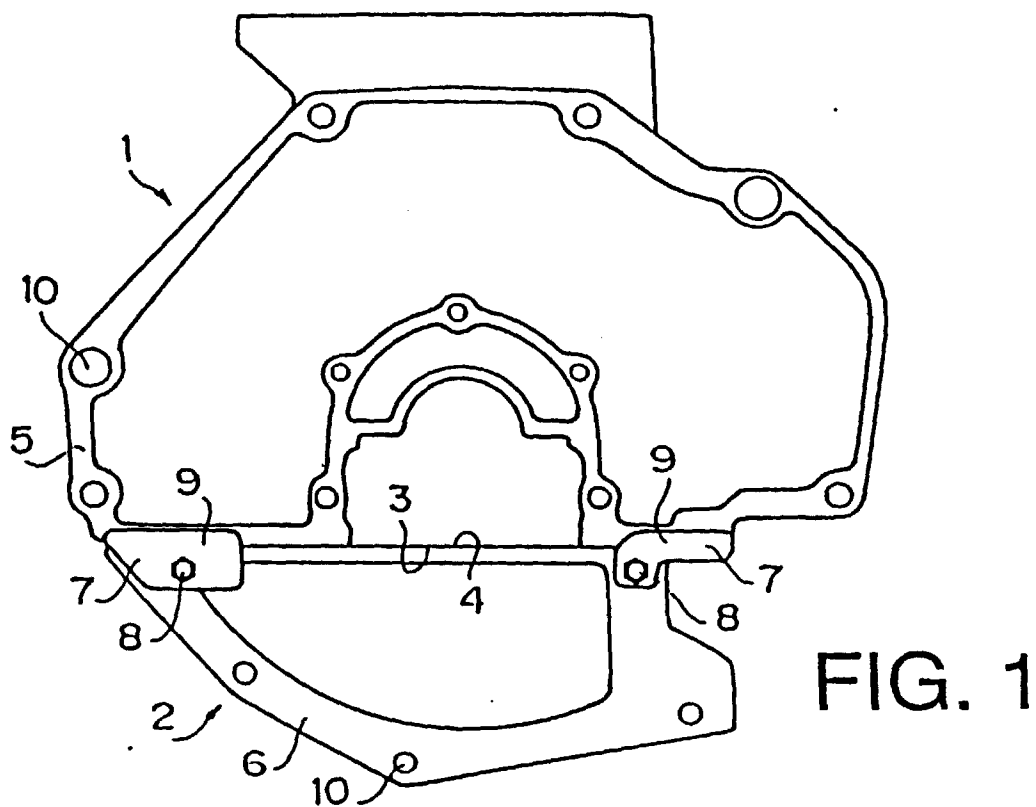
15. The cylinder block-crankcase assembling method according to any one of claims 9 to 14, characterized in that a pair of positioning members are provided on the rear end surface on its right and left sides.

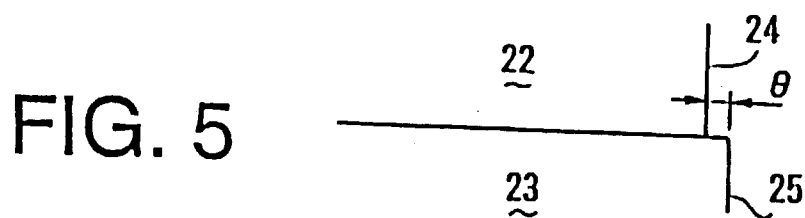
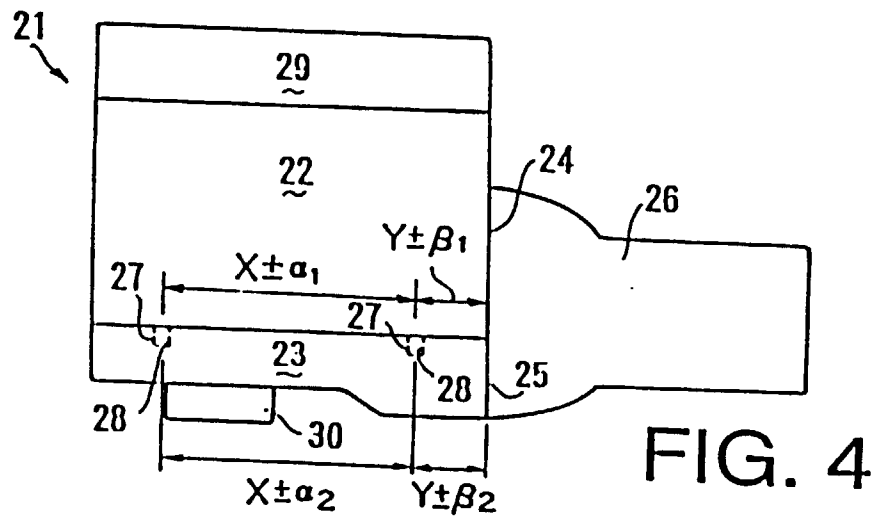
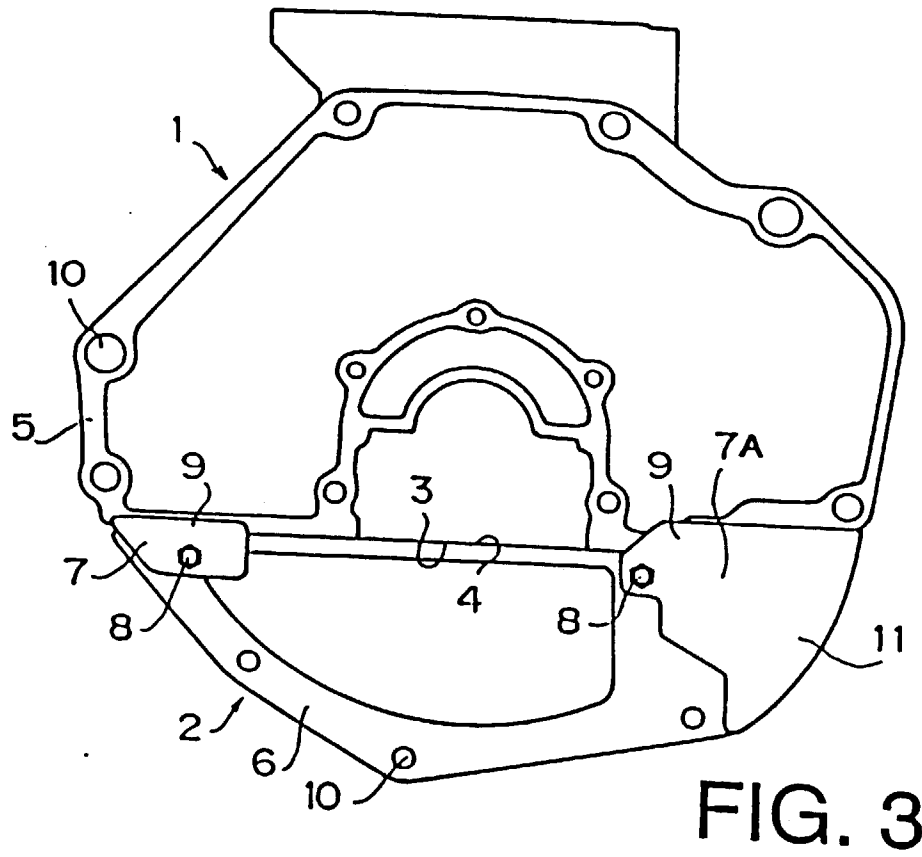
16. The cylinder block-crankcase assembling method

according to any one of claims 9 to 15, characterized in that the positioning member has a dust cover portion to close an opening of a transmission casing or flywheel housing.

17. The cylinder block-crankcase assembling method according to any one of claims 9 to 16, characterized in that the rear end surfaces of the cylinder block and crankcase are surfaces to contact a transmission casing or flywheel housing.

18. A cylinder block-crankcase assembling method characterized in that end plates as first positioning members are provided on a rear end surface of a crankcase on its right and left sides by bolts such that the end plates project upward from its contact surface to a cylinder block when assembled, a plurality of second positioning projections such as dowels are provided on one of the contact surfaces of the cylinder block and crankcase and a plurality of mating holes such as dowel holes are provided on the other contact surface to receive the second positioning projections, the cylinder block and crankcase are roughly positioned relative to each other by fitting the second positioning projections into the mating holes, the cylinder block and crankcase are moved relative to each other until the rear end surface of the cylinder block abuts against the end plates for final positioning between the cylinder block and crankcase, and the cylinder block and crankcase are firmly united by bolts.





INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP98/02292

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl ⁶ F02F7/00, F02F1/00, F02B77/00 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) Int.Cl ⁶ F02F7/00, F02F1/00, F02B77/00 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1926-1996 Toroku Jitsuyo Shinan Koho 1994-1998 Kokai Jitsuyo Shinan Koho 1971-1998 Jitsuyo Shinan Toroku Koho 1996-1998 Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 48111/1989 (Laid-open No. 139348/1990) (Mazda Motor Corp.), November 21, 1990 (21. 11. 90), Page 6, lines 9 to 13 ; page 7, line 16 to page 8, line 20 ; Figs. 2, 3, 5 (Family: none)	1-4, 9, 11-13
Y	JP, 62-279257, A (Mazda Motor Corp.), December 4, 1987 (04. 12. 87), Page 4, lower right column, line 15 to page 5, upper left column, line 4 ; Figs. 2, 3 & GB, 2193627, A1 & DE, 3726369, A1	8, 10
A	JP, 63-4356, U (Daihatsu Motor Co., Ltd.), January 12, 1988 (12. 01. 88) (Family: none)	6, 16
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search August 11, 1998 (11. 08. 98)		Date of mailing of the international search report August 18, 1998 (18. 08. 98)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
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