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D-81679 München (DE)**EP 0 657 234 A1**(54) **Mold for casting a laterally central portion of an engine block.**

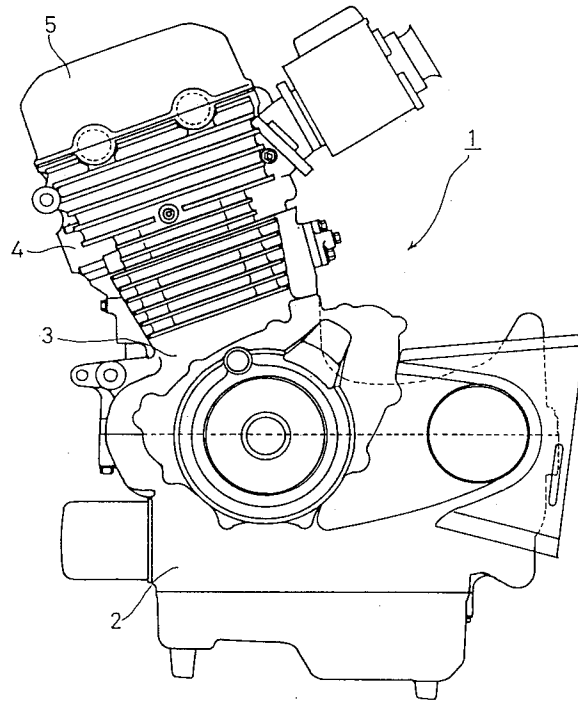
(57) A mold is provided which can greatly reduce cutting of an engine block of an internal combustion engine to aim at a cost reduction. A mold for casting an engine block of a two-cylinder four-cycle internal combustion engine, an upper inner mold is integrally formed with a cam chain storing chamber upper inner mold disposed intermediate of right and left liner retaining projections, for defining an upper portion of an inner surface of a tensioner lifter supporting hole. A lower inner mold is formed with a cam

chain storing chamber (10) lower inner mold (28) opposed to the cam chain storing chamber (10) upper inner mold (27) of the upper inner mold, for defining a lower portion of the inner surface of the tensioner lifter supporting hole. The lower inner mold (28) is further formed with an upper projection (32) projecting upward from an inner opening edge upper portion of the tensioner lifter supporting hole (22) facing a cam chain storing chamber (10). A rear outer mold (24) is formed with a lower projection

projecting downward from an outer opening edge
lower portion of the tensioner lifter supporting hole

facing the cam chain storing chamber.

Fig. 1



BACKGROUND OF THE INVENTION

Field of the invention

The present invention relates to a mold for casting a laterally central portion of an engine block of an internal combustion engine to be mounted on a motorcycle or the like. In addition, a cam chain tensioner device for an overhead valve operating cam type of four-cycle internal combustion engine is disclosed which is directed to a mounting portion of a tensioner body of such a cam chain tensioner device.

Description of Background Art

Figure 9 shows a conventional multicylinder in-line internal combustion engine having a plurality of cylinders tilted at their upper portions toward the front side of the engine. In such an internal combustion engine, an engine block 01 is formed by integrating a cylinder block and an upper crankcase 02. A crankcase is parted into the upper crankcase 02 of the engine block 01 and a lower crankcase 03 along a plane 04. A crankshaft 05 is rotatably supported in the plane 04, and a main shaft and a counter shaft (both not shown) for supporting gears of a transmission are also rotatably supported in the plane 04. A chain storing chamber 07 for driving overhead valve operating camshafts 06 is defined between the cylinders adjacent to each other rather than at one of right and left sides of the engine block 01. A supporting hole 09 for supporting a tensioner lifter 08 is formed through a wall of the chain storing chamber 07 at an upper side portion thereof so as to be inclined toward a line connecting axial centers of the cylinders.

Conventionally, the engine block 01 is cast by using a mold as shown in Figure 9. That is, the mold shown is composed of an upper inner mold 010, a lower inner mold 011, a front outer mold 012, and a rear outer mold 013.

In the engine block 01 cast by using the mold shown in Figure 9, a wall thickness of the engine block 01 at a portion thereof near the supporting hole 09 for the tensioner lifter 08 is made large, so as to reliably bear against vibration of a tensioner. Additionally, a padding of the engine block is increased in relation to mold releasing, and blowholes are easily generated. Furthermore, the amount of cutting of the wall of the supporting hole 09 is increased to result in an increase in cutting time and material cost. Accordingly, it is difficult to improve the productivity.

In addition, a conventional four-cycle internal combustion engine is provided with a cam chain tensioner device for removing slack of an endless

chain wound around cam sprockets integral with valve operating cams and a sprocket integral with a crankshaft to provide the endless chain with a proper tension.

A load applied to the valve operating cams is periodically changed in concert with opening and closing timings of intake and exhaust valves, causing a fluctuation in tension of the cam chain. To cope with this problem, Japanese Utility Model Laid Open No. 56-47232 discloses a cam chain tensioner device such that an elastic member is provided under a pin for supporting a lower end of a tensioner body to thereby absorb vibration applied to the tension body due to the fluctuation in the tension of the cam chain.

In the conventional cam chain tensioner device mentioned above, the vibration along a longitudinal direction of the tensioner body can be absorbed, but the vibration along the width of the cam chain cannot be absorbed.

SUMMARY AND OBJECTS OF THE INVENTION

The present invention relates to an improvement in a mold for casting a laterally central portion of an engine block, which has solved the above problem. According to the present invention, there is provided in a mold for casting a laterally central portion of an engine block of a multicylinder in-line internal combustion engine having a plurality of cylinders tilted in a longitudinal direction perpendicular to a line of arrangement of the cylinders, a hollow chamber defined between the cylinders adjacent to each other and extending in an axial direction of the cylinders, a hole formed through a wall of the hollow chamber at an upper side portion thereof so as to be inclined downward toward a line connecting axial centers of the cylinders, a crankshaft extending horizontally in a lateral direction parallel to the line of arrangement of the cylinders, and a crankcase parted into an upper crankcase and a lower crankcase along a plane in which a center line of the crankshaft lies, the crankshaft being rotatably supported in the plane between the upper crankcase and the lower crankcase, the upper crankcase being integrated with a cylinder block to form the engine block; the improvement comprising a lower inner mold so formed as to be released downward in a direction perpendicular to the plane, the lower inner mold having a projection projecting upward from an upper portion of an inner opening edge of the hole opening into the hollow chamber to form an upper surface of the hole; an upper inner mold so formed as to be released upward in the axial direction of the cylinders; an upper outer mold so formed as to be released upward in the direction perpendicular to the plane, for forming an upper inclined surface of

the engine block, the upper outer mold having a projection projecting downward from a lower portion of an outer opening edge of the hole to form a lower surface of the hole; and a lower outer mold so formed as to be released outward along the plane, for forming a lower inclined surface of the engine block.

With this arrangement, even when the depth of the hole opening into the hollow chamber is large and the wall thickness of the peripheral wall of the hole is accordingly large, a space surrounded by an inner wall surface of the hole can be partially filled with the projection of the lower inner mold projecting into a part of the hole from the hollow chamber and the projection of the upper outer mold projecting into a part of the hole from the outside of the engine.

Accordingly, the thickness of the wall of the engine block cast by using the mold according to the present invention can be made as small as possible to thereby suppress the generation of blowholes and reduce the amount of a molten metal to be poured into the mold, thereby reducing a material cost. Furthermore, a cutting time for formation of the hole can be reduced to thereby greatly improve the productivity.

In addition, a core that must be broken every time of casting is not required to thereby simplify pretreatment and posttreatment of casting, thus contributing to a cost reduction also in this respect.

The present invention further relates to an improvement in a cam chain tensioner device in an internal combustion engine, which has solved the problem of vibration along the width of the cam chain. According to the present invention, there is provided in a cam chain tensioner device in an internal combustion engine, having a tensioner body formed with a mounting base portion projecting in a lateral direction of the tensioner body, the mounting base portion being mounted in mounting grooves formed on abutting surfaces of upper and lower crankcases of the internal combustion engine and being held between the upper and lower crankcases, the mounting grooves extending in a direction perpendicular to a chain storing portion; the improvement wherein the tensioner body has an elastic member integral therewith, the elastic member being located between opposite side surfaces of the tensioner body and opposite inner wall surfaces of the chain storing portion.

With this structure of the present invention, a vibrational force applied to the tensioner body in its lateral direction is damped and absorbed by the elastic member held between the opposite side surfaces of the tensioner body and the opposite inner wall surfaces of the chain storing portion.

In the present invention, the vibrational force in the lateral direction of the articulated cam chain

that is prone to vibrate laterally responsive to pulsation of the internal combustion engine can be effectively damped to permit a valve operating mechanism to be operated silently and properly.

Further scope of applicability of the present invention will become apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become more fully understood from the detailed description given hereinbelow and the accompanying drawings which are given by way of illustration only, and thus are not limitative of the present invention, and wherein:

Figure 1 is a general side view of a two-cylinder four-cycle internal combustion engine manufactured by using a mold for casting a laterally central portion of an engine block according to the present invention;

Figure 2 is a vertical sectional side view of an essential part of the engine shown in Figure 1;

Figure 3 is a plan view of the engine block of the two cylinder four-cycle internal combustion engine shown in Figure 1;

Figure 4 is a front elevation of the engine block;

Figure 5 is a vertical section taken along the line V-V in Figure 3;

Figure 6 is a vertical section taken along the line VI-VI in Figure 3;

Figure 7 is an enlarged vertical section of a mold as taken along the line VI-VI in Figure 3;

Figure 8 is an enlarged vertical sectional side view of an essential part showing another preferred embodiment of the present invention;

Figure 9 is a vertical sectional side view of a mold for an engine block in the prior art.

Figure 10 is a vertical sectional side view of a cam chain tensioner device in an internal combustion engine according to a preferred embodiment of the present invention;

Figure 11 is a vertical section taken along the line XI-XI in Figure 10;

Figure 12 is a view taken in the direction of the arrow XII-XII in Figure 10;

Figure 13 is a horizontal section taken along the line XIII-XIII in Figure 12;

Figure 14 is a horizontal section taken along the line XIV-XIV in Figure 12; and

Figure 15 is a view taken in the direction of the arrow XV-XV in Figure 10.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A preferred embodiment of the present invention will now be described with reference to Figures 1 to 7.

As shown in Figure 1, in an overhead valve operating cam type of two-cylinder four-cycle internal combustion engine 1 to be mounted on a motorcycle (not shown), a crankshaft 6 is rotatably supported through sliding bearings (not shown) between a lower crankcase 2 and an engine block 3 as an integrated upper crankcase and cylinder block. Thus, a crankcase of the engine 1 is parted into the lower crankcase 2 and the upper crankcase. A cylinder head 4 is mounted on an upper end of the engine block 3, and a head cover 5 is mounted on an upper end of the cylinder head 4. Thus, the lower crankcase 2, the engine block 3, the cylinder head 4, and the head cover 5 are integrally connected together. The lower crankcase 2, the engine block 3, and the cylinder head 4 are formed by die casting of aluminum or aluminum alloy.

As shown in Figure 2, the crankshaft 6 is connected through connecting rods (not shown) to pistons (not shown) vertically reciprocatably fitted in cylinders 7 (see Fig. 3) of the engine block 3, so that the crankshaft 6 is rotationally driven by vertical movement of the pistons.

The cylinder head 4 is provided with intake valves and exhaust valves (both not shown). Valve operating cams (not shown) are located over the intake valves and the exhaust valves on the extensions thereof. Camshafts 9 integral with the valve operating cams are rotatably supported between the cylinder head 4 and a cam holder (not shown).

A cam chain storing chamber 10 for storing an endless chain 13 to be hereinafter described is defined at a laterally central portion between the right and left cylinders 7 in the engine block 3. A drive sprocket 11 is integrally formed on the crankshaft 6 at a central portion thereof, and cam sprockets 12 each having teeth twice in number that of the drive sprocket 11 is integrally mounted on the camshafts 9 at their central portions. The endless chain 13 is wound around the drive sprocket 11 and the cam sprockets 12 in the cam chain storing chamber 10. Accordingly, two revolutions of the crankshaft 6 bring about one revolution of the cam sprockets 12 and the valve operating cams.

A chain guide 14 is provided in the cam chain storing chamber 10 on the front side of a vehicular body (i.e., on the left side as viewed in Figure 1 where exhaust ports are provided). A cam chain tensioner device 15 is provided in the cam chain storing chamber 10 on the rear side of the vehicular body (i.e., on the right side as viewed in Figure

1 where intake ports are provided), and a chain guide 16 is provided also on the upper side of the cam sprockets 12. The hollow cam chain storing chamber 10 comprises a cooling water passage.

The cam chain tensioner device 15 includes a tensioner body 17 formed with a mounting base portion 18. A pivot pin 19 is integrally fitted with the mounting base portion 18 of the tensioner body 17. The pivot pin 19 is pivotally supported between the lower crankcase 2 and the engine block 3. A tensioner lifter 20 is provided on the rear side of the tensioner body 17 at a position somewhat higher than the center of the tensioner body 17. The tensioner lifter 20 has a rod 21 engaging at its tip with a recess 17a formed on a rear surface of the tensioner body 17. The tensioner lifter 20 is supported in a tensioner lifter supporting hole 22 formed through a rear wall of the engine block 3. The hole 22 comprises a cooling water communicating hole. The rod 21 of the tensioner lifter 20 is driven by a spring, hydraulic pressure, etc. to forward push the tensioner body 17 regardless of pivotal movement of the tensioner body 17, thereby maintaining a substantially constant tensile condition to the endless chain 13.

As shown in Figure 7, a mold for casting the engine block 3 is composed of a lower or front outer mold 23 for defining the shape of a front lower inclined surface of the engine block 3, a upper or rear outer mold 24 for defining the shape of a rear upper inclined surface of the engine block 3 on the side where the cam chain tensioner device 15 is provided, a left outer mold 25 for defining the shape of a left surface of the engine block 3 (see Figure 4 showing a front elevation of the engine block 3, so that the left outer mold 25 is shown on the right-hand side as viewed in Figure 4), a right outer mold 26 for defining the shape of a right surface of the engine block 3 (see Figure 4), an upper inner mold 27 for defining the shape of an upper surface of the engine block 3 and retaining cylinder liners 8, and a lower inner mold 28 for defining the shape of a lower surface of the engine block 3.

As shown in Figure 6, the upper inner mold 27 has right and left liner retaining projections 29 projecting downward so as to retain the cylinder liners 8 in the right and left cylinders 7 and close the bottom surfaces of the cylinder liners 8. As shown in Figure 7, the upper inner mold 27 is integrally formed with a cam chain storing chamber upper inner mold 30 disposed intermediate of the right and left liner retaining projections 29, for defining an upper portion of an inner surface of the tensioner lifter supporting hole 22.

As shown in Figure 7, the lower inner mold 28 is formed with a cam chain storing chamber lower inner mold 31 opposed to the cam chain storing

chamber upper inner mold 30 of the upper inner mold 27, for defining a lower portion of the inner surface of the tensioner lifter supporting hole 22. The lower inner mold 28 is further formed with an upper projection 32 projecting upward from an inner opening edge upper portion 22a of the tensioner lifter supporting hole 22 facing the cam chain storing chamber 10.

The upper or rear outer mold 24 is formed with a lower projection 33 projecting downward from an outer opening edge lower portion 22b of the tensioner lifter supporting hole 22 facing the cam chain storing chamber 10.

The cam chain storing chamber upper inner mold 30 of the upper inner mold 27 and the cam chain storing chamber lower inner mold 31 of the lower inner mold 28 are so formed as to contact together through a bent parting surface 34 inclined upward toward the rear side gradually at a front portion and steeply at a rear portion.

In this preferred embodiment shown in Figures 1 to 7, the lower or front outer mold 23, the upper or rear outer mold 24, the left outer mold 25, the right outer mold 26, the upper inner mold 27, and the lower inner mold 28 are jointed together at their mating faces, and such a jointed mold is set in a die casting apparatus (not shown). Then, the die casting apparatus is operated to pour a molten metal into the mold under pressure, thus obtaining a die casting.

In the engine block 3 thus cast, the cam chain storing chamber 10 is formed without the need of any machining. In particular, a wall thickness t of a portion for defining the tensioner lifter supporting hole 22 facing the cam chain storing chamber 10 is made smaller than a wall thickness T of a thick-walled peripheral wall of the tensioner lifter supporting hole 22 by the upper projection 32 and the lower projection 33. Furthermore, the wall thickness T of the peripheral wall of the tensioner lifter supporting hole 22 is set to a thickness enough to bear against an external force due to vibration or the like applied to the cam chain tensioner device 15. Accordingly, the amount of the molten metal to be required can be minimized to thereby reduce a material cost.

Accordingly, the amount of cutting of the wall of the tensioner lifter supporting hole 22 can be greatly reduced with the result that a working time can be greatly reduced to thereby greatly improve the productivity.

Further, no core that must be broken every time of casting is required to thereby simplify pretreatment and posttreatment of casting, thus contributing to a cost reduction also in this respect.

As another preferred embodiment shown in Figure 8, a recess 35 may be formed on the cam chain storing chamber upper inner mold 30 at a

position adjacent to an upper portion 34a of the bent parting surface 34 and facing the cam chain storing chamber 10. With this structure, a vibration stop for suppressing lateral vibration of the tensioner body 17 can be formed in the cam chain storing chamber 10.

Further, the shape of the bent parting surface 34 may be modified as shown by a broken line in Figure 8 to change the position of the recess 35.

A preferred embodiment of the present invention will now be described with reference to Figures 10 to 15.

In an overhead valve operating cam type of two-cylinder four-cycle internal combustion engine 101 to be mounted on a motorcycle (not shown), a crankshaft 107 is rotatably supported through sliding bearings 106, see Fig. 11, between a lower crankcase 102 and an engine block 103 as an integrated upper crankcase and cylinder block. Thus, a crankcase of the engine 101 is parted into the lower crankcase 102 and the upper crankcase. A cylinder head 104 is mounted on an upper end of the engine block 103, and a head cover 105 is mounted on an upper end of the cylinder head 104. Thus, the lower crankcase 102, the engine block 103, the cylinder head 104, and the head cover 105 are integrally connected together.

As shown in Fig. 11, the crankshaft 107 is connected through connecting rods 110 to pistons 109 vertically reciprocatably fitted in cylinders 108 of the engine block 103, so that the crankshaft 107 is rotationally driven by vertical movement of the pistons 109.

The cylinder head 104 is provided with intake valves 111 and exhaust valves (not shown). Valve operating cams 112 are located over the intake valves 111 and the exhaust valves on the extensions thereof. Camshafts 113 integral with the valve operating cams 112 are rotatably supported between the cylinder head 104 and a cam holder 132.

A sprocket 114 is integrally formed on the crankshaft 107 at a central portion thereof, and cam sprockets 115 each having teeth twice in number that of the sprocket 114 is integrally mounted on the camshafts 113 at their central portions. An endless chain 116 is wound around the sprocket 114 and the cam sprockets 115. Accordingly, two revolutions of the crankshaft 107 bring about one revolution of the cam sprockets 115 and the valve operating cams 112.

A cam chain storing chamber 117 is defined in the engine block 103 and the cylinder head 104 at a position between the right and left cylinders 108. A chain guide 118 is provided in the cam chain storing chamber 117 on the front side of a vehicular body (i.e., on the side of exhaust ports). A cam chain tensioner device 120 is provided in the cam chain storing chamber 117 on the rear side of the

vehicular body (i.e., on the side of intake ports), and a chain guide 119 is provided also on the upper side of the cam sprockets 115.

The cam chain tensioner device 120 includes a tensioner body 123 consisting of a steel strip 121 and a rubber cushion 122 integrally bonded to a front surface and a lower end portion of the steel strip 121. A steel pivot, pin 125 is integrally fitted with a mounting base portion 124 of the tensioner body 123. Further, a guide member 126 formed of a Teflon resin is integrally laminated on a front surface of the rubber cushion 122 which the endless chain 116 is in contact with. An upper half portion 126a of the guide member 126 is formed with a groove.

A lifter 128 is provided on the rear side of the tensioner body 123 at a position somewhat higher than the center of the tensioner body 123. The lifter 128 has a rod 129 engaging at its tip with a recess 127 formed on a rear surface of the tensioner body 123. The recess 127 has a width substantially equal to the diameter of the rod 129. The rod 129 of the lifter 128 is driven by a spring, hydraulic pressure, etc. to forward push the tensioner body 123 regardless of pivotal movement of the tensioner body 123, thereby maintaining a substantially constant tensile condition to the endless chain 116.

The pivot pin 125 integral with the tensioner body 123 is pivotally engaged at its opposite ends with recesses 130 formed on the engine block 103, and is held between the recesses 130 and the lower crankcase 102. A base portion 122a of the rubber cushion 122 at the mounting base portion 124 of the tensioner body 123 is held between right and left inner wall surfaces 117a of the cam chain storing chamber 117.

The operation of the above preferred embodiment shown in Figures 10 to 15 will now be described. When the four-cycle internal combustion engine 101 starts operating, rotation of the crankshaft 107 is transmitted through the sprocket 114, the endless chain 116, the cam sprockets 115, and the camshafts 113 to the valve operating cams 112 with the speed of the rotation reduced to one half. Accordingly, slippers 131 mounted on the tops of the intake valves 111 and the exhaust valves are pushed downward by the valve operating cams 112 in concert with vertical movement of the pistons 109, thereby intermittently opening the intake valves 111 and the exhaust valves.

In such an intermittent opening operation of the intake valves 111 and the exhaust valves, a load applied to the camshafts 113 is periodically increased to result in an increase in tension of the endless chain 116. Accordingly, the tensile condition of the endless chain 116 periodically changes. However, the tensioner body 123 is push-

ed forward, by the lifter 128 to prevent longitudinal vibration of the endless chain 116.

Furthermore, even when a lateral force is generated in the endless chain 116 to cause lateral vibration, the lateral vibration of the endless chain 116 can be reliably suppressed for the following reason. That is, the endless chain 116 is fitted in the groove 126a of the guide member 126 of the tensioner body 123. Further, the tip of the rod 129 of the lifter 128 is fitted in the recess 127 of the tensioner body 123, and both ends of the base portion 122a of the rubber cushion 122 at the mounting base portion 124 of the tensioner body 123 are held by the right and left inner wall surfaces 117a of the cam chain storing chamber 117, thereby elastically restrict lateral movement of the tensioner body 123.

The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.

Claims

1. In a mold for casting a laterally central portion of an engine block of a multicylinder in-line internal combustion engine having a plurality of cylinders tilted in a longitudinal direction perpendicular to a line of arrangement of said cylinders, a hollow chamber defined between said cylinders adjacent to each other and extending in an axial direction of said cylinders, a hole formed through a wall of said hollow chamber at an upper side portion thereof so as to be inclined downward toward a line connecting axial centers of said cylinders, a crankshaft extending horizontally in a lateral direction parallel to said line of arrangement of said cylinders, and a crankcase parted into an upper crankcase and a lower crankcase along a plane in which a center line of said crankshaft lies, said crankshaft being rotatably supported in said plane between said upper crankcase and said lower crankcase, said upper crankcase being integrated with a cylinder block to form said engine block, said mold comprising:

a lower inner mold so formed as to be released downward in a direction perpendicular to said plane, said lower inner mold having a projection projecting upward from an upper portion of an inner opening edge of said hole opening into said hollow chamber to form an upper surface of said hole;

an upper inner mold so formed as to be released upward in said axial direction of said

cylinders;

an upper outer mold so formed as to be released upward in said direction perpendicular to said plane, for forming an upper inclined surface of said engine block, said upper outer mold having a projection projecting downward from a lower portion of an outer opening edge of said hole to form a lower surface of said hole; and

a lower outer mold so formed as to be released outward along said plane, for forming a lower inclined surface of said engine block.

2. A mold for casting a laterally central portion of an engine block according to claim 1, wherein said hollow chamber comprises a chain storing chamber for driving overhead valve operating camshafts, and said hole comprises a tensioner lifter supporting hole.
3. A mold for casting a laterally central portion of an engine block according to claim 1, wherein said hollow chamber comprises a cooling water passage, and said hole comprises a cooling water communicating hole.
4. A mold for casting a laterally central portion of an engine block according to claim 1, wherein said upper inner mold includes right and left cylinder liner retaining projections.
5. A mold for casting a laterally central portion of an engine block according to claim 4, wherein said right and left cylinder liner retaining projections project downward from said upper inner mold so as to retain a pair of cylinder liners in a right and left cylinder and close the bottom surfaces of said cylinder liners.

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Fig. 1

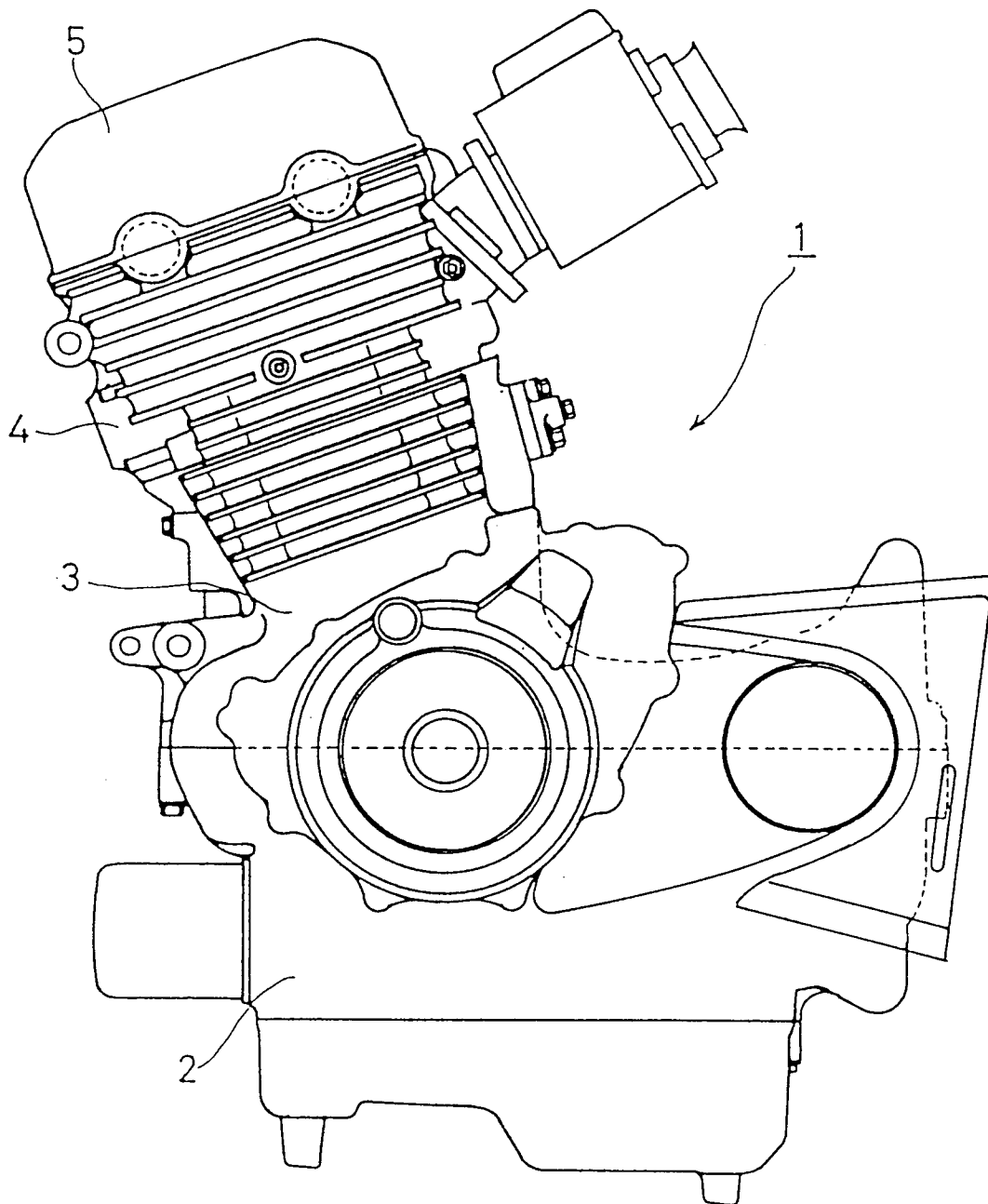
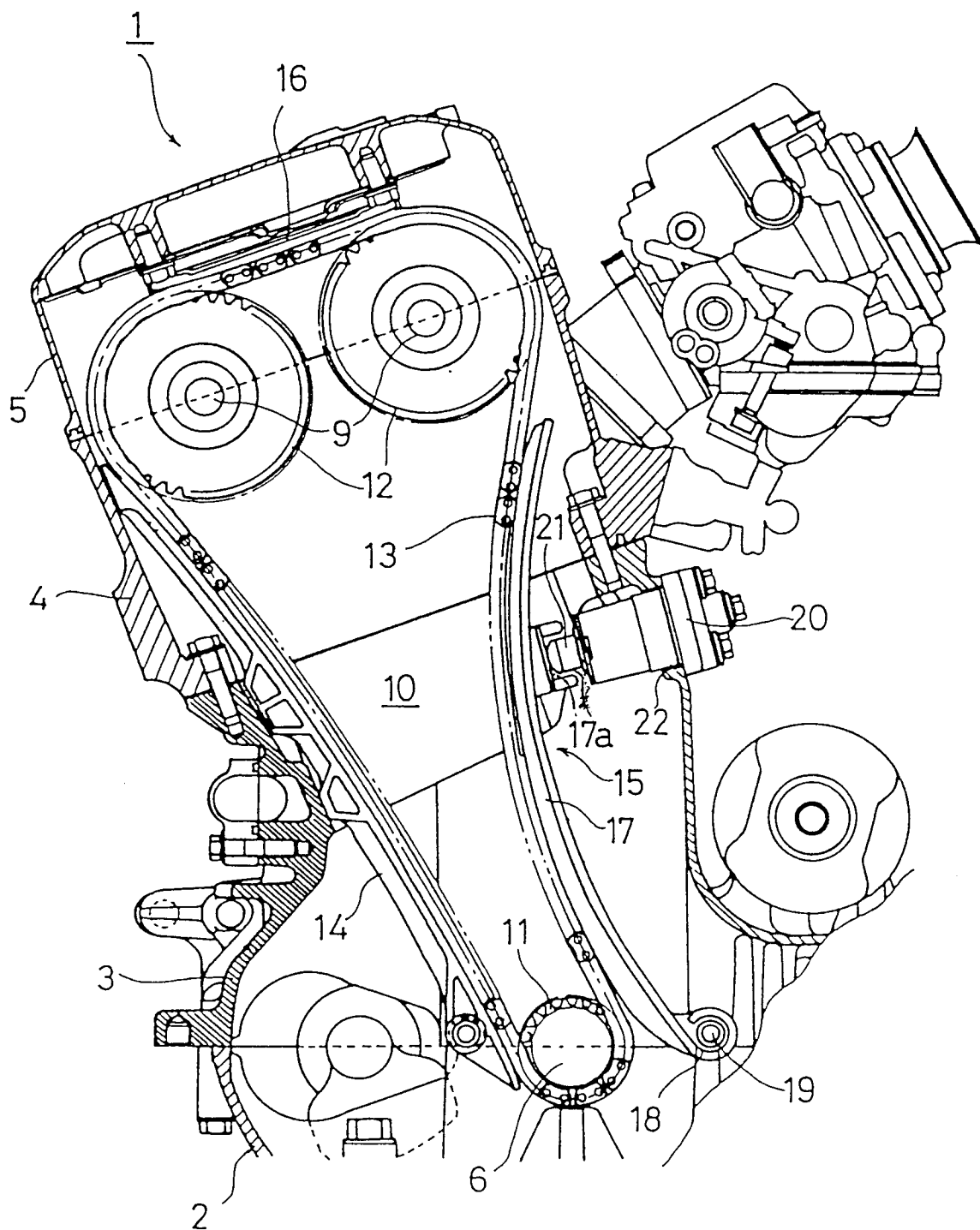


Fig. 2



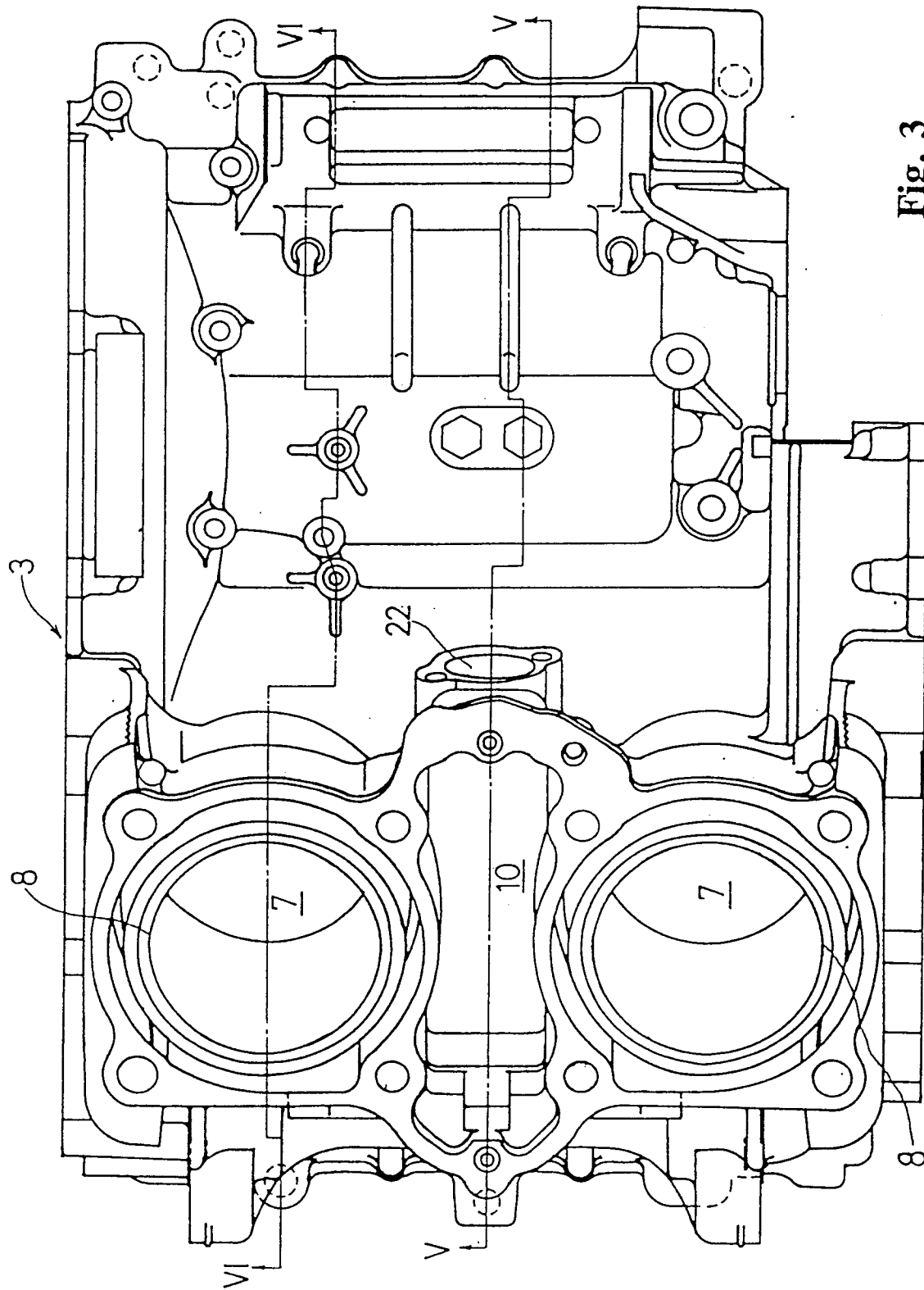


Fig. 3

Fig. 4

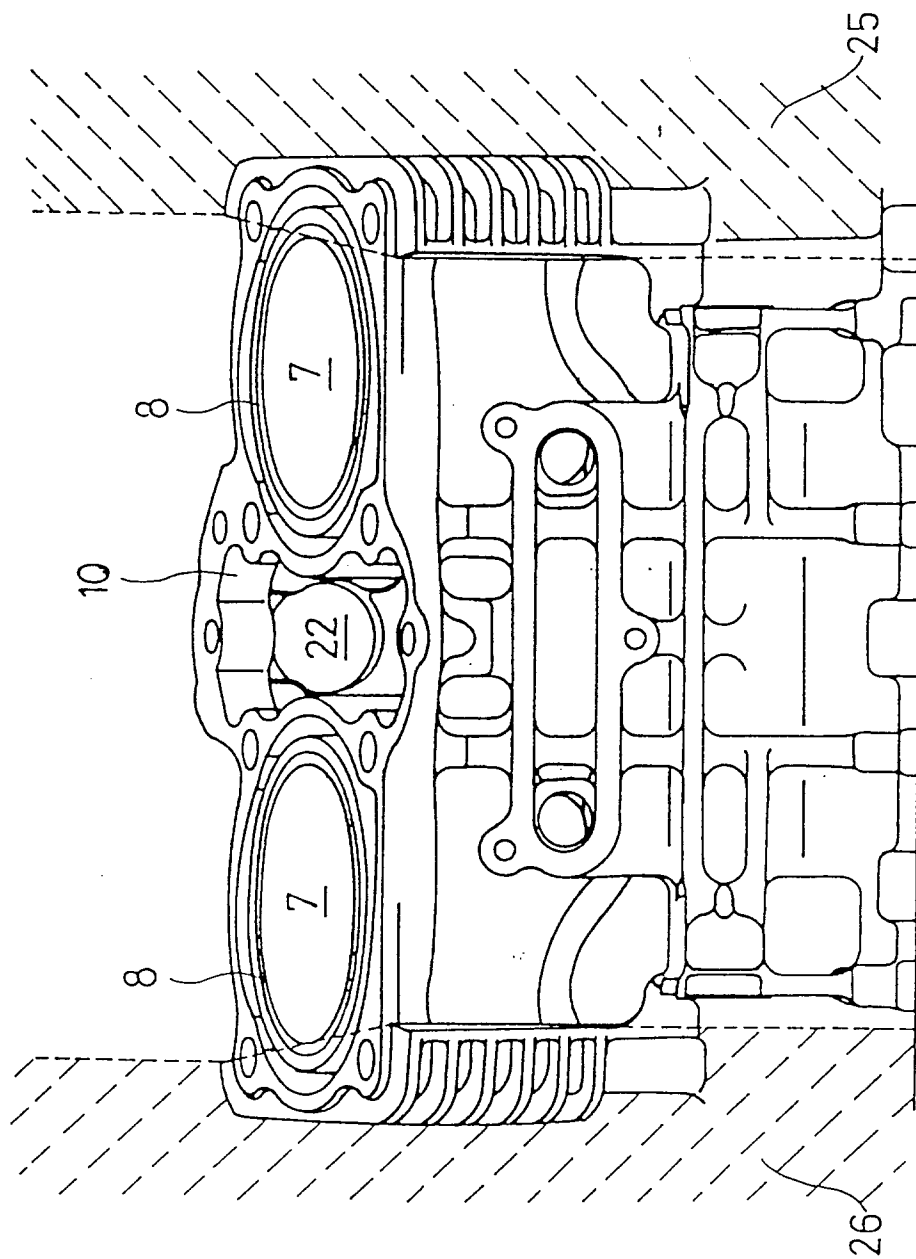


Fig. 5

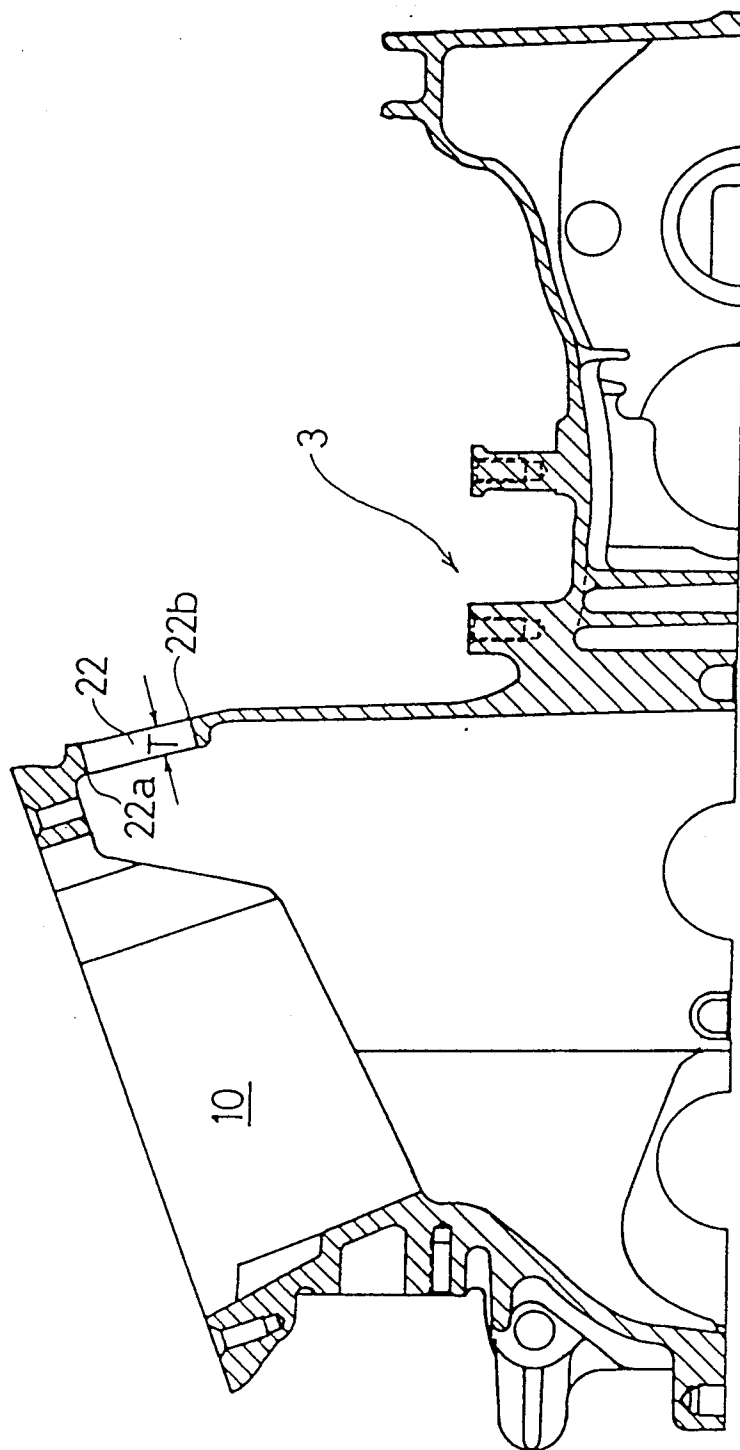
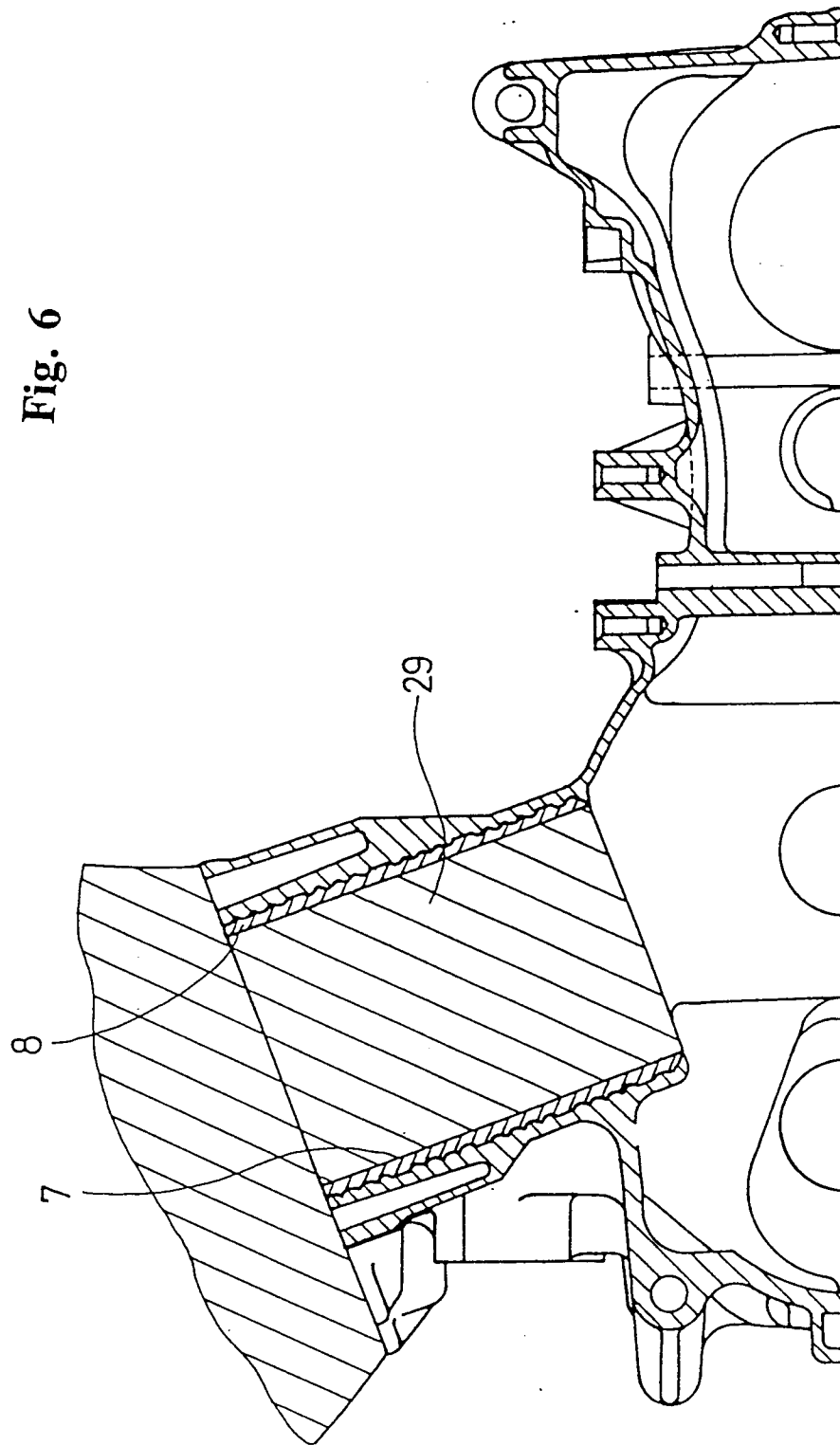


Fig. 6



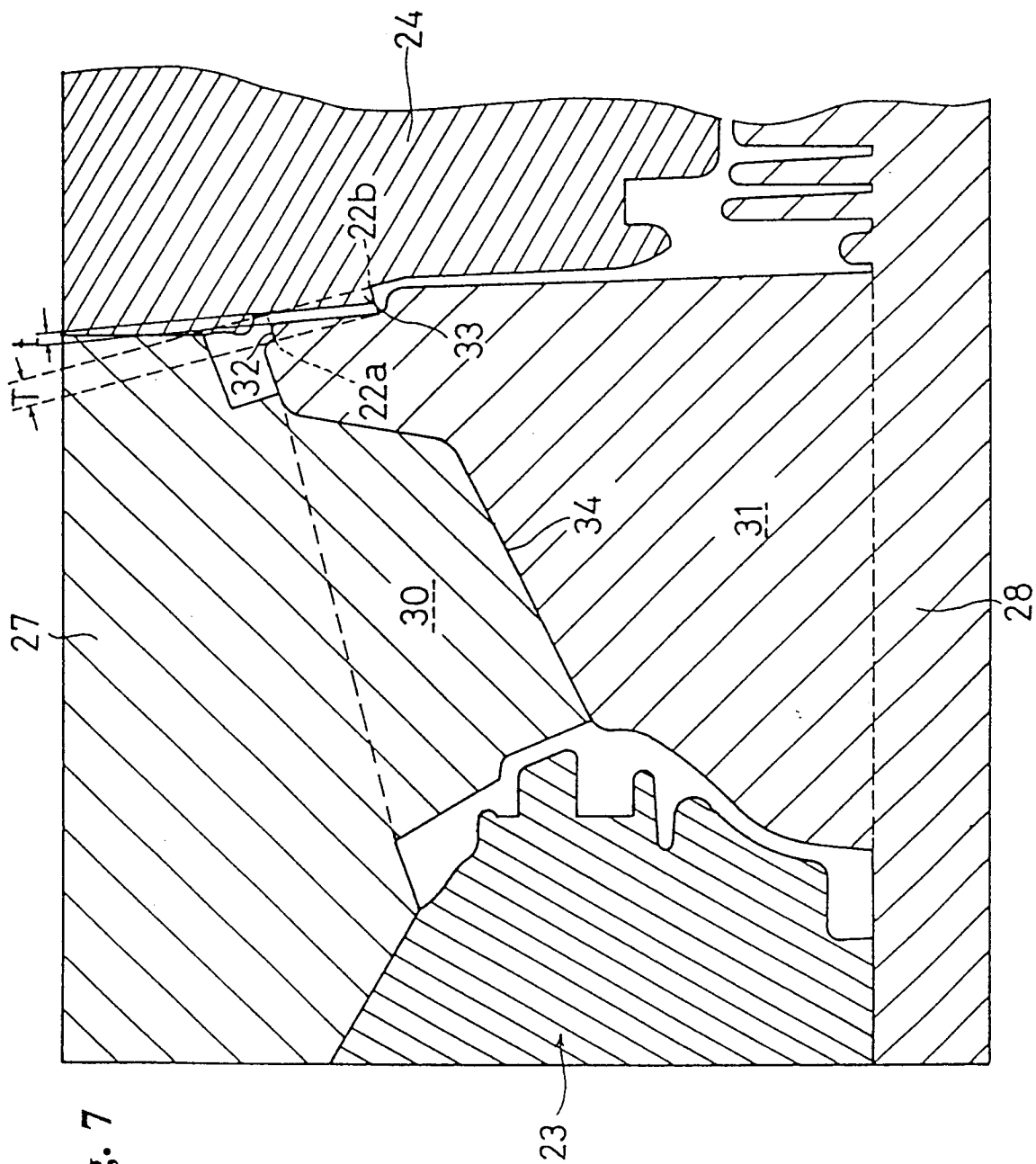


Fig. 7

Fig. 8

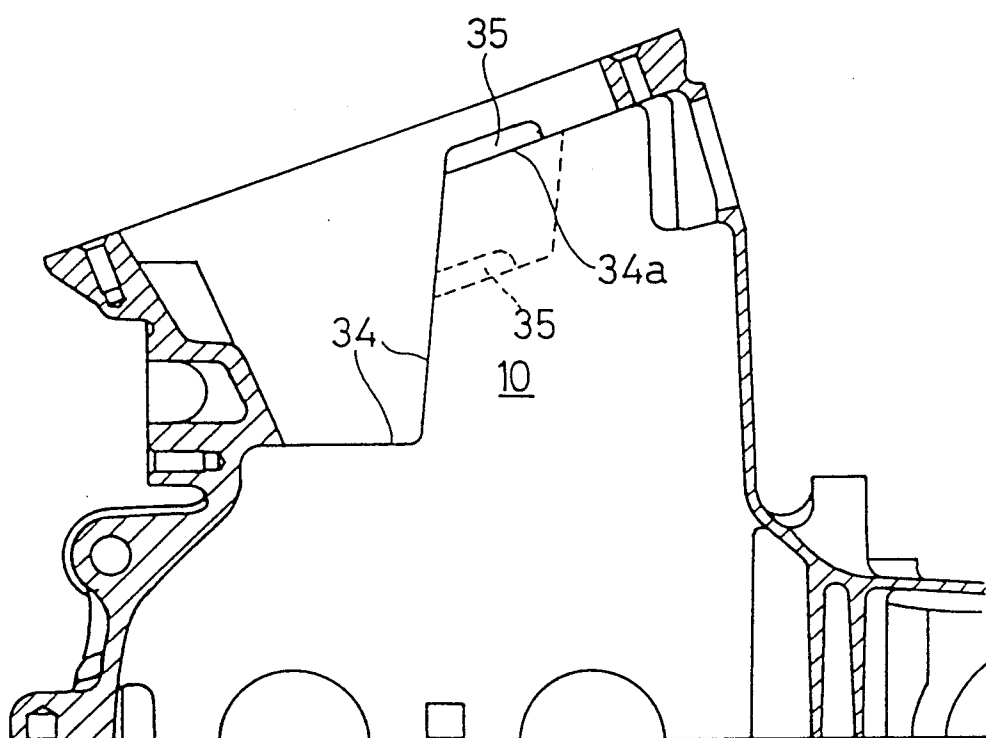


Fig. 9 **PRIOR ART**

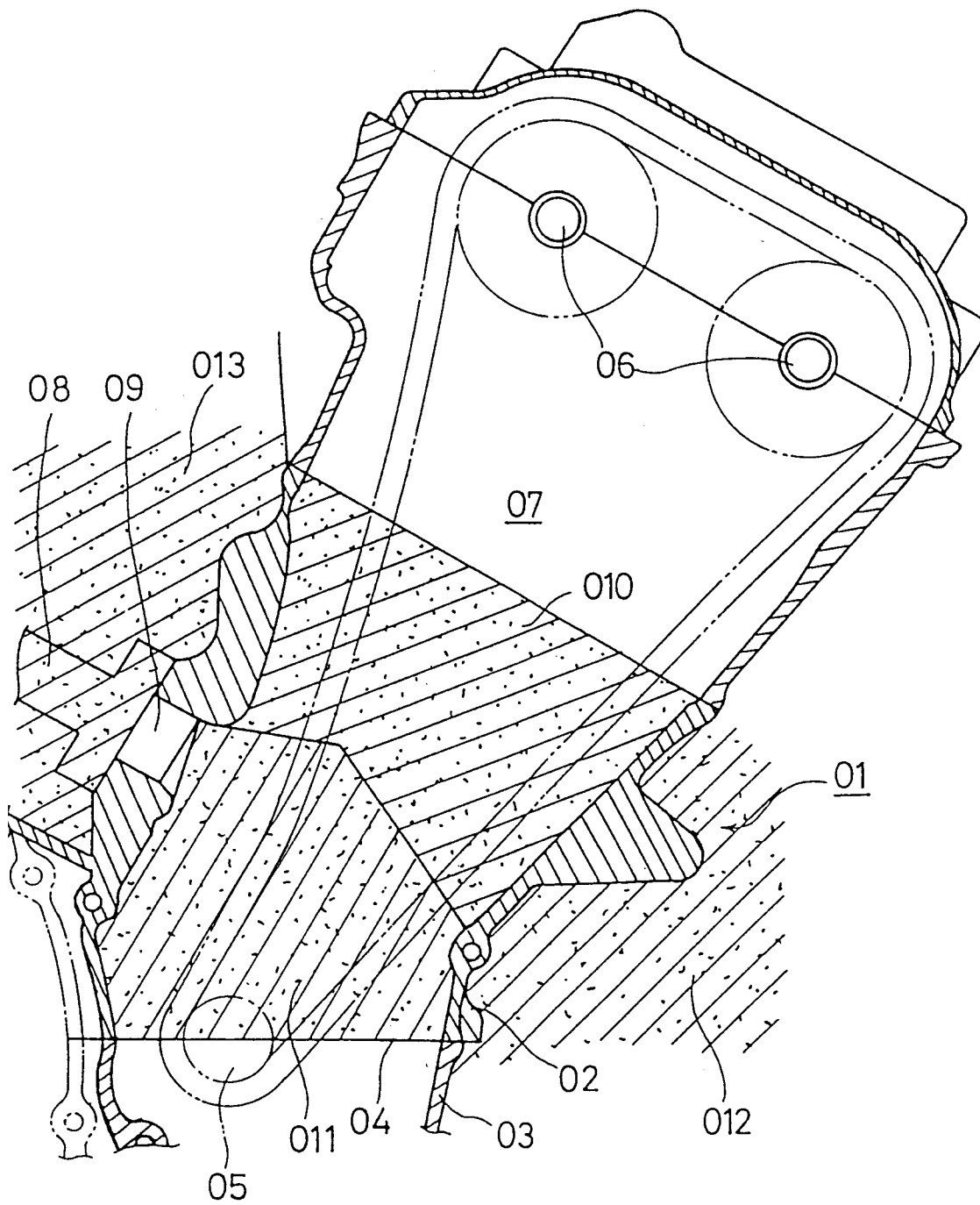


Fig. 10

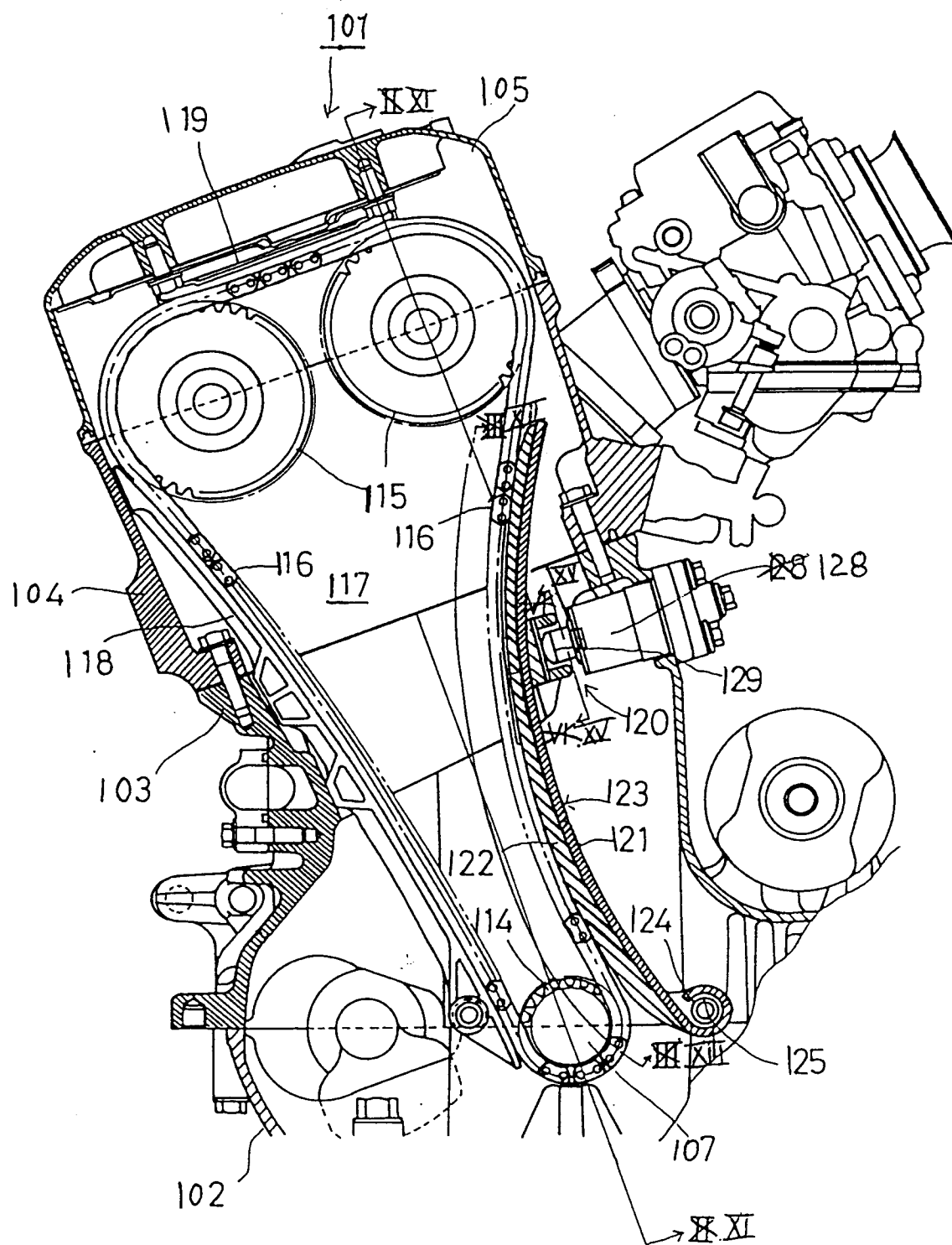


Fig. 11

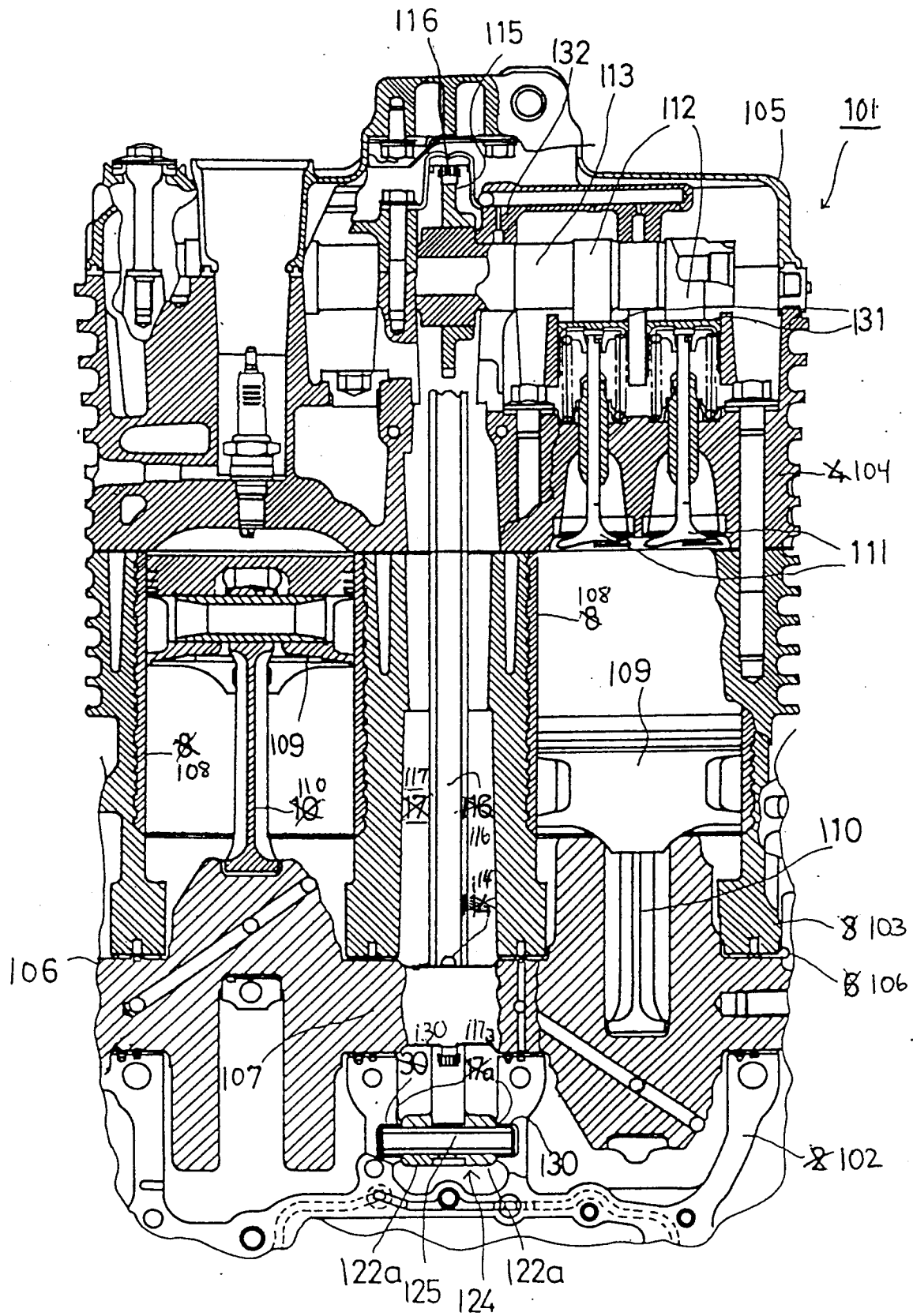


Fig. 12

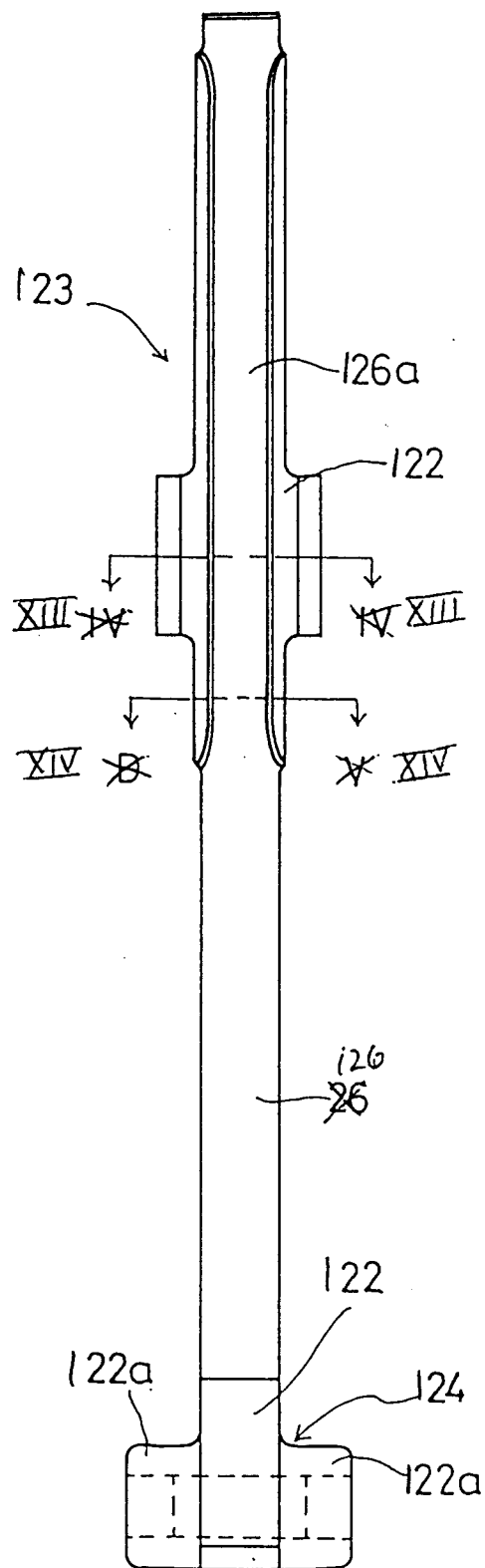


Fig. 13

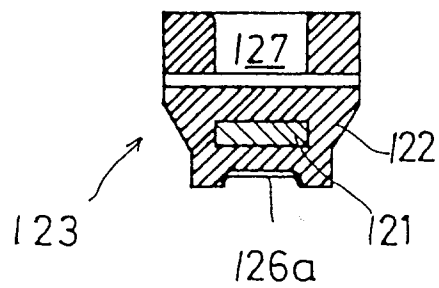


Fig. 14

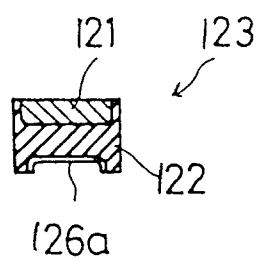
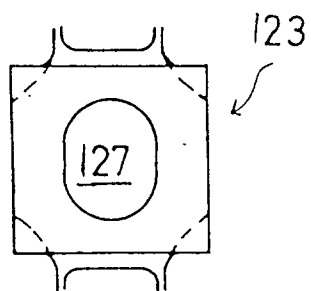


Fig. 15





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 11 3530

DOCUMENTS CONSIDERED TO BE RELEVANT		
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
A	US-A-4 757 857 (HORST HENKEL) ---	
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A	DE-C-84 304 (MASCHINENFABRIK ESSLINGEN) -----	
The present search report has been drawn up for all claims		
Place of search THE HAGUE		Date of completion of the search 4 January 1995
Examiner Hodiamont, S		
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document		