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(54) **INTERMEDIATE PIECE FOR CYLINDER HEAD COVER**

ZWISCHENSTÜCK FÜR ZYLINDERKOPFDECKEL

PIÈCE INTERMÉDIAIRE POUR COUVERCLE DE CULASSE

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Description

Technical field of the invention

[0001] The present invention relates to an intermediate piece for connecting a cylinder head cover to a cylinder head of a piston engine, as defined in claim 1.

Background of the invention

[0002] In large piston engines, such as ship or power plant engines, each cylinder of the engine is provided with an own cylinder head. In four-stroke engines, the cylinder head comprises intake ports for introducing intake air into the cylinder and exhaust ports for discharging exhaust gas from the cylinder. Typically two intake valves and two exhaust valves are provided for opening and closing the intake ports and exhaust ports, respectively. The intake and exhaust valves can be commonly called as gas exchange valves. The gas exchange valves are usually mechanically or electro-hydraulically actuated. A combination of mechanical and hydraulic functions can also be used. A valve actuating mechanism for opening and closing the gas exchange valves is arranged at least partly above the cylinder head. A cylinder head cover arranged above the cylinder head protects the valve actuating mechanism.

[0003] JP3114554B2 and DE102016117619 A1 disclose intermediate pieces for connecting a cylinder head cover of a multi-cylinder piston engine to a cylinder head.

Summary of the invention

[0004] An object of the present invention is to provide an intermediate piece for connecting a cylinder head cover of a multi-cylinder piston engine to a cylinder head that closes an upper end of a single cylinder of the engine. The characterizing features of the intermediate piece according to the invention are given in claim 1.

[0005] The intermediate piece according to the invention comprises a first portion, which forms a closed perimeter and which is configured to radially encircle the stems of the gas exchange valves of the cylinder. The intermediate piece thus protects the exhaust system of the engine from oil leaks from a valve actuating mechanism.

[0006] According to the invention, the intermediate piece comprises a second portion, which has a fork-shaped profile and which is arranged perpendicular to the first portion and configured to radially encircle an exhaust pipe connected to the cylinder head. The second portion can serve different purposes.

[0007] According to the invention, the second portion is configured to seal a covering arranged around an exhaust manifold of the engine. According to an embodiment of the invention, the second portion is provided with a cooling medium chamber.

[0008] According to an embodiment of the invention,

the intermediate piece forms a passage for receiving a push rod of a valve actuating mechanism of a gas exchange valve. The intermediate piece can thus protect the valve actuating mechanism and for example prevent oil leaks.

[0009] A piston engine according to an embodiment of the invention comprises a plurality of cylinders, each cylinder of the engine being provided with a cylinder head, which closes the upper end of the cylinder, at least one gas exchange valve, a valve actuating mechanism for operating the gas exchange valve, and a cylinder head cover, which is arranged above the cylinder head and configured to accommodate at least part of the valve actuating mechanism. An intermediate piece defined above is arranged between the cylinder head and the cylinder head cover.

Brief description of the drawings

[0010] Embodiments of the invention are described below in more detail with reference to the accompanying drawings, in which

Fig. 1 shows an intermediate piece according to an embodiment of the invention arranged between a cylinder head and a cylinder head cover,

Fig. 2 shows an exploded view of the arrangement of figure 1,

Fig. 3 shows a cross-sectional view of the arrangement of figure 1,

Fig. 4 shows an intermediate piece according to an embodiment of the invention,

Fig. 5 shows a bottom view of the intermediate piece of figure 4,

Fig. 6 shows a top view of the intermediate piece of figure 4,

Fig. 7 shows a side view of the intermediate piece of figure 4,

Fig. 8 shows a cross-sectional view of the intermediate piece of figure 6 taken along line A-A,

Fig. 9 shows a cross-sectional view of the intermediate piece of figure 6 taken along line B-B, and

Fig. 10 shows a cross-sectional view of the intermediate piece of figure 7 taken along line C-C.

Description of embodiments of the invention

[0011] Figure 1 shows one cylinder 1 of a multi-cylinder piston engine. The engine is a large internal combustion

engine, such as a main or an auxiliary engine of a ship or an engine that is used at a power plant for producing electricity. In the embodiment of figure 1, the engine is a V-engine, which comprises two cylinder banks. The engine can comprise any reasonable number of cylinders 1. The cylinder 1 is formed by a cylinder liner 2, which is arranged at least partly inside an engine block. The upper end of the cylinder 1 is closed by a cylinder head 3. The expression "upper end" refers here to the top dead center end of the cylinder 1. The cylinder 1 does not need to be in a vertical position. In the embodiment of figure 1, the cylinder 1 is slightly inclined in relation to a vertical plane. Each cylinder 1 of the engine is provided with an own cylinder head 3. The cylinder head 3 is attached to the engine block by means of stud bolts 4. In the embodiment of the figures, the cylinder head 3 is attached to the engine block with four stud bolts 4. In the embodiment of the figures, the cylinder head 3 is a one-piece part.

[0012] More details of the arrangement of figure 1 can be seen in figures 2 and 3. The cylinder head 3 comprises at least one intake port 5 and at least one exhaust port 6. Via the intake port 5, intake air is introduced into a combustion chamber 7, which is delimited by the cylinder liner 2 and the cylinder head 3. Via the exhaust port 6, exhaust gas is conveyed out of the combustion chamber 7. An intake duct 8 is connected to the intake port 5 and an exhaust duct 9 is connected to the exhaust port 6. Both the intake duct 8 and the exhaust duct 9 are partly inside the cylinder head 3. The cylinder 1 is provided with at least one intake valve 29 and at least one exhaust valve 30. The intake and exhaust valves are hereinafter also referred to as gas exchange valves. The intake valve 29 is used for opening and closing fluid communication between the intake duct 8 and the combustion chamber 7. The exhaust valve 30 is used for opening and closing fluid communication between the combustion chamber 7 and the exhaust duct 9.

[0013] An exhaust pipe 20 is connected to the exhaust duct 9. The exhaust pipe 20 is a separate part that is attached to the cylinder head 3. The exhaust pipe 20 is connected to an exhaust manifold 22a, which receives exhaust gas from several cylinders 3 of the engine. The exhaust pipe 20 can be an integral part of the exhaust manifold 22a. A covering 21 is arranged around the exhaust manifold 22a. The covering 21 functions as thermal insulation. The covering 21 also absorbs noise. The exhaust manifold 22a receives exhaust gas from the cylinders 1 of one bank of the engine. The engine is further provided with a second exhaust manifold 22b, which receives exhaust gas from the cylinders of another bank of the engine. Also the second exhaust manifold 22b is arranged inside the covering 21.

[0014] The engine is provided with an actuating mechanism for operating the gas exchange valves 29, 30. The gas exchange valves 29, 30 are closed and kept closed by means of valve springs 10. In the embodiment of the figures, the valve springs 10 are helical springs. However, also air springs could be used. The gas exchange

valves are cam-operated. However, in the embodiment of the figures, the valve actuating mechanism is partly hydraulic. Each cylinder of the engine is provided with an intake cam 11 and an exhaust cam for operating the gas exchange valves. A cam follower 12 converts the rotating movement of the cam 11 into a linear movement. The movement is transmitted by means of a push rod 13 to a first piston 33. The first piston 33 pressurizes hydraulic fluid, which is transmitted to the intake valves 29. The hydraulic pressure is exerted on a second piston that is connected to the intake valves 29 for pushing the intake valves 29 in the opening direction. The exhaust valves 30 are operated in a similar way. In the embodiment of the figures, the valve actuating mechanism thus comprises a cam 11, cam follower 12, push rod 13, first piston 33, second piston and valve spring 10. The valve actuating mechanism could also be completely mechanical. The movement of the pushrods 13 could thus be transmitted to the gas exchange valves 29, 30 by means of rocker arms. The valve actuating mechanism could also be configured to allow variable valve timing by means of hydraulic fluid.

[0015] The cylinder 1 is provided with a cylinder head cover 16. The cylinder head cover 16 is arranged above the cylinder head 3. The purpose of the cylinder head cover 16 is to accommodate and protect the valve actuating mechanism. In the embodiment of the figures, the cylinder head cover 16 comprises a lower part 17 and an upper part 18. The lower part 17 forms a space for accommodating parts of the valve actuating mechanism, such as the pistons 33. In case of a mechanical valve actuating mechanism, the rocker arms would be located within the lower part 17. The push rods 13 protrude into the lower part 17 of the cylinder head cover 16. The upper part 18 is a cap, which closes the upper end of the lower part 17. The separate cap 18 allows easier access to the valve actuating mechanism inside the cylinder head cover 16. However, the cylinder head cover 16 could also be a one-piece part. The cylinder head cover 16 is attached to the cylinder head 3 by means of bolts. The bolts are separate from the stud bolts 4 that are used for fastening the cylinder head 3 to the engine block 26. The cylinder head cover 16 can thus be detached from the cylinder head 3 without detaching the cylinder head 3 from the engine block 26. The cylinder head cover 16 can be made of cast iron or cast steel or some other suitable alloy.

[0016] An intermediate piece 19 is arranged between the cylinder head 3 and the cylinder head cover 16. The intermediate piece 19 connects the cylinder head cover 16 to the cylinder head 3. The cylinder head cover 16 is thus supported against the cylinder head 3 via the intermediate piece 19. The intermediate piece 19 comprises a first portion 19a. The first portion 19a forms a closed perimeter. When the intermediate piece 19 is connected to the cylinder head 3, the first portion 19a radially encircles the stems 31, 32 of the gas exchange valves 29, 30. The first portion 19a is thus a sleeve-like part that is ar-

ranged around the gas exchange valves 29, 30. The intermediate piece 19 is attached to the cylinder head 3 by means of bolts. The bolts are separate from the stud bolts that are used for attaching the cylinder head 3 to the engine block 26. The intermediate piece 19 can thus be detached from the engine block 26 without detaching the cylinder head 3 from the engine block 26. In the embodiment of the figures, the same bolts are used for attaching both the intermediate piece 19 and the cylinder head cover 16 to the cylinder head 3. However, also separate bolts could be used. In the embodiment of the figures, the stud bolts 4 are outside the perimeter of the first portion 19a of the intermediate piece 19.

[0017] The intermediate piece 19 further comprises a second portion 19b. The second portion 19b is fork-shaped. The second portion 19b is perpendicular to the first portion 19a. Seen in the axial direction of the engine, the intermediate piece 19 is L-shaped. The first portion 19a is configured to be parallel with the upper surface of the cylinder head 3. The second portion 19b extends downwards from the first portion 19a. The second portion 19b is thus parallel with a side surface of the cylinder head 3.

[0018] Details of the intermediate piece 19 can be best seen in figures 4 to 10. The second portion 19b resembles letter U, which opens downwards. The second portion 19b has a first side 19c, a second side 19d and an upper edge 19e. The bottom side of the second portion 19b is open. The second portion 19b is configured to encircle from three sides the exhaust pipe 20 that is connected to the cylinder head 3. An air gap is formed between the exhaust pipe 20 and the second portion 19b of the intermediate piece 19. This prevents heat conduction from the exhaust pipe 20 to the intermediate piece 19.

[0019] The sides 19c, 19d and the upper edge 19e of the second portion 19b of the intermediate piece 19 are provided with grooves 27. The grooves 27 are configured to receive the covering 21 so that the covering 21 is sealed against the intermediate piece 19. However, small gaps are provided between the covering 21 and the grooves 27 for preventing vibrations of the cylinder heads 3 from being transmitted to the covering 21.

[0020] The intermediate piece 19 forms a passage 24 for receiving a push rod 13 of a valve actuating mechanism. In the embodiment of the figures, the valve actuating mechanisms of both the intake valves 29 and the exhaust valves 30 are provided with pushrods 13. The intermediate piece 19 comprises passages for each of the pushrods 13. The passages 24 open into the space defined by the closed perimeter of the first portion 19a of the intermediate piece 19. A sleeve 25 is arranged inside the passage 24. The sleeve 25 forms a protective pipe for the push rod 13. The sleeve 25 prevents possible oil leaks from the valve actuating mechanism from becoming into contact with the exhaust pipe 20.

[0021] The second portion 19b is provided with a cooling medium chamber 23. Cooling medium, such as cooling water, can be circulated in the cooling medium cham-

ber 23. A cooling medium inlet 34 is arranged on the upper surface of the intermediate piece 19. A cooling medium outlet 35 is arranged on the lower surface of the intermediate piece 19. The cooling medium chamber 23 is divided into a first section 23a and a second section 23b. The first and the second sections 23a, 23b of the cooling medium chamber 23 are arranged adjacent to the passages 24 for the push rods 13. The cooling medium chamber 23 protects the push rods 13 of the valve actuating mechanism.

[0022] The intermediate piece 19 can be made of cast iron or cast steel. In the embodiment of the figures, the intermediate piece 19 is a one-piece part. However, the intermediate piece 19 could also be assembled from two or more parts.

[0023] It will be appreciated by a person skilled in the art that the invention is not limited to the embodiments described above, but may vary within the scope of the appended claims.

Claims

1. An intermediate piece (19) for connecting a cylinder head cover (16) of a multi-cylinder piston engine to a cylinder head (3) that closes an upper end of a single cylinder (1) of the engine, wherein the intermediate piece (19) comprises a first portion (19a), which forms a closed perimeter and which is configured to radially encircle the stems (31, 32) of the gas exchange valves (29, 30) of the cylinder (1), **characterized in that** the intermediate piece (19) comprises a second portion (19b), which has a fork-shaped profile and which is arranged perpendicular to the first portion (19a) and configured to radially encircle an exhaust pipe (20) connected to the cylinder head (3), and that the second portion (19b) is configured to seal a covering (21) arranged around an exhaust manifold (22a, 22b) of the engine.
2. An intermediate piece (19) according to claim 1, wherein the second portion (19b) is provided with a cooling medium chamber (23, 23a, 23b).
3. An intermediate piece (19) according to any of the preceding claims, wherein the intermediate piece (19) forms a passage (24) for receiving a push rod (13) of a valve actuating mechanism of a gas exchange valve (29, 30).
4. A piston engine comprising a plurality of cylinders (1), each cylinder (1) of the engine being provided with
 - a cylinder head (3), which closes the upper end of the cylinder (1),
 - at least one gas exchange valve (29, 30),
 - a valve actuating mechanism (11, 12, 13, 33)

for operating the gas exchange valve (29, 30),
and
- a cylinder head cover (16), which is arranged
above the cylinder head (3) and configured to
accommodate at least part of the valve actuating
mechanism (11, 12, 13, 33),

wherein an intermediate piece (19) according to any
of the preceding claims is arranged between the cyl-
inder head (3) and the cylinder head cover (16).

Patentansprüche

1. Zwischenstück (19) zum Verbinden eines Zylinder-
kopfdeckels (16) eines Mehrzylinderkolbenmotors
mit einem Zylinderkopf (3), der ein oberes Ende ei-
nes einzelnen Zylinders (1) des Motors schließt, wo-
bei das Zwischenstück (19) einen ersten Abschnitt
(19a) umfasst, der einen geschlossenen Umfang bil-
det und konfiguriert ist, um die Schäfte (31, 32) der
Gasaustauschventile (29, 30) des Zylinders (1) ra-
dial zu umschließen, **dadurch gekennzeichnet,**
dass das Zwischenstück (19) einen zweiten Ab-
schnitt (19b) umfasst, der ein gabelförmiges Profil
aufweist und der senkrecht zum ersten Abschnitt
(19a) angeordnet und konfiguriert ist, um ein mit dem
Zylinderkopf (3) verbundenes Auspuffrohr (20) radial
zu umschließen, und dass der zweite Abschnitt (19b)
konfiguriert ist, um eine Abdeckung (21) abzudich-
ten, die um einen Abgaskrümmers (22a, 22b) des Mo-
tors angeordnet ist.
2. Zwischenstück (19) nach Anspruch 1, wobei der
zweite Abschnitt (19b) mit einer Kühlmediumkam-
mer (23, 23a, 23b) versehen ist.
3. Zwischenstück (19) nach einem der vorhergehen-
den Ansprüche, wobei das Zwischenstück (19) ei-
nen Durchgang (24) zum Aufnehmen einer Schub-
stange (13) eines Ventilbetätigungsmechanismus
eines Gasaustauschventils (29, 30) bildet.
4. Kolbenmotor mit einer Vielzahl von Zylindern (1), wo-
bei jeder Zylinder (1) des Motors mit folgenden ver-
sehen ist
 - einen Zylinderkopf (3), der das obere Ende des
Zylinders (1) schließt,
 - mindestens ein Gasaustauschventil (29, 30),
 - einen Ventilbetätigungsmechanismus (11, 12,
13, 33) zum Betreiben des Gasaustauschventils
(29, 30) und
 - einen Zylinderkopfdeckel (16), der über dem
Zylinderkopf (3) angeordnet und konfiguriert ist,
um mindestens einen Teil des Ventilbetäti-
gungsmechanismus (11, 12, 13, 33) aufzuneh-
men, wobei ein Zwischenstück (19) gemäß ei-

nem der vorhergehenden Ansprüche zwischen
dem Zylinderkopf (3) und dem Zylinderkopfde-
ckel (16) angeordnet ist.

Revendications

1. Pièce intermédiaire (19) destinée à relier un couvre-
culasse (16) d'un moteur à pistons multicylindres à
une culasse (3) qui ferme une extrémité supérieure
d'un cylindre unique (1) du moteur, dans laquelle la
pièce intermédiaire (19) comprend une première
partie (19a), qui forme un périmètre fermé et qui est
conçue pour encercler radialement les tiges (31, 32)
des soupapes d'échange de gaz (29, 30) du cylindre
(1), **caractérisée en ce que** la pièce intermédiaire
(19) comprend une seconde partie (19b), qui a un
profil en forme de fourche et qui est agencée per-
pendiculairement à la première partie (19a) et con-
çue pour encercler radialement un tuyau d'échap-
pement (20) relié à la culasse (3), et **en ce que** la
seconde partie (19b) est conçue pour sceller un re-
vêtement (21) agencé autour d'un collecteur
d'échappement (22a, 22b) du moteur.
2. Pièce intermédiaire (19) selon la revendication 1,
dans laquelle la seconde partie (19b) est pourvue
d'une chambre d'agent de refroidissement (23, 23a,
23b).
3. Pièce intermédiaire (19) selon l'une quelconque des
revendications précédentes, dans laquelle la pièce
intermédiaire (19) forme un passage (24) destiné à
recevoir une tige de poussée (13) d'un mécanisme
d'actionnement de soupape d'une soupape d'échan-
ge de gaz (29, 30).
4. Moteur à pistons comprenant une pluralité de cylin-
dres (1), chaque cylindre (1) du moteur étant pourvu
 - d'une culasse (3), qui ferme l'extrémité supé-
rieure du cylindre (1),
 - d'au moins une soupape d'échange de gaz (29,
30),
 - d'un mécanisme d'actionnement de soupape
(11, 12, 13, 33) destiné à faire fonctionner la
soupape d'échange de gaz (29, 30), et
 - d'un couvre-culasse (16), qui est agencé au-
dessus de la culasse (3) et conçu pour loger au
moins une partie du mécanisme d'actionnement
de soupape (11, 12, 13, 33),

dans lequel une pièce intermédiaire (19) selon l'une
quelconque des revendications précédentes est
agencée entre la culasse (3) et le couvre-culasse
(16).

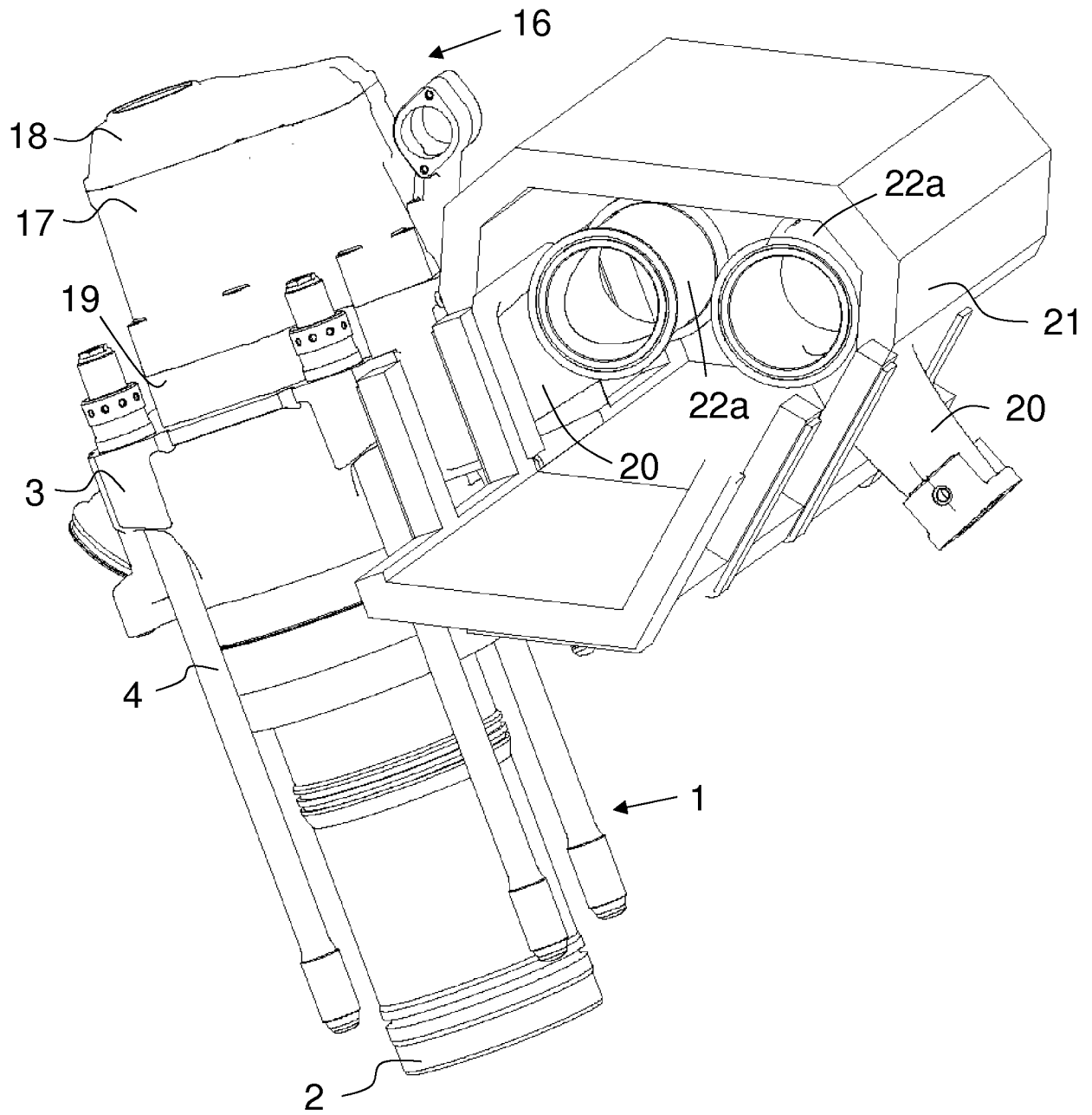


FIG. 1

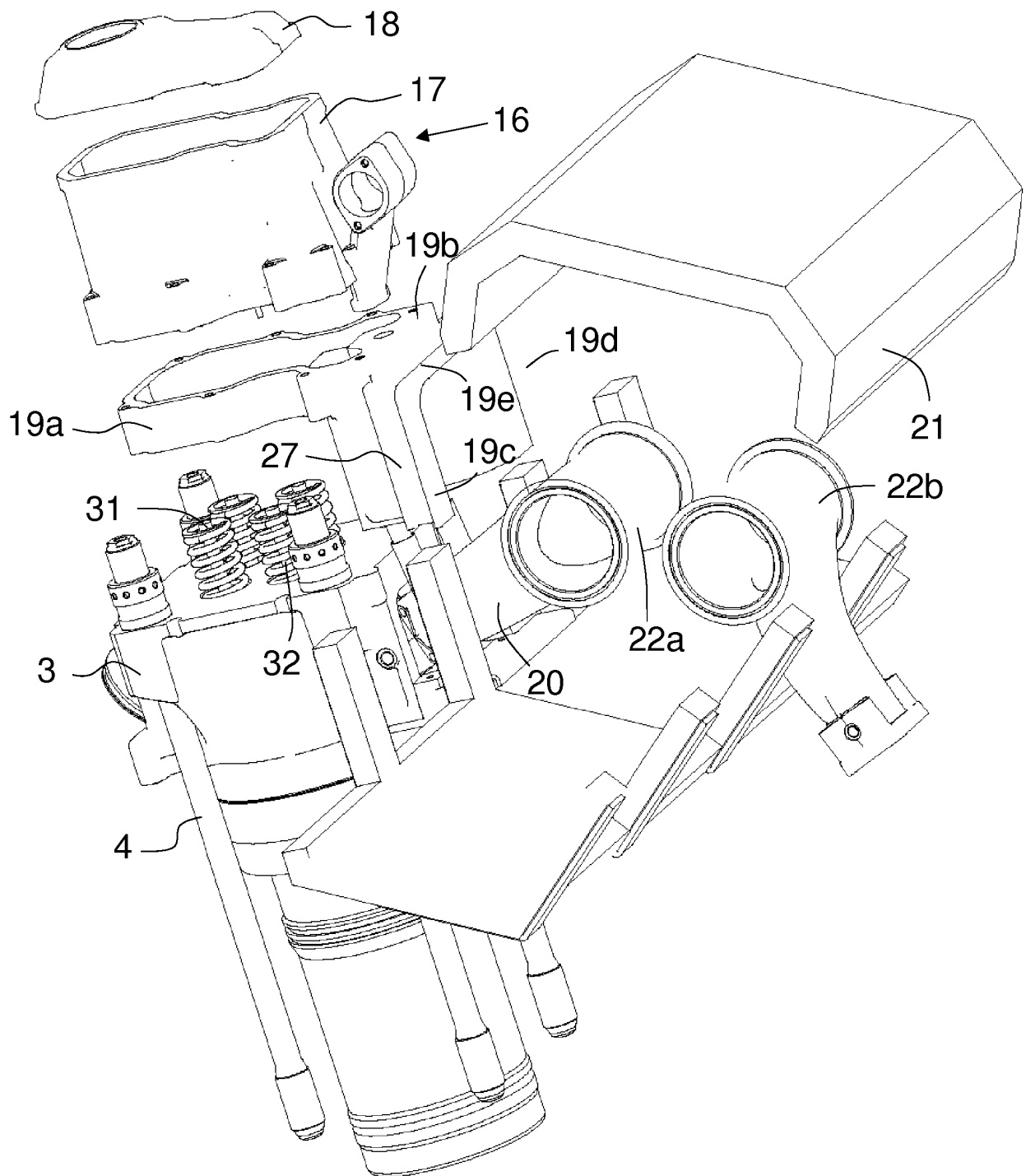


FIG. 2

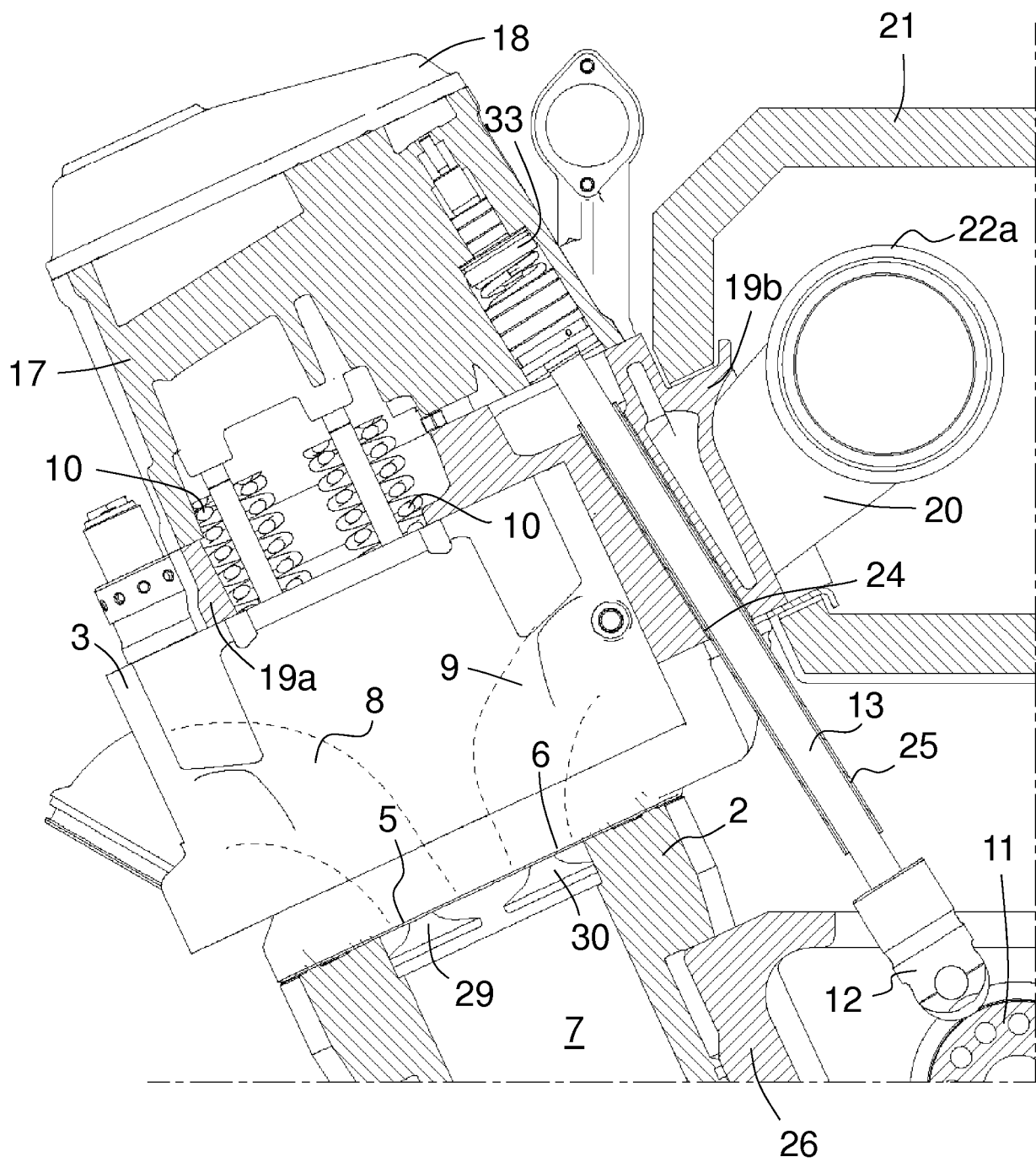


FIG. 3

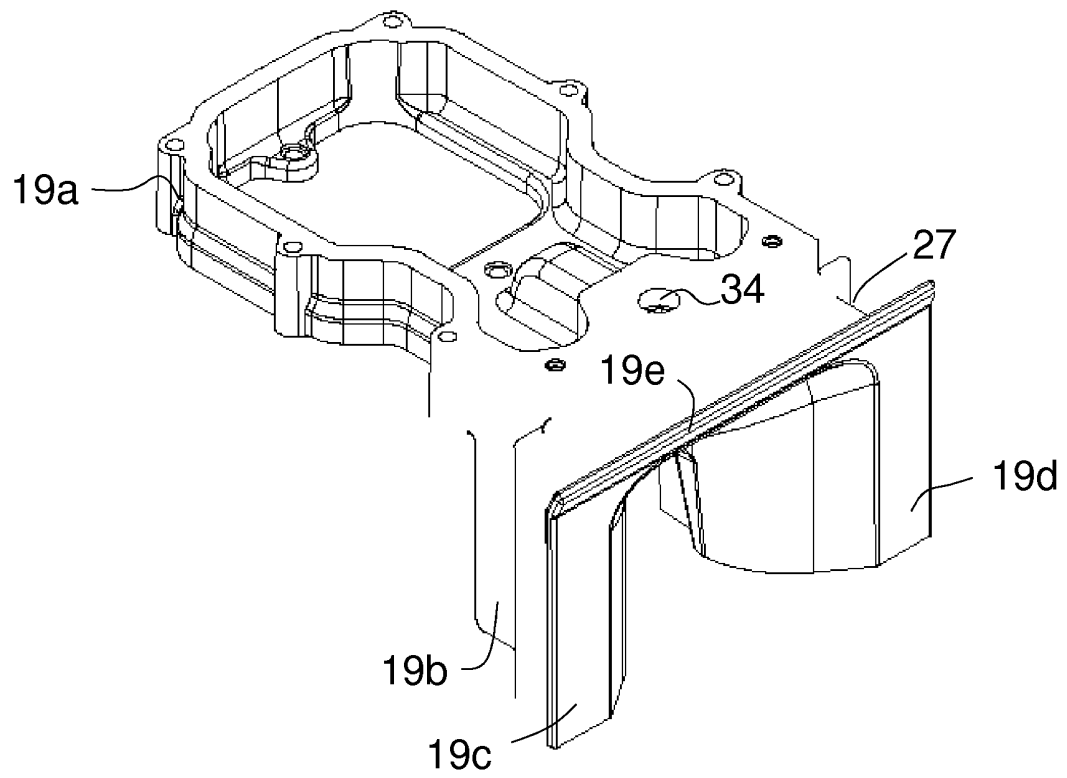


FIG. 4

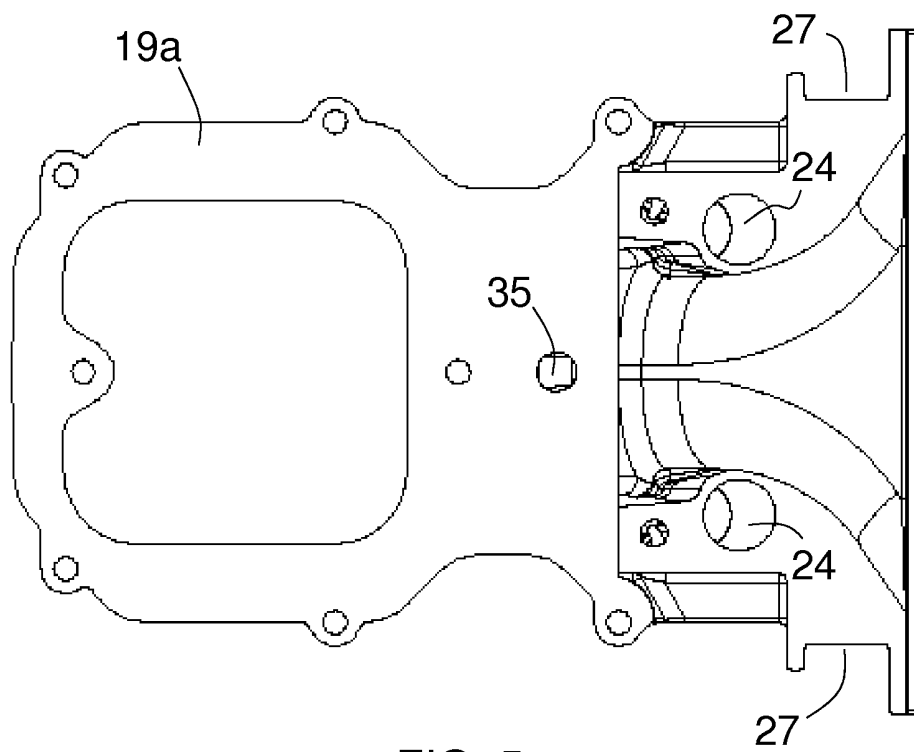


FIG. 5

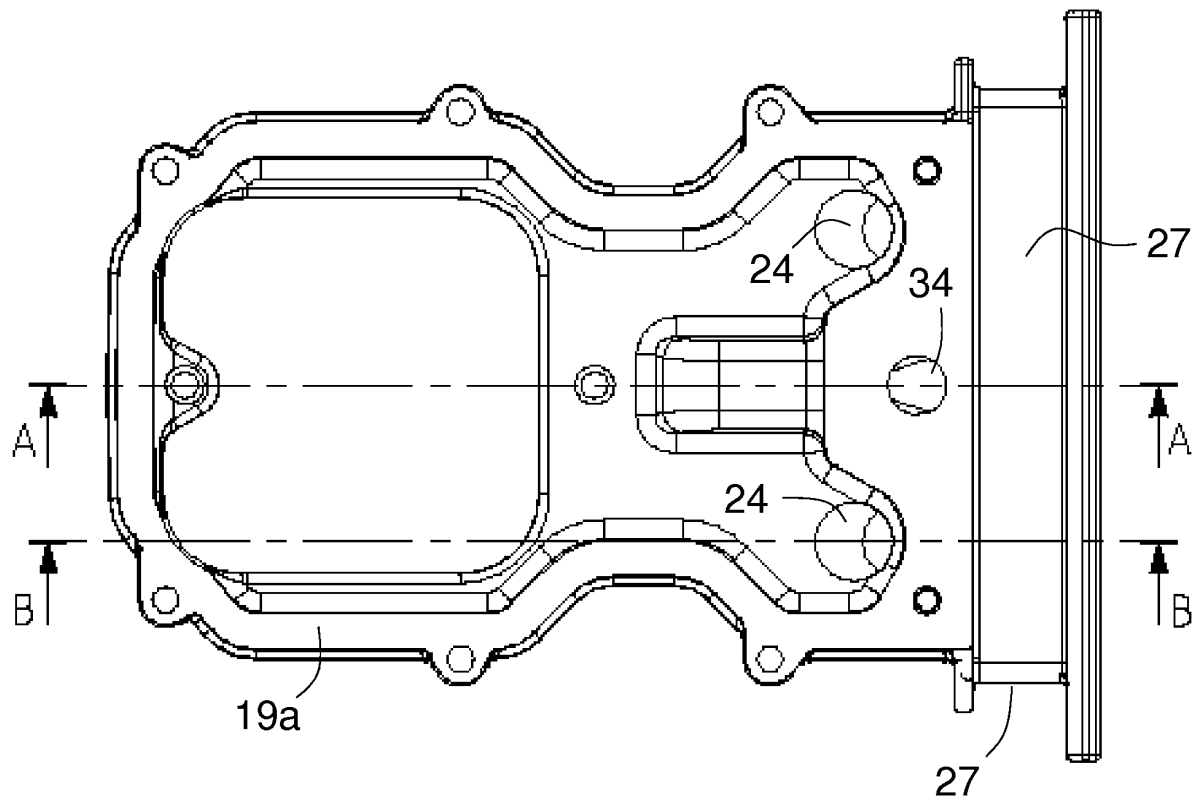


FIG. 6

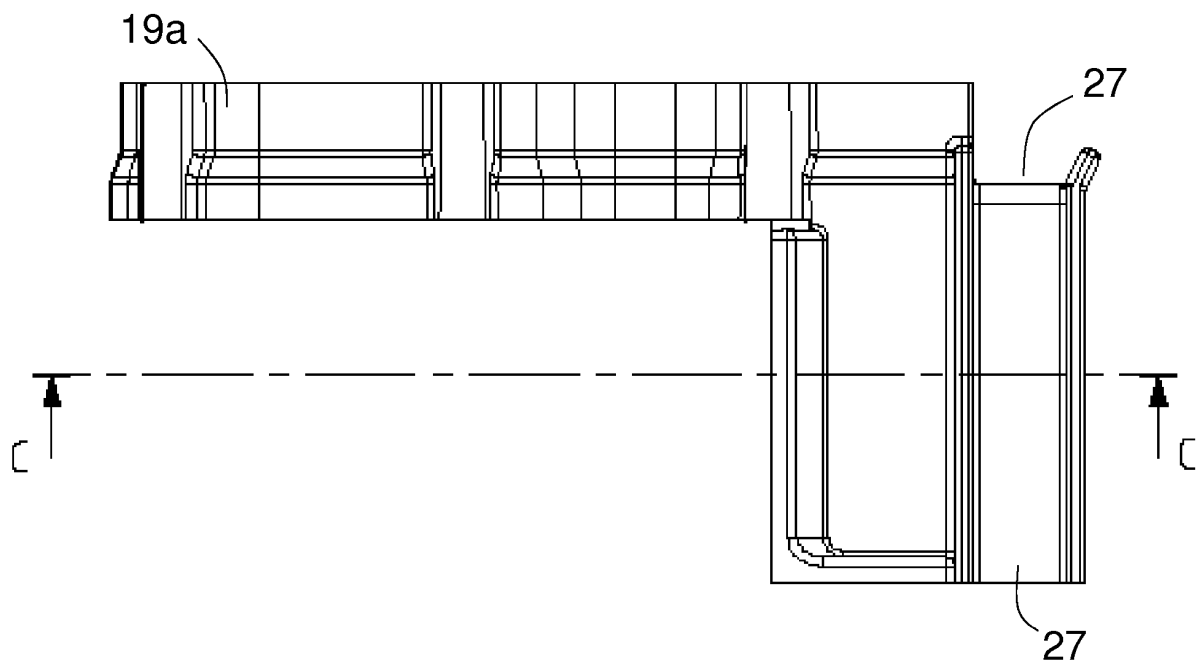


FIG. 7

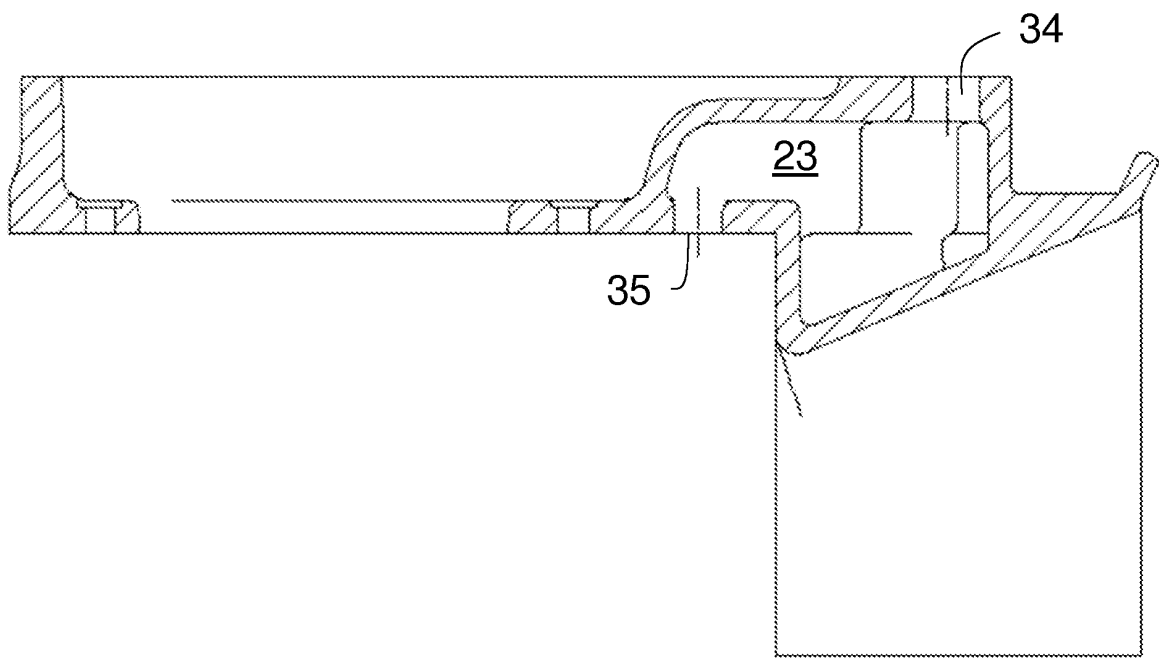


FIG. 8

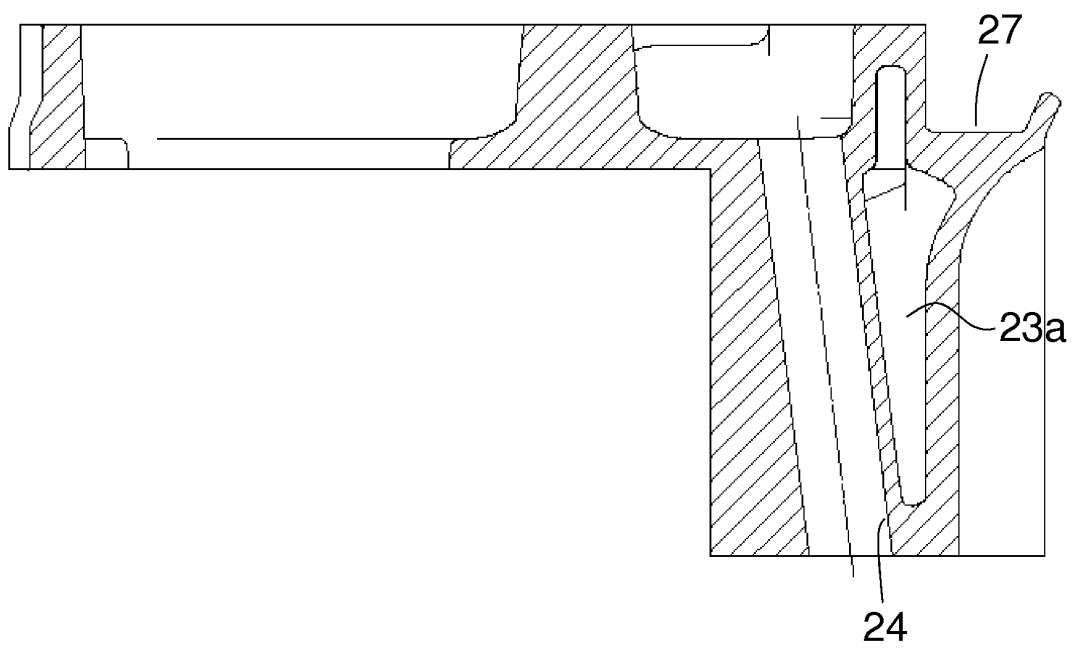


FIG. 9

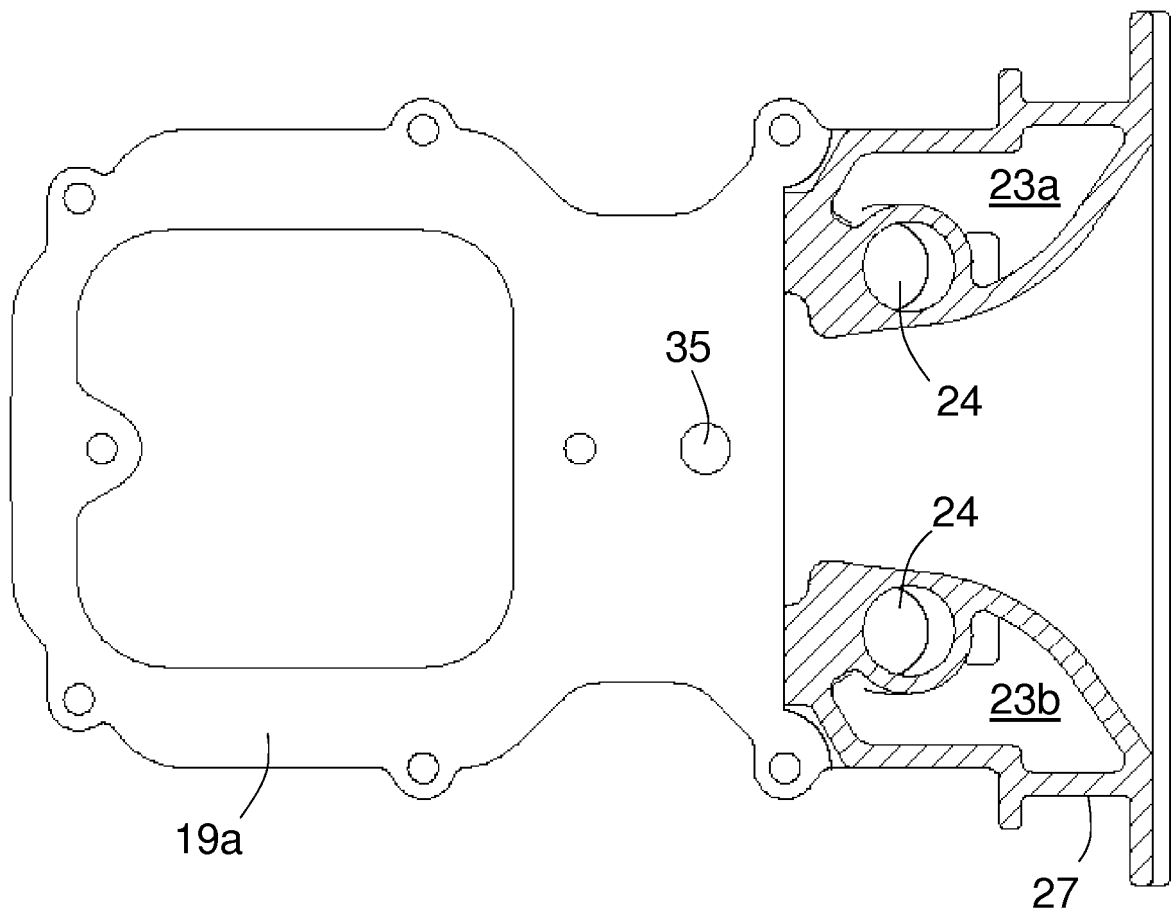


FIG. 10

REFERENCES CITED IN THE DESCRIPTION

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