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(54) AN INTERNAL COMBUSTION ENGINE

BRENNKRAFTMASCHINE

MOTEUR A COMBUSTION INTERNE

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Description

The present invention relates to an internal combustion engine finding application as a piston gasoline or diesel engine with supercharging for all kinds of transportation facilities such as motor vehicles, motor cycles, motor-boats, racing cars, industrial trucks, light-weight aircraft, as well as for water pumps, generators, hand tools, multistage piston compressors and others.

An internal combustion engine is known down GB-A-2 149 006 , consisting of a body in its upper hollow part performed as an internal cylindrical space whereas in its lower part is shaped a crankshaft casing with the crankshaft possessing a journal and a connecting rod,the said connecting rod fitted in its lower end to the crankshaft.

To the upper end of the connecting rod is suspended a compressor piston situated in a lower part of the cylindrical space whereas in an upper part of the cylindrical space is situated the working piston connected through a pipe to the compressor piston. In the zone between the compressor and the working pistons are shaped two horizontal valve plates forming a conduit connected through a throttle valve to the intake port.

Both valve plates have respectively an intake and an outlet port, symmetricaly disposed on both sides of the pipe between the pistons. The outlet port from the one valve plate and the intake port from the other valve plate are connected through a conduit and an intermediate chamber to an intake valve in the uppermost part of the cylindrical space.Next to the intake valve is situated an outlet valve whose port is also connected through a conduit.

The disadvantages of the known engine are as follows: complicated construction with large overall dimensions leading to great inertia of the moving parts which inertia is partialy balanced; complicated gas-distributing mechanism and valve system, using lamilar (plate) and bevelseated (conical) valves. long and complicated ways of the feeding and the discharging conduits leading to an enhancement of the resistance of the air-fuel mixture and of the exhaust gases accordingly;lower specific power per unit of working volume and weight having in mind that the engine is operating as a four-stroke internal combustion engine; as well as a worsened lubrication of the upper part of the inside cylindrical space and of the working piston.

The task of the present invention is the elaboration of an internal combustion engine possessing to a large degree a simplified construction,with reduced over all dimensions, a simplified gas-distribution mechanism using short and direct feeding and discharging ways of conduits, with increased specific power per unit of volume and weight, as well as a normal lubrication of the upper part of the inside cylindrical space and of the working piston.

This task is achieved with the internal combustion engine according to claim 1.

According to a first variant implementation of the engine in conformity with the invention,wherein the transfer port is below the piston rings in the upper end of the working piston and second variant wherein the transfer port is above the piston rings in the upper end of the working piston and the intake port and exhaust port in the engine block are fitted with an intake valve and an exhaust valve respectively.

The advantages of the internal combustion engine according to the invention are as follows: it operates as a two-stroke engine with no need for oil to be added into the fuel for lubricating the parts in the internal cylindrical space; there is no need of valve system and gas-distribution mechanism; the engine enables from 3 to 6 times the enhancement of the specific power per unit of volume and weight of the construction; during the pistons operation a counterstroke motion is used offering favourable conditions for relieving the dynamical balancing of the moving parts as well as a straightflow scavenging and charging of the combustion chamber.

The invention is explained is more detail refering to the enclosed figures as follows:

Figure 1 shows a cross-section of the engine in the upper dead point of the working cylinder.

Figure 2 shows a cross-section of the engine while the working cylinder is in a moment of expansion/compression/ of the fuel-air mixture.

Figure 3 shows a cross-section of the engine in the B D C.

Figure 4 shows a cross-section of the engine illustrating application of intake and exhaust valve.

As is shown in Figures 1,2 and 3 the internal combustion engine according to the invention consists of an engine block (1) having a hollow cylindrical space therein,said cylindrical space comprising an upper cylinder and a lower cylinder having a larger diameter than the upper cylinder,the lower end of said engine block being shaped into a casing (11) containing a crankshaft (5),said crankshaft carrying the big ends of three conrods (3, 4, 6) on journals spaced along said crankshaft,the two outer conrods (3, 4) being journaled on crankshaft eccentrics (15, 16) which are axially in line with each other,the central conrod (6) being journaled on a crankshaft eccentric (14) diametrically opposite to the other eccentrics (15, 16) with respect to the crankshaft axis, the little ends of the two outer conrods being attached to a hollow working piston (2) having an upper part (13), the outer diameter of which is matched to the upper cilinder, and a lower part (12), the outer diameter of which is matched to lower cylinder,the upper and lower parts of the working piston having piston rings (17) near their upper ends,the hollow inner space in the working piston (2) comprising an upper inner cylindrical space contained within the upper part of the working piston (13) and a lower inner cylindrical space contained within the lower part of the working piston (12) and a having a diameter greater than the upper inner cylindrical space, said engine block (1) further containing an inlet port (8) in communication with

the upper cylinder and an exhaust port (9) and a spark plug (10) in communication with the lower cylinder,said upper part of the working piston (13) having a transfer port (19, 22) adapted to allow the upper inner cylindrical space to communicate with the inlet port (8) at its TDC and the lower cylinder at its BDC,said exhaust port (9) in the engine block (1) being located so as to be uncovered by the upper end of the lower part of the working piston (12) at its BDC,the little end of said central conrod (6)being attached to a compressor piston (7) the outer diameter of which is matched to the lower inner cylindrical space of the working piston (2).As it is shown on figure 4, the port (22) is situated beneath the intake valve (20) and after the exhaust (outlet) port (9) is situated the outlet valve (21).

The engine operates as follows:

As is shown in figure 1 the working piston (2) of the engine is in the TDC, while the compressor piston (7) is in the BDC and owing to the vacuum created in the inside space of the working piston (2) a suction of fuel-air mixture is produced by the intake port (8) (or as it is shown on figure 4 by the intake valve (20)) of the body 1 and by the port (19) (or as it is shown on figure 4 by the port (22)) of the working piston (2). All this fuel-air mixture is compressed as a result of the displacement of the working piston (2) downward to the BDC and the respective displacement of the compressor piston (7) toward the TDC, according to the figure 2.When reaching the BDC by the working piston (2) and the TDC by the compressor piston (7), as it is shown in figure 3, the compressed fuel-air mixture flows through the port (19) (or as it is shown on figure 4 through the port (22)) of the working piston (2) into the space formed between the upper part of the body 1 and the working piston (2) itself.The fuel-air mixture fallen into the combustion chamber of the engine is subjected to compression by the displacement of the working piston (2) toward the TDC and when reaching it according to the figure 1, the mixture is ignited during the working stroke.At the opening of the outlet port (9) according to the figure 3 (or the valve (21) according to the figure 4) by the working piston (2) according to the figure 3, the burned gases flow out through the outlet port (9) and in the next moment the combustion chamber of the engine is filled with the fresh fuel-air mixture entering through the port (19) (or as it is shown on the figure 4 through the port (22)) of the working piston (2). In this moment is accomplished a straight-flow and a vortex-flow high performance scavenging of the combustion chamber and afterwards the above described working process is cyclicaly, manifold repeated, during the operation of the engine.

The highly efficient performance of the engine according to the invention is achieved owing to the coordination of a great number of constructive and physical factors such as: the reduced length of the suction track; the absence of useless constructive spaces and the double space resulting from the countersense motion of the working piston (2) and the compressor piston (7), enabling the achievement of an exclusively favourable charging of the engine with the fuel-air mixture.The high-velocity under pressure passing of the fuel-air mixture through the small port (19)(or through the port (22) as it is shown on figure 4) of the working piston (2), provokes an additional homogenizing, atomization and evaporation of the mixture.All this allows the achievement of a full economical and ecologicaly pure combustion process.

The straight-flow and the vortex-flow motion of the fuel-air mixture enables the complete scavenging of the burnt gases and at the same moment the cooling of the spark plug and its safe contacting with the combustion mixture. The absence of valves, springs, camshafts, the utilisation of the classical two-stroke working principle,the supercharging with the fuel-air mixture as well as the abovementioned advantages which are missing in the known similar engines, enable an extremely high power per litre of displacement and efficiency to be achieved, other conditions such as volume,weight, turbo-compressors, computer control, fuel injection etc. being equal.

The complete mechanical separation of the spaces above the pistons, the intake port 8 and the outlet port (9) of the casing (11) housing the crankshaft (5) and the three conrods (3, 4 and 6) enable the forced lubrication of the engine using the casing (11) charged with oil and the oil pump, unshown on the figures, for lubricating the moving parts as it is done in the classical four-stroke engines.All this enables the increasing of the tightness of the working piston (2) and the compressor piston (7), the noiselessness of the engine and the additional cooling of the working piston (2) by means of the oil which is cooled from the inside by the sucked in fresh fuel-air mixture. The possibility of the engine according to the invention to operate as a two-stroke engine with a pure fuel-air mixture without an obligatory addition of oil creates the conditions for a highly ecological performance at a minimal cost.

Claims

1. An internal combustion engine comprising ;

   - an engine block (1) having a hollow cylindrical space therein,said cylindrical space comprising an upper cylinder and a lower cylinder having a larger diameter than the upper cylinder,
   - the lower end of said engine block being shaped into a casing (11) containing a crankshaft (5),
   - said crankshaft carring the big ends of three conrods (3, 4, 6) on journals spaced along said crankshaft,
   - the two outer conrods (3, 4) being journaled on

crankshaft eccentrics (15, 16) which are axially in line with each other,the central conrod (6) being journaled on a crankshaft eccentric (14) diametrically opposite to the other eccentrics (15, 16) with respect to the crankshaft axis,

- the little ends of the two outer conrods being attached to a hollow working piston (2) having an upper part (13) , the outer diameter of which is matched to the upper cylinder, and a lower part (12), the outer diameter of which is matched to lower cylinder, the upper and lower parts of the working piston having piston rings (17) near their upper ends,

- the hollow inner space in the working piston (2) comprising an upper inner cylindrical space contained within the upper part of the working piston (13) and a lower inner cylindrical space contained within the lower part of the working piston (12) and a having a diameter greater than the upper inner cylindrical space,

- said engine block (1) further containing an inlet port (8) in communication with the upper cylinder and an exhaust port (9) and a spark plug (10) in communication with the lower cylinder,

- said upper part of the working piston (13) having a transfer port (19, 22) adapted to allow the upper inner cylindrical space to communicate with the inlet port (8) at its TDC and the lower cylinder at its BDC,

- said exhaust port (9) in the engine block (1) being located so as to be uncovered by the upper end of the lower part of the working piston (12) at its BDC,

- the little end of said central conrod (6) being attached to a compressor piston (7) the outer diameter of which is matched to the lower inner cylindrical space of the working piston (2).

2. An internal combustion engine as claimed in claim 1 wherein the transfer port (19) is below the piston rings (17) in the upper end of the working piston (13).

3. An internal combustion engine as claimed in claim 1 wherein the transfer port (22) is above the piston rings (17) in the upper ehd of the working piston (13) and the intake port (8) and exhaust port (9) in the engine block (1) are fitted with an intake valve (20) and an exhaust valve (21) respectively.

Patentansprüche

1. Verbrennungsmotor mit

einem Motorblock (1) mit einem darin ausgebildeten hohlen Zylinderraum, der einen oberen Zylinder, sowie einen unteren Zylinder mit einem Durchmesser, der größer als der Durchmesser des oberen Zylinders ist, aufweist,
das untere Ende des Motorblocks als ein eine Kurbelwelle (5) aufnehmendes Gehäuse (11) ausgebildet ist,

- die breiten Enden von drei Pleuelstangen (3, 4, 6) auf entlang der Kurbelwelle voneinander beabstandeten Kurbelzapfen gelagert sind,
- zwei äußere Pleuelstangen (3, 4) auf Exzentern (15, 16) der Kurbelwelle gelagert sind, die in einer Linie miteinander axial ausgerichtet sind, die mittlere Pleuelstange (6) auf einem Exzenter (14) der Kurbelwelle gelagert ist, der diametral entgegengesetzt der anderen Exzenter (15, 16) mit Bezug auf die Kurbelwellenachse angeordnet ist,
- die schmalen Enden der zwei äußeren Pleuelstangen mit einem hohlen Arbeitskolben (2) verbunden sind, der einen oberen Abschnitt (13), dessen äußerer Durchmesser passend zum oberen Zylinder ist, sowie einen unteren Abschnitt, dessen äußerer Durchmesser passend zum unteren Zylinder ist, aufweist, wobei der obere und untere Abschnitt des Arbeitskolbens in der Nähe ihrer oberen Enden Kolbenringe (17) haben,
- der hohle Innenraum des Arbeitskolbens (2) einen innerhalb des oberen Abschnitts des Arbeitskolbens (13) befindlichen oberen inneren Zylinderraum, sowie einen innerhalb des unteren Abschnitts des Arbeitskolbens (12) befindlichen unteren inneren Zylinderraum, dessen Durchmesser größer als der obere innere Zylinderraum ist, aufweist,
- der Zylinderblock (1) einen Einlaßkanal (8) in Verbindung mit dem oberen Zylinder, sowie einen Auslaßkanal (9) und eine Zündkerze (10) in Verbindung mit dem unteren Zylinder aufweist,
- der obere Abschnitt des Arbeitskolbens (13) einen Überströmkanal (19, 22) aufweist, der dazu geeignet ist, den oberen inneren Zylinderraum im oberen Totpunkt mit dem Einlaßkanal (8) und im unteren Totpunkt mit dem unteren Zylinder zu verbinden,
- der Auslaßkanal (9) des Motorblocks (1) so

angeordnet ist, daß er am unteren Totpunkt durch das obere Ende des unteren Abschnitts des Arbeitskolbens (12) nicht abgedeckt wird,

- das schmale Ende der mittleren Pleuelstange (6) mit einem Verdichterkolben (7) verbunden ist, dessen äußere Durchmesser passend zum unteren inneren Zylinderraum des Arbeitskolbens (2) ist.

2. Verbrennungsmotor nach Anspruch 1, bei dem sich der Überströmkanal (19) unterhalb der Kolbenringe (17) am oberen Ende des Arbeitskolbens (13) befindet.

3. Verbrennungsmotor nach Anspruch 1, bei dem der Überströmkanal (22) oberhalb der Kolbenringe (17) am oberen Ende des Arbeitskolbens (13) angeordnet ist, wobei der Einlaßkanal (8) und der Auslaßkanal (9) des Motorblocks (1) mit einem Einlaßventil (20) bzw. einem Auslaßventil (21) verbunden sind.

Revendications

1. Moteur à combustion interne, comprenant :

- un bloc-moteur (1) ayant un espace cylindrique creux qui comporte un cylindre supérieur et un cylindre inférieur ayant un diamètre supérieur à celui du cylindre supérieur,
- l'extrémité inférieure du bloc-moteur ayant une configuration de carter (11) contenant un vilebrequin (5),
- le vilebrequin portant les extrémités larges de trois bielles (3, 4, 6) sur des tourillons espacés le long du vilebrequin,
- les deux bielles externes (3, 4) tourillonnant sur des manetons (15, 16) du vilebrequin qui sont alignés axialement l'un sur l'autre, la bielle centrale (6) tourillonnant sur un maneton (14) du vilebrequin qui est diamétralement opposé aux autres manetons (15, 16) par rapport à l'axe du vilebrequin,
- les petites extrémités des deux bielles externes étant fixées à un piston creux (2) de travail ayant une partie supérieure (13) dont le diamètre externe correspond à celui du cylindre supérieur, et une partie inférieure (12) dont le diamètre externe correspond à celui du cylindre inférieur, les parties supérieure et inférieure du piston de travail ayant des segments (17) près de leurs extrémités supérieures,
- l'espace interne formé dans le piston de travail (2) comprenant un espace cylindrique interne supérieur placé dans la partie supérieure du piston de travail (13) et un espace cylindrique interne inférieur placé dans la partie inférieure du piston de travail (12) et dont le diamètre est supérieur à celui de l'espace cylindrique interne supérieur,
- le bloc-moteur (1) contenant une lumière d'admission (8) qui communique avec le cylindre supérieur et une lumière d'échappement (9) et une bougie d'allumage (10) qui communiquent avec le cylindre inférieur,
- la partie supérieure du piston de travail (13) ayant une lumière de transfert (19, 22) destinée à permettre la communication entre l'espace cylindrique interne supérieur et la lumière d'admission (8) au point mort haut et le cylindre inférieur au point mort bas,
- la lumière d'échappement (9) du bloc-moteur (1) étant disposée afin qu'elle soit découverte par l'extrémité supérieure de la partie inférieure du piston de travail (12) à son point mort bas,
- la petite extrémité de la bielle centrale (6) étant fixée à un piston (7) de compresseur dont le diamètre externe correspond à celui de l'espace cylindrique interne inférieur du piston de travail (2),

2. Moteur à combustion interne selon la revendication 1, dans lequel la lumière de transfert (19) est placée sous les segments (17) de piston à l'extrémité supérieure du piston de travail (13).

3. Moteur à combustion interne selon la revendication 1, dans lequel la lumière de transfert (22) se trouve au-dessus des segments (17) de piston dans l'extrémité supérieure du piston de travail (13) et la lumière d'admission (8) et la lumière d'échappement (9) du bloc-moteur (1) comportent une soupape d'admission (20) et une soupape d'échappement (21) respectivement.

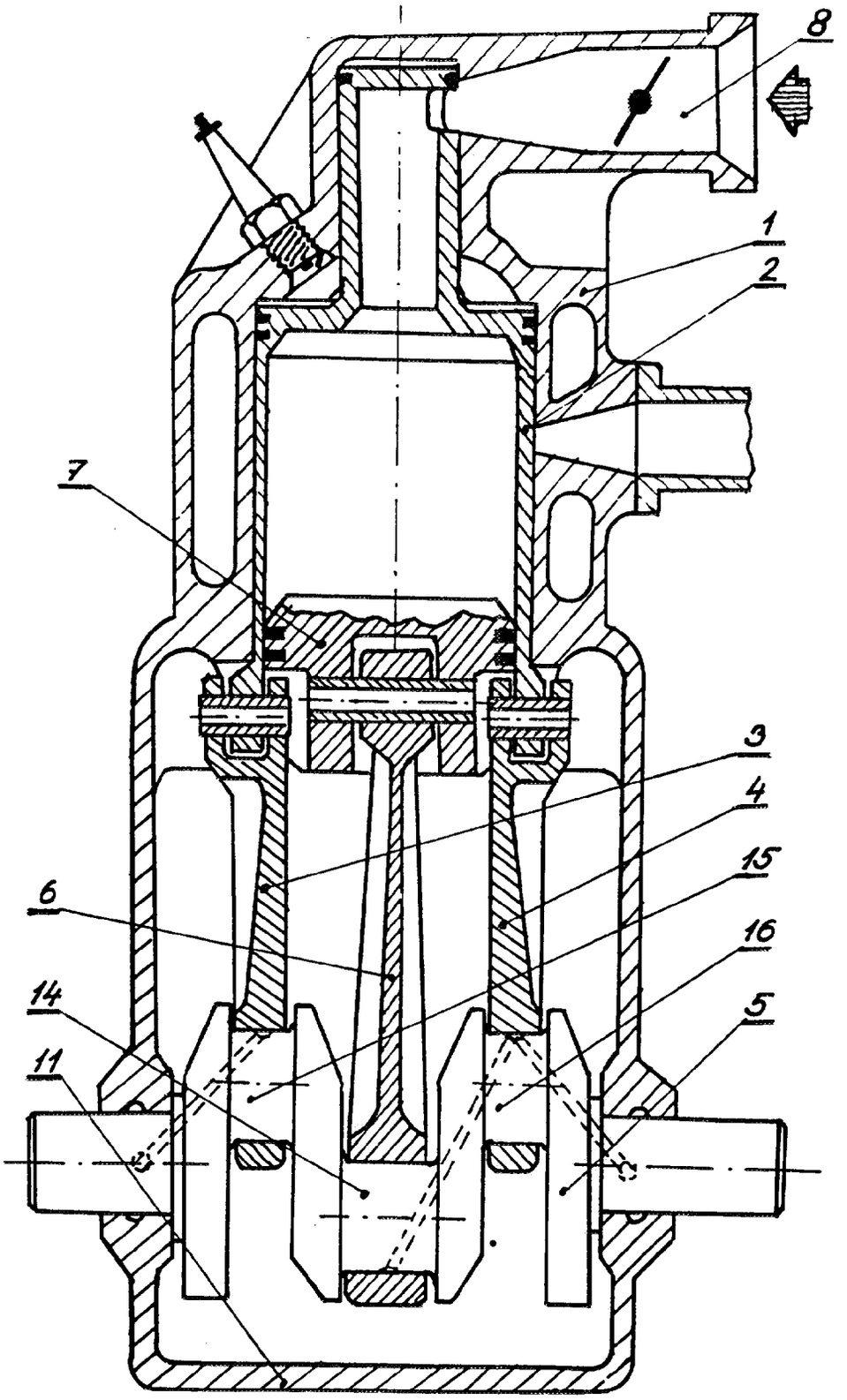


fig. 1

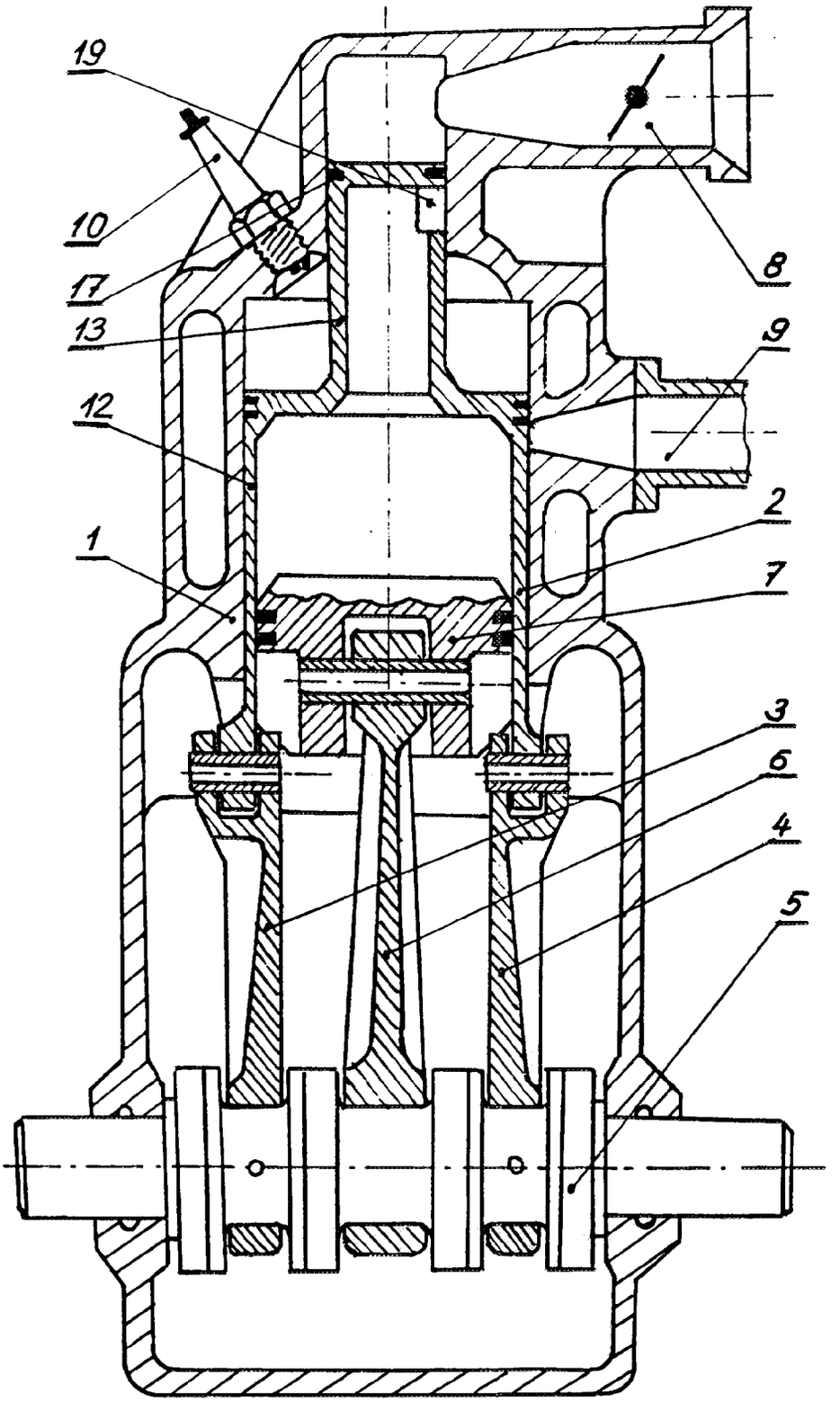


fig. 2

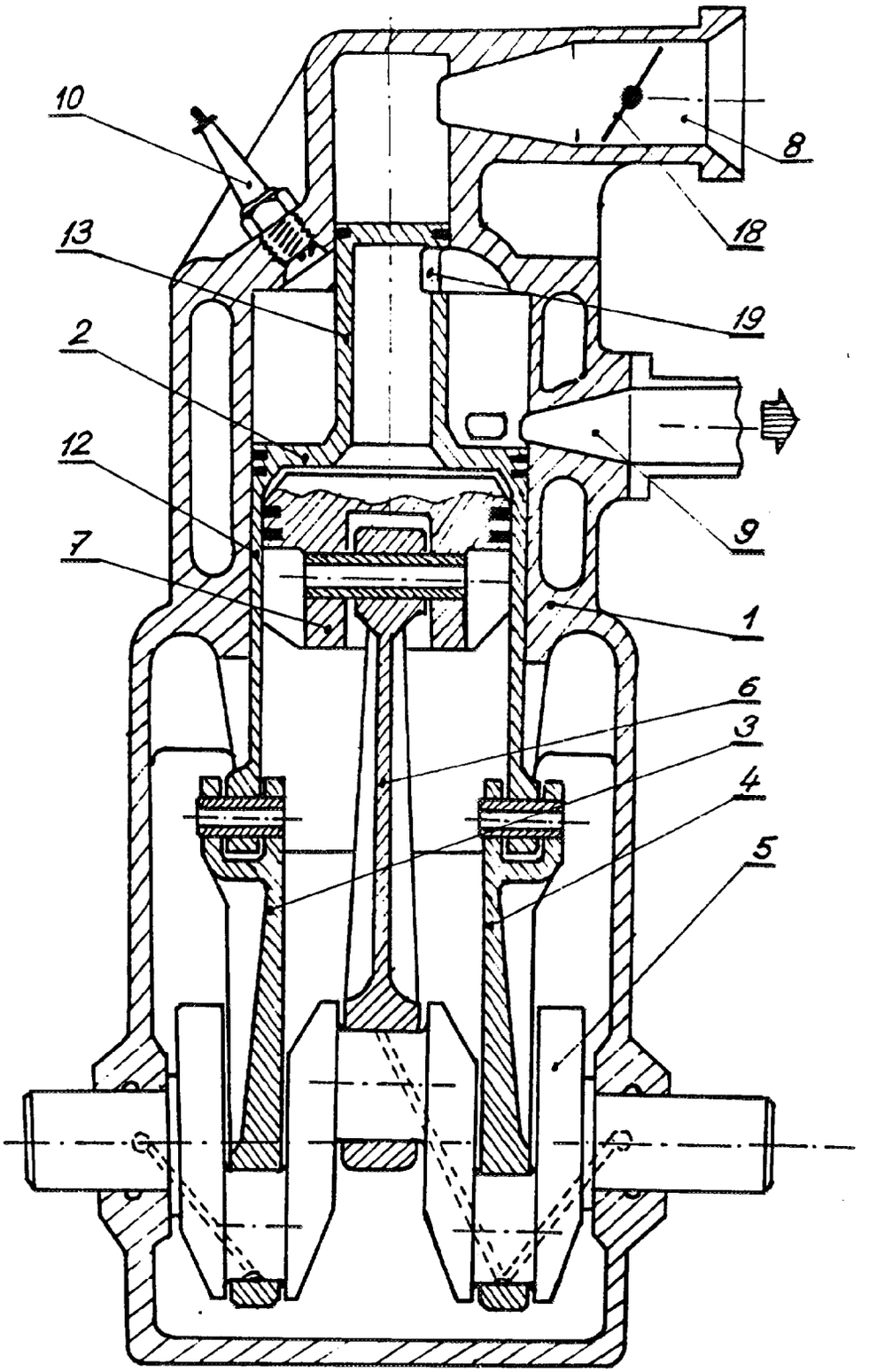


fig. 3

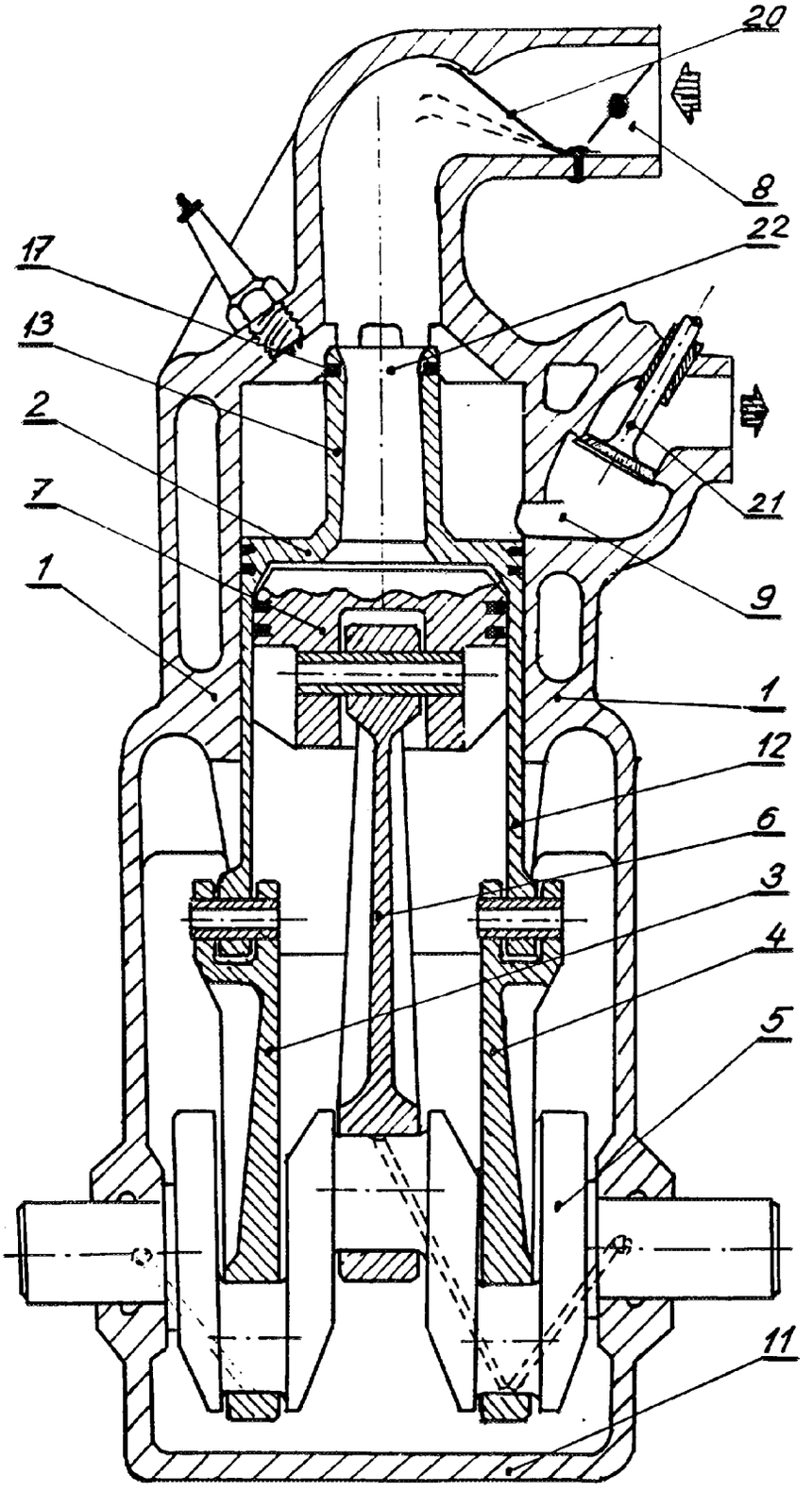


fig. 4