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(54) **CRANKCASE AND INTERNAL COMBUSTION ENGINE UNIT**

KURBELWELLEN- UND VERBRENNUNGSMOTOREINHEIT

CARTER ET MOTEUR À COMBUSTION INTERNE

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(73) Proprietor: **Husqvarna AB**
561 82 Huskvarna (SE)

(72) Inventors:
- **JOHANSSON, Peter**
  562 40 Taberg (SE)
- **GUNNARSSON, Peter**
  563 93 Gränna (SE)

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Description

TECHNICAL FIELD

[0001] The invention relates to an air-cooled combustion engine unit for a hand-held working machine, such as a brushcutter or a trimmer comprising at least one engine cylinder, a crankcase a carburettor and a muffler. The crankcase comprises a crankcase chamber, a fan wheel side with a fan scroll and a fan wheel with fan blades arranged in the fan scroll, a clutch side opposite the fan wheel side and, between the fan wheel side and the clutch side. It further comprises a number of crankcase walls, a cylinder connection side with opening for at least a connecting rod, and a carburettor side. The invention also relates to a handheld working machine, for example a brushcutter or a trimmer, with a rotating working tool, for example a saw blade, for clearing of smaller trees, bushes, brush or grass.

THE BACKGROUND OF THE INVENTION

[0002] Both the crankcase chamber and the crankcase walls of conventionally designed crankcases for combustion engines are significantly heated during engine operation. This can imply problems. Partly the main bearings, i.e. the crankshaft bearings that are arranged inside the crankcase chamber, can overheat, particularly the main bearing on the clutch side runs the risk of overheating, partly the carburettor can overheat through heat radiation from the crankcase side that is facing the carburettor. Heating of the carburettor from the crankcase can become particularly troublesome during a break, e.g. due to refuelling or any other reason, when the engine's fan wheel is at a standstill and therefore no cooling-air circulation takes place. Heating of the carburettor due to such after-heating can result in formation of fuel vapour bubbles in the carburettor. In turn, this can result in that the engine becomes difficult or impossible to restart without a long period of cooling, which constitutes a serious inconvenience. The more compact design of the engine units due to ergonomic or other reasons, the more the problem is accentuated. Combustion engine units in modern brushcutters and trimmers are examples of working machines where this type of problem can appear.

[0003] US 2004/206312 discloses a combustion engine unit of the type specified above. However the disclosed combustion engine lacks arrangement for effectively cooling the carburettor of the engine.

BRIEF DESCRIPTION OF THE INVENTION

[0004] The purpose of the invention is to remedy the above mentioned problem. According to a first aspect of the invention, the engine unit is characterised in that, the engine is a two-stroke engine of the crankcase scavenging type, i.e. that at least the combustion air for the engine flows through its crankcase and in that, through a crankcase wall on at least said carburettor side between the fan wheel side and the clutch side, one or more cooling ducts extends between one or more inlet openings for cooling air in the fan scroll and one or more outlet openings for the cooling air exiting in a clutch housing, for cooling of the wall on said carburettor side between the fan wheel side and the clutch side.

[0005] The fan wheel can, but needs necessarily not, be integrated in a flywheel. A separate flywheel can for instance be arranged on the clutch side.

[0006] Further aspects and characteristics of the invention are defined in the dependent patent claims and are described in the following description of a preferred embodiment.

BRIEF DESCRIPTION OF THE FIGURES

[0007] In the following description of a preferred embodiment, reference will be made to the appended drawings in different drawing figures, of which

Fig. 1, partly schematically, shows a combustion engine unit according to the invention, comprising a crankcase, viewed towards the fan wheel side, and a symbolically illustrated carburettor, engine cylinder and muffler,
Fig. 2 shows a perspective view of the crankcase as well as the fan wheel in a view from the rear/below,
Fig. 3 shows a detail in Fig. 2 in larger scale,
Fig. 4 shows a frontal view of the crankcase, i.e. towards the clutch side,
Fig. 5 shows the crankcase towards the side that is directed towards the carburettor, and
Fig. 6 shows a cross sectional view of the crankcase and the fan wheel along the line VI-VI in Fig. 5.

[0008] In all figures, the covers surrounding at least the crankcase and the carburettor have been removed.

DESCRIPTION OF PREFERRED EMBODIMENT

[0009] A crankcase according to the preferred embodiment of the invention is generally designated 1 in the drawing figures. On a fan wheel side 2, Fig. 5, shown as a frontal view in Fig. 1, there is a fan wheel 3 in a fan scroll 4, Fig.2. The fan wheel 3 is in a conventional way provided with fan blades 5 and forms together with the fan scroll a centrifugal fan, that is driving cooling air out through an outlet section 6 in the fan scroll 4 for cooling of primarily an engine cylinder 8 (schematically shown in Fig. 1), that is an integral part of a combustion engine.

[0010] The fan wheel 3 is, when the engine is running, rotated by a crankshaft 10, that extends through the crankcase 1. On the side, here designated clutch side 11, Fig. 5, that is located opposite the fan wheel side 2, there is a not shown centrifugal clutch for the crankshaft's 10 driving of a working tool, for example a rotating saw blade on a brushcutter via a transmission. The not shown

centrifugal clutch is, when assembled, arranged in a clutch housing 12, that, when assembled, normally is covered by a not shown clutch cover.

[0011] The crankcase 1 forms a part of a combustion engine unit, generally designated 14 in Fig. 1. Included in unit 14 are, apart from crankcase 1 and cylinder 8, also a carburettor 15 or other arrangement for supply of air/fuel mixture to the cylinder 8 and a muffler 16. Cylinder 8 is connected to crankcase 1 on one of the sides of the crankcase between the fan wheel side 2 and the clutch side 11, here designated cylinder connection side 17. Two other sides are designated; carburettor side 18, on which the carburettor 15 is connected and muffler side 19, on which side the muffler 16 is arranged at a short distance from the crankcase.

[0012] A crankcase chamber is designated 20. A connecting rod 21, that is connected to a not shown piston in the schematically shown cylinder 8, extends through a not shown opening in the crankcase wall on the cylinder connection side 17 for driving of the crankshaft 10 in a conventional way via a crank elbow 22, Fig. 6. The crankshaft 10 is suspended in the crankcase chamber 20 by means of two main bearings, namely a first main bearing 23 fitted in a crankcase gable 25 on the clutch side 11 and a second main bearing 24 fitted in an opposite crankcase gable 26 on the fan wheel side 2. The main bearings 23 and 24, and in particular the first main bearing 23, constitute critical elements in the crankcase design due to the risk of overheating.

[0013] Crankcase 1 consists of two halves 1A and IB, Fig. 6. Both halves 1A and IB, that are separately cast, are joined together to one unit by means of a screw fasteners and are in contact with each other in a contact plane 1C.

[0014] According to the invention, crankcase 1 has double walls in the area of the crankcase chamber 20 on the carburettor side 18, Fig. 6. An inner wall is designated 30 and an outer wall is designated 31. Between the inner wall 30 and the outer wall 31 there is a cooling air duct 32, that extends outside the crankcase chamber 20 within the area of at least essentially the entire part of the carburettor side 18 that is exposed towards the carburettor 15, i.e. that corresponds to the extent of the carburettor. In Fig. 5 this area has been indicated by broken lines and designated 33. In the outlet section 6 of the fan scroll 4 there is an inlet opening 35, Fig. 1 and Fig. 6, to an antechamber 36 to the cooling air duct 32. The inner and outer walls of the antechamber 36 are designated 37 and 38 respectively. The inner wall 37 forms an extension of the inner wall 30 of channel 32. Over the inlet opening 35 there is a nozzle, that forms an air inlet cover 40 made of moulding plastic, recessed in an indentation 47 in the bottom of the outlet section 6, the indentation adapted to the shape of the cover 40. An inlet opening 41 in the cover 40 is directed against the direction of air flow in the outlet section 6. The plane of the inlet opening 41, Fig 3, can be, but need not be, essentially perpendicular to the bottom wall of fan scroll 4 in the area of outlet section 6. From the inlet opening 41, a couple of side walls extend backwards, curved so that one side 42 connects to the fan wheel's 3 circular curvature and so that the opposite side 43 connects to the widening curvature of the outlet section. The roof 44 of the air inlet cover 40 is initially almost plane and is then curving down towards the bottom wall of outlet section 6. On the roof of the air inlet cover 40, there is a flange 46, that continuously extends in a curvature backwards in the outlet section 6 behind the cover. The cover 40 is bolted in the bottom wall of the outlet section 6. A screw hole in the wall and a seat 45 for the screw head is shown in Fig. 3.

[0015] In its other end, the cooling air duct 32 is provided with an outlet opening 50 in the crankcase gable 25 on the clutch side, Fig. 4 and Fig. 6. In the same crankcase gable 25 on the clutch side, inside the not shown centrifugal clutch, at a distance from the outlet opening 50, an evacuation opening 51 is arranged for guiding the cooling air away from the housing 12 on the clutch side, that is covered by the not shown centrifugal clutch, within which area 12 also the outlet opening 50 of the cooling air duct 32 is located.

[0016] The described unit 14 and the arrangement work in the following manner. With the engine operating, the fan wheel 3 is driven by the crankshaft 10. The crankcase chamber 20, including its walls and bearings 23, 24, is heated mainly due to the chamber's communication with the cylinder 8. At the same time, however, the inner and outer crankcase walls 30 and 31 respectively, are cooled by the cooling air pushed by the fan blades 5 into the cover 40 and further via the antechamber 36 into the cooling air duct 32, that prevents its walls 30, 31 from heating up to a disturbingly high temperature. In this connection, it shall be mentioned that only a sub-flow of the air that is set into motion by the fan blades 5 of the fan wheel is driven into the cover 40 and further through the chamber 36 and cooling air duct 32. The main flow is blown out through the mouth of the outlet section 6 in order to cool the outside of cylinder 8 in a normal manner. The arc-shaped flange 46 on the roof of the cover and behind the cover 40 is thus contributing to direct the airflow and create desired fan operation in the outlet section for cooling of the cylinder 8. From the cooling air duct 32, the diverted cooling air flows out through opening 50 in the clutch housing 12 and contributes to cool the centrifugal clutch under the not shown clutch cover and finally leaves the clutch housing 12 through the evacuation opening 51 to be spread into the ambient air. While the engine is running, the cooling of the inner wall 30 on the carburettor side contributes to keep the temperature of the crankcase chamber 20 at a moderately high level, with the intent to prevent the main bearings 23 and 24 from overheating.

[0017] As mentioned in the introduction, shorter operational interruptions with this type of machines can often be an inconvenient problem due to heating through radiation from the crankcase wall on the carburettor side of the crankcase. The outer wall 31 in the area of the

crankcase chamber 20 has however been continuously cooled by means of cooling air that flows through the cooling air duct 32, which prevents or at least strongly counteracts the heating of the carburettor due to the after-heat from the crankcase while the engine and consequently the fan wheel and its fan blades are at a standstill. The inner wall 30 in the area of the cooling air duct 32 has also been cooled during the operation of the machine, which also counteracts damage particularly to the main bearings 23, 24 due to after-heating during short operational interruptions.

Claims

1. An air-cooled combustion engine unit for a hand-held working machine, such as a brushcutter or a trimmer comprising at least an engine cylinder (8), a crankcase (1) a carburettor (15) and a muffler (16), the crankcase (1) comprising a crankcase chamber (20), a fan wheel side (2) with a fan scroll (4) and a fan wheel (3) with fan blades (5) arranged in the fan scroll (4), a clutch side (11) opposite the fan wheel side (2) and, between the fan wheel side (2) and the clutch side (11), a number of crankcase walls, a cylinder connection side (17) with opening for at least a connecting rod (21), and a carburettor side (18) **characterized in that** the engine is a two-stroke engine of the crankcase scavenging type, i.e. that at least the combustion air for the engine flows through its crankcase and **in that**, through a crankcase wall on at least said carburettor side (18) between the fan wheel side (2) and the clutch side (11), one or more cooling ducts (32) extends between one or more inlet openings (35) for cooling air in the fan scroll (4) and one or more outlet openings (50) for the cooling air exiting in a clutch housing (12), for cooling of the wall on said carburettor side (18) between the fan wheel side (2) and the clutch side (11).

2. A combustion engine unit according to claim 1, **characterized in that** the crankcase wall (30,31) on said carburettor side has double walls, comprising an inner wall (30) directed towards a crankcase chamber (20) and an outer wall (31), whereby a space between the walls (30,31) form a slit shaped cooling duct (32).

3. A combustion engine unit according to claim 1 or 2, **characterized in that** said one or more inlet openings (35) for cooling air in the fan scroll are covered by an inlet cover (40) for cooling air for diversion of a sub-flow of the air, that, by the fan wheel, is blown out through the outlet section of the fan scroll.

4. A combustion engine unit according to claim 3, **characterized in that** said inlet cover is arranged in the outlet section (6) of the fan scroll.

5. A combustion engine unit according to claim 4, **characterized in that** the mouth of the inlet cover is essentially transversely located in relation to the bottom of the fan scroll in the area of the outlet section (6).

6. A combustion engine unit according to any one of the claims 1-5, **characterized in that** an evacuation opening (51) is arranged at the bottom of the clutch housing (12) at a distance from said one or more outlet openings (50) for the cooling air, for evacuation of the spent cooling air from the clutch housing.

7. A combustion engine unit according to claims 1-2, **characterized in that** the cooling air duct (32) extends outside the crankcase chamber (20) within the area of the entire part of the carburettor side (18) that is exposed towards the carburettor.

8. A combustion engine unit according to any one of claims 1-7, **characterized in that** said one or more cooling ducts in the crankcase wall extend along an area (33) of the crankcase wall, that corresponds to at least a significant portion of the extent of the carburettor.

9. A combustion engine unit according to any one of the claims 1-8, **characterized in that** a sub-flow of the air that is blown out by the fan wheel through the outlet section (6) of the fan scroll is diverted to said one or more cooling ducts, while the remaining air is blown out through the outlet section for cooling of the engine cylinder.

10. A handheld working machine, such as a brushcutter or a trimmer, comprising a rotating working tool, for example a saw blade, for clearing of smaller trees, bushes, brush and/or grass, **characterized in that** the rotating working tool is driven by a combustion engine unit according to any one of the claims 1-9.

Patentansprüche

1. Luftgekühlte Verbrennungsmotoreinheit für eine handgeführte Arbeitsmaschine wie einen Gestrüppschneider oder einen Trimmer, die mindestens einen Motorzylinder (8), ein Kurbelgehäuse (1), einen Vergaser (15) und einen Schalldämpfer (16) umfasst, wobei das Kurbelgehäuse (1) eine Kurbelgehäusekammer (20), eine Gebläseradseite (2) mit einer Gebläsespirale (4) und ein Gebläserad (3) mit in der Gebläsespirale (4) angeordneten Gebläseflügeln (5), eine Kupplungsseite (11) gegenüber der Gebläseradseite (2) und, zwischen der Gebläseradseite (2) und der Kupplungsseite (11), eine Anzahl von Kurbelgehäusewänden, eine Zylinderanschlussseite (17) mit einer Öffnung für mindestens eine Kolbenstange (21) und eine Vergaserseite (18) um-

fasst, **dadurch gekennzeichnet, dass** der Motor ein Zweitaktmotor mit Kurbelgehäusespülung ist, das heißt, dass mindestens die Verbrennungsluft für den Motor durch sein Kurbelgehäuse strömt, und dadurch, dass durch eine Kurbelgehäusewand auf mindestens der Vergaserseite (18) zwischen der Gebläseradseite (2) und der Kupplungsseite (11) sich ein oder mehrere Kühlkanäle (32) zwischen einer oder mehreren Einlassöffnungen (35) für Kühlluft in der Gebläsespirale (4) und eine oder mehrere Auslassöffnungen (50) für die in ein Kupplungsgehäuse (12) austretende Kühlluft zum Kühlen der Wand auf der Vergaserseite (18) zwischen der Gebläseradseite (2) und der Kupplungsseite (11) erstrecken.

2. Verbrennungsmotoreinheit nach Anspruch 1, **dadurch gekennzeichnet, dass** die Kurbelgehäusewand (30, 31) auf der Vergaserseite Doppelwände aufweist, die eine innere Wand (30), die in Richtung einer Kurbelgehäusekammer (20) ausgerichtet ist, und eine äußere Wand (31) umfassen, wobei ein Raum zwischen den Wänden (30, 31) einen spaltförmigen Kühlkanal (32) bildet.

3. Verbrennungsmotoreinheit nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die eine oder mehreren Einlassöffnungen (35) für Kühlluft in der Gebläsespirale von einer Einlassabdeckung (40) für Kühlluft zum Umleiten eines Teilstroms der Luft abgedeckt sind, die von dem Gebläserad durch den Auslassabschnitt der Gebläsespirale geblasen wird.

4. Verbrennungsmotoreinheit nach Anspruch 3, **dadurch gekennzeichnet, dass** die Einlassabdeckung in dem Auslassabschnitt (6) der Gebläsespirale angeordnet ist.

5. Verbrennungsmotoreinheit nach Anspruch 4, **dadurch gekennzeichnet, dass** der Mund der Einlassabdeckung in Relation zu dem Boden der Gebläsespirale in dem Bereich des Auslassabschnitts (6) im Wesentlichen quer positioniert ist.

6. Verbrennungsmotoreinheit nach einem der Ansprüche 1-5, **dadurch gekennzeichnet, dass** eine Evakuierungsöffnung (51) an dem Boden des Kupplungsgehäuses (12) in einem Abstand von der einen oder den mehreren Auslassöffnungen (50) für die Kühlluft zum Evakuieren der verbrauchten Kühlluft aus dem Kupplungsgehäuse angeordnet ist.

7. Verbrennungsmotoreinheit nach den Ansprüchen 1-2, **dadurch gekennzeichnet, dass** sich der Kühlluftkanal (32) außerhalb der Kurbelgehäusekammer (20) innerhalb des Bereichs des gesamten Teils der Vergaserseite (18), die in Richtung des Vergasers freiliegt, erstreckt.

8. Verbrennungsmotoreinheit nach einem der Ansprüche 1-7, **dadurch gekennzeichnet, dass** sich ein oder mehrere Kühlkanäle in der Kurbelgehäusewand entlang eines Bereichs (33) der Kurbelgehäusewand erstrecken, der mindestens einem signifikanten Teil des Ausmaßes des Vergasers entspricht.

9. Verbrennungsmotoreinheit nach einem der Ansprüche 1-8, **dadurch gekennzeichnet, dass** ein Teilstrom der Luft, die von dem Gebläserad durch den Auslassabschnitt (6) der Gebläsespirale geblasen wird, zu dem einen oder den mehreren Kühlkanälen umgeleitet wird, während die übrige Luft durch den Auslassabschnitt zum Kühlen des Motorzylinders herausgeblasen wird.

10. Handgeführte Arbeitsmaschine wie ein Gestrüppschneider oder Trimmer, die ein drehendes Arbeitswerkzeug, beispielsweise ein Sägeblatt, zum Roden von kleineren Bäumen, Büschen, Gestrüpp und/oder Gras umfasst, **dadurch gekennzeichnet, dass** das drehende Arbeitswerkzeug durch eine Verbrennungsmotoreinheit nach einem der Ansprüche 1-9 angetrieben wird.

Revendications

1. Moteur à combustion interne refroidi par air pour une machine de travail portative, telle qu'une débroussailleuse ou un taille-bordures, comprenant au moins un cylindre de moteur (8), un carter (1), un carburateur (15) et un silencieux (16), le carter (1) comprenant une chambre de carter (20), un côté roue de ventilateur (2) avec une volute (4) et une roue de ventilateur (3) avec des pales de ventilateur (5) disposées dans la volute (4), un côté embrayage (11) opposé au côté roue de ventilateur (2) et, entre le côté roue de ventilateur (2) et le côté embrayage (11), plusieurs parois de carter, un côté raccordement de cylindre (17) avec une ouverture pour au moins une bielle (21), et un côté carburateur (18), **caractérisé en ce que** le moteur est un moteur deux temps du type à balayage par le carter, c'est-à-dire qu'au moins l'air de combustion pour le moteur circule à travers son carter et **en ce que**, à travers une paroi de carter sur au moins ledit côté carburateur (18) entre le côté roue de ventilateur (2) et le côté embrayage (11), au moins un canal de refroidissement (32) s'étend entre au moins une ouverture d'entrée (35) pour l'air de refroidissement dans la volute (4) et au moins une ouverture de sortie (50) pour l'air de refroidissement sortant dans un carter d'embrayage (12), pour refroidir la paroi dudit côté carburateur (18) entre le côté roue de ventilateur (2) et le côté embrayage (11).

2. Moteur à combustion interne selon la revendication 1, **caractérisé en ce que** la paroi de carter (30, 31) dudit côté carburateur a des doubles parois, comprenant une paroi intérieure (30) dirigée vers une chambre de carter (20) et une paroi extérieure (31), un espace entre les parois (30, 31) formant ainsi un conduit de refroidissement en forme de fente (32).

3. Moteur à combustion interne selon la revendication 1 ou 2, **caractérisé en ce que** ladite au moins une ouverture d'entrée (35) pour l'air de refroidissement dans la volute est recouverte par un couvercle d'entrée (40) pour l'air de refroidissement pour dévier un flux secondaire de l'air, qui, par la roue de ventilateur, est expulsé par la section de sortie de la volute.

4. Moteur à combustion interne selon la revendication 3, **caractérisé en ce que** ledit couvercle d'entrée est disposé dans la section de sortie (6) de la volute.

5. Moteur à combustion interne selon la revendication 4, **caractérisé en ce que** l'embouchure du couvercle d'entrée est située essentiellement transversalement par rapport à la partie inférieure de la volute dans la zone de la section de sortie (6).

6. Moteur à combustion interne selon l'une quelconque des revendications 1 à 5, **caractérisé en ce qu'**une ouverture d'évacuation (51) est disposée dans la partie inférieure du carter d'embrayage (12) à une distance de ladite au moins une ouverture de sortie (50) pour l'air de refroidissement, pour évacuer l'air de refroidissement utilisé du carter d'embrayage.

7. Moteur à combustion interne selon les revendications 1-2, **caractérisé en ce que** le conduit d'air de refroidissement (32) s'étend à l'extérieur de la chambre de carter (20) dans la zone de la partie entière du côté carburateur (18) qui est exposée vers le carburateur.

8. Moteur à combustion interne selon l'une quelconque des revendications 1 à 7, **caractérisé en ce que** ledit au moins un conduit de refroidissement dans la paroi de carter s'étend le long d'une zone (33) de la paroi de carter, qui correspond à au moins une partie significative de l'étendue du carburateur.

9. Moteur à combustion interne selon l'une quelconque des revendications 1 à 8, **caractérisé en ce qu'**un flux secondaire de l'air qui est expulsé par la roue de ventilateur à travers la section de sortie (6) de la volute est dévié vers ledit au moins un conduit de refroidissement, tandis que l'air restant est expulsé à travers la section de sortie pour le refroidissement du cylindre de moteur.

10. Machine de travail portative, telle qu'une débroussailleuse ou un taille-bordures, comprenant un outil de travail rotatif, par exemple une lame de scie, pour le débroussaillage de petits arbres, de buissons, de broussailles et/ou d'herbe, **caractérisée en ce que** l'outil de travail rotatif est entraîné par un moteur à combustion selon l'une quelconque des revendications 1 à 9.

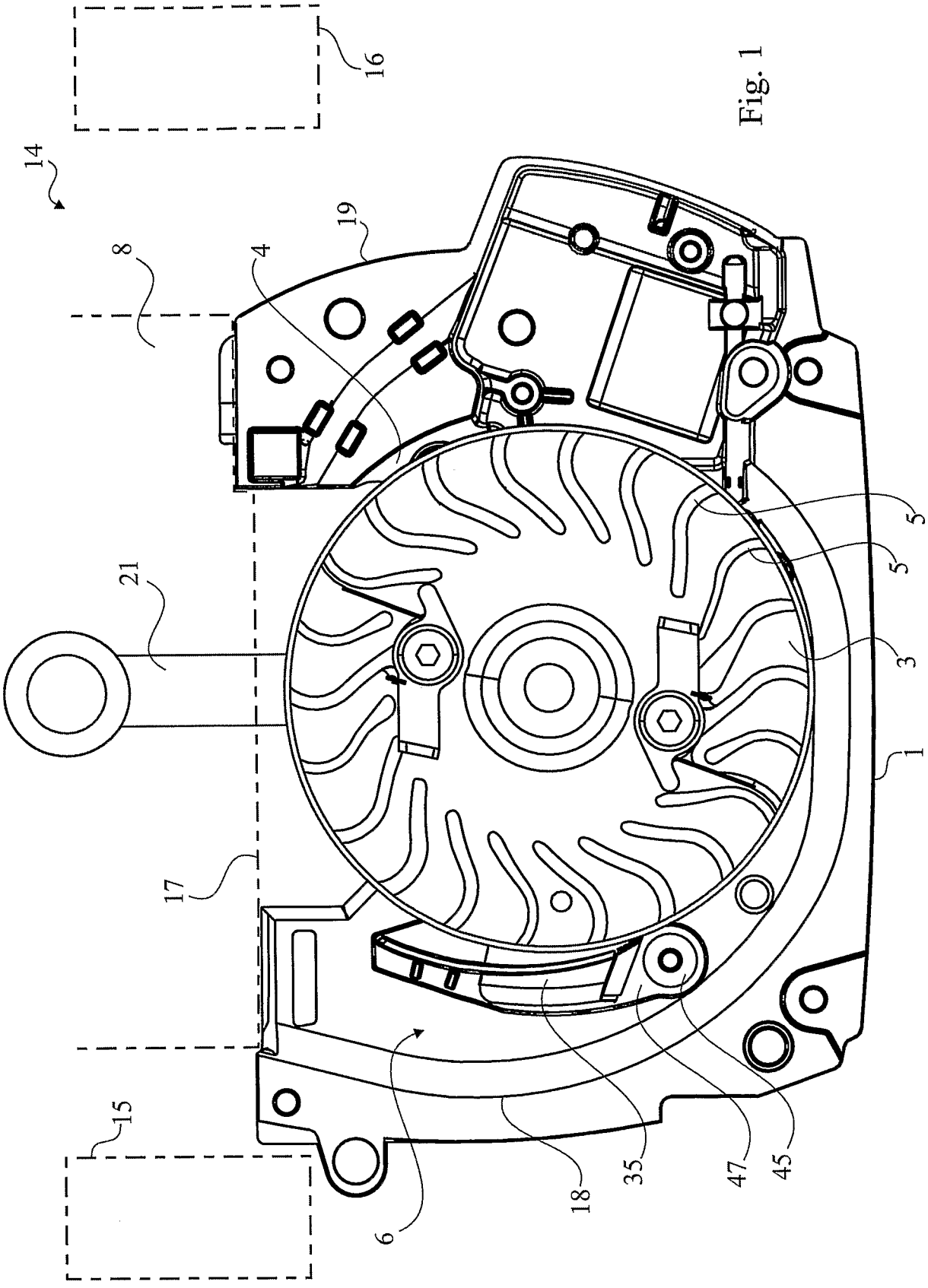


Fig. 1

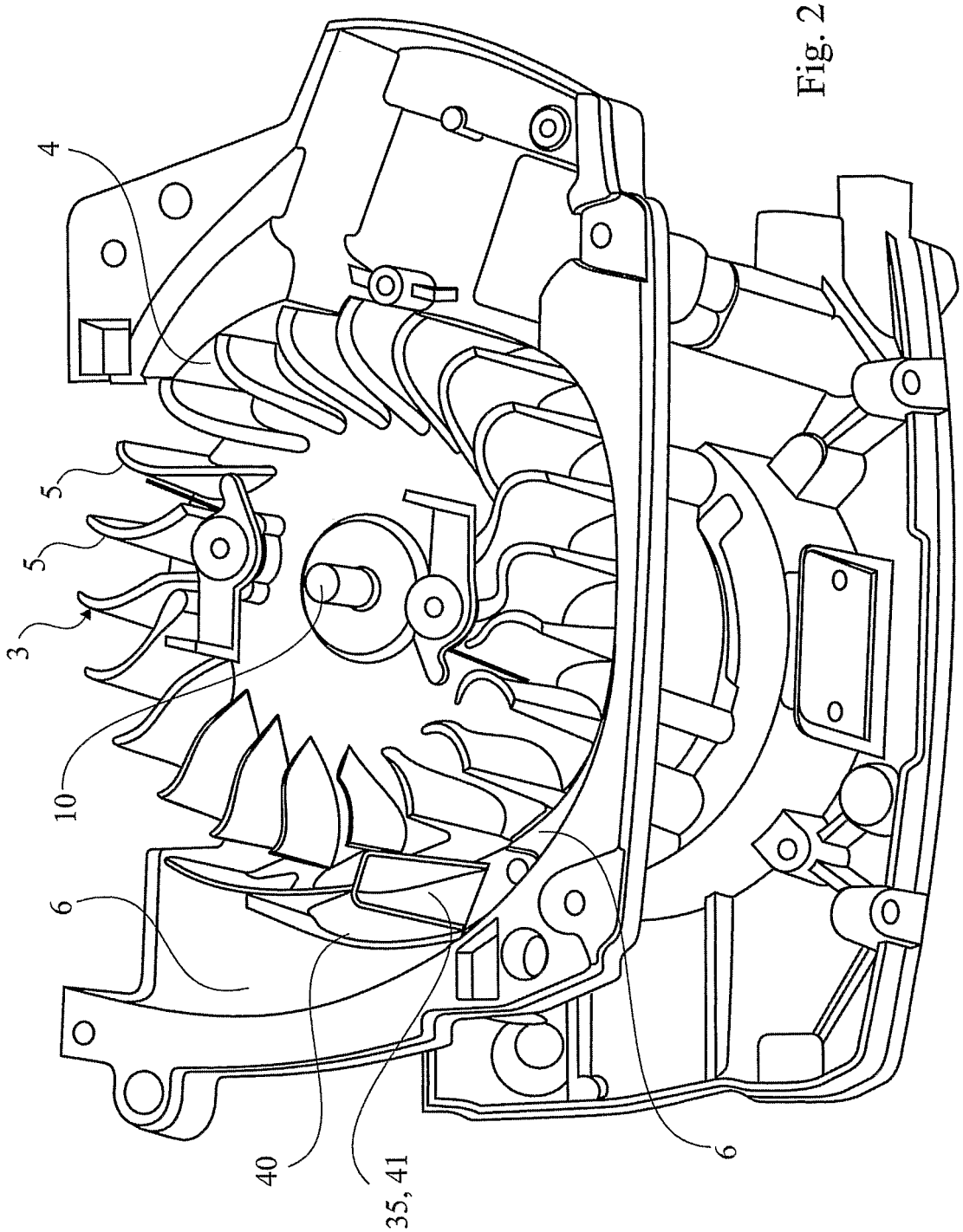


Fig. 2

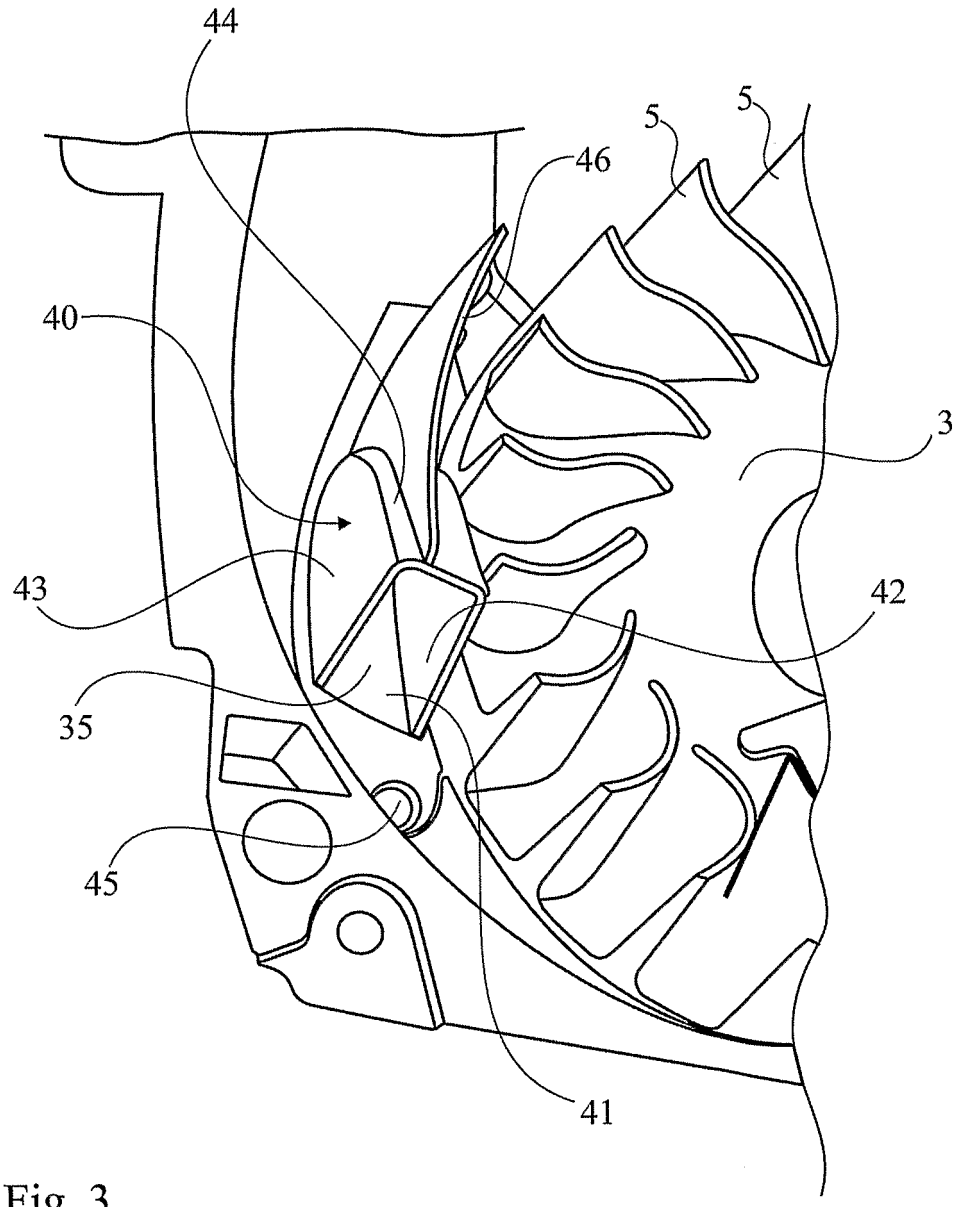


Fig. 3

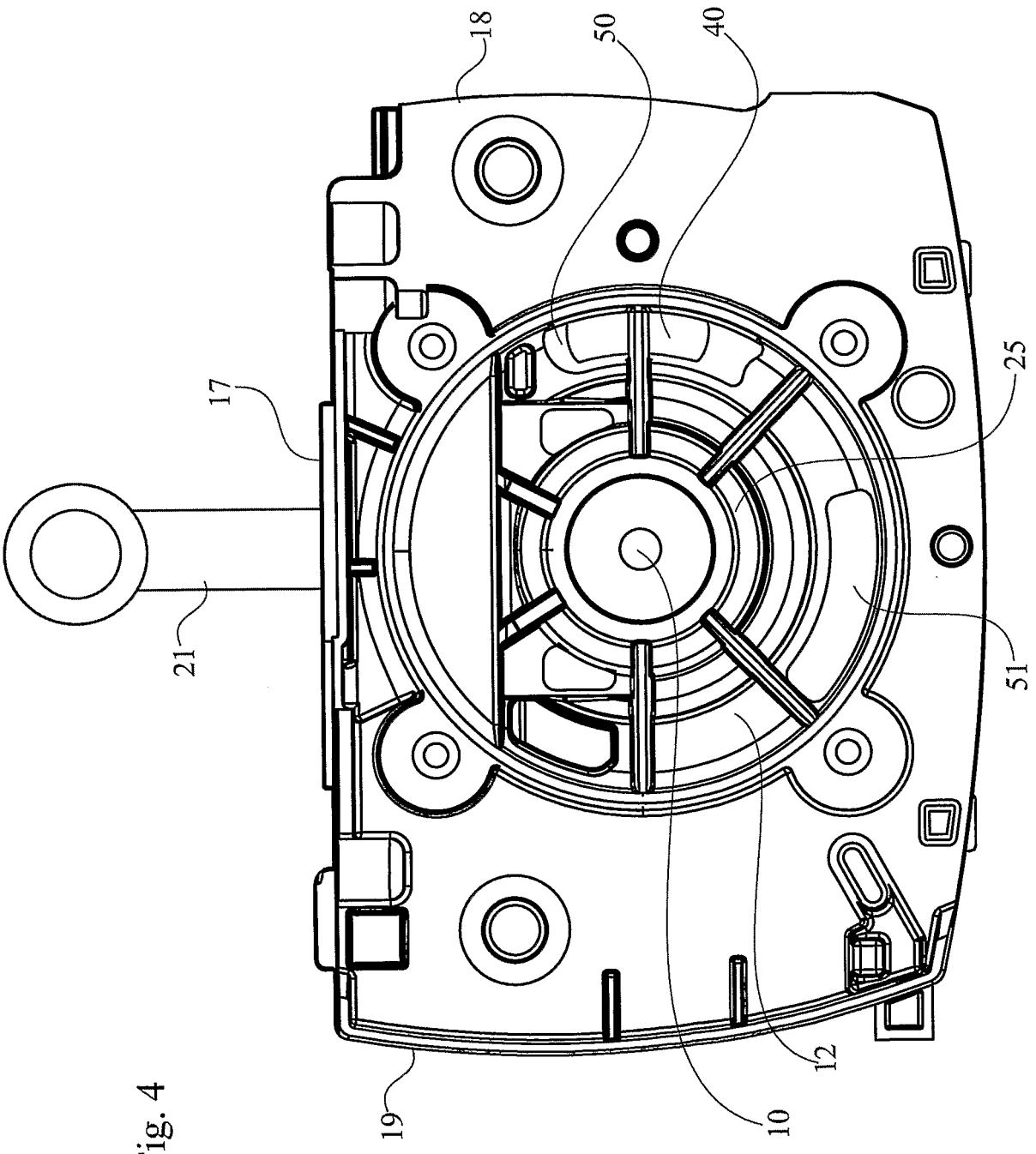
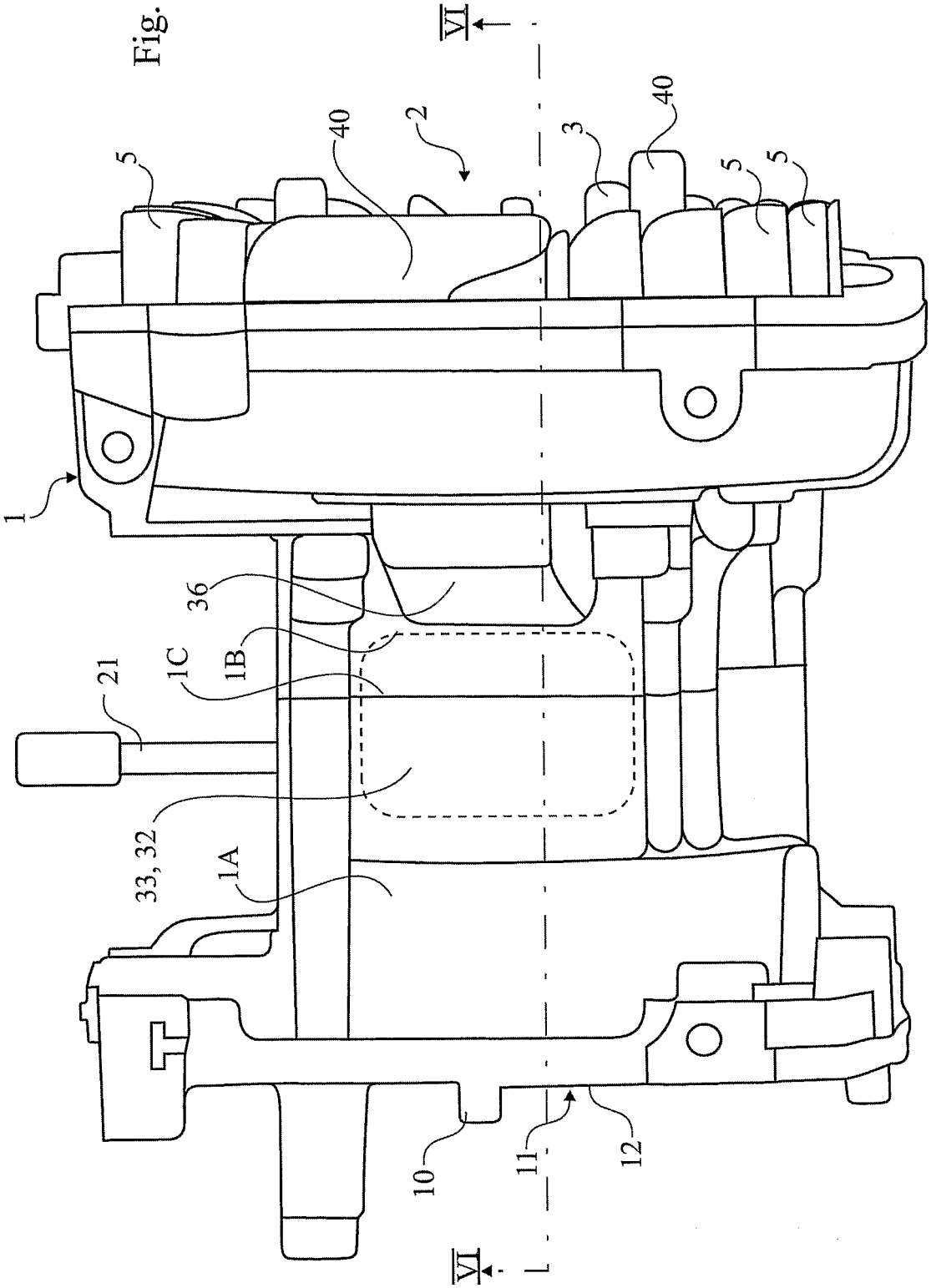


Fig. 4

Fig. 5



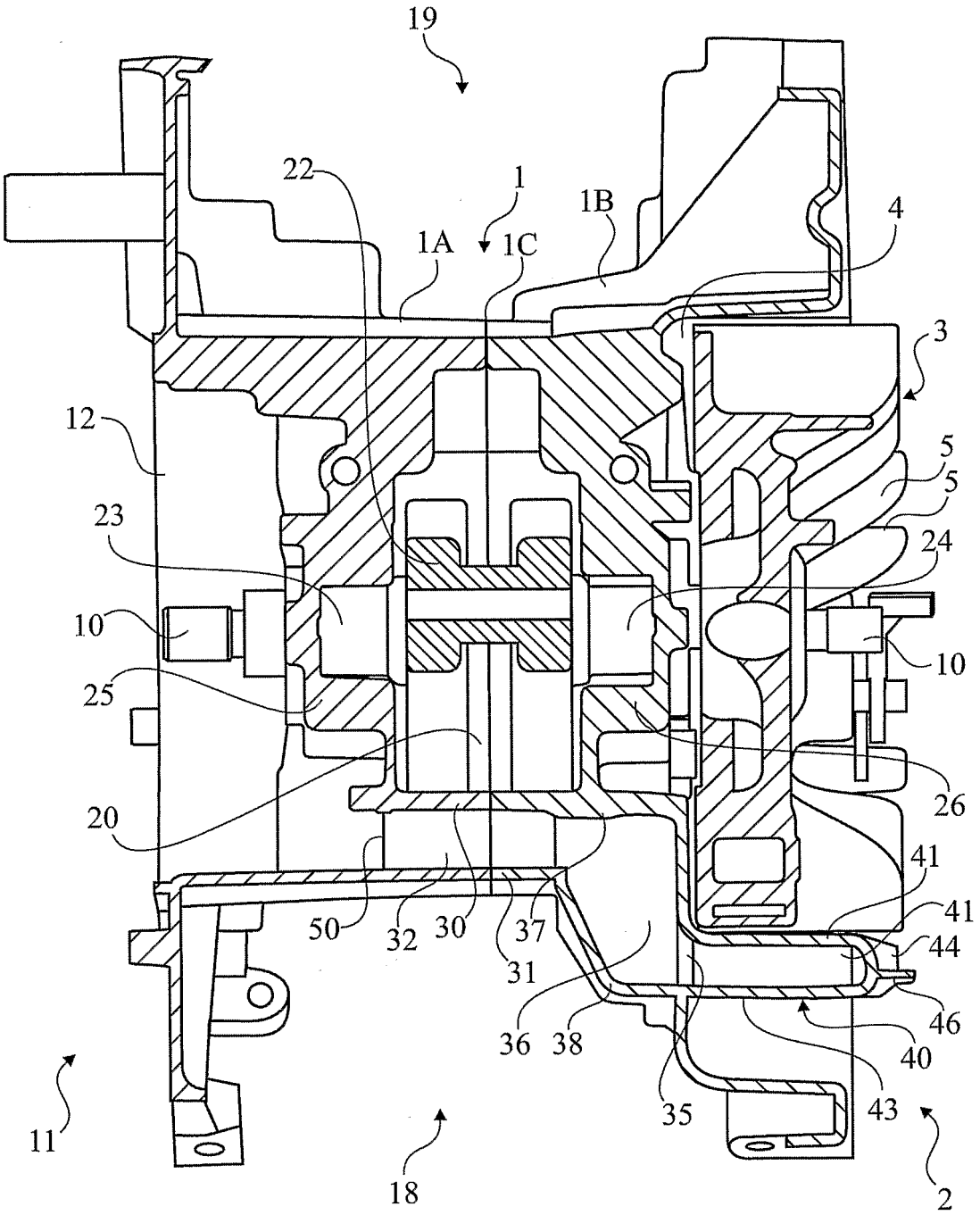

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Fig. 6

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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