United States Patent

Hatz

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[54] INTERNAL COMBUSTION ENGINE HAVING A COOLING-AIR BLOWER

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[51] **Int. Cl.** **F01p 1/02,** F01p 5/02, F01p 1/10

[58] **Field of Search** ..... 123/41.46, 41.49, 41.56, 41.58, 123/41.59, 41.6, 41.65, 41.66, 41.67, 41.69, 41.7, 41.31, 195 A, 195, 198 E, 193 H

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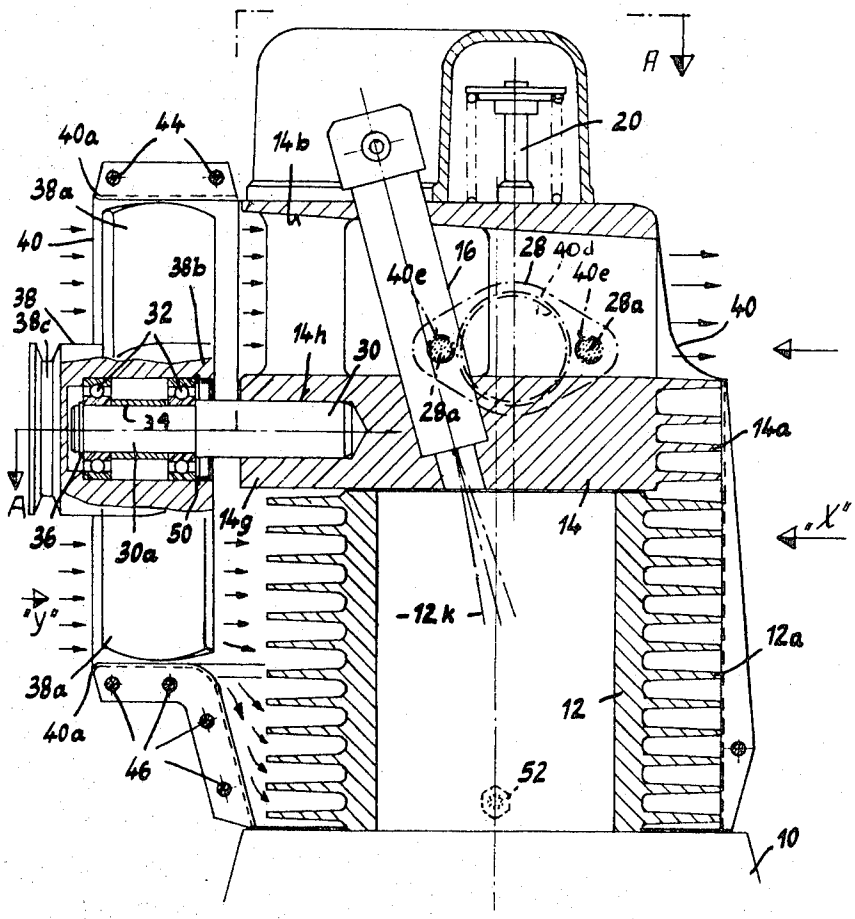
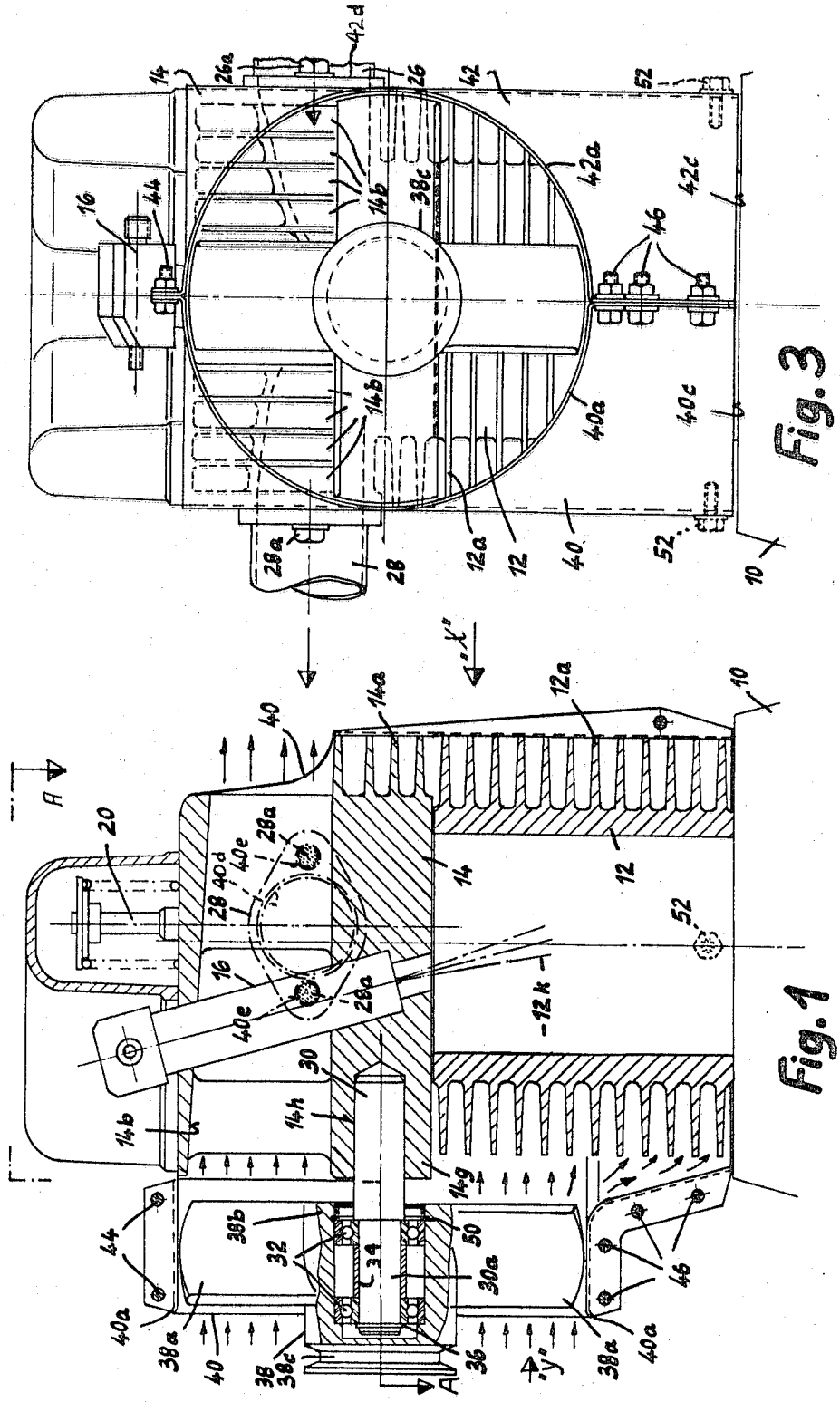
Attorney—Larson, Taylor and Hinds

[57] **ABSTRACT**

An internal combustion engine having a cooling-air blower such as an axial flow fan having a mounting bolt mounted directly on the cylinder head of the engine and a housing, preferably formed in two shell-halves connected together and mounted on the engine by screws or the like which already exist on the engine. The shell-halves form cooling-air passageways by the engine for air from the blower.

5 Claims, 4 Drawing Figures

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28a
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12
40
10
A
20
40d
40e
14a
12
52
-12k
30
14h
14g
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38c
38a
40a
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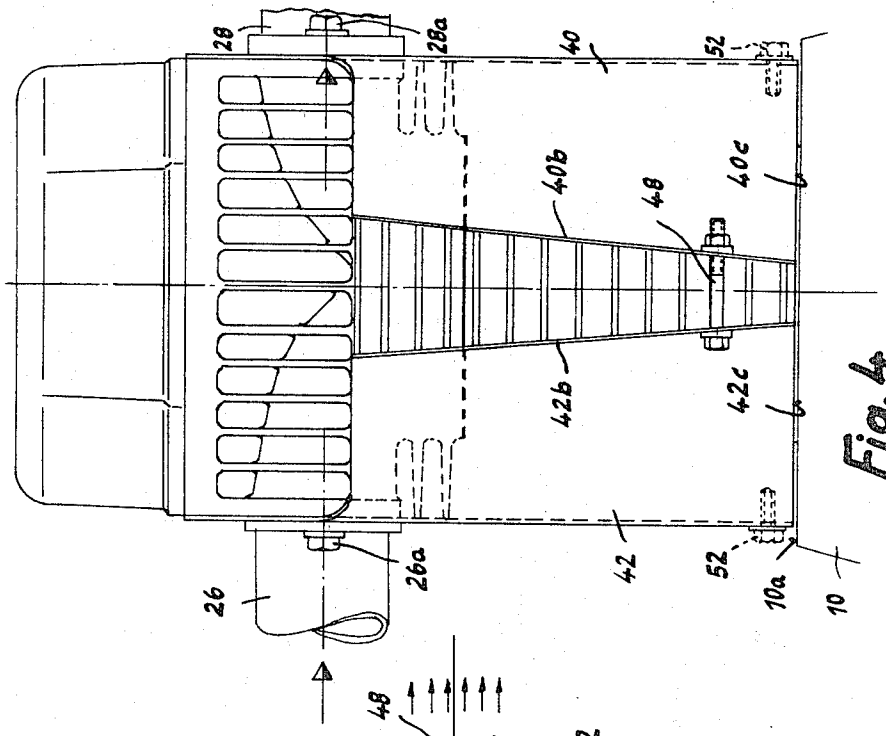
"x"

Fig. 3

Fig. 1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40b
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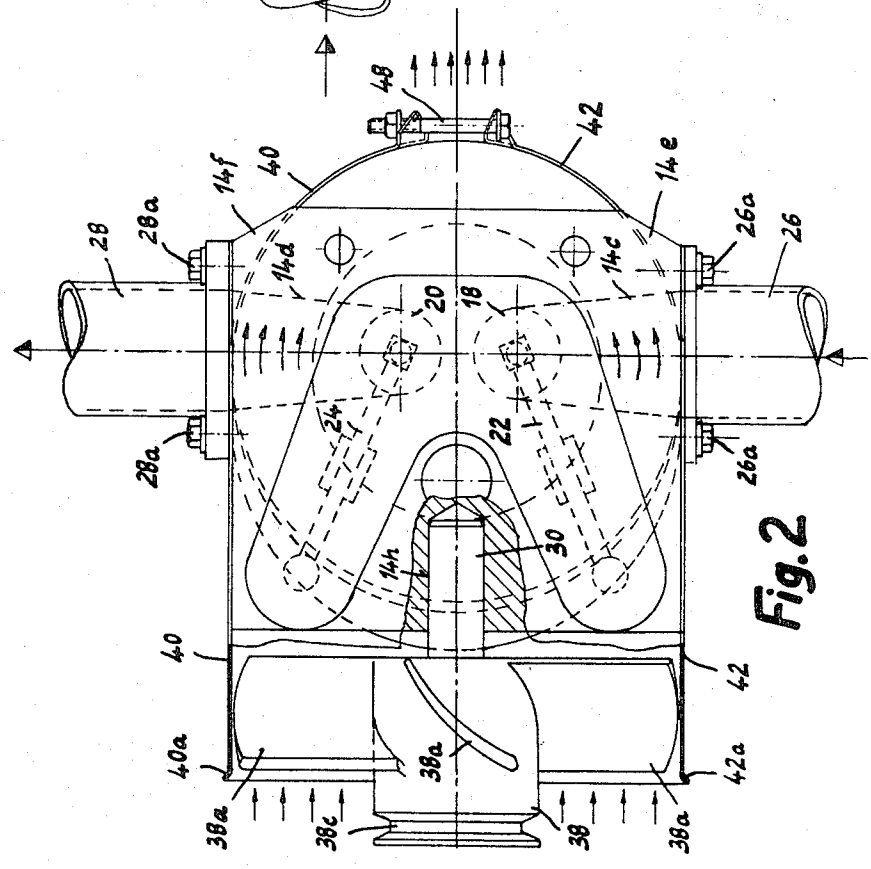
40c
42b
42c
26
26a
42
52
10a
10

Fig. 4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14e
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28a
14d
14c
26a
26
20
18
24
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28a
26a
30
14h
40
42
40a
38a
42a
38a
38c
38
38a

Fig. 2

INTERNAL COMBUSTION ENGINE HAVING A COOLING-AIR BLOWER

BACKGROUND OF THE INVENTION

This invention relates to an internal combustion engine, and in particular it relates to a cooling-air blower constructed in combination with an internal combustion engine such as a single-cylinder diesel engine or the like.

Cooling-air blowers, in particular axial-flow blowers of generally known constructions, comprise a jacket or casing which, by means of turbine blades or support webs, is welded or screwed to the bearing housing enclosing the bearing for the fan to form a unitary construction. In addition, these blowers are usually provided with a support arm which is connected to the crankcase of the engine. In some cases, a seat is also fixed to the crankcase, the above-described blower being held on said seat by bands. Arrangements of this kind are inherently of complicated construction, which not only increases manufacturing costs but also occupies considerable space.

Thus, there exists a need for a new, improved and simplified blower arrangement for an internal combustion engine.

SUMMARY OF THE INVENTION

The purpose of the invention is to overcome the disadvantages of the known constructions, and to provide a simplified blower arrangement which requires a minimum of parts and space, and which is also economical in manufacture and weight.

This purpose is achieved in accordance with the invention by the fact that the fan of the blower is mounted on a mounting bolt fixed in the cylinder head of the engine, and that the blower housing is so shaped that it is held in place on the cylinder head with the aid of holding means already on the latter.

According to a further feature of the invention, the screws in the cylinder head for the inlet and exhaust manifolds are preferably used as holding means.

In a preferred embodiment of the invention, the blower housing is made of two shell-halves which are screwed together. Moreover, it is of advantage to arrange these shell-halves so that they also serve to define the cooling-air passages around the cylinder head and cylinder.

In a particularly simple construction of these shell-halves, in accordance with a further feature of the invention, the shell-halves are connected together in a plane passing through the cylinder axis and are screwed together at a plurality of locations, in particular, around the periphery of the fan. An arrangement in which the blower is an axial blower produces an advantageous arrangement in which the mounting bolt for the fan is arranged at right angles to the cylinder axis and is pressed into the body of the cylinder head.

According to another feature of the invention, mounting of the blower on the engine is simplified by the fact that the fan, its drive pulley and its mounting bolt are constructed as a unit which is mounted in the cylinder head by fixing the mounting bolt in its bore at the appropriate position on the cylinder head.

Thus, it is a purpose of this invention to provide a new and improved cooling-air blower in combination with an internal combustion engine.

It is another object of this invention to provide a simplified blower arrangement for an internal combustion engine comprising a fan having a mounting bolt fixed onto the engine and including a pair of shell-halves connected together and forming a blower housing for the fan.

It is still another object of this invention to provide a new and improved combination internal combustion engine including a fan mounted directly on the engine and a housing comprising a pair of shell-halves surrounding the engine and the blower so as to form a blower housing for the fan and cooling-air passageways around the engine.

It is still another object of this invention to provide a new and improved combination blower and internal combustion engine wherein the blower comprises a fan including a mounting bolt and drive pulley mounted together as a unit, the mounting bolt being connected directly to the engine.

It is still another object of this invention to provide a simplified blower for an internal combustion engine wherein the blower housing is connected to the engine by connecting means normally forming a part of the engine in the absence of the blower housing.

Other objects and advantages of the present invention will become apparent from the detailed description to follow, together with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

There follows a detailed description of preferred embodiments of the invention to be read together with the accompanying drawings.

FIG. 1 is a longitudinal section through an internal combustion engine and blower constructed in accordance with the present invention.

FIG. 2 is a partial plan, partial horizontal sectional view taken along line A—A of FIG. 1.

FIG. 3 is a side view taken in the direction of the arrow Y in FIG. 1.

FIG. 4 is a side view taken in the direction of the arrow X in FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT:

In the accompanying drawings, like elements are represented by like numerals throughout the several views.

The illustrated internal combustion engine is a single cylinder diesel engine of known form comprising a crankcase **10**, a cylinder **12** arranged with its axis vertical and a cylinder head **14** all of which are connected together in usual fashion, not shown. Both the cylinder and cylinder head are formed with horizontal cooling ribs, **12***a* and **14***a* respectively, around their peripheries. Moreover, the cylinder head **14** includes a number of cooling-air channels **14***b* which extend horizontally therethrough.

An injection nozzle **16** is mounted in the cylinder head **14**, and is directed towards the piston which is arranged in the combustion chamber, but which has been omitted for clarity. In addition, inlet and outlet valves **18**, **20** are arranged in the cylinder head in known fashion and are operated by rockers **22**, **24** from the camshaft. The passageways in the cylinder head **14** which lead to the valves are designated **14***c* and **14***d*. Inlet and outlet manifolds **26**, **28** are connected to these passageways, the inlet manifold **26** by means of two screws **26***a*, and the outlet manifold by means of two screws **28***a*. The screws **26***a* and **28***a* are fixed to corresponding flanges **14***e* and **14***f*, respectively, on the cylinder head **14**.

An axial-flow cooling-air blower is provided to cool this internal combustion engine and is of the following construction. A bore **14***h*, in which a mounting bolt **30** can be pressed, is provided in the body of **14***g* of the cylinder head **14** on cylinder **12** and extends at right angles to the cylinder axis. Two ball bearings **32** and a spacer sleeve **34** are mounted on the free, projecting end **30***a* of the bolt **30**. A circlip **36** on the end **30***a* maintains the required axial positioning of the parts **32** and **34** on the bolt **30**. A fan **38** having, for example, four identical propeller-form vanes **38***a* is turnably mounted with its hollow boss **38***b* on the bearings **32**. The boss **38***b* is also shaped at its outer end to form a V-belt pulley **38***c*, by means of which the fan **38** is driven by a belt (not shown) from a drive pulley, for example, on the crankshaft. Fan **38** is surrounded by a housing designed to produce a high blowing efficiency, this housing comprising two thin-walled shell-halves **40** and **42** which are shaped as mirror images of one another and are connected to a narrow rim around the fan **38** by screws **44**, **46**. A turned-over rim **40***a*, **42***a* on the inlet side of

the shell-halves **40, 42** ensures rigidity of these parts of the housing.

The shell-halves **40, 42** are sidewardly extended in the region in which they form the blower housing and are shaped to serve as cooling-air deflectors which surround the cooling ribs **12***a* on the cylinder and the cooling ribs **14***a* on the head, being held together by a screw **48** at the side of the engine remote from the blower, so as to leave an outlet slit for the cooling-air (FIG. **4**) between the edge portions **40***b* and **42***b*. The lower edges **40***c* and **42***c* of the shell-halves **40, 42** extend down to the region of the top **10***a* of the crankcase **10** and said halves include, in the region of the manifolds **26** and **28** respectively, a large through-flow aperture **40***d* and **42***d* and the two smaller openings **40***e* and **42***e* respectively. In this way, the two shell-halves can be fixed between the manifolds **26** and **28** and the cylinder head **15** by means of the two screws **26***a* and **28***a*. The diameters and positions of the openings **40***e* and **42***e* are chosen exactly and the latter preferably serve, together with the bolts of the screws **26***a* and **28***a* as fitting means to ensure the required exact drive setting of the blower housing **40***a*, **42***a* relative to the fan **38** and to maintain the required minimum clearance between these parts after the shell-halves **40, 42** have been fitted to the cylinder head **14**. If necessary, a screw **52** could be screwed into the cylinder **12** in the region of each lower edge **40***c*, **42***c* to prevent the lower regions of the shell-halves from flapping. This screw is shown in dotted lines in FIGS. **1** and **2**.

It can be readily seen that the cooling-air—as indicated by arrows in the drawings—is sucked in at the forward end of the blower and is fed by the rotating vanes **38***a* of the fan **38**, being blown through the shell-halves **40, 42** partly by way of the channels **14***b* and along the cooling ribs **14***a* of the cylinder and partly along the cooling ribs **12***a* of the cylinder to cool these parts and, after cooling, issues through the opposite side by way of the slit between edges **40***b* and **42***b*. The position of the blower and its diameter are so chosen that the parts of the cylinder head and of the cylinder at a thermal maximum are effectively cooled by the air blow. The blower has a minimum of parts, requires minimum preparation and, moreover, takes up minimum space in the engine. By tightening or loosening a number of screws, the whole housing, together with the associated ducting, can be easily removed or re-mounted respectively.

The fan is made in a conventional manner as an injection moulding in aluminum or similar material and, so that the inner bore only of its boss requires finishing. The bolts for mounting the fan can be easily mass produced in the required size, and the bores in the cylinder head to receive the same can be made during construction without further expense so as to incur no further cost. The shell-halves can either be made as aluminum mouldings or pressings, being light in weight and low in price. Alternatively, the shell-halves could be made in a plastics material of an appropriate rigidity.

By using a circlip **50** in the bore in the boss **38***b*, the fan **38** can be made as a single unit with the mounting parts **32** and **30** so that mounting on the engine is simply a case of pressing, screwing or fixing in similar fashion, the mounting bolt **38** in bore **14***h* in the cylinder head **14**.

Finally, it should be noted that in FIG. **1** the spacing between the bolts **26***a*, **28***a* and the openings **40***e*, **42***e* has been exaggerated for clarity. In practice there is only a narrow space between these parts which—as mentioned above—ensures centralization or adjustment of the shell-halves **40, 42** relatively to the fan **38**.

Although the invention has been described in considerable detail with respect to a preferred embodiment thereof, it will be apparent that the invention is capable of numerous modifications and variations apparent to those skilled in the art, without departing from the spirit and scope of the invention.

I claim:

1. An internal combustion engine including a combustion cylinder and a cylinder head, at least one engine element mounted on said cylinder head, holding means for holding said engine element in its mounted position on said cylinder head, a blower mounted on said internal combustion engine, said blower including a fan formed about a mounting bolt, said mounting bolt connected to said cylinder head, and said blower further comprising a blower housing in the form of two shell-halves rigidly connected together and arranged on the engine to direct the air from the fan by the engine to cool the latter, said shell-halves being connected together by screws along a plane which passes through the axis of said cylinder, said screws being applied at a plurality of positions along said plane, including a plurality of positions in the area where the housing forms the blower housing surrounding the fan, said holding means of said engine element being arranged for simultaneously holding said blower housing on the cylinder head.

2. An internal combustion engine according to claim **1**, wherein said cylinder head includes inlet and exhaust passages leading, respectively, to and from inlet and exhaust valves of said engine, said engine element comprising inlet and outlet manifolds connected to said inlet and outlet passages, respectively, said holding means comprises elements normally performing a holding function on the engine itself in the absence of the blower housing of attaching said inlet and exhaust passages to said inlet and exhaust manifolds, respectively.

3. An internal combustion engine according to claim **2**, wherein said holding means for holding the blower housing comprises screws which also hold the said manifolds in the cylinder head.

4. An internal combustion engine according to claim **1**, wherein the shell-halves forming the blower housing also serve to define cooling-air passageways around the cylinder head and the cylinder.

5. An internal combustion engine according to claim **1**, wherein the blower fan is constructed as an axial blower fan having a plurality of radially extending vanes and the said mounting bolt for the fan is arranged substantially at right angles to the axis of the cylinder and is fixed in the body of the cylinder head.

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