HOUSING FOR A FLUID FLOW ENGINE

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ABSTRACT
A housing (1) for a fluid flow engine comprises a first rotor space (2) for receiving and housing a turbine rotor, a bearing space (4) to house a shaft (5) of said turbine rotor, and a second rotor space (3) for receiving and housing a compressor rotor. The housing portions, which surround the bearing space (4), are integrally formed at least in part with those portions that surround at least one of the rotor spaces (2, 3).
HOUSING FOR A FLUID FLOW ENGINE

FIELD OF THE INVENTION

[0001] The present invention relates to a housing for a fluid flow engine, such as a turbocharger, a secondary air charger or the like. More particularly, the invention relates to a housing for such a fluid flow engine which comprises a first rotor space for receiving a turbine rotor, a bearing space for supporting a shaft supporting the turbine rotor at one of its ends, and a second rotor space for receiving and housing a compressor rotor, both rotor spaces being surrounded by channels for conveying a gas, such as exhaust gas or air.

BACKGROUND OF THE INVENTION

[0002] Such housings are known from a variety of documents, for example from document CA 1,270,120 or U.S. Pat. Nos. 2,860,827; 4,173,247 or 4,659,295. In all these known constructions, the housing consists of several housing parts, mostly three. For example, in most cases a separate housing part forms each the turbine rotor space, another one the bearing space and a third one the compressor rotor space. These housing parts have then to be screwed or assembled in some way together, which is cumbersome, requires small tolerances and is, thus, expensive.

[0003] However, forming the housing of several parts was, generally based on a certain reason, i.e. to make heat conduction more difficult and to be able to choose different materials for the different housing parts.

SUMMARY OF THE INVENTION

[0004] The present invention is based on the recognition that a multipart realization of such a housing is not necessary for all applications. It is, therefore, an object of the invention to reduce costs of production and assembly.

[0005] According to the invention, this object is achieved in that the housing portion, that surrounds and defines the bearing space, is integrally formed with at least one of the housing portions which surround and define one of the rotor spaces. Accordingly, it would be possible to cast for each rotor a housing, that surrounds the respective rotor space and which is integrally interconnected with at least part of the housing portion, which surrounds and defines at least part of the bearing space. In this way, only the two rotor housing portions had to be assembled.

[0006] In the context of this specification, the fact that a part is “integral” with another one should mean that both of them consist of a single piece.

[0007] Of course, it is still more favorable if all three spaces, i.e. the two rotor spaces and the intermediate bearing space are surrounded by an integrally formed or cast housing.

[0008] A special advantage of the construction according to a preferred embodiment of the invention resides in that only a single technically high-grade part has to be produced instead of a plurality of them (involving an adaptation of tolerances to one another). The rotor spaces, open to the exterior, can be covered with a simple flange member so that mounting the housing requires only mounting the two flanges, thus being less cumbersome.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Further details of the invention will become apparent from the following description of an especially preferred embodiment schematically illustrated in the drawings, in which:

[0010] FIG. 1 is an axial cross-section of a housing for a fluid flow engine according to the invention, in which, for better understanding, a bearing plus rotors and housing cover are mounted, as is schematically indicated;

[0011] FIG. 2 is a side elevation according to line II-II of FIG. 1.

DETAILED DESCRIPTION

[0012] A single piece housing 1 which is, for example, produced from cast material, such as gray cast iron or a light metal casting, surrounds and defines with its inner walls a turbine rotor space 2 for a turbine rotor 2, shown in FIG. 1, at one of its axial ends, a compressor rotor space 3 for a compressor rotor 3 to be accommodated therein at the opposite axial end of the housing, and in-between a bearing space 4 for a shaft 5 which, as known to one of ordinary skill in the art, supports each of the two rotors 2 and 3 on one of its ends. To each of the rotor spaces 2, 3 a channel is assigned which, ordinarily, surrounds the rotor space in an approximately annular or spiral form, i.e. a supply channel 6 and a discharge channel 7.

[0013] A gaseous medium, i.e. in the case of a turbocharger an exhaust gas of a combustion motor, in the case of a secondary air charger it is air, or any other fluid, such as a liquid, is supplied to the supply channel 6 from a connection piece 8 shown in FIG. 2, which is preferably also integrally formed on the housing 1, and which may be connected to the exhaust of a combustion motor. On the other hand, air is supplied to the compressor rotor space 3 through an axially extending connection piece 17 (see arrow a), which is situated on a housing cover 18 to be fastened to the end of the housing 1 by means of bolts 19. Compressed air is then discharged through a discharge channel 7 and a connection piece 9.

[0014] It should be noted that the housing 1 according to the invention can also be closed at its opposite axial end by a housing cover 20, to which end it may comprise threaded bores 21 (only one is represented), which bores receive screws or bolts 22 in a similar way as described with reference to bolts 19. In this case, this cover would define and limit the rotor space 2, just as the cover 18 delimits rotors space 3. In similar manner, cover 20 possesses an axial connection piece 23 through which fluid is discharged in correspondence with arrow a, said fluid having been supplied to rotor 2 through the supply channel 6.

[0015] As best seen in FIG. 1, the housing 1 is relatively thick, but is formed to have a shape that is easily produced. However, it is within the scope of the present invention to restrict the housing 1 more or less between the turbine rotor space 2 and the compressor rotor space 3 and to provide it, if desired, with outer ribs for eliminating heat.

[0016] Even though a single housing 1 is shown in FIG. 1 which surrounds all three spaces 2-4, the invention is not limited to this embodiment. For example, it would be conceivable to produce the housing 1 from two separable
interconnected parts, as is indicated with dotted line L. Of course, a tolerance problem could arise from this two-part construction for which reason a completely integral construction for all three spaces 2-4 is preferred. However, tolerance problems could be better managed if the two parts of the two-partite housing 1 have inter-engaging fitting surfaces, particularly conical fitting surfaces 10, so that they have only to be fitted into each other then and to be secured in a manner known to one of ordinary skill in the art. Such a subdivision of the housing 1 can also be effected in another way, for example by providing a housing that surrounds one of the rotor spaces and the whole bearing space. A further modification could consist in that both rotor spaces 2 and 3 and/or the supply and discharge channels 6 and 7 are of equal size.

[0017] It should further be noted that the bearing space 4 can receive and house a conventional slide bearing which, if desired, may be subdivided into at least two axially off-set parts, or an antifriction bearing is used.

[0018] In contrast to the prior art where axial fixing of the bearing was effected in the middle of the bearing space (see U.S. Pat. No. 4,179,247), it is preferred according to the invention if an axial fixing arrangement, such as thrust bearing, is provided at an end of the bearing space 4 facing the respective rotor space 2 and/or 3. In this way, axial fixing can be achieved without expensive treatment of surfaces and either a thrust bearing can easily be mounted or a corresponding arrangement can be easily provided. Such an arrangement is shown on the right side of FIG. 1 and is formed by an annular wall 15. This wall 15 surrounds a space 14 for passing the shaft 5 through, i.e. that end of the shaft that supports the turbine rotor 2 within the turbine space 2, and determines and closes the bearing space 4 at that end thereof. It is clear that the wall 15 is not necessarily an annular wall, but this embodiment is preferred.

[0019] On the other hand, a cylindrical space 16 is provided at the other end of the bearing space 4 (at left in FIG. 1) where an axial fixing assembly, for example a thrust bearing, can be accommodated. Such axial fixing assemblies or thrust bearings are known to those skilled in the art and, therefore, need not be explained in detail. Thus the bearing space 4 has preferably the shape of a bushing. In this way, it is possible to insert the shaft 5 together with a pre-mounted bearing unit (or alternatively the bearing alone) into the bushing formed by the bearing space 4 where it abuts and engages the annular wall 15. The annular wall 15 itself and its opening 14 for passing the shaft 5 through (i.e. the opening 14 corresponds in size approximately to the diameter of the shaft 5) may either be formed as a friction or slide bearing itself or may receive such bearing (or may be left without any bearing). As soon as the bearing unit, having preferably the same axial length as the bearing space 4, has been introduced into that bearing space 4, the bearing may be axially fixed by inserting a thrust bearing or any other axial fixing device into the space 16.

[0020] Numerous modifications are possible within the scope of the present invention, some of them having been mentioned already above. Furthermore, it would be conceivable to provide lubricating bores which lead from the exterior, e.g. from an appropriate nipple, into the bearing space 4. The housing 1 itself could comprise radially extending outer connection flanges at both its ends (or on one of them) where the housing covers 18 and 20 including the appropriate axial connection pieces 17, 23 for discharging a fluid, such as the exhaust gas (at right in FIG. 1) or for supplying air (at left in FIG. 1) may be screwed on. In each case, however, it will be seen that not only the housing construction is simplified, but that in addition mounting is facilitated. With respect to the rotors 2, 3, they may be of any conventional type; in this connection, reference is made to the documents cited at the outset.

[0021] Instead of the above-mentioned axial fixing arrangement, as preferred, one could provide an axial fixing device within the bearing space 4, as is known to one of ordinary skill in the art from U.S. Pat. No. 4,179,247, for example by providing at least one annular groove 24 in the bushing-like bore of the bearing space 4 in order to accommodate there such an axial fixing unit. In this way, it would be possible, if desired, to provide an arrangement for axially fixing the bearing between both the ends of the bearing space 4.

1-6. (cancelled)
7. A housing (1) for a fluid flow engine, said housing comprising:
   a first rotor space (2) for receiving a turbine rotor (2) and
   comprising flow conduits for supply and removal of a gas (6, 23);
   a second rotor space (3) for receiving a compressor rotor
   (3') and comprising flow conduits for supply and removal of a gas (17, 7);
   a bearing space (4) for a shaft (5) comprising a first end
   adapted to be axially attached to said turbine rotor (2),
   and a second end adapted to be axially attached to said
   compressor rotor (3');
   wherein said housing (1) is formed as one piece and at
   least one of said spaces (2, 3, 4) surrounds each said
   rotor (2, 3).
8. The housing of claim 7, wherein all three said spaces
   (2-4) are defined by a unitary housing (1).
9. The housing of claim 7, wherein said bearing space
   (4) is larger than the diameter of said shaft (5) for receiving
   a bearing (13, 13).
10. The housing of claim 8, wherein said housing (1)
    comprises at least one supply support (8 or 9) for channeling
    a gas to the associated supply channel (6 or 7).
11. The housing of claim 7, further comprising at least one
    means (15, 16) for axially fixing the bearing, wherein said
    means are located at at least one end of the bearing space (4).
12. The housing of claim 7, wherein said means (15, 16)
    for axially fixing the bearing are located at both ends of
    the bearing space (4).
13. The housing of claim 11, wherein the bearing space
    (4) further comprises a radially inward directed ring-wall
    (15) at one end of said bearing space for mounting and
    axially fixing the shaft (5).
14. The housing of claim 13, wherein said ring-wall is an
    axial bearing.

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