



US 20110182717A1

(19) **United States**

(12) **Patent Application Publication**

Tries et al.

(10) **Pub. No.: US 2011/0182717 A1**

(43) **Pub. Date: Jul. 28, 2011**

(54) **TURBOCHARGER**

Publication Classification

(75) Inventors: **Timo Tries**, Kaiserslautern (DE);
Ralf Boening, Reiffelbach (DE);
Dirk Frankenstein, Worms (DE)

(51) **Int. Cl.**
F04D 29/56 (2006.01)

(73) Assignee: **BorgWarner Inc.**, Auburn Hills,
MI (US)

(52) **U.S. Cl.** **415/160**

(21) Appl. No.: **12/295,013**

(57) **ABSTRACT**

(22) PCT Filed: **Mar. 28, 2007**

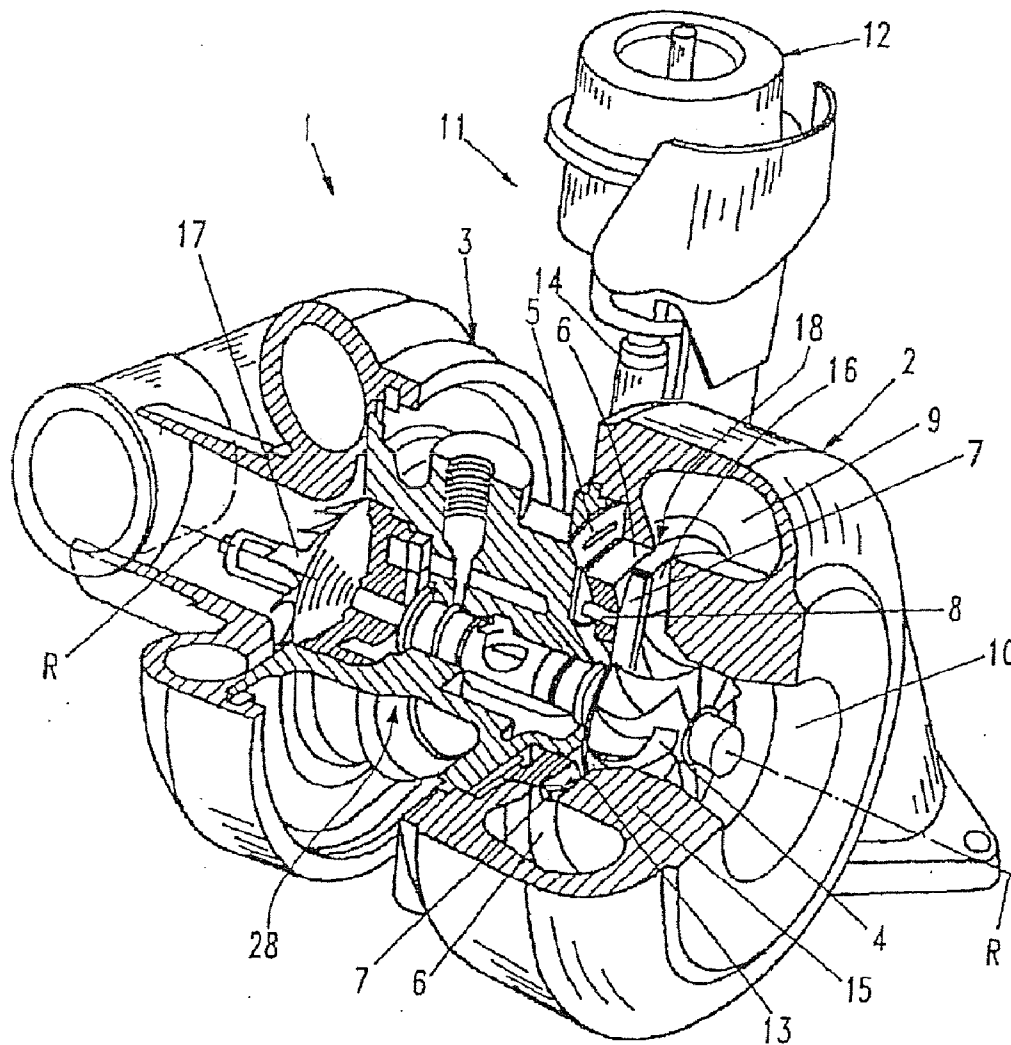
(86) PCT No.: **PCT/EP2007/002757**

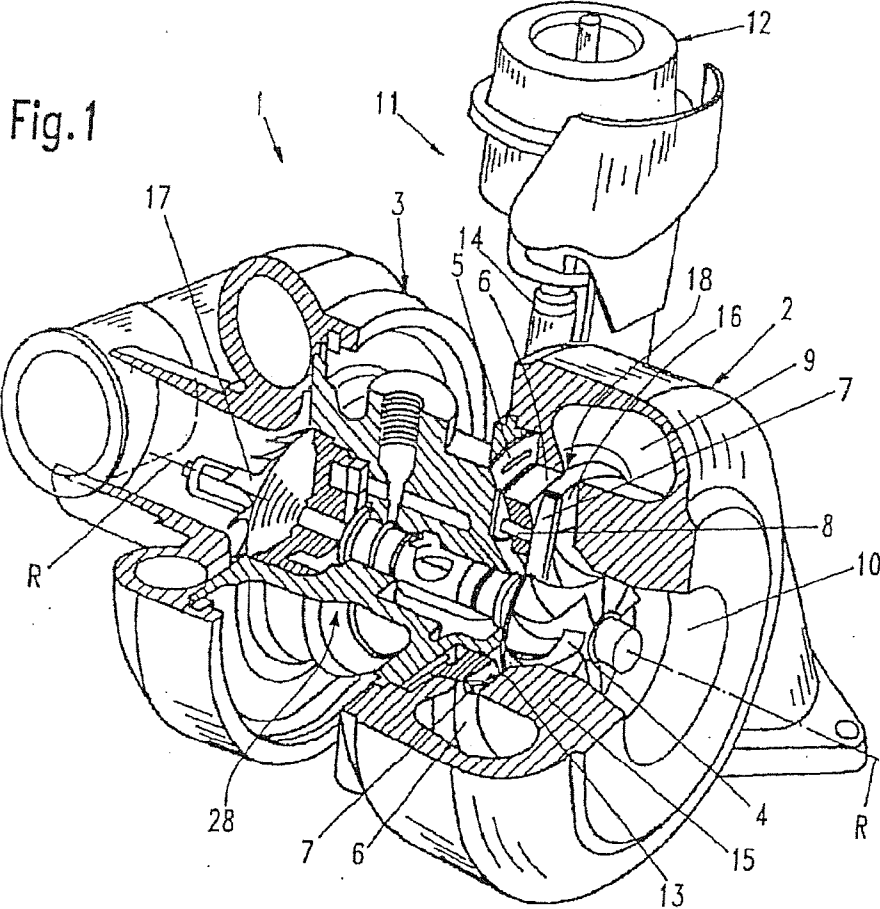
§ 371 (c)(1),
(2), (4) Date: **Nov. 24, 2008**

(30) **Foreign Application Priority Data**

Mar. 30, 2006 (DE) 10 2006 014 896.7

The invention relates to a turbocharger (1) with variable turbine geometry (VTG), comprising a multiplicity of guide blades (7). Each guide blade (7) has a blade lever (19, 19'), wherein the center plane (Em2) of an intermediate region (24; 24') of the blade lever (19, 19') is arranged so as to be offset axially along a blade shaft longitudinal axis (L) at a distance (a) from the center plane (Em1) of a first end region (20; 20') of the blade lever (19, 19') and of a second end region (23; 23') of the blade lever (19, 19'), and wherein a recess (26; 26') is arranged adjacent to the intermediate region (24; 24') between the first end region (20; 20') and the second end region (23; 23').





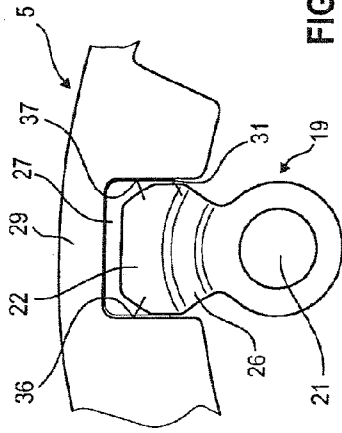


FIG. 3

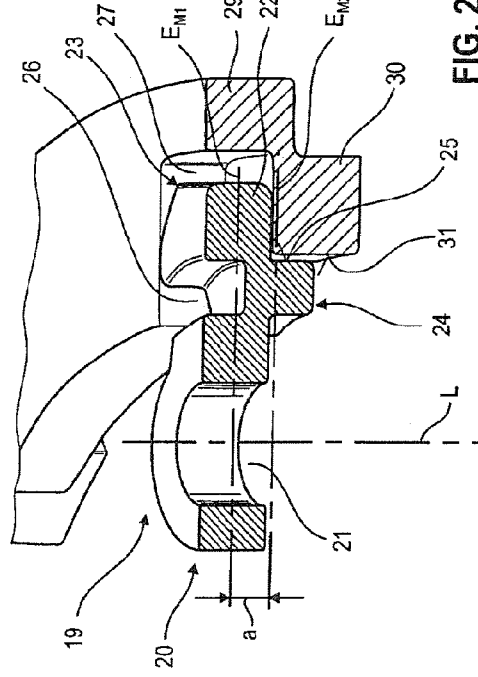


FIG. 2

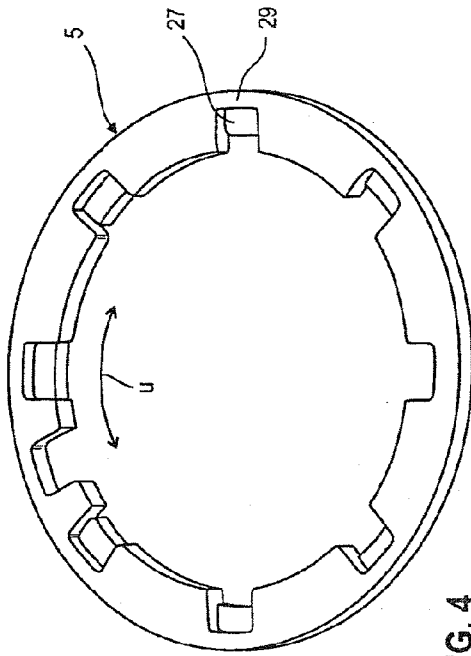


FIG. 4

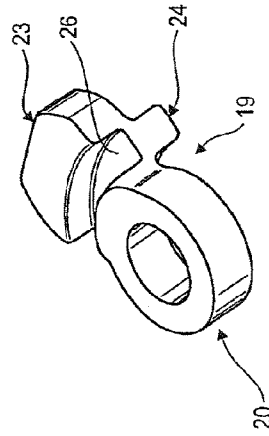


FIG. 5

TURBOCHARGER

[0001] The invention relates to a turbocharger according to the preamble of claim 1.

[0002] A turbocharger of this type is known from EP 1 520 959 A1.

[0003] In this turbocharger construction, the blade levers are configured as parts which are machined with the removal of material, for example milled parts.

[0004] It is accordingly an object of the present invention to provide a turbocharger according to the preamble of claim 1, in which a simpler and less expensive method of manufacturing these parts with high dimensional accuracy is made possible by special shaping of the blade levers.

[0005] This object is achieved by the features of claim 1.

[0006] The configuration according to the invention of the blade levers results in a simplification and cost reduction of the manufacturing process by virtue of the fact that the levers for the connection between the guide blade and the adjusting ring can be manufactured by punching or forcing through.

[0007] The subclaims have advantageous developments of the invention as contents.

[0008] Further details, advantages and features of the invention result from the following description and the drawing, in which:

[0009] FIG. 1 shows a perspective view of the turbocharger according to the invention, shown partially in section,

[0010] FIG. 2 shows a perspective partial sectional illustration of an adjusting ring and a blade lever according to the invention which is in engagement with the former,

[0011] FIG. 3 shows a plan view of a receiving recess of the adjusting ring with the blade lever according to the invention which is in engagement with said adjusting ring,

[0012] FIG. 4 shows a perspective illustration of the adjusting ring with receiving recesses which are formed by means of the manufacturing process "forcing through" for the blade levers according to the invention,

[0013] FIG. 5 shows a perspective illustration of the blade lever according to the invention,

[0014] FIG. 6 shows a perspective view which corresponds to FIG. 2 of a part of a second embodiment of the adjusting ring and the blade lever according to the invention,

[0015] FIG. 7 shows a plan view which corresponds to FIG. 3 of the adjusting ring and the blade lever according to the invention,

[0016] FIG. 8 shows a perspective view which corresponds to FIG. 4 of the adjusting ring according to FIG. 6, and

[0017] FIG. 9 shows a perspective illustration of the second embodiment of the blade lever according to the invention.

[0018] FIG. 1 shows a turbocharger 1 according to the invention which has a turbine housing 2 and a compressor housing 3 which is connected to the former via a bearing housing 28. The housings 2, 3 and 28 are arranged along a rotational axis R. The turbine housing 2 is shown partially in section, in order to clarify the arrangement of a blade bearing ring 6 and a radially outer guide cascade 18 which is formed by the former and has a plurality of guide blades 7 which are distributed over the circumference and have blade shafts 8. As a result, nozzle cross sections are formed which are larger or smaller depending on the position of the guide blades 7 and load the turbine rotor 4 which lies in the center on the rotational axis R to a greater or lesser extent with the exhaust gas of an engine, which exhaust gas is fed in via a feed channel 9

and is discharged via a central connection 10, in order to drive a compressor impeller 17 via the turbine rotor 4, which compressor impeller 17 is seated on the same shaft.

[0019] An actuating device 11 is provided in order to control the movement and the position of the guide blades 7. Said actuating device 11 can be configured as desired per se, but one preferred embodiment has a control housing 12 which controls the control movement of a tappet element 14 which is fastened to it, in order to transform its movement to an adjusting ring 5 which lies behind the blade bearing ring 6 into a slight rotational movement of said adjusting ring 5. A clearance 13 for the guide blades 7 is formed between the blade bearing ring 6 and an annular part 15 of the turbine housing 2. In order for it to be possible to secure said clearance 13, the blade bearing ring 6 has integrally formed spacer elements 16. It is possible in principle to provide more or fewer spacer elements 16 of this type.

[0020] FIG. 2 is a perspective sectional illustration of a blade lever 19 according to the invention which is in engagement with a receiving recess 27 of the adjusting ring 5. At its first end region 20, the blade lever 19 according to the invention has a receiving recess 21 for a shaft end of the blade shaft 8 which is shown symbolically in FIG. 2 by its longitudinal axis L. Said receiving recess 21 of the blade lever 19 is adjoined in the radial direction by an intermediate region 24 and a second end region 23. On its radial outer side, the intermediate region 24 has a supporting face 25 which is supported on an opposite bearing face 31 of a bearing part 30 of the adjusting ring 5. As can be seen from FIG. 3, this bearing face 31 lies in the interior of the receiving recess 27 of the adjusting ring 5.

[0021] Furthermore, FIG. 2 clarifies that the center plane E_{M2} of the intermediate region 24 is arranged axially offset along the blade shaft longitudinal axis L by a spacing a and parallel to the center plane E_{M1} of the first end region 20 and of the second end region 23.

[0022] In addition, a recess 26 which is arranged adjacently to the intermediate region 24 is arranged between the first end region 20 and the second end region 23.

[0023] The adjusting ring 5 has one receiving recess 27 per lever head 22, which can be seen from FIG. 4. As can be seen from FIGS. 2, 3 and 4, the receiving recess 27 of the adjusting ring 5 has a stop wall 29 which is arranged radially on the outside.

[0024] Furthermore, the shaping of the blade lever 19 and the configuration of the recess 26 which extends in the shape of a partial circular arc can be seen from viewing FIGS. 2, 3 and 5 together. As can be seen from this, side wall faces 36, 37 of the receiving recess 27 form, in the circumferential direction U of the adjusting ring 5, a delimitation for the rolling movement of the intermediate region 24 of the blade lever 19.

[0025] FIGS. 6 to 9 show a second embodiment of a blade lever 19' and of an adjusting ring 5' of the present invention. All the parts which coincide with the first embodiment are provided with the same designations, but with a prime symbol.

[0026] The adjusting ring 5' differs from the adjusting ring 5 of the first embodiment in that it has a receiving recess 27' which reaches through the entire annular wall thickness W, as can be seen from FIG. 7. Furthermore, the adjusting ring 5' has a plurality of elevations 34 which have a smaller wall thickness or width B_E than the adjusting ring 5', the wall thickness or radial width of which is indicated by the dimension B_V .

[0027] Furthermore, the blade lever 19' differs from the blade lever 19 of the first embodiment in that, as can be seen from FIGS. 7 and 9, it has an intermediate region 24', in which rounded shoulders 32, 33 are arranged which protrude beyond the width B of the lever head 22' on both sides of it. Furthermore, in this embodiment, the intermediate region 24 of the blade lever 19' is supported radially exclusively on that inner face 35 of the adjusting ring 5' which is defined by the internal diameter of the adjusting ring.

[0028] As a result of the above-described shapings of the blade lever 19, 19', said components can be configured as precision punched parts.

[0029] In order to complement the disclosure, reference is made explicitly in addition to the graphic illustration of the invention in FIGS. 1 to 9.

LIST OF DESIGNATIONS

- [0030] 1 Turbocharger
- [0031] 2 Turbine housing
- [0032] 3 Compressor housing
- [0033] 4 Turbine rotor
- [0034] 5, 5' Adjusting ring
- [0035] 6 Blade bearing ring
- [0036] 7 Guide blade
- [0037] 8 Blade shaft
- [0038] 9 Feed channel
- [0039] 10 Axial connection
- [0040] 11 Actuating device
- [0041] 12 Control housing
- [0042] 13 Clearance for guide blades 7
- [0043] 14 Tappet element
- [0044] 15 Annular part of the turbine housing 2
- [0045] 16 Spacer element/spacer cam
- [0046] 17 Compressor impeller
- [0047] 18 Guide cascade
- [0048] 19, 19' Blade lever
- [0049] 20, 20' End region
- [0050] 21, 21' Receiving recess
- [0051] 22, 22' Lever head
- [0052] 23, 23' End region
- [0053] 24, 24' Intermediate region
- [0054] 25 Supporting face
- [0055] 26, 26' Recess
- [0056] 27, 27' Receiving recess
- [0057] 28 Bearing housing
- [0058] 29 Stop wall
- [0059] 30 Bearing part
- [0060] 31 Bearing face
- [0061] 32, 33 Shoulders
- [0062] 34 Elevations
- [0063] 35 Inner face
- [0064] 36, 36' Side wall faces
- [0065] 37, 37' Side wall faces
- [0066] B Width, lever head
- [0067] B_E Width, elevation
- [0068] B_V Width, adjusting ring
- [0069] EM₁ Center plane of the first end region 20, 20' and of the second end region 23, 23'
- [0070] EM₂ Center plane of the center region 24, 24'
- [0071] U Circumferential direction of the adjusting ring 5, 5'

1. A turbocharger (1) with variable turbine geometry (VTG)

having a turbine housing (2) with a feed channel (9) for exhaust gases;

having a turbine rotor (4) which is mounted rotatably in the turbine housing (2);

having a guide cascade (18) with variable turbine geometry which surrounds the turbine rotor (4) radially to the outside,

which has a blade bearing ring (6),

which has a plurality of guide blades (7) which have in each case one blade shaft (8) which is mounted in the blade bearing ring (6) and has a blade shaft longitudinal axis (L),

which has an adjusting ring (5; 5') which is operatively connected to the guide blades (7); and

which has one blade lever (19; 19') per guide blade (7),

having a receiving recess (21; 21') which is arranged in a first end region (20) for one shaft end of the blade shaft (8) which has a longitudinal axis (L),

having a lever head (22, 22') at a second end region (23; 23') which has the same center plane (E_{M1}) as the first end region (20; 20'), and

having an intermediate region (24; 24'), on which a supporting face (25) is arranged for radial mounting of the adjusting ring (5; 5'),

wherein the center plane (E_{M2}) of the intermediate region (24; 24') is arranged axially offset along the blade shaft longitudinal axis (L) by a spacing (a) with respect to the center plane (E_{M1}) of the first end region (20; 20') and the second end region (23; 23'), and

wherein in that a recess (26; 26') is arranged adjacent to the intermediate region (24; 24') between the first end region (20; 20') and the second end region (23; 23').

2. The turbocharger (1) with variable turbine geometry (VTG) as claimed in claim 1, wherein the intermediate region (24; 24') is of arcuate configuration.

3. The turbocharger (1) with variable turbine geometry (VTG) as claimed in claim 1, wherein a bearing part (30) having a bearing face (31) which interacts with the supporting face (25) is arranged below a receiving recess (27; 27') of the adjusting ring (5; 5').

4. The turbocharger (1) with variable turbine geometry (VTG) as claimed in claim 3, wherein the supporting face (25) is arranged within the receiving recess (27; 27').

5. The turbocharger (1) with variable turbine geometry (VTG) as claimed in claim 3, wherein the receiving recess (27; 27') has side wall faces (36; 36' and 37; 37') as a delimitation for the rolling movement of the intermediate region (24; 24') in the circumferential direction (U) of the adjusting ring (5; 5').

6. The turbocharger (1) with variable turbine geometry (VTG) as claimed in claim 3, wherein exclusively an adjusting ring inner face (35) is provided as radial support of the intermediate region (24; 24').

7. The turbocharger (1) with variable turbine geometry (VTG) as claimed in claim 6, wherein the adjusting ring (5; 5') has elevations (34), the radial width (B_E) of which is smaller than the radial width (B_V) of the adjusting ring (5).

8. A blade lever (19) for a turbocharger (1) with variable turbine geometry (VTG)

having a receiving recess (21; 21') which is arranged in a first end region (20; 20') for one shaft end of the blade shaft (8) which has a longitudinal axis (L),

having a lever head (22; 22') at a second end region (23; 23') which has the same center plane (E_{M1}) as the first end region (20; 20'), and

having an intermediate region (24; 24'), on which a supporting face (25) is arranged for radial mounting of the adjusting ring (5; 5'),

wherein the center plane (E_{M2}) of the intermediate region (24; 24') is arranged axially offset along the blade shaft longitudinal axis (L) by a spacing (a) with respect to the center plane (E_{M1}) of the first end region (20; 20') and the second end region (23; 23'), and

in that a recess (26; 26') is arranged adjacent to the intermediate region (24; 24') between the first end region (20; 20') and the second end region (23; 23').

9. A blade lever (19; 19') for a turbocharger (1) with variable turbine geometry (VTG), which blade lever (19; 19') is attached to a guide blade (7) and includes:

a receiving recess (21; 21') which is arranged in a first end region (20) for one shaft end of the blade shaft (8) which has a longitudinal axis (L),

a lever head (22, 22') at a second end region (23; 23') which has the same center plane (E_{M1}) as the first end region (20; 20'), and

an intermediate region (24; 24'), on which a supporting face (25) is arranged for radial mounting of the adjusting ring (5; 5'),

wherein the center plane (E_{M2}) of the intermediate region (24; 24') is arranged axially offset along the blade shaft longitudinal axis (L) by a spacing (a) with respect to the center plane (E_{M1}) of the first end region (20; 20') and the second end region (23; 23'),

wherein recess (26; 26') is arranged adjacent to the intermediate region (24; 24') between the first end region (20; 20') and the second end region (23; 23') and

wherein the intermediate region (24; 24') is of arcuate configuration.

10. An adjusting ring for a turbocharger (1) with variable turbine geometry (VTG) according to claim 3.

* * * * *