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(54) Title: REGULATING ROD

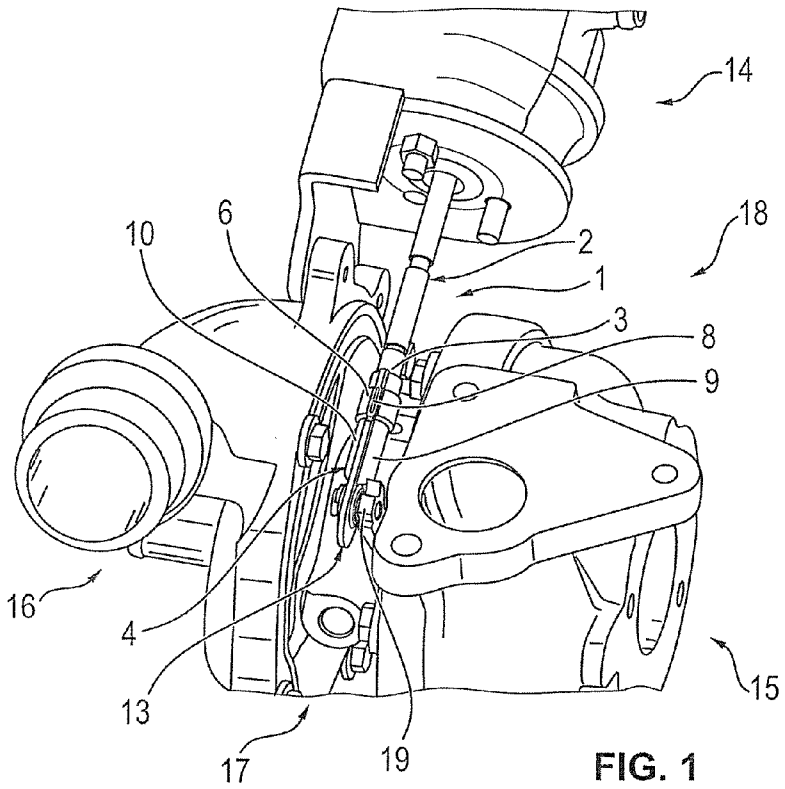

FIG. 1

(57) Abstract: The invention relates to a regulating rod (1) having a rod part (2) which has an end region (3) provided with an external thread; and having an end piece (4) which has a receiving recess (5) and which has a setting piece (6) which is arranged and guided in the receiving recess (5) and which has an internal thread into which the external thread of the end region (3) is screwed in order to set the effective length of the rod part (2), wherein the end piece (4) has a fastening portion (7) for the cohesive fixing of the set effective length of the rod part (2).

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TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

— *of inventorship (Rule 4.17(iv))*

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— *with international search report (Art. 21(3))*

REGULATING ROD

DESCRIPTION

The invention relates to a regulating rod according to the preamble of claim 1.

In exhaust-gas turbochargers, use is in some cases made of a so-called variable turbine geometry (VTG) for regulating the exhaust-gas mass flow through the turbine. A VTG of said type is actuated for example by means of a pneumatic actuator. For this purpose, the actuator is connected via a regulating rod to an outside lever of the VTG.

The setting of the VTG is on the one hand realized by means of an end piece which is held in the set position by two lock nuts. It is also known for a knurled nut to be used for the height compensation of the actuator or of the control capsule, which knurled nut is subsequently secured by means of a lock nut.

The use of one or more lock nuts in exhaust-gas turbochargers such as are known for example from US 6,895,947 B2 however has the disadvantage that the control capsule diaphragm can easily be twisted during the locking of the nut. Furthermore, an oblique position of the setting piece may easily arise.

It is therefore an object of the present invention to provide a regulating rod of the type indicated in the preamble of claim 1 by means of which the disadvantages of the prior art can be eliminated.

This object is achieved by the features of claim 1.

The regulating rod according to the invention combines the advantages of a knurled nut without the need to resort to the disadvantageous locking of the nut as explained above. This is because, after the setting of the control capsule play by means of the knurled nut, the set effective length of the rod part of the regulating rod can be secured in cohesive fashion by means of a fastening portion of the end piece. Here, "effective length" is to be understood to mean the length which, after the setting of the actuator and the fixing of the end piece, actively serves for transmission of force.

The dependent claims contain advantageous developments of the invention.

Further details, advantages and features of the present invention become apparent from the following description of an exemplary embodiment with reference to the drawing, in which:

figure 1 is a perspective illustration of an exhaust-gas turbocharger according to the invention with a regulating rod according to the invention in an installed state, and

figure 2 shows a perspective view of an end piece of the regulating rod as per figure 1.

Figure 1 illustrates an exhaust-gas turbocharger 18 which has a compressor 16 and a turbine 15. A bearing housing 17 is arranged, in the conventional way, between the compressor 16 and the turbine 15.

The exhaust-gas turbocharger 18 is equipped with a variable turbine geometry, of which only an outside lever 19 is visible in figure 1. A variable turbine geometry of said type is understood to mean a structural unit which, between a vane bearing ring and a disk, delimits an inflow duct for the passage of exhaust gases to the turbine wheel of the turbine 15. A VTG of said type also has a multiplicity of vanes which are arranged in the inflow duct. The vanes can be moved rotatably in the vane bearing ring between a closed and an open position. For this purpose, the vanes have vane shafts which are connected to vane levers. Each vane lever in turn has a lever head which engages into an adjusting ring. For the adjustment of the vanes, the adjusting ring is actuated by means of an actuator 14, for example of a pneumatic control capsule. For this purpose, the control capsule 14 has a regulating rod 1. The regulating rod 1 has a rod part which, at the inner end not visible in figure 1, is connected to a diaphragm of the control capsule. The other end which is visible in figure 1, or the visible end region 3, is provided with an external thread, which external thread is however not illustrated in figure 1 because the end region 3 is screwed into an end piece 4.

Said end piece 4 is shown in detail and in an enlarged illustration in figure 2. The end piece 4 is provided with a receiving recess 5 in which a setting piece 6, in the form of a knurled nut in the example, is arranged and guided. The setting piece 6 has an internal thread into which the external thread of the end region 3 of the rod part 2 can be screwed.

As can be seen in particular from the enlarged illustration of figure 2, the end piece 3 has a fastening portion 7. In the embodiment illustrated in figures 1 and 2, said fastening portion 7 is formed by a weld window 8 which is delimited by two webs 8A and 8B which run parallel to one another and which merge into one another at their end regions.

Figures 1 and 2 show that said weld window 8 runs across the knurled nut 6.

The end piece 7 is assembled from two sheet-metal halves 9 and 10 which delimit a cavity for receiving the free end region 3 of the rod part 2. Said cavity is not visible in figures 1 and 2 but forms a cylinder which is formed by the two semi-circular bulged regions 9A and 10A.

Figure 2 in particular also shows that the end piece 4 is provided with a compensating ball joint 11 which is arranged in a receiving recess 12 of a flattened connection region 13 of the end piece 4. Said flattened connection region 13 adjoins the cylindrical cavity or the spherical regions 9A and 10A, as can be seen in detail from figure 2.

For the connection of the two sheet-metal halves, it is possible in principle to use any suitable type of connecting means. Particular preference is given to welded connections, brazed connections, riveted connections or else screw connections, or in principle also combinations of said connection techniques.

To set the VTG or the control capsule 14, the free end region 3 is screwed with its external thread into the internal thread of the knurled nut 6. The fine adjustment is then performed by actuation of the knurled nut 6. When the setting process is complete, the final position is fixed by means of the fastening portion 7. In the particularly preferred exemplary embodiment illustrated in figures 1 and 2, this means that the weld window 8 is filled with weld filler such that the knurled nut 6 is non-detachably fixed.

By means of the additionally provided compensating ball joint 11, it is possible for an axial play of the control capsule to be ensured and the assembly of the arrangement as a whole to be facilitated.

In addition to the above written disclosure of the invention, reference is explicitly made to figures 1 and 2 to supplement the disclosure of the invention.

LIST OF REFERENCE SIGNS

1	Regulating rod
2	Rod part
3	End region
4	End piece
5	Receiving recess
6	Setting piece
7	Fastening portion
8	Weld window
8A, 8B	Webs
9	Sheet-metal half
9A	Semi-circular sheet-metal half portion
10	Sheet-metal half
10A	Semi-circular sheet-metal half portion
11	Compensating ball joint
12	Receiving recess
13	Connection region
14	Actuator (control capsule)
15	Turbine
16	Compressor
17	Bearing housing
18	Exhaust-gas turbocharger
19	Outside lever

CLAIMS

1. A regulating rod (1)

- having a rod part (2) which has an end region (3) provided with an external thread; and

- having an end piece (4)

- which has a receiving recess (5) and

- which has a setting piece (6) which is arranged and guided in the receiving recess (5) and which has an internal thread into which the external thread of the end region (3) is screwed in order to set the effective length of the rod part (2),

wherein

- the end piece (4) has a fastening portion (7) for the cohesive fixing of the set effective length of the rod part (2).

2. The regulating rod as claimed in claim 1, wherein the fastening portion (7) has a weld window (8) which extends across the setting piece (6).

3. The regulating rod as claimed in claim 1, wherein the setting piece (6) is formed as a knurled nut.

4. The regulating rod as claimed in one of claims 1 to 3, wherein the end piece (4) comprises two sheet-metal halves (9, 10) which delimit a cavity for receiving the free end region (3) of the rod part (2).

5. The regulating rod as claimed in one of claims 1 to 4, wherein the end piece (4) has a compensating ball joint (11).

6. The regulating rod as claimed in claim 5, wherein the compensating ball joint (11) is arranged and guided in a receiving recess (12) in a flattened connection region (13) of the end piece (4).

7. The regulating rod as claimed in one of claims 4 to 6, wherein the sheet-metal halves (9, 10) are welded, brazed, riveted and/or screwed to one another.

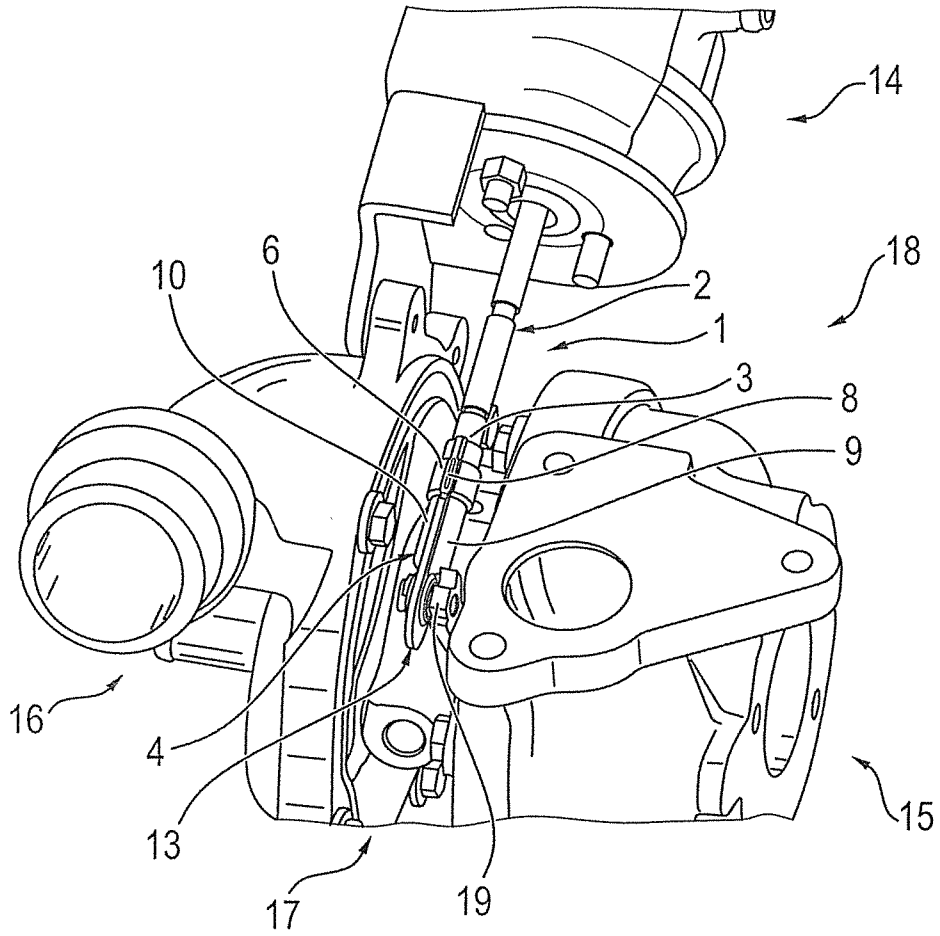

FIG. 1

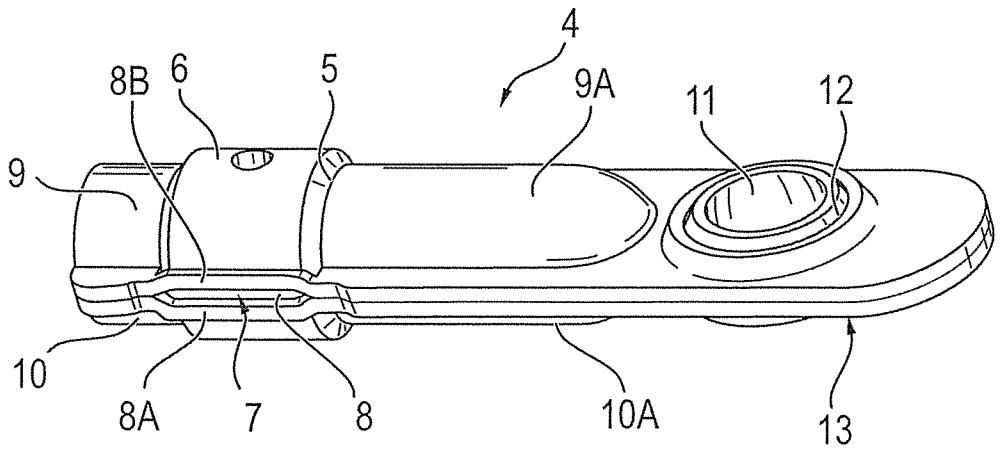

FIG. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/037347

A. CLASSIFICATION OF SUBJECT MATTER

F02B 37/00(2006.01)i, F02B 37/12(2006.01)i, F02B 39/00(2006.01)i, F16D 125/00(2012.01)i, F16D 125/64(2012.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F02B 37/00; B23P 11/00; F02B 33/44; F01D 17/16; F02D 23/00; F02B 37/12; F02B 39/00; F16D 125/00; F16D 125/64

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & Keywords: turbocharger, regulate, control, adjust, actuator, wastegate control capsule, rod and bar

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009-0092481 A1 (GENIN, EMERIC et al.) 09 April 2009 See abstract, paragraphs [0020]-[0028],[0032],[0035]-[0037] and figures 2-5.	1-7
A	US 2004-0055297 A1 (ALLMANG, RUDIGER et al.) 25 March 2004 See abstract, paragraphs [0025]-[0034] and figures 1-3.	1-7
A	US 2005-0050888 A1 (MCEWAN, JAMES, A.) 10 March 2005 See abstract, paragraphs [0028],[0030]-[0033] and figures 1-6.	1-7
A	US 2001-0017032 A1 (JINNAI, YASUAKI) 30 August 2001 See abstract, paragraphs [0033],[0034],[0037],[0038] and figures 1-3.	1-7
A	KR 10-2002-0046542 A (HYUNDAI MOTOR COMPANY) 21 June 2002 See abstract, pages 4,5 and figures 1-3.	1-7

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009-0092481 A1	09/04/2009	DE 602005024062 D1	18/11/2010
		EP 1945926 A1	23/07/2008
		EP 1945926 B1	06/10/2010
		US 8100639 B2	24/01/2012
		WO 2007-044012 A1	19/04/2007
US 2004-0055297 A1	25/03/2004	EP 1400658 A1	24/03/2004
		JP 2004-132368 A	30/04/2004
		US 6895947 B2	24/05/2005
US 2005-0050888 A1	10/03/2005	CN 1204334 C	01/06/2005
		CN 1244627 A	16/02/2000
		DE 69922302 D1	05/01/2005
		DE 69922302 T2	03/11/2005
		EP 0976919 A2	02/02/2000
		EP 0976919 A3	02/05/2001
		EP 0976919 B1	01/12/2004
		GB 9816275 D0	23/09/1998
		JP 2000-054851A	22/02/2000
		US 6658846 B1	09/12/2003
		US 7677040 B2	16/03/2010
US 2001-0017032 A1	30/08/2001	AT 302897 T	15/09/2005
		BR 0102037 A	23/03/2004
		BR 0102037 B1	18/11/2008
		CN 1289792 C0	13/12/2006
		CN 1307171 A0	08/08/2001
		DE 60112822 D1	29/09/2005
		DE 60112822 T2	18/05/2006
		EP 1120546 A2	01/08/2001
		EP 1120546 A3	23/07/2003
		EP 1120546 B1	24/08/2005
		JP 03842943 B2	08/11/2006
		JP 2001-207858 A	03/08/2001
		KR 10-0566704 B1	03/04/2006
		KR 10-2001-0074546 A	04/08/2001
		US 6543994 B2	08/04/2003
KR 10-2002-0046542 A	21/06/2002	KR 10-0380685 B1	26/04/2003