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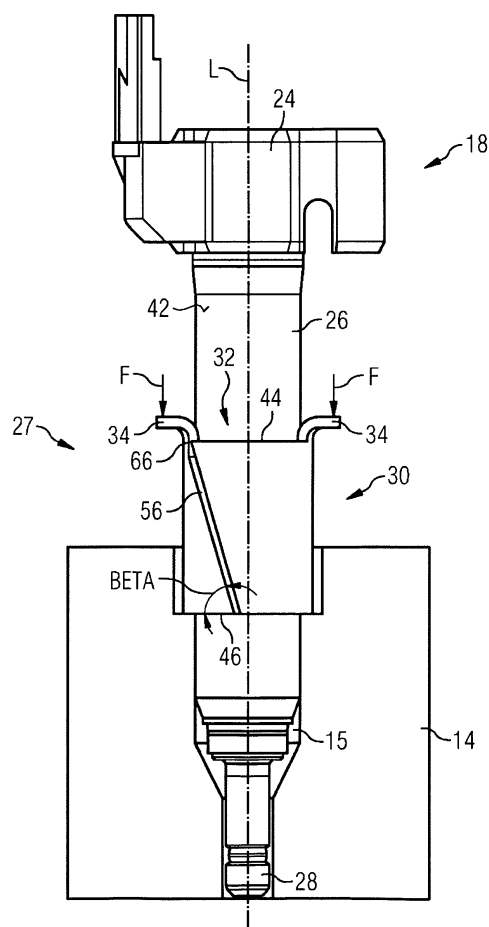
Remarks:

This application was filed on 24-02-2010 as a divisional application to the application mentioned under INID code 62.

(54) **Fixing device for fixing a fuel injector in a cylinder head of a combustion engine**

(57) Fixing device (30) for fixing a fuel injector (18) in a cylinder head (14) of a combustion engine (22), comprising a tubular portion (32) including a central longitudinal axis (L), the tubular portion (32) being designed to engage the fuel injector (20) and to be rigidly coupable to the fuel injector (18), a supporting element (38) with a first axial end (48) and a second axial end (50), the second axial end (50) having a larger radial distance relative to the central longitudinal axis (L) than the first axial end (48), and the first axial end (48) being rigidly coupled to the tubular portion (32), a force receiving element (36) extending outwards in radial direction relative to the central longitudinal axis (L) from an inner coupling section (52) to an outer coupling section (54), the inner coupling section (52) being designed to be rigidly coupable to the fuel injector (18) and the outer coupling section (54) being rigidly coupled to the supporting element (38).

FIG 2



Description

[0001] The invention relates to a fixing device for fixing a fuel injector in a cylinder head of a combustion engine according to the preamble of claim 1 and to a fuel injector.

[0002] Fuel injectors are in wide spread use, in particular for internal combustion engines where they may be arranged in order to dose fuel into an intake manifold of the internal combustion engine or directly into the combustion chamber of a cylinder of the internal combustion engine. Fuel can be supplied to the internal combustion engine by the fuel injector that comprises the fixing device. The fuel injectors can be coupled to the cylinder head of the internal combustion engine in different manners.

[0003] The coupling of the fuel injectors to the cylinder heads needs to be very precise to get a correct injection angle.

[0004] DE 101 51 004 A discloses a fixing device according to the preamble of claim 1.

[0005] The object of the invention is to create a fixing device for fixing a fuel injector in a cylinder head of a combustion engine which is simply to be manufactured and which facilitates a reliable and precise coupling between the fuel injector and the cylinder head of the combustion engine.

[0006] It is furthermore the object of the invention to create a fuel injector that ensures a precise dosing of fuel.

[0007] The objects are achieved by the features of the independent claims. An advantageous embodiment of the invention is given in the sub-claim.

[0008] According to an aspect the invention is distinguished by a fixing device for fixing a fuel injector in a cylinder head of a combustion engine, comprising a tubular portion including a central longitudinal axis, the tubular portion being designed to engage the fuel injector and to be rigidly coupled to the fuel injector, the tubular portion comprising a first axial end and a second axial end being designed to be completely attachable to the fuel injector, and projections being formed in one piece with the tubular portion and being arranged at the first axial end of the tubular portion and being designed to receive a retaining force, the retaining force acting in the direction of the central longitudinal axis to retain the fuel injector in the cylinder head, wherein the tubular portion is formed from a panel comprising a first portion of a non-rectangular parallelogram shape and a second portion of a triangular shape being in one-piece with the first portion and the second portion being designed in a manner that the first axial end of the tubular portion is circumferentially closed.

[0009] This has the advantage that a continuous welding of the first axial end of the tubular portion to the fuel injector is possible. By this, a firm coupling of the fixing device to the injector is possible. Furthermore, the fixing device can be flexible in particular in radial direction due to a recess which can be formed in the tubular portion. Additionally, a good force introduction from the projec-

tions into the first axial end of the tubular portion is possible.

[0010] In an advantageous embodiment of this aspect of the invention the second portion of the tubular portion is arranged to directly follow one of the projections in the direction of the retaining force. This has the advantage that a high robustness of the fixing device against mechanical stress due to permanent retaining forces is possible. Furthermore, a force introduction via the projections into the first axial end of the tubular portion causes only small mechanical stress to the first axial end of the tubular portion.

[0011] According to another aspect the invention is distinguished by a fuel injector comprising a respective fixing device.

[0012] Exemplary embodiments of the invention are explained in the following with the aid of schematic drawings. These are as follows:

Figure 1 an internal combustion engine in a schematic view,

figure 2 the fuel injector with an embodiment of the fixing device and the cylinder head in a side view,

figure 3 the embodiment of the fixing device for the fuel injector in a perspective view,

figure 4 a further view of the embodiment of the fixing device for the fuel injector of figure 3, and

figure 5 another embodiment of the fixing device for the fuel injector in a perspective view.

[0013] Elements of the same design and function that occur in different illustrations are identified by the same reference character.

[0014] Figure 1 shows an internal combustion engine 22, with an intake air tract 10, a motor block 12, a cylinder head 14 and an exhaust gas tract 16. In the motor block 12 a combustion chamber 20 is arranged.

[0015] The cylinder head 14 comprises a fuel injector 18 and a sparking plug 19. A fixing device 30 enables the fixing of the fuel injector 18 to the cylinder head 14 of the combustion engine 22.

[0016] The fuel injector 18 (figure 2) comprises an injector coupling portion 24 and a valve assembly 27. The injector coupling portion 24 is designed to be coupled to a high-pressure fuel chamber of the internal combustion engine 22, the fuel is stored under high pressure, for example, under the pressure of about 200 bar in the case of a gasoline engine or of about 2,000 bar in the case of a diesel engine.

[0017] Furthermore, the injector coupling portion 24 is designed to be coupled to an electrical supply to actuate a not shown actuator unit of the fuel injector 18.

[0018] The valve assembly 27 comprises a valve body

26 with a central longitudinal axis L and a not shown cavity which is axially led through the valve body 26. The valve assembly 27 further comprises a not shown valve needle taken in the cavity of the valve body 26. On a free end of the valve assembly 27 an injection nozzle 28 is formed which is closed or opened by an axial movement of the valve needle. In a closing position a fuel flow through the injection nozzle 28 is prevented. In an opening position fuel can flow through the injection nozzle 28 into the combustion chamber 20 of the internal combustion engine 22.

[0019] In an embodiment of the fixing device 30 shown in figures 2 to 4 the first axial end 44 of the fixing device 30 is circumferentially closed. With this it is possible to rigidly fix the fixing device 32 to the fuel injector 18 over the whole circumference of the fuel injector 18 via the first axial end 44. This enables a very strong coupling between the fuel injector 18 and the fixing device 30.

[0020] As can be best seen in Figure 4, the tubular portion 32 is formed from a panel 60 which comprises a first portion 62 and a second portion 64 and two projections 34. The first portion 62 is of a non-rectangular parallelogram shape with the first axial end 44 and the second axial end 46 of the tubular portion 32 and a first lateral end 68 and a second lateral end 70 of the tubular portion 32. The second portion 64 of the panel 60 has a triangular shape and is arranged at the second lateral end 70 of the tubular portion 32. The second axial end 46 of the tubular portion 32 and the second lateral end 70 of the first portion of the tubular portion 32 form an angle BETA.

[0021] The first portion 62, the second portion 64 and the two projections 34 of the panel 60 are forming a one-piece element. The triangular shaped second portion 64 of the panel 60 is arranged to directly follow one of the projections 34 in the direction of the retaining force F. The second portion 64 of the panel 60 is directly followed by the parallelogram shaped first portion 62 of the panel 60. By this a direct transfer of the retaining force F from the projection 32 via the second portion 64 of the panel 60 to the first portion 62 of the panel 60 is possible. The panel 60 has a coupling passage 66 which allows to directly couple the first lateral end 68 and the second lateral end 70 of the tubular portion 32.

[0022] As can be seen in Figure 3, the construction of the tubular portion 32 allows a continuous welding seam of the first axial end 44 of the tubular portion 32 to the fuel injector 18. As the second portion 64 of the tubular portion 32 is directly following one of the projections 34 in the direction of the retaining force F a very robust construction of the fixing device 30 against mechanical stress due to a permanent retaining force F can be obtained. Therefore, an introduction of the retaining force F via the projections 34 into the first axial end 44 of the tubular portion 32 causes only small mechanical stress exerted on the first axial end 44.

[0023] Due to the welding between the first axial end 44 and the fuel injector 18, a circumferentially continuous coupling of the tubular portion 32 at the first axial end 44

can be obtained via the coupling passage 66.

[0024] It is preferred that the angle BETA between the second axial end 46 of the tubular portion 32 and the second lateral end 70 of the first portion of the tubular portion 32 is about 60°. By this the second portion 64 of the tubular portion 32 is large enough to transfer the retaining force F from the projection 34 to the first portion 62 of the tubular portion 32 thereby allowing a good distribution of the mechanical load.

[0025] Figure 5 shows another embodiment of the fixing device 30, wherein each of the projections 34 comprises one of the force receiving elements 36 and one of the supporting elements 38.

[0026] In the following, the assembly of the fuel injector 18 and the fixing device 30 and the fixing of the fuel injector 18 in the cylinder head 14 of the combustion engine 22 will be described:

[0027] For assembling the fuel injector 18 the fuel injector 18 is inserted into the fixing device 30. The fixing device 30 is clamped together. By this the first axial end 44 and the second axial end 46 of the tubular portion 32 are in contact with the outer surface 42 of the fuel injector 18 thereby enabling a fixed coupling of the fixing device 30 to the fuel injector 18 preferably by welding.

[0028] The fuel injector 18 with the fixing device 30 is inserted into the recess 15 of the cylinder head 14 with the support of a protrusion which allows orienting the fuel injector 18 relative to the cylinder head 14. Additionally, a force exerting device is arranged in a way that it is in contact with the force receiving elements 36. Consequently, the retaining force F from the force exerting device is transmitted to the force receiving elements 36 and the supporting elements 38 or to the projections 34 of the fixing device 30. By this the fuel injector 18 can be fixed in a secure manner in the recess 15 of the cylinder head 14 even if large forces exert on the fuel injector 18 in opposite direction to the retaining force F.

[0029] As the tubular portion 32 directly follows the supporting elements 28 or the projections 34 in the direction of the retaining force F the fixing device 30 is very robust against mechanical stress in particular in the area between the supporting elements 28 and the tubular portion 32 or the projections 34 and the tubular portion 32. By this a high lifetime of the fixing device 30 can be obtained.

Claims

1. Fixing device (30) for fixing a fuel injector (18) in a cylinder head (14) of a combustion engine (22), comprising
 - a tubular portion (32) including a central longitudinal axis (L), the tubular portion (32) being designed to engage the fuel injector (18) and to be rigidly coupled to the fuel injector (18), the tubular portion (32) comprising a first axial end

(44) and a second axial end (46) being designed to be completely attachable to the fuel injector (18), and

- projections (34) being formed in one piece with the tubular portion (32) and being arranged at the first axial end (44) of the tubular portion (32) and being designed to receive a retaining force (F), the retaining force (F) acting in the direction of the central longitudinal axis (L) to retain the fuel injector (18) in the cylinder head (14),

characterized, in that the tubular portion (32) is formed from a panel (60) comprising a first portion (62) of a non-rectangular parallelogram shape and a second portion (64) of a triangular shape being in one-piece with the first portion (62) and the second portion (64) being designed in a manner that the first axial end (44) of the tubular portion (32) is circumferentially closed.

2. Fixing device (30) in accordance with claim 1, with the second portion (64) of the tubular portion (32) being arranged to directly follow one of the projections (34) in the direction of the retaining force (F).

3. Fuel injector (18) comprising a fixing device (30) according to one of the preceding claims.

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FIG 1

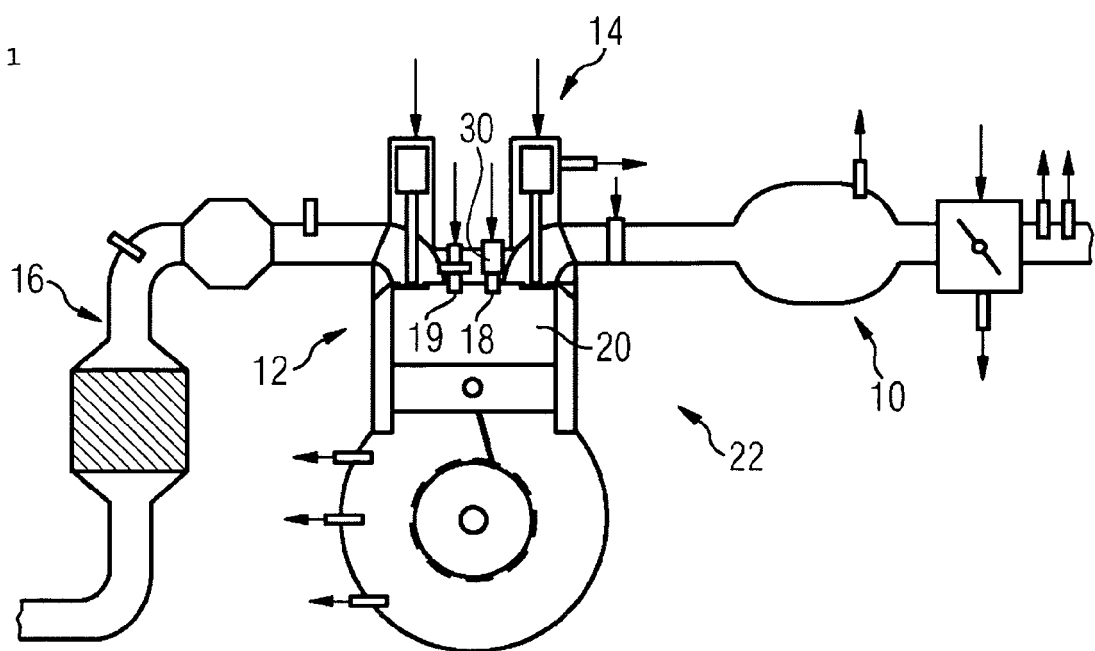


FIG 2

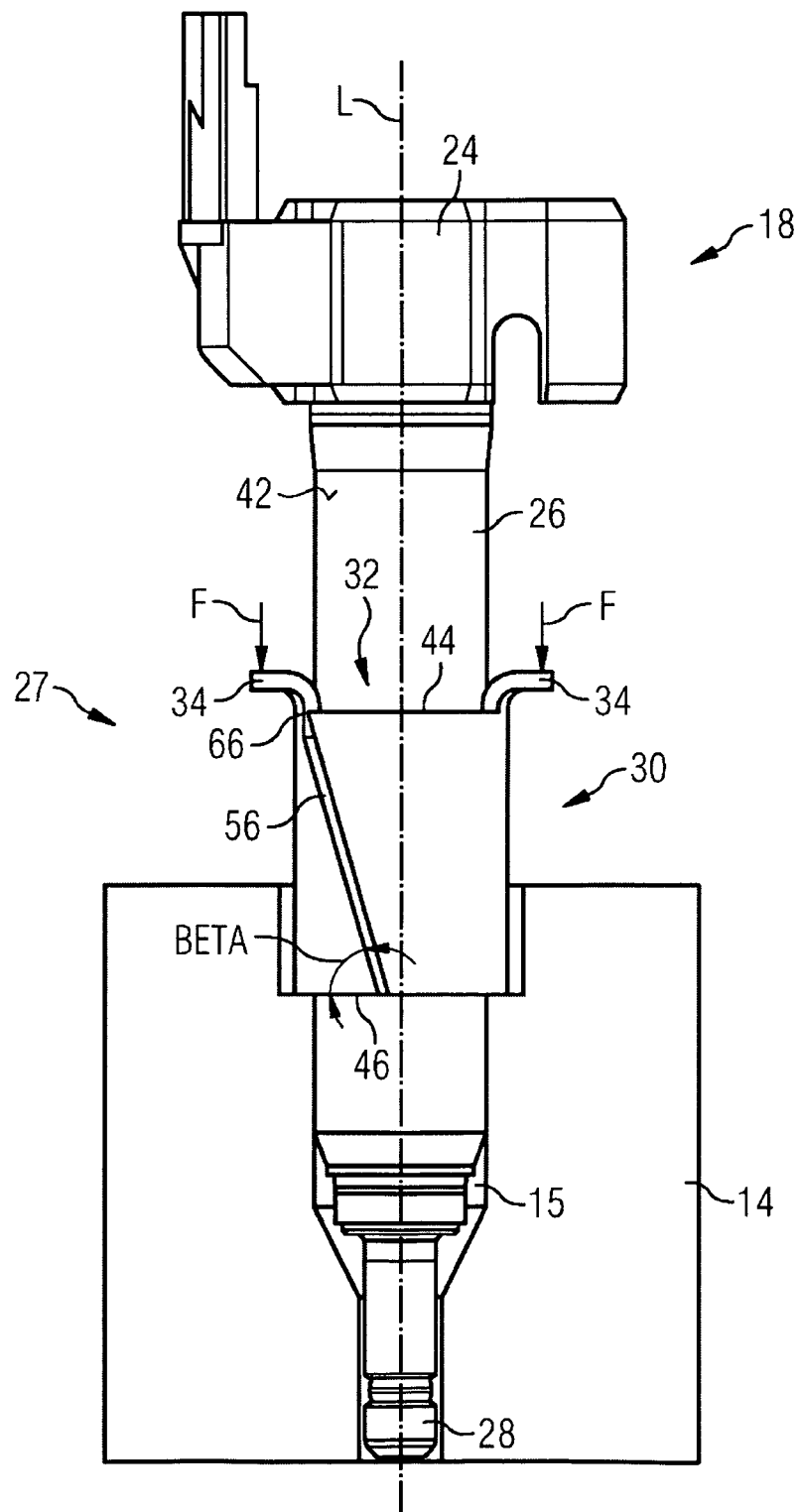


FIG 3

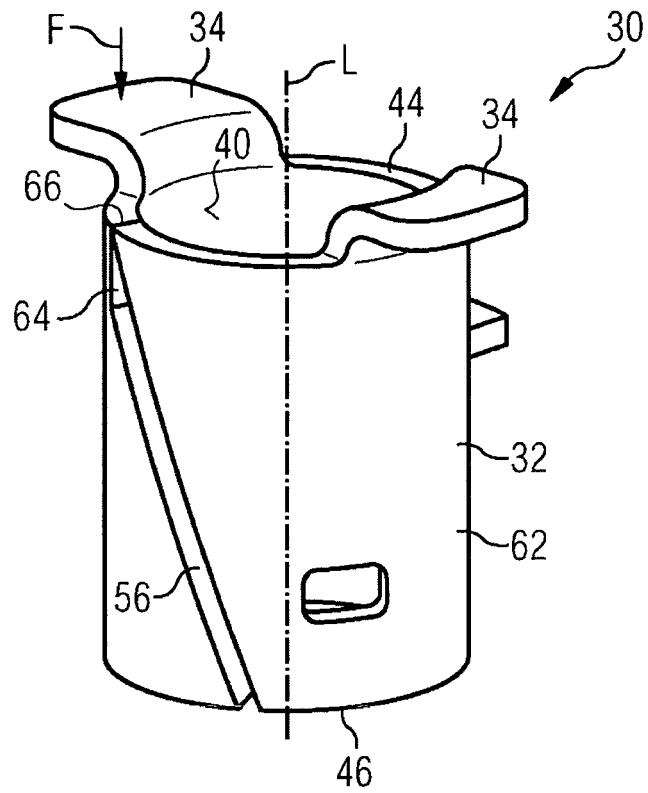
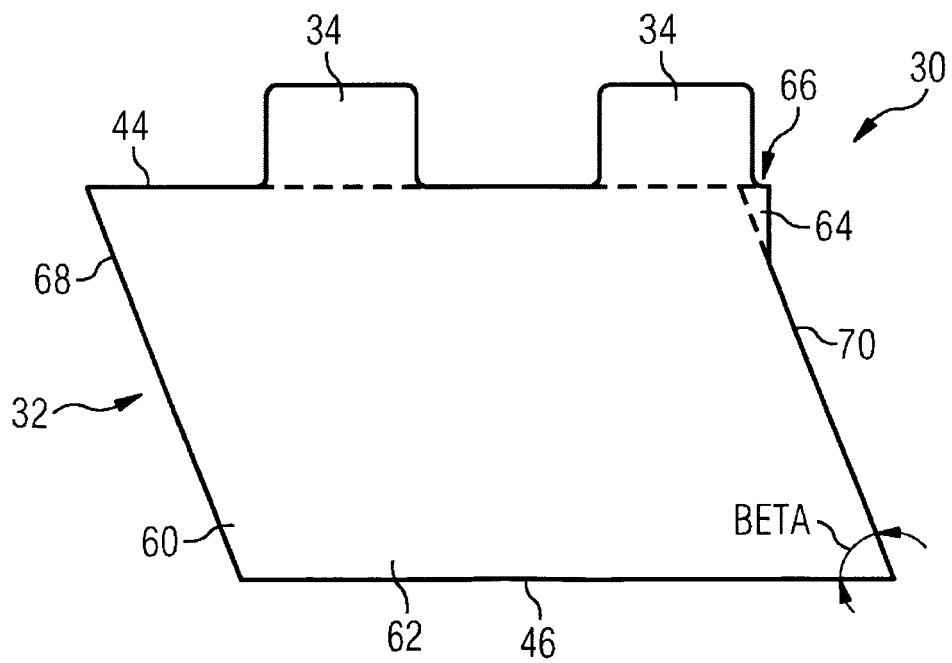


FIG 4



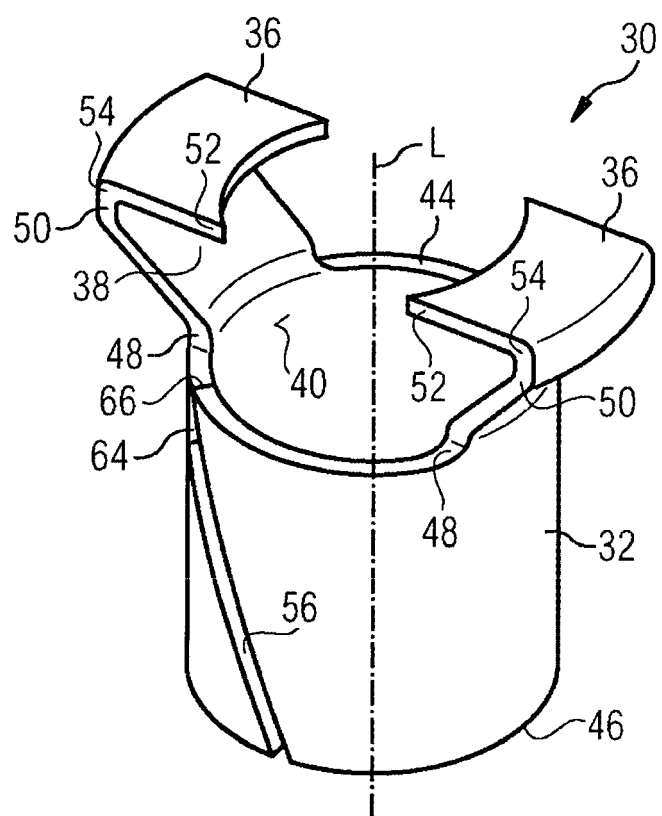


FIG 5



EUROPEAN SEARCH REPORT

Application Number
EP 10 00 1914

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 6 May 2010	Examiner Wagner, A
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03/02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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The members are as contained in the European Patent Office EDP file on
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