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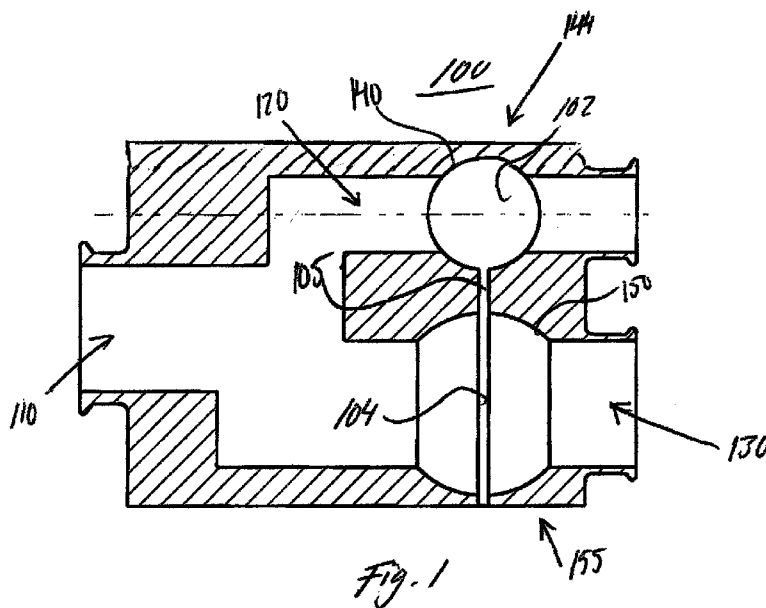
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(54) Title: TWO FLOW PASSAGE VALVE



(57) Abstract: The invention relates to a valve device (100) for regulating a first flow of fluid in a first passage (120) and a second flow of a fluid in a second passage (130), said valve device (100) comprising a single shaft (105), a first valve (144) comprising a first rotating part (102) and a first fixed part (140), a second valve (155) comprising a second rotating part (104) and a second fixed part (150), said first and second rotating parts (102, 104) are attached to said shaft (105), characterized in that, said first rotating part (102) is rotatable between a first and second position for regulating said first flow of fluid between a first and second valve while said second valve (155) is closed for said second flow of fluid.

DESCRIPTION

Two flow passage valve

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TECHNICAL FIELD

The invention relates to a two flow passage valve according to the preamble of the independent claim.

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BACKGROUND OF THE INVENTION

Present regulatory conditions in the automotive market have led to an increasing demand to improve fuel economy and reduce emissions in present vehicles.

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These regulatory conditions must be balanced with the demands of a consumer for high performance and quick response for a vehicle.

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In order to control NOx emissions from a diesel powered internal combustion engine, techniques such as exhaust gas recirculation and NOx catalysts provided in an exhaust gas after treatment system may be used.

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The exhaust gas after treatment system usually is efficient within a predetermined temperature range. In an EGR flow there is usually provided an EGR cooler for cooling the recirculated exhaust gases. At certain times, for example during engine start up or low load, it is preferable to stop the exhaust gases from being cooled.

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This is done in order to speed up the heating of the exhaust gas after treatment system to come within said predetermined temperature range and thereby start to reduce NOx emissions quicker. It is known to bypass said EGR cooler with a valve arrangement having main flow and a bypass flow. In the main flow said EGR cooler is provided and in said bypass flow said EGR cooler is bypassed. For different reasons there is a need to direct the flow of the EGR gases independently of each other, i.e., regulating the main flow independently of the bypass flow. This has been solved according to the state of the art by relatively complicated valve arrangements which design adds cost and is relatively space consuming.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a two flow passage valve which is smaller
5 and less complicated than known two flow passage valves.

The objects are achieved by the features of the independent claims. The other claims and the description disclose advantageous embodiments of the invention.

10 In a first aspect of the invention it is provided a valve device for regulating a first flow of fluid in a first passage and a second flow of a fluid in a second passage, said valve device comprising a single shaft, a first valve comprising a first rotating part and a first fixed part, a second valve comprising a second rotating part and a second fixed part. Said first and second rotating parts are attached to said shaft.
15 Said first rotating part is rotatable between a first and second position for regulating said first flow of fluid between a first and second valve while said second valve is closed for said second flow of fluid.

An advantage of the present example embodiment of the invention is that the main
20 flow and bypass flow may be regulated with a single actuator.

Another advantage is that the main flow or bypass flow can be regulated between fully open and fully closed while the bypass flow or main flow respectively is maintained closed.

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BRIEF DESCRIPTION OF THE DRAWINGS

The present invention together with the above-mentioned and other objects and advantages may best be understood from the following detailed description of the
30 embodiment(s), but not restricted to the embodiments, wherein is shown schematically:

Fig. 1 illustrates a cross sectional view along A-A in figure 3 of a two flow passage valve according to an example embodiment of the present invention.

Fig. 2 illustrates a first side view of a two flow passage valve according to an example embodiment of the present invention.

- 5 Fig. 3 illustrates a second side view of a two flow passage valve according to an example embodiment of the present invention.

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS OF THE INVENTION

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In the drawings, equal or similar elements are referred to by equal reference numerals. The drawings are merely schematic representations, not intended to portray specific parameters of the invention. Moreover, the drawings are intended to depict only typical embodiments of the invention and therefore should not be
15 considered as limiting the scope of the invention.

20

Fig. 1 depicts schematically a valve device 100 for regulating a first flow of fluid in a first passage 120 and a second flow of a fluid in a second passage 130. Said valve device 100 comprising a single shaft 105, a first valve 144 comprising a first
20 rotating part 102 and a first fixed part 140, a second valve 155 comprising a second rotating part 104 and a second fixed part 150, said first and second rotating parts 102, 104 are attached to said shaft 105. Said first rotating part 102 is rotatable between a first and second position for regulating said first flow of fluid between a first and second valve while said second valve 155 is closed for said
25 second flow of fluid.

In figure 1 the first and second passages 120, 130 merge upstream said first and second valves 144, 155 into a main passage 110.

30

The valve device 100 may be provided in an exhaust system connectable to an internal combustion engine for regulating exhaust gas recirculation (EGR) flow. The main passage 110 may be the connecting pipe between the exhaust side and the intake side of the internal combustion engine for directing part of the exhaust gases from the internal combustion engine back to the intake system of the same

internal combustion engine. An EGR circuit may comprise said connecting pipe between said exhaust side and intake side of the internal combustion engine, said valve device 100 and at least one EGR cooler. In order to control the temperature of the exhaust gases, said EGR cooler may be provided in one of said first and
5 second passages 120, 130. In figure 1 the first passage 120 has been illustrated to have a smaller diameter than the second passage 130. By providing an EGR cooler in the second passage 130 a flow (main flow) of fluid in said second passage will be somewhat restricted due to said EGR cooler. In order to have essentially equal flow of exhaust gases in the second passage with said EGR
10 cooler and a first passage without said EGR cooler, said first passage 120 is made with a smaller diameter for compensating the absence of an EGR cooler in said first passage 120. The first passage 120 can be seen as a bypass flow for the EGR cooler provided in the second passage 130. The first and second passages 120, 130 may merge downstream said first and second valves 102, 104 and said
15 EGR cooler. In another example embodiment said first and second passages 120, 130 will end up on the intake manifold as two separate connections.

By provision of the valve device 100 according to figure 1, said second rotating part 104 is adapted to be regulated between a first and second position for
20 regulating said second flow of fluid between a first and second valve while said first valve is closed for said first flow of fluid. In the example of EGR this means that the first passage 120 (bypass flow) is closed during the regulation of flow in the second passage 130 (main flow) which may contain one or more EGR coolers. This may be performed by rotating said single shaft 105. An actuator, for example
25 an electric motor, may be attached to said single shaft, which in turn may be operated by an engine control unit.

By provision of the valve device 100 according to figure 1, said first rotating part 102 is adapted to be regulated between a first and second position for regulating
30 said first flow of fluid between a first and second valve while said second valve 155 is closed for said second flow of fluid. In the example of EGR, this means that the second passage 130 (main flow) is closed during the regulation of flow of EGR in the first passage 120 (bypass flow). In figure 1 said second passage 130 may be connected upstream an EGR cooler. Said first passage 120 may in that case

be used to bypass the EGR cooler. The flow of EGR gases in this embodiment goes in the direction from the left to the right in figure 1, i.e., the valve 155 is located upstream said EGR cooler. This means that the rotating part 104 is arranged upstream the EGR cooler.

5

The flow direction of EGR gases may also flow from the right to the left in figure 1. In this case the EGR cooler is located upstream the valve device 100, i.e., said EGR cooler is arranged to the right of the valve 100 in figure 1. This means that the rotating part 104 is arranged downstream the EGR cooler. The first passage 120 is arranged to bypass the EGR cooler.

10

Fig. 2 illustrates a cross sectional side view the valve device 100 as shown in figure 1. The first and second rotating parts 102, 104, which are provided in the first and second fixed parts 140, 150, are forming the first and second valves 144 and 155 respectively. The fixed part 140, 150 is forming a valve seat for the rotating part 102, 104. A complete edge of the rotating part 102, 104 may be in close contact with the fixed part 140, 150 for achieving a tight valve 144, 155 when in closed position. In figure 1-3, the rotating part 102, 104 has a shape of a circular flap. The fixed part 140, 150 is formed like a sphere with two opposite positioned opened parts. The size and shape of the fixed part is adapted to the size and shape of the rotating part. When part of the edge of the rotating part 102, 104 is positioned in the open part of the fixed part 140, 150, said valve 144, 155 is in an open position. Other shapes of the rotating part than circular may be used, for instance elliptical. According to what is disclosed above, said fixed part is adapted to the size and shape of the rotating part.

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Imagine that the rotating part in figure 2 is rotating in a clockwise direction. If the valve is positioned as in figure 2, both first passage 120 and second passage 130 are closed. By starting to rotate the rotating parts 102, 104, by rotating the single shaft 105, in a clockwise direction, said first passage will remain closed to start with and said second passage will start to open. In figure 2 said second rotating part 104 is positioned 90 degrees ahead of said first rotating part 102 if said first and second parts 102, 104 is rotated in a clockwise direction. The open parts of the spherical shaped fixed parts 140, 150 are designed so that both valves can

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simultaneously be in a closed position, a possibility to regulate any one of the valves between 0-100% open while the other one is closed. However, the open parts of the spherical shaped fixed parts 140, 150 are designed so that said first and second valves cannot be opened simultaneously. In figure 1-3, said open
5 parts of said spherical shaped fixed part 140, 150 have the same diameter as the first and second passage 120, 130 respectively.

In a first example embodiment said first value for said first flow is 0% and said second value for said first flow is 100%. In another example embodiment said first
10 value for said second flow is 0% and said second value for said second flow is 100%. In still another example embodiment said first value for said first flow is between 0-100%. In yet another example embodiment said second value for said first flow is between 0-100%. In still another example embodiment said first value for said second flow is between 0-100%. In still another example embodiment said
15 second value for said second flow is between 0-100%.

The second rotating part 104 may be rotatable in a closed position while said first rotating part 102 is rotatable between said first and second position. The first rotating part 102 may be rotatable in a closed position while said second rotating
20 part 104 is rotatable between said first and second position.

The first and second rotating parts 102, 104 are illustrated in figures 1-3 as a butterfly flap, however, said first and/or second rotating part may also be formed as a part of a ball or sphere and thereby forming a ball valve 144, 155.
25

Fig. 3 illustrates a second side view of a two flow passage valve according to an example embodiment of the present invention. In figure 3 said first passage 120 is fully open and said second passage 130 is fully closed.

30 The internal combustion engine may comprise said EGR circuit comprising said valve device 100, which internal combustion engine may be provided in a vehicle. Said vehicle may be a car, truck or bus.

A computer program may comprise program code means for performing at least the open loop experiment when said program is run on a computer.

5 A computer program product may comprise program code means stored on a computer readable medium for performing at least the open loop experiment when said program product is run on a computer.

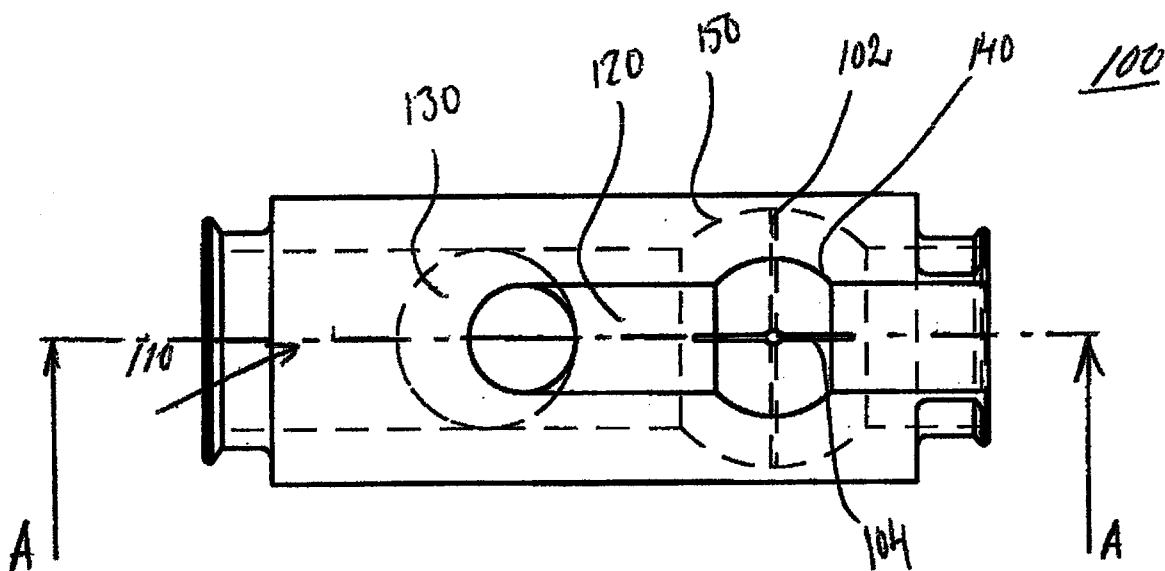
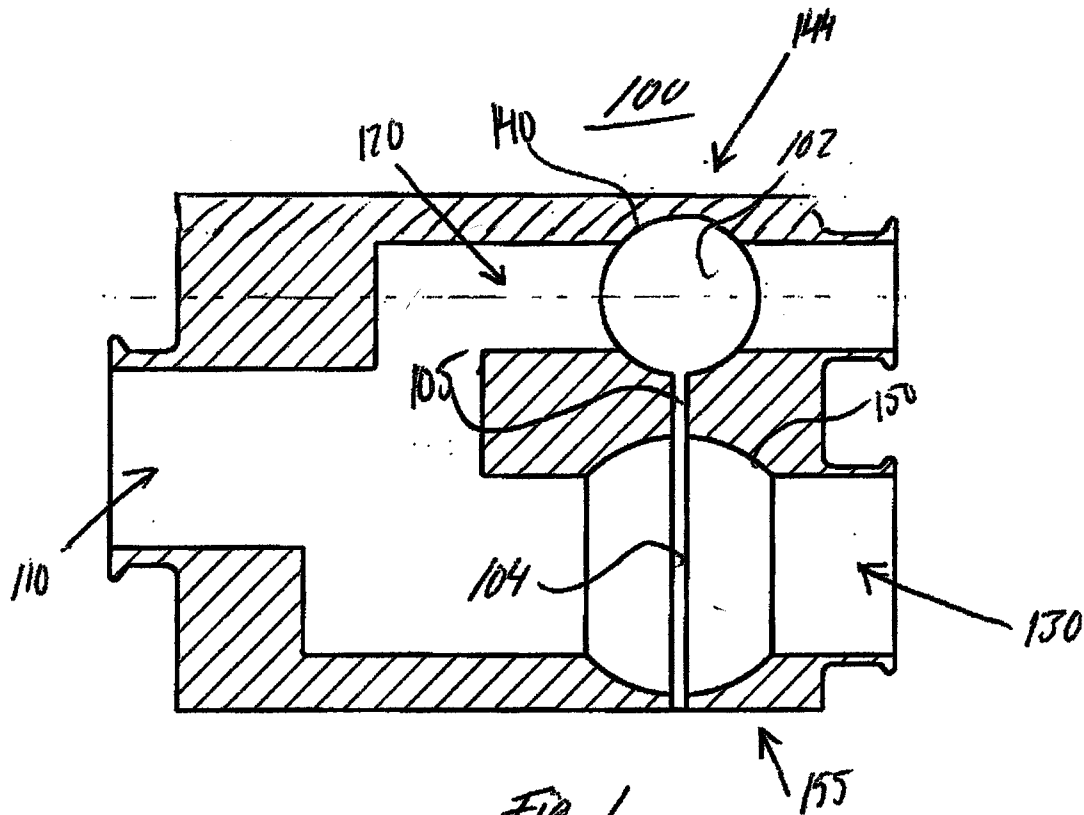
The invention should not be deemed to be limited to the embodiments described above, but rather a number of further variants and modifications are conceivable
10 within the scope of the following patent claims.

C L A I M S

1. A valve device for regulating a first flow of fluid in a first passage and a
5 second flow of a fluid in a second passage, said valve device comprising
- a. a single shaft,
 - b. a first valve comprising a first rotating part and a first fixed part
 - c. a second valve comprising a second rotating part and a second
10 fixed part,
 - d. said first and second rotating parts are attached to said shaft,
characterized in that,
 - e. said first rotating part is rotatable between a first and second position
for regulating said first flow of fluid between a first and second valve
while said second valve is closed for said second flow of fluid.
- 15
2. The valve device according to claim 1, wherein said second rotating part is
adapted to be regulated between a first and second position for regulating
said second flow of fluid between a first and second valve while said first
valve is closed for said first flow of fluid.
- 20
3. The valve device according to claim 1 or 2, wherein said first valve is
adapted to close said first flow of fluid while said second valve means is
adapted to close said second flow of fluid.
- 25
4. The valve device according to claim 1, wherein said first valve for said first
flow is 0% and said second valve for said first flow is 100%.
5. The valve device according to claim 2, wherein said first valve for said
second flow is 0% and said second valve for said second flow is 100%.
- 30
6. The valve device according to claim 1, wherein said first valve for said first
flow is between 0-100%.

7. The valve device according to claim 1, wherein said second value for said first flow is between 0-100%.
- 5 8. The valve device according to claim 2, wherein said first value for said second flow is between 0-100%.
9. The valve device according to claim 2, wherein said second value for said second flow is between 0-100%.
- 10 10. The valve according to claim 1, wherein said second rotating part is rotatable in a closed position while said first rotating part is rotatable between said first and second position.
11. The valve according to claim 2, wherein said first rotating part is rotatable in
15 a closed position while said second rotating part is rotatable between said first and second position.
12. The valve according to any one of claims 1-3, wherein said first and/or second rotating part together with said first and/or second fixed parts are
20 forming a butterfly valve.
13. The valve according to any one of claims 1-3, wherein said first and/or second rotating part together with said first and/or second fixed parts are forming a ball valve. .
25
14. The valve device according to any one of claim 1-5, wherein said first flow passage has a smaller cross sectional area than said second flow passage.
15. The valve device according to any one of claim 1-6, wherein said first and
30 second flow passages merge upstream said first and second valves.
16. The valve device according to any one of claim 1-7, wherein said first and second flow passages merge downstream said first and second valves.

17. An internal combustion engine comprising an exhaust gas recirculation (EGR) circuit, characterized in that a valve device according to any one of claims 1-16 is provided in said EGR circuit.
- 5 18. A vehicle comprising an internal combustion engine according to claim 17



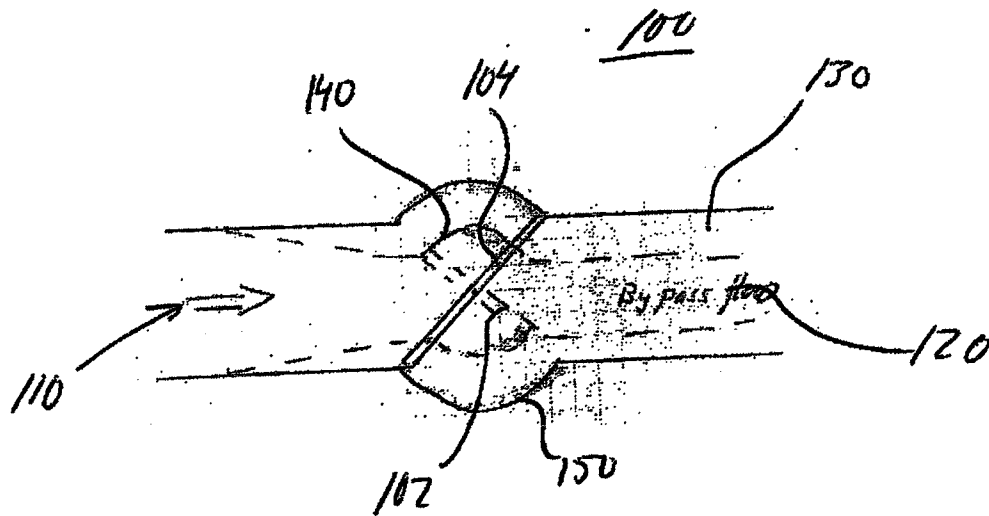


Fig 2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE2010/000113

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

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)

IPC: F02M, F16K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	EP 2211048 A1 (PIERBURG GMBH), 28 July 2010 (28.07.2010), figure 6, paragraphs [0043]-[0045] --	1-12,17-18
X	WO 2009059999 A1 (DAYCO ENSA, S.L.), 14 May 2009 (14.05.2009), page 2, line 24 - line 26; page 5, line 27 - line 33; page 7, line 32 - page 8, line 4, abstract --	1-9,14-18
X	US 3635245 A (CANFIELD, JOHN L.), 18 January 1972 (18.01.1972), column 2, line 68 - column 3, line 27; column 4, line 13 - line 18, figures, details 31, 32	1-12
Y	--	13-18

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE2010/000113

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0987427 A1 (MODINE MANUFACTURING COMPANY), 22 March 2000 (22.03.2000), figure 4, paragraphs [0019]-[0022] --	13-18
A	JP 2007321708 A, TOYOTA MOTOR CORP, 2007-12-13, (abstract) Retrieved from: PAJ database; Original document: paragraphs [0028], figures 3, 4 --	1-18
A	EP 1273786 A2 (PIERBURG GMBH), 8 January 2003 (08.01.2003), figure 6, paragraph [0015] -- -----	1-18

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Cited literature, if any, will be enclosed in paper form.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/SE2010/000113

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