Figure 8

Title: MODULE SYSTEM FOR FORMATION OF A RADIATOR DEVICE, AND CHARGE AIR COOLER AND RADIATOR OR LIQUID COOLER FORMED BY SUCH A MODULE SYSTEM

Abstract: Module system for formation of a radiator device (1") for a motor vehicle comprising a basic module (10) and two or more supplementary modules (40, 40’) which are connectable to the basic module. Each module comprises an inlet tank (11, 41), an outlet tank (12, 42) and a radiator element (13, 43) which extends between the inlet tank and the outlet tank. The inlet tank (11) of the basic module is provided with a first connecting outlet at an upper end and a second connecting outlet at a lower end, each of which outlets is connectable to the inlet of the inlet tank (41) of respective supplementary modules. The outlet tank (12) of the basic module is similarly provided with a first connecting inlet at an upper end and a second connecting inlet at a lower end, each of which inlets is connectable to the outlet of the outlet tank (42) of respective supplementary modules.
Module system for formation of a radiator device, and charge air cooler and radiator liquid cooler formed by such a module system.

FIELD OF THE INVENTION AND PRIOR ART

The present invention relates to a module system according to the preamble of claim 1 for formation of a radiator device for a motor vehicle. The invention relates also to a charge air cooler formed by such a module system, and to a radiator liquid cooler formed by such a module system.

A module system for formation of a radiator device of a motor vehicle is previously known from WO 2004/027232 A1. This known module system is intended for formation of a radiator device in the form of a radiator liquid cooler, i.e. a radiator device for cooling of coolant for the combustion engine of a motor vehicle, and comprises a basic module provided with an inlet intended to be connected to a pipeline of a motor vehicle in order to feed circulating coolant into the radiator device, and an outlet intended to be connected to a pipeline of the motor vehicle in order to discharge such coolant from the radiator device. The basic module further comprises a first connecting aperture connected to the inlet, and a second connecting aperture connected to the outlet. The module system according to WO 2004/027232 A1 further comprises a number of supplementary modules which can be connected to one another and to the basic module. Each supplementary module comprises an inlet tank, an
outlet tank and, between them, a radiator element. The inlet tank of each supplementary module is provided with an inlet aperture connectable to said first connecting aperture of the basic module, and a connecting aperture connectable to the inlet aperture of inlet tanks of other supplementary modules. The outlet tank of each supplementary module is provided with an outlet aperture connectable to said second connecting aperture of the basic module, and a connecting aperture connectable to the outlet aperture of outlet tanks of other supplementary modules.

Assembling a radiator device involves a first supplementary module being connected to the basic module and thereafter being combined with desired numbers of further supplementary modules stacked upon one another with their inlet tanks connected to one another in series and their outlet tanks connected to one another in series.

OBJECT OF THE INVENTION

The object of the present invention is to propose a further development of a module system of the type described above for achieving a module system with a configuration which in at least some aspects affords an advantage compared with the type described above.

SUMMARY OF THE INVENTION

According to the present invention, said object is achieved by means of a module system having the features defined in claim 1.
The module system according to the invention is intended for formation of a radiator device for a motor vehicle and comprises a basic module and two or more supplementary modules which are connectable to the basic module.

The basic module of the module system according to the invention comprises
- a main inlet intended to be connected to a pipeline of a motor vehicle in order to feed a circulating cooling medium into a radiator device formed by the module system,
- a main outlet intended to be connected to a pipeline of a motor vehicle in order to discharge said cooling medium from the radiator device,
- an inlet tank connected to said main inlet,
- an outlet tank connected to said main outlet, and
- a radiator element which extends between the inlet tank and outlet tank of the basic module and is provided with throughflow ducts through which said cooling medium is intended to flow from the basic module’s inlet tank to its outlet tank while giving off heat to the surroundings.

Each supplementary module of the module system according to the invention comprises
- an inlet tank provided with an inlet,
- an outlet tank provided with an outlet, and
- a radiator element which extends between the inlet tank and outlet tank of the supplementary module and is provided with throughflow ducts through which said cooling medium is intended to flow from the supplementary module’s inlet tank to its outlet tank while giving off heat to the surroundings.
The inlet tank of the basic module is provided with a first connecting outlet at an upper end and a second connecting outlet at a lower end, each of which outlets is connectable to the inlet of the inlet tank of respective supplementary modules. The outlet tank of the basic module is similarly provided with a first connecting inlet at an upper end and a second connecting inlet at a lower end, each of which inlets is connectable to the outlet of the outlet tank of respective supplementary modules.

The fact that it is provided with a radiator element of its own makes it possible for the basic module to be used independently, i.e. without any supplementary module connected to it, as a radiator device in cases where a radiator device with only a small cooling capacity is needed. In such cases, the basic module's connecting outlet and connecting inlet are closed by suitable closure means, e.g. covers, plugs or the like. The fact that the basic module's inlet tank and outlet tank are provided with respective connecting outlets and connecting inlets both at the top and at the bottom also makes it possible to add to the basic module one or more supplementary modules in desired vertical directions or supplementary modules in opposite vertical directions. This results in greater scope for adapting the radiator device to the space available for it in the respective motor vehicle.

The module system according to the invention makes it possible for one or more supplementary modules to be connected directly to the basic module in order to achieve a radiator device with a cooling capacity appropriate to the cooling requirement without
having to provide any separate pipelines between the various modules in order to connect them to one another. Leakproof combining of the modules is thus easy to achieve.

According to an embodiment of the invention, the module system comprises two or more supplementary modules which differ in height. Using supplementary modules of different heights makes it possible to use a limited number of supplementary modules to achieve a relatively large number of different sizes of radiator device. For example, a basic module and two supplementary modules of different heights may be used to build radiator devices of four different sizes, whereas a basic module and two supplementary modules of the same height could only be used to build three different sizes of radiator device.

According to another embodiment of the invention, one or more supplementary modules have a valve means situated close to the inlet of the supplementary module's inlet tank or close to the outlet of supplementary module's outlet tank, which valve means is switchable between a closed state in which it is adapted to keeping the respective inlet or outlet closed and thereby preventing cooling medium from passing through, and an open state in which the valve means is adapted to keeping the respective inlet or outlet open and thereby allowing cooling medium to pass through. Putting a valve means of a supplementary module into a closed state is an easy and quick way of responding to any need to prevent the cooling medium from flowing through a supplementary module which is part of a radiator device formed by the module system according to the invention. When it is thus led through a reduced proportion of
the radiator elements which constitute the radiator device, the cooling medium acquires a higher flow velocity through the radiator elements available at the time as compared with when all of the radiator elements of the radiator device are available for it to flow through. The dwell time of the cooling medium in the radiator elements is thus shortened, subjecting it to a reduced cooling effect. In the case of a charge air cooler there is risk of ice forming in the throughflow ducts of its radiator elements. In a charge air cooler formed by the module system according to the invention, said valve means of a supplementary module may be used to reduce the cooling capacity of the charge air cooler and thereby reduce the risk of icing in the throughflow ducts of the radiator elements.

Other advantageous features of the module system according to the invention are indicated by the independent claims and the description set out below.

The invention relates also to a charge air cooler having the features defined in claim 11 and a radiator liquid cooler having the features defined in claim 12.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is described in more detail below on the basis of embodiment examples with reference to the attached drawings, in which
is a schematic perspective view from in front of a basic module which forms part of a module system according to an embodiment of the present invention,

is a schematic perspective view from behind of a radiator device formed by the basic module according to Fig 1,

is a schematic front view of a radiator device formed by a basic module and a supplementary module connected to it which is of a first height,

is a detail enlargement in cross-section of a portion of the radiator device according to Fig 3,

is a detail enlargement in cross-section of another portion of the radiator device according to Fig 3,

is a detail enlargement in cross-section of a further portion of the radiator device according to Fig 3,

is a schematic front view of a radiator device formed by a basic module and a supplementary module connected to it which is of a second height,

is a schematic front view of a radiator device formed by a basic module and two supplementary modules connected to it, and
Fig 9 is a detail enlargement in partial cross-section of a portion of the radiator device according to Fig 8.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

Fig. 1 illustrates a basic module 10 which is part of a module system according to an embodiment of the present invention for formation of a radiator device for a motor vehicle. This basic module 10 comprises an inlet tank 11, an outlet tank 12 and a radiator element 13 which extends between the inlet tank 11 and the outlet tank 12. The radiator element 13 is provided with throughflow ducts 14 (see Figs. 4-6) through which a cooling medium is intended to flow from the basic module's inlet tank 11 to its outlet tank 12 while giving off heat to the surroundings. The basic module's inlet tank 11 and outlet tank 12 are elongate and extend parallel with one another at opposite ends of the radiator element 13 at right angles to its longitudinal axis. The basic module 10 comprises a main inlet 15 (see Fig. 2) connected to the inlet tank 11, and a main outlet 16 connected to the outlet tank 12. The main inlet 15 is intended to be connected to a pipeline of a motor vehicle in order to feed a circulating cooling medium into the basic module's inlet tank 11, and the main outlet 16 is intended to be connected to a pipeline of the motor vehicle in order to discharge said cooling medium from the basic module's outlet tank 12. The basic module's main inlet 15 and main outlet 16 thus respectively serve as inlet and outlet for cooling medium in a radiator device formed by the module system here concerned.
The basic module’s inlet tank 11 is provided with a first connecting outlet 17a at an upper end 11a, and a second connecting outlet 17b at a lower end 11b. The basic module’s outlet tank 12 is provided with a first connecting inlet 18a at an upper end 12a and a second connecting inlet 18b at a lower end 12b.

Fig. 2 illustrates a radiator device 1 formed by the basic module 10 depicted in Fig. 1. In this case the connecting outlets 17a, 17b and the connecting inlets 18a, 18b of the basic module 10 are sealingly closed by closure means 30. In the example illustrated, the closure means 30 take the form of covers placed over the respective outward-facing apertures of the connecting outlets 17a, 17b and connecting inlets 18a, 18b. A seal means 31, e.g. in the form of an O-ring, is situated between an insert portion 32 of each closure means 30 and an internal surface 19 of the respective connecting outlet 17a, 17b or connecting inlet 18a, 18b, as illustrated in Fig. 4. In the example illustrated, the seal means 31 is situated in an external groove 33 which extends round said insert portion 32.

The closure means 30 may be fastenable to the basic module 10 by means of, for example, threaded connections, clamping connections or press fits. In the example illustrated the closure means 30 are fastened to the basic module 10 by threaded connections, to which end the basic module is provided with a fastening plate 24 at each connecting outlet 17a, 17b and connecting inlet 18a, 18b. Each closure means 30 is provided with a corresponding fastening plate 34 intended to abut against one of the basic module's fastening plates 24 when the closure
means is put in place in a connecting outlet 17a, 17b or connecting inlet 18a, 18b. The fastening plates 24, 34 have holes 25, 35 running through them to accommodate a threaded fastening element 36 (see Fig. 4). In the example illustrated the fastening element 36 takes the form of a bolt which cooperates with a nut 37 to clamp together the respective pair of fastening plates 24, 34.

The module system further comprises two or more supplementary modules 40, 40'. These supplementary modules may be of the same height but the module system comprises with advantage supplementary modules of two or more different heights. Each supplementary module 40, 40' comprises an inlet tank 41, an outlet tank 42 and a radiator element 43 which extends between the inlet tank 41 and the outlet tank 42. The radiator element 43 is provided with throughflow ducts 44 (see Figs. 5 and 6) through which cooling medium is intended to flow from the supplementary module’s inlet tank 41 to its outlet tank 42 while giving off heat to the surroundings. The supplementary module’s inlet tank 41 and outlet tank 42 are elongate and extend parallel with one another at opposite ends of the radiator element 43 at right angles to its longitudinal axis. The supplementary module’s inlet tank 41 is provided with an inlet 47, and its outlet tank 42 is provided with an outlet 48. Said inlet 47 is situated at a first end 41a of the inlet tank, and said outlet 48 is situated at a corresponding first end 42a of the outlet tank. The inlet 47 and outlet 48 thus face the same direction.

Each of the basic module’s connecting outlets 17a, 17b is connectable to the inlet 47 of the inlet tank 41 of respective
supplementary modules 40, 40'. Similarly, each of the basic module connecting inlets 18a, 18b is connectable to the outlet 48 of the outlet tank 42 of respective supplementary modules 40, 40'. This means that the inlet tank 41 of a supplementary module can be connected to the basic module's inlet tank 11 so that they together form an inlet tank of a radiator device.

Similarly, the outlet tank 42 of a supplementary module can be connected to the basic module's outlet tank 12 so that they together form an inlet tank of a radiator device. The fact that a first pair of connecting outlet 17a and connecting inlet 18a are situated at the top of the basic module 10, and a second pair of connecting outlet 17b and connecting inlet 18b are situated at the bottom of the basic module 10, makes it possible for an individual supplementary module 40, 40' to be fitted either above or below the basic module. It is of course also possible to fit a first supplementary module above the basic module and a second supplementary module below the basic module, as illustrated in Fig. 8.

To make it easier to combine a supplementary module 40, 40' and the basic module 10, each connecting outlet 17a, 17b of the basic module's inlet tank 11 is provided with a connecting portion 20 (see Figs. 5 and 6) configured to engage with a corresponding connecting portion 50 of the inlet 47 of the inlet tank 41 of the respective supplementary module. Similarly, each connecting inlet 18a, 18b of the basic module's outlet tank 12 is provided with a connecting portion 21 configured to engage with a corresponding connecting portion 51 of the outlet 48 of the outlet tank 42 of respective supplementary modules 40, 40'. In the
embodiment depicted, the basic module 10 is provided with female connecting portions 20, 21 for engagement with corresponding male portions 50, 51 of the supplementary modules. Alternatively it would of course be possible for the basic module to be provided with male connecting portions for engagement with corresponding female portions of the supplementary modules.

A seal means 52, e.g. in the form of an O-ring, is provided between the respective connecting portion 20, 21 of the basic module and the corresponding connecting portion 50, 51 of a supplementary module 40, 40' connected to the basic module, as illustrated in Figs. 5 and 6. In the example illustrated, the seal means 52 is situated in an external groove 53 which extends round the supplementary module's connecting portion 50, 51.

Each supplementary module 40, 40' may be fastenable to the basic module 10 by, for example, threaded connections or clamping connections. In the example illustrated, each supplementary module 40, 40' is kept fastened to the basic module 10 by threaded connections, to which end the supplementary module is provided with a fastening plate 54 at the inlet 47 and at the outlet 48. Each fastening plate 54 is intended to abut against one of the basic module's fastening plates 24 when the supplementary module 40, 40' is connected to the basic module 10. The fastening plates 24, 54 have holes 25, 55 running through them to accommodate a threaded fastening element 36 (see Figs. 5 and 6). In the example illustrated, the fastening element 36 takes the form of a bolt which cooperates with a nut 37 to clamp firmly together the respective pair of fastening plates 24, 54.
In the supplementary modules 40, 40' depicted in Figs. 3, 7 and 8 the second end 41b, 42b of the inlet tank 41 and the outlet tank 42 is closed, making it impossible to connect together two or more supplementary modules on the same side of the basic module 10. As an alternative, however, connecting apertures with respective connecting portions may be provided at both ends of the inlet tank and the outlet tank of one or more supplementary modules to make it possible to connect together two or more supplementary modules on the same side of the basic module 10.

The radiator element 13, 43 of the basic module 10 and the supplementary modules 40, 40' are substantially platelike and comprise throughflow ducts 14, 44 in the form of a number of elongate pipelines 26, 56 which extend at distances from one another and are connected to, and extend between, respective inlet tanks 11, 41 and outlet tanks 12, 42 in order to convey cooling medium between them. Cooling flanges 27, 57 or the like are connected in a conventional way to the pipelines 26, 56 to increase the heat transfer surface. Cooling medium is intended to be led through the pipelines 26, 56 from the respective inlet tank 11, 41 to the respective outlet tank 12, 42 in order to give off heat via the pipeline walls and the cooling flanges 27, 57 to surrounding air which passes through air passages between the pipelines 26, 56. The cooling medium is thus cooled by ambient air passing between the pipelines 26, 56.

Assembling a radiator device involves connecting one or more supplementary modules 40, 40' to the basic module 10, these
modules being stacked upon one another with their inlet tanks 11, 41 connected to one another in series to form a combined inlet tank of the radiator device, and with their outlet tanks 12, 42 connected to one another in series to form a combined outlet tank of the radiator device.

Fig. 3 illustrates a radiator device 1' formed of a basic module 10 with a supplementary module 40 of a first height hi connected on top of it. In this case the upper connecting outlet 17a of the basic module's inlet tank 11 and the upper connecting inlet 18a of the basic module's outlet tank 12 are each closed by their respective closure means 30.

Fig. 7 illustrates a radiator device 1'' formed of a basic module 10 with a supplementary module 40' of a second height h2, which is greater than the aforesaid first height hi, connected on top of it. Here too the upper connecting outlet 17a of the basic module's inlet tank 11 and the upper connecting inlet 18a of the basic module's outlet tank 12 are each closed by their respective closure means 30.

Fig. 8 illustrates a radiator device 1''' formed by a basic module 10, a first supplementary module 40 of said first height hi connected to the top of the basic module, and a second supplementary module 40' of said second height h2 connected at the bottom of the basic module.

To make it easier to fasten in a motor vehicle a radiator device formed by the module system, the basic module 10 is with
advantage provided with fastening means (not depicted) situated on the outside of its inlet tank 11 and outlet tank 12.

One or more of the supplementary modules 40, 40' which form part of the module system may be provided with a valve means 58 (see Fig. 9) situated close to the inlet 47 of the supplementary module's inlet tank 41 or close to the outlet 48 of the supplementary module's outlet tank 42. This valve means 58 is switchable between a closed state in which it is adapted to keeping the respective inlet/outlet closed and thereby preventing cooling medium from passing through, and an open state in which it is adapted to keeping the respective inlet/outlet open and thereby allowing cooling medium to pass through. The valve means 58 is with advantage supported for pivoting in the supplementary module 40, 40' so as to be pivotable about a pivot pin 59 between its closed and open states. In its closed state, the valve means 58 abuts against a seat 60 which may extend all round or partly round an internal surface of the respective inlet tank/outlet tank of the supplementary module. Each valve means 58 may for example take the form of a valve flap such as illustrated in Fig. 9. In the radiator device 1'' illustrated in Fig. 9, each supplementary module 40, 40' is provided with such a valve means 58 close to the inlet 47 of its inlet tank 41. In Fig. 9 the valve means 58 is represented by continuous lines in its open state and by broken lines in its closed state.

The valve means 58 may be adapted to being operated and controlled in the ways described in more detail in Swedish patent application no. 1050162-5, the content of which is herein incorporated by citation.
The basic module 10 and the supplementary modules 40, 40' may be provided with inlet tanks 11, 41 and outlet tanks 12, 42 made of metal for formation of a radiator device in the form of a charge air cooler, i.e. the radiator device for cooling of charge air for the combustion engine of a motor vehicle. The basic module 10 and the supplementary modules 40, 40' may alternatively be provided with inlet tanks 11, 41 and outlet tanks 12, 42 made of plastic material for formation of a radiator device in the form of a radiator liquid cooler, i.e. a radiator device for cooling of coolant for the combustion engine of a motor vehicle.

The module system according to the invention is particularly intended to be used for formation of a charge air cooler or radiator liquid cooler for a heavy motor vehicle, e.g. a bus, a tractor unit or a truck.

The invention is of course in no way restricted to the embodiments described above, since a variety of possibilities for modifications thereof are likely to be obvious to one skilled in the art without thereby deviating from the invention's basic concept such as defined in the attached claims.
CLAIMS

1. A module system for formation of a radiator device for a motor vehicle, which system comprises

- a basic module (10) provided with a main inlet (15) intended to be connected to a pipeline of a motor vehicle in order to feed a circulating cooling medium into a radiator device formed by the module system, a main outlet (16) intended to be connected to a pipeline of a motor vehicle in order to discharge said cooling medium from the radiator device, a connecting outlet (17a) and a connecting inlet (18a), and
- two or more supplementary modules (40, 40') which are connectable to the basic module and each comprise
  - an inlet tank (41) provided with an inlet (47) configured for connection to said connecting outlet (17a) of the basic module (10),
  - an outlet tank (42) provided with an outlet (48) configured for connection to said connecting inlet (18a) of the basic module (10), and
  - a radiator element (43) which extends between the supplementary module's inlet tank (41) and outlet tank (42) and is provided with throughflow ducts (56) through which said cooling medium is intended to flow from the supplementary module's inlet tank (41) to its outlet tank (42) while giving off heat to the surroundings,

characterised

- in that the basic module (10) comprises
  - an inlet tank (11) connected to said main inlet (15),
  - an outlet tank (12) connected to said main outlet (16),

and
• a radiator element (13) which extends between the inlet tank (11) and outlet tank (12) of the basic module and is provided with throughflow ducts (26) through which said cooling medium is intended to flow from the basic module's inlet tank (11) to its outlet tank (12) while giving off heat to the surroundings,

- that the inlet tank (11) of the basic module is provided with a first connecting outlet (17a) at an upper end (11a) and a second connecting outlet (17b) at a lower end (11b), each of which outlets (17a, 17b) is connectable to the inlet (47) of the inlet tank (41) of respective supplementary modules (40, 40'), and

- that the outlet tank (12) of the basic module is similarly provided with a first connecting inlet (18a) at an upper end (12a) and a second connecting inlet (18b) at a lower end (12b), each of which inlets (18a, 18b) is connectable to the outlet (48) of the outlet tank (42) of respective supplementary modules (40, 40').

2. A module system according to claim 1, **characterised** in that the system comprises two or more supplementary modules (40, 40') of mutually different heights.

3. A module system according to claim 1 or 2, **characterised**

- in that each connecting outlet (17a, 17b) of the basic module's inlet tank (11) comprises a connecting portion (20) configured to engage with a corresponding connecting portion (50) of the inlet (47) of the inlet tank (41) of respective supplementary modules (40, 40'), and
- that each connecting outlet \((18a, 18b)\) of the basic module's outlet tank \((12)\) comprises a connecting portion \((21)\) configured to engage with a corresponding connecting portion \((51)\) of the outlet \((48)\) of the outlet tank \((42)\) of respective supplementary modules \((40, 40')\).

4. A module system according to any one of claims 1-3, characterised in that the inlet tank \((41)\) and the outlet tank \((42)\) of each supplementary module \((40, 40')\) are elongate and each have two opposite ends, said inlet \((47)\) of the supplementary module's inlet tank \((41)\) being situated at a first end \((41a)\) of the inlet tank and said outlet \((48)\) of the supplementary module's outlet tank \((42)\) being situated at a corresponding first end \((42a)\) of the outlet tank.

5. A module system according to claim 4, characterised in that the second end \((41b, 42b)\) of the inlet tank \((41)\) and outlet tank \((42)\) of respective supplementary modules \((40, 40')\) is closed.

6. A module system according to any one of claims 1-5, characterised in that one or more supplementary modules \((40, 40')\) are provided with a valve means \((58)\) which is situated close to the inlet \((47)\) of the supplementary module's inlet tank \((41)\) or close to the outlet \((48)\) of the supplementary module's outlet tank \((42)\) and is switchable between a closed state in which it is adapted to keeping the respective inlet \((47)\) or outlet \((48)\) closed and thereby preventing cooling medium from passing through, and an open state in which it is
adapted to keeping the respective inlet (47) or outlet (48) open and thereby allowing cooling medium to pass through.

7. A module system according to claim 6, characterised in that said valve means (58) is supported for pivoting in the respective supplementary module (40, 40') so as to be movable about a pivot pin (59) between its closed and open states.

8. A module system according to claim 7, characterised in that said valve means (58) takes the form of a valve flap.

9. A module system according to any one of claims 1-8, characterised in that the basic module (10) and the supplementary modules (40, 40') are provided with inlet tanks (11, 41) and outlet tanks (12, 42) made of metal in cases where the module system is intended for formation of a radiator device in the form of a charge air cooler.

10. A module system according to any one of claims 1-8, characterised in that the basic module (10) and the supplementary modules (40, 40') are provided with inlet tanks (11, 41) and outlet tanks (12, 42) made of plastic material in cases where case module system is intended for formation of a radiator device in the form of a radiator liquid cooler.

11. A charge air cooler, characterised in that it is formed by a module system according to any one of claims 1-9.
12. A radiator liquid cooler, **characterised** in that it is formed by a module system according to any one of claims 1-8 or 10.
INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE201 1/051431

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: B60K, F01 P, F02B

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

SE, DK, Fl, NO classes as above

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

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Form PCT/ISA/210 (second sheet) (July 2009)
## International Search Report

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