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(54) A method for charging a washing liquid in a laundry washing machine

(57) Method for charging a washing liquid in a laundry washing machine (1) comprising a washing compartment (2) housing a rotatable drum (3). The method comprises the step of implementing a first iterative procedure comprising, in the following temporal order, at least the following steps:

- charging a washing liquid into the drum (3), the washing liquid charged into the drum (3) being at least partly absorbed by laundry in the drum (3); washing liquid charged inside the drum (3) and not absorbed by the laundry, if

any, flows through a perforated side wall (34) of the drum (3) in a zone (20) of the washing compartment (2) outside the drum (3);

- checking with the level gauge (5) that a first configuration has been reached where, as compared to a predetermined reference level, there is a predetermined increment of the level of the liquid in the washing compartment (2) on account of the outflow from the drum (3) of the liquid not absorbed by the laundry; a negative result for this check causing the first procedure to be repeated until the check returns a positive result.

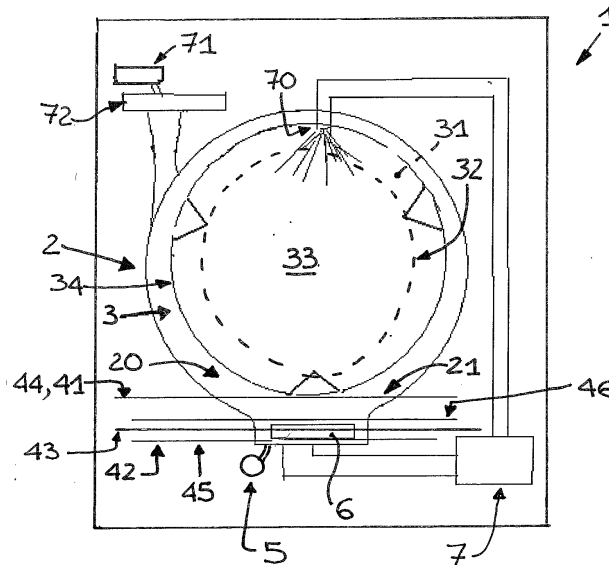


Fig. 1

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Description

[0001] The present invention relates to a method for charging a washing liquid in a laundry washing machine.

[0002] In washing machines of the known type, a step for charging water is performed before starting the wash cycle proper. The water charging step involves feeding mains supply water into a washing compartment.

[0003] In this charging step, the water level reaches and partially floods a drum located in the washing compartment, in which there is the laundry to be washed.

[0004] At this point, the drum starts turning and the water is absorbed by the laundry. To ensure complete soaking of the laundry, other water is requested from the mains water supply and this is fed into the drum.

[0005] This solution has drawbacks. A first drawback is associated with the waste of water, on account of the quantity of water charged being largely in excess of that required to completely soak the laundry and determines the presence of excess water in the bottom part of the washing compartment (indicated in technical jargon as "dead volume" of water). A further drawback is that all the water present in the washing compartment is heated by a heating element, but only a small amount of this water is actually in contact with the laundry. This results in a waste of electric power. Secondly, the rotation of the drum partly submerged in the "dead volume" requires a greater force on account of the braking action of the water.

[0006] The aim of the present invention is to provide a method for charging a washing liquid which permits water and energy to be saved while still ensuring optimal soaking of the laundry.

[0007] The technical task explained and the objects specified are substantially achieved by a method comprising the technical features detailed in one or more of the appended claims.

[0008] Further features and advantages of the present invention will become more apparent by the approximate, and thus non-limiting, description of a preferred, but not exclusive, embodiment of a washing machine, as shown in the accompanying drawings, in which figure 1 shows a schematic view of a washing machine implementing a method according to the present invention.

[0009] The object of the present invention is a method for charging a washing liquid in a laundry washing machine 1. The laundry washing machine is indicated with reference number 1 in the accompanying figure. It could be a washing machine or a washer-drier. The washing machine 1 comprises a washing compartment 2 housing a rotatable drum 3, intended to contain the laundry to be washed. The drum 3 comprises:

- a front frame delimiting an opening 32 for loading/removing laundry; in figure 1, this frame 31 is shown by a dashed line to indicate it has been removed to better show the sections behind it (this frame 31 could be a front flange of the drum 3, but if necessary,

it could also simply consist of a front edge of the drum 3);

- a rear end wall 33 opposite to the opening 32;
- a perforated side wall 34 extending between the rear end wall 33 and the frame 31.

[0010] The perforated side wall 34 comprises at least one hole or preferably a plurality of holes. These holes are located all along the side wall 34. The at least one hole in the perforated side wall 34 places the inner drum 3 and a zone 20 of the washing compartment 2 outside the drum 3, in fluid communication. Advantageously, the drum 3 may rotate about an axis of rotation which is horizontal. Preferably, when moving from the rear end wall 33 towards the frame 31, the perforated side wall 34 does not have a convergent or divergent shape.

[0011] The method also comprises the step of implementing a first iterative procedure comprising, in the following temporal order, at least the following steps:

- charging a washing liquid into the drum 3; the washing liquid charged into the drum 3 is at least partly absorbed by laundry in the drum 3; any washing liquid charged inside the drum 3 and not absorbed by the laundry flows into the zone 20 (part of the washing compartment 2) outside the drum 3 through the at least one hole in the perforated side wall 34; the washing liquid charged inside the drum 3 and not absorbed by the laundry is liquid substantially in excess of that needed to completely soak the laundry; the condition of maximum soaking is a condition in which the laundry to be washed has absorbed the maximum quantity of washing liquid that can be absorbed;
- checking with a level gauge 5 that a first configuration has been reached where, compared to a predetermined reference level, there is a predetermined increment of the level of the liquid in the washing compartment 2 on account of the outflow from the drum 3 of the liquid not absorbed by the laundry, that is, the excess liquid; a negative result for this check will cause the first procedure to be repeated until the check returns a positive result.

[0012] Advantageously, the level gauge 5 comprises a pressure switch. This pressure switch is opportunely located below the washing compartment 2 and is in fluid communication with the compartment 2.

[0013] The step of charging a washing liquid into the drum 3 comprises the following steps:

- feeding the washing liquid into the zone 20 until the level in the compartment 2 reaches a first predetermined level 41; the washing liquid fed into the zone 20 will be placed in a lower portion 21 (as seen when viewed on the vertical) of the compartment 2;
- pumping the washing liquid from the zone 20 (in particular, from the lower portion 21 of the compartment

2) to the drum 3 until the washing liquid in the zone 20 (in particular, in the lower portion 21) reaches a second predetermined level 42 which is less than the first predetermined level 41. Advantageously, the predetermined reference level coincides with the second predetermined level 42. Advantageously the predetermined reference level conveniently coincides with the level of the liquid at the end of the step of charging the washing liquid into the drum 3. The step of pumping the washing liquid from the zone 20 to the drum 3 involves spraying the washing liquid into the drum 3 by making it transit through the opening 32. The step of spraying the washing liquid into the drum 3 is performed by a nozzle 70 outside the drum 3 which guides the jet towards the opening 32. The step of pumping the washing liquid from the zone 20 to the drum 3 is performed by a lifting pump 7 in fluid communication with a bottom of the washing compartment 2. In a specific constructional embodiment, the pump 7 could be flanged directly onto the delimiting wall of the washing compartment 2. Alternatively, the pump 7 could be in fluid communication with the washing compartment 2 by means of an intermediate pipe. Advantageously this pipe could be closed off when required by a valve.

[0014] The step of checking that the first configuration has been reached returns a positive result if the level of the liquid in the washing compartment 2 is greater than or equal to a third predetermined level 43, which is greater than the second predetermined level 42 by a predetermined quantity. The third predetermined level 43 could also coincide with the first predetermined level 41. Preferably, the third predetermined level 43 is less than the first predetermined level 41. In the preferred embodiment, the first, the second and the third predetermined levels 41, 42, 43 strictly remain fixed.

[0015] In a non-preferred embodiment, at all iterations of the first procedure, the first predetermined level 41 may also take on a different value (a similar thing may be said for the second and/or third predetermined levels 42, 43). In this case, there is a control logic which manages this variability; this embodiment is not the preferred one in light of these complications.

[0016] The predetermined increment indicated above is equal to the interval which becomes necessary to reach the third predetermined level 43 from the level 42 reached at the end of the step for charging the washing liquid into the drum 3.

[0017] As indicated above, in the preferred embodiment, the first configuration is reached when the washing liquid in the compartment 2 exceeds the third predetermined level 43. At all iterations of the first procedure, the level of the liquid in the zone 20 of the compartment 2 is advantageously equal to a second predetermined level 42 at the end of the step of charging the washing liquid into the drum 3.

[0018] Preferably the difference between the third pre-

determined level 43 and the second predetermined level 42 is equal to the predetermined increment.

[0019] Advantageously this predetermined increment could also be equal to the lowest value of the sensitivity of the level gauge (or better, to the minimum increment of the level as compared to the second predetermined level 42 which can be detected by the gauge 5).

[0020] In a non-limiting, example embodiment this increment could be between 0 and 20 millimetres of column of water.

[0021] The step of checking with a level gauge 5 that the first configuration has been reached occurs after a predetermined time period at the end of the step of charging a washing liquid into the drum 3. Advantageously but without constituting a limited factor, this predetermined time period is between 30 and 120 seconds.

[0022] Advantageously the washing liquid charged into the drum 3 and not absorbed by the laundry flows into the zone 20 alone under the force of gravity while the drum 3 is stationary. Hence, during the aforementioned time period, the drum 3 remains stationary. This permits the use of traditional drums 3 of the type mounted on most washing machines. Moreover, keeping the drum 3 stationary, minimises the risk of the water flowing out into the zone 20 through the perforated side wall 34 being excess liquid, it rather being liquid which outflows on account of the wringing effect caused by the centrifuge force acting on the laundry.

[0023] The first predetermined level 41 is conveniently located completely under the drum 3. Consequently, the second and the third predetermined levels 42, 43 are completely located under the drum 3.

[0024] The step of charging a washing liquid into the drum 3 comprises the step of heating the liquid present in the zone 20 of the washing compartment 2. The step of heating the washing liquid is at least partly between the step of feeding the washing liquid into the zone 20 of the compartment 2 and the step of pumping the washing liquid from the zone 20 of the washing compartment 2 to the drum 3. The step of heating the washing liquid involves activating a heating element 6 located in the zone 20, in particular located in the lower portion 21 of the washing compartment 2. The heating element 6 is advantageously located in the washing compartment 2 located between the first and the second predetermined levels 41, 42. The activation of the heating element 6 is subordinate to the detection by the level gauge 5 of a level of washing liquid which is greater than a level 46 for activating the element. This prevents overheating of the element 6 which might otherwise damage the element 6 or components of the washing machine 1 located close to the element 6.

[0025] The method also involves interrupting the step of heating the liquid present in the washing compartment 2 when a measurement of the temperature of the liquid present in the washing compartment 2 detects a temperature greater than a predetermined temperature value (preferably this predetermined temperature value is

equal to a first value between 15 and 60°C, advantageously between 30 and 45°C).

[0026] The step of pumping the washing liquid from the zone 20 to the drum 3 starts after a measurement of the temperature of the liquid present in the zone 20 detects a temperature greater than a predetermined temperature value. This latter predetermined temperature value may or may not coincide with the first value. This permits the liquid which was already heated to be fed into the drum 3. A first advantage of this characteristic is associated with the fact that the heating allows the detergent to be activated should the washing liquid be a mixture of water and detergent. A further advantage is associated with the fact that this method improves soaking. Advantageously, the step of charging the washing liquid in the washing compartment 2 involves feeding a mixture of water and at least one chemical washing detergent.

[0027] For this purpose, the step of feeding the washing liquid into the zone 20 until the level in the zone 20 of the compartment 2 reaches a first predetermined level 41, comprises the following steps:

- requesting water from the mains water supply (for example, by opening a solenoid valve 71);
- causing it to transit through a tray 72 for feeding the detergent and causing the water-detergent mixture to outflow into the washing compartment 2. The mixture will arrive in the lower portion 21 of the compartment 2 under the force of gravity.

[0028] The step of implementing the first procedure is advantageously preceded by the step of:

- feeding water into the zone 20 of the washing compartment 2 until the level in the zone 20 of the compartment 2 reaches a fourth predetermined level 44, the fourth level 44 being located completely under the drum 3. The fourth level 44 may coincide with the first predetermined level 41 (in particular, the first and the fourth levels 41, 44 coincide in the preferred embodiment; see also figure 1);
- pumping the washing liquid from the zone 20 of the washing compartment 2 into the drum 3 at least until the washing liquid in the zone 20 reaches a fifth predetermined level 45 which is less than the fourth predetermined level 44. The fifth predetermined level 45 may coincide with the second predetermined level 42 (for example, see figure 1).

[0029] The method also comprises the step of transferring into the drum 3 part of the liquid present in the zone 20 of the washing compartment 2 if the step of checking that the first configuration has been reached returns a positive result.

[0030] The step of transferring into the drum 3 part of the liquid present in the washing compartment 2 ends when the step of transferring into the drum 3 part of the

liquid determines a decrease of the level in the zone 20 equal to the predetermined increment (in particular, it ends following a reduction of the level which compensates for the increment on account of the excess washing liquid which flowed from the drum 3 into the zone 20 during the implementation of the last iteration of the first procedure).

[0031] In a specific constructional example embodiment, at the end of the step of charging the washing liquid into the drum 3 and before the step of checking that the first configuration has been reached, the first procedure involves the following steps:

- using the gauge 5 to determine the specific level of liquid in the zone 20 of the compartment 2;
- assuming the predetermined reference level coinciding with the specific level. The predetermined reference level could also vary (non-preferred embodiment) at all iterations of the first procedure.

[0032] The object of the present invention is also a method for washing laundry implementing at least:

- the charging method having one or more of the technical features described above;
- a successive step of performing a wash cycle in which each time that the level of liquid in the washing compartment 2 exceeds a predetermined threshold, the liquid is pumped from the washing compartment into the drum 3, the predetermined threshold of the level of liquid being completely under the drum 3. The predetermined threshold advantageously coincides with the third predetermined level 43.

[0033] The object of the present invention (in addition to that already disclosed above) is also a method for washing laundry comprising the steps of:

- performing a cycle 2 for charging washing liquid in the washing compartment 2; the washing compartment 2 comprising a drum 3 in which there is laundry to be washed;
- performing a wash cycle successive to the cycle of charging the washing liquid.

[0034] The step of performing a wash cycle is as follows. Each time that the level of liquid located in a lower portion 21 of the washing compartment 2 exceeds a higher predetermined level 43, the washing liquid is pumped from the lower portion 21 of the compartment 2 into the drum 3 until the level of the liquid in the lower portion 21 of the compartment 2 reaches a lower level which is less than or equal to a lower predetermined level 42; the lower predetermined level 42 being below (as seen when viewed on the vertical) the higher predetermined level 43, which in turn is entirely under the drum 3.

[0035] The invention described above enables the achievement of multiple advantages.

[0036] Firstly, it allows only the quantity of water required to be charged, thus allowing savings in water consumption; moreover, it avoids heating an unused volume of water and moving the drum in contact with the volume of water present in the bottom of the compartment (thus generating dissipation on account of friction).

[0037] The invention thus conceived is susceptible to several modifications and variants all falling within the scope of the inventive concept characterizing it. Furthermore, all the details may be replaced by other technically equivalent elements. In practice, any materials and dimensions may be employed, according to needs.

Claims

1. A method for charging a washing liquid in a laundry washing machine (1) comprising a washing compartment (2) housing a rotatable drum (3), the drum (3) being designed to contain the laundry and comprising: a front frame (31) which delimits an opening (32) for loading/removing the laundry, a rear end wall (33) opposite the opening (32), a perforated side wall (34) extending between the rear end wall (33) and the frame (31), at least one hole in the perforated side wall (34) placing the inside of the drum (3) in fluid communication with a zone (20) of the washing compartment (2), outside the drum (3); the method comprising the step of implementing a first iterative procedure comprising, in the following temporal order, at least the following steps:

- charging a washing liquid into the drum (3), the washing liquid charged into the drum (3) being at least partly absorbed by the laundry inside the drum (3), while washing liquid, if any, charged into the drum (3) and not absorbed by the laundry flows through the at least one hole in the perforated side wall (34) into the zone (20) of the washing compartment (2) outside the drum (3);
- checking with a level gauge (5) that a first configuration has been reached where, compared to a predetermined reference level, there is a predetermined increase of the level of liquid in the washing compartment (2) on account of the outflow from the drum (3) of the liquid not absorbed by the laundry; a negative result for this check causing the first procedure to be repeated until the check returns a positive result.

2. The method according to claim 1, **characterized in that** the washing liquid charged into the drum (3) and not absorbed by the laundry flows spontaneously into the washing compartment (2) by the effect of gravity alone and while the drum (3) is stationary.

3. The method according to claim 1 or 2, **characterized**

in that the method comprises the step of transferring into the drum (3) part of the liquid present in the zone (20) of the washing compartment (2) if the step of checking that the first configuration has been reached returns a positive result.

4. The method according to any of the preceding claims, **characterized in that** the step of charging a washing liquid into the drum (3) comprises the following steps:

- feeding the washing liquid into the zone (20) until, the level in the zone (2) reaches a first predetermined level (41);
- pumping the washing liquid from the zone (20) to the drum (3) until the washing liquid in the zone (20) of the compartment (2) reaches a second predetermined level (42) less than the first predetermined level (41);

the step of checking that the first configuration has been reached returning a positive result if the level of the liquid in the zone (20) is greater than or equal to a third predetermined level (43) which is greater than the second predetermined level (42) by a preset quantity; it being possible for the first, the second and the third predetermined level (41, 42, 43) to have a different value each time the first procedure is iterated.

5. The method according to claim 4, **characterized in that** the predetermined reference level coincides with the second predetermined level (42).

6. The method according to claim 4 or 5, **characterized in that** the first predetermined level (41) is completely below the drum (3); it being possible for the first predetermined level (41) to coincide with the third predetermined level (43).

7. The method according to claim 4, 5 or 6, **characterized in that** the step of charging a washing liquid into the drum (3) comprises the step of heating the liquid present in the zone (20) of the washing compartment (2), the step of heating the washing liquid being performed at least in part between the step of feeding the washing liquid into the zone (20) and the step of pumping the washing liquid from the zone (20) into the drum (3).

8. The method according to any of the claims from 4 to 7, **characterized in that** the step of pumping the washing liquid from the zone (20) into the drum (3) starts when the value of the liquid temperature measured in the zone (20) exceeds a predetermined temperature value.

9. The method according to any of the foregoing claims, **characterized in that** the step of charging the wash-

ing liquid into the washing compartment (2) comprises feeding a mixture of water and at least one chemical washing detergent.

10. The method according to claim 9 when it depends directly or indirectly on claim 4, **characterized in that** the step of implementing the first procedure is preceded by the step of:

- feeding water into the washing compartment (2) until the level in the compartment (2) reaches a fourth predetermined level (44), the fourth predetermined level (44) being completely under the drum (3) and it being possible for it to coincide with the first predetermined level (41);
- pumping the washing liquid from the washing compartment (2) into the drum (3) at least until the washing liquid in the drum (3) reaches a fifth predetermined level (45) less than the fourth predetermined level (44), it being possible for the fifth predetermined level (45) to coincide with the second predetermined level (42).

11. The method according to any of the preceding claims, **characterized in that** the step of checking with a level gauge (5) that the first configuration has been reached occurs after a predetermined time interval from the end of the step of charging a washing liquid into the drum (3).

12. A method for washing laundry implementing at least:

- the charging method according to any of the claims from 1 to 11;
- a subsequent step of performing a washing cycle where the washing liquid is pumped from the washing compartment into the drum (3) each time the level of liquid in the washing compartment (2) exceeds a predetermined threshold, the predetermined threshold being completely under the drum (3).

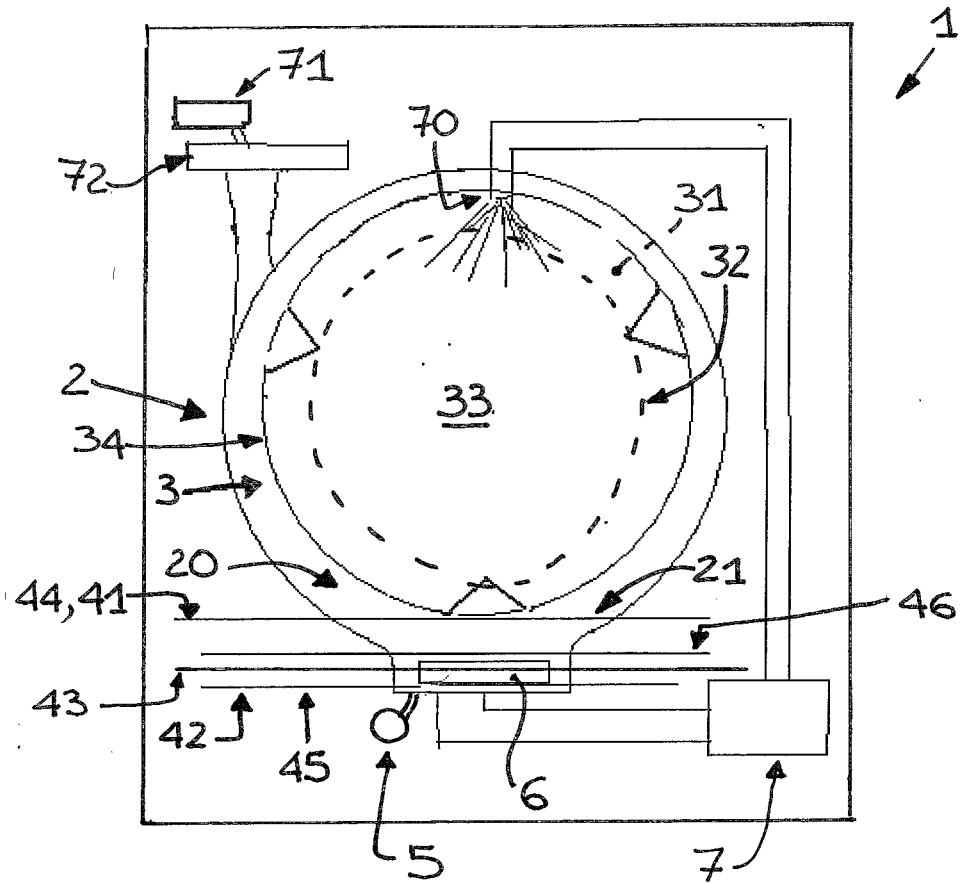


Fig. 1



EUROPEAN SEARCH REPORT

Application Number
EP 12 15 3792

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 44 31 654 A1 (MIELE & CIE [DE]) 7 March 1996 (1996-03-07) * column 4, line 4 - column 5, line 17; claim 1; figures 1,3 * -----	1-3	INV. D06F39/08
X	DE 43 04 031 A1 (LICENTIA GMBH [DE]) 18 August 1994 (1994-08-18) * column 1, line 35 - column 2, line 24; claim 1; figure 1 * -----	1-3	
X	FR 2 684 116 A3 (LICENTIA GMBH [DE]) 28 May 1993 (1993-05-28) * page 2, line 29 - page 4, line 36; claim 3; figure 1 * -----	1-3	
X	DE 41 22 307 A1 (LICENTIA GMBH [DE]) 14 January 1993 (1993-01-14) * the whole document * -----	1-3	
A	DE 42 42 414 A1 (LICENTIA GMBH [DE] AEG HAUSGERAETE GMBH [DE]) 23 June 1994 (1994-06-23) * the whole document * -----	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			D06F
Place of search		Date of completion of the search	Examiner
Munich		15 June 2012	Fachin, Fabiano
CATEGORY OF CITED DOCUMENTS		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	
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			

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ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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15-06-2012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 4431654 A1	07-03-1996	NONE	
DE 4304031 A1	18-08-1994	DE 4304031 A1 EP 0616068 A1	18-08-1994 21-09-1994
FR 2684116 A3	28-05-1993	DE 4138636 A1 FR 2684116 A3 IT 1256433 B	27-05-1993 28-05-1993 05-12-1995
DE 4122307 A1	14-01-1993	DE 4122307 A1 FR 2678959 A1 IT 1255455 B	14-01-1993 15-01-1993 31-10-1995
DE 4242414 A1	23-06-1994	NONE	