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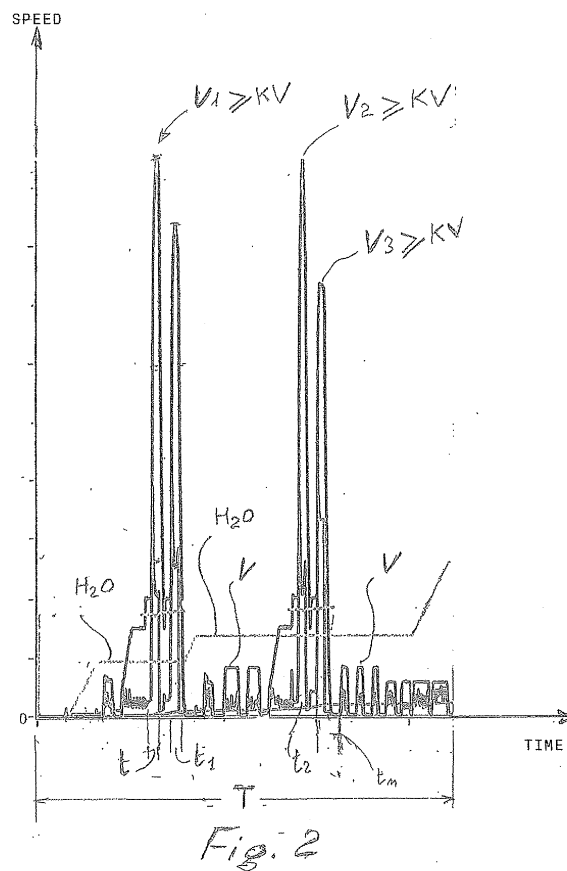
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(54) **A method for intensifying the activation of a detergent in a washing machine or in a washer-dryer**

(57) A method for intensifying the activation of detergent in laundry in a washing machine (2), during the stage in which the detergent is introduced into the drum (3) while the latter rotates in the washing tub (1) of the machine at a speed  $V$  causing the laundry to be at least partially distributed within the drum (3), comprising the introduction into the tub (1) of a specified quantity of liquid for dissolving the detergent and the recirculation of this quantity of washing liquid with detergent by drawing the liquid from the tub (1) and subsequently introducing it so that it passes through the laundry, the recirculation taking place for a period  $T$ . The rotation of the drum (3) with the laundry comprises at least one stage at a speed of  $V_1 \geq KV$  for a period  $t$  which is less than  $T$ , wherein  $K$  is a multiplication factor, which may or may not be an integer, in the range from 2 to 4, including the extreme values.



## Description

**[0001]** The present invention relates to a method for intensifying the activation of the detergent on the laundry in a washing machine or a washer-dryer, during the stage in which the detergent is introduced into the drum while the latter rotates in the washing tub of the machine at a speed V causing the laundry to be at least partially distributed within the drum, comprising the introduction into the tub of a specified quantity of liquid for dissolving the detergent and the recirculation of this quantity of washing liquid with detergent by drawing the liquid from the tub and subsequently introducing it so that it passes through the laundry contained therein, the recirculation taking place for a period T.

**[0002]** As is known, the operating cycle of a washing machine comprises an initial stage in which the detergent, of which a dose in powder, granular or liquid form has been loaded into a suitable compartment, is made to flow into the machine. A first, relatively small, quantity of liquid, usually water, is made to flow into this compartment, causing the dose of detergent to flow from the loading compartment into the tub of the machine.

**[0003]** In order to dissolve the dose of detergent completely, further quantities of liquid are subsequently added to the first quantity of liquid which makes the detergent flow out, the amount added depending on the load of laundry present in the machine.

**[0004]** According to the prior art, the total quantity of liquid present in the tub in the preliminary stage of the washing cycle is generally not more than 5 litres. Since the dose of detergent used is approximately 150 g for a conventional laundry load of 5 kg, the concentration of detergent in the liquid in this stage of the cycle is up to 30 g/litre.

**[0005]** The recirculation of the liquid with the detergent takes place for a sufficiently long period T, normally 10 or 12 minutes, with the drum rotating at a speed V, normally in the range from 75 to 120 revolutions per minute, known as the orbital speed, for the distribution of the laundry in the drum. In spite of this, the circulated liquid and detergent do not reach all the areas of the laundry. This because a large proportion of the recirculated liquid is retained by the laundry which becomes progressively wetter, and therefore the quantity of liquid available for recirculation decreases and continues to decrease during the cycle in the period T, thus limiting the distribution of the detergent in the laundry.

**[0006]** As a result of the aforementioned operating condition according to the prior art, much of the distribution of the detergent in the laundry inevitably takes place during the later stages of the washing cycle.

**[0007]** However, in these stages a further quantity of liquid is added to the initial quantity, thus increasing the total to approximately 15 litres and causing the detergent concentration to decrease from the initial 30 grams per litre to approximately 10 grams per litre.

**[0008]** The distribution of the detergent in the laundry

is therefore completed at a concentration markedly lower than that present in the initial stage of introduction into the tub, resulting in a lower effectiveness of the detergent on any stains present on the fabric of the laundry.

**[0009]** The problem which the present invention is intended to resolve is that of ensuring that the effect of the detergent on the fabric to be washed is fully exploited in the first stage of the operating cycle of the machine, when the detergent is dissolved in the tub in a relatively limited quantity of water and is then recirculated while its concentration in the liquid is relatively higher than the concentration present in later washing stages in the machine.

**[0010]** The problem is resolved by the method indicated in Claim 1 below.

**[0011]** The invention will now be described more fully with reference to the attached drawings, provided solely for guidance and without limiting intent, in which:

- Figure 1 is a schematic view of the tub and drum of a washing machine with its detergent drawer and the principal plumbing connections for the recirculation of the liquid,
- Figure 2 is a functional diagram of the machine in the stage of introduction of the detergent and initial recirculation according to the invention.

**[0012]** With reference to the aforesaid drawings, the number 1 indicates the washing tub of a washing machine, indicated as a whole by 2.

**[0013]** A drum 3 for containing the laundry (not shown in the drawing) is positioned in the tub 1 in a conventional way.

**[0014]** The drum 3 is mounted in the machine in a conventional way so as to be rotatable at the different speeds and in the different directions which are characteristic of a washing machine, using suitable supports, a motor and a mechanical transmission (not shown).

**[0015]** The machine 1 is provided with a drawer 4 into which is loaded a dose of detergent, schematically indicated by 5, which can be conventionally produced in powder, tablet or liquid form.

**[0016]** The detergent drawer 4 is connected to a conduit 6 through which a preliminary quantity of liquid, generally water, is supplied to the drawer in order to make the detergent flow out through a conduit 7 from the drawer 4 to the tub 1 of the machine at the start of a washing cycle.

**[0017]** The tub 1 is also provided with a drainage conduit 8 which runs from the base of the tub to a liquid collection reservoir, indicated as a whole by 9, from which the liquid is recirculated by a first pump 10 into the tub 1 through a conduit 11 which feeds one or more conventional sprays 12.

**[0018]** These sprays 12 are preferably created by nozzles located around the conventional joint around which the drum 3 rotates, or in areas close to this joint. They are designed to direct the liquid spray 12 towards the centre of the load of laundry, and more particularly deeply

into the centre of the annular configuration, which is known and is therefore omitted from the drawing, assumed by the items of laundry as a result of their orbital positioning in the drum 1.

[0019] The drum 3 is conventionally provided with walls having through holes, indicated schematically by 13, and ribs 14 for the movement and orbital distribution of the load of laundry during the rotation of the drum.

[0020] When a washing cycle is started, a preliminary quantity of water is directed through the conduit 6 to the drawer 4 containing the dose of detergent 5.

[0021] The dose of detergent is consequently made to flow out through the conduit 7 into the tub 1, where a further quantity of water is added by means of conventional water feed devices, in order to dissolve the detergent until a total of approximately 5 litres of liquid has been introduced, thus creating a detergent concentration of approximately 30 g per litre.

[0022] The line identified by H<sub>2</sub>O in the diagram in Figure 2 provides a qualitative indication of the quantity of water present in the tub 1 during the stage T.

[0023] This stage of the cycle causes the commencement of the wetting of the laundry in the drum 3 by the recirculation of the liquid and detergent by means of the pump 10 which draws the liquid from the tub 1 through the conduit 8 and subsequently introduces it through the conduit 11 and the sprays 12.

[0024] During the recirculation of the liquid and detergent, the drum 3 is rotated at the speed V, usually in the range from 75 to 120 revolutions per minute, in order to distribute the laundry in the drum 3 and separate the items of the laundry load from each other.

[0025] The combination of the rotation of the drum 3 and the recirculation provided by the pump 10 causes the liquid and detergent to be distributed over the laundry, which is initially dry but then starts to absorb the liquid, thus reducing the quantity of liquid available for recirculation.

[0026] According to the invention, as shown in the diagram of Figure 2, during the stage of distribution and activation of the detergent, indicated by T on the time axis, the drum 3 containing the laundry load and rotating at the conventional speed V is subjected, for a period 5 in the range from 5 to 20 seconds, to at least one stage of rotation at a speed V1 equal to or greater than the speed V multiplied by a factor, which may or may not be an integer, in the range from 2 to 4, including the extreme values. This stage is followed by a stage in which the speed is returned to the initial level V.

[0027] The speed V1 imparted to the drum 3 for the period 5 can also reach or approach the speed imparted to the drum during the spin stage at the end of the washing cycle.

[0028] Preferably, within the period T in which the recirculation takes place for wetting the laundry and distributing the detergent, there is a plurality of periods t1, t2, ... tn in which the rotation speed of the drum 3 is increased to the speed

[0029] V1 and then returned to the speed V.

[0030] Also preferably, the stages in which the speed of the drum is brought to the level V1 can be close to each other in time, thus being paired, or separated.

5 [0031] If the stages are paired, the first stage can take place at a speed of V2 and the next stage at a speed V3, the speeds V2 and V3 being different from each other provided that they both meet the condition of being greater than the speed V multiplied by a factor in the range from 2 to 4.

10 [0032] In particular, the speed V3 of the later rotation stage in the pair of stages can be lower than the speed V2 of the preceding rotation stage.

15 [0033] According to the method of the invention, the pulses of high speed imparted to the drum during the stage of dissolution of the detergent and recirculation of the liquid have the effect of squeezing the laundry, although for a limited time only, resulting in a partial recovery of liquid which is circulated by the recirculating pump 10, thus increasing the efficiency of the recirculation.

20 [0034] Additionally, these pulses of high speed, greater than the conventional speed for the orbital distribution of the laundry in the drum, create a mechanical force on the laundry load which tends to separate its constituent items from each other more completely, thus exposing a greater surface area of the fabric to the liquid and detergent circulated by the pump 10 and sprayed by the sprays 12 as far as possible into the load of laundry. This causes the detergent to be more active on the laundry as soon as it has dissolved in the tub, when its concentration is higher than in the subsequent stages of the washing cycle. This is advantageous in terms of the overall efficiency of the machine, including the energy efficiency.

25 [0035] Although the method has been described with reference to a washing machine, it can clearly also be used in the washing cycle of a washer-dryer.

## Claims

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1. A method for intensifying the activation of detergent in laundry in a washing machine or washer-dryer (2), during the stage in which the detergent is introduced into the drum (3) while the latter rotates in the washing tub (1) of the machine at a speed V at which the laundry is at least partially distributed within the drum (3), comprising the introduction into the tub (1) of a specified quantity of liquid for dissolving the detergent, and the recirculation of this quantity of washing liquid containing detergent by drawing it from the tub (1) and subsequently introducing it through the laundry, the recirculation taking place for a period T, **characterized in that** the rotation of the drum (3) with the laundry comprises at least one stage at a speed  $V1 \geq KV$  for a period t which is less than T, wherein K is a multiplication factor which may or may not be an integer, in the range from 2 to 4, including the extreme values.
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2. A method according to Claim 1, wherein the rotation of the drum with the laundry comprises a plurality of stages in which the rotation takes place at the speed V1. 5
3. A method according to Claims 1 and 2, **characterized in that** the plurality of stages of rotation of the drum with the laundry comprises at least a pair of stages in which the speed V2 of one stage of the pair is greater than the speed V3 of the other stage of the same pair, these stages taking place one after the other and both of the speeds V2 and V3 being greater than or equal to KV. 10
4. A method according to Claim 3, wherein the stage of rotation at the speed V3 which is lower than that of the other stage of the pair takes place after the stage in which the rotation speed is higher. 15
5. A method according to any one of Claims 1 to 4, **characterized in that** the rotation speed V1 is in the range extending from 300 revolutions per minute to the spin speed of the washing machine. 20
6. A method according to any one of Claims 1 to 5, wherein the duration t of the stage of rotation of the drum with the laundry at the speed V1 and/or V2 and/or V3 is in the range from 5 to 20 seconds. 25
7. A method according to any one of Claims 1 to 6, **characterized in that** the pairs of stages of rotation of the drum with the laundry at a speed V1 are spaced apart in time at intervals in the range from 2 to 6 minutes. 30
8. A method according to any one of Claims 1 to 7, **characterized in that** the introduction of the washing liquid with the detergent in the recirculation stage takes place by means of sprays (12) directed towards the centre of the laundry present in the drum (3) and deeply into the annular configuration assumed by the items in the laundry after their orbital positioning in the drum (3). 35 40

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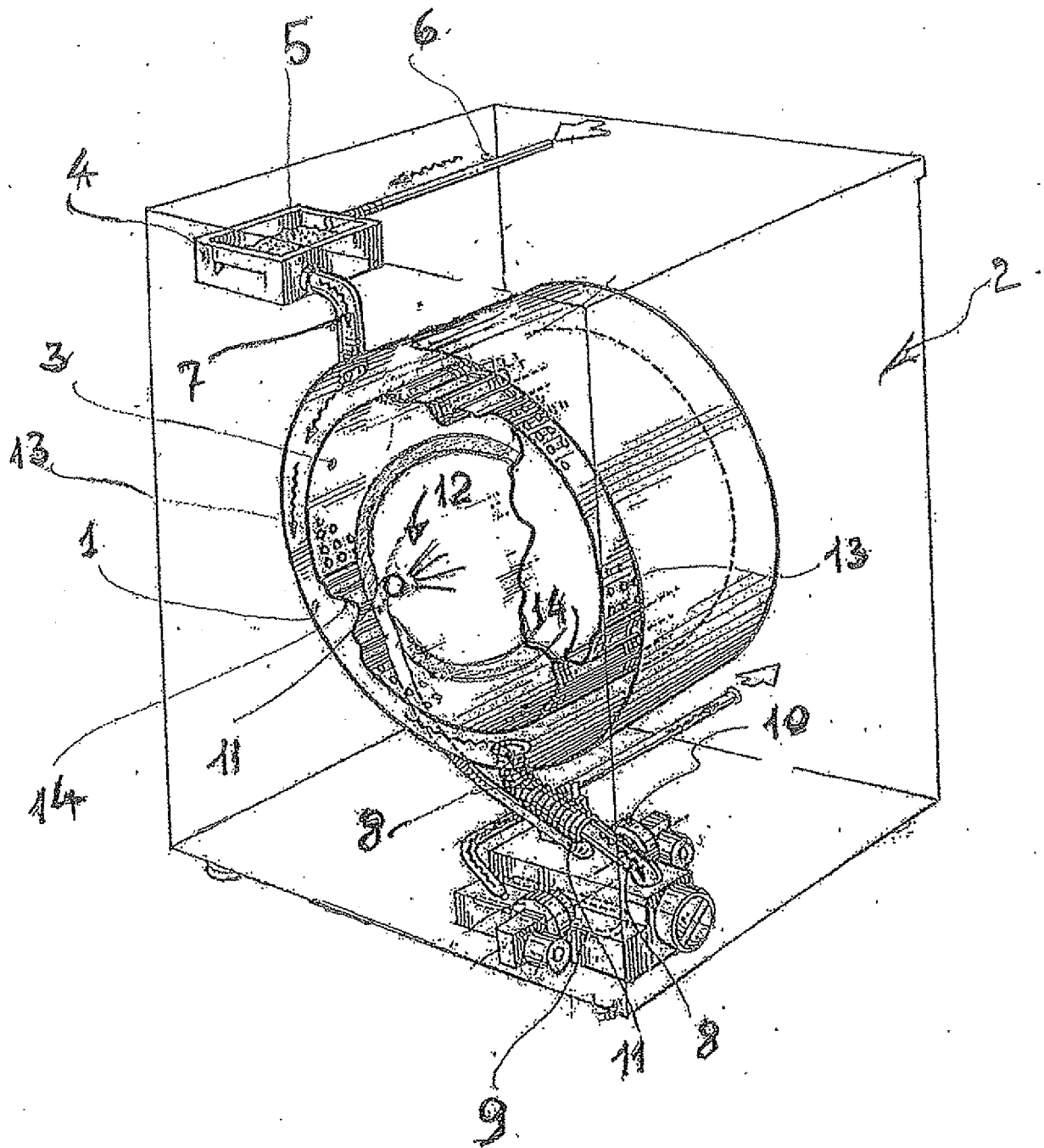


Fig. 1

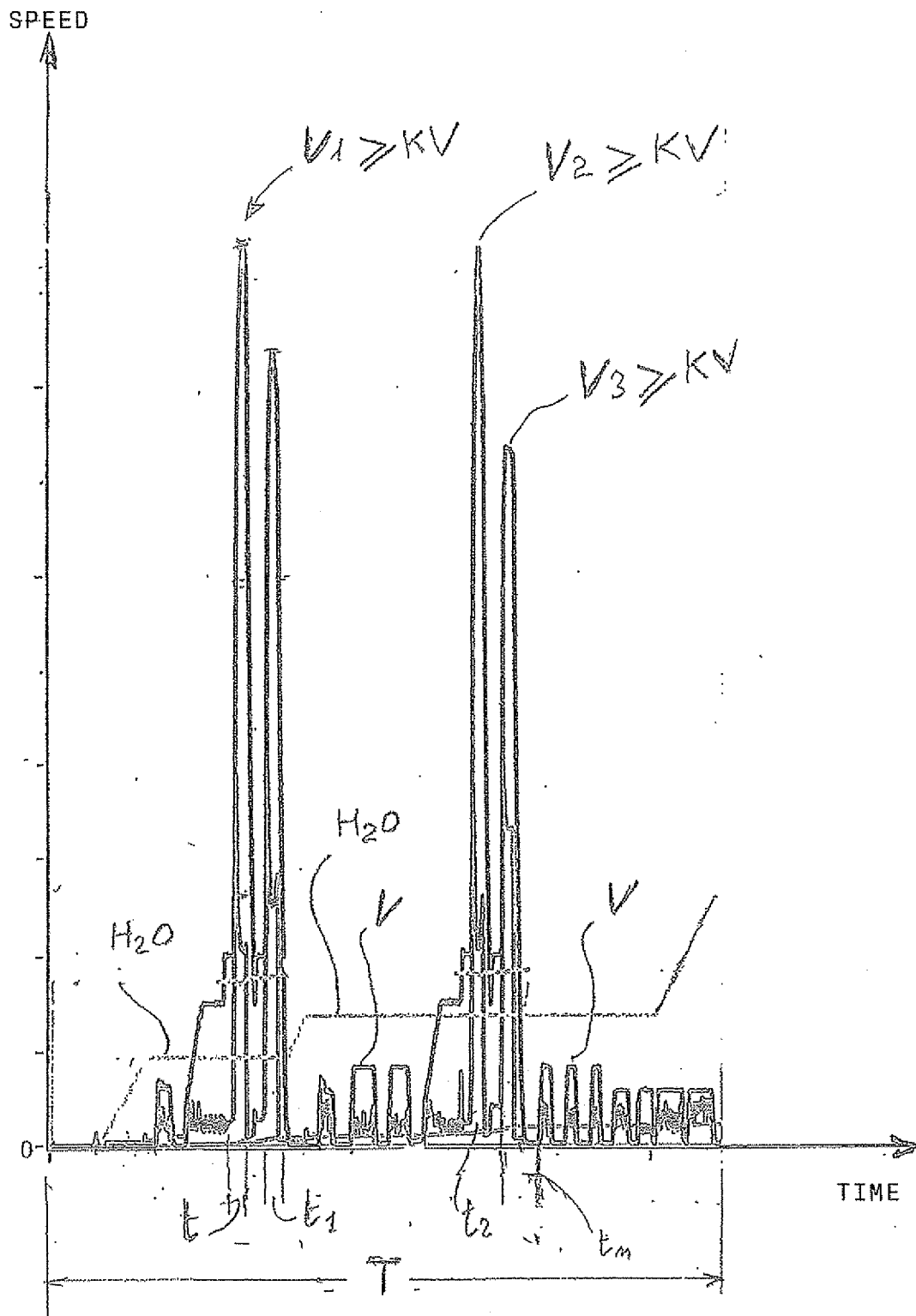


Fig. 2



## EUROPEAN SEARCH REPORT

Application Number  
EP 11 42 5104

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search <b>Munich</b>		Date of completion of the search <b>27 September 2011</b>	Examiner <b>Hannam, Martin</b>
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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