(54) Title: A METHOD FOR MODERNISING AN ELEVATOR

(57) Abstract: The invention relates to a method for modernizing the hoisting function of an elevator, in the case of an elevator with machine room provided with hoisting ropes (4), wherein the suspension (1) of the elevator is changed in conjunction with modernization into N:1 suspension, where N has at least an integer value in the range of 2...16. The rope suspension (1) is provided with at least two diverting pulleys (7, 12), around which each hoisting rope (4) runs in such manner that, in the running direction of the hoisting rope (4), the first diverting pulley (7) lies between diverting pulleys (6) and (8) connected to the counterweight (3), and that, in the running direction of the hoisting rope (4), the second diverting pulley (12) lies between diverting pulleys (11) and (13) connected to the elevator car (2).
Published: with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
A METHOD FOR MODERNISING AN ELEVATOR

The present invention relates to a method as defined in the preamble of claim 1 for modernizing the hoisting function of an elevator and to a modernization arrangement as defined in the preamble of claim 6.

An important aim in elevator development work has been to achieve efficient and economical utilization of building space. In prior-art elevator solutions provided with a machine room or a corresponding space, the placement of the hoisting machine and the space required by it limit the freedom of choice in elevator lay-out solutions. Additional space is required for the arrangements for rope passage between the machine room and the elevator shaft. The size and weight of especially a machine designed for larger loads, higher speeds and/or greater hoisting heights are a problem in respect of installation because it is not always possible to place the machine and the diverting pulleys in the required positions due to insufficient space.

Specification WO 99/43589 discloses an elevator suspended using flat belts wherein relatively small belt bending diameters on the drive sheave and diverting pulleys are achieved. Problems with this solution, however, are a limited lay-out solution, placement of components in the elevator shaft and alignment of the diverting pulleys. Moreover, the alignment of the polyurethane-coated belts used, which have a load-bearing steel component inside them, is problematic e.g. in a situation where the car is tilted. In an elevator implemented in this manner, at least the machine and/or the structures on which it is secured in place must be fairly massive to avoid undesirable vi-
brations. Also, the massive construction of the rest of the elevator structure required to maintain the mutual alignment of the diverting pulleys and the traction sheave increases the weight and cost of the elevator. In addition, the installation and adjustments of such a system are difficult tasks requiring great precision.

In connection with modernization of an elevator it is possible to alter the suspension of the elevator by replacing an earlier 1:1 or 2:1 suspension arrangement with an arrangement with a suspension ratio of 4:1 or even greater. This makes it possible to use a hoisting machine and diverting pulleys of a smaller size, which will be easier to place in appropriate positions in respect of elevator layout. In the case of elevators with machine room, however, there is the problem that the number of holes through the bottom of the machine room has to be increased to allow all the new rope passages needed in 4:1 suspension to be implemented.

However, making new holes in the bottom of the machine room is expensive and hazardous because there may be reinforcement bars or the like in the bottom structure just where a new hole should be made. In previously known solutions, enlarging the old holes has not been sufficient. Often in the case of a machine room disposed above the shaft, another problem is how to pass the elevator hoisting ropes from the machine room to the elevator car and counterweight in the shaft.

The object of the present invention is to overcome the above-mentioned drawbacks and to reduce the size and/or weight of an elevator machine by providing an economical and simple-and-easy-to-implement possibility of using drive and diverting pulleys of a smaller diameter by changing the elevator suspension in connection with modernization into an N:1 suspension,
where \( N \) has at least an integer value in the range of 2...16. A good practical application will be achieved when the value of \( N \) is 4. In particular, even values of the car suspension ratio are quite simple to implement. For example, by increasing the number of diverting pulleys on the car to three, a 6:1 suspension ratio is obtained, while four diverting pulleys will give a suspension ratio of 8:1 and five diverting pulleys a suspension ratio of 10:1. This of course means that diverting pulleys will have to be added to other parts of the elevator as well and the total length of the ropes is increased. On the other hand, increasing the suspension ratio enables the use of fewer parallel ropes, so the total rope length of the elevator ropes is not necessarily increased very much as the suspension ratio is increased. An additional aim is to enable the elevator ropes to be quickly and easily installed. A further objective is to reduce the consumption of electricity.

The method of the invention for modernizing the hoisting function of an elevator is characterized by what is disclosed in the characterization part of claim 1, and the modernization arrangement of the invention is characterized by what is disclosed in the characterization part of claim 6. Other embodiments of the invention are characterized by what is disclosed in the other claims.

By applying the invention, one or more of the following advantages, among others, can be achieved:

- due to thin hoisting ropes and 4:1 suspension, the traction sheave and the diverting pulleys are small and light as compared with those used in conventional elevators
- with a small traction sheave, the operating brakes of the elevator are smaller
- due to the small traction sheave, the torque requirement is lower, and thus both the motor and its operating brakes can be smaller
- due to the smaller traction sheave and 4:1 suspension, a higher rotational speed is needed to achieve a given speed of the elevator car, so the same motor output power is achieved with a smaller motor
- the use of a small traction sheave makes it possible to use an elevator drive motor of smaller size, which means a reduction of the acquisition/manufacturing costs of the drive motor
- the small size and thin ropes allow relatively easy disposition of the elevator machine in the machine room
- the weight of the elevator car and counterweight can be completely or at least partially carried by the elevator guide rails
- in elevators applying the invention, centric suspension of the elevator car and counterweight can be easily arranged, thus reducing the lateral supporting forces imposed on the guide rails
- the invention reduces the elevator installation time and the total installation costs as compared to a situation where new holes would have to be made in the bottom of the machine room
- the light, thin and easy-to-handle ropes and the possibility to drop the ropes from the machine room into the elevator shaft allow considerably easier and faster installation
- by using ropes of a diameter of about 4…6 mm, elevators according to the invention of a fairly large
size and capable of fairly high speeds can be achieved
the invention is applicable in geared and gearless
elevator motor solutions.

The primary sphere of application of the invention is
in elevators designed for the transportation of people
and/or freight. The elevator solution of the invention
uses ropes that are thinner than those used before in
elevators to be modernized, preferably substantially
thin ropes having a diameter of e.g. about 4...6 mm or
even less. This allows a definite reduction in the
size of the traction sheave and diverting pulleys.

In the following, the invention will be described in
detail with reference to an embodiment example and the
attached drawings, wherein

Fig. 1 presents a diagrammatic view of an elevator
modernized by the method of the invention, seen obliquely from above, in which an ear-
lier 2:1 suspension has been replaced with
4:1 suspension,

Fig. 2 is a diagrammatic and simplified illustration
of the principle of the invention for lowering
the elevator ropes into the elevator
shaft, seen in side view, and

Fig. 3 presents an oblique top view of an installa-
tion tool applicable for lowering a diverting pulley aggregate into the elevator shaft.

Fig. 1 presents a typical elevator suspension solution
1 according to the invention, wherein an earlier 2:1
suspension has been changed in conjunction with mod-
ernization to a 4:1 suspension by using openings 16
ready made in the machine room floor 15. The elevator
hoisting machine is connected via a traction sheave 9
to a set of hoisting ropes, consisting of mutually parallel hoisting ropes 4 of e.g. substantially round cross-section and supporting the counterweight 3 and elevator car 2 moving along their tracks, i.e. guide rails. For the sake of clarity, only one of the parallel hoisting ropes 4 is shown in the figures.

The parallel hoisting ropes 4 are attached by their first end to a fixed starting point 5 in the machine room above the elevator shaft, from where the hoisting ropes go downwards through an opening 16b in the machine room floor 15 towards a first diverting pulley 6 connected to the counterweight 3 and disposed e.g. on the top of the counterweight 3. From diverting pulley 6, the elevator ropes go upwards to a second corresponding diverting pulley 7 disposed in the machine room above the elevator shaft. The ropes going upwards are passed through an opening 16a in the machine room floor 15. Having passed around the traction sheave 7, the ropes 4 go again downwards through opening 16a to a second diverting pulley 8 which is mounted on the top of the counterweight 3 and which is of the same size with the first diverting pulley 6 and is placed right beside the latter, the shafts of both diverting pulleys being mounted one after the other on the same line, and which diverting pulley 8 rotates about its shaft in the opposite direction to that of diverting pulley 6. Having passed around the second diverting pulley 8, the hoisting ropes 4 go upwards through the opening 16b in the machine room floor to the traction sheave 9 of the elevator machine in the machine room. Thus, the ropes 4 have been passed four times through each opening 16a and 16b.

Having passed over the traction sheave 9, the hoisting ropes 4 pass over a diverting pulley 10 and go again downwards into the elevator shaft from the machine
room through a third opening 16c in the machine room floor 15. By means of diverting pulley 10, the ropes are shifted horizontally to the correct position above opening 16c. From diverting pulley 10, the hoisting ropes 4 go downwards to a first diverting pulley 11 placed on the top of the elevator car 2, and having passed around this diverting pulley the ropes go up again through a fourth opening 16d in the machine room floor 15 to a diverting pulley 12 placed in the machine room. Having passed around diverting pulley 12, the hoisting ropes 4 go again downwards through opening 16d to a second diverting pulley 13 placed on the top of the elevator car 2, which diverting pulley is of the same size with the first diverting pulley 11 and is placed right beside the latter, the shafts of both diverting pulleys 11 and 13 being placed one after the other on the same line, which diverting pulley 13 rotates about its shaft in the opposite direction to that of diverting pulley 11. Having passed around the second diverting pulley 13, the hoisting ropes 4 go upwards again through opening 16c in the machine room floor to a fixed anchorage 14 in the machine room. Thus, the ropes 4 have been passed four times through openings 16c and 16d as well.

To make it possible for the hoisting ropes 4 to be passed twice through all the openings 16a...16d in the machine room floor 15, the fixed points 5 and 14, diverting pulleys 7 and 12 and the traction sheave 9 and diverting pulley 10 have to be so disposed that the hoisting ropes running in different directions through the holes 16a...16d will not hinder each other's passage. According to the invention, the above-mentioned devices are additionally so disposed that the openings 16a...16d ready made in the machine room floor 15 and designed for 2:1 suspension will be sufficient for all the required rope passages through the floor. There-
fore, for example the rope anchorages 5 and 14 a disposed above or in connection with the openings closest to the machine and the traction sheave 9, i.e. the middlemost openings 16b and 16c.

Similarly, diverting pulleys 7 and 12 are placed mutually above or in connection with the outermost openings 16a and 16d which are closer to the side walls of the machine room, and these diverting pulleys have been suitably rotated and turned relative to their shafts to allow the ropes to be passed through the floor. In addition, if necessary, diverting pulleys 7 and 12 are provided with a structure that allows them to move so that no extra strain is imposed on the hoisting ropes 4 when the rope angle is slightly changed as the elevator car and counterweight move from the upper end of the elevator shaft to its lower end and vice versa.

Fig. 2 illustrates a principle according to the invention for lowering the hoisting ropes 4 from the machine room into the elevator shaft in conjunction with modernization as mentioned above, wherein an earlier 2:1 suspension is changed into a 4:1 suspension. When the hoisting ropes 4 are being lowered from the machine room into the elevator shaft, there is often the problem of how to get the ropes neatly and easily down, because the risk of the thin and long parallel ropes becoming twisted and entangled in the narrow space is very great. In addition, making a skein of rope even slightly entangled descend is difficult if it is only pulled by the weight of the rope itself.

According to the invention, when the ropes are to be lowered down, the diverting pulleys 11, 13 and 6, 8 to be mounted on the top of the car and counterweight are used as weights and to keep the ropes as wide apart from each other as possible. The rope to be mounted to
run around the diverting pulleys 6 and 8 of the counterweight 3 is mounted by first driving the elevator car 2 to the upper end of the elevator shaft, where it is secured in place by means of ropes or tackles or equivalent. The counterweight 3 is now correspondingly at the lower end of the elevator shaft, where it is secured and the old elevator ropes are removed.

In the machine room, diverting pulleys 6 and 8, which have been combined to form a suitable diverting pulley aggregate 17, which can be passed through an opening 16a...16d in the machine room floor into the elevator shaft space. In the diverting pulley aggregate 17 according to the example, diverting pulleys 6 and 8 are placed side by side in accordance with their final operating positions.

When everything is ready in the elevator shaft for the installation of the ropes, the installation is started e.g. with the elevator ropes suspending the counterweight. First, the elevator ropes are fitted onto the diverting pulleys 6 and 8 to be attached to the counterweight, in the manner the ropes will run in the final operating position. The first end of the hoisting ropes 4 is pulled from a reel 18 in the machine room first around diverting pulley 8, whereupon the ropes are passed further to diverting pulley 7, which has already been secured in the machine room, and over it further around diverting pulley 6, after which the first end of the ropes is secured to a fixed starting point 5 in the machine room. In this connection, all the diverting pulleys 6...8 are also provided with supporting elements to ensure that the hoisting ropes cannot come off the rope grooves of the diverting pulleys.

The diverting pulley aggregate 17 provided with ropes, which comprises at least rope pulleys 6 and 8, is now
lowered down through opening 16a or 16b in the machine room floor into the elevator shaft, the aggregate being supported by the hoisting ropes. In the elevator shaft, at least one person is standing on the top of the elevator car to receive the aggregate, who reaches up to the diverting pulleys and takes them down at first e.g. onto the top of the elevator car. After this, on the top of the car, a framework as illustrated in Fig. 3 serving as an installation tool is mounted around the diverting pulley aggregate 17 consisting of diverting pulleys 6 and 8.

The framework shown in Fig. 3 has a frame structure consisting of two parallel horizontal square tube shaped frame beams 21 connected to each other. At the outer end of each frame beam 21 is a substantially vertical guide beam 20, the upper and lower ends of which are provided with guide elements 23 fitted to receive the counterweight guide rails and, if necessary, the car guide rails of the elevator as well. The horizontal distance between the guide beams 20 can be adjusted to fit the distance between the guide rails in the elevator shaft. This adjustment is made by moving the guide beams 20 in the longitudinal direction of the frame beams 21 and locking the guide beams in place by means of a locking element 22. If necessary, the installation tool can be provided with additional weights 19 to facilitate the lowering of the ropes from the machine room.

After the installation tool has been assembled around the diverting pulley aggregate, the installation tool is mounted on the guide rails of the counterweight 3 so that the guide elements 20 can move along the counterweight guide rails. The rope is let down from the reel 18 in the machine room and the installation tool with the diverting pulleys 6 and 8 is allowed to glide
downwards along the counterweight guide rails until the diverting pulley aggregate hits the top beam of the counterweight 3 in the lower part of the shaft. Next, the diverting pulley aggregate is secured to the counterweight and the installation tool is removed.

The use of the above-described installation tool provides the advantage that the ropes remain straight throughout the lowering procedure and can not be e.g. twisted about each other. A further advantage is that the mass of the installation tool alone is generally sufficient for lowering the diverting pulleys, requiring no additional weights.

The above-described method and also the installation tool, if necessary, can be applied for installing the diverting pulleys 11 and 13 to be mounted on the top of the elevator car 2 and likewise for lowering the hoisting rope. However, as the distance from the machine room to the top of the elevator car 2 in its high position is short and the installation on the top of the car is easy to carry out in respect of space available, the use of an installation tool can in most cases be omitted. In this case it is thus sufficient that the diverting pulley aggregate ready provided in the machine room with ropes as described above and comprising at least diverting pulleys 11 and 13 is lowered down through a suitable opening 16a...16d in the machine room floor and received directly on the top of the elevator car and mounted in place.

It is obvious to the person skilled in the art that different embodiments of the invention are not limited to the example described above, but that they may be varied within the scope of the claims presented below. According to the examples described above, the skilled person can vary the embodiment of the invention e.g. by placing the rope anchorages 5 and 14 and the di-
verting pulleys 7 and 12 of the machine room in positions differing from the above description. If possible, the fixing points 4 and 5 may also be disposed in the upper part of the elevator shaft right below the floor of the machine room. In this case, there will be even more space for the hoisting ropes in openings 16b and 16c. It is also possible to place both the fixing points 4 and 5 and diverting pulleys 7 and 12, or only diverting pulleys 7 and 12, in the elevator shaft below the floor of the machine room as described above. In this case there will be more space for the hoisting ropes in openings 16a and 16d as well.

It is further obvious to the skilled person that the shape and installation-time use of the diverting pulley aggregates 17 facilitating the installation work may differ from the above description. Thus, the various devices can be installed and made ready for operation by an installation procedure differing from that described above. Similarly, depending on the dimensions, the diverting pulleys may be placed in the diverting pulley aggregate 17 either side by side, as in the example, or they may also be place one under the other. Likewise, the size, number and location of the openings 16a, 16b in the machine room floor may be different from those described above.

It is also obvious to the person skilled in the art that, when the car is being moved, the parallel diverting pulleys 6 and 8 connected to the counterweight 3 and the parallel diverting pulleys 11 and 13 connected to the elevator car 2 may rotate either in the same direction or in opposite directions relative to each other, depending on the arrangement of the ropes and diverting pulleys, so that the circumferential speed of the parallel diverting pulleys of the elevator with 4:1 suspension is 2:1.
It is further obvious to the skilled person that, although the preferred embodiment of the invention uses fairly thin ropes, the invention is also applicable in the case of elevators in which the new ropes are clearly thicker than these ropes. For example, a modernization wherein earlier 12-mm ropes are replaced with 8-mm ropes may be included in the scope of the invention.
CLAIMS

1. A method for modernizing the hoisting function of an elevator, in the case of an elevator with machine room provided with hoisting ropes (4), wherein the suspension (1) of the elevator is changed in conjunction with modernization into N:1 suspension, where N has at least an integer value in the range of 2...16, characterized in that the rope suspension (1) is provided with at least two diverting pulleys (7, 12), around which each hoisting rope (4) is fitted to run in such manner that, in the running direction of the hoisting rope (4), the first diverting pulley (7) is disposed between diverting pulleys (6) and (8) connected to the counterweight (3); and that, in the running direction of the hoisting rope (4), the second diverting pulley (12) is disposed between diverting pulleys (11) and (13) connected to the elevator car (2).

2. A method according to claim 1, characterized in that each elevator rope (4) is fitted in the rope suspension (1) in such manner that, when the elevator car is being moved, the parallel diverting pulleys (6) and (8) connected to the counterweight (3) and the parallel diverting pulleys (11) and (13) connected to the elevator car (2) rotate either in the same direction or in opposite directions, depending on the arrangement of the ropes/diverting pulleys, so that the circumferential speed of the parallel diverting pulleys of the elevator with 4:1 suspension is 2:1.

3. A method according to claim 1 or 2, characterized in that, in conjunction with the installation of 4:1 suspension, all the required rope passages between the machine room and the elevator shaft are passed through openings (16a...16d) ready made in the floor (15) of the machine room.
4. A method according to claim 1, 2 or 3, **characterized** in that, in conjunction with the installation of 4:1 suspension, the diverting pulleys (7, 10, 12) to be mounted in the machine room and the fixed anchorages (5, 14) to be mounted in the machine room are placed substantially above the openings (16a...16d) ready made in the machine room floor (15) and in the vertical direction substantially in alignment with said openings (16a...16d).

5. A method according to any one of the preceding claims, **characterized** in that, in conjunction with the installation, the elevator hoisting ropes (4) are lowered from the machine room into the elevator shaft through openings (16) in the machine room floor (15), the hoisting ropes having been fitted to support a diverting pulley aggregate (17) consisting of two diverting pulleys (6 and 8) and/or (11 and 13) and an additional weight (19).

6. An elevator modernization arrangement, wherein the suspension of an elevator provided with at least one hoisting rope (4) and a machine room is changed in conjunction with modernization into N:1 suspension, where N has at least an integer value in the range of 2...16, and which arrangement comprises at least diverting pulleys (6, 8) connected to a counterweight (3) and diverting pulleys (11, 13) connected to the elevator car (2), **characterized** in that at least two diverting pulleys (7, 12) are disposed in the rope suspension (1) and the hoisting rope (4) is fitted around said diverting pulleys (7, 12) in such manner that the hoisting rope (4) is passed from the first diverting pulley (6) connected to the counterweight around the first diverting pulley (7) in the rope suspension (1) to the second diverting pulley (8) connected to the counterweight, and that the hoisting rope (4) is
passed from the first diverting pulley (13) connected to the elevator car around the second diverting pulley (12) in the rope suspension (1) to the second diverting pulley (11) connected to the elevator car.

7. An elevator modernization arrangement according to claim 6, characterized in that diverting pulleys (6) and (8) are placed side by side on the top of the counterweight (2) and arranged to rotate either in the same direction or in opposite directions, depending on the suspension arrangement of the ropes/diverting pulleys, in such manner that the circumferential speed of the parallel diverting pulleys of the elevator with 4:1 suspension is 2:1, and that diverting pulleys (11) and (13) are placed side by side on the top of the elevator car (3) and arranged to rotate either in the same direction or in opposite directions, depending on the suspension arrangement of the ropes/diverting pulleys, in such manner that the circumferential speed of the parallel diverting pulleys of the elevator with 4:1 suspension is 2:1.

8. A modernization arrangement according to claim 6 or 7, characterized in that the diverting pulley (7) which, according to passage of the hoisting rope (4), lies between the diverting pulleys (6, 8) of the counterweight is located in the machine room, and that the diverting pulley (12) which, according to passage of the hoisting rope (4), lies between the diverting pulleys (11, 13) of the elevator car is located in the machine room.

9. A modernization arrangement according to claim 8, characterized in that all the rope passages between the machine room and the elevator shaft are passed through openings (16a...16d) ready made in the floor (15) of the machine room, and that the diverting pulleys (7, 10, 12) of the machine room and the fixed an-
chorages (5, 14) to be mounted in the machine room are above the openings (16a...16d) ready made in the machine room floor (15) and in the vertical direction substantially in alignment with the same openings.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7  B66B11/00  B66B11/08

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 7  B66B

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

Electronic database consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>YO 02/26611 A (CARPARELLI DONATO; ACH ERNST (CH); BEGLE GUNTRAM (CH); INVENTIO AG (C) 4 April 2002 (2002-04-04) page 6, lines 1-15; figures 3,4</td>
<td>3-5,8,9</td>
</tr>
<tr>
<td>Y</td>
<td>WO 02/072460 A (HITACHI LTD; IDE KIEJI (JP); YOSHIDA KAORU (JP); ARABORI NOBORU (JP)); 19 September 2002 (2002-09-19) abstract; figures 1-8</td>
<td>1,6</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents:
  *A* document defining the general state of the art which is not considered to be of particular relevance
  *E* earlier document but published on or after the international filing date
  *L* later document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  *O* document referring to an oral disclosure, use, exhibition or other means
  *P* document published prior to the international filing date but later than the priority date claimed

"*" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"*X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"*Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"*Z" document member of the same patent family

Date of the actual completion of the international search
25 August 2004

Date of mailing of the international search report
02/09/2004

Name and mailing address of the ISA
European Patent Office, P.B. 5618 Patentlaan 2 NL -- 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fac. (+31-70) 340-3816

Authorized officer
Janssens, G
<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
</table>
| A        | EP 0 588 364 A (KONE ELEVATOR GMBH)  
23 March 1994 (1994-03-23)  
abstract | 1,6                  |
<table>
<thead>
<tr>
<th>Patent document cited in search report</th>
<th>Publication date</th>
<th>Patent family member(s)</th>
<th>Publication date</th>
</tr>
</thead>
<tbody>
<tr>
<td>JP 2002003126 A</td>
<td>09-01-2002</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>AU 8563401 A</td>
<td>08-04-2002</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BR 0114189 A</td>
<td>22-07-2003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WO 0226611 A1</td>
<td>04-04-2002</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CN 1466540 T</td>
<td>07-01-2004</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 50102491 D1</td>
<td>08-07-2004</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 2003159891 A1</td>
<td>28-08-2003</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AT 138891 T</td>
<td>15-06-1996</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AU 660110 B2</td>
<td>08-06-1995</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AU 4735993 A</td>
<td>31-03-1994</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BR 9303814 A</td>
<td>05-04-1994</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CA 2106436 A1</td>
<td>19-03-1994</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CN 1086786 A ,B</td>
<td>18-05-1994</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 69302978 D1</td>
<td>11-07-1996</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 69302978 T2</td>
<td>10-10-1996</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DK 508364 T3</td>
<td>05-08-1996</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP 0588364 A1</td>
<td>23-03-1994</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ES 2089663 T3</td>
<td>01-10-1996</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JP 6206677 A</td>
<td>26-07-1994</td>
</tr>
<tr>
<td></td>
<td></td>
<td>US 5351788 A</td>
<td>04-10-1994</td>
</tr>
</tbody>
</table>