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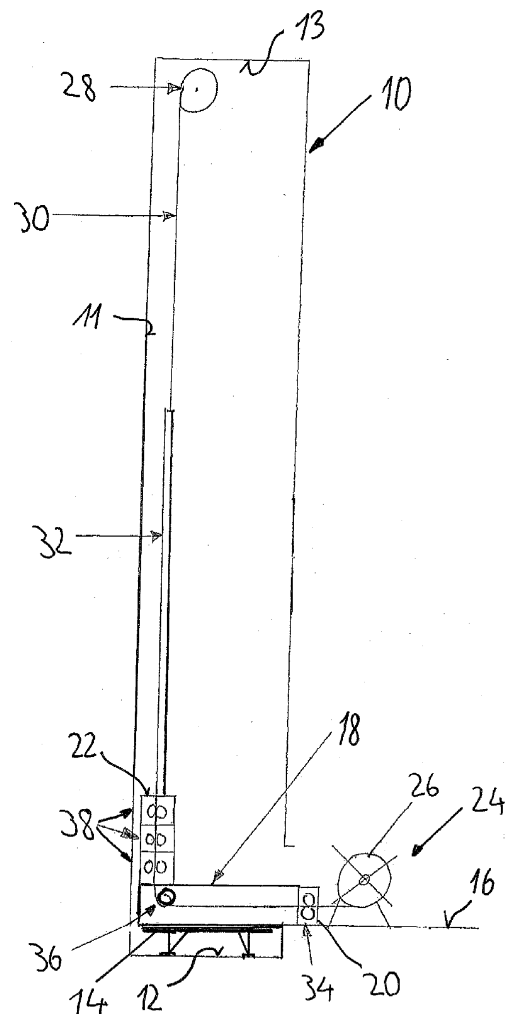
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(54) **Elevator guide rails**

(57) The invention relates to a method for providing elevator guide rails (32) in an elevator shaft (10), in which method the guide rails are formed with a forming machine in or adjacent to the elevator shaft.

Via this measure the effort for installing and adjusting guide rails in an elevator shaft can be essentially reduced.



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## Description

**[0001]** The present invention relates to a method for providing elevator guide rails in an elevator shaft.

**[0002]** Currently, guide rail pieces with a length of several metres are transported to a building site and are mounted there end-to-end along the whole length of the elevator shaft so as to form one continuous guide rail reaching from the shaft bottom to the shaft top. The aligning and mounting of the guide rail parts is troublesome and laborious and needs a lot of positioning. Particularly in high-rise elevator the mounting and aligning of the guide rails belong to the most laborious tasks in the construction of the complete elevator. Furthermore, it needs a high effort to align all the guide rail parts so exactly that the passenger riding comfort is really unaffected.

**[0003]** It is object of the present invention to at least partly reduce some of the disadvantages mentioned in connection with the prior art.

**[0004]** The object is solved with a method according to claim 1. Preferred embodiments of the invention are subject-matter of the dependent claims.

**[0005]** Whereas the well known construction concept is based on delivering readymade guide rail parts to the building site, the present invention goes a totally different way by forming the guide rails at the building site.

**[0006]** Thus, the guide rails can be formed with the aid of a forming machine in the shaft or adjacent to the shaft, e.g. on a floor, particularly the uppermost or lowermost floor directly adjacent to the shaft so that the formed guide rail can be output vertically in mounting direction of the guide rail. The forming machine can also be mounted on the building roof directly beside the elevator shaft so the ready formed guide rail is outputted downwards into the shaft so that it can be mounted afterwards to a shaft wall.

**[0007]** On that behalf, preferably at least one longitudinal metal semi-finished part is brought to a location in or near the elevator shaft. This could be for example the ground floor beside the elevator shaft or - if the shaft is larger - the bottom of the elevator shaft itself. Of course, it may also be the uppermost floor or roof of the building or a machine room or working site at the top of the elevator shaft. Now the semi-finished part is formed to a guide rail in the forming machine which is located and operated in or near the elevator shaft. The forming machine could for example be located at the bottom or on top of the elevator shaft, e.g. in a machine room or working site on the top of the building. The semi-finished part is fed to the forming machine which forms from the semi-finished part the guide rail which is preferably output from the forming machine in a vertical direction to the opposite shaft end. This means, if the forming machine is on the bottom of the elevator shaft the guide rail is outputted vertically upwards, e.g. drawn with a hoist to the top of the elevator shaft. If the forming machine is located on top of the elevator shaft or building, the guide rail formed from the semi-finished part is output vertically downwards and is drawn, e.g. via a hoist, or guided to the bottom of

the elevator shaft.

**[0008]** Of course, it is possible to guide the end of the new formed guide rail by any other means than a hoist along the shaft. Anyway it is important to guide the end along the shaft so that the guide rail end does not hit any obstacle in the shaft, e.g. a landing floor.

**[0009]** The semi-finished part may be a longitudinal beam-like sheet metal wound on a coil and being transported to the building site. It is of course also possible to provide the semi-finished part as several separate beams which anyway may have a length much longer than the previously known guide rail parts. This is possible because during the forming of the guide rail from the semi-finished part, the semi-finished part is bent and directed vertically into the elevator shaft so that the length of the semi-finished part is no obstructive parameter for putting the part into the elevator shaft.

**[0010]** Preferably, the forming machine has a drive for feeding and passing the material through the forming machine during the forming process. Via this step, a continuous and homogeneous forming of the guide rail can be ensured and it is not necessary to have a hoist to pull the ready-made guide rail from the forming machine.

**[0011]** For drawing or pulling the guide rail end along the elevator shaft, a hoist, e.g. a crane at the building site or the future drive motor of the elevator or any other hoisting device which is available on a building site may be used. Well-known are auxiliary hoists used in elevator shafts for transporting or carrying goods or hoists for mounting platforms in the elevator shaft.

**[0012]** Preferably, the semi-finished part is fed horizontally into the forming machine and is bent in the forming machine into a vertical direction so that it exits the forming machine in a (vertical) direction along the elevator shaft. Via this measure, the feeding of the semi-finished part is easy, particularly if the semi-finished part is fed on the ground floor. By bending the semi-finished part during or before the forming process into the vertical direction, the guide rail is immediately outputted in a direction in which it can be mounted to the elevator shaft wall. This means that after the guide rail end has been drawn, e.g. by a hoist to the shaft top (or shaft bottom), it can be cut from the forming machine and be mounted to the shaft wall. Thereafter, a new guide rail can be outputted which is again drawn along the complete length of the elevator shaft and again cut and mounted in its position.

**[0013]** In a preferred embodiment of the invention, the semi-finished part is brought to the building site wound on a coil. Being wound on a coil, a large length of semi-finished part can be delivered which may be sufficient to produce a guide rail extending along the whole shaft length, even in high-rise elevators. At least it is possible to produce guide rails which only need two or three or four parts over the complete length of the elevator shaft. For example, in an elevator shaft with a length of 100 m, a guide rail made from two parts can be manufactured if the semi-finished part is 50 m long and wound on a coil. In this case, two coils are needed to provide one elevator

guide rail. It is apparent that wound or coiled up semi-finished parts are much easier to transport and to arrange in the building site than longitudinal guide rail parts unless the guide rail parts are comparably short which again necessitates a lot of guide rail parts mounted end-to-end to build one guide rail.

**[0014]** If the semi-finished part is wound on a coil, it is preferably that the semi-finished part is straightened before being formed to a guide rail in the forming machine. The straightening device can thereby be part of the forming machine or a separate device located in feeding direction ahead of the forming machine.

**[0015]** By straightening the semi-finished part, any pretensions in the material can be eliminated before the guide rail is formed in the forming machine.

**[0016]** Preferably, the guide rail is formed in the forming machine by roll forming which is comparably easily to be performed at the building site in contrast to heat forming which would necessitate a lot of energy, heat and much more labour and machine effort at the building site.

**[0017]** Preferably, the guide rails are formed from a metal sheet material, which leads to light weight non-massive steel constructions. This solution has the advantage, that the forming of the guide rail is easier than with massive metal guide rails and the wall thickness of the guide rails can be adjusted to needs, e.g. whether or not emergency braking is performed, which necessitates larger or smaller wall thicknesses.

**[0018]** Preferably the sheet metal is filled with a filler during or after the forming of the guide rail. The filler could be e.g. plastics foam, e.g. PU-foam. This facilitates on one hand the forming of the guide rail, and on the other hand a good noise insulation is obtained.

**[0019]** Preferably, the guide rail is formed in successive forming modules of the forming machine so that each forming step gradually leads to the end product without adversely material properties in the end product which might occur when the forming step applied to the semi-finished part is too excessive.

**[0020]** Preferably, the forming machine is fixed at the elevator shaft bottom or the elevator shaft top or building top before the forming operation starts. By this measure, it is ensured that the forming machine remains in place when forces by the feeding device or by the drawing of the guide rail from the forming machine are applied to the forming machine.

**[0021]** On this behalf preferable a horizontal table (xy-table) is fixed to the elevator shaft bottom or on top of the shaft or building, on which table the forming machine or parts of the forming machine are fixed after being positioned in a desired position. Being fixed in a desired position might preferably be a position where the guide rail may immediately be fixed to the elevator shaft wall after being drawn from the forming machine to the opposite end of the elevator shaft. If, for example, four guide rails have to be placed in the elevator shaft, the forming machine might be placed on the table in these four po-

sitions so that the guide rail is outputted at least adjacent to the position where the guide rail has to be mounted to the shaft wall.

**[0022]** Preferably, the semi-finished part is brought to the building site via a delivery device, e.g. a coil or a box or cage, where longitudinal semi-finished parts are stored. The delivery device might also have an own feeding device which feeds the semi-finished part to the forming machine.

**[0023]** In total, the complete construction process may be as follows: The roll forming machine is brought and fixed in the elevator shaft. The semi-finished part supported by a delivery device, e.g. a coil, is brought into the elevator shaft or to a floor adjacent to the elevator shaft. Afterwards, the semi-finished part is fed from the delivery device into the forming machine. In the forming machine, the guide rail is formed from the semi-finished part and is output vertically from the forming machine. If necessary, the semi-finished part is straightened and redirected before forming. The output guide rail is drawn or guided by a hoist or any other guiding means to the top of the elevator shaft. Preferably hereafter, the guide rail is immediately mounted to the shaft wall after being drawn to the shaft top. Via this measure, an easy construction installation of guide rails made of one piece or of much less pieces than before is possible with essentially less alignment work than before.

**[0024]** In summary it can be stated that the time for constructing the elevator guide rails via the invention may be reduced from e.g. 300 - 500 hours to 40 - 70 hours, i.e. about a tenth of the time which is used today. The savings by using the inventive 'upward roll forming' is therefore an essential option for cost saving in elevator construction.

**[0025]** The above-mentioned preferred embodiments may be combined with each other as long as there are no contradicting technical features.

**[0026]** The following schematic figure shows one example of the invention which is not limiting in any way.

**[0027]** The Figure shows an elevator shaft 10 having a shaft bottom 12 on which an (xy-)table 14 is aligned with the adjacent base floor 16. The table 14 is secured to the shaft bottom 12. On the table 14, a forming machine 18 is fixed in a desired position as it will be carried out later on. The forming machine has an inlet end 20 extending horizontally and an outlet end 22 extending vertically to the top of the elevator shaft. On the base floor 16, a delivery coil 24 is positioned with a longitudinal metal semi-finished part 26 wound onto the coil.

**[0028]** In the top end of the shaft, a hoist 28 is provided which is - via a hoisting rope 30 - connected to the top end of the guide rail 32 formed in the forming machine 18.

**[0029]** The forming machine has behind its entrance end 20 a straightening device 34 followed in feeding direction by a diverting device 36 followed by three forming modules 38 via which the guide rail 32 is formed from the semi-finished part 26.

**[0030]** The embodiment functions as follows. After the

delivery coil 24 has been brought to the base floor 16 and the forming machine 18 has been fixed on the table 14 in the desired position, the semi-finished part is fed into the entrance end 20 and is guided through the forming machine 18 first passing a straightening device 34 for removing the bending caused by the delivery coil 24 followed by the diverting device 36 which comprises one or several rolls for diverting and bending the semi-finished part from the horizontal feeding direction into the vertical output direction. The now vertically directed semi-finished part 26 is guided through three roll forming modules 38 by which the semi-finished part is formed to a guide rail 32. The guide rail 32 is drawn by its upper end via the hoist 28 to the top of the elevator shaft 10. After the formed guide rail 32 has reached the top part of the elevator shaft 10, the guide rail is cut above the output end 22 of the forming machine 18 and is mounted and aligned to the shaft wall to build one guide rail of the elevator.

**[0031]** Afterwards, the forming machine 18 may be released and fixed into a new position which corresponds to the new position of a new guide rail and the procedure is repeated until also this second guide rail is formed and mounted accordingly in the elevator shaft.

**[0032]** Preferably, the length of the semi-finished part 26 wound on the coil 24 is long enough to build at least one guide rail 32 along the complete length of the elevator shaft 10. If this is, for example, because of a very high elevator shaft, not possible, the semi-finished part should be delivered such that as little separate parts as possible are necessary to build one complete guide rail length.

**[0033]** After all guide rails have been aligned and fixed in place, the delivery device 24, i.e. the coil as well as the forming machine 18, are removed from the elevator shaft 10 and the table 14 is removed from the shaft bottom 12 and from the building site.

**[0034]** The forming machine may be built in a way that it is not necessary to use a mounting table 14 for fixing the forming machine 18 in the elevator shaft. Thus, the forming machine can immediately be fixed to the shaft bottom or to the adjacent floor 16. Of course, the forming machine 18 as well as the delivery device 24 may also be located on the top of the elevator shaft or of the building whereby in this case the output end 22 of the forming machine 18 would be directed downwards to the elevator shaft. In this case, the hoist 28 would be located at the bottom 12 of the elevator shaft.

**[0035]** It is obvious for the skilled person that the forming machine may also be another forming machine than a roll forming machine and may have another construction than shown in the figure. Accordingly, a straightening device 34 is merely operational and not absolutely necessary. Furthermore, the forming part of the forming machine 18 does not necessarily need three forming modules but the forming part of the forming machine 18 can be embodied in a way which is per se known in the art.

**[0036]** The shaft does not need to be vertical but it can also be inclined to the horizontal plane in another angle

than 90 degrees. Of course the output end of the forming machine is then directed to the opposite end of the shaft.

**[0037]** The invention can be modified within the scope of the independent patent claims.

## Claims

1. Method for providing elevator guide rails (32) in an elevator shaft (10), in which method the guide rails are formed with a forming machine in or adjacent to the elevator shaft.

2. Method according to claim 1, with following steps:

At least one longitudinal metal semi-finished part (26) is brought to a location in or near the elevator shaft and the semi-finished part is formed to a guide rail in the forming machine (18) located and operated in or near the elevator shaft.

3. Method according to claim 2, wherein the semi-finished part (26) is fed horizontally into the forming machine (18) and is bent (36) into a vertical direction.

4. Method according to claim 2 or 3, wherein the semi-finished part (26) is brought to the elevator building site via a delivering device (24), e.g. wound on a coil.

5. Method according to one of claims 2 to 4, wherein the semi-finished part (26) is straightened (34) before being formed to a guide rail (32) via the forming machine (18).

6. Method according to one of claims 2 to 5, wherein

- the forming machine (18) is brought into the elevator shaft (10);
- the semi-finished part (26) supported by a delivering device (24) is brought into the elevator shaft or to a floor adjacent to the elevator shaft,
- the semi-finished part is fed from the delivering device into the forming machine (18),
- in the forming machine the guide rail (32) is formed from the semi-finished part (26),
- the formed guide rail is output (22) vertically from the forming machine and drawn by a hoist (28) to the top (13) of the elevator shaft.

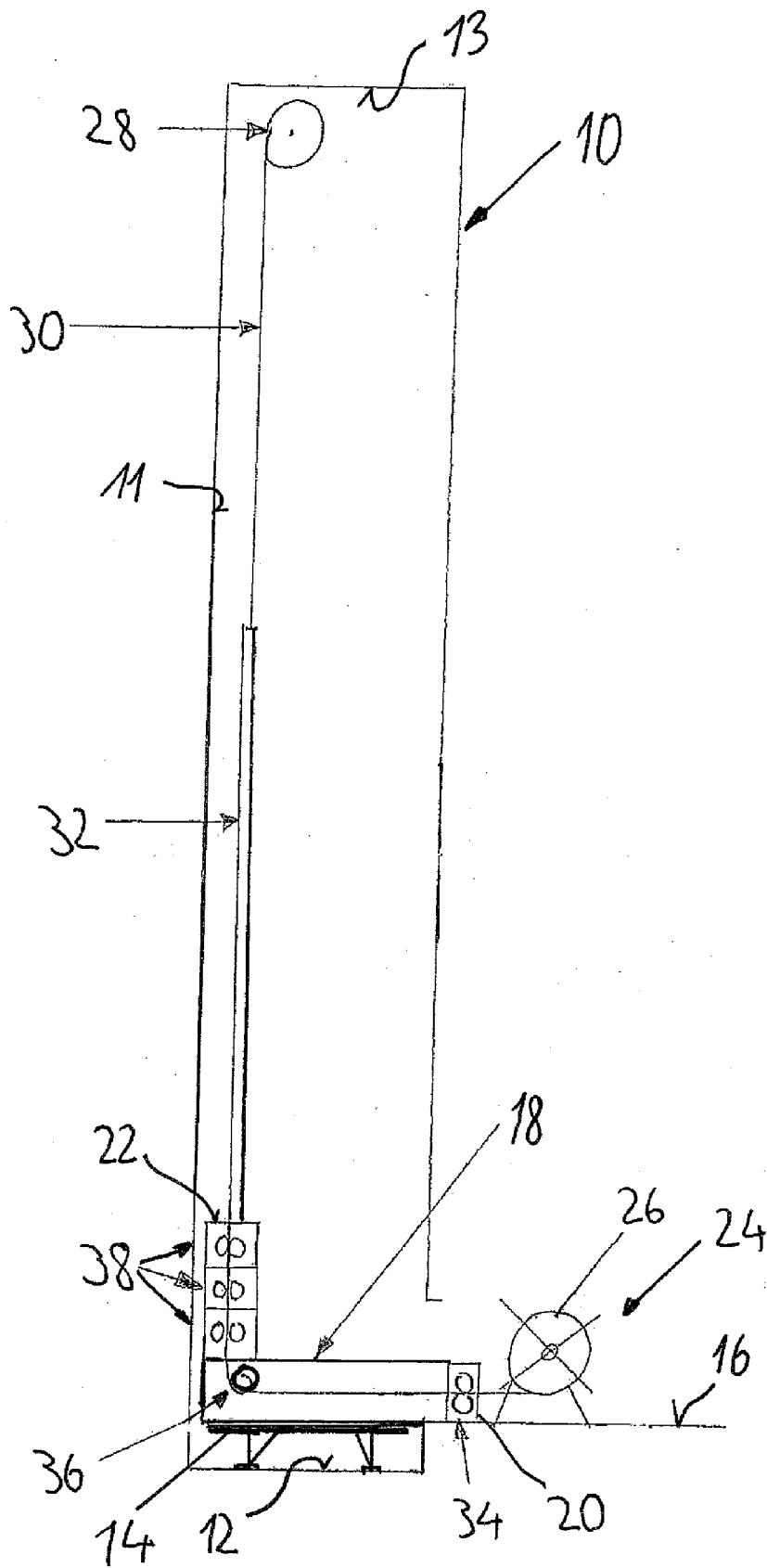
7. Method according to one of claims 2 to 6, wherein the forming machine (18) is fixed in its position on the shaft bottom (12) before the guide rail (32) is formed from the semi-finished part (26).

8. Method according to one of the preceding claims, wherein the guide rail (32) is formed as one piece part over the complete shaft length.

9. Method according to one of the preceding claims, wherein the formed guide rail is outputted from the forming machine in or into the shaft in essentially vertically direction and the guide rail is mounted afterwards at a shaft wall of the elevator shaft. 5
10. Method according to one of the preceding claims, wherein the forming machine is located on or near the bottom (12) of the elevator shaft (10) and the formed guide rail (32) is drawn upwards from the forming machine (18) via a hoist (28). 10
11. Method according to claim 10, wherein the guide rail (32) is mounted to the shaft wall (11) after being drawn to the shaft top (13). 15
12. Method according to one of the preceding claims, wherein the guide rails are formed from sheet metal.
13. Method according to claim 12, wherein the sheet metal is formed to a sandwich construction with a filler during or after the forming of the guide rail. 20
14. Method according to one of the preceding claims, wherein the guide rail (32) is formed in the forming machine (18) by roll forming. 25
15. Method according to one of the preceding claims, wherein the guide rail (32) is formed in successive roll forming modules (38) of the forming machine (18). 30
16. Method according to one of the preceding claims, wherein a horizontal table (14) is brought into the elevator shaft (10) and is fixed to the shaft bottom (12) and wherein the forming machine (18) and/or parts (34, 36, 38) thereof are fixed on the table in a desired position. 35
17. Guide rail (32) built by a method according to one of the preceding claims. 40
18. Elevator being constructed under use of guide rails (32) according to claim 17. 45

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## EUROPEAN SEARCH REPORT

Application Number  
EP 13 15 0828

| 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                                                                                                                                                                                                                       | WO 2011/146071 A1 (OTIS ELEVATOR CO [US]; PIECH ZBIGNIEW [US]; FARGO RICHARD N [US]; RIVE) 24 November 2011 (2011-11-24)<br>* abstract *<br>* paragraph [0026] *<br>* figure 12 *<br>----- | 1-18                                                                                                                                                                                                                                                                                  | INV.<br>B66B19/00<br>B21D3/10<br>B21D5/08 |
|                                                                                                                                                                                                                         |                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                       | TECHNICAL FIELDS SEARCHED (IPC)           |
|                                                                                                                                                                                                                         |                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                       | B66B<br>B21D                              |
| The present search report has been drawn up for all claims                                                                                                                                                              |                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                       |                                           |
| Place of search<br>The Hague                                                                                                                                                                                            |                                                                                                                                                                                            | Date of completion of the search<br>25 June 2013                                                                                                                                                                                                                                      | Examiner<br>Oosterom, Marcel              |
| CATEGORY OF CITED DOCUMENTS                                                                                                                                                                                             |                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                       |                                           |
| X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document |                                                                                                                                                                                            | T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>.....<br>& : member of the same patent family, corresponding document |                                           |

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**ANNEX TO THE EUROPEAN SEARCH REPORT  
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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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25-06-2013

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82