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Declarations under Rule 4.17:

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))
- of inventorship (Rule 4.17(iv))

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(54) Title: TRANSVERSE-ROLLER BELTS AND MODULES

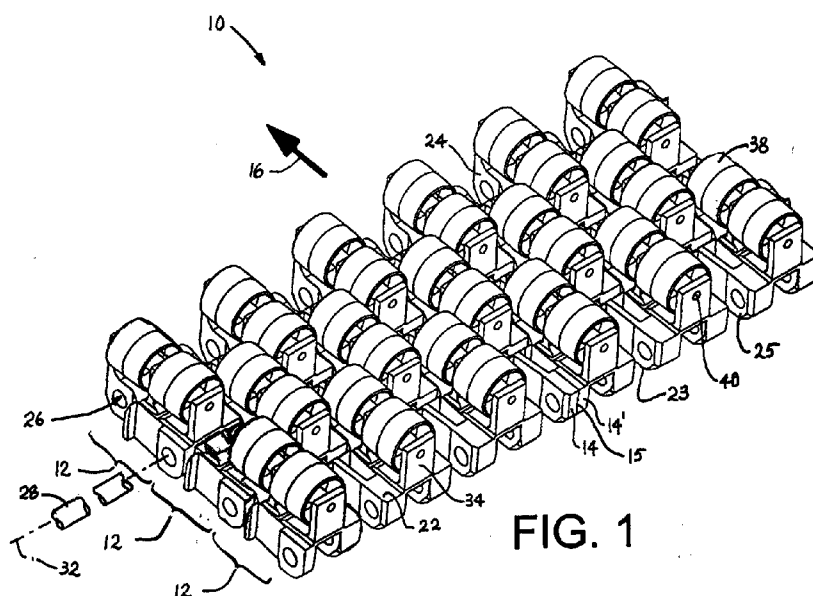


FIG. 1

(57) Abstract: A modular roller-top conveyor belt (10) with a dense array of rollers (38) freely rotatable toward the sides of the belt. The rollers are arranged in offset lines and columns in a checkerboard pattern on top side of the belt. The rollers rotate on axes parallel to the direction of belt travel (16). The rollers extend in the direction of belt travel over the hinge axes formed between adjacent rows (12) of belt modules (14, 14').

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TRANSVERSE-ROLLER BELTS AND MODULES

BACKGROUND

The invention relates generally to power-driven conveyor belts and, more particularly, to modular conveyor belts having article-supporting rollers arranged to rotate on axes in the direction of belt travel.

Roller belts having article-supporting rollers arranged to rotate freely on axes in the direction of belt travel are often used to convey articles, especially high-friction articles such as tires. The freely rotatable rollers make it easy to slide articles onto and off the belt from the sides. Modular roller-top conveyor belts constructed of rows of roller-top belt modules connected in series at hinge joints are used in many conveying applications. In these belts, the rollers are arranged at the top sides of the belt rows between the hinge joints, forming a gap in the roller arrangement along each hinge joint. Small articles or articles presenting a base with small dimensions to the supporting rollers can get caught in the gap. Unlike cured tires, which present an entire sidewall as a base to a conveyor belt, uncured, or "green," tires present only a narrow circular bead as a base to a conveyor belt. The narrow bead can get caught in the roller gap at the hinge joints of conventional roller-top belts.

SUMMARY

These shortcomings are overcome and other advantages are provided by a conveyor belt embodying features of the invention. In one aspect, the conveyor belt comprises a series of rows of one or more belt modules connected together at hinge joints. Each row of modules extends longitudinally in a direction of belt travel between a first end and a second end, laterally between a first side edge and a second side edge, and in thickness between a top side and a bottom side. The hinge joints define laterally disposed hinge axes. Rollers having axles aligned in the direction of belt travel are supported at the top side of the conveyor belt. The axles define longitudinal axes of rotation for the rollers. Some of the rollers in a row of belt modules extend over the hinge axis at the first end of the row.

In another aspect, the modular conveyor belt has roller supports upstanding from the top side of the belt. Rollers supported in the roller supports are arranged to rotate towards the first and second side edges of the belt. Some of the rollers are positioned above the hinge axes so that a plane containing one of the hinge axes and perpendicular to another plane containing both of the hinge axes of a belt row intersects the rollers above the hinge axis.

In yet another aspect of the invention, a conveyor belt module comprises a first end and an opposite second end defining the module's length, opposite first and second side edges defining its width, and opposite top and bottom sides defining its thickness. A first set of aligned hinge elements and a second set of aligned hinge elements are spaced apart across the width of the module at the first and second ends. The aligned hinge elements define first and second hinge axes, which define a first plane. Rollers are supported at the top side of the module for rotation toward the first and second side edges. Some of the rollers intersect a second plane perpendicular to the first plane and intersecting the first hinge axis.

BRIEF DESCRIPTION OF THE DRAWINGS

These features and aspects of the invention, as well as its advantages, are better understood by referring to the following description, appended claims, and accompanying drawings, in which:

FIG. 1 is an isometric view of a portion of one version of a conveyor belt embodying features of the invention;

FIG. 2 is a top plan view of the conveyor belt of FIG. 1;

FIG. 3 is a side elevation view of the conveyor belt of FIG. 1;

FIG. 4 is a front elevation view of the conveyor belt of FIG. 1;

FIG. 5 is a side elevation view of another version of a conveyor belt embodying features of the invention, including three lines of rollers across the width of each module; and

FIG. 6 is a pictorial view of an interior portion of yet another version of a conveyor belt embodying features of the invention, including a single line of rollers across the width of each module.

DETAILED DESCRIPTION

A portion of one version of a conveyor belt embodying features of the invention is shown in FIGS. 1–4. The portion of the belt shown includes three rows of a single belt module or side-by-side belt modules separated at a seam. Each row extends in length longitudinally (in the direction of belt travel) from a first end to a second end, laterally (in a width direction) from a first side edge to an opposite second side edge and in thickness from a top side to a bottom side. Hinge elements, in the form of hinge eyes in this example, are spaced apart laterally along the first and second ends of each row. The hinge eyes at the first end of a row are interleaved with the hinge eyes at the second

end of an adjacent row. Aligned openings 26 in the interleaved hinge eyes form a lateral passageway between rows. A hinge pin 28 received in the passageways connects adjacent modules together at hinge joints 30 defining a hinge axis 32 about which adjacent rows can pivot to allow the belt to articulate about drive or diverting elements such as sprockets, drums, shoes, or return rollers.

Upstanding from the top side 22 of the belt modules are groups of three supports 34, 35, 36 for rollers 38. The end supports 34, 36 stand up from the hinge eyes at the first and second ends of each module. The middle support 35 stands up from the middle of the module. The supports have aligned openings 40 that receive and support an axle 42. The rollers are mounted on the axles. In this example, a single roller is mounted between each pair of supports in each group of three. The roller axles are aligned in the direction of belt travel to allow the rollers to rotate freely toward the first and second side edges of the belt in a transverse-roller configuration.

As best shown in FIG. 2, two lateral lines 44, 45 of rollers are formed along each row. The rollers in each line are spaced apart laterally by a distance D slightly greater than the diameter d of the rollers. This allows the rollers in a row to nest closely with the laterally offset rollers of an adjacent row. As best shown in FIG. 3, the rollers 38 extend over the hinge axis 32 so that a plane P_1 defined by consecutive hinge axes intersects a plane P_2 perpendicular to P_1 through the hinge axis. Because the rollers extend over the hinge axis, they overlap portions of the interleaved hinge eyes of adjacent rows and fit into the gaps 46 between the laterally spaced sets of rollers. The result is a conveyor surface with an array of rollers arranged in lateral lines and offset longitudinal columns to form a checkerboard pattern with relatively minor voids 48 between the sets of rollers.

Another version of a belt having similar characteristics is shown in part in FIG. 5. This belt 50 is constructed of rows of modules 52 connected together at hinge joints 54 by hinge pins. Pockets 56 in the underside of the module receive teeth from drive and idle sprockets. A mounting base 58 is fastened to the top side 60 of each module by bolts, screws, or other fasteners retained in threaded holes 62 or inserts in the top side of the module. Rollers supports 64 extend upward from the mounting base to support a set of three rollers 66 for rotation on an axle or axes 68 parallel to the direction of belt travel 16. Like the rollers in the configuration of FIGS. 1–4, the rollers in FIG. 5 extend over the hinge axes to overlap longitudinally with the laterally offset rollers on the adjacent belt rows.

The interior portion of a belt having a single line of rollers per row is shown in FIG. 6. In the belt 70, each row 72 has a single lateral line 74 of rollers 76. The rollers rotate on axles 78 aligned in the direction of belt travel 16. The ends of the axles are supported in roller supports 80 upstanding from the top surface 82 of the belt. The rollers extend over the hinge axes 84 so that they overlap the rollers in an adjacent row. Like the other versions, the belt shown in FIG. 6 eliminates a significantly wide gap at the hinge joint between lateral lines of rollers that are freely rotatable toward the side edges of the belt.

Although the invention has been described with reference to a few preferred versions, other versions are possible. As one example, there could be multiple individual rollers between consecutive roller supports. As another example, the belts depicted are modular plastic conveyor belts, but could be modular metal or ceramic belts as well. As still another example, the axles may be non-rotating and extend through bores in the rollers or could be stubs that protrude from the sides of the rollers to rotate in receptacles in the supports. So, as these few examples suggest, the claims are not meant to be limited to the preferred versions described in detail.

What is claimed is:

CLAIMS

1. A conveyor belt comprising:
 - a plurality of rows of one or more belt modules, each row extending longitudinally in a direction of belt travel between a first end and a second end, laterally between a first side edge and a second side edge, and in thickness between a top side and a bottom side, wherein the rows are hingedly connected together first end to second end at hinge joints each defining a laterally disposed hinge axis allowing the conveyor belt to articulate;
 - a plurality of rollers supported at the top side, the rollers having axles aligned in the direction of belt travel defining longitudinal axes of rotation for the rollers;
 - wherein at least some of the rollers in a row of belt modules extend over the hinge axis at the first end of the row.
2. A conveyor belt as in claim 1 comprising a plurality of roller supports upstanding from the top side of the rows to support the roller axles.
3. A conveyor belt as in claim 2 wherein each of the rollers is supported between a longitudinally spaced pair of the roller supports.
4. A conveyor belt as in claim 2 further including a mounting base fastened to the top side of a row and wherein the roller supports extend from the mounting base.
5. A conveyor belt as in any preceding claim wherein the rollers are arranged in a checkerboard pattern.
6. A conveyor belt as in any preceding claim wherein each row includes a single lateral line of rollers.
7. A conveyor belt as in any of claims 1–5 wherein each row includes a plurality of lateral lines of rollers.
8. A conveyor belt as in claim 7 wherein the rollers in a line are laterally offset from the rollers in an adjacent line.
9. A conveyor belt as in any preceding claim wherein the rollers at the first end of the row are laterally offset from the rollers at the second end of the row.
10. A conveyor belt as in any preceding claim wherein none of the rollers in a row extend over the hinge axis at the second end of the row.
11. A conveyor belt comprising:
 - a series of rows of one or more belt modules, each row extending longitudinally in a direction of belt travel between a first end and a second end, laterally between a first

side edge and a second side edge, and in thickness between a top side and a bottom side, wherein the rows are hingedly connected together first end to second end at hinge joints defining laterally disposed hinge axes at each end of each row on which the conveyor belt articulates, wherein the hinge axes at opposite ends of a row define a first plane;

roller supports upstanding from the top side;

rollers supported in the roller supports and arranged to rotate toward the first and the second side edges;

wherein at least some of the rollers are positioned above the hinge axes so that a second plane perpendicular to the first plane through one of the hinge axes of the row intersects the rollers positioned above the hinge axes.

12. A conveyor belt as in claim 11 wherein each of the rollers is supported between a longitudinally spaced pair of the roller supports.

13. A conveyor belt as in any of claims 11 and 12 further including a mounting base fastened to the top side of a row and wherein the roller supports extend from the mounting base.

14. A conveyor belt as in any of claims 11–13 wherein the rollers are arranged in a checkerboard pattern.

15. A conveyor belt as in any of claims 11–14 wherein each row includes a single lateral line of rollers.

16. A conveyor belt as in any of claims 11–14 wherein each row includes a plurality of lateral lines of rollers.

17. A conveyor belt as in claim 16 wherein the rollers in a line are laterally offset from the rollers in an adjacent line.

18. A conveyor belt as in any of claims 11–17 wherein the rollers at the first end of the row are laterally offset from the rollers at the second end of the row.

19. A conveyor belt as in any of claims 11–18 wherein none of the rollers in a row extend over the hinge axis at the second end of the row.

20. A conveyor belt module comprising:

a first end and an opposite second end defining the length of the module;

a first side edge and an opposite second side edge defining the width of the module; and

a top side and an opposite bottom side defining the thickness of the module;

a first set of aligned hinge elements spaced apart across the width of the module body along the first end to define a first hinge axis through the aligned hinge elements;

a second set of aligned hinge elements spaced apart across the width of the module body along the second end to define a second hinge axis through the aligned hinge elements;

wherein the first and second hinge axes define a first plane;

5 a plurality of rollers supported at the top side for rotation toward the first and second side edges;

wherein at least some of the rollers intersect a second plane perpendicular to the first plane through the first hinge axis.

21. A conveyor belt module as in claim 20 comprising a plurality of roller supports
10 upstanding from the top side of the module to support the rollers.

22. A conveyor belt module as in claim 21 wherein each of the rollers is supported between a pair of the roller supports spaced apart in the length direction.

23. A conveyor belt module as in claim 21 further including a mounting base fastened to the top side of the module and wherein the roller supports extend from the mounting base.

15 24. A conveyor belt module as in any of claims 20–23 wherein each module includes a single line of rollers extending along the width of the module.

25. A conveyor belt module as in any of claims 20–23 wherein each module includes a plurality of lines of rollers extending along the width of the module and wherein the rollers in a line are offset in the width direction from the rollers in an adjacent line.

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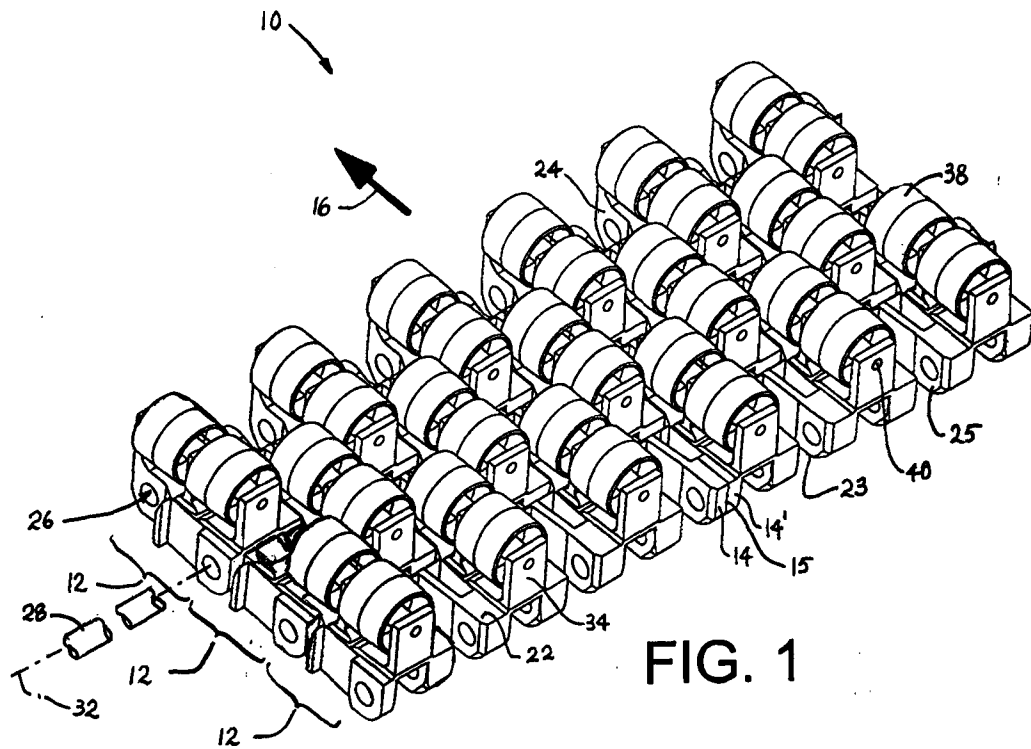


FIG. 1

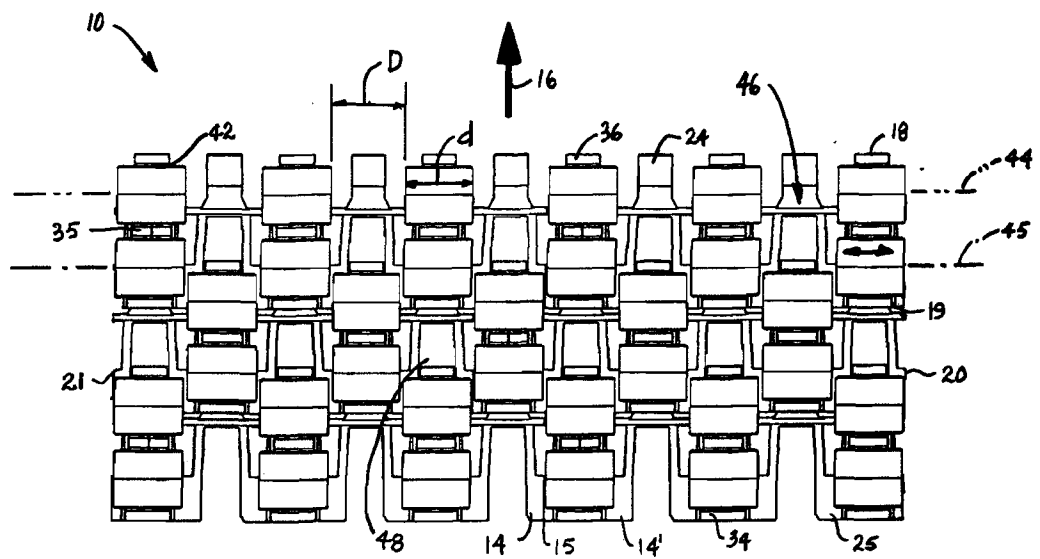


FIG. 2

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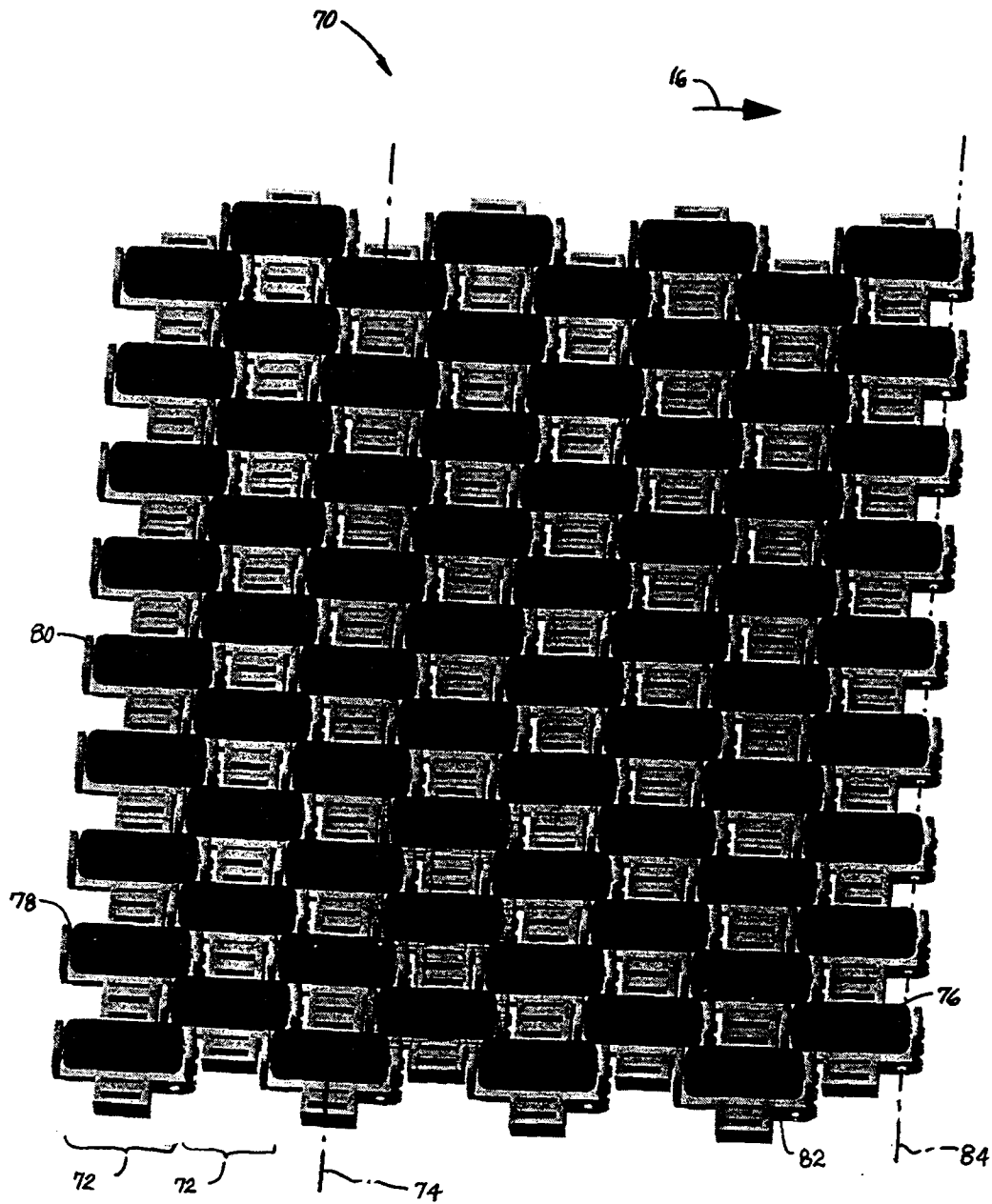


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2008/062028

A. CLASSIFICATION OF SUBJECT MATTER INV. B65G17/40		
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) B65G		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6 148 990 A (LAPEYRE ROBERT S [US] ET AL) 21 November 2000 (2000-11-21) column 5, line 36 - line 57; figures 4-6 -----	1,11,20
A	US 4 231 469 A (ARSCOTT JOHN R) 4 November 1980 (1980-11-04) column 3, line 31 - line 43; figures 4-6 -----	
<div style="display: flex; justify-content: space-between;"> <input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex. </div>		
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>* Special categories of cited documents :</p> <p>*A* document defining the general state of the art which is not considered to be of particular relevance</p> <p>*E* earlier document but published on or after the international filing date</p> <p>*L* 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)</p> <p>*O* document referring to an oral disclosure, use, exhibition or other means</p> <p>*P* document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>*T* 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</p> <p>*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</p> <p>*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.</p> <p>*Z* document member of the same patent family</p> </div> </div>		
Date of the actual completion of the international search	Date of mailing of the international search report	
10 July 2008	17/07/2008	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer Schneider, Marc	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2008/062028

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