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(54) **Title:** TIRE CARCASS CABLE DEPTH GAUGE AND METHOD OF USE

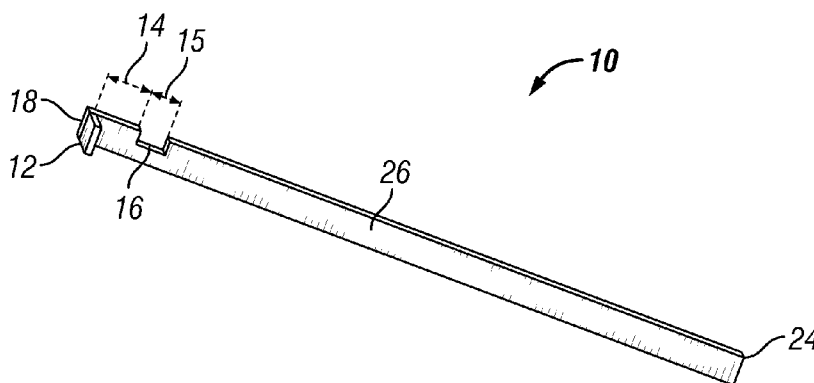


FIG. 1

(57) **Abstract:** A cable depth gauge and method for determining the depth of a cable embedded in a sidewall of a tire, the cable depth gauge comprising an elongate body having a proximal end and a distal end, the proximal end having an indicator point set to reference a surface of the tire, the elongate body having a width to determine eligibility if the repair hole being examined meets the minimum size for the repair process and a first measuring region and a second measuring region located at the proximal end of the elongate body, the first measuring region and the second measuring region being at a known distance from the indicator point.



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TIRE CARCASS CABLE DEPTH GAUGE AND METHOD OF USE

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] This invention relates generally to tire repair and more specifically to determining the location of metal cables in the tire sidewall to establish appropriate depth for any surface treatment or repair.

Description of the Related Art

[0002] Steel cord is used in the body ply and belts of truck tires. These steel cords, also known as cables, are located in the tire sidewall. When repairing an injury to a tire sidewall, the injured area may be buffed or ground to remove material and prepare the area for patch application or repair. Cables may be located at various depths within the sidewall depending upon the dimension of the tire, its architecture, its type and usage, its manufacturer, and the production parameters and conditions. During the repair operation of the tire, it is crucial to avoid damaging or disturbing the undamaged metal cables that are adjacent to the injury and/or that fall within the repair area.

[0003] Various electromagnetic mechanisms are known for determining metal cable depth; however, these mechanisms are complex and require calibration to specific tire types. A low technology, easy to use apparatus is needed to quickly and definitively classify cable depth in individual tires without the necessity of calibration.

SUMMARY OF THE INVENTION

[0004] Particular embodiments of the present invention include a cable depth gauge for determining the depth of a cable embedded in a sidewall of a tire. The cable depth gauge comprises an elongate body having a proximal end and a distal end. The proximal end having an indicator point set to reference a surface of the tire. The elongate body having a width to determine eligibility if the repair hole being examined meets the minimum size for the repair process and a first measuring region and a second measuring region located at the proximal

end of the elongate body. The first measuring region and the second measuring region being at a known distance from the indicator point.

[0005] Particular embodiments of the present invention include a method for determining the depth of a cable embedded in a sidewall of a tire. The method comprises the steps of inserting the cable depth gauge into a repair hole formed through a tire, positioning the indicator point of the cable depth gauge at a surface of the tire, determining whether the cable falls within the first measuring region, the second measuring region or beyond the second measuring region and classifying the depth of the cable as shallow if the cable falls within the first measuring region, medium if the cable falls within the second measuring region or deep if the cable falls beyond the second measuring region.

[0006] Particular embodiments of such methods may further include selecting an appropriate setting on a subsequent operation based upon the classified depths.

[0007] The foregoing and other objects, features and advantages of the invention will be apparent from the following more detailed descriptions of particular embodiments of the invention, as illustrated in the accompanying drawing wherein like reference numbers represent like parts of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 is a front perspective view of an embodiment of the cable depth gauge.

[0009] FIG. 2 is a side perspective view of another embodiment of the cable depth gauge.

[0010] FIG. 3 is a schematic view of the positioning of the cable depth gauge into a tire with an injury.

[0011] FIG. 4 is an enlarged cross sectional view of the tire sidewall and the gauge measuring shallow depth cables.

[0012] FIG. 5 is an enlarged cross sectional view of the tire sidewall and the gauge measuring medium depth cables.

[0013] FIG. 6 is an enlarged cross sectional view of the tire sidewall and the gauge measuring deep depth cables.

DETAILED DESCRIPTION OF PARTICULAR EMBODIMENTS

[0014] Embodiments of the present invention include a cable depth gauge and methods of use. A cable depth gauge to classify cable depth as shallow, medium and deep would be extremely useful in processes to prepare a tire for repair. It is important in these processes to grind or treat the surface close to the cables without damaging or disturbing the undamaged cables. The cable depth classification may be used to determine depth of grinding or treatment.

[0015] Referring to FIGS. 1 and 2, a cable depth gauge **10** configured pursuant to a particular embodiment of the invention is formed of any suitable known materials such as plastic or steel. The gauge **10** includes an elongate body **26** having a proximal end **18** and a distal end **24**. The distal end **24** may be fashioned as shown, i.e. an extension of the elongate body **26** or may include an expanded width region for ease of gripping. The elongate body **26** has an indicator point **12**, a first measuring region **14** and a second measuring region **15** located at the proximal end **18** of the elongate body **26**.

[0016] The gauge **10** must be long enough to be partially inserted through a repair section of a tire sidewall where the sidewall cords or cables have been exposed while being held securely in one's hand. In one embodiment, for example, the length of the gauge may be between 6 cm and 20 cm. The width dimension of the gauge **10** is dependent upon the minimum hole size permitted by the repair specifications of the repair process that requires the use of the cable depth gauge. The width dimension of the gauge thus limits the insertion of the gauge into holes having a size that is inferior to the repair specifications of the process of interest. In one embodiment, the gauge has a width of about 4 mm. It is understood that in particular embodiments, the width of the gauge **10** may range, for example, between 3 mm and 30 mm depending upon the repair process specifications. The embodiment of the gauge illustrated in the drawings is rectangular in shape; however, almost any shape may be appropriate for this application.

[0017] The indicator point **12** located on the proximal end **18** of the gauge **10** catches or aligns on the inside (for the exemplary embodiment) of the tire sidewall to locate the gauge at that known position. In the illustrated embodiment, the indicator point **12** may

be a tab that extends perpendicular to the elongate body **26** to physically catch on the inner sidewall surface of the tire being repaired. In the illustrated embodiment, the tab height is 3 mm but this is not a critical height constraint. The tab may be any shape, length and thickness sufficient to enter the repair hole and couple to the inner sidewall surface of the tire.

[0018] This invention is not limited to the illustrated embodiment. In other particular embodiments, the indicator point **12** may be, for example, merely an indication line, a mark or color coding on the elongate body set to reference an inner or outer surface of the tire. As such, the surface referenced may be the inner surface or the outer surface of the tire. Thus, the elongate body **26** may be configured to classify the depth of the cables from the inside of the tire or from the outside of the tire.

[0019] The depth regions are determined by evaluating placement of metal cables in many tires from various manufacturers. The following depth regions were determined, for example, using truck tires. The depth regions will vary depending on the size of the class of the tire, such as, for example an off road tire will have different measuring regions compared to a truck tire. In particular embodiments, the first measuring region **14** extends from the indicator point **12** to the edge of the second measuring region **15**. The first measuring region **14** may be designated as the shallow cable depth region (for the exemplary embodiment). In a particular embodiment, the length of the first measuring region **14** is, for example, between 3.0 mm and 4.0 mm. In another embodiment, the length of the first measuring region is about 3.5 mm.

[0020] The second measuring region **15** extends beyond the length of the first measuring region **14**. The first and second measuring regions **14**, **15** may be marked, labeled or color coded to indicate the regions. In one embodiment the second measuring region **15** is a notch **16**. The second measuring region **15** may be designated as the medium depth region (for the exemplary embodiment). In a particular embodiment, the length of the second measuring region **15** is, for example, between 1.0 mm and 2.0 mm. In another embodiment, the length of the second measuring region is about 1.8 mm. Any cable positions in the repair section of the tire that are observed beyond the second measuring region **15** may be designated as the deep depth region (for the exemplary embodiment).

[0021] A tire may receive an injury from road debris that causes a puncture or rupture of the rubber sidewall. It is commonly recommended for preparing the injury for repair that a clean hole be drilled or ground at the injury site. With reference to FIG. 3, a portion of a tire **20** is depicted, the tire **20** having an injury and repair hole **22** in the sidewall. Particular embodiments of methods of determining the depth of a cable embedded in a tire sidewall include producing a repair hole in the sidewall of a tire and inserting a cable depth gauge into a repair hole formed through a tire. The cable depth gauge may be inserted from the inside or the outside of the tire. Particular embodiments of the invention are shown inserting the cable depth gauge from the outside of the tire.

[0022] Referring to FIGS. 4, 5 and 6, the steps of positioning and reading the cable depth gauge for particular embodiments of the invention are illustrated. Of course if the reference indicator point **12** has aligned with the outer surface, then the cable depth gauge would have to have different first and second measuring region locations. The cable depth gauge **10** is inserted in the repair hole **22** from the outside **34** of the tire. Then the cable depth gauge is positioned in a reference position using an indicator point **12** on the end of the cable depth gauge **10**. The cable depth gauge **10** is inserted through the sidewall then pulled back toward the outside of the tire until the indicator point **12** aligns on the interior surface **32** of the sidewall. The depth of the cables **36** may be read in relation to the first measuring region **14** and the second measuring region **15** on the proximal end of the cable depth gauge **10**.

[0023] In particular embodiments of the invention, the depth of the cables may be classified as shallow, medium or deep in relation to the interior surface **32** of the tire. FIG. 4 illustrates a shallow depth classification where the metal cables are positioned in the first measuring region **14**. FIG. 5 illustrates a medium depth classification where the metal cables are positioned in the second measuring region **15**. FIG. 6 illustrates a deep depth classification where the metal cables are positioned beyond the second measuring region **15**.

[0024] The method of using the cable depth gauge to determine the depth of metal cable embedded in a tire sidewall may further include selecting an appropriate setting on any subsequent operations to reflect the depth of the cables. For example, a grinding operation may be set to shallow, medium or deep grind levels depending upon the classification determined using this method and apparatus.

[0025] The terms “comprising,” “including,” and “having,” as used in the claims and specification herein, shall be considered as indicating an open group that may include other elements not specified. The term “consisting essentially of,” as used in the claims and specification herein, shall be considered as indicating a partially open group that may include other elements not specified, so long as those other elements do not materially alter the basic and novel characteristics of the claimed invention. The terms “a,” “an,” and the singular forms of words shall be taken to include the plural form of the same words, such that the terms mean that one or more of something is provided. The terms “at least one” and “one or more” are used interchangeably. The term “one” or “single” shall be used to indicate that one and only one of something is intended. Similarly, other specific integer values, such as “two,” are used when a specific number of things is intended. The terms “preferably,” “preferred,” “prefer,” “optionally,” “may,” and similar terms are used to indicate that an item, condition or step being referred to is an optional (not required) feature of the invention. . Ranges that are described as being “between a and b” are inclusive of the values for “a” and “b.”

[0026] It should be understood from the foregoing description that various modifications and changes may be made to the embodiments of the present invention without departing from its true spirit. The foregoing description is provided for the purpose of illustration only and should not be construed in a limiting sense. Only the language of the following claims should limit the scope of this invention.

CLAIMS

What is claimed is:

1. A cable depth gauge for determining the depth of a cable embedded in a sidewall of a tire, the cable depth gauge comprising:

an elongate body having a proximal end and a distal end, the proximal end having an indicator point set to reference a surface of the tire, the elongate body having a width to determine eligibility if the repair hole being examined meets the minimum size for the repair process; and

a first measuring region and a second measuring region located at the proximal end of the elongate body, the first measuring region and the second measuring region being at a known distance from the indicator point.

2. The cable depth gauge of claim 1, wherein the second measuring region is a notch in the elongate body.

3. The cable depth gauge of claim 1, wherein the indicator point is a tab.

4. The cable depth gauge of claim 3, wherein the tab extends perpendicular to the elongate body.

5. The cable depth gauge of claim 1, wherein the first measuring region is between 3.0 mm and 4.0 mm.

6. The cable depth gauge of claim 5, wherein the second measuring region is between 1.0 mm and 2.0 mm.

7. The cable depth gauge of claim 1, wherein the width of the elongate body at the proximal end is between 2 mm and 6 mm.

8. The cable depth gauge of claim 1, wherein the indicator point is set to reference an inner surface of the tire.
9. A method for determining a depth of cable embedded in a sidewall of a tire, the method comprising:
 - inserting the cable depth gauge of claim 1 into a repair hole formed through a tire;
 - positioning the indicator point of the cable depth gauge at a surface of the tire;
 - determining whether the cable falls within the first measuring region, the second measuring region or beyond the second measuring region; and
 - classifying the depth of the cable as shallow if the cable falls within the first measuring region, medium if the cable falls within the second measuring region or deep if the cable falls beyond the second measuring region.
10. The method of claim 9, further comprising:
 - selecting an appropriate setting on a subsequent operation based upon the classified depths.
11. The method of claim 9, wherein the second measuring region is a notch in the elongate body.
12. The method of claim 9, wherein the indicator point is a tab.
13. The method of claim 12, wherein the tab extends perpendicular to the elongate body.
14. The method of claim 9, wherein the first measuring region is between 3.0 mm and 4.0 mm.
15. The method of claim 14, wherein the second measuring region is between 1.0 mm and 2.0 mm.

16. The method of claim 9, wherein the width of the elongate body at the proximal end is between 2 mm and 6 mm.

17. The method of claim 9, wherein the indicator point is set to reference an inner surface of the tire.

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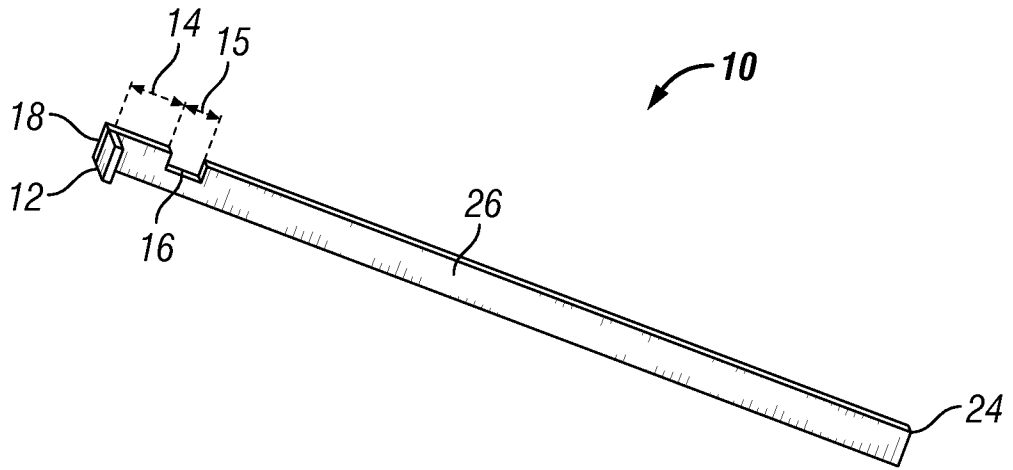


FIG. 1

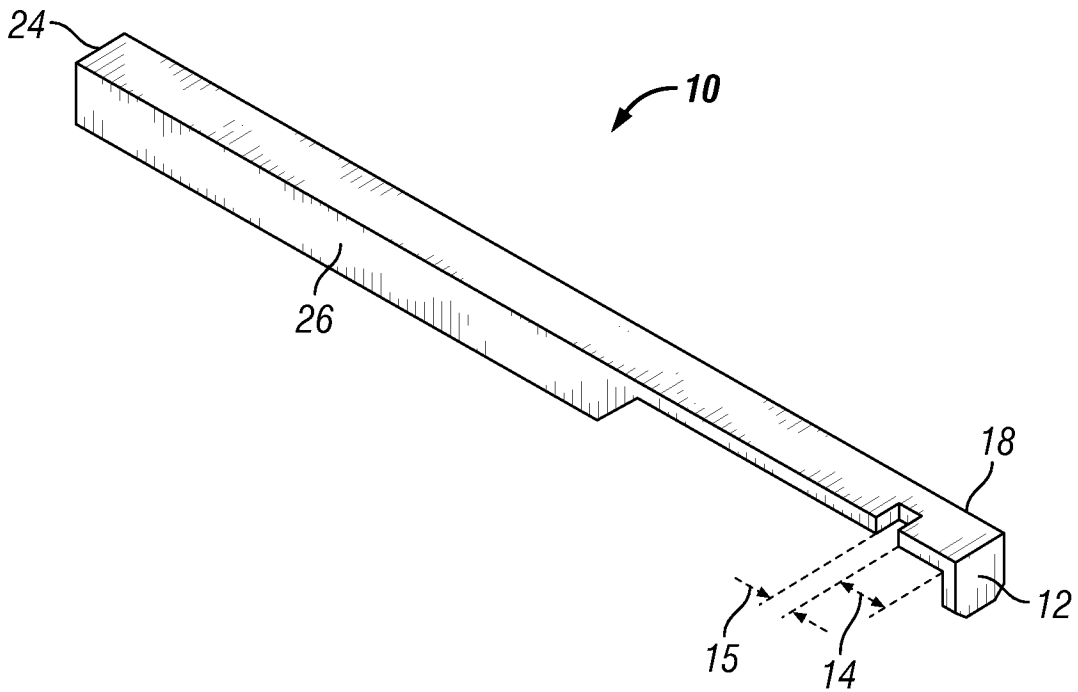


FIG. 2

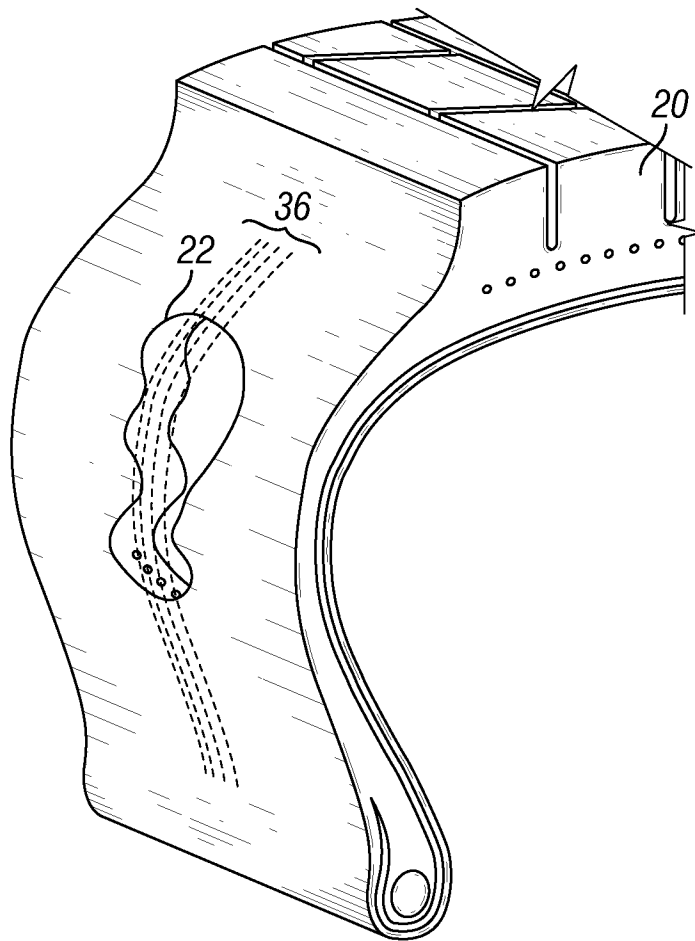


FIG. 3

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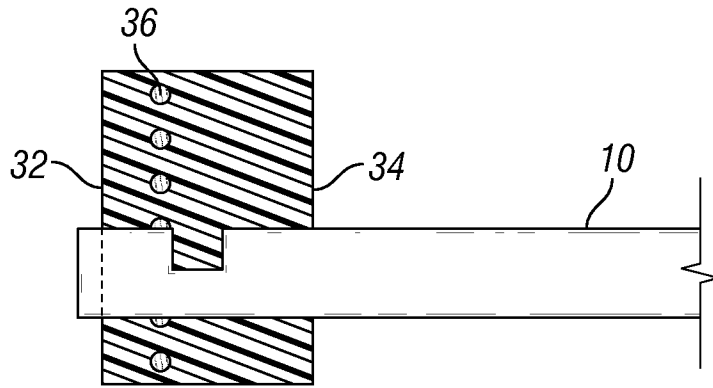


FIG. 4

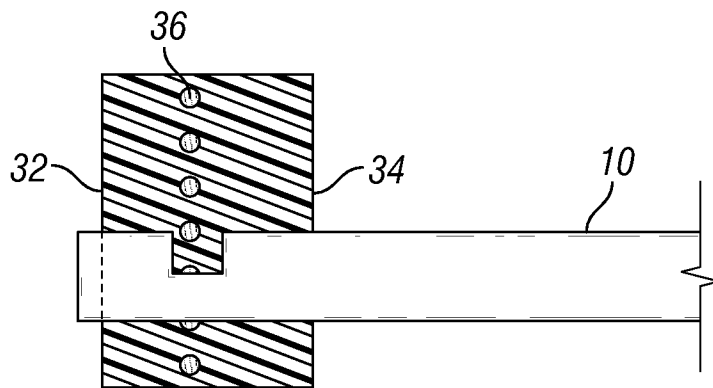


FIG. 5

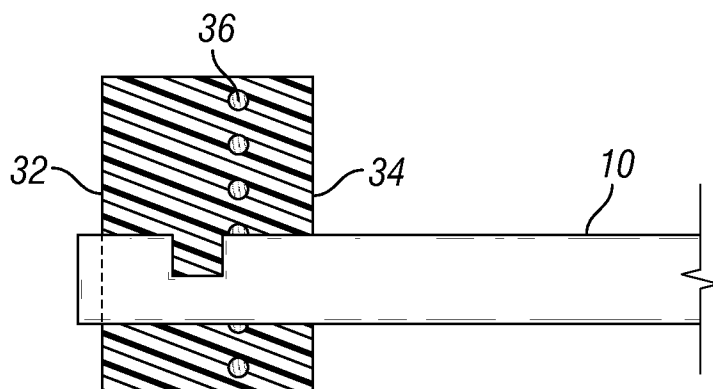


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2009/047323

A. CLASSIFICATION OF SUBJECT MATTER
 IPC(8) - G01M 17/02 (2009.01)
 USPC - 73/146
 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(8) - G01M 17/02 (2009.01)
 USPC - 73/146

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 practicable, search terms used)
 MicroPatent

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 7,497,113 B1 (PATEL) 03 March 2009 (03.03.2009) entire document	1-17
Y	US 4,980,902 A (HEGLAND et al) 25 December 1990 (25.12.1990) entire document	1-17
Y	WO 2007/047466 A1 (DELL'OCA) 26 April 2007 (26.04.2007) entire document	1-8, 12-13
Y	US 5,536,346 A (HENDRY et al) 16 July 1996 (16.07.1996) entire document	1-17
Y	EP 1,374,784 B1 (MARKWORTH) 02 January 2004 (02.01.2004) entire document	2, 11
Y	US 2008/0229598 A1 (LIU) 25 September 2008 (25.09.2008) entire document	4, 13
Y	US 4,234,256 A (YEAGER) 18 November 1980 (18.11.1980) entire document	8, 17

Further documents are listed in the continuation of Box C.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"E" earlier application or patent but published on or after the international filing date	"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
"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)	"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
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 23 July 2009	Date of mailing of the international search report 04 AUG 2009
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