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(71) Applicant: **CONTINENTAL AUTOMOTIVE GMBH**
[DE/DE]; Vahrenwalder Straße 9, 30165 Hanover (DE).(72) Inventors: **DAS, Mithun**; 7 Boon Keng Road, #21-130, Singapore 330007 (SG). **SARADINDUBASU, Saptarshi**; 50 Bukit Batok East Ave 5, #14-02 Regent Heights, Singapore 659801 (SG). **AGARWAL, Manuj Prakash**; Block 914 Jurong West Street 91, #04-202, Singapore 640914 (SG). **KALE, Prashant**; Jurong West Street 52, #09-413 Block 531, Singapore 640531 (SG). **MOHANDAS, Rajesh**; Ang Mo Kio Avenue 1, 03 - 509 - Block 223, Singapore 560223 (SG).(74) Agents: **SCHWEIGER, Martin** et al.; 105 Cecil Street, #12-04 The Octagon, Singapore 069534 (SG).

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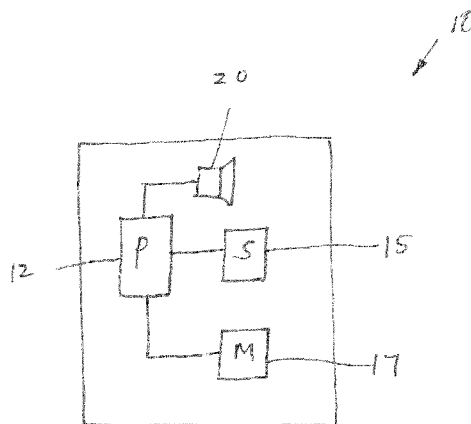
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(54) Title: SMART WATCH BASED MICRO-MOVEMENT DETECTION FOR VEHICLES

FIG. 1



(57) Abstract: The application provides an apparatus for detecting placement of driver hand on a vehicle steering wheel. The apparatus includes a movement detection device and a processor. The movement detection device is wearable on a wrist of the driver and it is provided for detecting movement of the wrist of the driver. The processor is adapted for receiving data regarding the detected wrist movement from the movement detection device, comparing the data regarding the detected wrist movement with a predetermined wrist movement pattern. The processor is also adapted for, when a deviation of the data regarding the detected wrist movement from the predetermined wrist movement pattern is detected, sending an alert signal to an output port.

SMART WATCH BASED MICRO-MOVEMENT DETECTION FOR VEHICLES

This application relates to a vehicle with improved safety.

5 US 20130317699 A1 discloses a method for detecting contact between driver hands and a vehicle steering wheel. The method includes an actuator selectively applying a steering force, according to a test force pulse pattern, on the steering wheel. Steering force sensors then measures instantaneous
10 steering force or a steering angle being associated with the steering wheel. The instantaneous steering force measurement or the steering angle measurement, which provides an indication of a driver reaction to the test force pattern, is then used to detect driver hands contact on the steering wheel.

15 US 8983732 B2 discloses a vehicle safety system that includes a steering wheel, a plurality of pressure sensitive sensors being located in the steering wheel, and a control unit. The pressure sensitive sensors are located in different regions of
20 the steering wheel. The pressure sensitive sensors determine if a driver's hand is pressing upon a respective region of the steering wheel associated with one or more of the pressure sensitive sensors. The control unit is configured for determining whether the driver hand is pressing upon the steering
25 wheel.

It is an object of this application to provide an improved vehicle.

30 The application provides an apparatus for detecting placement of a driver hand on a steering wheel of a vehicle.

The vehicle is used for transporting goods and people. A driver rotates the steering wheel in order to steer the vehicle.

The driver also operates and controls direction and speed of the vehicle.

In detail, the driver hand detection apparatus includes a
5 movement detection device and a computing processor.

The movement detection device is wearable on a wrist of a driver. In other words, the movement detection device is intended for wearing on the wrist of the driver. The movement
10 detection device is also provided for detecting movement of the wrist.

The processor is adapted for receiving data regarding detection of wrist movement from the movement detection device. The
15 processor then compares the received wrist movement detection data with a predetermined wrist movement pattern. The processor later, when a deviation of the wrist movement detection data from the predetermined wrist movement pattern is detected, sends an alert signal to an output port.

20 The alert signal is intended for warning the driver about not placing the driver hand on the steering wheel, which can compromise safety of the driver as well as passengers of the vehicle.

25 In effect, the driver hand detection apparatus acts to enhance safety of the vehicle.

The movement detection device can be adapted for detecting rotational movement of the wrist. The steering wheel is movable
30 and it can be tilted or shifted to a plane, which is selected by the driver. The selected plane can be positioned vertically or be positioned at an angle with respect to the vertical. When the driver hand is placed on the steering wheel, the

driver hand rotates about a point, wherein the hand rotational movement is placed in this plane of the steering wheel.

In implementation, the movement detection device can include
5 an acceleration sensor for detecting a linear movement of the driver hand.

The movement detection device can also include an gyroscope sensor for detecting a rotational movement of the driver hand.
10

The driver hand detection apparatus often includes a speaker for producing a warning or alert sound according to the alert signal.

15 The driver hand detection apparatus can also include a vibration unit for producing vibrating movement according to the alert signal, wherein the wrist of the driver feels the vibrating movement.

20 The driver hand detection apparatus can also be linked to an interior part of the vehicle by a string or wire. One example of the interior part is a part of a dashboard. The string prevents the apparatus from being misplaced.

25 The application also provides a wristwatch. The wristwatch includes a clock module and the above driver hand detection apparatus. This wristwatch allows a single unit to provide functions of a clock and to provide detection of driver hand on a vehicle steering wheel.

30

The application also provides an improved steering wheel that includes the above driver hand detection apparatus.

The application also provides a system that includes a vehicle that includes a steering wheel. The system also includes the above driver hand detection apparatus.

- 5 The vehicle can include a vehicle speaker for producing an warning or alert sound according to an alert signal from the driver hand detection apparatus. The vehicle speaker can produce a loud noise, which is effective for warning the driver. The vehicle speaker can also produce different sounds, which
10 are also effective for alerting the driver.

The system can include a string. One part of the string is connected to the driver hand detection apparatus while another part of the string is connected to an inside part of the vehicle.
15 The string acts to prevent the driver hand detection apparatus from being misplaced or lost.

The application also provides a method for driving a vehicle. The method includes a step of providing a movement detection
20 device on a wrist of a driver. The movement detection device then provides data regarding detected wrist movement. The wrist can move in a linear direction, in a rotational direction, or in a combination of both a linear and a rotational direction. A processor later compares the wrist movement data
25 with a predetermined wrist movement pattern. When a deviation of the wrist movement data from the predetermined wrist movement pattern is detected, the processor sends an signal for alerting the driver.

30 The application also provides a computer program product, which is stored on a computer readable medium. Examples of the computer readable medium include an optical data disk and a magnetic hard disk. The computer program product includes a

computer code for instructing a computer processor to perform steps of the above method for driving a vehicle.

Fig. 1 illustrates an improved wristwatch with a wrist movement sensor, and

Fig. 2 illustrates a driver wearing the wristwatch of Fig. 1, wherein hands of the driver are placed on a vehicle steering wheel.

In the following description, details are provided to describe embodiments of the application. It shall be apparent to one skilled in the art, however, that the embodiments may be practiced without such details.

Some parts of the embodiments have similar parts. The similar parts may have the same names or similar part numbers. The description of one similar part also applies by reference to another similar parts, where appropriate, thereby reducing repetition of text without limiting the disclosure.

Fig. 1 shows an improved wristwatch 10 for detecting a driver hand on a steering wheel of a vehicle.

The wristwatch 10 includes a computing processor (P) 12, a micro-movement or movement sensor (S) 15, a memory unit (M) 17, and an audio speaker 20. The processor 12 is electrically connected to the movement sensor 15, to the memory unit 17, and to the speaker 20. The movement sensor 15 includes an accelerator sensor and a gyroscope sensor.

Fig. 2 shows, hands 22 and 24 of a vehicle driver being placed on a steering wheel 25 of a vehicle 21.

The driver wears the wristwatch 10 on the driver hand 22.

The steering wheel 25 is placed essentially in a vertical plane.

- 5 In use, the driver hands 22 and 24 are placed in the steering wheel 25 for turning or rotating the steering wheel 25.

The steering wheel 25 can rotate essentially in the vertical plane. This wheel rotation movement is within a pre-determined
10 short range, which is often less than 180 degrees.

When the hands 22 and 24 are holding the steering wheel 25, these hands 22 and 24 also rotate essentially, in the vertical plane. This hand rotation movement is also within the above-
15 mentioned pre-determined short range of the steering wheel 25.

Moreover, when the hand 22 or 24 is not holding the steering wheel 25, the hand 22 or 24 does not often rotate in the vertical plane. In other words, the hand 22 or 24 moves usually
20 in a manner, which is different from the rotational movement of the steering wheel 25.

Not placing the hand 22 on the steering wheel 25 can compromise safety of the driver and passengers in the vehicle 21.
25

The vehicle 21 moves in essentially in a linear or a circular movement or motion, in a horizontal plane.

The driver and his hands 22 and 24 then also move the linear
30 and circular movement in the horizontal plane of the vehicle 21.

In effect, the hands 22 have two movement components, which comprise movement in the vertical plane and movement in the horizontal plane.

- 5 The movement sensor 15 acts to detect these movements of the driver hand 22. In particular, the accelerator sensor detects linear movement while the gyroscope sensor detects rotational movement of the driver hand 22.
- 10 In particular, the movement sensor 15 detects movement of the driver hand 22, essentially in the vertical plane.

The movement sensor 15 also sends data of the detected hand movement to the processor 12.

15

The memory unit 17 stores a computer program with instructions for determining whether the driver hand 22 is placed on the steering wheel 25.

- 20 The processor 12 compares the detected rotation movement of the hand 22, essentially in the vertical plane, with a pre-determined rotation movement pattern, according the instructions of the program, which is stored in the memory unit 17.
- 25 When the processor 12 detects a deviation of the detected rotation movement from the pre-determined rotation movement pattern, the processor 12 sends an alert signal to the speaker 20. The deviation indicates the driver hand 22 is not placed on the steering wheel 25.
- 30 The speaker 20 produces an alert sound to the driver, according to the alert signal.

Moreover, the data of the detected hand movement is also logged and is stored for future reference and analysis. In one application, a bus company reviews a hand movement data of a bus driver to determine a driving performance of the bus driver.

In a special embodiment, a vibration module replaces the speaker 20. The vibration module provides vibrating movement, which is felt by the driver, in order to alert the driver.

10 This embodiment provides a different means of alerting the driver.

In another embodiment, the wristwatch 10 includes a speaker and a vibration module, wherein both the speaker and the vibration module provide feedback or alert signal to the driver.

15 This embodiment provides a further means of alerting the driver.

In one embodiment, a vehicle audio speaker of a vehicle entertainment system replaces the wristwatch speaker 20. The wristwatch 10 sends the alert signal to the vehicle entertainment system, wherein the vehicle audio speaker produces an alert sound to the driver, according to the alert signal. The vehicle audio speaker is able to produce a much louder sound that

25 is more effective in warning the driver. The vehicle entertainment system is able to store many sounds or songs, which can be more interesting or more effective, for alerting the driver.

30 In a further embodiment, the wristwatch 10 is connected to an interior part of the vehicle 21 by a wire or a string. The string acts to prevent loss of the wristwatch 10, especially when a few persons drive the same vehicle 21.

In a general sense, this wristwatch 10 can be applied for vehicles for all market segments.

The wristwatch 10 is difference from other detection devices
5 that have micro-movement sensors. These sensors are integrated into a steering wheel of a vehicle for providing detection of movements of the steering wheel, wherein the detected movement serves as an indication of driver hands on the steering wheel.

10 Some vehicles, such as entry-level vehicles, do not have such a steering wheel for saving cost. Moreover, such steering wheel with these attached micro-movement sensors can also be made ineffective by some external apparatus that generates micro-movements. One example of the external apparatus is a
15 faulty engine mounting.

The wristwatch 10 provides several advantages. The wristwatch 10 requires a low production cost. It can be implemented easily using off-the-shelf components. The development of the
20 wristwatch 10 is also short. It can also be used for vehicles for different market segments. It can also be easily modified to accommodate any future enhancements, without incurring higher costs. It can also be implemented as a generic module for incorporating in multiple wearables or smart watches,
25 which are available commercially.

In summary, the above embodiment provides a smart wristwatch that includes a hand movement detector.

30 The wristwatch includes an algorithm for detection of driver hands on the steering wheel according to detected movement of the wristwatch. The wristwatch also generates appropriate alert or indication with minimum latency when it detects that the driver hand is not on the steering wheel.

In use, when a driver removes his hand from a vehicle steering wheel, the smart wristwatch detects this hand removal and provides an alert or indication signal regarding this hand removal.
5 al.

The removal of driver hand from the steering wheel can compromise safety of the driver and safety of passengers in the vehicle.
10

Data from the wearable smart watch are also recorded to provide behavioural driving pattern of the driver.

The embodiments can also be described with the following lists of features or elements being organized into an item list. The respective combinations of features, which are disclosed in the item list, are regarded as independent subject matter, respectively, that can also be combined with other features of the application.
15

20

1. An apparatus for detecting driver hand on a vehicle steering wheel, the apparatus comprising
 - a movement detection device being wearable on a wrist of a driver, the movement detection device is provided for detecting movement of the wrist,
25 a processor being adapted for
 - receiving data regarding the detected wrist movement from the movement detection device,
 - comparing the data regarding the detected wrist movement with a predetermined wrist movement pattern, and
30
 - when a deviation of the data regarding the detected wrist movement from the predetermined

wrist movement pattern is detected, sending an alert signal to an output port.

2. The apparatus according to item 1, wherein
5 the movement detection device is adapted for detecting rotational movement of the wrist.
3. The apparatus according to item 1 or 2, wherein
10 the movement detection device comprise an acceleration sensor for detecting linear movement.
4. The apparatus according to one of the above-mentioned items, wherein
15 the movement detection device comprise an gyroscope sensor for detecting rotational movement.
5. The apparatus according to one of the above-mentioned items further comprising
20 a speaker for producing an alert sound according to the alert signal.
6. The apparatus according to one of the above-mentioned items further comprising
25 a vibration unit for producing vibrating movement, according to the alert signal, to the wrist of the driver.
7. A wristwatch comprising
a clock module and
an apparatus, according to one of above-mentioned
30 items, for detecting driver hand on a vehicle steering wheel.
8. A system comprising
a vehicle comprising a steering wheel and

an apparatus according to one of items 1 to 6, the apparatus is provided for detecting driver hand on the steering wheel.

- 5 9. The system according to item 8, wherein the vehicle further comprise a vehicle speaker for producing an alert sound according to an alert signal from the apparatus.
- 10 10. The system according to item 8 or 9 further comprises a string being connected to the apparatus and to an inside part of the vehicle.
11. A method for driving a vehicle, the method comprising
15 providing a movement detection device on a wrist of a driver,
providing data regarding movement of the wrist by the movement detection device,
comparing the wrist movement data with a predetermined wrist movement pattern, and
20 when a deviation of the wrist movement data from the predetermined wrist movement pattern is detected, sending an signal for alerting the driver.
- 25 12. A computer program product stored on a computer readable medium, the computer program product comprising a computer code to perform steps of a method according to item 11 for driving a vehicle.

30 Although the above description contains much specificity, this should not be construed as limiting the scope of the embodiments but merely providing illustration of the foreseeable embodiments. The above stated advantages of the embodiments should not be construed especially as limiting the scope of

the embodiments but merely to explain possible achievements if the described embodiments are put into practice. Thus, the scope of the embodiments should be determined by the claims and their equivalents, rather than by the examples given.

REFERENCE NUMBERS

	10	wristwatch
	12	processor
	15	movement sensor
5	17	memory unit
	20	audio speaker
	21	vehicle
	22	driver hand
	24	driver hand
10	25	steering wheel

CLAIMS

1. An apparatus for detecting driver hand on a vehicle steering wheel, the apparatus comprising
 - 5 a movement detection device being wearable on a wrist of a driver, the movement detection device is provided for detecting movement of the wrist,
 - a processor being adapted for
 - receiving data regarding the detected wrist
 - 10 movement from the movement detection device,
 - comparing the data regarding the detected wrist movement with a predetermined wrist movement pattern, and
 - when a deviation of the data regarding the de-
 - 15 tected wrist movement from the predetermined wrist movement pattern is detected, sending an alert signal to an output port.
2. The apparatus according to claim 1, wherein
 - 20 the movement detection device is adapted for detecting rotational movement of the wrist.
3. The apparatus according to claim 1, wherein
 - 25 the movement detection device comprise an acceleration sensor for detecting linear movement.
4. The apparatus according to claim 1, wherein
 - 30 the movement detection device comprise an gyroscope sensor for detecting rotational movement.
5. The apparatus according to claim 1 further comprising a speaker for producing an alert sound according to the alert signal.

6. The apparatus according to claim 1 further comprising a vibration unit for producing vibrating movement, according to the alert signal, to the wrist of the driver.
- 5 7. A wristwatch comprising
a clock module and
an apparatus, according to claim 1, for detecting driver hand on a vehicle steering wheel.
- 10 8. A system comprising
a vehicle comprising a steering wheel and
an apparatus according to claim 1, the apparatus is provided for detecting driver hand on the steering wheel.
- 15 9. The system according to claim 8, wherein the vehicle further comprise a vehicle speaker for producing an alert sound according to an alert signal from the apparatus.
- 20 10. The system according to claim 8 further comprises a string being connected to the apparatus and to an inside part of the vehicle.
11. A method for driving a vehicle, the method comprising
25 providing a movement detection device on a wrist of a driver,
providing data regarding movement of the wrist by the movement detection device,
comparing the wrist movement data with a predetermined wrist movement pattern, and
30 when a deviation of the wrist movement data from the predetermined wrist movement pattern is detected, sending an signal for alerting the driver.

12. A computer program product stored on a computer readable medium, the computer program product comprising
a computer code to perform steps of a method according to claim 11 for driving a vehicle.

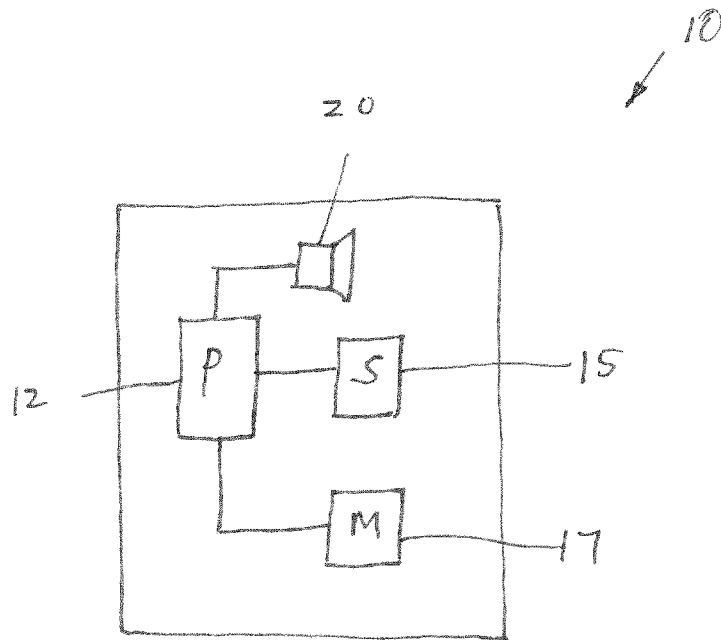


FIG. 1

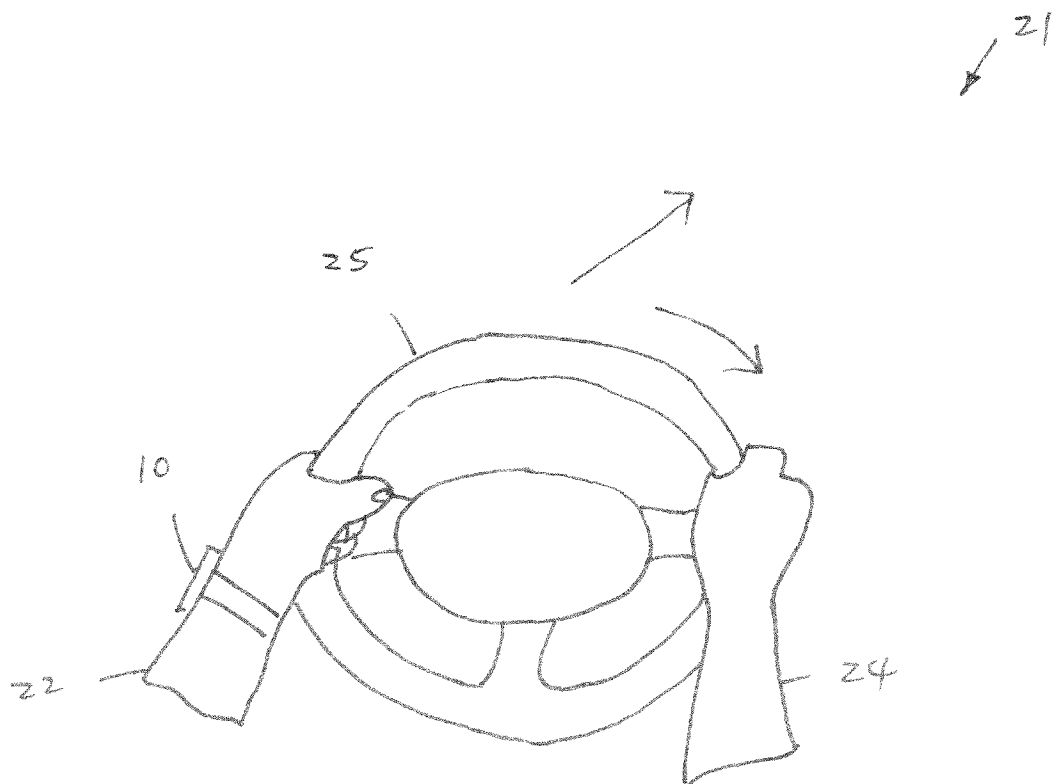


FIG. 2

A. CLASSIFICATION OF SUBJECT MATTER**B60W 50/08(2006.01)i, B60W 40/08(2006.01)i, B60K 28/02(2006.01)i, B62D 1/04(2006.01)i**

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)

B60W 50/08; B60R 25/24; G08B 21/24; H04W 4/02; G09G 5/00; B62D 15/00; B60W 40/08; B60K 28/02; B62D 1/04

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & keywords: vehicle, steering wheel, driver, hand, smart watch, wearable device, detect, and alert

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 9037125 B1 (GOOGLE INC.) 19 May 2015 See abstract, column 5, line 3 - column 6, line 34, column 7, lines 5-15, column 9, line 61 - column 10, line 13, column 33, lines 10-55, claims 1-3, and figures 1-2.	1-12
Y	US 2014-0266692 A1 (INTELLIGENTM) 18 September 2014 See abstract, paragraphs [0026], [0033], [0037], claims 12, 16, and figures 1A-2.	1-12
A	US 8952869 B1 (WEAVER et al.) 10 February 2015 See abstract, claims 1-5, and figures 1-3.	1-12
A	US 2013-0317699 A1 (FORD GLOBAL TECHNOLOGIES, L.L.C.) 28 November 2013 See abstract, paragraphs [0026]-[0030], and figure 2.	1-12
A	KR 10-1509596 B1 (KYUNGPOOK NATIONAL UNIVERSITY INDUSTRY-ACADEMIC COOPERATION FOUNDATION) 08 April 2015 See abstract, claim 1, and figures 1-2.	1-12



Further documents are listed in the continuation of Box C.



See patent family 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 application or patent but published on or after the international filing date

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"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

"&" document member of the same patent family

Date of the actual completion of the international search

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Name and mailing address of the ISA/KR

International Application Division

Korean Intellectual Property Office

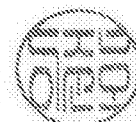
189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea

Facsimile No. +82-42-472-7140

Authorized officer

RHEE, Jun Ho

Telephone No. +82-42-481-8288



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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