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(54) Title: APPARATUS FOR DETERMINING FRUIT BUNCH RIPENESS

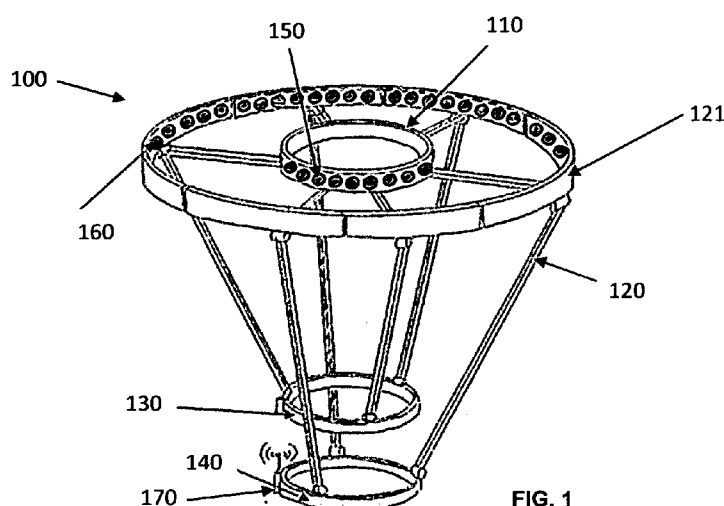


FIG. 1

(57) Abstract: The present invention relates to an apparatus (100) for determining the ripeness of a fruit bunch by detecting the fruit abscission. The apparatus (100) comprises of an inner top ring (110) clamped to a tree trunk; at least two support structures (120) with one end attached to the inner top ring (110) and another end attached to a middle ring (130) or a bottom ring (140), and wherein the two support structures (120) having an outer top ring (121); the middle ring (130) clamped to the tree trunk beneath the inner top ring (110); the bottom ring (140) clamped to the tree trunk beneath the middle ring (130); a plurality of emitters (150) mounted on the inner top ring (110); a plurality of receivers (160) mounted on the outer top ring (121) and aligned to the plurality of emitters (150); a processing means configured to determine the fruit bunch ripeness after detecting fruit abscission; and a power supply.



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## **APPARATUS FOR DETERMINING FRUIT BUNCH RIPENESS**

### **FIELD OF INVENTION**

The present invention relates to an apparatus for determining the ripeness of fruit bunch. More particularly, the present invention relates to an apparatus for  
5 determining the ripeness of fruit bunch by detecting the fruit abscission.

### **BACKGROUND OF THE INVENTION**

Individual fruit of an oil palm fruit bunch ripen in varying time. Fruits at the end  
10 of each spikelet ripen first than those at the base. For extracting an optimum amount and quality of oil content from a fruit bunch, harvesting must be done at the correct time to prevent it from being too early that the oil accumulation in the fruit bunch is not complete or rather too late that the Free Fatty Acid (FFA) content of the oil accumulated in the fruit bunch increases while the oil quality declines. Fruit  
15 abscission is one method to determine oil palm fruit bunch ripeness. However, this method of determining the oil palm fruit bunch ripeness is time consuming and requires rigorous amount of labour to monitor the fruit abscission.

Other method of determining fruit ripeness is through spectral assessment as  
20 disclosed in Japan Pat No. JP8122250. The sunlight scattered by sarcocarp by passing through the rind of a fruit comes to have spectral characteristics based on quality information on sarcocarp due to an integrating sphere effect by the rind of the fruit, and is reradiated to an external space with almost uniform intensity from the whole surface of the rind of the fruit. Then, a light condensing part is pushed against  
25 surfaces of measuring object fruits and vegetables emitted by the sunlight, and the transmitted light of the sunlight is taken out. The taken-out transmitted light is taken out as near infrared two wave length components by spectral filters, and is converted into two electric signals by photo-detectors. Its two electric signals are amplified by variable gain amplifiers, and are inputted to an output indicating part, and the output  
30 intensity ratio of the electric signals is calculated by a comparator, and is displayed on a display unit.

Another apparatus that uses spectral assessment of fruit to determine fruit ripeness is disclosed in PCT Pat No WO0167073. The apparatus comprises a sensor  
35 head positioned adjacent a near infrared light source, the sensor head being coupled

to a spectrometer via fibre optics, the sensor head being positioned close to the periphery of fruit substantially parallel with the light from the light source so that the fibre optics sense only the internally reflected or refracted light emanating from the fruit.

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However, none of the prior arts abovementioned relates to detecting fruit abscission to determine the ripeness of a fruit bunch. Therefore, there is a need to provide an apparatus to detect fruit abscission as an indication of fruit ripeness.

## 10 SUMMARY OF INVENTION

The present invention relates to an apparatus (100) for determining the ripeness of a fruit bunch by detecting the fruit abscission. The apparatus (100) comprises of an inner top ring (110) clamped to a tree trunk; at least two support structures (120) with one end attached to the inner top ring (110) and another end  
15 attached to a middle ring (130) or a bottom ring (140), and wherein the two support structures (120) having an outer top ring (121); the middle ring (130) clamped to the tree trunk beneath the inner top ring (110); the bottom ring (140) clamped to the tree trunk beneath the middle ring (130); a plurality of emitters (150) mounted on the inner top ring (110); a plurality of receivers (160) mounted on the outer top ring (121) and  
20 aligned to the plurality of emitters (150); a processing means configured to determine the fruit bunch ripeness after detecting fruit abscission; and a power supply.

Preferably, the emitters (150) and receivers (160) are infrared emitters and receivers.

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Preferably, the apparatus (100) further comprises a wireless module (170) mounted on the bottom ring (140). The wireless module (170) is used for relaying data from the plurality of receivers (160) to the processing means.

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Preferably, the processing means is a decision support system and it is located at a remote location.

Preferably, each of the at least two support structures (120) comprises an arm structure (122) with one end attachable to the inner top ring (110) and another  
35 end attached to a swivelling means (124); a leg structure (123) with one end

attachable to the middle ring (130) or the bottom ring (140) and another end attached to the swivelling means (124); the swivelling means (124) for allowing the arm structure (122) and the leg structure (123) to rotate vertically for collapsing and expanding the apparatus (100); and an outer top ring part (121a) affixed on the swivelling means (124), wherein the outer top ring part (121a) is able form a single unitary circular structure (121) when the apparatus (100) is assembled together.

Preferably, the middle ring (130) and the bottom ring (140) have a belt-like structure for clamping around a tree trunk.

A method of determining fruit bunch ripeness by detecting fruit abscission using the apparatus (100) comprises the steps of setting up and clamping the apparatus (100) to a tree trunk; emitting light from the plurality of emitters (150) to the plurality of receivers (160) to create a detection area (190); detecting a fruit abscission by detecting light interruption in the detection area (190) when a fruit passes through the detection area (190); identifying the location information of the occurrence of the fruit abscission; transmitting a notification of the occurrence of the fruit abscission and its location to the processing means; and determining by processing means of whether the number of fruit abscised for the location provided is equivalent to the required count of fruit abscission for the fruit bunch to ripen.

Preferably, the identification of the location information further includes the steps of assigning coordinate to each emitter (150); dividing the detection area (190) into sectors (191), wherein each sector (191) is relative to each emitter (150); identifying the sector (191) that the light has been interrupted due to the fruit passes through the detection area (190); and identifying the coordinate of the emitter (150) which is relative to the identified sector (191).

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

**FIG. 1** illustrates an apparatus (100) of determining fruit bunch ripeness in accordance with an embodiment of the present invention.

**FIG. 2** illustrates a top view of the apparatus (100) of **FIG. 1**.

**FIGS. 3(a-b)** illustrate an inner top ring (110) of the apparatus (100) of **FIG. 1**.

**FIG. 4** illustrates a support structure (120) of the apparatus (100) of **FIG. 1**.

**FIG. 5** illustrates a side view of the apparatus (100) with the infrared receivers (150) aligned to the infrared emitters (150) to create a detection area (190).

**FIG. 6** illustrates a middle ring (130) of the apparatus (100) of **FIG. 1**.

**FIG. 7** illustrates a wireless module (170) attached to a bottom ring (140).

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**FIGS. 8(a-b)** illustrate the apparatus (100) of **FIG. 1** in expanded and collapsed positions.

**FIG. 9** illustrates the apparatus (100) of **FIG. 1** clamped to a tree trunk (180).

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**FIG. 10** illustrates the detection area (190) divided into sectors (191).

**FIGS. 11(a-c)** illustrate the detection of fruit abscission within the detection area (190) of the apparatus (100) of **FIG. 1**.

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**FIG. 12** is a flowchart of the operation of the apparatus (100) in accordance with an embodiment of the present invention.

#### **DESCRIPTION OF THE PREFERRED EMBODIMENT**

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A preferred embodiment of the present invention will be described herein below with reference to the accompanying drawings. In the following description, well known functions or constructions are not described in detail since they would obscure the description with unnecessary detail.

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Reference is made initially to **FIG. 1** which illustrates an apparatus (100) for determining fruit bunch ripeness by detecting the fruit abscission. The apparatus (100) comprises of an inner top ring (110), six support structures (120) forming an outer top ring (121), a middle ring (130), a bottom ring (140), a plurality of infrared emitters (150) mounted on the inner top ring (110), a plurality of infrared receivers (160) mounted on the outer top ring (121), a wireless module (170) mounted on the

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bottom ring (140), a power supply (not shown), and a decision support system (not shown). The apparatus (100) is attached to a tree trunk. When a fruit from a fruit bunch drops, the infrared receivers (150) detect the event and transmit it to the decision support system located at a remote area to determine the readiness of the fruit bunch to be harvested and the location of the fruit bunch. A top view of the apparatus (100) is shown in FIG 2. Preferably, the apparatus (100) is made out of material suitable for harsh environment such as but not limited to Acrylonitrile butadiene styrene (ABS) material with acrylic lens and indicator cover to protect the infrared receivers (160) and emitters (150).

Referring now to FIG. 3a, the inner top ring (110) can be dismantled into two parts (110a, 110b). Both of the parts (110a, 110b) are clamped together to a tree trunk through at least two fastening means (111) to produce a single unitary device as illustrated in FIG 3b. The at least two fastening means (111) are located at the end of each part (110a, 110b). At the bottom portion of the inner top ring parts (110a, 110b), six brackets (112) are provided to attach the support structures (120) to the inner top ring (110). The plurality of infrared emitters (150) are mounted and positioned peripherally around the inner top ring (110). This allows the infrared lights to be emitted outwardly from the inner top ring (110). The infrared emitters (150) and infrared receivers (160) are configured to operate at a specific frequency to filter out any other infrared light emitted from other sources during detection of fruit abscission. Preferably, the infrared emitters (150) and receivers (160) operate at a frequency of 40 KHz.

FIG. 4 illustrates a supporting structure (120) which includes an arm structure (122), a leg structure (123), a swivelling means (124), and an outer top ring part (121a). The arm structure (122) has one end connected to the swivelling means (124) for vertically rotating the arm structure (122). At another end of the arm structure (122), there is provided a connecting portion (125) for slotting into the bracket (112) of the inner top ring (110). Similarly, the leg structure (123) has one end connected to the swivelling means (124) and another end having a connecting portion (126) to affix to either the middle ring (130) or bottom ring (140). The swivelling means (124) allows the arm structure (122) and the leg structure (123) to rotate vertically for collapsing and expanding the apparatus (100). The outer ring part (121a) is affixed to the swivelling means (124). The outer top ring part (121a) forms a

single unitary outer top ring (121) when the supporting structures (120) are assembled together as illustrated in FIG. 1.

The outer top ring part (121a) is mounted with a plurality of infrared receivers (160). The infrared receivers (160) are positioned peripherally around the inner layer of the outer top ring part (121a) and are aligned to receive the infrared light emitted by the infrared emitters (150) of the inner top ring (110). The alignment of the infrared receivers (160) of the outer top ring (121) is done by adjusting the leg structure (123) so that the arm structures (122) are perpendicular to the tree trunk. FIG. 5 illustrates a side view of the apparatus (100) with the infrared receivers (160) aligned to the infrared emitters (150) to create a detection area (190) for detecting fruit abscission from the fruit bunch. The infrared receivers (160) include a band-pass filter to reject any other light energy or unwanted data signals which are not modulated at a specific band-pass filter center frequency and thus, detecting only the infrared light emitted by the infrared receivers (160) at a specific frequency. The infrared emitters (150) and receivers (160) are also configured to have an adaptive power output levels to compensate for variations in ambient lighting conditions. In dark lighting condition, the infrared receivers (160) increase the gain of its internal amplifier circuit whereas in bright lighting condition, the infrared receivers (160) reduce the gain of its internal amplifier circuit to filter out false output pulses from the infrared receivers (160) output.

Referring now to FIG. 6, the middle ring (130) has a belt-like structure. The middle ring (130) has a locking tab at one end portion and another end portion having a plurality of longitudinally spaced apart openings extending from the end back to a desired distance. The locking tab is slotted through one of the openings to facilitate proper adjustment of the encircled middle ring (130) around a tree trunk.

The bottom ring (140) has a similar structure to the middle ring (130) and it is attached with the wireless module (170) as illustrated in FIG. 7. The wireless module (170) is configured to relay a sensing data from the infrared receivers (160) to the decision support system for further processing to determine the ripeness of the fruit bunch. The sensing data includes event notification data of the light interrupted due to fruit abscission, and location coordinates of the fruit abscission that occurred. The

sensing data can either be relayed directly to the decision support system or through a base station.

When the apparatus (100) is clamped to a tree trunk (180), the apparatus  
5 (100) can be configured to an expanded position or a collapsible position. FIG. 8a illustrates the apparatus (100) in an expanded position whereby the arm structures (122) are perpendicular to the tree trunk (180). Thus, this aligns the infrared receivers (160) to the infrared emitters (150) for detecting the emitted infrared light. In the expanded position, the apparatus (100) is readily detecting the fruit abscission from a  
10 fruit bunch.

During non-active operation, the apparatus (100) is configured to a collapsible position as illustrated in FIG. 7b. In such position, the middle ring (130) and bottom ring (140) are pulled downwards and thus, the outer top ring parts (121) are  
15 separated from each other and deforming a unitary circular structure.

When the apparatus (100) is clamped to a tree trunk (180) and it is in expanded position as illustrated in FIG. 9, the detection area (190) is created in between the infrared receivers (160) and the infrared emitters (150). The detection  
20 area (190) can further be divided into sectors (191) as shown in FIG. 10. The number of sectors (191) is dependent on the number of infrared emitters (150) used. Each emitter (150) is assigned with a coordinate and preferably, a Cartesian coordinate system is used to define the position of each infrared emitter (150) relative to the tree position. Each sector (191) is defined from each infrared emitter (150).

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Referring now to FIG. 11a, when a fruit (181) drops from its fruit bunch (182), the fruit (181) passes through the detection area (190) of the apparatus (100). In the detection area (190), the fruit (181) interrupts the infrared light emitted from an infrared emitter (150) to the infrared receivers (160) as illustrated in FIGS. 11(b-c).  
30 This changes the intensity of light received by the infrared receivers (160) and thus, the sector (191) that the fruit (181) dropped is determined. Since each sector (191) is relative to each infrared emitter (150), the coordinate of the infrared emitter (150) from which the light has been interrupted is identified and transmitted to the decision support system. If a particular sector (191) has detected at least 10 fruit abscission,

the decision support system notifies that the location information of the ripen fruit bunch.

**FIG. 12** is a flowchart of the operation of the apparatus (100) to determine fruit bunch ripeness. Initially, as in step 201, the apparatus (100) is clamped to a tree trunk (180) and positioned near the fruit bunch (182). The apparatus (100) is positioned in a manner that the detection area (190) covers most of the possible fruit (181) drop zones. Step 201 also includes aligning the infrared receivers (160) to the infrared emitters (150). Thereon, in step 202, all electrical connections of the apparatus (100) is established which includes supplying power to the electrical connection, establishing the wireless connection between the apparatus (100) and the decision support system, configuring the detection of infrared light emitted by the infrared emitters (150) to the infrared receivers (160), and establishing the connection between the infrared receivers (160) to the wireless module (170). Once all of the connections have been established, the infrared emitters (150) emit infrared light to the infrared receivers (160) to create the detection area (190).

In decision 203, if there is no fruit abscission detected within the detection area (190), the infrared emitters (150) remain emitting infrared light to the infrared receivers (160) as in step 204.

If a fruit (181) abscises from its fruit bunch (182) into the detection area (190), the infrared light within a sector (191) of the detection area (190) is interrupted and the coordinate of the infrared emitter (150) from which the light has been interrupted is determined (decision 203 and step 205). Thereon, the coordinate of the infrared emitter (150) is transmitted to the wireless module (170) as in step 206. In step 207, the wireless module (170) transmits a sensing data which includes event notification data of fruit abscission, and the coordinate of the infrared emitter (150) to the decision support system. The decision support system analyses the data into coordinate tracking system as depicted in step 208.

If the decision support system determines that the infrared emitter's coordinate has detected at least 10 fruit abscission, the decision support system notifies the location information of the ripen fruit bunch (decision 209 and step 210).

Otherwise, the decision support system records the count of fruit abscission for the infrared emitter's coordinate (decision 209 and step 211).

5 During harvesting of the ripen fruit bunch, the apparatus (100) is collapsed by sliding the bottom and middle rings (130, 140) downwards. This is to prevent damaging the apparatus (100) or bruising the fruit bunch (182) when fruit bunch (182) drops during harvesting.

10 Although described in the description that the infrared emitters (150) and infrared receivers (160) are used to detect the fruit abscission, the infrared emitters (150) and receivers (160) can be substituted with any other sensor device capable of detecting an opaque object passing through a detection area. Non-limiting example of the device may include ultrasound sensor, capacitive sensor.

15 Furthermore, although in the description, the apparatus (100) is described of having six supporting structures (120), the apparatus (100) can be provided with at least two supporting structures (120) as long as the number of supporting structures (120) are capable to form a circular structure of the outer top ring (121) and are capable to collapse when the bottom ring (140) and middle ring (130) are pulled  
20 downwards.

Furthermore, although described in the description that the decision support system counts 10 fruit abscission to determine the fruit bunch ripeness, the count is exemplary only and may be modified as required within the scope of the invention.

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While embodiments of the invention have been illustrated and described, it is not intended that these embodiments illustrated and describe all possible forms of the invention. Rather, the words used in the specifications are words of description rather than limitation and various changes may be made without departing from the  
30 scope of the invention.

**CLAIMS**

1. An apparatus (100) for determining the ripeness of a fruit bunch characterized in that the apparatus (100) comprising:
  - a. an inner top ring (110), wherein the inner top ring (110) is clamped to a tree trunk;
  - b. at least two support structures (120), wherein one end of the at least two support structures (120) are attached to the inner top ring (110) and another end is attached to a middle ring (130) or a bottom ring (140), and wherein the two support structures (120) having an outer top ring (121);
  - c. the middle ring (130), wherein the middle ring (130) is clamped to the tree trunk;
  - d. the bottom ring (140), wherein the middle ring (140) is clamped to the tree trunk;
  - e. a plurality of emitters (150), wherein the plurality of emitters (150) are mounted on the inner top ring (110);
  - f. a plurality of receivers (160), wherein the plurality of receivers (160) are mounted on the outer top ring (121), and wherein the plurality of receivers (160) are aligned to the plurality of emitters (150);
  - g. a processing means, wherein the processing means is configured to determine the fruit bunch ripeness after detecting fruit abscission; and
  - h. a power supply.
2. An apparatus (100) as claimed in claim 1, wherein the emitters (150) and receivers (160) are infrared emitters and receivers.
3. An apparatus (100) as claimed in claim 1, wherein the apparatus (100) further comprises a wireless module (170) mounted on the bottom ring (140), and

wherein the wireless module (170) is for relaying data from the plurality of receivers (160) to the processing means.

4. An apparatus (100) as claimed in claim 1, wherein the processing means is a decision support system, and wherein the processing means is provided at a remote location.
5. An apparatus (100) as claimed in claim 1, wherein each of the at least two support structures (120) comprising:
  - 10 a. an arm structure (122), wherein one end is attachable to the inner top ring (110) and another end attached to a swivelling means (124);
  - b. a leg structure (123), wherein one end is attachable to the middle ring (130) or the bottom ring (140) and another end attached to the swivelling means (124);
  - 15 c. the swivelling means (124), wherein the swivelling means (124) allows the arm structure (122) and the leg structure (123) to rotate vertically for collapsing and expanding the apparatus (100); and
  - 20 d. an outer top ring part (121a), wherein the outer top ring part (121a) is affixed on the swivelling means (124), and wherein the outer top ring part (121a) is able form a single unitary circular structure (121) when the apparatus (100) is assembled together.
- 25 6. An apparatus (100) as claimed in claim 1, wherein the middle ring (130) and the bottom ring (140) have a belt-like structure for clamping around a tree trunk.
- 30 7. A method of determining fruit bunch ripeness by detecting fruit abscission using the apparatus (100) as claimed in any of the claims 1 to 5, characterized by the steps of:
  - a. setting up and clamping the apparatus (100) to a tree trunk;

- 5                   b. emitting light from the plurality of emitters (150) to the plurality of receivers (160) to create a detection area (190);
- c. detecting a fruit abscission by detecting light interruption in the detection area (190) when a fruit passes through the detection area (190);
- 10                  d. identifying the location information of the occurrence of the fruit abscission;
- e. transmitting a notification of the occurrence of the fruit abscission and its location to the processing means;
- 15                  f. determining by processing means of whether the number of fruit abscised for the location provided is equivalent to the required count of fruit abscission for the fruit bunch to ripen.
8.           A method as claimed in step d of claim 7, wherein identification of the location information further includes the steps of:
- 20                  a. assigning coordinate to each emitter (150);
- b. dividing the detection area (190) into sectors (191), wherein each sector (191) is relative to each emitter (150);
- 25                  c. identifying the sector (191) that the light has been interrupted due to the fruit passes through the detection area (190);
- d. identifying the coordinate of the emitter (150) which is relative to the identified sector (191).

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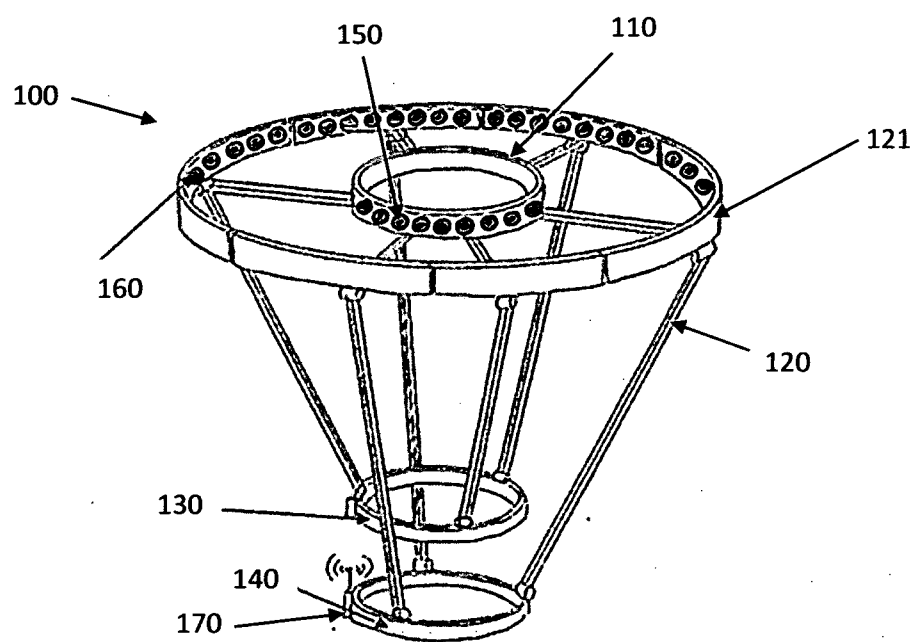


FIG. 1

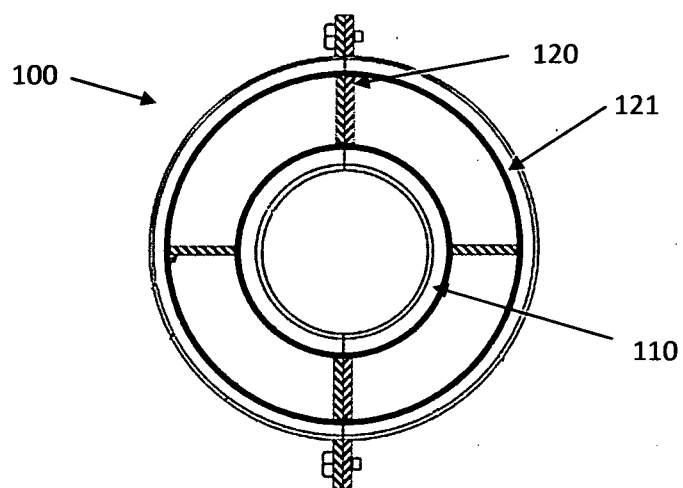


FIG. 2

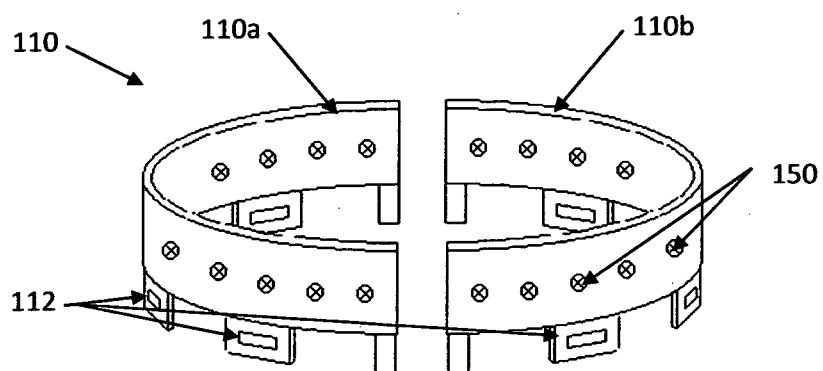


FIG. 3a

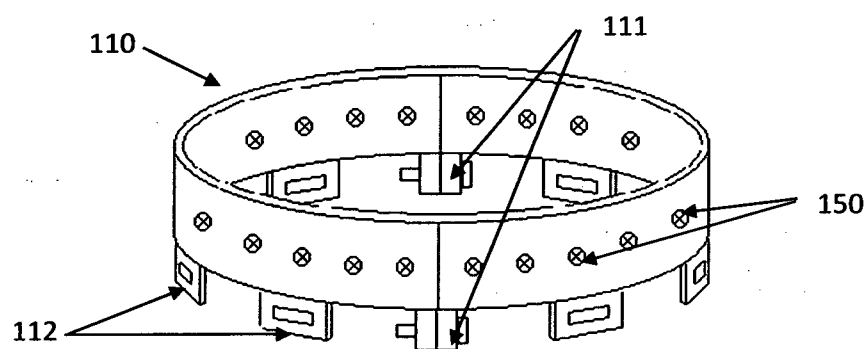


FIG. 3b

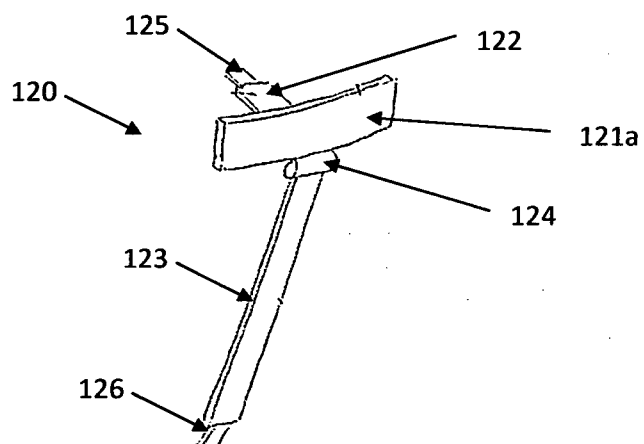


FIG. 4

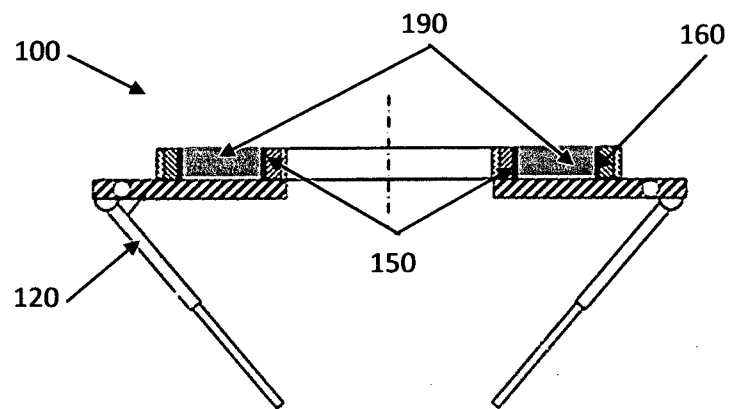


FIG. 5

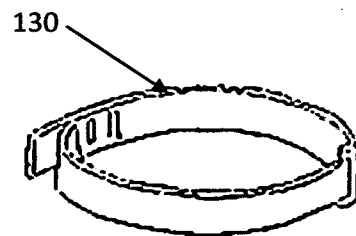


FIG. 6

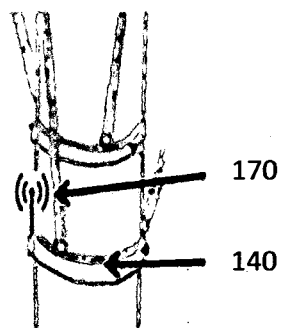


FIG. 7

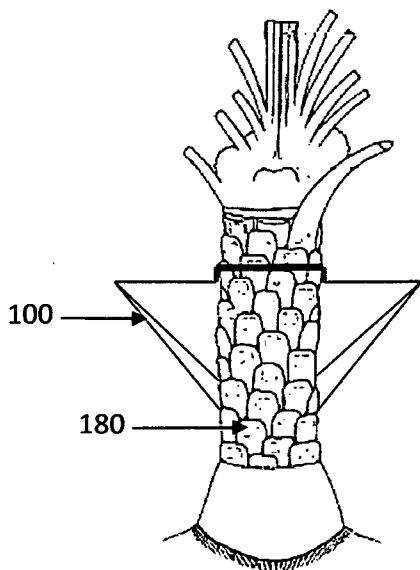


FIG. 8a

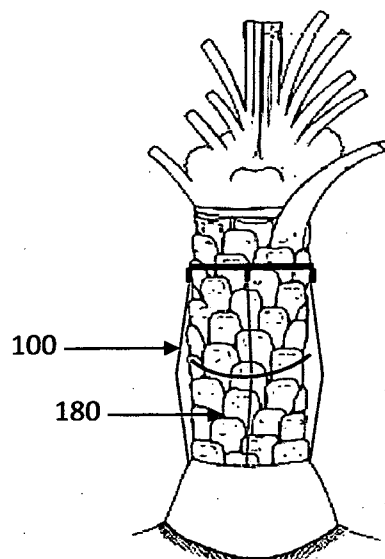


FIG. 8b

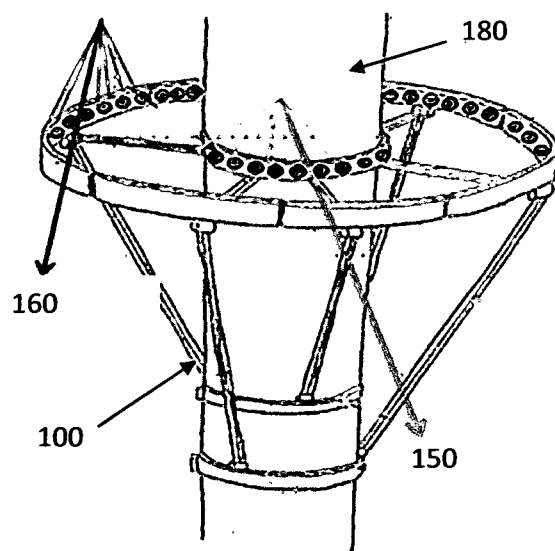


FIG. 9

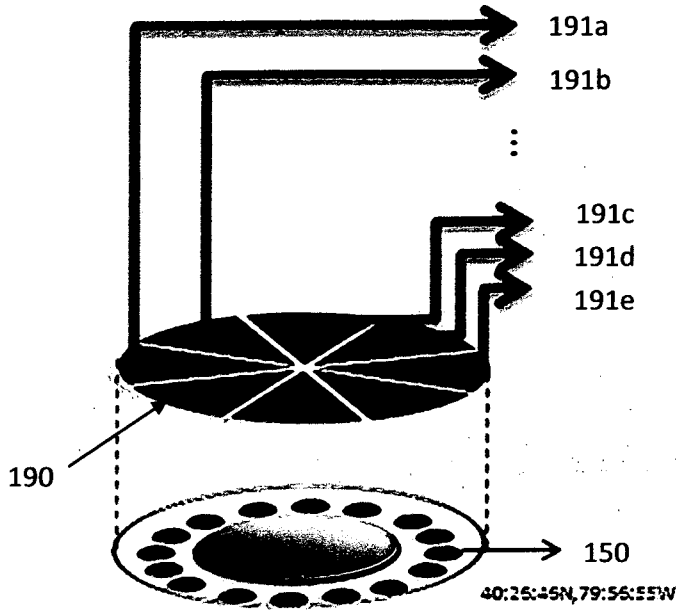


FIG. 10

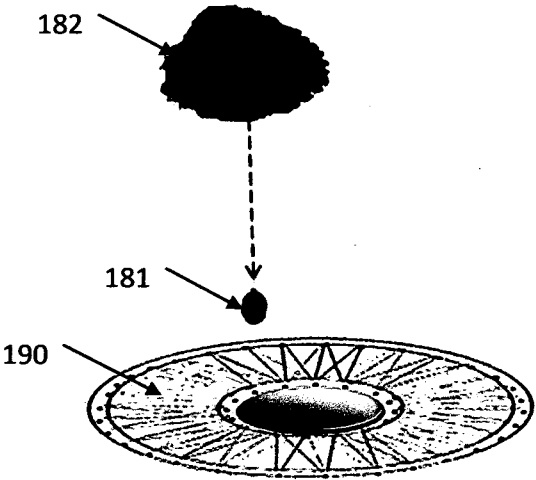
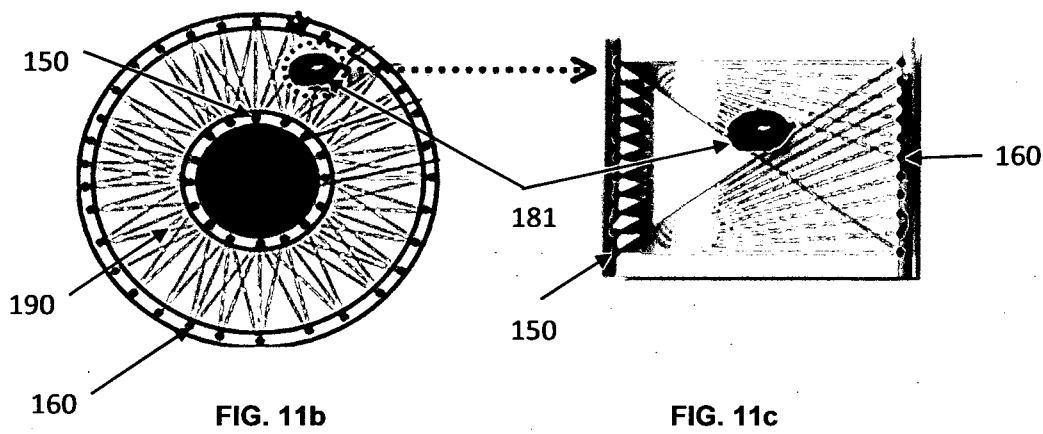


FIG. 11a



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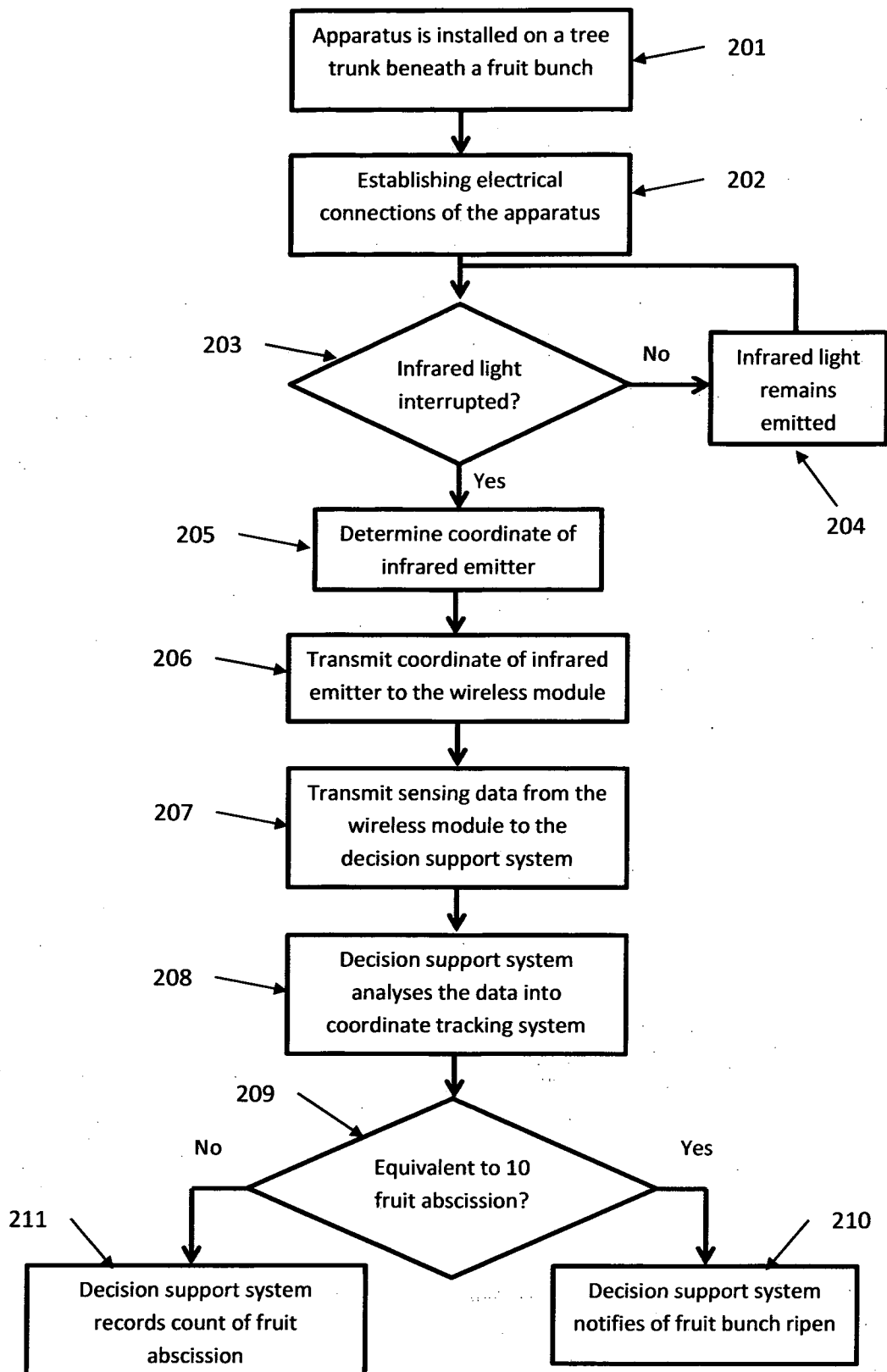


FIG. 12

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/MY2011/000072

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                       |                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| A. CLASSIFICATION OF SUBJECT MATTER                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                       |                                                                                                                                                |
| Int. Cl.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                       |                                                                                                                                                |
| A01D 46/00 (2006.01) G01N 21/84 (2006.01) G01N 33/00 (2006.01)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                       |                                                                                                                                                |
| 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)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                       |                                                                                                                                                |
| 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)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                       |                                                                                                                                                |
| WPI, EPODOC: absciss+, ripe+, fall+, drop+, shed+, fruit+, palm, bunch+, A01D46/IC/EC, detect+, sens+, check+, assess+, G01N/IC/EC, tree?, trunk?, clamp+, collar+, ring, mount+, and similar terms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                       |                                                                                                                                                |
| C. DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                       |                                                                                                                                                |
| Category*                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Citation of document, with indication, where appropriate, of the relevant passages                                    | Relevant to claim No.                                                                                                                          |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | AU 2008200703 A1 (CHUNG KUO PING @ RICHARD) 28 August 2008<br>Abstract                                                |                                                                                                                                                |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | GB 114673 A (LEVER BROTHERS LIMITED et al) 17 April 1918<br>Page 1-3, Fig 1-2                                         |                                                                                                                                                |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Patent Abstracts of Japan, JP 2003-000031 A (BIO ORIENTED TECHNOL RES<br>ADVANCEMENT INST) 7 January 2003<br>Abstract |                                                                                                                                                |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Patent Abstracts of Japan, JP 07-229834 A (TECHNO ISHII:KK) 29 August 1995<br>Abstract                                |                                                                                                                                                |
| <input type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                       |                                                                                                                                                |
| * Special categories of cited documents:<br>"A" document defining the general state of the art which is not considered to be of particular relevance<br>"E" earlier application or patent but published on or after the international filing date<br>"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)<br>"O" document referring to an oral disclosure, use, exhibition or other means<br>"P" document published prior to the international filing date but later than the priority date claimed<br>"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<br>"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<br>"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<br>"&" document member of the same patent family |                                                                                                                       |                                                                                                                                                |
| Date of the actual completion of the international search<br>11 August 2011                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                       | Date of mailing of the international search report<br>12.08.2011                                                                               |
| Name and mailing address of the ISA/AU<br>AUSTRALIAN PATENT OFFICE<br>PO BOX 200, WODEN ACT 2606, AUSTRALIA<br>E-mail address: pct@ipaaustralia.gov.au<br>Facsimile No. +61 2 6283 7999                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                       | Authorized officer<br><b>Ian Barrett</b><br>AUSTRALIAN PATENT OFFICE<br>(ISO 9001 Quality Certified Service)<br>Telephone No : +61 2 6283 2189 |

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/MY2011/000072**

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

| Patent Document Cited in<br>Search Report                                                                                 |            | Patent Family Member |
|---------------------------------------------------------------------------------------------------------------------------|------------|----------------------|
| AU                                                                                                                        | 2008200703 | NONE                 |
| GB                                                                                                                        | 114673     | NONE                 |
| JP                                                                                                                        | 2003000031 | NONE                 |
| JP                                                                                                                        | 7229834    | NONE                 |
| Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001. |            |                      |
| END OF ANNEX                                                                                                              |            |                      |