

METHOD AND SYSTEM FOR MONITORING AND MEASURING WEAR AND TEAR CONDITIONS OF VEHICLE TYRES

Field of the Invention

[0001] The present invention relates to a method and system for monitoring and measuring wear and tear condition of vehicle tyres. In particular, this invention relates to a method and system for monitoring and measuring the depths of treads and grooves in tyres to determine the wear and tear condition of the vehicle tyres using radio frequency communication.

Background of the Invention

[0002] All vehicle tyres have treads and grooves for displacing water on wet grounds away for better contact between the tyres and the ground. Treads and grooves on tyres nowadays have the ability of displacing water away at a rate up to 40 litres per minute at vehicular speed of 100 kilometres per hour.

[0003] The ability of the tyres to displace water and provide better grip depends very much on the depth of the tyre treads. In the event that the tyre is worn, the depth of the tyre treads is greatly reduced, resulting in the reduction in the tyre's capability to displace water away. Consequently, accidents on wet roads may occur for vehicles with worn out tyres, as vehicles with worn out tyres tend to skid and slide out of control.

[0004] It is therefore extremely important that the wear and tear condition of tyres are monitored and checked regularly for the safety reasons. A tyre is considered "bald" or worn out when one or more of its treads or grooves is reduced to its critical depth, which is normally 2/32 inch in depth. In comparison, a new tyre normally has treads or grooves having depths averaging at about 10/32 inch. When the critical depth of the treads or grooves is reached, it is strongly advisable that the driver replaces the worn out tyre with a new one.

[0005] There are a few methods for checking the wear and tear conditions of tyres. Tyre manufacturers have made inspecting bald tyres easier by placing moulded horizontal bars at the bottom of the grooves. As the surface of the tyres is worn off due to use, the depth of the grooves decreases. The moulded horizontal bars are substantially of a thickness corresponding with the critical depth of the treads and grooves. When the depth of the treads and grooves has decreased to the critical depth, the horizontal bars are visible to the eye as the surface of the tyre is at the same level as the surfaces of the moulded horizontal bars. Through visual inspection, one can then determine whether the tyre ought to be changed by looking out for visible features of the moulded horizontal bars. This method is unreliable and requires the driver to visually inspect tyres regularly.

[0006] Another method for checking for bald tyres is to use a tread depth gauge. Using a tread depth gauge can be tedious and the driver has to conduct checks regularly to ensure that the tyres are not worn out or turned bald. Both methods discussed so far require professional mechanics to conduct the checks. These methods are time consuming and costly especially when they involve professional mechanics to conduct the checks.

[0007] Therefore, a need clearly exists for a method and system for monitoring and measuring the wear and tear condition of vehicle tyres without the disadvantages discussed above. The present invention seeks to provide a method and system for monitoring and measuring wear and tear condition of vehicle tyres and alert the user once a bald tyre is detected. Drivers do not have to conduct checks on their vehicle tyres at regular intervals, thereby avoiding the inconvenience associated with these checks.

Summary of the Invention

[0008] The present invention seeks to provide a system for monitoring and measuring wear and tear condition of vehicle tyres, the system comprising a vehicle tyre and at least one identifying means. The vehicle tyre comprises an outer circumferential surface that comes into contact with the ground; and a plurality of treads and grooves formed on the outer circumferential surface. The at least one identifying means each comprises a top

surface, a bottom surface and a plurality of embedded RFID tag layers therebetween, wherein the at least one identifying means is disposed at the outer circumferential surface of the vehicle tyre.

[0009] Accordingly, in one aspect, the present invention provides a method for monitoring and measuring wear and tear condition of vehicle tyres, the method comprising steps of a) providing a vehicle tyre comprising an outer circumferential surface that comes into contact with the ground; and a plurality of treads and grooves formed on the outer circumferential surface; b) providing at least one identifying means comprising a top surface; a bottom surface; and a plurality of embedded RFID tag layers therebetween, each of the plurality of embedded RFID tag layers is disposed one above the other at a predetermined distance from each other within each of the at least one identifying means; and c) disposing the at least one identifying means at the outer circumferential surface of the vehicle tyre.

Brief Description of the Drawings

[0010] A preferred embodiment of the present invention will now be more fully described, by way of example, with reference to the drawings of which:

[0011] FIG. 1 illustrates a schematic diagram of a tyre;

[0012] FIG. 2 illustrates an enlarged view of a portion of surface of the tyre of FIG. 1;

[0013] FIG. 3 illustrates a perspective view of an embodiment of the present invention;

[0014] FIG. 4 illustrates a perspective view of another embodiment of the present invention; and

[0015] FIG. 5 illustrates a cross sectional view along line A – A' of the embodiment of the present invention in FIG. 4.

Detailed Description of the Drawings

[0016] In the following description, details are provided to describe the embodiments in accordance with the present invention. It shall be apparent to one skilled in the art, however, that the invention may be practiced without such details. Some of these details may not be described at length so as not to obscure the invention.

[0017] The method and system in accordance with the present invention use radio frequency communication to monitor the wear and tear condition of a vehicle tyre. In the preferred embodiment, a passive Radio Frequency Identification (RFID) transponder is used to communicate with a RFID transceiver to monitor the wear and tear condition of the vehicle tyre. The passive RFID transponder, which requires no power source, receives and responds to radio frequency queries from an RFID transceiver (not shown in drawings). A bald tyre is detected by the RFID transceiver when there is no signal detected by the RFID transceiver and the driver is thus alerted. This saves the driver the hassle of checking the wear and tear condition of the vehicle tyres regularly.

[0018] Referring to FIG. 1, an illustration is shown of a typical vehicle tyre 100 that may be used in the present invention. The tyre 100 is typically circular and made of rubber. The tyre 100 comprises an outer circumferential surface 110 and an inner circumferential surface 120. A plurality of treads 130 and grooves 140 are formed on the outer circumferential surface 110 to disperse water on a wet ground when the tyre 100 comes into contact with the ground. When fixed to a vehicle rim (not shown) under pressure, the inner circumferential surface 120 is in contact with the vehicle rim, whereas the outer circumferential surface 110 is in contact with the ground.

[0019] Referring to FIG. 2, an enlarged perspective view of a portion of the outer circumferential surface 110 is shown. The outer circumferential surface 110 is shown having a plurality of treads 130 and grooves 140. In the present invention, an identifying means (not shown in FIG. 2) is disposed within one of the treads 130 or grooves 140 for monitoring reduction in depths of the treads 130 and grooves 140. The identifying means may also be disposed within the area of the outer circumferential surface 110 defined by

the plurality of treads 130 and grooves 140, beneath the outer circumferential surface 110, for monitoring the reduction in the depth of the treads 130 and grooves 140.

[0020] Referring to FIG. 3, a perspective view of an embodiment of the present invention is shown. At least one identifying means 300 is securely disposed within the plurality of treads 130 and grooves 140. The identifying means 300 may be securely disposed within a junction formed by a tread 130 and a groove 140, or within the tread 130 or the groove 140. The identifying means 300 comprises a top surface 320, a bottom surface 350 and a plurality of embedded RFID tag layers 310 therebetween. Each embedded RFID tag layer 310 is disposed one above the other at a predetermined distance from each other. The length of the identifying means 300 from the top surface 320 to the bottom surface 350 corresponds with the depth of the plurality of treads 130 and grooves 140.

[0021] The embedded RFID tag layer 310 each corresponds with a predetermined depth of the tread 130. The top surface 320 of the identifying means 300 is at the same level as the outer circumferential surface 110 when the identifying means 300 is securely disposed within one of the treads 130.

[0022] The identifying means 300 may be secured within tread 130 by means of adhesive material such as rubber glue. The adhesive material can be applied to all surfaces of identifying means 300 before securely attached within thread 130. The surfaces of identifying means 300 must also be jagged to increase the frictional factor between the surfaces of identifying means 300 and tread 130. The adhesive material must be dry to ensure that the identifying means 300 is securely disposed within the tread 130 before the tyre is ready for use.

[0023] As the tyre 100 is being used, wear and tear will occur on both the outer circumferential surface 110 of the tyre 100 and the identifying means 300. Over a period of time, the plurality of embedded RFID tag layers 310 is worn off layer by layer together with the outer circumferential surface 110 of the tyre 100 due to use. The wearing off of the embedded RFID tag layers 310 starts from an outer most embedded

RFID tag layer 330, which is nearest to the outer circumferential surface 110 of the tyre in contact with the ground, to the lowest embedded RFID tag layer 340 nearest to the bottom surface 350. The remaining outer most embedded RFID tag layer 310, which is not worn off or damaged due to wear and tear, is at a predetermined depth that corresponds with the depth of the tread 130.

[0024] When an RFID transceiver (not shown) is placed near the identifying means 300, the RFID transceiver receives up signal from each remaining embedded RFID tag layer 310 of the identifying means 300 that is not worn out or damaged. The worn out or damaged embedded RFID tag layers 310, which signals are not received by the transceiver, indicate that those embedded RFID tag layers 310 are already worn out. The driver is thus able to determine the depth of the tread 130 as the remaining embedded RFID tag layers 310, which signals are received by the RFID transceiver, correspond to a predetermined depth of the tread 130.

[0025] Referring to FIG. 4, a perspective view of another embodiment of the present invention is shown. An identifying means 400 comprises a top surface 420, a bottom surface 450 and a plurality of embedded RFID tag layers 410 therebetween. Each embedded RFID tag layer 410 is disposed one above the other at a predetermined distance from each other.

[0026] In the example shown, the identifying means 400 is cylindrical and made of rubber. The outer circumferential surface 110 is having at least one cavity 430 each for housing the identifying means 400 therein. The dimensions of each cavity 430 correspond with the dimensions of each identifying means 400. In particular, the length of the identifying means 400 from the top surface 420 to the bottom surface 450 corresponds with the depth of the plurality of treads 130 and grooves 140. When the identifying means 400 is securely disposed within the at least one cavity 430, the top surface 420 of identifying means 400 is at the same level as the outer circumferential surface 110.

[0027] The identifying means 400 may be secured within cavity 430 by means of adhesive material such as rubber glue. The adhesive material can be applied to all surfaces of identifying means 400 before securely attached within cavity 430. The surfaces of identifying means 400 must also be jagged to increase the frictional factor between the surfaces of identifying means 400 and cavity 430. The adhesive material must be dry to ensure that the identifying means 400 is securely disposed within the cavity 430 before the tyre is ready for use.

[0028] Referring to FIG. 5, a cross sectional view along line A – A' of the embodiment of the present invention in FIG. 4 is shown. Each embedded RFID tag layer 410 corresponds with a predetermined depth of the tread 130.

[0029] As the tyre 100 is being used, wear and tear will occur on both the outer circumferential surface 110 of the tyre 100 and the identifying means 400. Over a period of time, the plurality of embedded RFID tag layers 410 is worn off layer by layer together with the outer circumferential surface 110. The wearing out of the embedded RFID tag layers 410 starts from the outer most embedded RFID tag layer 460, which is nearest to the outer circumferential surface 110 of the tyre, to the lowest embedded RFID tag layer 440 nearest to the bottom surface 450. The remaining outer most embedded RFID tag layer 410, which is not worn out or damaged due to wear and tear, is at a predetermined depth that corresponds with the depth of the tread 130.

[0030] When an RFID transceiver (not shown) is placed near the identifying means 400, the RFID transceiver receives up signal from each remaining embedded RFID tag layer 410 of the identifying means 400 that has not been worn off or damaged. The worn out or damaged embedded RFID tag layers 410, which signals are not received by the RFID transceiver, indicate that those embedded RFID tag layers 410 are already worn out. The driver is thus able to determine the depth of the tread 130 as the remaining embedded RFID tag layers 410, which signals are received by the RFID transceiver, correspond to a predetermined depth of the tread 130.

[0031] The RFID transceiver may be connected to a computer mounted on the vehicle. A critical embedded RFID tag layer 340, 440 corresponds with the critical depth of the tread 130 and grooves 140. When the critical embedded RFID tag layer 340, 440 is worn out or damaged, the RFID transceiver is unable to receive any signal from the worn out or damaged critical embedded RFID tag layer 340. The absence of signal from the critical embedded RFID tag layer 340, 440 triggers the computer to send an alarm to alert the driver of a need to change the tyre. The alarm may be in the form of a visual indicator on the dashboard of the vehicle.

[0032] Instead of having a computer mounted onto the vehicle, the computer having a RFID transceiver connected thereto may be placed at petrol kiosk or car repair garages for drivers to conduct regular checks on their own. The computer is able to provide information of the depth of the plurality of treads 130 and grooves 140 based on the signals received from the plurality of embedded RFID tag layers 310, 410 that are not worn out or damaged. Each of the plurality of embedded RFID tag layers 310, 410 corresponds to a predetermined depth of the plurality of treads 130 and grooves 140. The signals received by the RFID transceiver from the plurality of embedded RFID tag layers 310, 410 that are not worn out or damaged will indicate the depth of the plurality of treads 130 and grooves 140.

[0033] It will be appreciated that although one preferred embodiment has been described in detail, various modifications and improvements can be made by a person skilled in the art without departing from the scope of the present invention.

Claims

1. A system for monitoring and measuring wear and tear condition of vehicle tyres, the system comprising:
 - a vehicle tyre comprising:
 - an outer circumferential surface that comes into contact with the ground;
 - and
 - a plurality of treads and grooves formed on the outer circumferential surface; and
 - at least one identifying means each comprising:
 - a top surface;
 - a bottom surface; and
 - a plurality of embedded RFID tag layers therebetween;
 - wherein at least one identifying means is disposed at the outer circumferential surface of the vehicle tyre.
2. The system of claim 1, wherein the at least one identifying means is disposed within one of the plurality of treads and grooves.
3. The system of claim 2, wherein the top surface of the at least one identifying means is at the same level as the outer circumferential surface of the tyre when the at least one identifying means is disposed within one of the plurality of treads and grooves.
4. The system of claim 1, wherein the outer circumferential surface is further having at least one cavity for housing the at least one identifying means therein.
5. The system of claim 4, wherein the at least one identifying means is disposed within the at least one cavity.
6. The system of claim 5, wherein the top surface of the at least one identifying means is at the same level as the outer circumferential surface of the tyre when the at least one identifying means is disposed within the at least one cavity.

7. The system of claim 1, wherein each of the plurality of embedded RFID tag layers is disposed one above the other at a predetermined distance from each other within each of the at least one identifying means.
8. The system of claim 7, wherein each of the plurality of embedded RFID tag layers corresponds with a predetermined depth of the plurality of treads and grooves.
9. The system of claim 8, wherein the system further comprises an RFID transceiver for receiving signals from the plurality of embedded RFID tag layers that are not worn out or damaged.
10. The system of claim 9, wherein the plurality of embedded RFID tag layers further comprises a critical embedded RFID tag layer, the critical embedded RFID tag layer corresponds with a critical depth of the plurality of treads and grooves that renders a change of tyre when the depth of the plurality of treads and grooves is reduced to the critical depth due to wear and tear.
11. The system of claim 10, wherein the RFID transceiver is connected to a computer mounted on a vehicle, the computer sends an alarm when the RFID transceiver is unable to receive a signal from the critical embedded RFID tag layer.
12. The system of claim 9, wherein the RFID transceiver is connected to a computer, the computer provides information of the depth of the plurality of treads and grooves based on the signals received from the plurality of embedded RFID tag layers that are not worn out or damaged, thereby determining the wear and tear condition of the tyre.
13. The system of claim 1, wherein the length of the identifying means, from the top surface to the bottom surface, corresponds with the depth of the plurality of treads and grooves.

14. The system of claim 1, wherein the identifying means is having jagged surfaces for higher frictional contact.

15. A method for monitoring and measuring wear and tear condition of vehicle tyres, the method comprising steps of:

a) providing a vehicle tyre comprising:

an outer circumferential surface that comes into contact with the ground;

and

a plurality of treads and grooves formed on the outer circumferential surface;

b) providing at least one identifying means comprising:

a top surface;

a bottom surface; and

a plurality of embedded RFID tag layers therebetween, each of the plurality of embedded RFID tag layers is disposed one above the other at a predetermined distance from each other within each of the at least one identifying means; and

c) disposing the at least one identifying means at the outer circumferential surface of the vehicle tyre.

16. The method of claim 15, wherein the method further comprising a step of d) providing an RFID transceiver for receiving signals from the plurality of embedded RFID tag layers that are not worn out or damaged.

17. The method of claim 16, wherein the step b) further comprising:

b1) providing a critical embedded RFID tag layer between the top surface and the bottom surface of the at least one identifying means, the critical embedded RFID tag layer corresponds with a critical depth of the plurality of treads and grooves that renders a change of tyre when the depth of the plurality of treads and grooves is reduced to the critical depth due to wear and tear.

18. The method of claim 17, wherein the method further comprising a step of e) connecting the RFID transceiver to a computer mounted on a vehicle, the computer sends an alarm when the RFID transceiver is unable to receive a signal from the critical embedded RFID tag layer.

19. The method of claim 16, wherein the method further comprising a step of e) connecting the RFID transceiver to a computer, the computer provides information of the depth of the plurality of treads and grooves based on the signals received from the plurality of embedded RFID tag layers that are not worn out or damaged, thereby determining the wear and tear condition of the tyre.

20. The method of claim 16 or 19, wherein the step c) further comprising:

c1) disposing the at least one identifying means is disposed within one of the plurality of treads and grooves.

21. The method of claim 18 or 19, wherein the step c) further comprising:

c1) providing at least one cavity on the outer circumferential surface, the at least one cavity for housing the at least one identifying means therein; and

c2) disposing the at least one identifying means within the at least one cavity.