US 20160039250A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2016/0039250 A1**

(43) **Pub. Date: Feb. 11, 2016**

Colantoni et al.

(54) **TIRE TREAD DEPTH INDICATOR**

(71) Applicant: **Caterpillar Inc.**, Peoria, IL (US)

(72) Inventors: **David Colantoni**, Metamora, IL (US); **Adam Ofisher**, Elk Grove, IL (US); **Trent J. Cleveland**, Metamora, IL (US)

(73) Assignee: **Caterpillar Inc.**, Peoria, IL (US)

(21) Appl. No.: **14/920,886**

(22) Filed: **Oct. 23, 2015**

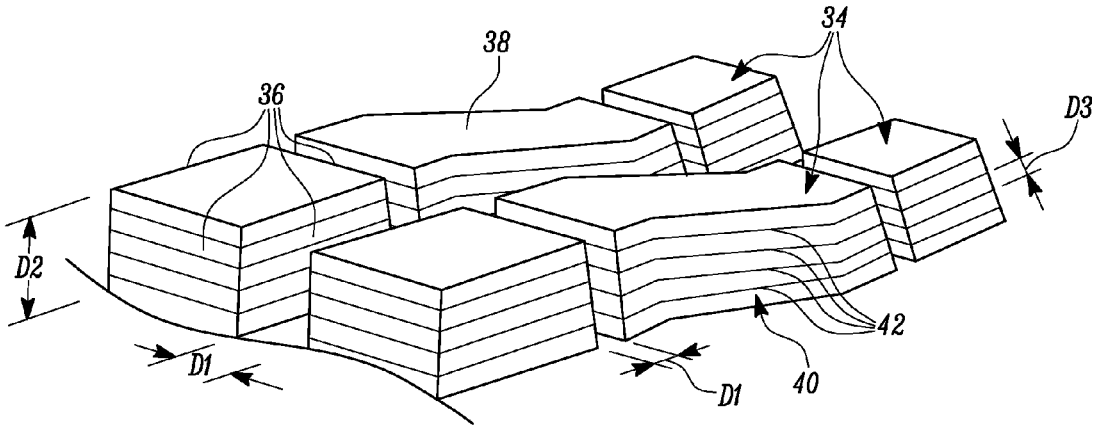
Publication Classification

(51) **Int. Cl.**
B60C 11/24 (2006.01)

(52) **U.S. Cl.**
CPC ***B60C 11/24*** (2013.01)

(57) **ABSTRACT**

A tire is provided. The tire includes a body. The body includes a first surface for supporting a plurality of treads. The plurality of treads extends at a pre-defined depth from the first surface to a second surface configured for ground contact. The treads include a third surface extending between the first surface and the second surface. The tire further includes a tread depth indicator molded on the third surface. The tread depth indicator includes a plurality of spaced tread depth markings provided on the third surface. Further, each of the plurality of tread depth markings are spaced apart at a predetermined distance from an adjacent tread depth marking. The plurality of tread depth markings indicates a progressive wear and reduction of the pre-defined depth of the plurality of treads relative to the second surface.



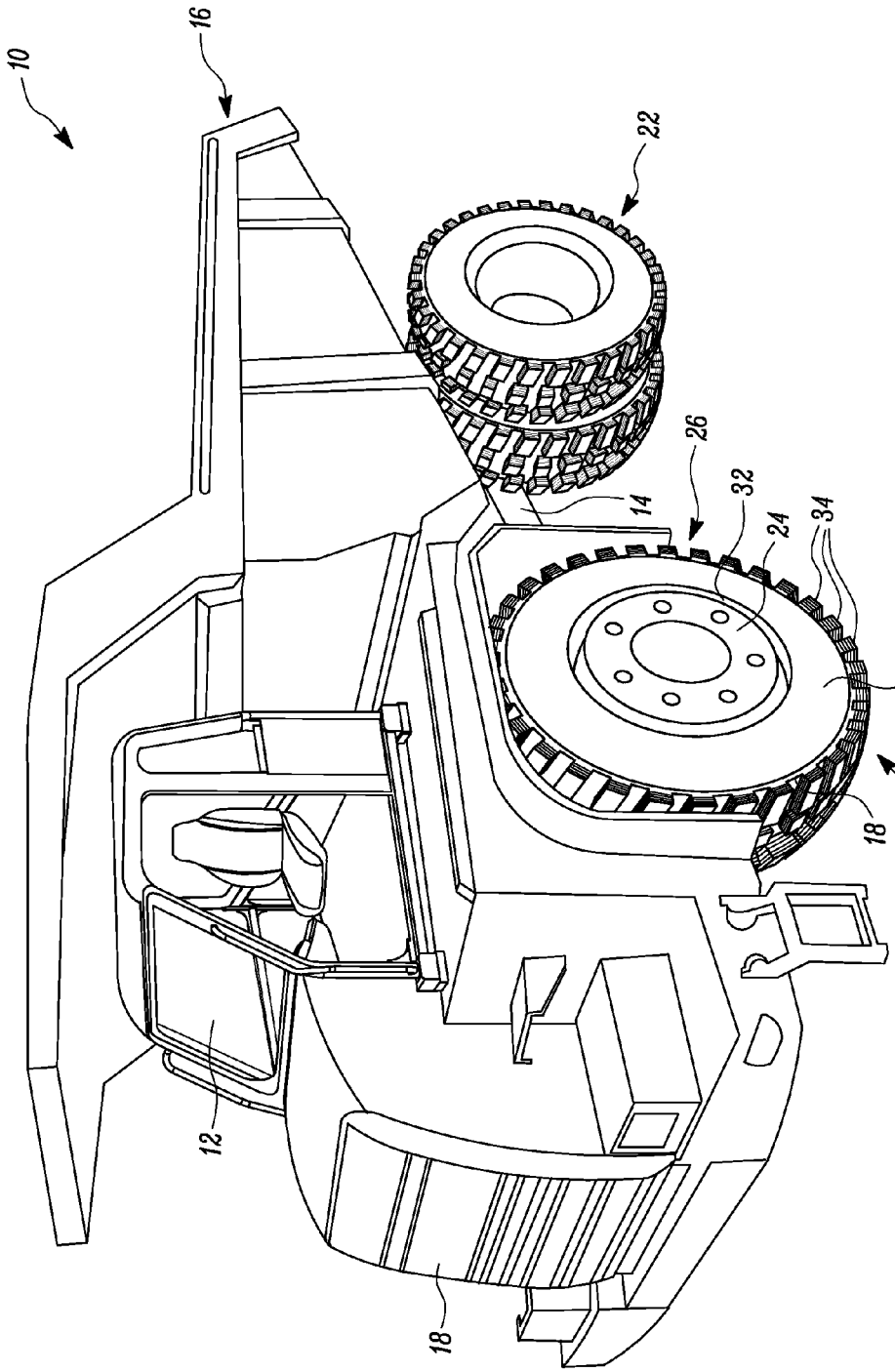


FIG. 1

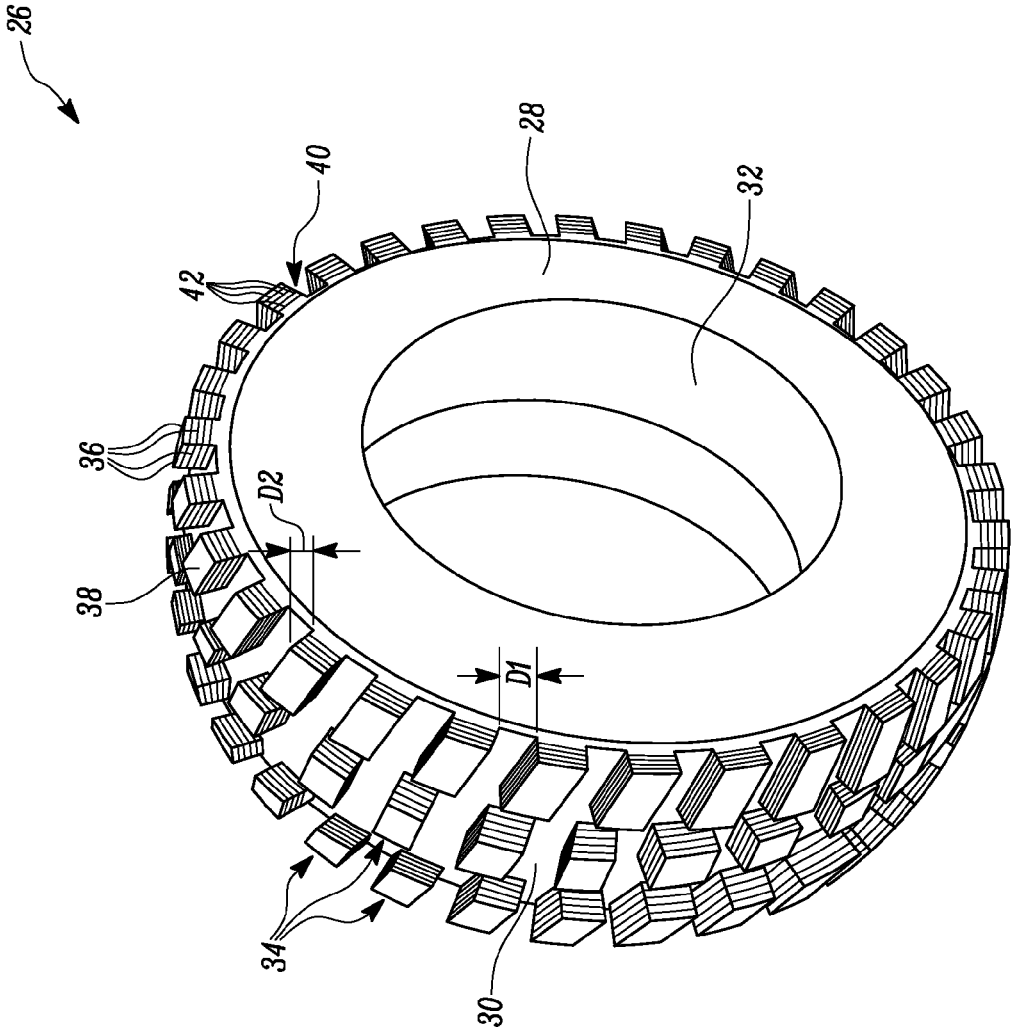


FIG. 2

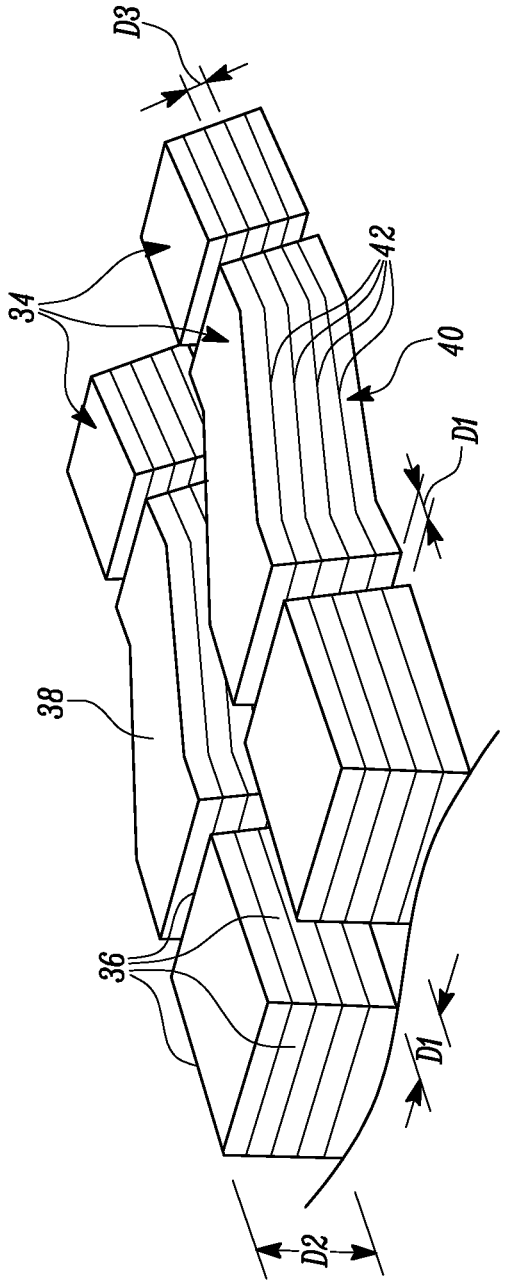


FIG. 3

TIRE TREAD DEPTH INDICATOR

TECHNICAL FIELD

[0001] The present disclosure relates to a tire, and more particularly to a tire having a built-in tread depth indicator.

BACKGROUND

[0002] Machines, such as off-highway trucks, are used to perform various operations in different industries, such as construction, mining, and transportation. Operation of the machines may result in wear of various components of the machines, such as tires. More particularly, a tread of the tires are prone to wear over a period of time. The treads are periodically inspected to identify whether the tires require repair or replacement. Conventional methods for identifying wear of the treads require special depth measurement tools, such as a tread depth gauge. The identification methods also require skilled labor for accurate identification of the wear of the treads.

[0003] U.S. Pat. No. 8,403,012, hereinafter referred to as the '012 patent, describes a tread wear indicator for a tire. The tread wear indicator is molded into the shoulder region of a tire tread and has three symbols. Two of the symbols of the tread wear indicator are alphanumeric characters and the third symbol is surrounding the two symbols. All three symbols are visible prior to wearing the tread. After the tread has been worn a first amount, the first symbol is invisible and the second and third symbols are visible to indicate the wear. After the tread has been worn a second amount, the first and second symbols are invisible and the third symbol is visible. However, the '012 patent does not provide a progressive wear indication of the treads of the tire.

SUMMARY OF THE DISCLOSURE

[0004] In one aspect of the present disclosure, a tire is provided. The tire includes a body. The body includes a first surface for supporting a plurality of treads. The plurality of treads extends at a pre-defined depth from the first surface to a second surface configured for ground contact. The treads include a third surface extending between the first surface and the second surface. The tire further includes a tread depth indicator molded on the third surface. The tread depth indicator includes a plurality of spaced tread depth markings provided on the third surface. Further, each of the plurality of tread depth markings are spaced apart at a predetermined distance from an adjacent tread depth marking. The plurality of tread depth markings indicates a progressive wear and reduction of the pre-defined depth of the plurality of treads relative to the second surface.

[0005] Other features and aspects of this disclosure will be apparent from the following description and the accompanying drawings.

BRIEF DESCRIPTION O F THE DRAWINGS

[0006] FIG. **1** is a perspective view of an exemplary machine having one or more tires, according to the concepts of the present disclosure;

[0007] FIG. **2** is a perspective view of the tire having treads, according to the concepts of the present disclosure; and

[0008] FIG. **3** is a partial perspective view of the treads shown in FIG. **2**.

DETAILED DESCRIPTION

[0009] Reference will now be made in detail to specific embodiments or features, examples of which are illustrated in the accompanying drawings. Wherever possible, corresponding or similar reference numbers will be used throughout the drawings to refer to the same or corresponding parts.

[0010] FIG. **1** illustrates an exemplary machine **10**. The machine **10** may perform different tasks on a worksite. For example the machine **10** may be used to transport material from one location to another on the worksite. The machine **10** may include, but not limited to, a mining truck, a haul truck, an on-highway truck, an off-highway truck or an articulated truck. Alternatively, the machine **10** may embody a loading machine that unloads load onto another machine. In such an example, the machine **10** may include, but not limited to, a large wheel loader, a track-type loader, a shovel or a crane.

[0011] As shown in FIG. **1**, the machine **10** is an off-highway truck. However, the concepts of the present disclosure may be embodied in a different type of machine. The machine **10** includes a frame **14**. An operator cabin **12** is mounted on the frame **14** of the machine **10**. The machine **10** also includes a load carrier **16** for carrying payload. Further, an engine cabin **18** may be mounted on the frame **14**. A power source (not shown) is positioned within the engine cabin **18**. The power source can be an engine that generates power to propel the machine **10**. The machine **10** also includes a powertrain (not shown) supported on the frame **14**. The power train is drivably connected to the power source.

[0012] The machine **10** also includes a number of wheels of which two wheels **20**, **22** are shown in the accompanying figures. Each wheel of the machine **10** is rotatably coupled with the powertrain. It should be noted that the number of wheels shown in the accompanying figures are exemplary in nature, and the number of wheels may vary based on type of operation performed by the machine **10**. For exemplary purposes, the present disclosure will be described with respect to the wheel **20**. However, it should be noted that the description provided is equally applicable to each wheel of the machine **10**.

[0013] The wheel **20** includes a hub **24** connected to the powertrain. The wheel **20** further includes a tire **26** connected to the hub **24**. The tire **26** as shown in FIG. **1** are ground engaging members of the machine **10**. The tire **26** may provide a desired amount of traction and cushioning between the machine **10** and a ground surface on the worksite. For example, the tire **26** may support the machine **10** in a loaded, partially loaded, and empty condition, so that a desired amount of traction and/or cushioning is provided, regardless of the load. The tire **26** may be manufactured by any suitable manufacturing method known in the art. The tire **26** can be bias, radial or bias-belted, steel belted.

[0014] Referring to FIGS. **1** and **2**, the tire **26** includes a body **28**. The tire **26** also includes a first surface **30**, hereinafter interchangeably referred to as outer surface **30**, and an inner surface **32**. Further, the inner surface **32** of the tire **26** is coupled with the hub **24**.

[0015] As shown in FIGS. **1** and **2**, the tire **26** includes a number of treads **34**. The treads **34** are supported on the outer surface **30** of the body **28**. The treads **34** improves traction of the tire **26** at the interface between the tire **26** and the ground surface across which the tire **26** rolls. The treads **34** are embodied as protrusions extending radially from the outer surface **30** of the tire **26**. In one embodiment, the body **28** and the treads **34** are integrally formed as a single, monolithic

piece, for example, via molding. In another embodiment the treads **34** are formed separately, and are later assembled with the body **28** to form a single, monolithic piece. In yet another embodiment, the treads **34** and the body **28** may be chemically bonded to one another.

[0016] Referring to FIG. **2**, a perspective view of the tire **26** having the number of treads **34** is illustrated. Each of the treads **34** are spaced apart from each other by a pre-defined distance "D**1**". The pre-defined distance "D**1**" between the treads **34** may allow evacuation of water, mud, and the like from the tire **26**. The pre-defined distance "D**1**" may vary on expected use of the tire **26**. For example, the tire **26** used in high performance machines may have a reduced distance "D**1**" between the treads **34** to provide increased contact of the treads **34** with the ground surface for higher traction. Further, the tire **26** of machines used for off tract or worksite applications may have an increased distance "D**1**" between the treads **34** to provide higher gripping performance.

[0017] The treads **34** may be disposed on the outer surface **30** of the tire **26** in a pre-defined tread pattern. In one example, the pre-defined distance "D**1**" between the treads **34** is defined based on the pre-defined tread pattern. The pre-defined pattern includes, but not limited to, rib, lug, rib-lug, block, or a combination of patterns known in the industry. The pre-defined tread pattern is determined based on the expected use of the machine **10** in which the tire **26** is implemented. In one example, for paved road and high speed applications, rib type treads may be used to provide low rolling resistance, reduced heat generation, high resistance to side slippage, improved steering and safety, and reduced vibration. In another example, block type of treads may be implemented mainly in off road and worksite applications such as loading or sand service vehicles. The block type treads may provide improved propulsion, braking, steering, and safety.

[0018] As shown in the FIGS. **2** and **3**, the treads **34** include a second surface **38**, such that the treads **34** extend at a pre-defined depth "D**2**" from the outer surface **30** of the body **28** to the second surface **38**. The second surface **38** of the treads **34** contacts the ground surface. The treads **34** also include a third surface **36**, hereinafter interchangeably referred to as a lateral surface **36**. The lateral surfaces **36** extend radially with respect to the outer surface **30** of the tire **26**. The lateral surfaces **36** extend between the outer surface **30** of the body **28** and the second surface **38** of the treads **34**. Further, the second surface **38** connects the pair of lateral surfaces **36** close to a top end of the respective tread **34**. The treads **34** also include a bottom surface (not shown). The bottom surface of the treads **34** is attached to the outer surface **30** of the tire **26**.

[0019] The treads **34** includes a pre-defined depth "D**2**" defined between the second surface **38** and the bottom surface of the treads **34**. The pre-defined depth "D**2**" of the treads **34** is determined based on the expected use of the tire **26**. In one example, the pre-defined depth "D**2**" may be approximately between 90 mm to 100 mm. In another example, the pre-defined depth "D**2**" may be approximately between 60 mm to 70 mm.

[0020] The tire **26** experiences significant wear during operation of the machine **10**. Thus, the pre-defined distance "D**1**" of the treads **34** reduces gradually after the machine **10** is put in operation. During a maintenance schedule of the machine **10**, a maintenance personnel may determine a current depth of the treads **34** so that the tire **26** may be repaired or replaced accordingly. The term "current depth" referred to herein may be defined as the depth of the treads **34** after the machine **10** is put in operation. The current depth of the tread **34** is generally less than the pre-defined depth "D**2**".

[0021] In order to determine the current depth of the treads **34**, a tread depth indicator **40** is molded on the lateral surface **36** of the treads **34**. Referring to FIGS. **2** and **3**, the tread depth indicator **40** includes a number of spaced tread depth markings **42**. In one example, the tread depth markings **42** indicate a progressive wear of the treads **34** and a reduction of the pre-defined depth "D**2**" of the treads **34** with respect to the second surface **38** of the treads **34**. The tread depth markings **42** are disposed on the lateral surfaces **36** of the treads **34**. Each of the tread depth markings **42** are spaced apart at a predetermined distances "D**3**" (see FIG. **3**) from an adjacent tread depth marking **42**.

[0022] The distance "D**3**" between each tread depth marking **42** is appropriately chosen based on the pre-defined depth "D**2**" of the treads **34**. More particularly, if the distance "D**3**" between the adjacent tread depth markings **42** is less than a pre-defined distance, a visual identification of a count of the tread depth markings **42** may be difficult. Similarly, if the distance "D**3**" between the adjacent tread depth markings **42** is more than the pre-defined distance, the wear of the treads **34** may not be recorded and/or noticed accurately. The pre-defined distance disclosed herein may be defined based on an expected application of the machine **10** and/or the pre-defined depth "D**2**" of the treads **34**. For instance, if the pre-defined depth "D**2**" of the treads **34** is approximately equal to 90 mm, the pre-defined distance between the adjacent tread depth markings **42** may be approximately between 3 mm to 5 mm.

[0023] As shown in FIG. **3**, the tread depth markings **42** are provided on the lateral surfaces **36** of the treads **34**. The tread depth markings **42** are embodied as linear graduations on the lateral surfaces **36** of the treads **34**. The tread depth markings **42** may be formed on the lateral surfaces **36** during manufacturing of the treads **34**. In one example, the tread depth markings **42** may be formed during molding of the treads **34**. For example, a mold pattern of the treads **34** may include a number of spaced apart projections provided on its inner surface. After molding of the treads **34**, the projections may form grooves on the treads **34** indicative of the tread depth markings **42**. The tread depth markings **42** may have a U-shaped groove, a V-shaped groove, etc., without any limitations. In another embodiment, the tread depth markings **42** may be formed by engraving the lateral surfaces **36** of the treads **34** in a preferred shape. The tread depth markings **42** may include symbols indicating the number of tread depth markings **42**. The symbols may be alphabets, alphanumeric, and/or numerals. In one example, the treads **34** may be painted to form the tread depth markings **42**.

[0024] As indicated in FIG. **3**, the tread depth markings **42** defined at the lateral surface **36** of the treads **34** are visible prior to wearing of the treads **34**. During an operation of the machine **10**, the second surface **38** of the treads **34** interacts with the ground surface. Over a period of time, the treads **34** are subjected to wear due to constant contact between the treads **34** and the ground surface. As the treads **34** wear, a count of the tread depth markings **42** decreases. A product of the count of the tread depth markings **42** and the distance "D**3**" between the adjacent tread depth markings **42** gives an indication of the current depth of the treads **34**.

[0025] The tread depth indicators **40** disclosed herein may be provided on the lateral surface **36** of the treads **34** by other methods known in the art such as, for example, by permanent

marking, laser engraving, embossing, or etching, without limiting the scope of the present disclosure.

INDUSTRIAL APPLICABILITY

[0026] The present disclosure relates to the tires **26** of the machine **10**. The tires **26** incudes the tread depth indicator **40** defined on the treads **34**. The tread depth indicator **40** includes the number tread depth markings **42**. Since the tread depth markings **42** are provided on the lateral surfaces **36** of the treads **34** during manufacture thereof, any additional components or system are not required for tread depth measurements or wear monitoring of the treads **34**. Each of the tread depth markings **42** is indicative of the progressive wear of the treads **34** with respect to the second surface **38**. Based on the determination of the current depth of the treads **34**, the maintenance personnel is notified whether the treads **34** require repair and/or replacement. Further, the tread depth markings **42** may provide an indication if the tires **26** require immediate attention. Thus, any possible failures of the machine components may be prevented, thereby reducing machine **10** downtime.

[0027] Additionally, the tread depth markings **42** provided on the treads **34** enables identification of several types of abnormal tread wear. For example, the innermost or outermost treads **34** of the tire **26** may be subjected to wear due to poor wheel alignments. Also, unbalanced wheels can cause uneven wear of the treads **34** due to abnormal wheel rotation. Further, defects in respect of a suspension system of the machine **10** can also be identified based on the worn condition of the treads **34**.

[0028] The tread depth indicator **40** disclosed herein provides a cost effective and easy to implement solution for tread depth measurement and also provides simplified wear indication. Further, in some situations, the tread depth indicator **40** allows determination of the current depth of the treads **34** by visually inspecting the treads **34**, thereby eliminating requirement of costly and time consuming indication apparatus.

[0029] While aspects of the present disclosure have been particularly shown and described with reference to the embodiments above, it will be understood by one skilled in the art that various additional embodiments may be contemplated by the modification of the disclosed machines, systems and methods without departing from the spirit and scope of what is disclosed. Such embodiments should be understood to fall within the scope of the present disclosure as determined based upon the claims and any equivalents thereof.

What is claimed is:

1. A tire comprising:

a body having a first surface for supporting a plurality of treads, the plurality of treads extending at a pre-defined depth from the first surface to a second surface configured for ground contact, and a third surface extending between the first surface and the second surface; and

a tread depth indicator molded on the third surface, the tread depth indicator including:

a plurality of spaced tread depth markings provided on the third surface, each of the plurality of tread depth markings are spaced apart at a predetermined distance from an adjacent tread depth marking, the plurality of tread depth markings being indicative of a progressive wear and reduction of the pre-defined depth of the plurality of treads relative to the second surface.

* * * * *