

DIFFERENTIAL CHAINSAW CHAIN

CROSS REFERENCE TO RELATED APPLICATION

5 This application claims priority to U.S. provisional application number 62/128,134 filed on March 4, 2015, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

10 Example embodiments generally relate to hand held power equipment and, more particularly, relate to cutting chain improvements for a chainsaw.

BACKGROUND

15 Chainsaws are commonly used in both commercial and private settings to cut timber or perform other rigorous cutting operations. Because chainsaws are typically employed in outdoor environments, and the work they are employed to perform often inherently generates debris, chainsaws are typically relatively robust hand held machines. They can be powered by gasoline engines or electric motors (e.g., via batteries or wired connections) to turn a chain around a guide bar at relatively high speeds. The chain includes cutting teeth that engage
20 lumber or another medium in order to cut the medium as the teeth are passed over a surface of the medium at high speed.

25 Given that the chainsaw may be employed to cut media of various sizes and types, it should be appreciated that the design of the chain itself may have an impact on the effectiveness of the cutting operations. As such, it may be desirable to explore a number of different chain design improvements that could be employed alone or together with other design changes to improve overall chainsaw, and cutting chain, performance.

BRIEF SUMMARY OF SOME EXAMPLES

30 Some example embodiments may provide for a chainsaw chain constructed with a differential chain. The differential chain may improve cutting efficiency and minimize the energy required for executing the cutting procedure. Other improvements may also be possible, and the improvements can be made completely independent of each other, or in combination with each other in any desirable configuration. Accordingly, the operability and utility of the chainsaw may be enhanced or otherwise facilitated.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

Having thus described some example embodiments in general terms, reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

- 5 FIG. 1 illustrates a side view of a chainsaw according to an example embodiment;
- FIG. 2 illustrates a side view of a chainsaw guide bar that does not employ a differential chain according to an example embodiment; and
- FIG. 3 illustrates a side view of a differential chain in accordance with an example embodiment.

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DETAILED DESCRIPTION

Some example embodiments now will be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all example embodiments are shown. Indeed, the examples described and pictured herein should not be construed as
15 being limiting as to the scope, applicability or configuration of the present disclosure. Rather, these example embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like reference numerals refer to like elements throughout. Furthermore, as used herein, the term “or” is to be interpreted as a logical operator that results in true whenever one or more of its operands are true. As used herein, operable coupling
20 should be understood to relate to direct or indirect connection that, in either case, enables functional interconnection of components that are operably coupled to each other.

FIG. 1 illustrates side view of a chainsaw 100 according to an example embodiment. As shown in FIG. 1, the chainsaw 100 may include a housing 110 inside which a power unit or motor (not shown) is housed. In some embodiments, the power unit may be either an
25 electric motor or an internal combustion engine. Furthermore, in some embodiments, the power unit may include more than one electric motor where one such electric motor powers the working assembly of the chainsaw 100 and the other electric motor of the power unit powers a pump that lubricates the working assembly or provides momentum for moving other working fluids within the chainsaw 100. The chainsaw 100 may further include a guide
30 bar 120 that is attached to the housing 110 along one side thereof. A chain (not shown) may be driven around the guide bar 120 responsive to operation of the power unit in order to enable the chainsaw 100 to cut lumber or other materials. The guide bar 120 and the chain may form the working assembly of the chainsaw 100. As such, the power unit may be operably coupled to the working assembly to turn the chain around the guide bar 120.

The chainsaw 100 may include a front handle 130 and a rear handle 132. A chain brake and front hand guard 134 may be positioned forward of the front handle 130 to stop the movement of the chain 122 in the event of a kickback. In an example embodiment, the hand guard 134 may be tripped by rotating forward in response to contact with a portion of the arm (e.g., the hand/wrist) of the operator of the chainsaw 100. In some cases, the hand guard 134 may also be tripped in response to detection of inertial measurements indicative of a kickback.

The rear handle 132 may include a trigger 136 to facilitate operation of the power unit when the trigger 136 is actuated. In this regard, for example, when the trigger 136 is actuated (e.g., depressed), the rotating forces generated by the power unit may be coupled to the chain either directly (e.g., for electric motors) or indirectly (e.g., for gasoline engines). The term "trigger," as used herein, should be understood to represent any actuator that is capable of being operated by a hand or finger of the user. Thus, the trigger 136 may represent a button, switch, or other such component that can be actuated by a hand or portion thereof.

Some power units may employ a clutch to provide operable coupling of the power unit to a sprocket that turns the chain. In some cases (e.g., for a gasoline engine), if the trigger 136 is released, the engine may idle and application of power from the power unit to turn the chain may be stopped. In other cases (e.g., for electric motors), releasing the trigger 136 may secure operation of the power unit. The housing 110 may include a fuel tank for providing fuel to the power unit. The housing 110 may also include or at least partially define an oil reservoir, access to which may be provided to allow the operator to pour oil into the oil reservoir. The oil in the oil reservoir may be used to lubricate the chain as the chain is turned.

As can be appreciated from the description above, actuation of the trigger 136 may initiate movement of the chain around the guide bar 120. A clutch cover 150 may be provided to secure the guide bar 120 to the housing 110 and cover over the clutch and corresponding components that couple the power unit to the chain (e.g., the sprocket and clutch drum). As shown in FIG. 1, the clutch cover 150 may be attached to the body of the chainsaw 100 (e.g., the housing 110) via nuts 152 that may be attached to studs that pass through a portion of the guide bar 120. The guide bar 120 may also be secured with the tightening of the nuts 152, and a tightness of the chain can be adjusted based on movement of the guide bar 120 and subsequent tightening of the nuts 152 when the desired chain tightness is achieved. However, other mechanisms for attachment of the clutch cover 150 and/or the guide bar 120 may be provided in other embodiments including, for example, some

tightening mechanisms that may combine to tighten the chain in connection with clamping the guide bar 120.

In some embodiments, the guide bar 120 may be formed from two laminate core sheets that lie in parallel planes along side each other to define a channel around a periphery of the guide bar 120. The chain (or at least a portion of the chain) may ride in the channel, as the rest of the chain rides along the periphery of the guide bar 120 to engage media for cutting. FIG. 2 illustrates a typical chain 200 disposed on the guide bar 120. The chain 200 includes a plurality of center drive links 210 that each include a portion thereof that rides in the channel. Each center drive link 210 is attached to an adjacent pair of side links 220 by rivets 230 that extend perpendicular to the longitudinal length of the links. A rivet 230 is provided at the front portion of each center drive link 210 to attach the center drive link 210 to the rear portion of a preceding side links 220 and another rivet 230 is provided at the rear portion of each center drive link 210 to attach the center drive link 210 to the front portion of a subsequent side links 220. As such, each pair of side links 220 connects to opposing sides of the center drive links 210, and the connections are repeated in alternating fashion to complete a circular or endless chain.

For some pairs of side links 220 of the chain 200 one of the side links may be formed as a cutter link 240. Meanwhile, pairs of side links that do not include a cutter link 240 may be referred to as tie links 250. The cutter links 240 may be provided with two portions including a depth gauge portion 260 and a cutting portion 270. The cutting portion 270 may generally engage material that extends beyond the depth of the depth gauge portion 260 when the chain 200 is rotated. Meanwhile, the tie links 250 may not include cutting portions or depth gauge portions and may be provided to simply extend the length of the chain 200 while providing a space between portions of the chain 200 that will create friction during cutting operations. If every side link 220 included a cutter link 240, the friction on the chain 200 would be very high, and it would be difficult to provide sufficient power to turn the chain, and control of the chainsaw 100 could also become difficult.

The cutter links 240 typically have the cutting portion 270 extend along one side or the other of the link (e.g., as a side plate) and then bend over to form a top plate. The cutter links 240 that have the side plate along the left side of the link may be referred to as left cutter links, and the cutter links 240 that have the side plate on the right side of the link may be referred to as right cutter links. For a typical chain, the cutter links 240 are alternated between left cutter links and right cutter links. The spacing between cutter links 240, which may be determined by the number of tie links 250 placed between cutter links 240, may be

consistent or vary in different examples. However, in any case, a repeated pattern is generally provided. Thus, for example if one tie link (T) is provided between each right cutter link (R) and left cutter link (L), the pattern may essentially be R-T-L-T ..., as shown in the example of FIG. 2. This pattern may repeat over the entire length of the chain 200.

5 However, in other cases, such as where two tie links are provided between cutter links, the pattern may look like R-T-T-L-T-T Any number of tie links could be provided between alternating cutter links.

As mentioned above, in some examples, the number of tie links could vary between cutter links. Thus, for example a pattern of R-T-L-T-T ... could be provided or L-T-R-T-T
10 However, in each of these examples, regardless of the number of tie links between cutter links, and regardless of whether the number of tie links is the same or changing, the general rule is that alternating cutter links are on opposing sides of each other relative to the ordering of links around the chain 200.

In accordance with an example embodiment, a differential chain 300 is provided in
15 which that ordering is differentiated. In this regard, the differential chain 300 provides for improved cutting efficiency. The differential chain 300 therefore provides different combinations of segments of cutter links in an effort to optimize the cutting procedure with the use of as little energy as possible. The differential chain 300 may also facilitate ensuring that the energy that is expended is more efficiently applied to the cutting procedure by
20 reducing the amount of energy that does not go into the cutting process or contribute to cutting efficiency. As a result, less energy may be required in order to cut, and more effective cutting may be achieved.

Some examples of differential chain 300 arrangements may include T-L-R-T-T-L-T-T-R ... L-T-R-L-T-R-T-T-L-T-R-T ... L-L-T-T-R-R-T-T ..., L-T-L-T-R-T-R-T ..., and L-T-
25 T-L-T-R-T-T-R-T As such, again, the number of tie links in the differential chain 300 can either be the same between each alternating cutting link or different. However, the typical pattern of left and right cutters being alternated with a selected number of links in between is, in any case, modified to create the differential chain 300. Thus, a cutting chain of an example embodiment (e.g., a differential chain) may include a plurality of center drive
30 links, and a plurality of side links attached to the center drive links in alternating fashion via rivets. At least some of the side links are cutter links having a cutting portion disposed on a left side or a right side thereof. Cutter links having the cutting portion on the right side are right cutter links and cutter links having the cutting portion on the left side thereof are left cutter links. The chain includes at least one right cutter link for which a next cutter link is

another right cutter link, or at least one left cutter link for which the next cutter link is another left cutter link.

In some cases, a predetermined number of tie links may be disposed between alternating cutter links. In an example embodiment, a different number of tie links may be disposed between at least some pairs of alternating cutter links. In some embodiments, at least one cutter link may be separated from another cutter link by a center drive link without any tie link therebetween. In an example embodiment, the cutter links may each include a depth gauge portion provided thereon. In some cases, at least one depth gauge portion of at least one cutter link overlaps with a depth gauge portion provided at a corresponding center drive link. In an example embodiment, at least two tie links are provided between at least one set of adjacent cutter links. In some embodiments, a center drive link between the at least two tie links does not include a depth gauge portion. In an example embodiment, a depth gauge portion is included on each center drive link preceding a cutter link and is not included on each center drive link following any cutter link.

Many modifications and other embodiments of the inventions set forth herein will come to mind to one skilled in the art to which these inventions pertain having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the inventions are not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Moreover, although the foregoing descriptions and the associated drawings describe exemplary embodiments in the context of certain exemplary combinations of elements and/or functions, it should be appreciated that different combinations of elements and/or functions may be provided by alternative embodiments without departing from the scope of the appended claims. In this regard, for example, different combinations of elements and/or functions than those explicitly described above are also contemplated as may be set forth in some of the appended claims. In cases where advantages, benefits or solutions to problems are described herein, it should be appreciated that such advantages, benefits and/or solutions may be applicable to some example embodiments, but not necessarily all example embodiments. Thus, any advantages, benefits or solutions described herein should not be thought of as being critical, required or essential to all embodiments or to that which is claimed herein. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

CLAIMS

1. A cutting chain (300) for a chainsaw, the chain (300) comprising:

a plurality of center drive links (210); and

5 a plurality of side links (220) attached to the center drive links (210) in alternating fashion via rivets,

wherein at least some of the side links (220) are cutter links (240) having a cutting portion disposed on a left side or a right side thereof, cutter links (240) having the cutting portion on the right side being right cutter links and cutter links (240) having the cutting portion on the left side thereof being left cutter links, and

10 wherein the chain (300) includes at least one right cutter link for which a next cutter link is another right cutter link, or at least one left cutter link for which the next cutter link is another left cutter link.

15 2. The chain (300) of claim 1, wherein a predetermined number of tie links (250) is disposed between alternating cutter links (240).

3. The chain (300) of claim 1, wherein a different number of tie links (250) is disposed between at least some pairs of alternating cutter links (240).

20 4. The chain (300) of claim 1, wherein at least one cutter link is separated from another cutter link by a center drive link without any tie link therebetween.

25 5. The chain (300) of claim 1, wherein the cutter links (240) each include a depth gauge portion provided thereon.

6. The chain (300) of claim 5, wherein at least one depth gauge portion of at least one cutter link overlaps with a depth gauge portion provided at a corresponding center drive link.

30 7. The chain (300) of claim 6, wherein at least two tie links (250) are provided between at least one set of adjacent cutter links (240).

8. The chain (300) of claim 7, wherein a center drive link between the at least two tie links does not include a depth gauge portion.

9. The chain (300) of claim 1, wherein a depth gauge portion is included on each center drive link preceding a cutter link and is not included on each center drive link following any cutter link.

10. A chainsaw (100) comprising:
a housing (110);
a guide bar (120) operably coupled to the housing (110); and
a chain (300) operably coupled to the guide bar (120) to be driven around the guide bar (120) responsive to operation of a power unit, the chain comprising:
a plurality of center drive links (210); and
a plurality of side links (220) attached to the center drive links (210) in alternating fashion via rivets,
wherein at least some of the side links (220) are cutter links (240) having a cutting portion disposed on a left side or a right side thereof, cutter links (240) having the cutting portion on the right side being right cutter links and cutter links (240) having the cutting portion on the left side thereof being left cutter links, and
wherein the chain (300) includes at least one right cutter link for which a next cutter link is another right cutter link, or at least one left cutter link for which the next cutter link is another left cutter link.

11. The chainsaw (100) of claim 10, wherein a predetermined number of tie links (250) is disposed between alternating cutter links (240).

12. The chainsaw (100) of claim 10, wherein a different number of tie links (250) is disposed between at least some pairs of alternating cutter links (240).

13. The chainsaw (100) of claim 10, wherein at least one cutter link is separated from another cutter link by a center drive link without any tie link therebetween.

14. The chainsaw (100) of claim 10, wherein the cutter links (240) each include a depth gauge portion provided thereon.

15. The chainsaw (100) of claim 14, wherein at least one depth gauge portion of at least one cutter link overlaps with a depth gauge portion provided at a corresponding center drive link.

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16. The chainsaw (100) of claim 15, wherein at least two tie links (250) are provided between at least one set of adjacent cutter links (240).

17. The chainsaw (100) of claim 16, wherein a center drive link between the at
10 least two tie links does not include a depth gauge portion.

18. The chainsaw (100) of claim 10, wherein a depth gauge portion is included on each center drive link preceding a cutter link and is not included on each center drive link following any cutter link.

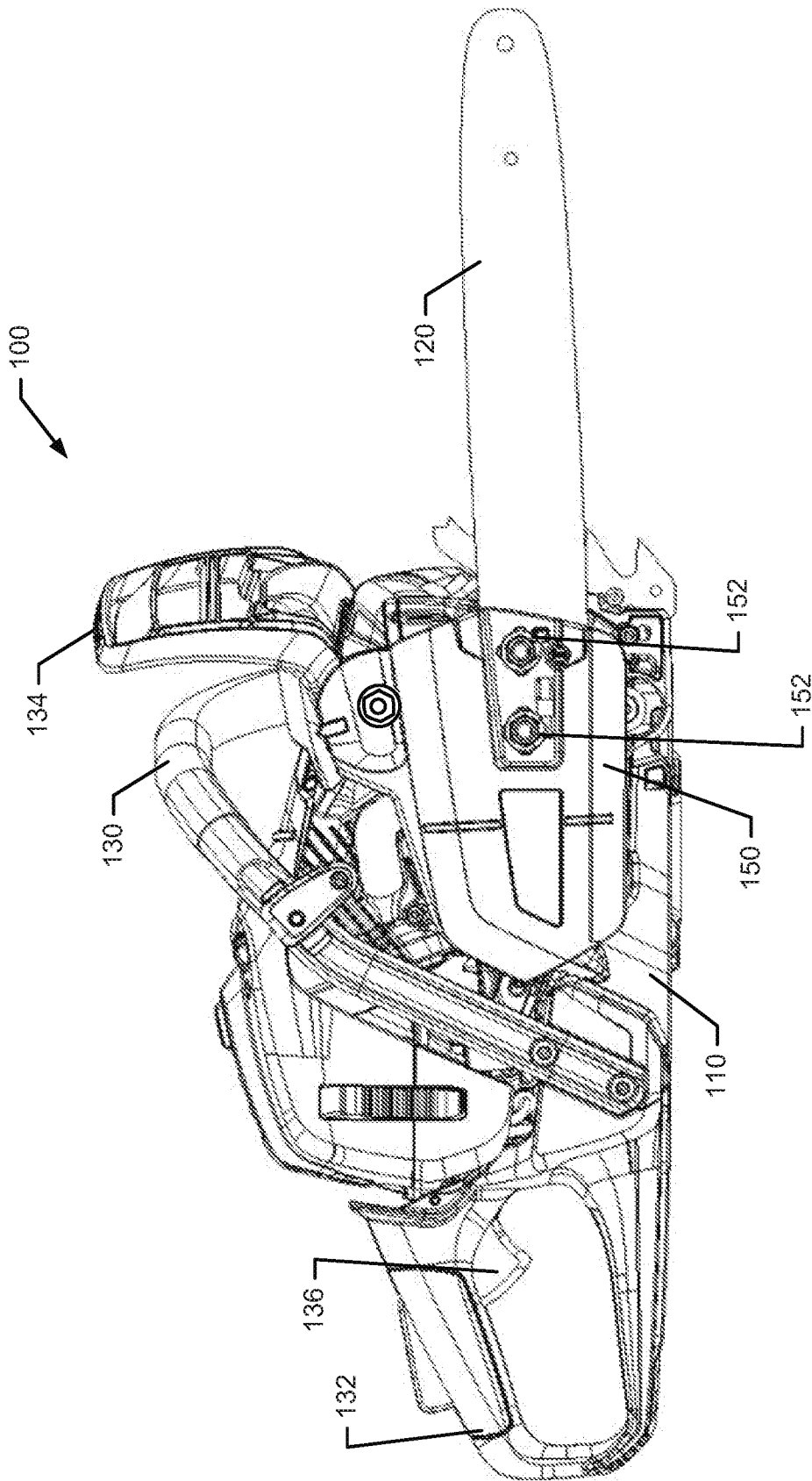


FIG. 1

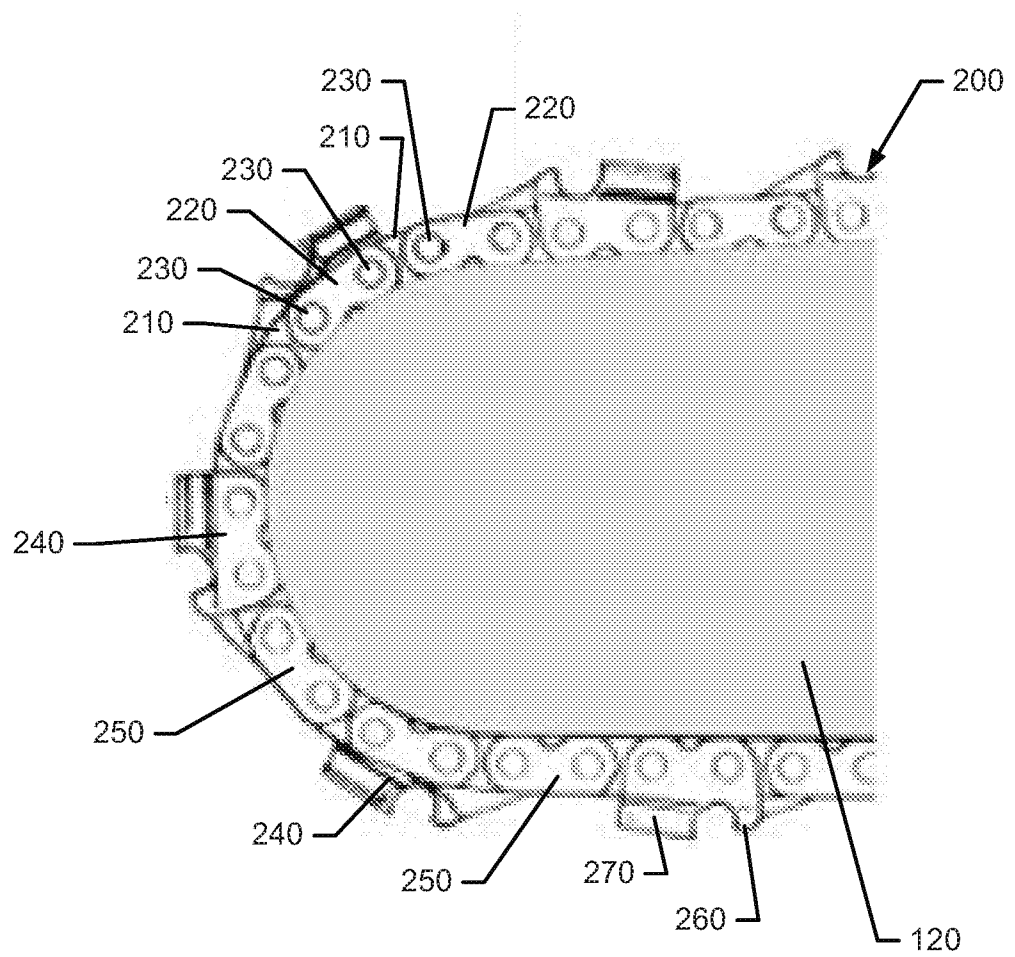


FIG. 2

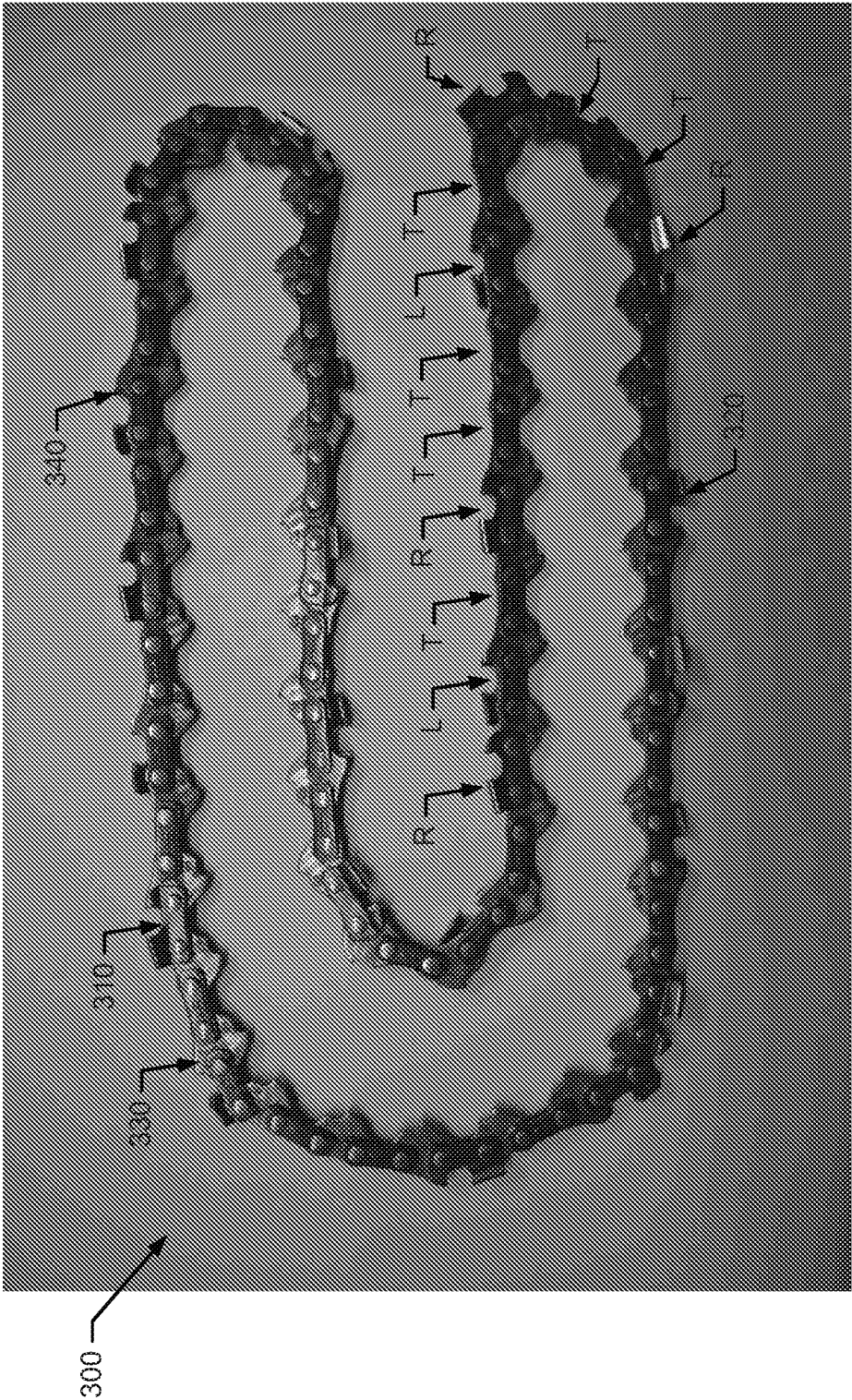


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2016/051238

A. CLASSIFICATION OF SUBJECT MATTER
INV. B27B33/14
ADD.

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)
B27B

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)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 040 789 A (MALL ARTHUR W ET AL) 26 June 1962 (1962-06-26)	1-5, 10-14
Y	column 2, line 50 - column 3, line 70 figures	6-9, 15-18

X	US 3 608 595 A (OEHRLE JOHN W) 28 September 1971 (1971-09-28)	1-4, 10-13
A	the whole document column 5, line 23 - line 40 in particular: figures 6-8	5-9, 14-18

X	US 3 066 711 A (NAPOLEON WINNERT ERIK GUNNAR ET AL) 4 December 1962 (1962-12-04)	1-3,5, 10-12,14
A	column 1, line 69 - column 2, line 24 figures 1,2	4,6-9, 13,15-18

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Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"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

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

20 May 2016

Date of mailing of the international search report

31/05/2016

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INTERNATIONAL SEARCH REPORT

International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2008/072733 A1 (SCHULZ MATTHIAS [DE] ET AL) 27 March 2008 (2008-03-27) paragraph [0026] figure 2 -----	6-9, 15-18

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2016/051238

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3040789	A	26-06-1962	NONE

US 3608595	A	28-09-1971	BE 735831 A 16-12-1969
		DE 1934647 A1	15-01-1970
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		US 3608595 A	28-09-1971
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US 3066711	A	04-12-1962	NONE

US 2008072733	A1	27-03-2008	NONE
