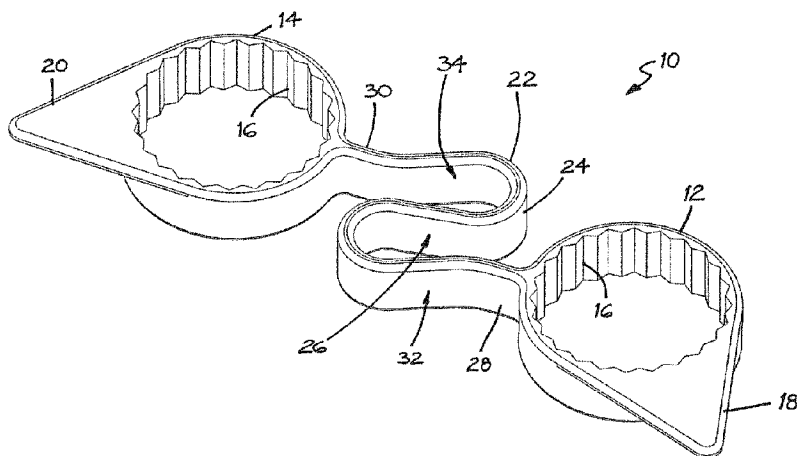




(86) Date de dépôt PCT/PCT Filing Date: 2014/04/04
(87) Date publication PCT/PCT Publication Date: 2015/01/08
(45) Date de délivrance/Issue Date: 2021/07/06
(85) Entrée phase nationale/National Entry: 2015/11/20
(86) N° demande PCT/PCT Application No.: AU 2014/000363
(87) N° publication PCT/PCT Publication No.: 2015/000013
(30) Priorités/Priorities: 2013/07/05 (AU2013902494);
2013/08/14 (AU2013903053)

(51) Cl.Int./Int.Cl. *F16B 39/10* (2006.01),
B60B 3/16 (2006.01), *F16B 37/14* (2006.01)
(72) Inventeur/Inventor:
MASON, RONALD ROBERT, AU
(73) Propriétaire/Owner:
MARCHMONT PTY LIMITED, AU
(74) Agent: OYEN WIGGS GREEN & MUTALA LLP

(54) Titre : INDICATEUR D'ECROU DE ROUE DESSERRE
(54) Title: LOOSE WHEEL NUT INDICATOR



(57) **Abrégé/Abstract:**

An apparatus (10) for visually indicating a loose wheel nut on a motor vehicle has a first means, such as a ring (12), for engaging a first wheel nut so as to be rotatable therewith and a second means, such as a ring (14), for engaging a second wheel nut adjacent to the first wheel nut so as to be rotatable therewith. The first ring (12) has a first pointer (18) for indicating a start position of the first ring (12), and the second ring (14) has a second pointer (20) for indicating a start position of the second ring (14). An elongate member (22), which is resiliently flexible, interconnects the first and second rings (12, 14). The elongate member (22) is configured to curve in at least two directions and has a first end portion (28) and an opposed second end portion (30). The first end portion (28) is connected to the first ring (12) and the second end portion (30) is connected to the second ring (14). In use, any loosening rotation of the first wheel nut will cause the first ring (12) and its pointer (18) to rotate therewith, thereby providing a visual indication of a loosening of the first wheel nut.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

CORRECTED VERSION

(19) World Intellectual Property
Organization
International Bureau



(10) International Publication Number
WO 2015/000013 A9

(43) International Publication Date
8 January 2015 (08.01.2015)

(51) International Patent Classification:

F16B 39/10 (2006.01) *B60B 3/16* (2006.01)
F16B 37/14 (2006.01)

(21) International Application Number:

PCT/AU2014/000363

(22) International Filing Date:

4 April 2014 (04.04.2014)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

2013902494 5 July 2013 (05.07.2013) AU
2013903053 14 August 2013 (14.08.2013) AU

(71) Applicant: **MARCHMONT PTY LIMITED** [AU/AU];
1019 Redlynch Intake Road, Redlynch, Queensland 4870
(AU).

(72) Inventor: **MASON, Ronald Robert**; 1019 Redlynch In-
take Road, Redlynch, Queensland 4870 (AU).

(74) Agent: **GRIZIOTIS, George**; Peter Maxwell and Associ-
ates, Level 6, 60 Pitt Street, Sydney, New South Wales
2000 (AU).

(81) Designated States (*unless otherwise indicated, for every
kind of national protection available*): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME,
MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,
OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA,
SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM,
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM,
ZW.

(84) Designated States (*unless otherwise indicated, for every
kind of regional protection available*): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,
MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

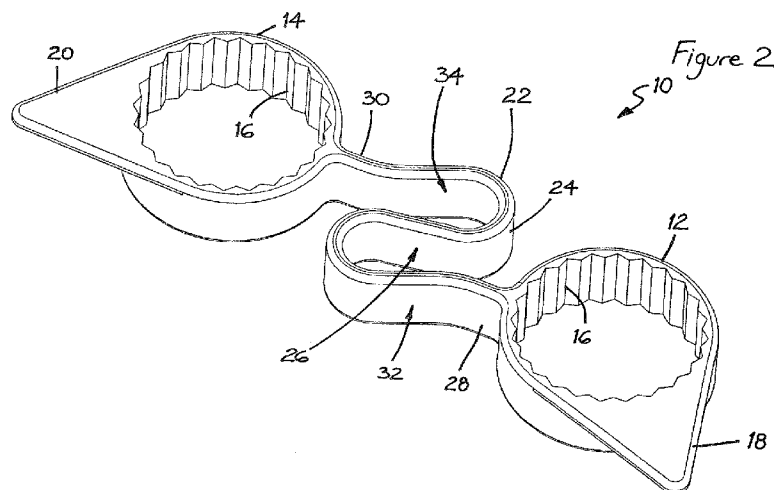
(48) Date of publication of this corrected version:

19 February 2015

(15) Information about Correction:

see Notice of 19 February 2015

(54) Title: LOOSE WHEEL NUT INDICATOR



(57) Abstract: An apparatus (10) for visually indicating a loose wheel nut on a motor vehicle has a first means, such as a ring (12), for engaging a first wheel nut so as to be rotatable therewith and a second means, such as a ring (14), for engaging a second wheel nut adjacent to the first wheel nut so as to be rotatable therewith. The first ring (12) has a first pointer (18) for indicating a start position of the first ring (12), and the second ring (14) has a second pointer (20) for indicating a start position of the second ring (14). An elongate member (22), which is resiliently flexible, interconnects the first and second rings (12, 14). The elongate member (22) is configured to curve in at least two directions and has a first end portion (28) and an opposed second end portion (30). The first end portion (28) is connected to the first ring (12) and the second end portion (30) is connected to the second ring (14). In use, any loosening rotation of the first wheel nut will cause the first ring (12) and its pointer (18) to rotate therewith, thereby providing a visual indication of a loosening of the first wheel nut.

LOOSE WHEEL NUT INDICATOR

TECHNICAL FIELD

The present invention relates to a loose wheel nut indicator and, in particular, to an apparatus for visually indicating a loose wheel nut of a road motor vehicle. More particularly, the present invention relates to such an apparatus which may also be used to prevent any loosening of a wheel nut which is adjacent to the loose wheel nut, such that any further loosening of the loose wheel nut is restrained.

BACKGROUND ART

Road motor vehicles commonly have disc wheels which are held onto a hub of an axle by a plurality of wheel nuts, usually six, eight or ten in number, that are adapted to be threadably engaged to a corresponding number of studs equally spaced in a circle around the hub flange. The studs pass through holes in the wheel, and the wheel is secured to the hub by screwing the nuts tightly onto the studs to the correct torque.

However, the wheel nuts may loosen over time due to continuous or prolonged vibration of the vehicle and its front and rear axles. This problem may be particularly pronounced in heavy road motor vehicles and many other commercial road vehicles, which may have a larger number of axles, more than one wheel held onto each hub thereof, and very large and heavy wheels which make tightening of the nuts relatively difficult.

The tendency for wheel nuts to loosen over time in all road motor vehicles may be accelerated by a number of factors. These include a failure to initially tighten the nuts to the correct torque, the fitting of an incorrect wheel nut, the regular overtightening of the nuts with automated tools that cause stretching and fatigue of the studs, and the "settling" of the wheel on the hub

that may occur after a wheel change which causes the force of the nut on the hub to be reduced.

Loosening of the wheel nuts can have serious adverse consequences. If a wheel nut becomes loose while the vehicle is in motion, the wheel may experience an increased radial load which, if unchecked, can cause severe damage to the wheel itself and/or to the stud, hub and possibly even the nut. In extreme cases, the wheel nut may unscrew from its stud or the wheel may sever the stud due to excessive bending loads, causing the wheel to detach from the hub with potentially disastrous results.

There have been many and varied attempts to address these problems, most of which have met with little or no success.

One approach has involved finding ways of preventing wheel nuts from becoming loose.

Apart from maintaining regular inspection and, if required, correction of wheel nut tighteners, well known self locking nut systems have been developed which rely on an interference fit between the thread on the stud and the thread on the nut to create a lock which stiffens the rotation of the nut, either by a portion of the nut thread being deformed and providing a resistance during the threaded engagement, or by locating a nylon or other deformable insert within the threaded bore of the nut and through which the stud cuts the thread against a stiffening resistance.

A problem with self locking nut systems is that they are designed to operate at maximum locking effectiveness for one tightening cycle only and, if used more than once, will have markedly reduced locking capability.

Furthermore, the self locking nut cannot be tightened quickly by hand in the initial stage of its threaded engagement with the stud because the lock stiffens the rotation of the nut, with the result being that a spanner or other tool is

required also at the initial stage, thereby considerably lengthening the time it takes to tighten the wheel nut and hence attach the wheel to the hub. These problems and shortcomings may be unacceptable to many users given that a wheel nut may have to be removed many times during the life of a vehicle.

- 5 Replacement of worn out or damaged nuts would also become very expensive.

Another approach has involved finding ways to visually indicate in a timely manner when a wheel nut becomes loose so that appropriate intervention can occur to retighten or replace the nut before serious damage results.

- 10 It is known to provide loose wheel nut indicators in the form of one piece polymeric rings or caps which are firmly clipped around or over an individual wheel nut and which include a pointed or arrowhead portion to visually indicate any loosening of the wheel nut by its unwanted rotation.

- A problem with loose wheel nut indicators of the type described above is
15 that the arrowhead portion needs to be pointing in a predetermined start direction and any indication of wheel nut loosening must require the identification of deviation from that initial direction. In many cases, loosening of a wheel nut that may lead to problems could result from a rotation of greater than about 5°, but for rotations from about 5° to up to about 20°, identification of
20 such deviation may be very difficult to visually detect or may be missed altogether with the use of such one piece, clip on, pointed indicators.

- Furthermore, these indicators operate on individual wheel nuts, and so any loosening of one nut is independent of the behaviour of any of the other nuts. Therefore, each indicator does not have any means of preventing any
25 other nut from loosening or of restraining any further loosening of the already loosened nut.

Australian Innovation Patent No. 2010 101 053, now ceased, discloses a loose wheel nut indicator in the form of a cap or cover having a body that can closely fit over a tightened nut so as to be rotatable with the nut, and which includes a dial or other means that is rotatable relative to the nut for visibly
5 indicating any loosening of the nut. This indicator is complex in its construction, requiring both a body and a dial which are separately manufactured, together with a complex structure for their cooperation with the nut, and furthermore operates only on individual nuts.

DISCLOSURE OF INVENTION

10 It is an object of the present invention to provide a loose wheel nut indicator that overcomes, or at least substantially ameliorates, the problems and shortcomings of the aforementioned prior art, or at least provides a useful alternative.

According to the present invention, there is provided an apparatus for
15 visually indicating a loose wheel nut on a motor vehicle, comprising:

- (a) a first means for engaging a first wheel nut so as to be rotatable therewith and having a first pointer for indicating a start position of the first engaging means,
- (b) a second means for engaging a second wheel nut adjacent to the
20 first wheel nut so as to be rotatable therewith, and having a second pointer for indicating a start position of the second engaging means, and
- (c) an elongate member which is resiliently flexible and which interconnects the first and second engaging means, the elongate member being configured to curve in at least two directions and having a
25 first end portion and an opposed second end portion, wherein the first end portion is connected to the first engaging means and the second end portion is connected to the second engaging means, such that, in

use, any loosening rotation of the first wheel nut will cause the first engaging means and its pointer to rotate therewith, thereby providing a visual indication of a loosening of the first wheel nut.

Preferably, the elongate member is configured such that any
5 straightening of the elongate member caused by loosening of the first wheel nut will cause the elongate member to apply a compressive tension on the second engaging means, thereby countering any loosening rotation of the second wheel nut to prevent any loosening thereof.

Preferably, the elongate member is configured such that the
10 compressive tension applied on the second engaging means will cause the elongate member to apply a compressive tension on the first engaging means, thereby countering any further loosening rotation of the first wheel nut to restrain any further loosening thereof.

It is preferred that each of the first and second engaging means is
15 selected from the group consisting of rings, caps, loops and covers.

Each of the first and second engaging means may, in some preferred embodiments, be a ring having spaced apart transverse grooves formed on the inwardly facing surface of the ring so as to grip the wheel nut around its angled corners.

20 Alternatively, each of the first and second engaging means may be a cap having spaced apart transverse grooves formed on the inwardly facing surface of the cap so as to grip the wheel nut around its angled corners.

In a preferred form, the elongate member is configured to include the general shape of an inverted S.

25 Preferably, each of the first and second pointers comprises an arrowhead formed integrally with the respective engaging means.

According to another aspect of the present invention, there is provided a method for visually indicating a loose wheel nut on a motor vehicle, including the steps of:

- 5 (a) providing a first apparatus and a second apparatus according to the present invention,
- (b) engaging the first apparatus and the second apparatus with respective adjacent first and second pairs of first and second wheel nuts, wherein the start position of each of the first and second engaging means indicated by the respective pointer is such that a first pointer of a first engaging means of the first apparatus points in a direction that is
10 aligned with a direction of pointing of a second pointer of a second engaging means of the second apparatus, and
- (c) visually monitoring any rotation of the pointer of the first engaging means and/or the pointer of the second engaging means of each of the
15 first and second apparatus to indicate a loosening of the respective wheel nut.

BRIEF DESCRIPTION OF THE DRAWINGS

In order that the invention may be more readily understood and put into practical effect, reference will now be made to the accompanying drawings, in
20 which:

Figure 1 is a plan view of a loose wheel nut indicating apparatus according to a preferred embodiment of the present invention,

Figure 2 is a perspective view of the apparatus of Figure 1,

Figure 3 is a plan view of a loose wheel nut indicating apparatus
25 according to another preferred embodiment of the present invention,

Figure 4 is a side view of the apparatus of Figure 3, and

Figure 5 is a side view of a loose wheel nut indicating apparatus according to yet another preferred embodiment of the present invention,

Figure 6 is an end view of the apparatus of Figure 5,

Figure 7 is a bottom view of the apparatus of Figure 5,

5 Figure 8 is a perspective view of the apparatus of Figure 5,

Figure 9 is a side view of a loose wheel nut indicating apparatus according to still another preferred embodiment of the present invention,

Figure 10 is an end view of the apparatus of Figure 9,

Figure 11 is a bottom view of the apparatus of Figure 9,

10 Figure 12 is a perspective view of the apparatus of Figure 9,

Figure 13 is a top view of the apparatus of Figure 5 when engaged with a first pair of first and second wheel nuts,

Figure 14 is a cross-sectional view through A-A of Figure 13,

15 Figure 15 is a side view of the apparatus when engaged with the nuts as shown in Figure 13,

Figure 16 is a perspective view of the apparatus when engaged with the nuts as shown in Figure 13,

20 Figure 17 is a side view of a wheel shown fitted with a number of loose wheel nut indicating apparatus of Figure 3, and showing the pointers of each apparatus in a start position at the time of fitting, and

Figure 18 is a side view of the wheel fitted with the apparatus as shown in Figure 17, and showing the pointers of some of the apparatus in a rotated position indicating a loosening of the wheel nuts to which those apparatus are engaged.

25 MODES FOR CARRYING OUT THE INVENTION

The apparatus 10 shown in Figures 1 and 2 is to be used primarily for visually indicating a loose wheel nut on a road motor vehicle, but may also be

used to prevent any loosening of an adjacent wheel nut which, in turn, may restrain any further loosening of the loose wheel nut.

The apparatus 10 has a pair of rings 12, 14 for engaging around respective first and second wheel nuts which are adjacent to each other and
5 arranged as a part of a conventional, equally spaced, circular arrangement of wheel nuts around the hub flange of a disc wheel. Alternatively, the apparatus 10 may have a pair of caps, loops, covers or other suitable means for engaging a pair of adjacent wheel nuts.

The rings 12, 14 are rotatable with their respective wheel nut by having
10 spaced apart transverse grooves 16 formed on their inwardly facing surface so as to grip the wheel nut around its angled corners. Such common rotation may alternatively be due to some other form of profile or shape on one or more inwardly facing surface of the wheel nut engaging means which creates the necessary grip, or due to the tightness with which the wheel nut engaging
15 means grips the nut.

The rings 12, 14 have a respective pointer 18, 20 which indicates a start position of each ring. Each pointer 18, 20 is, in this embodiment, in the shape of an arrowhead and is formed integrally with its ring. Alternatively, the pointer may be in the form of a barb or be otherwise wedge shaped, or may comprise
20 some other form of visual indicator of a start position, such as a printed, grooved or embossed line.

The apparatus 10 also has an elongate member 22 which is made of a resiliently flexible material, such as polypropylene or a low density polyethylene (LDPE) or other suitable polymer material, and which interconnects the rings
25 12, 14.

In this embodiment, the elongate member 22 is formed integrally with the rings 12, 14, which are thus made of the same polymer material as the

elongate member, such as by a plastic injection moulding process.

Alternatively, the rings 12, 14 may be made of a different material to the elongate member 22 and the separate components connected together under suitable heat and pressure conditions or by other suitable connecting means.

5 The elongate member 22 is configured to curve in at least two directions. In this embodiment, where the nut tightening direction is clockwise, this curved configuration of the elongate member 22 includes the general shape of an inverted S (similar to a reflected S) when the apparatus 10 is viewed in use (which view is from the positions used to show the apparatus in Figures 1 and
10 2). As best shown in Figure 1, a central portion 24 of the elongate member 22 defines the general shape of an inverted S which is the predominant shape in the configuration of the elongate member 22. As such, the central portion 24 curves in two directions with a single point or region of inflection 26 therebetween. There are shorter first and second curved end portions 28, 30 of
15 the elongate member 22 extending from respective opposite ends of the central portion 24 at which there are points or regions of inflection 32, 34. The curved end portions 28, 30 are connected to the respective rings 12, 14. Each change in the direction of curvature in the configuration of the elongate member 22 is identified by the points or regions of inflection 26, 32, 34.

20 In this embodiment, each of the first and second curved end portions 28, 30 is connected to its respective ring 12, 14 at a point and in a direction that is generally perpendicular to a line that is tangential to the point, although other suitable points and directions at which the curved end portions 28, 30 are connected to the rings 12, 14 are within the ambit of the invention, such as
25 tangential directions.

 In use, an apparatus 10 is engaged to each adjacent pair of wheel nuts on a disc wheel of a road motor vehicle.

The start position, in this instance of use, of each of the rings 12, 14 indicated by the respective pointer 18, 20 is such that the pointer 18 of the ring 12 of one apparatus points in a direction that is aligned with a direction of pointing of the pointer 20 of the ring 14 of an adjacent apparatus 10.

5 Any loosening rotation of the first wheel nut will cause the ring 12 and its pointer 18 to rotate therewith, thereby providing a visual indication of a loosening of the first wheel nut. This will also cause the elongate member 22 to become straighter, and so provide a possible further visual indication of the loose first wheel nut.

10 This result will also arise in the course of use of the apparatus of the invention having any of the above described configurations of the elongate member interconnecting the first and second wheel nut engaging means.

Furthermore, the configuration of the elongate member 22 is such that any straightening of the elongate member 22 caused by loosening of the first
15 wheel nut will cause the elongate member 22 to apply a compressive tension on the ring 14, thereby countering any loosening rotation of the second wheel nut to prevent any loosening thereof.

Moreover, the configuration of the elongate member 22 is such that the compressive tension applied on the ring 14 will cause the elongate member 22
20 to apply a compressive tension on the ring 12, thereby countering any further loosening rotation of the first wheel nut to restrain any further loosening thereof.

The apparatus 40 shown in Figures 3 and 4 has the same use or purpose as the apparatus 10, and is similar in structure and function to the apparatus 10, and so like features are identified, and are to be understood, by
25 reference to like numerals.

The apparatus 40 only differs structurally from the apparatus 10 by having a pair of cut-outs 42, 44 formed on opposite sides of each pointer 18,

20, and by having a plurality of raised lines 46 or ribs formed on the upper surface of an upwardly projecting annulus portion 48 immediately surrounding the grooves 16 of each ring 12, 14. In this embodiment, there are twelve raised lines 46 which are equidistant and radially spaced apart from each other, but
5 the number of such lines may vary.

The apparatus 50 and 60, shown in Figures 5 to 8 and Figures 9 to 12, respectively, have the same use or purpose as the apparatus 10 and 40, and have some features which are like, or similar in structure and function to, features of the apparatus 10 and 40. Like features are identified, and are to be
10 understood, by reference to like numerals.

The apparatus 50, shown in Figures 5 to 8 in isolation and shown in Figures 13 to 16 when engaged with a first pair of first and second wheel nuts, differs structurally from the apparatus 10 and 40 by having a pair of caps 52, 54 for engaging around, and over the top of, respective first and second wheel
15 nuts which are adjacent to each other. The top 56 of each cap 52, 54 is slightly dome shaped.

The caps 52, 54 of apparatus 50, like the rings 12, 14 of apparatus 10 and 40, are rotatable with their respective wheel nut by having spaced apart transverse grooves 16 formed on their inwardly facing surface so as to grip the
20 wheel nut around its angled corners.

The caps 52, 54 have a respective pointer 18, 20 at the upper ends thereof which indicates a start position of each cap. Each pointer 18, 20 is formed integrally with its cap 56.

The apparatus 50 also has an elongate member 22 which is made of a
25 resiliently flexible material and which integrally interconnects the caps 52, 54 at the upper ends thereof. The elongate member 22 of apparatus 50 is configured to curve in a similar way to that of apparatus 10 and 40, and is

connected at its opposed ends to the respective caps 52, 54 in a similar way to that of apparatus 10 and 40.

Figures 13 to 16 show the apparatus 50 engaged in the manner described above with a first pair of first and second wheel nuts 57, 58 which
5 may be threadably engaged to corresponding studs arranged through a disc wheel of a road motor vehicle or the like.

The apparatus 60 shown in Figures 9 to 12 differs structurally from the apparatus 10 and 40, and is similar to the apparatus 50, by having a pair of caps 62, 64. However, unlike the pair of caps 52, 54 of apparatus 50, the caps
10 62, 64 of apparatus 60 have a respective top 66 which is shaped to resemble the top of a nut.

The caps 62, 64 of apparatus 60, like the rings 12, 14 of apparatus 10 and 40 and like the caps 52, 54 of apparatus 50, are rotatable with their respective wheel nut by having spaced apart transverse grooves 16 formed on
15 their inwardly facing surface so as to grip the wheel nut around its angled corners.

The caps 62, 64 have a respective pointer 18, 20 at the lower ends thereof which indicates a start position of each cap. Each pointer 18, 20 is formed integrally with its cap.

20 The apparatus 60 also has an elongate member 22 which is made of a resiliently flexible material and which integrally interconnects the caps 62, 64 at the lower ends thereof. The elongate member 22 of apparatus 60 is configured to curve in a similar way to that of apparatus 10, 40 and 50, and is connected at its opposed ends to the respective caps 62, 64 in a similar way to that of
25 apparatus 10, 40 and 50.

The use of each apparatus 40, 50 and 60 can be readily understood by reference to the earlier description of the use of the apparatus 10 above and by

substituting reference in that description to the rings 12, 14 of apparatus 10 with reference instead to the rings or caps of each apparatus 40, 50 and 60.

By way of specific example, Figures 17 and 18 show the use of apparatus 40 shown in Figures 3 and 4 engaged to each adjacent pair of wheel
5 nuts 57, 58 on a disc wheel 70 of a road motor vehicle. For ease of reference, each of the above apparatus 40 shown in Figures 17 and 18 is identified separately as apparatus 40a to 40e.

Figure 17 shows the start position of each apparatus 40a to 40e. In this instance of use, the pair of rings 12, 14 of each apparatus 40a to 40e has a
10 start position indicated by the respective pointers 18, 20. The pointer 18 of the ring 12 of any one of the apparatus 40a to 40e points in a direction that is aligned with a direction of pointing of the pointer 20 of the ring 14 of an adjacent one of the apparatus 40a to 40e.

Figure 18 shows that, with use, there has been a loosening rotation of
15 the wheel nuts 57, 58 to which apparatus 40a, 40b and 40e are each engaged. For example, the loosening rotation of the wheel nuts 57, 58 to which apparatus 40a is engaged has caused the rings 12, 14 and their respective pointers 18, 20 of that apparatus 40a to rotate therewith, thereby providing a visual indication of a loosening of those nuts 57, 58. This has also caused the
20 elongate member 22 of apparatus 40a to become straighter, and so provide a further visual indication of the loose wheel nuts 57, 58.

The straightening of the elongate member 22 has also applied a compressive tension on the ring 14, thereby countering any loosening rotation of the wheel nut 58 to prevent any further loosening thereof.

25 The compressive tension applied on the ring 14 has also caused the elongate member 22 to apply a compressive tension on the ring 12, thereby

countering any further loosening rotation of the wheel nut 57 to restrain any further loosening thereof.

It will also be readily apparent to persons skilled in the art that various modifications may be made in details of design and construction of the loose
5 wheel nut indicators described above without departing from the scope or ambit of the invention.

CLAIMS:

1. An assembly comprising a first apparatus and a second apparatus for visually indicating a loose wheel nut on a motor vehicle, in which a wheel of the motor vehicle has a plurality of wheel nuts having angled corners, and the first apparatus is engagable to a first pair of the wheel nuts, and the second apparatus is engagable to a second pair of the wheel nuts which are adjacent to the first pair, each of the first apparatus and the second apparatus comprising:
 - (a) a first means for engaging a first wheel nut so as to be rotatable therewith, and having a first pointer for indicating a start position of the first engaging means,
 - (b) a second means for engaging a second wheel nut adjacent to the first wheel nut so as to be rotatable therewith, and having a second pointer for indicating a start position of the second engaging means, and
 - (c) an elongate member which is resiliently flexible and which interconnects the first and second engaging means, the elongate member having a central portion, a first end portion and an opposed second end portion, the central portion curving in at least two directions with a central inflection point, wherein the first end portion is connected to the first engaging means and the second end portion is connected to the second engaging means, such that, the first pointer of the first engaging means is configured to rotate with any loosening rotation of the first wheel nut, thereby providing a visual indication of a loosening of the first wheel nut, and wherein any straightening of the elongate member caused by loosening of the first wheel nut will cause the elongate member to apply a compressive tension on the second

engaging means, thereby countering any loosening rotation of the second wheel nut to prevent any loosening thereof,

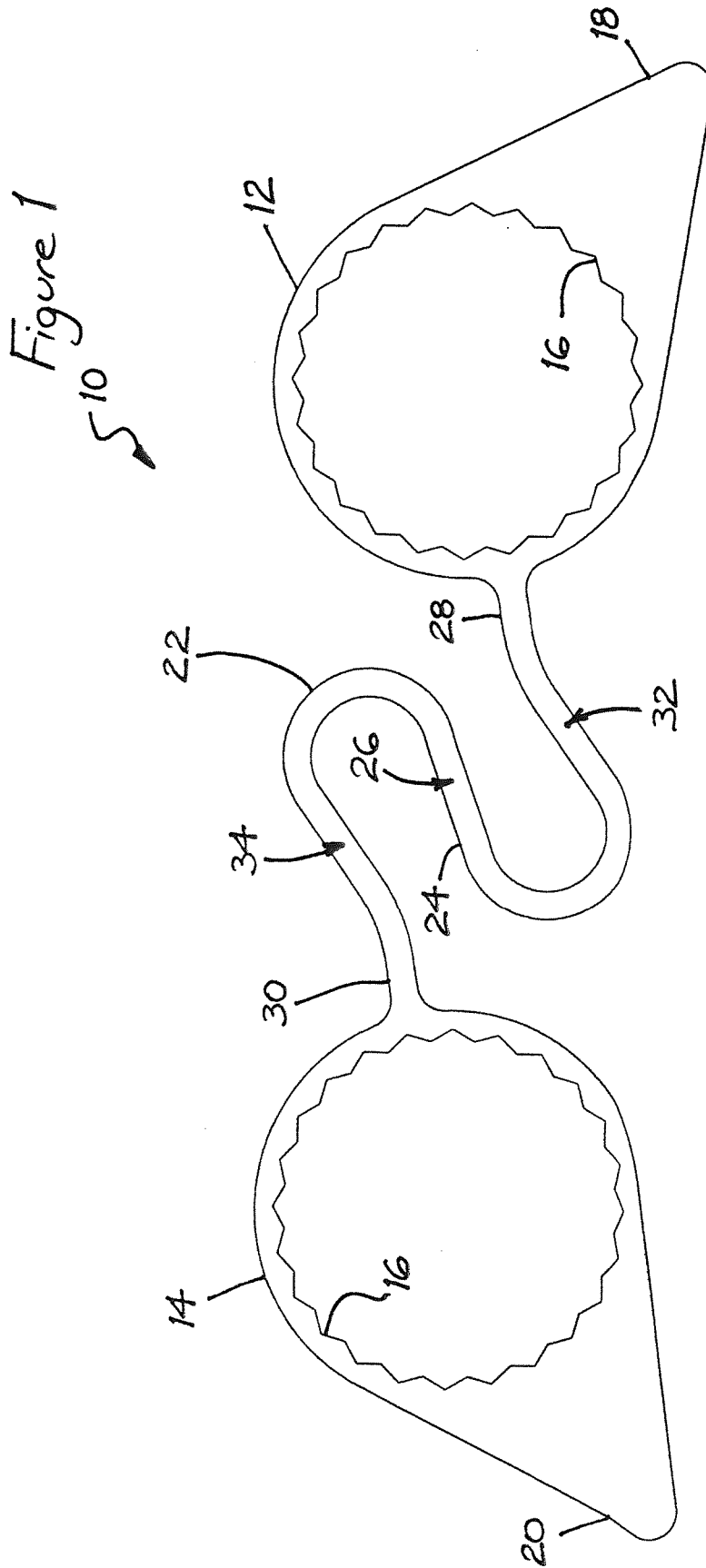
wherein the start position of the first pointer of the first engaging means of the first apparatus and the start position of the second pointer of the second engaging means of the second apparatus are such that the first pointer of the first engaging means of the first apparatus points in a direction that is aligned with a direction of pointing of the second pointer of the second engaging means of the second apparatus.

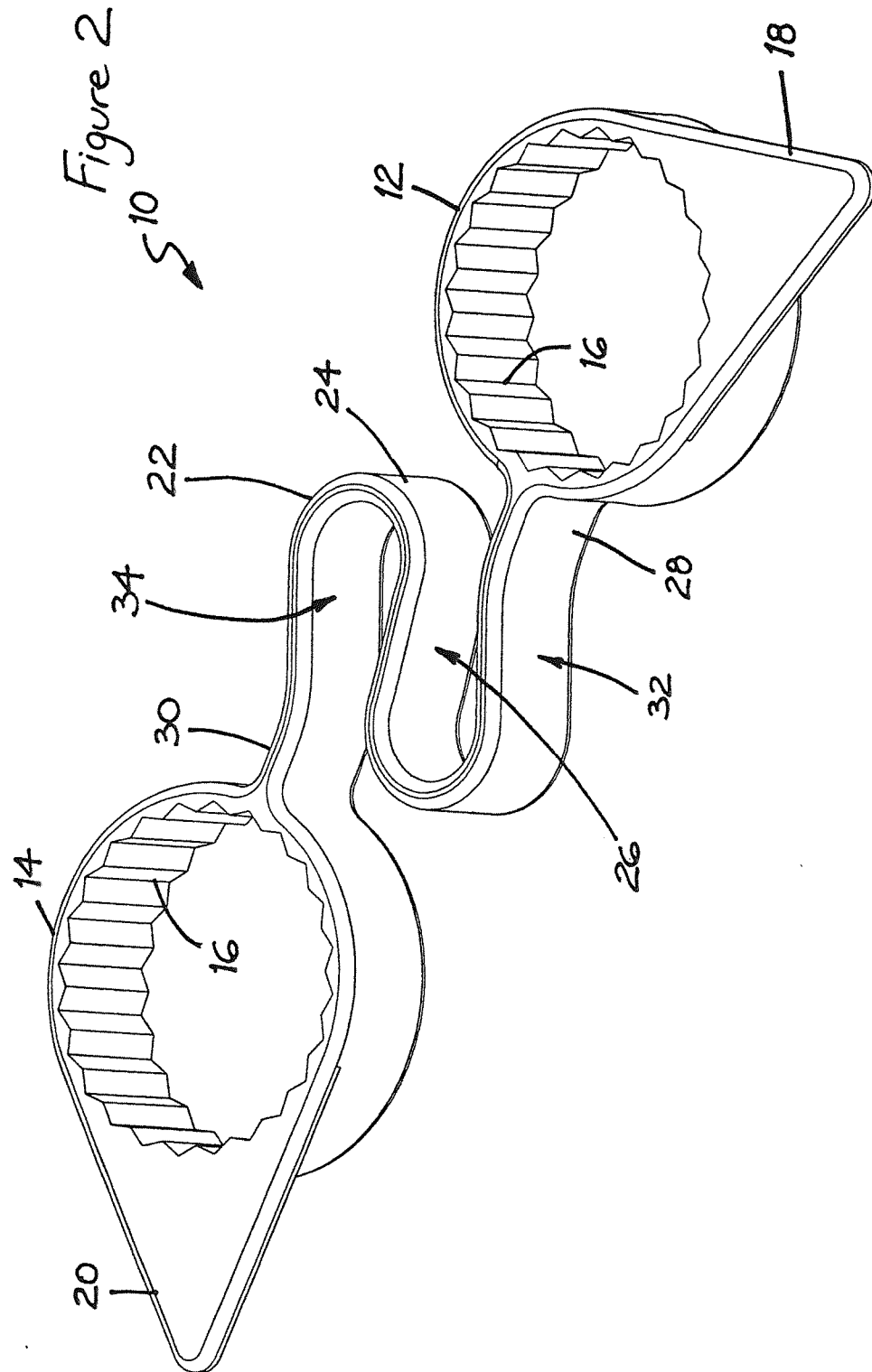
2. The assembly of claim 1 wherein any straightening of the elongate member caused by loosening of the second wheel nut will cause the elongate member to apply a compressive tension on the first engaging means, thereby countering any loosening rotation of the first wheel nut to prevent any loosening thereof.
3. The assembly of either of claims 1 and 2 wherein the first end portion and the second end portion of the elongate member are each curved and connected to the respective engaging means at a point and in a direction that is perpendicular to a line that is tangential to the point.
4. The assembly of any one of claims 1 to 3 wherein each of the first and second engaging means is selected from the group consisting of rings, caps, loops and covers.
5. The assembly of claim 4 wherein each of the first and second engaging means is a ring having spaced apart transverse grooves formed on the inwardly facing surface of the ring so as to grip the angled corners of the first and second wheel nuts respectively.

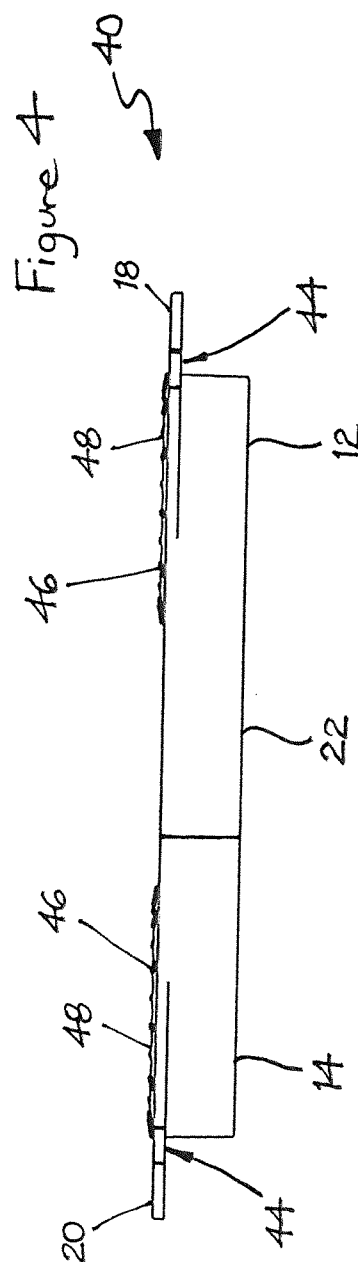
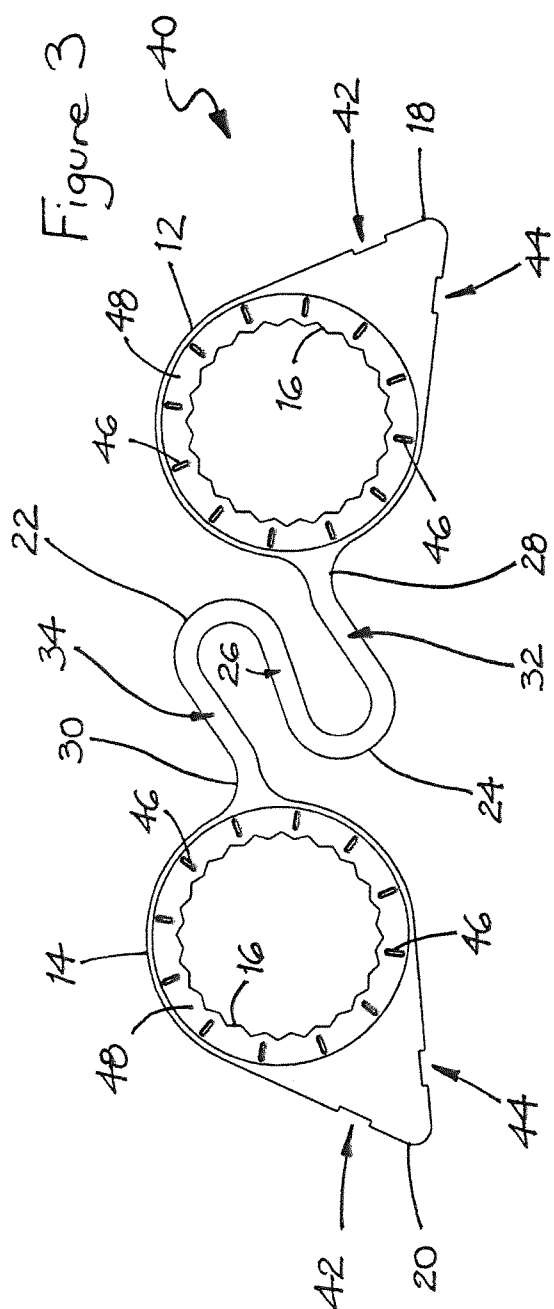
6. The assembly of claim 4 wherein each of the first and second engaging means is a cap having spaced apart transverse grooves formed on the inwardly facing surface of the cap so as to grip the angled corners of the first and second wheel nuts respectively.
7. The assembly of any one of claims 1 to 6 wherein the elongate member is configured to include the general shape of an inverted S.
8. The assembly of any one of claims 1 to 7 wherein each of the first and second pointers comprises an arrowhead formed integrally with the respective engaging means.
9. A method for visually indicating a loose wheel nut on a motor vehicle, including the steps of:
 - (a) providing the assembly of any one of claims 1 to 8,
 - (b) engaging the first apparatus and the second apparatus with respective adjacent first and second pairs of first and second wheel nuts, wherein the start position of each of the first and second engaging means indicated by the respective pointer is such that the first pointer of the first engaging means of the first apparatus points in a first direction of pointing that is aligned with a second direction of pointing of the second pointer of the second engaging means of the second apparatus, and
 - (c) visually monitoring for any rotation of the first pointer of the first engaging means of the first apparatus wherein any rotation identified by way of the first direction of pointing no longer being aligned with

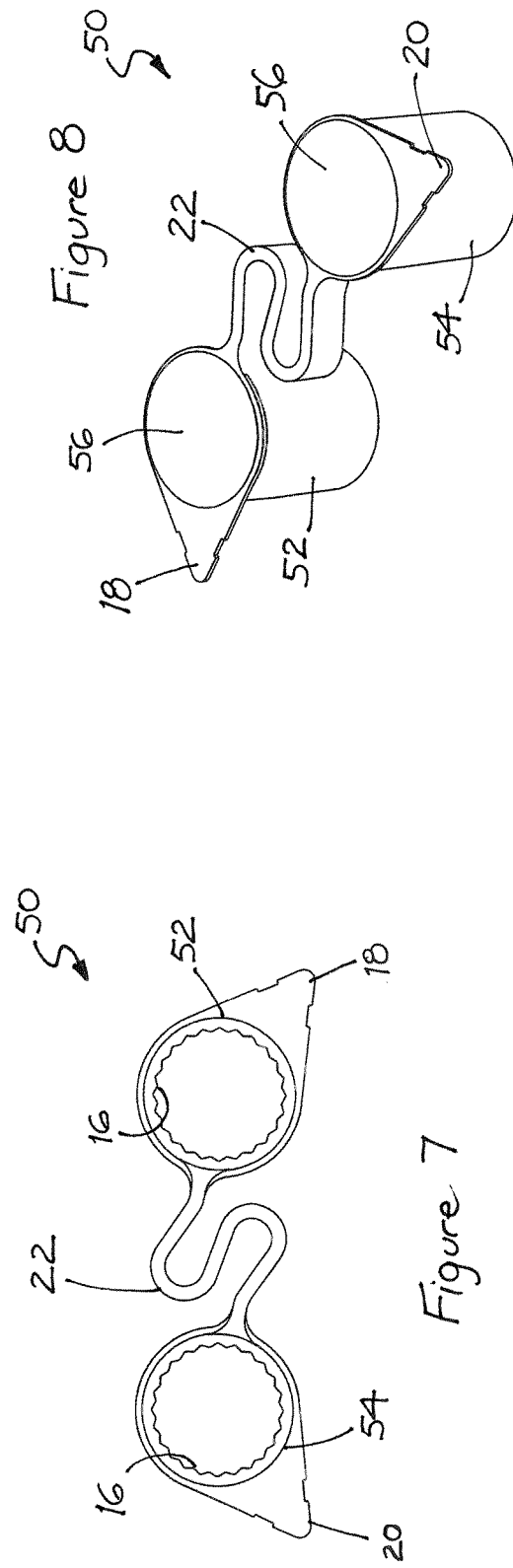
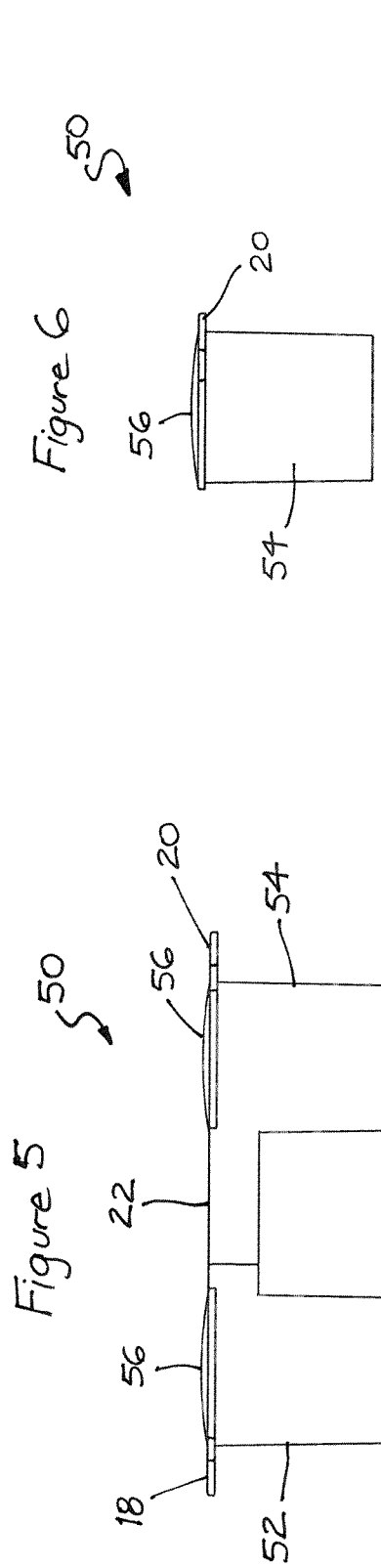
the second direction of pointing indicates a loosening of one of the nuts of the of the first pair of wheel nuts.

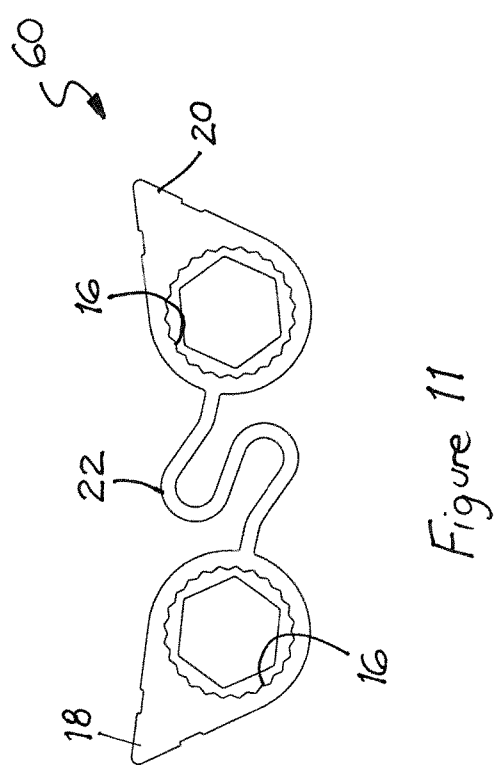
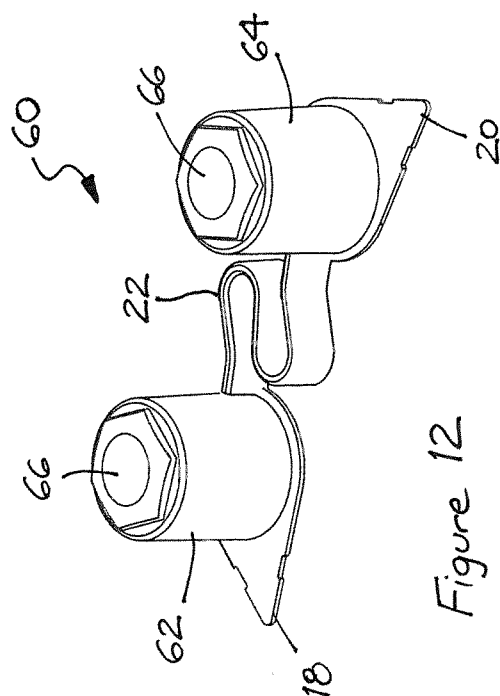
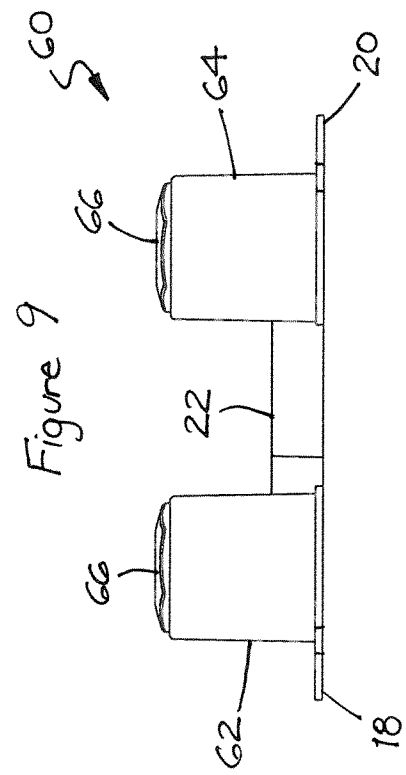
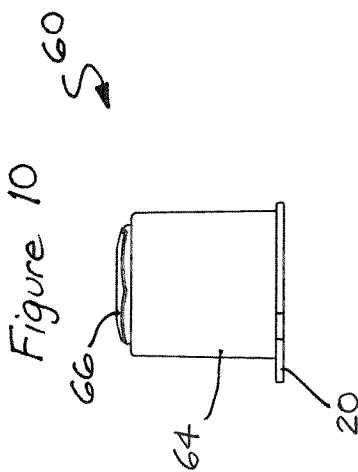
10. The method according to claim 9, including the steps of:
 - (d) visually monitoring for any rotation of the second pointer of the second engaging means of the second apparatus wherein any rotation identified by way of the second direction of pointing no longer being aligned with the first direction of pointing indicates a loosening of one of the nuts of the of the second pair of wheel nuts.

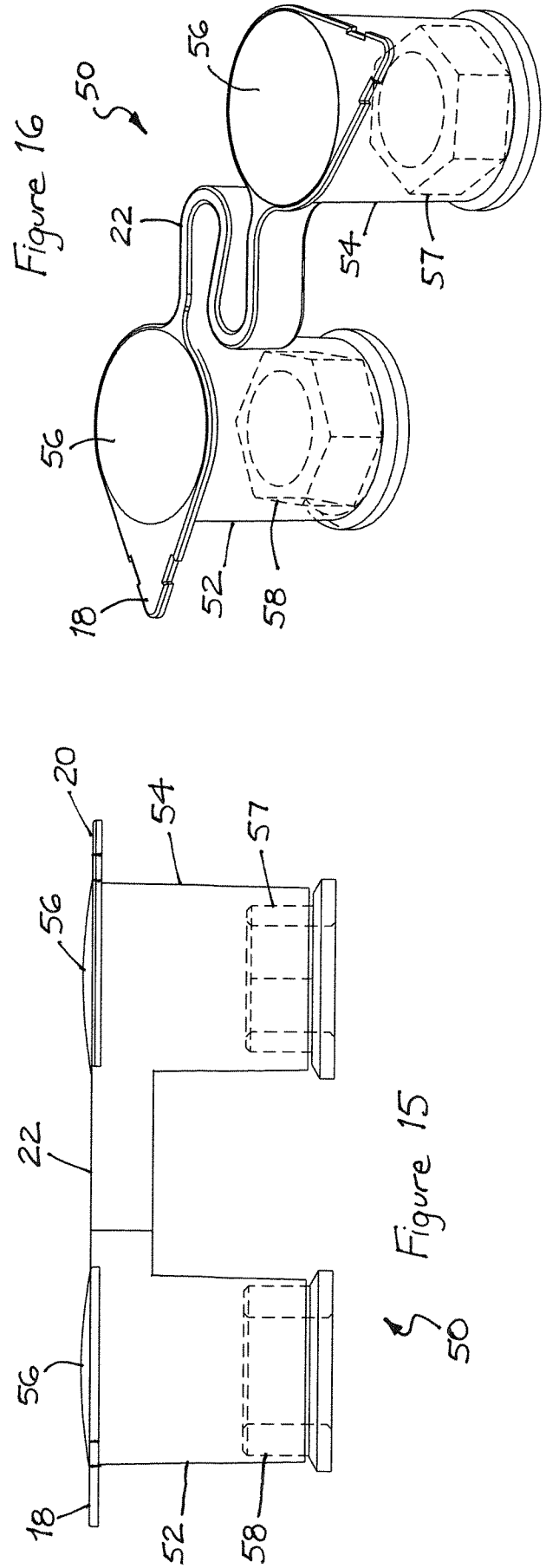
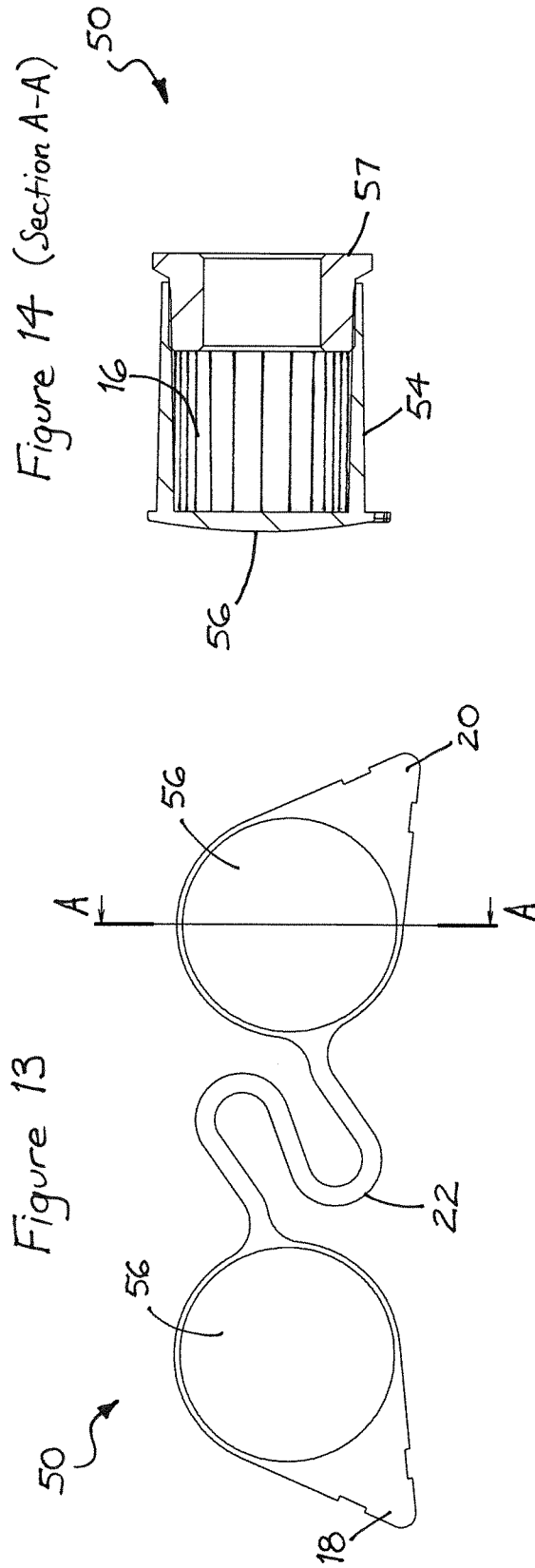












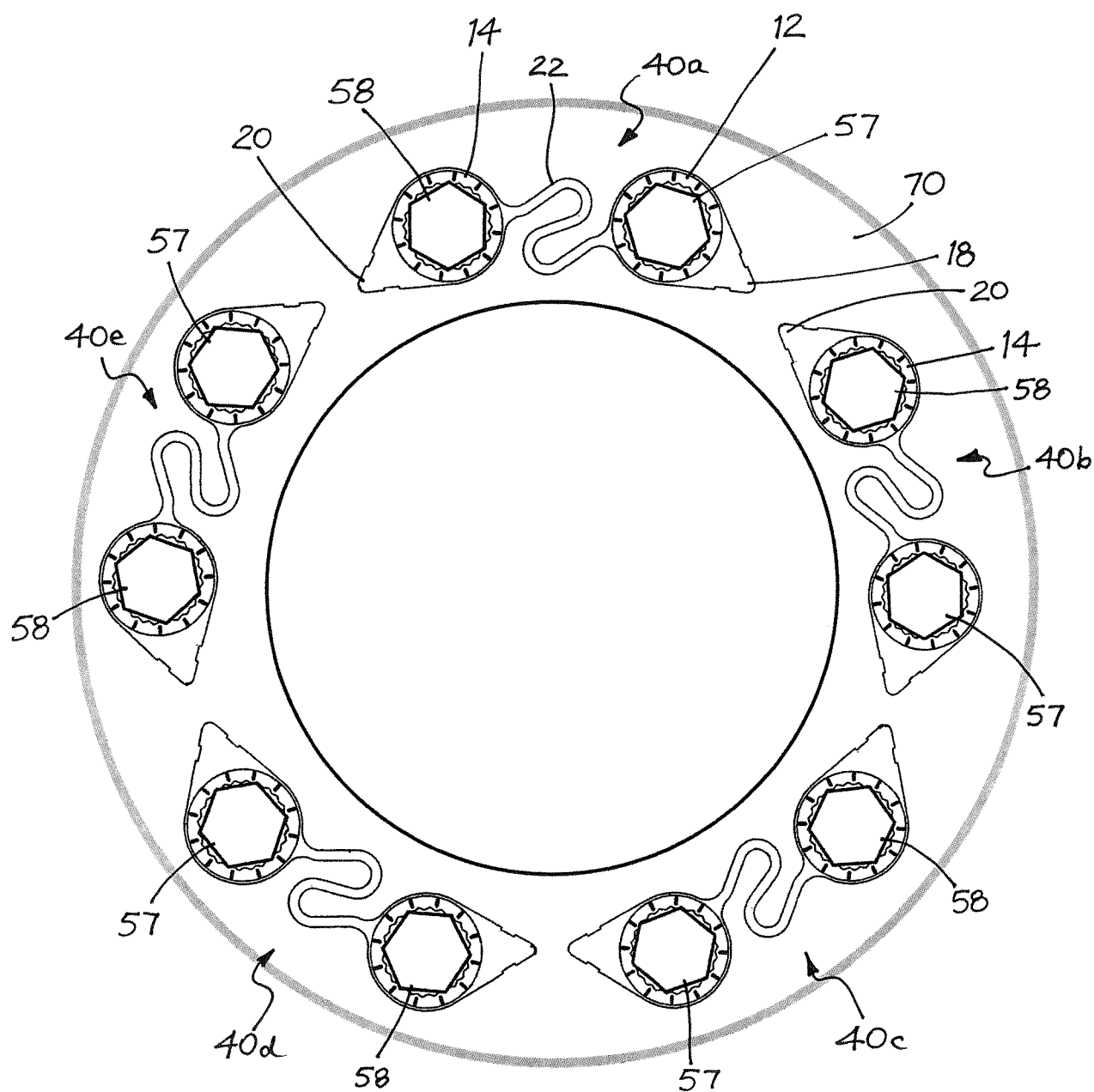


Figure 17

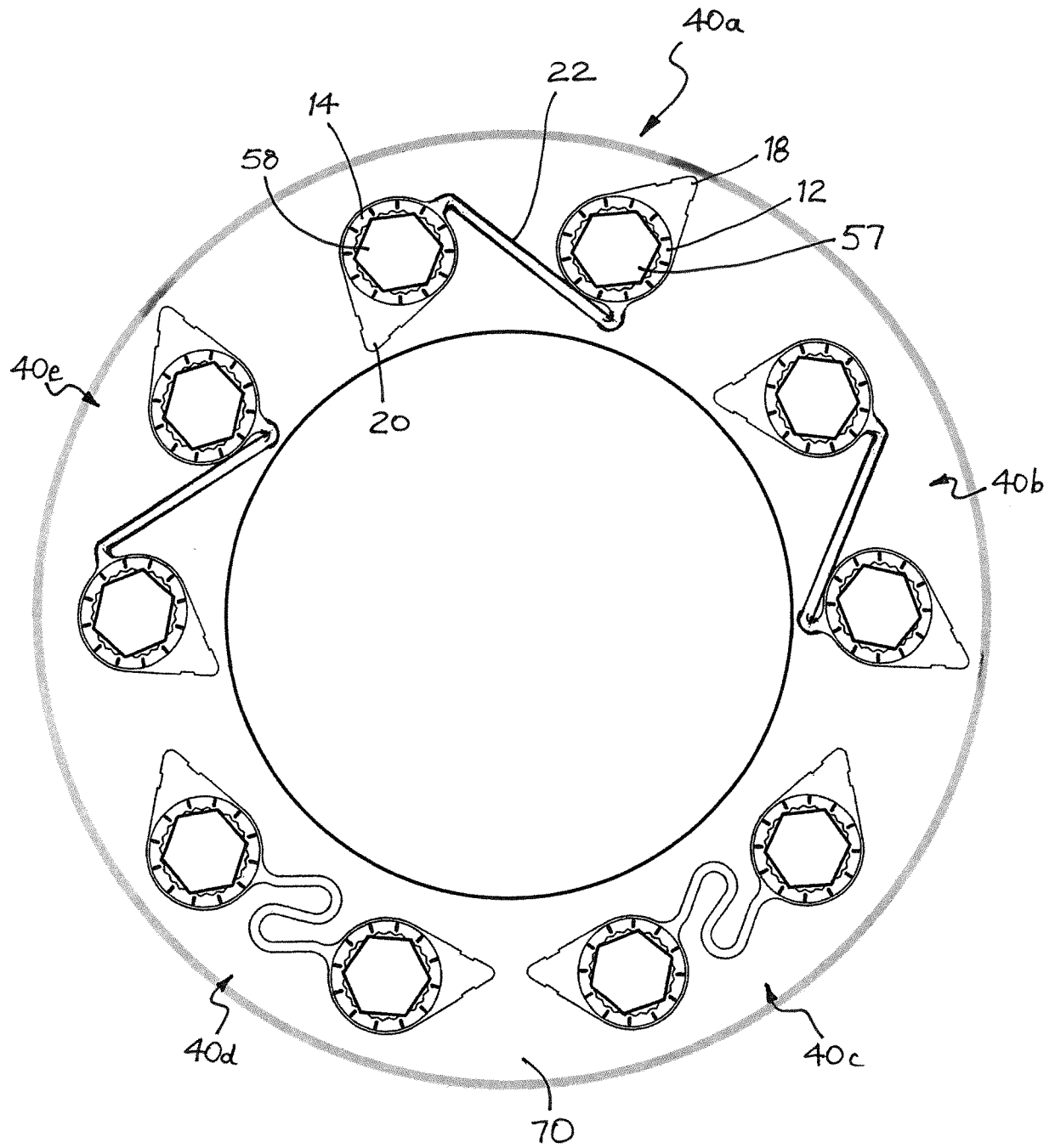


Figure 18

