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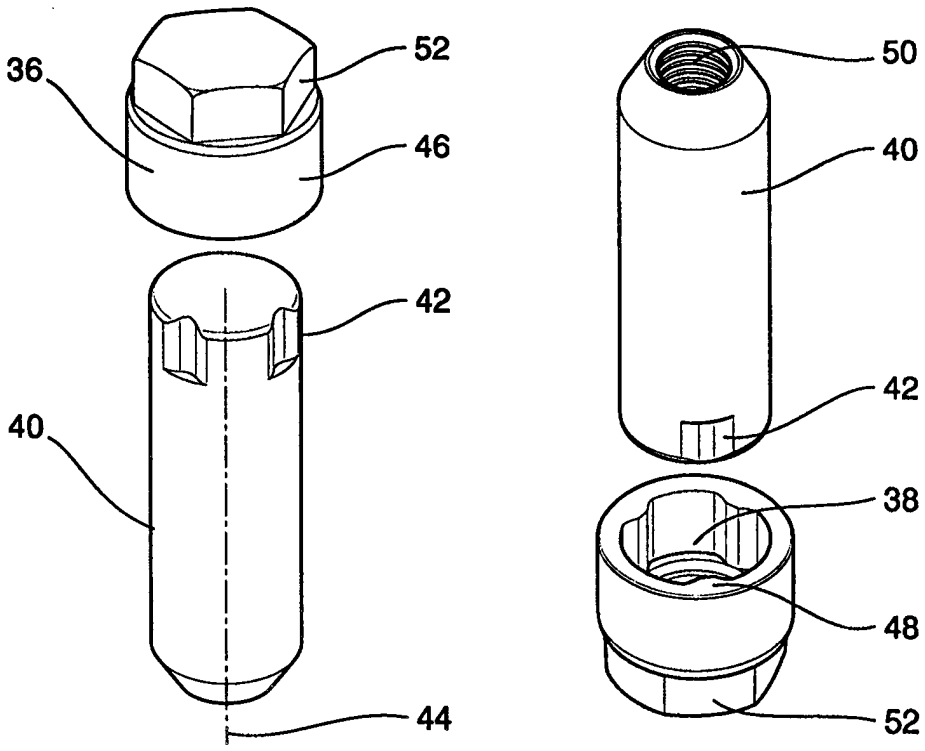
(54) Title: ANTI–THEFT LOCK–NUT AND KEY

(57) Abstract

A vehicle wheel securing means for securing a wheel to a vehicle including a lock–nut (40) and a key (36). The lock–nut (40) includes a threaded bore (50) adapated to engage a wheel stud of a vehicle axle and also includes a surface adapted to engage the wheel to secure the wheel to the axle. The lock–nut (40) is generally of a cylindrical construction at one end of which there is the threaded bore (50) and the other end of which includes an outer surface that includes a plurality of grooves (42) positioned radially around the longitudinal axis (44) of the lock–nut (40). The key (36) is also of a cylindrical construction and includes a sleeve (46) on the inner surface of which are located detents (48) adapted to engage the grooves (42) of the lock–nut (40). Only when said detents (48) are aligned with the grooves (42) can the key (36) engage the lock–nut (40) and by choosing the angular positioning of the grooves (42) and even their length one needs a unique combination of a key (36) to allow this engagement to occur. Once the key (36) has engaged the lock nut (40), a normal wheel brace may be used to rotate the lock–nut and thus secure or unsecure the wheel.



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ANTI-THEFT LOCK-NUT AND KEY

The present invention is for a securing device and has particular application to a vehicle wheel securing device and specifically to a combination lock-nut and key that is used to provide security against the theft of a vehicle wheel when attached to a vehicle, such as an automobile.

BACKGROUND OF THE INVENTION

It is an unfortunate aspect of today's society that has resulted in the need to protect material possessions from theft. This relates very much so to the motor vehicle which is an integral part of today's lifestyle and which is a common target for the undesirable element in our society. One such target of criminals is the motor vehicle and accessories such as the vehicle tyres and wheels (rims or mags) which can easily be laundered to unsuspecting customers. This is especially true in relation to customised wheels and tyres whose value can run into thousands of dollars.

For that reason various means have been developed to provide some security against the undesirable removal of vehicle wheels from a vehicle. These are generally secured by nuts that engage studs on the vehicle axle that protrude though the wheel, and are attached or removed by using a wheel brace, spanner or other suitable tool.

One known method of securing a wheel includes a lock-nut that does not have an external shape compatible with a common wheel brace or spanner and requires a key adapted to engage the lock-nut, the key adapted to be engaged by the wheel brace. By using the key, the lock-nut can be unscrewed from the stud thereby releasing the wheel. To tighten or loosen and remove the lock-nut one needs to supply a significant amount of torque through the wheel brace which in turn applies a torque on the key, which in turn applies a torque to the lock-nut. It is therefore important that there is good coupling between the wheel brace, the key, and the lock-nut, to ensure that the tightening or loosening of the lock-nut is as efficient as possible and that no slippage between any one of the three occurs which may damage the wheel, the locknut or even the car.

However, known lock-nuts include a cavity which is adapted to be engaged by the key, and although said cavity can not be engaged by a standard wheel brace, other tools may be used to engage the cavity, such as a chisel, and whereupon a torque may be applied to the lock-nut to thereby remove it. In addition, with the cavity located within the dimensions of the lock-nut, an efficient coupling between the key and the lock-nut only occurs when the two are co-axial, which is not always easy to maintain.

It is an object of this invention to provide a means for securing a wheel to a vehicle by the use of a key and a lock-nut which overcomes at least some of the above-mentioned problems or at least provides the public with a useful alternative.

SUMMARY OF THE INVENTION

In one form of the invention there is a securing means including;

a body portion and a cap portion;

said body portion having grooves on its outer circumferential surface; and

said cap having co-operating detents wherein said cap is adapted to engage said body portion when said grooves and detents are aligned.

In a further form of the invention there is a vehicle wheel securing means for securing a wheel to a vehicle including a lock-nut and a key, said lock-nut adapted to attach the wheel to the vehicle by engaging a wheel stud and said wheel, said securing means characterised by;

said locknut including a first end adapted to engage said stud and a second end thereof including an outer surface disposed radially on which are a plurality of grooves; and

said key including a sleeve inside of which are disposed a plurality of detents adapted to engage said grooves said sleeve adapted to extend over said second end.

In preference said lock-nut includes a third surface adapted to engage said wheel.

Preferentially the lock-nut is of a substantially cylindrical construction and has a longitudinal axis with said grooves positioned on said outer surface radially

around and extending substantially parallel to said axis.

Preferably said lock-nut is of a substantially cylindrical construction and having a longitudinal axis said detents positioned on the inside of said sleeve radially around and extending substantially parallel to said axis, said detents correspondingly positioned to said grooves.

In preference the angular position of said grooves around said axis is non-symmetrical. This requires a unique key to engage a unique lock-nut.

In preference said lock-nut includes at least three grooves, and said key includes an equal number of detents.

In preference said key includes less detents than there are grooves on said lock-nut. The only requirement is that the lock-nut must have equal to or more grooves than the key has detents.

In preference at least two of said grooves are of a different length, the corresponding detents on said key being correspondingly of a different length. This is a further security feature.

In preference said grooves are of a smooth curvature. By being smooth, it removes any surface whereby a tool may be used to try and unscrew the lock-nut, such as a chisel.

In preference said grooves are of a shallow construction. This also assists in minimising any outside interference.

Preferably said bore threadably engages said stud.

In a further form of the invention there is proposed a vehicle wheel securing means for securing a wheel to a vehicle including a lock-nut and a key, said lock-nut including a threaded bore adapted to threadably engage a vehicle wheel stud of a vehicle axle and including a surface adapted to engage said wheel to thereby secure said wheel to said axle;

said locknut having an axis and being of a substantially cylindrical construction extending one end of which includes said threaded bore and the outer surface of the other end thereof including at least one groove;

said key having an axis and being of a cylindrical construction and including a sleeve on the inside of which is located a detent so shaped to engage said groove, said sleeve adapted to extend over said outer surface when said detent and groove are aligned to thereby cause the axis of the lock-nut and key to be coincident; and

wherein rotation of said key around said coincident axis causes the rotation of said lock-nut with respect to the stud.

Preferably the lock-nut is of such a length that when the wheel is secured to said stud, the lock-nut does not protrude beyond the planar surface of said wheel.

In preference said key includes an outer surface thereof adapted to be rotatably engaged by a tool.

In preference said tool is a hexagonal wheel brace.

Preferably said lock-nut and key are manufactured from hardened steel.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG 1 is a perspective view of a typical motor vehicle wheel rim;

FIG 2 is a cross sectional view of a typical wheel when attached to a vehicle axle;

FIG 3 is a cross sectional view of a sports (mag) wheel when attached to a vehicle axle;

FIG 4 is a perspective view of currently known keys and lock-nuts for securing a wheel to a vehicle;

FIG 5 is the key and lock-nut of Figure 4 indicating the difficulties when in use;

FIG 6 is an exploded perspective view of a first embodiment of the present a invention;

FIG 7 is a perspective view of the key and lock-nut of Figure 6;

FIG 8 is a partial cross sectional view of a standard nut used to secure a wheel to a stud;

FIG 9 is a partial cross sectional view of a known lock-nut and key used to secure a wheel to a stud;

FIG 10 is a partial cross sectional view of the lock-nut and key which is the subject of this invention used to secure a wheel to a stud;

FIG 11 is a top view of a lock-nut and key including in figure (a) five grooves and in (b) four grooves; and

FIG 12 is a perspective view of a lock-nut wherein at least two grooves are of a different length.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning now to the drawings in detail it is to be understood that like numbers are used to indicate like components in the different figures. Furthermore although the embodiment described will refer to a vehicle wheel securing device it is to be understood that the present invention may equally well be used to secure any other article.

Shown in Fig 1 is a typical sports or mag wheel rim 10 that is commonly installed on vehicles either by the initial vehicle manufacturer or by after-sale modifications by individuals who desire a more individual wheel. The wheel rim 10 is attached to the vehicle by the use of nuts or lock-nuts that engage vehicle studs on the vehicle axle (not shown) through bores 12 in the wheel rim 10. The number of bores varies depending on the size of the wheel and is usually in the order of between 4 and 6 bores. Obviously heavier vehicles such as trucks and buses may have wheel rims that are secured to the axle by as many as 12 studs.

Standard wheels are commonly attached to a vehicle as shown in Fig 2 where a wheel includes a rim 10 and a tyre 14 mounted on said rim, said wheel attached to axle 16 of a vehicle including studs 18. The studs 18 are of a

sufficient length to pass through the bores 12 of the wheel rim 10 where they are engaged by nuts 20. The nuts 20 are of an external hexagonal construction and include internal threads allowing them to be rotatably secured to the studs 18. The nuts are of an external dimension larger than the diameter of the bores and by tightening the nuts onto the studs, the wheel is securely attached to the axle. Due to the torque needed to do this, one requires the use of a wheel brace (not shown) that includes a cavity so shaped to engage nut 20 and provide enough torque to tighten the nut so as to ensure that the wheel is firmly attached to the axle and thus to the vehicle so as to prevent the nut from unscrewing itself due to vibrations and the like or to any interference from persons without using an appropriate tool.

However, not only does this type of arrangement result in the nuts 20 protruding from the rim and not being very attractive it additionally does not provide any security for the wheel since by the simple use of a spanner or other suitable tool, such as multi-grips, it is possible for any one person to untighten and completely remove the nuts 20 thus allowing them to remove the wheel from the vehicle. Not only is this a security problem but it is also a safety issue since unbeknownst to the vehicle owner the nuts on a wheel may be loosened and if such a vehicle is driven could lead to accidents.

Mag or sports wheels, as shown in Figure 3, also comprise a rim 10 whose bores 12 are of a depth so that when nut 20 engages stud 18 and is tightened, the nut is wholly contained within the bore 12. To enable a wheel brace to engage nut 20 when wholly contained within the bore the first several centimeters of the bore 24 are enlarged to accommodate the outside dimensions of the wheel brace or spanner. This construction not only improves the appearance of the wheel as a whole it also limits the removal of the nut to the use of a wheel brace or other tool that is not only adapted to engage the nut but can also reach it. It should also be noted that to accommodate for the depth of the bore, and to firmly fix the wheel the length of either or both the studs and the bores may be adjusted.

To secure the wheel and to ensure that the nuts are not easily removable it is known to use a lock-nut 22 that is adapted to be engaged by key 24 as shown in Figures 4 and 5. at least on one of the studs to which a wheel is secured. The lock-nut 26 comprises a uniquely shaped internal cavity 26 with the key comprising an appropriately shaped projection 28 adapted to engage the

cavity 26. Having no external proturbances the lock-nut 22 cannot be engaged by a standard wheel-brace or spanner and is engagable by a key 24 which includes an appropriately shaped head 30 which is adapted to be engaged by a wheel brace. To therefore impart a rotational motion to the lock-nut one has to do it by engaging the key which engages the lock-nut. Without using the key it is not possible to impart any rotational motion to the lock-nut with a wheel brace and other tools and which therefore assists in securing the wheel against unauthorised removal or tampering.

To ensure that the key 24 substantially engages the lock-nut 22 it is necessary that the longitudinal axes of the two are, when in use, substantially co-axial. The difficulty with this is that when applying a torque to the key through a wheel brace the orientation of the keys' longitudinal 32 axis may vary to the orientation of the longitudinal axis 34 of the lock-nut which is itself aligned to the axis of the axle and the stud. This is shown in Figure 5, where the key is shown with solid lines when the orientation of its longitudinal axis is coincident with that of the lock-nut, and with the dashed lines when it is not. The result of any mis-alignment of the longitudinal axis of the key to the lock-nut is that when one is imparting a rotational motion to the key with the wheel brace rotating the wheel brace and thus the key, the transfer of torque is not as efficient and the key may be caused to disengage the lock-nut and slip out.

Shown in Figures 6 is the present invention that overcomes these difficulties by teaching a key 36 including a cavity 38 so shaped so as to engage the outer surface of the lock-nut 40, Figure 6 (a) showing a top perspective view and (b) the bottom perspective view. The engagement of the key to the lock-nut is shown with a top perspective view in Figure 7(a) and the bottom perspective view in Figure 7 (b). The outer surface 42 of the lock-nut 40 includes detents or grooves 42 located around the outer perimeter of the cylindrical lock-nut, the grooves being angularly spaced around the longitudinal axis 44 of said lock-nut 40. In this particular embodiment three grooves are shown although it is not intended to limit the construction to three, it could even be 2 or four or more.

The key 36 includes an envelope or sleeve 46 whose internal dimension is correspondingly shaped to the outer dimension of the lock-nut 40 and that includes dimples or splines 48 whose orientation and number is the same as that of the lock-nut and which are adapted to engage the grooves 42. Of

course, the key may include less splines than there are grooves on the lock-nut, but can certainly not include more otherwise the key will not be able to engage the lock-nut.

The lock-nut includes a internally threaded bore 50 adapted to engage a stud on a vehicle axis. The key further includes a head 52 so shaped to be engaged by a conventional wheel brace or spanner, usually being of a hexagonal construction.

The use of key 36 adapted to surround and engage lock-nut 40 ensures that their longitudinal axis are substantially co-aligned even when the key engages the lock-nut and a torque is applied to the key though a wheel brace or spanner.

In addition, not only does the above mentioned construction ensure that s standard wheel brace may not be used to undo the lock-nut, by choosing a particular angular position of the grooves as well as the total number of grooves located around the perimeter of the lock-nut, it is possible to have a relatively unique combination of a key and lock-nut . Thus if for example there is three grooves and the angular separation between the first and the second is 90 degrees than the angular separation between the second and third and the first and the third is 135 degrees and a correspondingly shaped key will only engage the lock-nut with an exact angular separation of the splines.

The splines 48 and grooves 42 may also vary in their particular shape so that there is only one particular spline that will engage one particular groove in addition to the above discussed angular separation. It is also preferential for the grooves to be of a gentle curvature so as to prevent the tampering of the lock-nut by the use of tools such as multi-grips. Thus one can see that there are numerous variations that may be made to the shape of the lock-nut resulting in only a particular key being able to engage a particular lock-nut.

To further assist in the understanding of the invention reference is made to Figures 8, 9 and 10, showing the use of a standard nut, existing lock-nuts as well as the lock-nut as claimed in this invention respectively.

In standard wheels, as shown in Figure 8 nut 20 can be attached to as well as removed from the stud 18 by applying a rotation to it through a wheel brace

54. The nut 20 protrudes from the rim 10 and accordingly is accessible to not only wheel brace 54 but other tools such as a spanner.

Figure 9 shows a known lock-nut and key whereupon the key 24 includes projections 28 adapted to engage cavities 26 in lock-nut 22. The wheel brace 54 by engaging key engages the lock-nut. However, the horizontal extent of the projections is less than the outer dimensions of the key which can result in the key wobbling within the lock-nut causing it to slip out especially when applying a torque. In addition this type of arrangement requires the key to be held firmly against the lock-nut and requiring a force in the longitudinal direction. Not only is this unsatisfactory but the cavity 26 may accommodate a tool such as a screwdriver or chisel which when jammed therein may allow one to impart some rotational motion causing the lock-nut to be unscrewed and thus compromising the security of the wheel.

An embodiment of the present invention is shown in operation in Figure 10. The key 36 includes sleeve 46 that envelopes the top of lock-nut 40. The key 36 includes splines or dimples 48 adapted to engage correspondingly shaped grooves 42 in the lock-nut 40. It is therefore not possible to engage the lock-nut with the key unless the key equal to or less splines than the lock-nut has grooves and their relative angular orientation is the same. With no cavity in the lock-nut one can not engage the lock-nut with tools such as screwdrivers or chisels thus improving on the security. Furthermore with the key enclosing the lock-nut, one does not need to hold the two in relative position and the application of torque is much easier resulting in the tendency for the key to slip being reduced thereby reducing any potential damage.

In a further embodiment, a lock-nut may include a plurality of grooves, such as that seen Figure 11 (a) where key 36 includes five dimples 48 adapted to engage five grooves 42 on lock-nut 40 and in Figure 11 (b) where there are four dimples and four grooves. One can see that by choosing a non-symmetrical angular separation between the grooves on the lock-nut a key will only be able to engage the lock-nut when it includes the same angular separation for its dimples.

As a further security measure, the grooves on the lock-nut may also be varies in their depth, that shown in Figure 12 where groove 56 is of a lesser depth to groove 58. This then requires that the key which can engage the lock-nut in

Figure 12 must not only have the same angular separation of its detents as the lock-nut it also means that the depths of the splines must correspond to the depths of the grooves.

CLAIMS

1. A securing means including;

a body portion and a cap portion;

said body portion having grooves on its outer circumferential surface; and

said cap having co-operating detents wherein said cap is adapted to engage said body portion when said grooves and detents are aligned.

2. A vehicle wheel securing means for securing a wheel to a vehicle including a lock-nut and a key, said lock-nut adapted to attach the wheel to the vehicle by engaging a wheel stud and said wheel, said securing means characterised by;

said locknut including a first end adapted to engage said stud and a second end thereof including an outer surface disposed radially on which are a plurality of grooves; and

said key including a sleeve inside of which are disposed a plurality of detents adapted to engage said grooves said sleeve adapted to extend over said second end.

3. A vehicle wheel as in claim 2 wherein said lock-nut includes a third surface adapted to engage said wheel.

4. A vehicle wheel securing means as in any one of claims 2 or 3 wherein said lock-nut is of a substantially cylindrical construction and having a longitudinal axis said grooves positioned on said outer surface radially around and extending substantially parallel to said axis.

5. A vehicle wheel securing means as in any one of claims 2 to 4 wherein said lock-nut is of a substantially cylindrical construction and having a longitudinal axis said detents positioned on the inside of said sleeve radially around and extending substantially parallel to said axis, said detents correspondingly positioned to said grooves.

6. A vehicle wheel securing means as in claim 4 or 5 wherein the angular position of said grooves around said axis is non-symmetrical.

7. A vehicle wheel securing means as in any one of claims 2 to 6 wherein said lock-nut includes at least three grooves, and said key includes an equal number of detents.

8. A vehicle wheel securing means as in claim 5 wherein said key includes less detents than there are grooves on said lock-nut.

9. A vehicle wheel securing means as in any one claim 2 to 8 where at least two of said grooves are of a different length, the corresponding detents on said key being correspondingly of a different length.

10. A vehicle wheel securing means as in any one of claim 2 to 9 wherein said grooves are of a smooth curvature.

11. A vehicle wheel securing means as in any one of claim 2 to 10 wherein said grooves are of a shallow construction.

12. A vehicle wheel securing means as in any one of claim 2 to 11 wherein said lock-nut includes a threaded bore adapted to threadably engage said stud.

13. A vehicle wheel securing means for securing a wheel to a vehicle including a lock-nut and a key, said lock-nut including a threaded bore adapted to threadably engage a vehicle wheel stud of a vehicle axle and including a surface adapted to engage said wheel to thereby secure said wheel to said axle;

said locknut having an axis and being of a substantially cylindrical construction extending one end of which includes said threaded bore and the outer surface of the other end thereof including at least one groove;

said key having an axis and being of a cylindrical construction and including a sleeve on the inside of which is located a detent so shaped to engage said groove, said sleeve adapted to extend over said outer surface when said detent and groove are aligned to thereby cause the axis of the lock-nut and key to be coincident; and

wherein rotation of said key around said coincident axis causes the rotation of said lock-nut with respect to the stud.

14. A vehicle wheel securing means as in any one of claims 2 to 13 wherein

when the wheel is secured to said stud, the lock-nut does not protrude beyond the planar surface of said wheel.

15. A vehicle wheel securing means as in any one of claims 2 to 14 wherein said key includes an outer surface thereof adapted to be rotatably engaged by a tool.

16. A vehicle wheel securing means as in claim 15 wherein said tool is a hexagonal wheel brace.

17. A vehicle wheel securing means as in any one of the above claims wherein said lock-nut and key are manufactured from hardened steel.

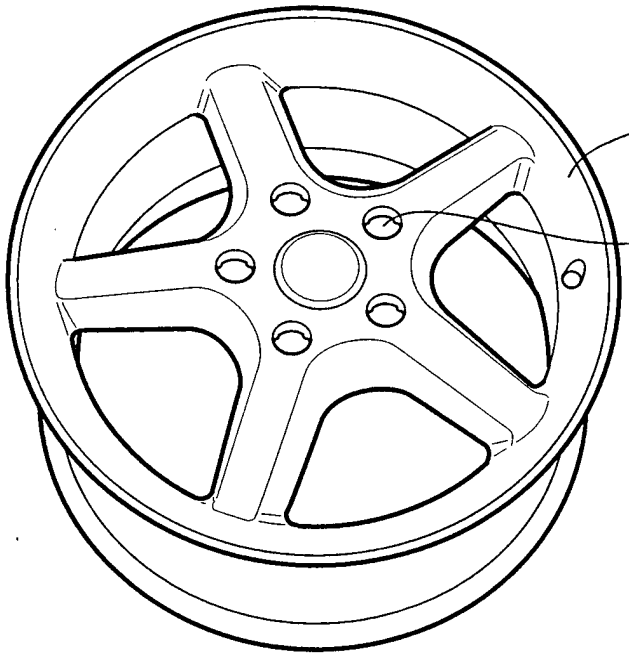

FIG 1

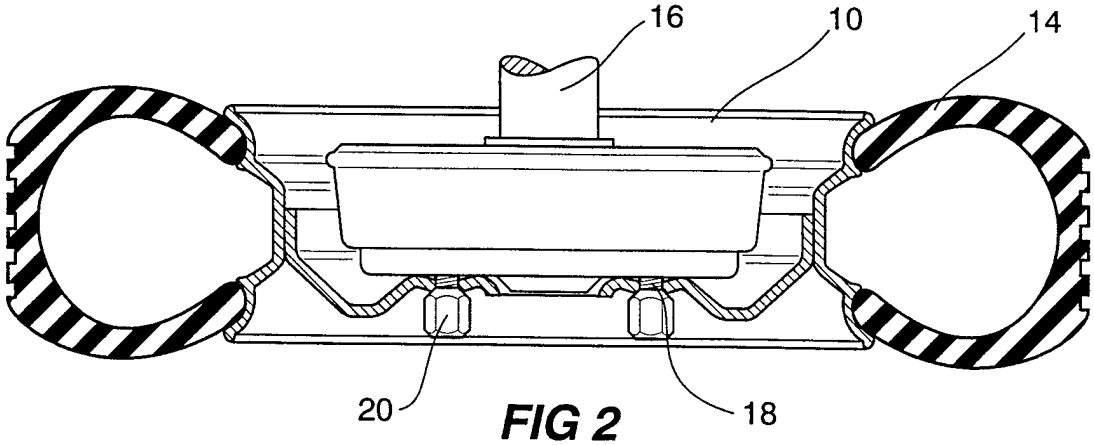

FIG 2

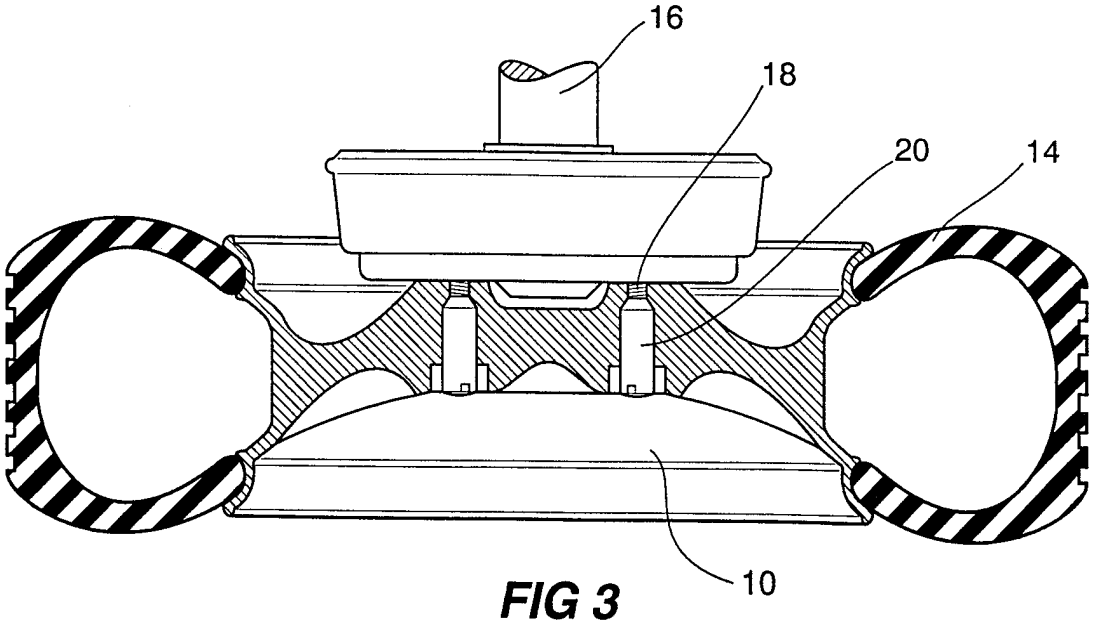

FIG 3

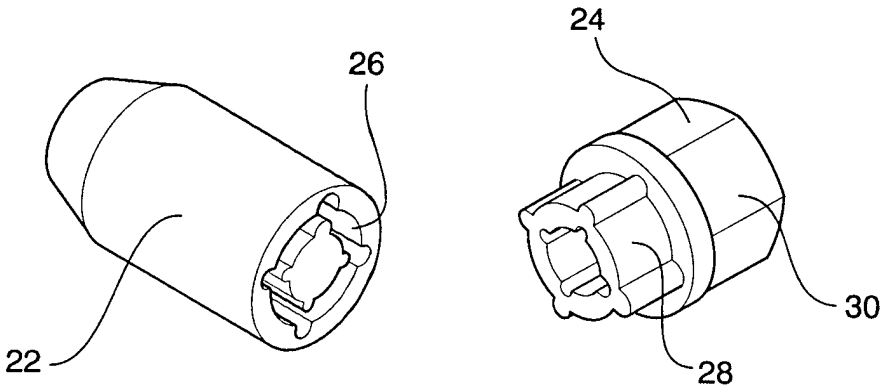

FIG 4

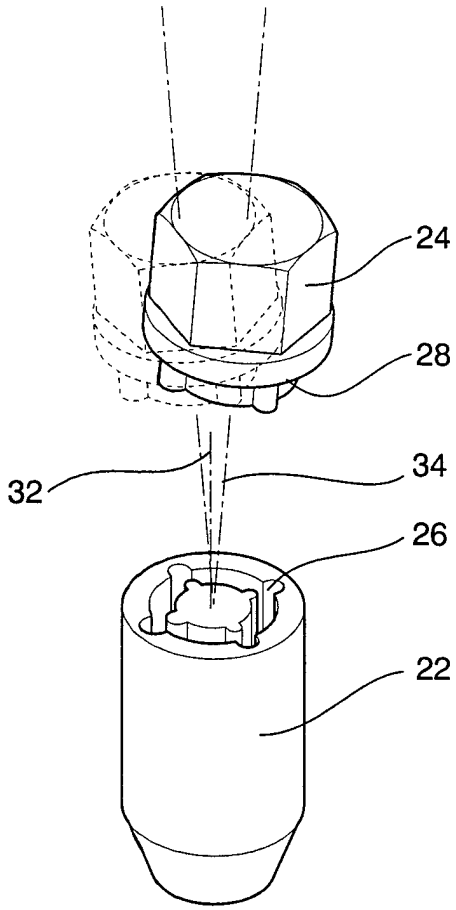

FIG 5

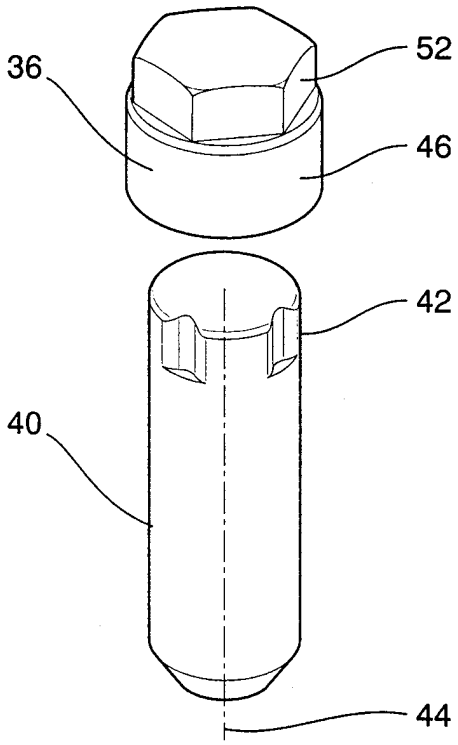

FIG 6a

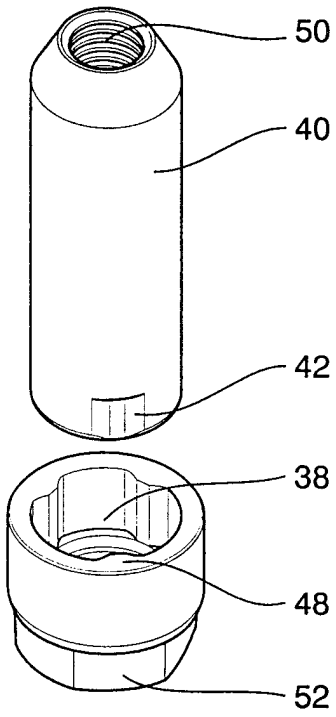

FIG 6b

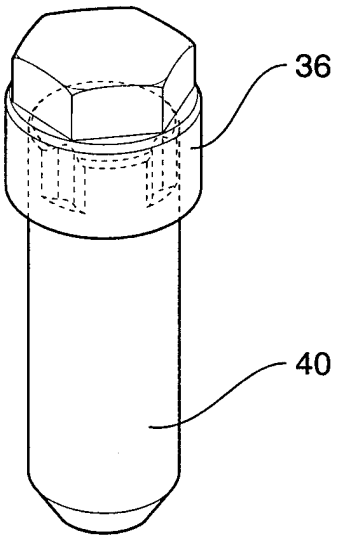

FIG 7a

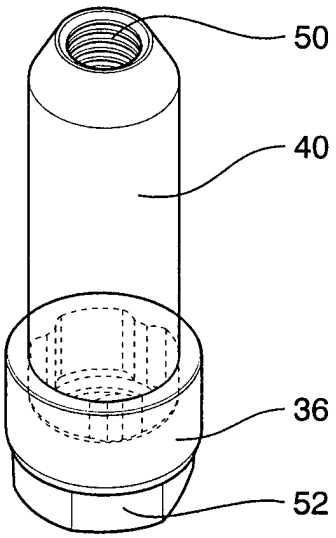

FIG 7b

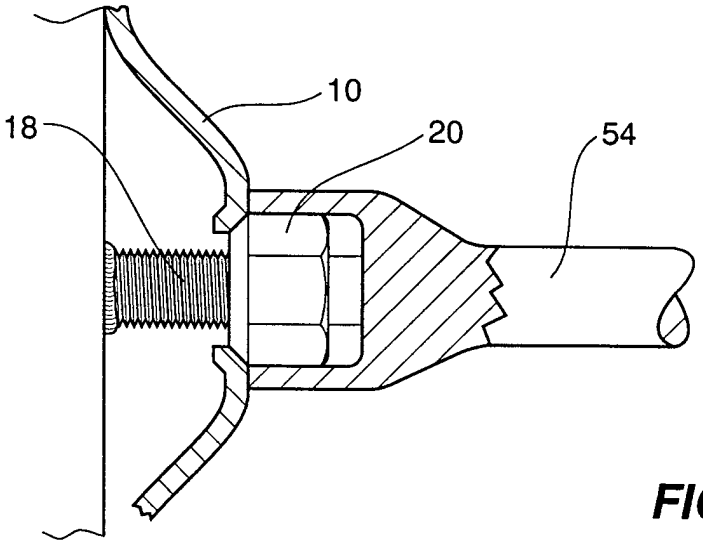

FIG 8

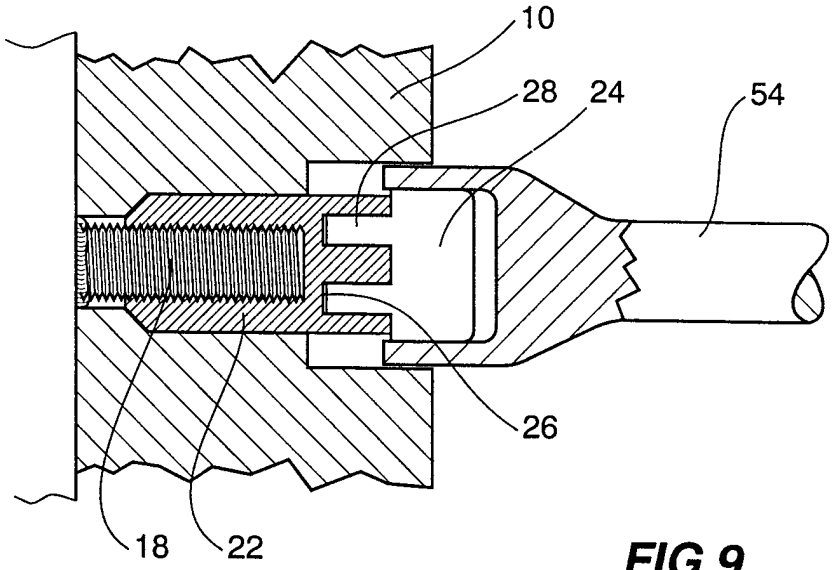

FIG 9

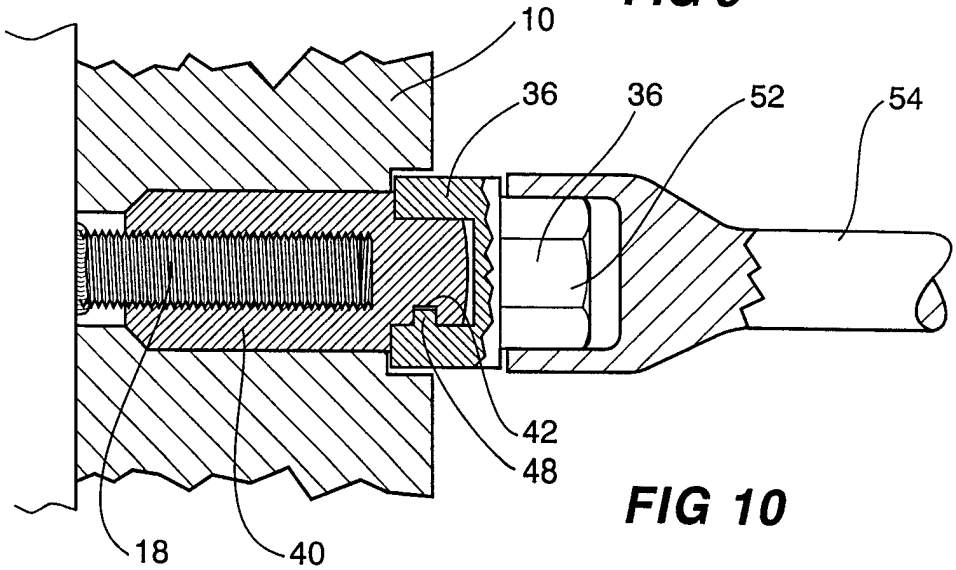

FIG 10

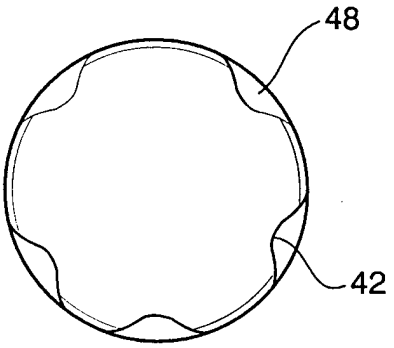

FIG 11a

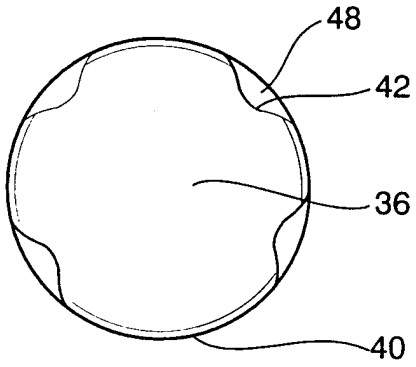

FIG 11b

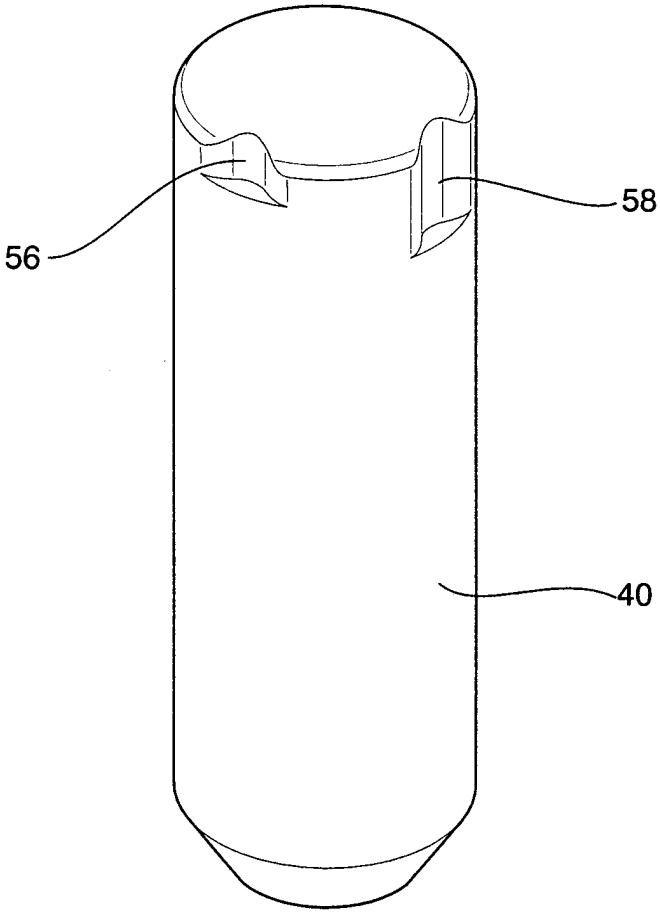

FIG 12

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/AU 98/00241

A. CLASSIFICATION OF SUBJECT MATTER

Int Cl[6]: B60B 3/16; B60R 27/00; F16B 23/00, 41/00

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)
IPC: as above

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)
DERWENT WPAT: WHEEL# and NUT# and THEFT:/ANTITHEFT

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, X	US 5628602 A (OHSAWA), 13 May 1997 Whole document	1-7, 10-17
X	US 4693655 A (OMORI), 15 September 1987 Whole document	1-5, 7, 11-17
X	US 4616535 A (CHIAVON), 14 October 1986 Whole document	1-7, 10-17
X	US 5037260 A (RUBIN), 6 August 1991 Whole document	1-7, 9-15, 17

[X] Further documents are listed in the continuation of Box C

[X] See patent family annex

* Special categories of cited documents:

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"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	Date of mailing of the international search report
14 May 1998	25 MAY 1998

Name and mailing address of the ISA/AU	Authorized officer
AUSTRALIAN INDUSTRIAL PROPERTY ORGANISATION PO BOX 200 WODEN ACT 2606 AUSTRALIA Facsimile No.: (06) 285 3929	**R. SUBBARAYAN** Telephone No.: (06) 283 2379

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/AU 98/00241

C (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0287702 A1 (BBS KRAFTFAHRZEUGTECHNIK AG), 26 October 1988 Whole document	1, 15-16
A	US 4211128 A (PLUMER), 8 July 1980 Column 1, lines 6-8, lines 25-37, Figures 1-5	6, 11-12, 15-17
A	US 3930428 A (HALE), 6 January 1976 Column 1, lines 11-14, lines 58-68, column 2, lines 1-2, Figures 1-4	1-5, 12-13, 15-17

INTERNATIONAL SEARCH REPORT
Information on patent family members

International Application No.
PCT/AU 98/00241

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

Patent Document Cited in Search Report		Patent Family Member					
US	5037260	BR	9105736	CA	2063268	CN	1056841
		CS	9101240	EP	483340	PL	290094
		WO	9117364				
EP	287702	DE	3713166	HK	939/91	JP	63263102
		SG	666/91				
US	3930428	AU	66208/74	CA	987934	DE	2407735
		IT	1003629	JP	49126033		

END OF ANNEX