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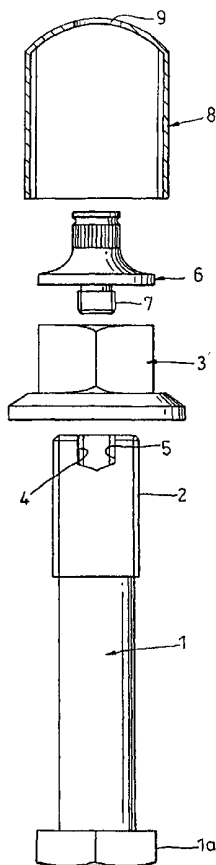
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[Continued on next page]

(54) Title: IMPROVED WHEEL NUT ASSEMBLY



(57) **Abstract:** A wheel nut assembly is disclosed comprising a wheel stud (1) having a first portion having a first external thread (2) which is adapted to co-operate with an internal thread provided on a wheel nut (3) and a second portion (4) having a thread (5) of the opposite hand to the first external thread which co-operate with a retaining member (6) having a thread which is of the same hand as the second threaded member, and a locking member (8) which is adapted to engage both the retaining member (6) and the wheel nut (3) to prevent relative movement therebetween, and in which the locking member (8) is so constructed and arranged to permit the location of the retaining member to be visually identified whilst the locking member is in place. Preferable, the locking member comprises a cap that may completely or partially cover the wheel nut and the retaining member.

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IMPROVED WHEEL NUT ASSEMBLY

This invention relates to improvements in a method and apparatus for mounting and retaining a wheel onto a hub, and in particular relates to
5 fixings for vehicle wheels.

It is known to fix a wheel onto a vehicle hub using a plurality of wheel studs which are fixed to the hub and a plurality of wheel nuts with one nut provided for each stud. The studs usually have an external threaded
10 portion which is adapted to co-operate with a corresponding internal threaded portion of the wheel nut. Such a wheel nut assembly will hereinafter be referred to as being of the kind set forth.

Modern vehicle wheels, especially those for use on commercial vehicles,
15 comprise a rim portion and a nave or wheel disc. The nave joins the rim to the wheel centre, and is welded to the rim. Alternatively, one piece wheels are sometimes employed in which the rim and the nave are integral parts. To assemble the wheel to the vehicle hub, the wheel is first positioned so that the wheel is concentric with the hub and the wheel
20 studs project through openings in the nave or disc. The wheel nuts are then tightened onto the studs. Because the nuts are of a larger diameter than the openings through which the studs are passed, the wheel is firmly clamped in place, by the nut against the hub.

25 Whilst the wheel nut assembly of the kind set forth is widely used to mount wheels on vehicles, there is a serious problem with the nuts working loose. In a worst case, if all the nuts work loose, the wheel can release itself from the hub with potentially catastrophic results. In practice, even if only one of the nuts retaining a wheel is loose, this will
30 place extra loading on the adjacent nuts which causes them to start to

work loose. It is not unknown for a whole wheel to work free within 20 minutes of a single nut starting to vibrate loose.

One solution to the problem of wheel loss is taught from British patent application GB 9701533.3. In this application, a wheel nut assembly is provided of the kind in which a wheel stud is adapted to receive a wheel nut of a first handed thread. The wheel nut also includes a bore with an internal thread of opposite hand to that which receives the wheel nut. This opposite hand thread receives a locking bolt or retaining member. A locking cap is then placed over both the wheel nut and the retaining member. This locking cap co-operates with both the cap and the wheel nut. Because the wheel nut and retaining member have opposing threads the nut will not work free. A small retaining magnet located in the cap holds it securely in place.

Whilst the above arrangement provides a significant improvement over the existing art the applicant has appreciated that in its most rudimentary form as outlined above several disadvantages are present over the use of a simple wheel nut assembly. Firstly, because the cap covers the wheel nut and retaining member, a visual inspection of the location of the nut or retaining member cannot be made without first removing the cap. This is time consuming for a set of nuts on a wheel. Secondly, the magnet may work loose from its fastening onto the cap. Finally, in cases where the cap is shaped to resemble a hexagonal nut for aesthetic reasons, a driver may attempt to "tighten" the cap with a wrench under the mistaken belief that it is a wheel nut. This can cause catastrophic damage to the cap. Even if the cap is removed, the provision of the retaining member may impede location of a socket body onto the wheel nut for tightening.

It is an object of at least one aspect of the present invention to ameliorate one or more of the above mentioned problems.

In accordance with a first aspect, the invention provides a wheel nut assembly comprising:

5 a wheel stud having a first portion having a first external thread which is adapted to co-operate with an internal thread provided on a wheel nut and a second portion having a thread of the opposite hand to the first external thread which co-operates with a retaining member having a thread which is of the same hand as the second threaded member, and

10 a locking member which is adapted to engage both the retaining member and the wheel nut to prevent relative movement therebetween, and in which the locking member is so constructed and arranged to permit the location of the retaining member to be visually identified whilst the locking member is in place.

15 Preferably, the locking member comprises a cap that may completely or partially cover the wheel nut and the retaining member. The cap may be provided with an opening which permits viewing of at least a part of the retaining member.

20 The retaining member may extend at least part way through the opening which can conveniently be located in an end face of the cap. For example, the retaining member may in one arrangement comprise a threaded bolt which is received within an internal threaded bore in the stud. An end portion of the bolt may be extended axially away from the
25 bore to pass through the opening in the end face of the cap.

The portion of the retaining member that passes through the opening may be of a different colour to the external surface of the cap that surrounds the opening to make it easier to identify. The protruding portion may be
30 fluorescent to aid identification in low-light conditions.

The locking member may be a snap-fit onto the wheel nut, the wheel stud or the retaining member. For example, the locking member may comprise a cap with an inwardly directed protrusion that co-operates with a groove or lip on one of the other components. Of course, other forms of “snap-fit” engagement are envisaged within the scope of the invention.

In an alternative, the cap may also include a magnet in addition to the snap-fit engagement.

10 The retaining member may be so constructed and arranged to permit location of a socket onto the wheel nut without removing the retaining member.

An advantage of such an arrangement is that it allows the wheel nut to be
15 tightened down using a socket without removing the retaining member.

Where the wheel nut has a standard hexagonal profile and retaining member comprises a bolt, it is preferred that the maximum radial extent of the retaining member away from its central axis is smaller than the
20 minimum radial extent of the flats of the wheel nut. In this case, the wheel nut can be engaged by an appropriate socket body for any position of the retaining member. Of course, this assumes that the retaining member is axially aligned with the wheel nut.

25 The retaining member may comprise a bolt which is received in an internal bore provided in the wheel stud. Alternatively, it may comprise a retaining nut which is received upon a threaded extension of the wheel stud. In each case, the minimum radial extent of the head of the retaining member must be larger than the inner thread diameter of the wheel nut.

The retaining member may, in an alternative, comprise at least two discrete components. It may comprise a washer and a retaining bolt or nut, the washer being held between one face of the wheel nut and the head of the retaining bolt or retaining nut. In this case, a smaller nut or bolt
5 may be used as long as the diameter of the washer exceeds the internal threaded diameter of the wheel nut. The locking member may be adapted to co-operate with both the wheel nut and the bolt or nut of the retaining member.

10 The washer may have a circular outline or may have another irregular shape. It may be made of a different material to the retaining nut or bolt. The washer may be aluminium for lightness with the nut or bolt being of ferrous material. The cap may be provided with a magnet, or several magnets, that engage the nut or bolt.

15 An advantage of such a two-part construction for the retaining member is that weight can be saved. A retaining member made from one piece of ferrous material would be heavier for a similar size.

20 There will now be described, by way of example only, several embodiments of the present invention with reference to the accompanying drawings of which:

25 **Figure 1 (a)** is an exploded cross-sectional view and 1 (b) is a corresponding assembled view of a first embodiment of a wheel nut assembly in accordance with the present invention;

30 **Figure 2 (a)** is an exploded cross-sectional view and 2 (b) is a corresponding assembled view of a second embodiment of a wheel nut assembly in accordance with the present invention;

Figure 3 (a) is an exploded cross-sectional view and **3 (b)** is a corresponding assembled view of a third embodiment of a wheel nut assembly in accordance with the present invention; and

5 **Figure 4** is a view of the locking cap used in Figures 1 to 3 of the accompanying drawings (a) from above, (b) from the side; and (c) from underneath the cap.

A first embodiment of the present invention is shown in an exploded form
10 in Figure 1 (a) of the accompanying drawings and in its assembled form in Figure 1 (b).

The wheel nut assembly comprises a stud 1 which is attached at one end
15 1a onto a hub (not shown). The stud 1 can be welded in place. The stud 1 has an external thread 2 provided over at least its uppermost portion spaced from the hub. A wheel nut 3 is adapted to threadedly engage with the stud 1 by means of an internal thread (not shown) which co-operates with the external thread 2 on the stud 1. The nut 3 may be tightened to the required torque using a socket or wrench and acts to trap a part of the
20 vehicle wheel (not shown) onto the wheel hub.

The thread 2 on the stud 1 is of greater length than the thickness of the nut 3 so that when the wheel nut is fully tightened onto the stud, an end portion of the stud 1 protrudes from the wheel nut 3.

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An internal bore 4 is provided in the protruding end portion of the stud distal from the wheel hub 2. The internal surface of the bore 4 is provided with a thread 5 which is of the opposite hand to the external thread 2.

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A retaining member is provided in the form of a bolt having a head 6 and a threaded shank 7 that is complementary to the internal thread 5 in the bore 4. The bolt can be tightened into the bore 5 by engagement of thread 7 with thread 5 and turning the bolt in the opposite direction to that required to tighten the wheel nut 2.

A locking means in the form of a cap 8 is also provided. The locking cap 8 is adapted to fit over and co-operate with both the wheel nut 3 and retaining bolt 6. The inside of the cap 8 has a multi-faced profile, as shown in Figure 4 of the accompanying drawings. When fitted, the inside of the cap co-operates with the wheel nut 2.

The head 6 of the retaining bolt 6 has a stepped outline and in use extends through an opening 9 provided in the end of the cap 8. This allows the location of the retaining member to be visually identified. The opening in the cap has a profile that complements that of the bolt 6 so that when fitted the cap prevents rotation of the bolt 6. A small groove around the head 6 also protrudes through the cap 8 and can receive a circlip (not shown) that prevents accidental release of the cap 8 from the bolt 6.

20

The outer face of the cap is provided with indicia, in the example in the form of an arrow. This enables the orientation of the cap to be visually identified from a distance (question- why do this?). Also, the portion of the retaining member that protrudes from through the opening of the cap has a different colour to that of the cap surrounding the opening so that it can be easily identified.

25

Several modifications are envisaged within the scope of the invention as typified by the alternative embodiments of Figures 2 and 3 of the accompanying drawings. Where possible the reference numerals used in Figure 1 have been used in Figures 2 and 3 to denote like components.

30

In the alternative embodiment shown in Figures 2 (a) and 2 (b) of the accompanying drawings, the portion of the bolt that extends through the cap has fewer facets, as does the complementary opening in the cap 8. This restricts the number of possible combinations of cap and retaining member angular position.

In a still further modification shown in Figure 3 (a) and Figure 3 (b) of the accompanying drawings the one-piece retaining member of the first and second embodiments is substituted by a two-part retaining member. The retaining member comprises a bolt 20 and a washer 21 which is located between the head of the bolt 20 and the wheel nut 2. The washer 21 is manufactured from a light weight material, such as aluminium, whilst the bolt is manufactured from a ferrous material. A circular magnet 22 is provided on the cap to retain the cap 8 to the bolt 20.

CLAIMS

1. A wheel nut assembly comprising a wheel stud having a first portion having a first external thread which is adapted to co-operate with
5 an internal thread provided on a wheel nut and a second portion having a thread of the opposite hand to the first external thread which co-operates with a retaining member having a thread which is of the same hand as the second threaded member, and a locking member which is adapted to engage both the retaining member and the wheel nut to prevent relative
10 movement therebetween, and in which the locking member is so constructed and arranged to permit the location of the retaining member to be visually identified whilst the locking member is in place.
2. The wheel nut assembly of Claim 1 in which the locking member
15 comprises a cap that completely or partially covers the wheel nut and the retaining member.
3. The wheel nut assembly of Claim 2 in which the cap is provided with an opening which permits viewing of at least a part of the retaining
20 member.
4. The wheel nut assembly of Claim 3 in which the retaining member extends at least part way through the opening which is located in an end face of the cap.
25
5. The wheel nut assembly of Claim 4 in which the portion of the retaining member that passes through the opening is of a different colour to the external surface of the cap that surrounds the opening.
- 30 6. The wheel nut assembly of Claim 4 or Claim 5 in which the protruding portion is fluorescent.

7. The wheel nut assembly of any preceding claim in which the locking member is a snap-fit onto the wheel nut, the wheel stud or the retaining member.

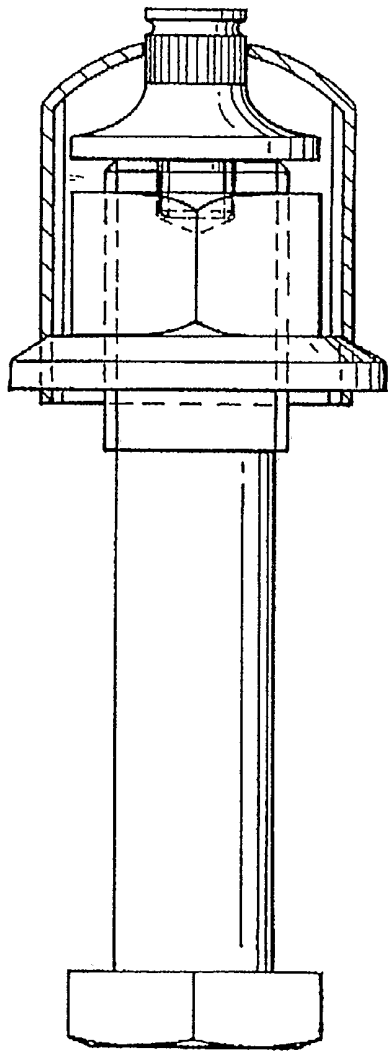


Fig. 1(b)

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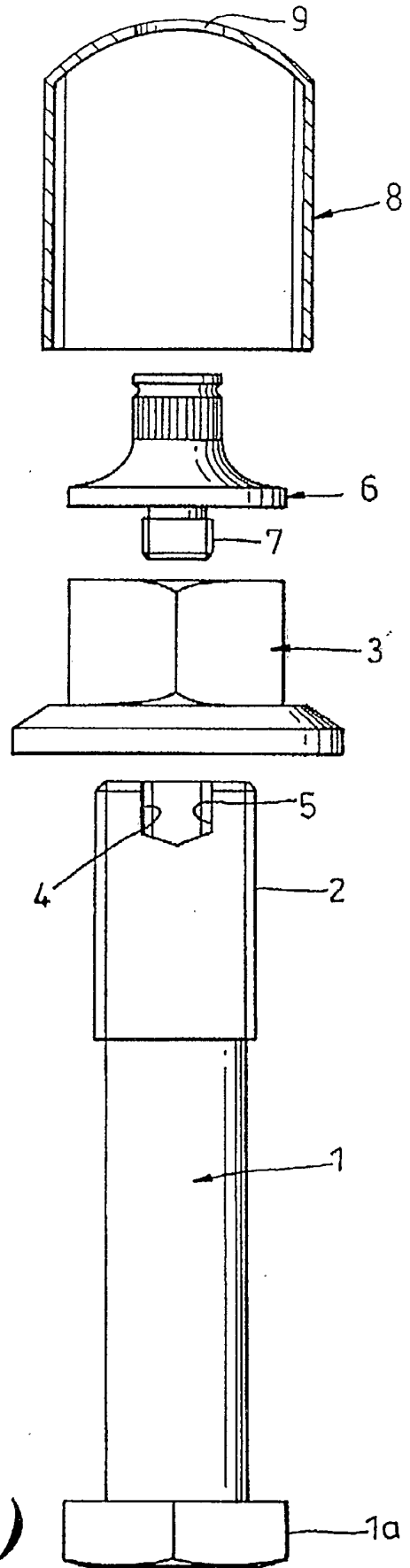


Fig. 1(a)

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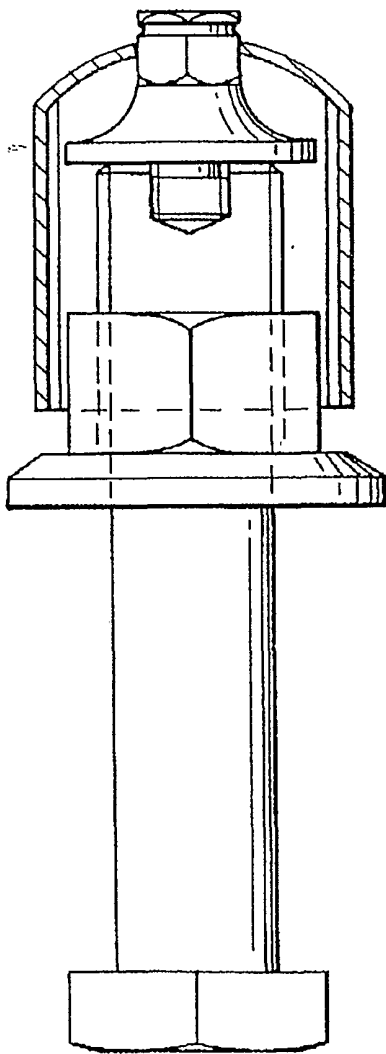


Fig. 2(b)

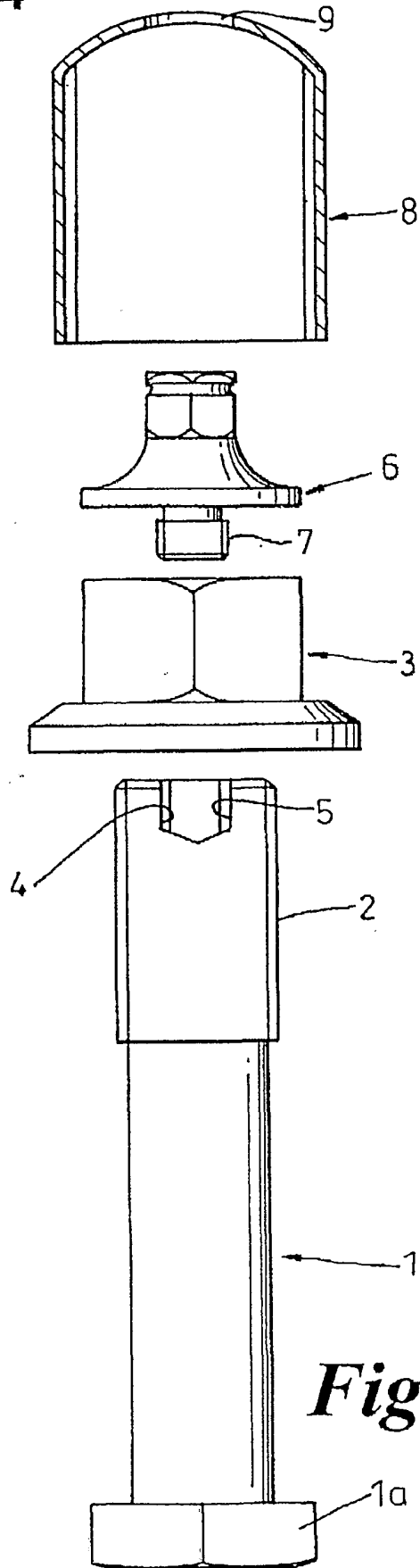


Fig. 2(a)

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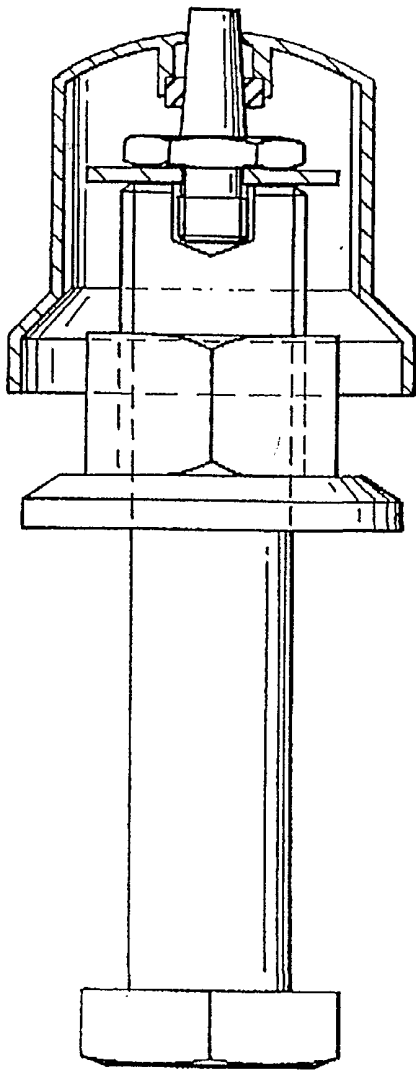


Fig. 3(b)

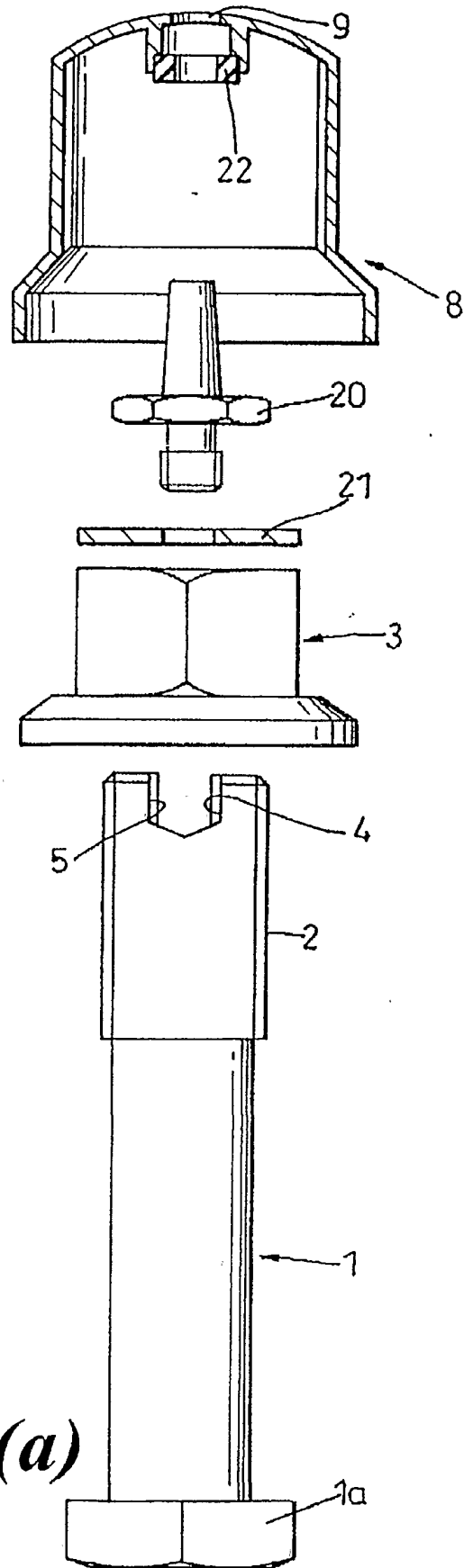


Fig. 3(a)

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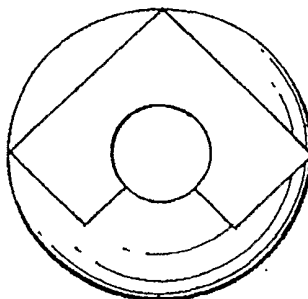


Fig. 4(a)

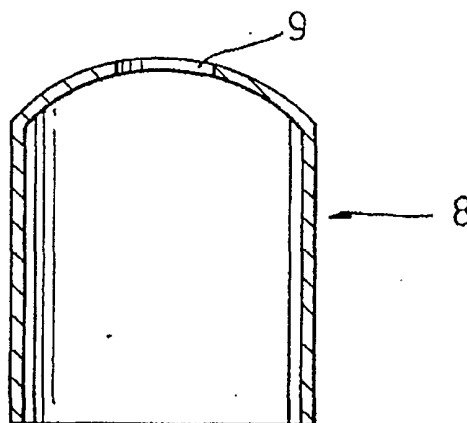


Fig. 4(b)

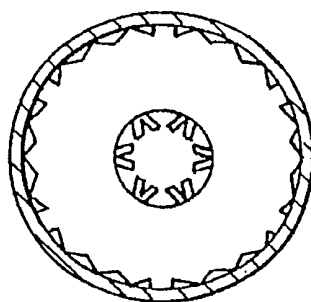


Fig. 4(c)

INTERNATIONAL SEARCH REPORT

Inter: I Application No
PCT/GB 01/03211

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F16B39/16 B60B3/16

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 7 F16B B60B

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 practical, search terms used)

EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 1 490 024 A (HALLIE QUINN GEORGE) 8 April 1924 (1924-04-08) the whole document	1-4,7
X	US 1 413 024 A (HARRELL ANNIE L) 18 April 1922 (1922-04-18) claim 1; figures 1-8	1-4
X	US 1 525 979 A (BROUGHTON JOHN C) 10 February 1925 (1925-02-10) page 1, line 53 - line 109; figures 1-3	1
A	WO 98 32617 A (LEES JOHN SIDNEY) 30 July 1998 (1998-07-30) abstract; figures 1,2	1
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Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

° Special categories of cited documents :

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- *Z* document member of the same patent family

Date of the actual completion of the international search

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18 October 2001

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 01/03211

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 659 484 A (ALBERTO ATTIAS) 24 October 1951 (1951-10-24) the whole document ---	1
A	GB 2 036 908 A (SUMITOMO ELECTRIC INDUSTRIES) 2 July 1980 (1980-07-02) claim 1; figures 1A-2B -----	5

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 01/03211

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