

The invention relates to a device according to the pre-characterizing clause of the main claim (US-A-4,616,535).

Aluminium wheel rims are expensive and consequently the object of thefts or attempted thefts. There are here a variety of possible ways of attempting to hinder theft. Many of these attempts consist in providing lockable wheel bolts. This approach to the problem has the following disadvantages:

- a) A key is needed which is extremely small and can therefore easily be lost.
- b) It is therefore almost impossible to provide keys with a high degree of security for the very reason that the lock cylinders are very small and the coding of the lock therefore remains primitive.
- c) When the wheel bolt has been tightened, the lock must then be closed again, which many people forget after they have previously unlocked the lock.
- d) The lock is provided in an extremely exposed position where it can become dirty, can freeze up or can be damaged in some other way, such that it becomes inoperative. The lock can also corrode easily.
- e) The lock represents a weakness for the wheel bolt and must thus be produced from special material if the weaknesses are to be compensated.
- f) It is too expensive to provide for each wheel bolt to be lockable, with the result that the security is usually provided only for a single wheel bolt.
- g) If the thief succeeds in exposing the hexagon head situated underneath, by tearing off the security cap, there is no longer any protection against theft.
- h) The security devices which can be locked by means of a key have four parts if one counts the wheel bolt.
- i) The known devices are so expensive that only a single device can be afforded per wheel.

Another approach to the problem, of the generic type (US-A-4,616,535), consists in designing the head of the wheel bolt such that a normal wheel nut wrench does not fit. Instead, such a tool can only be attached with

the interposition of an adaptor which is supplied with the wheel bolt. Nevertheless, so that owners of an adaptor are unable to free someone else's wheel bolts, both parts are form-coded such that an adaptor only fits onto the associated wheel bolt. According to US-A-4,616,535, grooves are provided at the periphery of the head of the wheel bolt which are unevenly distributed, the coding being realised by different positions of the grooves relative to one another. The fitting adaptor has correspondingly positioned, radially inwardly projecting ridges. Different positions of the grooves or ridges relative to one another - and more particularly varying from set to set - result in an expensive manufacturing process. Nevertheless, tolerances are inevitable here which can be absorbed such that the respective adaptor can be fitted onto the associated wheel bolt, but usually only two pairs of a plurality of groove/ridge pairs are effective for the transmission of torque. This limits the transmissible torque and the life of the device, or compels the use of expensive special steel. At the same time, the ridges must have a large base width, as a result of which their number is limited and the variability of the coding restricted. In operation, it proves to be disadvantageous that the adaptor can be fitted onto the head of the wheel bolt in only one given position of rotation. Lastly, the known device is based on the concept of giving the wheel bolt the appearance of a normal production wheel bolt, which means that an ornamental cap is fitted which imitates the appearance of the hexagon cap. So that no imbalance occurs at the vehicle wheel, the overall weight of the wheel bolt and ornamental cap must equal the weight of a production wheel bolt, whereby less material is available for the wheel bolt itself.

The object of the invention is to provide a device of the type mentioned at the beginning which has the combined features of making a thief aware of the difficulties to be encountered, and also of having few parts, and also allows the wheel bolt to retain its

strength, and also can be screwed on using impact screw-drivers, as is the practice in workshops, and also copes with dirt, water and ice, and also can reliably absorb the torque occurring when the wheel bolt is tightened or loosened, and also requires little rethinking with respect to normal wheel bolts, and also has forms which can be easily mass-produced and is thus cheap, and also considerably hinders theft and makes the time which a thief would require in order to loosen the wheel bolt too long.

According to the invention, this object is achieved by the features apparent in the characterising part of the main claim.

The visible toothing indicates that theft protection exists, so that loosening of the other non-secured production wheel bolts on the wheel does not take place. The toothings can be produced with the technology developed for this purpose which is cost-effective and ensures that the torque is distributed over a large number of the teeth, which avoids damage even in the event of seized wheel bolts. The relatively large number of teeth increases the possibilities of coding with respect to the number of teeth, and substitute tools, such as pliers, also slip off better. The adaptor can be fitted onto the wheel bolt in a multiplicity of positions of rotation, as a result of which laborious trial and error is no longer necessary. The coding with respect to the tooth height can, as a consequence of the good distribution of torque, be expanded to small tooth heights of only 0.5 mm and in this connection a substitute tool can have a particularly poor grip.

Simple and cheap manufacture, coupled with high strength, are achieved by the features of Claim 2.

The same applies for the features of Claim 3 with respect to the hexagon cap.

The features of Claim 4 provide a toothing which serves per se for quite different purposes but here is capable of transmitting high forces. Point forces or linear forces are then avoided.

The dimensioning according to Claim 5 is suitable for such devices, especially those in which the screw thread is determined by the hub and can be only either M12 x 1.5 or M14 x 1.5, and in which on the other hand the hexagon cap is likewise determined and must have the wrench size of either 17 or 19 mm.

By virtue of the very high tolerance and play values according to Claim 6, the apparatus can be manufactured simply, and the hexagon cap slid on simply and rendered capable of coping easily with dirt, ice etc. The clearance is preferably 0.2 mm.

The features of Claim 7 provide space for the dirt. In most cases, however, it should be impossible to provide the annular groove if the head is cold extruded. Instead, a turning operation is normally necessary for this purpose.

Such [sic] features of Claim 8, it is possible to manufacture in [sic] the run-off also using cold extrusion technology.

By virtue of the features of Claim 9, it is possible to join the two parts of the device to each other better.

By virtue of the features of Claim 10, the dirt is coped with even better.

By virtue of the features of Claim 11, a saving is made on structural height such that the hexagon cap comes nearer to the threaded shaft, and the forces are transmitted better from the hexagon cap to the threaded shaft.

The invention will now be described with reference to two illustrative embodiments. The drawing is to scale. Details of the scale allow dimensions to be taken from the drawing.

In the drawing:

Figure 1 shows an essentially enlarged representation of a wheel bolt in side view,

Figure 2 shows the partially cutaway side view of an adaptor provided for the wheel bolt according to Figure 1,

Figures 3 and 4 show the same representation of a second illustrative embodiment,

Figure 5 shows the representation, still further enlarged, of the dirt run-off for the second illustrative embodiment.

A wheel bolt 11 consists of 10.9 quality bolt material. It has a geometrical longitudinal axis 12. Its shaft 13 is rotationally symmetrical about this geometrical longitudinal axis 12. It is 40 mm long and thus has the required length for aluminium wheel rims. A screw thread 14 M12 x 1.5 is cut into the shaft 13 over a length of 25 mm. The remaining 4 mm remain without a screw thread. At the top, the shaft 13 merges into a thickened portion 16 which has the shape of a cup of a ball with a diameter of 24 mm, and is rotationally symmetrical about the geometrical longitudinal axis 12. The thickened portion 16 merges at the top into an annular outer surface 17. This merges upwards into an end annular surface 18 which is likewise rotationally symmetrical and merges towards the inside into an annular groove 19 which has a radius of 2 mm and is rotationally symmetrical. Since the annular groove 19 is offset towards the inside by the dimension of the end annular surface 18 and since the upper end of the annular groove lies above the lower end, a head 21 adjoining the annular groove 19 also has an external diameter of 21.8 mm. The head is 11.5 mm high. It is rotationally symmetrical and carries - apart from a bevel 20 which is inclined at 45° - an external tothing 22 whose teeth 23 all have the same form, are parallel to the axis and are regularly distributed. The external tothing is a tothing in accordance with DIN 5480, and has a reference diameter of 22 mm. The head 21 has an end surface 24 which is perpendicular to the geometrical longitudinal axis 12 and is flat.

The external tothing 22 has tooth numbers of 15, 16, 17, 19, 20 and 21.

According to Figure 2, an adaptor 26 has a geometrical longitudinal axis 27 which is aligned with



Patent claims:

1. Device for hindering the theft of aluminium wheel rims from motor vehicles, comprising a wheel bolt (11) which is to be used instead of a production wheel bolt and with a threaded shaft (13) which has an external screw thread with M12 x 1.5 mm or M14 x 1.5 mm, with a thickened portion (16, 36) rotationally symmetrical about the geometrical longitudinal axis of the wheel bolt (11), increasing in diameter, which is seated when in use in a complementary depression of the wheel rim, and which has an end annular surface (18, 39), and with a head (21) lying, viewed from the external screw thread (14), on the other side of the thickened portion (16, 36), which is smaller in terms of its circumference than the largest diameter of the thickened portion and has, at its circumference, engagement surfaces, running parallel to the geometrical longitudinal axis (12), for the introduction of a torque, which device furthermore comprises an adaptor (26, 42) which can be fitted loosely onto the head (21) of the wheel bolt (11), with a hexagon cap (28) for the attachment of a torque tool whose wrench size is 17 mm or 19 mm, and with a cap edge (29) covering the head (21) of the wheel bolt (11) and on the inner surface of which counterengagement surfaces are designed which are complementary to the engagement surfaces of the head (21), the external circumference of the cap edge (29) being considerably larger than the external circumference of the hexagon cap (28), characterised by the following features:
- a) the engagement surfaces are the flanks of the regularly distributed teeth (23) of an external toothing (22, 37),
  - b) the counterengagement surfaces are the flanks of the teeth of a corresponding internal toothing (33),
  - c) the external toothing (22, 37) and internal toothing (33) each have an identical number  $n$  of teeth (23),  $n$  being a number between 12 and 24 and the teeth (23) having a height of between 0.5 mm and 3 mm,



d) a run-off (19, 41) for dirt lying in the toothing is provided in the end region of the external toothing (22, 37) in front of the end annular surface (18, 39),

5 e) the wheel bolt has the same weight as the production wheel bolt.

2. Device according to Claim 1, characterised in that at least the head (21) is cold extruded.

3. Device according to Claim 1, characterised in that the hexagon cap (28) is cold extruded.

10 4. Device according to Claim 1, characterised in that the external toothing (22, 37) and internal toothing (33) are designed in accordance with DIN 5480.

5. Device according to Claim 4, characterised in that the reference diameter is 22 mm.

15 6. Device according to Claim 1, characterised in that tolerance and play in the region a11 (external toothing) and H11 (internal toothing) are in accordance with ISA standards.

20 7. Device according to Claim 1, characterised in that the run-off for the dirt is an annular groove (19) which is provided between the external toothing (22) and the end annular surface (18).

25 8. Device according to Claim 1, characterised in that the run-off for the dirt is an incline (41), frusto-conical in side view, of the tooth bottom situated between the teeth in the direction of the end annular surface (39).

30 9. Device according to Claim 1, characterised in that the head (21) has, in its free end region, a chamfer (20, 38) which has a length in the region of millimetres and which chamfers at least the teeth, and in that the head (21) ends after the chamfer.

35 10. Device according to Claim 1, characterised in that the internal toothing is at a distance from the end surface (44) of the cap edge, and this space is a dirt-collection space.

11. Device according to Claim 1, characterised in that the height of the internal recess of the adaptor (26, 42) is slightly higher than the head (21).



12. Device according to Claim 1, characterised in that  $n$  is a number between 15 and 21.