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(54) **ROAD STUD**

(57) A road stud includes a reflector having a reflective surface. The road stud includes a patterned surface configured to direct rainwater falling on the road stud to

flow down over the reflective surface of the reflector. For example, the patterned surface comprises one or more channels to direct the flow of rainwater.

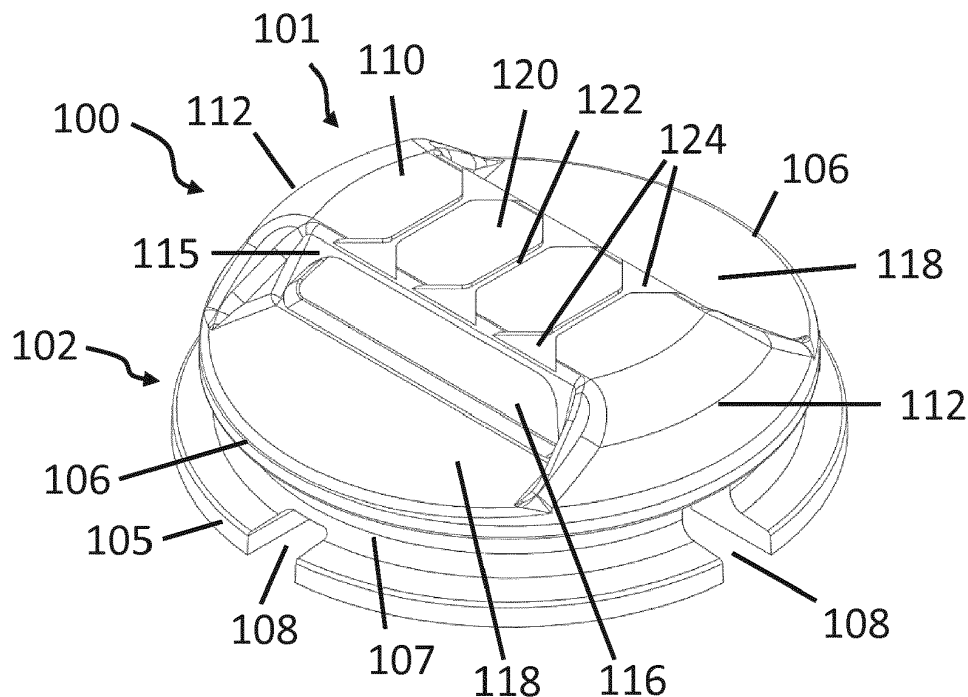


Figure 2

Description

Field

[0001] The present invention relates to road studs, such as used for marking lanes along a road.

Background

[0002] Road studs are in widespread use to provide visible guidance and warnings to motorists and other road users. Such road studs typically include one or more reflectors made out of glass or plastic to reflect light from vehicle headlights. The road studs especially help a motorist to determine his or her position on the road during hours of darkness.

[0003] There are two main types of road stud in use in the UK (although other intermediate or hybrid types of road stud are also available). A first type is generally known as a "stick on", and is normally formed from a plastic unit incorporating one or more plastic reflectors. Plastic stick-on reflectors are placed on top of the surface of the road and are attached to the road by adhesive. They are relatively cheap but also have a relatively short life-time. For example, they may become detached from the road surface by passing traffic, and/or the visibility of the reflector may become reduced, for example by dirt being deposited onto the surface of the reflector.

[0004] A second type of road stud in use in the UK is a depressible (also sometimes referred to as a "cat's eye"). This comprises a base unit, normally made of cast iron, which holds a resilient insert. The insert is typically made of rubber, and carries one or more glass or plastic reflectors. This type of road stud is installed by drilling a hole in the road, and then bonding the road stud into location using bitumen.

[0005] In some common situations, the inserts for depressible road studs may be provided with one or more wiper blades. When the insert is compressed, for example because a lorry has driven over the road stud, these blades are designed to wipe across the reflectors. This helps to keep the surface of the reflectors free from dirt, and hence helps to maintain high visibility.

[0006] One example of a depressible road stud is described in GB 2263298 B. A road stud generally in accordance with this patent is sold commercially under the "Light Dome" trademark by Industrial Rubber Ltd, of Fareham, Hampshire. The insert described in this patent includes ducts to allow water that has collected in the base of the road stud to be applied to the wiper blades. The water helps to lubricate the wiping action of the blades on the reflectors, thereby reducing wear, as well as assisting with the overall cleaning process.

[0007] There is a continued interest in improving the properties of road studs, for example, to enhance visibility.

Summary

[0008] The invention is defined in the appended claims.

[0009] As disclosed herein, a road stud includes a reflector having a reflective surface. The road stud includes a patterned surface configured to direct rainwater falling on the road stud to flow down over the reflective surface of the reflector. For example, the patterned surface comprises one or more channels to direct the flow of rainwater. Such a configuration allows the rainwater to help clean the reflective surface.

Brief Description of the Drawings

[0010] Various implementations in accordance with the claimed invention will now be described in detail by way of example only with reference to the following drawings:

Figure 1 is a front view of a road stud in accordance with some examples of the invention;

Figure 2 is a perspective view of the road stud of Figure 1.

Figure 3 is a front view of a reflector for fitting to the road stud of Figure 1.

Detailed Description

[0011] Figure 1 illustrates a front view of a road stud 100 to be provided with one or more reflectors in accordance with some example implementations of the invention, while Figure 2 illustrates a perspective (isometric) view of the same road stud as shown in Figure 1. The front of the road stud is considered to be the end facing oncoming traffic for normal installation of the road stud in a road. It will be appreciated that in some implementations, the road stud is provided with a reflector (or reflectors) at just one end. This might typically be the case, for example, for a road stud which is being used to mark the edge of the road, and hence is primarily intended to be visible to vehicles travelling along next to this edge (in contrast to vehicles travelling in the opposite direction, which will typically be on the opposite side of the road). In other cases, both the front end and the back end of the road stud may be provided with reflectors, in which case the road stud typically has bi-directional symmetry - i.e. the front and back are the same. Such a symmetric road stud might be located, for example, along the centre-line of a road, so as to provide visibility (reflectivity) to traffic coming in both directions. Although many implementations of a bi-directional road stud will have the same reflectors front and back, in some cases the reflectors front and back may be different. For example, the reflector in one direction (which we can regard as the front) might be green in colour, to indicate that a vehicle is allowed to advance in this direction (past the road stud), while the same road stud may have a reflector in the opposite direction (which we can regard as the back)

which might be red in colour, to indicate that a vehicle should not advance in this direction.

[0012] The body of the road stud 100 is generally made of cast iron, with the one or more reflectors then being bonded or attached (e.g. glued) to the road stud 100. In other implementations, the body of the road stud may be made of some other metal, or alternatively of moulded plastic, or any other suitable material(s). In some implementations, the body of the road stud 100 may be formed from multiple components, which are bonded or otherwise connected together to form the road stud.

[0013] The road stud 100 can be considered as having a lower section 102, for bonding to the road, and an upper section 101, which provides one or more reflectors. After installation, the lower section 102 is typically beneath (submerged into) the road surface and the upper section 101 typically stands above the road surface.

[0014] In the example of Figure 1, the lower section 102 of the road stud 100 is formed from a circumferential wall having a substantially circular (annular) shape. In particular, the wall includes a lower lip 105 and an upper lip 106 separated by (defining) a channel 107. The lower lip 105 defines the base of the road stud 100 and has a circular profile. The upper lip 106 is shown as coaxial to the lower lip 105, but the upper lip 106 may have a smaller diameter than the lower lip 105 (as shown in Figure 1). The top edge of upper lip 106 may be considered to define the boundary between the upper section 101 and the lower section 102. For example, after installation the upper edge of upper lip 106 is approximately flush (i.e. level) with the road surface.

[0015] Between the upper lip 106 and lower lip 105 is the channel 107, which extends around the circumference of the lower section 102 of the road stud 100. The channel is likewise circular (circumferential) in shape, but with a smaller cross-sectional profile (radius) than the lower and upper lips 105, 106.

[0016] The underside of the lower section 102 includes a central cavity defined by the outer wall (not visible in Figure 1). The cavity (hollow, recess, void) is formed within the lower section 102 such that the lower lip 105 (at least) has an annular profile. Several flow holes 108 extend through the circumferential wall, in particular through the lower lip 105 and channel 107, to provide connectivity (access) to the central cavity. In the example shown in Figure 1, the road stud 100 has four flow holes 108, namely front, back, and on opposing sides (only two of the flow holes 108 are visible in Figure 2). The size, shape, number and location of the flow holes 108 may be dependent on the shape of the cavity and the overall properties of the road stud 100 etc.

[0017] In a typical installation process, a hole which is slightly wider than the road stud 100 is drilled into a road surface to a depth corresponding approximately to the height of the lower section 102. Bitumen (or some other similar material to act as road grout) is then poured into the hole, after which the road stud 100 is placed into the hole. As the bitumen fills the cavity within the lower sec-

tion 102, the flow holes 108 allow air from the cavity to escape from the cavity, being displaced therein by the bitumen. Accordingly, the flow holes 108 help to prevent air from being trapped within the cavity during installation to ensure a consistent and reliable bonding of the road stud to the road as the bitumen solidifies. Note also that the bitumen fills channel 107 and hence overlies lower lip 105, again helping to retain the road stud 100 in position.

[0018] The upper section 101 of the road stud comprises a raised bar or ridge 110 which extends in a transverse direction from one side of the road stud 100 to the other side - i.e. the ridge is formed in a direction perpendicular to the front-back axis of the road stud 100. Accordingly, the ridge comprises a pair of approximately vertical faces (sides) 115, one facing to the front of the road stud (as visible in Figure 1) and one facing to the rear of the road stud (not visible in Figure 1). A reflector is supported on the front face 115 of ridge 110, and a second reflector may also be provided if desired on the back face 115 of ridge 110 (not visible in Figure 2). First and second side walls 112 are formed at respective ends of the ridge 110, in other words, the ridge 110 terminates at these side walls 112. The side walls help to protect the road stud 100, and in particular the reflector(s), from damage by passing vehicles (and also help to smooth the ride of such vehicles over the road stud).

[0019] Each of the faces 115 is provided with a recess 116 to receive a respective reflector (Figures 1 and 2 show the road stud before the reflectors are fitted). When the reflector is fitted into the corresponding recess 116, the outer surface of the reflector is generally substantially flush (level or flat) with the respective face. Each reflector may be retained in the recess 116 by suitable fixing means, for example by using adhesive, clips (or other mechanical mechanism), and so on. Although Figure 1 shows a single recess 116 on face 115 for receiving a single reflector, in other implementations there may be more than one recess per face 115 to allow multiple reflectors to be fitted onto a single face (or alternatively a single recess 116 may potentially be configured to receive multiple reflectors). As mentioned above, a road stud may be designed for use in a single direction (a front reflector only), or for bi-directional use (front and back reflectors). In the former case, a reflector may be fitted onto only a single face 115 of the bar 110 (and the opposing face, not visible in Figure 2, may not be provided with a recess).

[0020] The road stud 100 is designed so that a reflector fitted into the recess 116 is unobscured in the direction normal to its face 115, i.e. from the front. In particular, the road stud 100 includes a flat surface 118 at the front which extends from the bottom of face 115 to the front of the road stud 100 (a similar surface is also provided at the back of the road stud, as shown in Figure 2, for bidirectional use). It will be appreciated that this flat surface 118 allows oncoming vehicles to have good visibility of the reflector located in recess 116. In general, the flat

surface 118 is approximately level with (or slightly above) the road surface after installation of the road stud 100. In addition, the flat surface 118 may have a slight gradient downwards from the face 115 towards the top lip 106 (for example, by an angle in the range 1-20 degrees, more preferably 2-12 degrees, thereby helping to remove rainwater, etc from the road stud, and to avoid pooling of water).

[0021] The top surface of the ridge 110 is patterned to direct rainwater falling onto the top of the ridge to flow down over the surface of the one or more reflectors provided in the road stud 100, thereby helping to keep the surfaces of the reflectors clean (since if dirt accumulates on the reflector surfaces, the performance of the reflector will tend to degrade, both in terms of the amplitude and directionality of reflected light).

[0022] In the example shown in Figures 1 and 2, the top (patterned) surface of the ridge 100 includes a set of raised platforms 120 between which channels (grooves) 122 are formed. Other than for the channels 122, the patterned surface of the ridge is substantially flat and horizontal - i.e. the surfaces of the raised platforms 120 are substantially flat and horizontal. The example of Figure 2 shows three channels 122, but it will be appreciated that in other implementations there may be a different number of channels (such as one channel, two channels, or four or more channels). Likewise, the example of Figure 2 shows an equal spacing of the three channels, however, other implementations may have a different spacing.

[0023] Each of the channels is configured to receive water present on the top of the ridge 110, such as rainwater falling onto the ridge. The end of each channel widens to form a delta portion 124. Also shown in Figure 2, the edge of each platform 120 parallel to the top edge of face 115 may be sloped towards the face 115 (rather than being configured vertically like the other edges). This sloping again helps to direct rainwater onto the insert, and also can provide greater resilience for contact with passing vehicles. Similarly, the delta portions 124 may likewise be slightly inclined downwards from the channels 122 towards the face 115 to help water flow in this direction. (The angle of inclination is typically small, for example, an angle in the range 1-20 degrees, more preferably 2-12 degrees).

[0024] By way of example only, the width of the ridge or bar 110 (from one face 115 to the other) may be in the range of 20 to 60 mm, and typically around 40 mm. The width of each raised platform 120 (corresponding also to the separation of adjacent channels 122) may be in the range of 10 mm to 40 mm and typically around 20 mm. Each channel 122 may have a width of 1 to 5 mm, and may have a length of between 40% and 60% of the width of the ridge (prior to the delta portion at each end of the channel). Each channel 122 may additionally have a depth of between 0.5 and 3 mm, and typically around 1 mm. It will be appreciated that these dimensions are given by way of example only, without limitation, and will

vary according to the circumstances of any given road stud, such as being dependent on the number of channels provided on the ridge 110.

[0025] Furthermore, it will be appreciated that the length of the channels 122 relative to the delta portions 124 can be altered. In some cases, the channels 122 may shrink to have little or no length, in which case the patterning is based on the provision of the delta portions, while in other cases, the delta portions 124 may be omitted, such that the channels extend to the edge of face 115. A full range of intermediate configurations may also be implemented. (Note that if the delta portions are reduced in size, this may allow a higher number of channels to be formed in the top surface of the ridge 110).

[0026] The patterned top surface of ridge 110 is configured so that rainwater falling onto the ridge 110 fills the channels 122 and then flows into delta portions 124, which act to direct the water over the external surface of a reflector mounted in recess 116. This flow of water helps to clean the surface of the reflector, for example, by removing dust and other dirt which may otherwise hinder the operation of the reflectors. The widening of the delta portions 124 helps to provide a more uniform flow of water across the majority of the reflector surface.

[0027] Note that the depth of the patterning (such as channels 122) may also be used to provide an indication of the wear of the road stud 100. For example, if the road stud 100 has experienced heavy use (a high volume of passing vehicles travelling over the road stud), then the raised platforms 120 may be eroded such that the depth of the channels 122 is reduced. Accordingly, inspection of the groove depth may be used to provide an indication to a user that replacement of the road stud 100 is advisable.

[0028] Although Figure 2 provides one example of a patterned surface, the skilled person will be aware of many other potential variants. For example, while the patterned surface of Figure 2 shows three channels 122 connecting to six delta portions 124, in other examples there may be more or fewer channels and delta portions. In addition, although Figure 2 shows a patterning having a first height for the top surface of the raised platforms 120 and a second height for the bottom surface of the channels 122, in other implementations there may be a greater number of heights. For example, rather than having a single height, the raised platforms 120 may have a continuous or stepped gradient with a greatest height in the centre of the platform, and a lower height bordering the channel 122. Changes in height (gradients) may be continuous or stepped (discontinuous). Likewise, rather than having linear channels 122 such as shown in Figure 2, in other implementations the channels may include bends, angles or curvature as appropriate. Additionally, while in Figure 2 each groove or channel is independent of other channels, in other implementations the channels may be interconnected; for example the channels may form a criss-cross pattern or similar. Likewise, in some implementations, the different delta portions 124 may po-

tentially join together (e.g. in their wider regions). Accordingly, the skilled person will appreciate that the topography (topology) of the patterned surface may have a wide variety of potential configurations dependent upon the circumstances of any given road stud.

[0029] Figure 3 depicts an example of a reflector 200 to fit into the recess 116 of the road stud 100 of Figures 1 and 2. The reflector 200 has a shape corresponding to the recess 116, such that when reflector 200 is inserted into the recess 116, the external (reflective) surface of the reflector 200 is substantially flush with face 115 of the road stud 100 surrounding the recess 116. Accordingly, rainwater directed by the patterned surface at the top of the ridge (bar) 110 runs down this reflective surface to help keep the reflector clean. The reflector 200 shown in Figure 1 comprises a number of individual reflector components 210, but other reflectors may have a different structure, and the road stud 100 can be fitted with any suitable reflector providing a high reflectance (such reflectors are, in themselves, well-known in the art).

[0030] Although Figures 1-3 depict an example of a road stud 100 in accordance with the present invention, the skilled person will be aware of many possible modifications. For example, in implementations in which a reflector is only provided for one direction, the ridge or central bar 100 may extend to (and slope down towards) the rear of the road stud, thereby giving the rear portion of the road stud 100 more of a (half) dome-like appearance.

[0031] Furthermore, the skilled person will be aware of many possible variations for the lower portion 102 of the road stud (below the road surface in use). For example, the lower portion 102 of road stud 100 may be elongated to have an elliptical or oval shape (in plan view), or have any other suitable shape, such as square or hexagonal. In addition, the flow holes 108 may be omitted in some implementations, and the cavity underneath the lower section might be replaced by a more complex configuration of openings.

[0032] In summary, a road stud is disclosed herein. The road stud includes a reflector having a reflective surface, for example, for providing drivers with markings on the road at night by using reflections from vehicle headlights. The road stud includes a patterned surface configured to direct rainwater falling on the road stud to flow down over the reflective surface of the reflector, thereby helping to clean the reflector surface and maintain a high level of performance (such as high reflectivity, without scatter).

[0033] The patterned surface has a topography to direct the water flow as desired. For example, the patterned surface may comprise one or more channels; e.g. there may be three or more channels to promote the flow of the rainwater. The channels may widen into a delta portion adjacent the reflector to help spread the water over a greater portion of the width of the reflector, so that most if not all of the reflector surface experiences a cleaning water flow. For example, the delta portions of the one or more channels may correspond to at least half the width

of the reflector. Additionally (or alternatively), the delta portions may be inclined downwards from the channel towards the reflector to encourage the water flow in this direction. The remainder of the patterned surface (i.e. other than the one or more channels) may be substantially horizontal (according to the orientation of the road stud for normal installation into the road). Note that the relatively flat, horizontal top of the road stud 100 prevents the road stud from protruding too far above the road surface (which is helpful both to minimise wear and tear on the road stud itself, and also to minimise any impact on passing vehicles). In addition, the patterning or topography of the top of the road stud may provide texturing to help increase tyre grip for vehicles passing over the road stud.

[0034] The road stud may have a raised portion having a substantially vertical face directed towards the front of the road stud, wherein the reflector is mounted on the vertical face, and wherein the patterned surface is formed on the top of the raised portion. For example, the raised portion may comprise a central bar running transversely from one side of the road stud to the other. The bar has two opposing, substantially vertical faces directed towards the front and rear of the road stud, with a reflector mounted on each of the two substantially vertical faces. For such a configuration, the channels extend between the two substantially vertical faces such that each end of the channel is configured to direct rainwater falling on the road stud to flow down over the reflective surface of a respective reflector.

[0035] In conclusion, although a variety of embodiments have been described herein, these are provided by way of example only, and many variations and modifications on such embodiments will be apparent to the skilled person and fall within the scope of the present invention, which is defined by the appended claims and their equivalents.

[0036] Additional embodiments include those set out in the following consistory clauses:

CONSISTORY CLAUSES

[0037]

1. A road stud including a reflector having a reflective surface, wherein the road stud includes a patterned surface configured to direct rainwater falling on the road stud to flow down over the reflective surface of the reflector.

2. The road stud of clause 1, wherein the patterned surface comprises one or more channels.

3. The road stud of clause 2, wherein the patterned surface comprises three equally spaced channels.

4. The road stud of clause 2 or 3, wherein each channel widens into a delta portion adjacent the reflector.

5. The road stud of clause 4, wherein the delta portions of the one or more channels extend for at least half the width of the reflector.

6. The road stud of clause 4 or 5 wherein the delta portions are inclined downwards from the channel towards the reflector.

7. The road stud of any of clauses 2 to 6, wherein the depth of the one or more channels provides an indication of the wear of the road stud.

8. The road stud of any preceding clause, wherein the patterned surface, other than said one or more channels, is substantially horizontal.

9. The road stud of any preceding clause, further comprising a raised portion having a substantially vertical face directed towards the front of the road stud, wherein the reflector is mounted on the vertical face, and wherein the patterned surface is formed on the top of the raised portion.

10. The road stud of clause 9, wherein the raised portion comprises a central bar running transversely from one side of the road stud to the other, said bar having two opposing, substantially vertical faces directed towards the front and rear of the road stud, and wherein a reflector is mounted on each of the two substantially vertical faces.

11. The road stud of clause 10, wherein the patterned surface comprises one or more channels that extend between the two substantially vertical faces such that each end of the channel is configured to direct rainwater falling on the road stud to flow down over the reflective surface of a respective reflector.

12. The road stud of clause 11, wherein each channel widens at each end into a delta portion adjacent the respective reflector

13. The road stud of any of clauses 9 to 12, wherein the one or more channels run in a direction between the front and rear of the road stud.

14. The road stud of any of clauses 9 to 13, wherein the vertical face includes a recess for receiving the reflector, and wherein the reflector surface is flush with the vertical face.

15. The road stud of any preceding clause, further comprising a substantially flat surface in front of the reflector to provide an unobstructed view of the reflector.

16. The road stud of clause 15, wherein the substantially flat surface slopes downwards away from the

reflector.

Claims

1. A road stud including a reflector having a reflective surface, wherein the road stud includes a patterned surface configured to direct rainwater falling on the road stud to flow down over the reflective surface of the reflector;
wherein the patterned surface comprises a plurality of channels, each channel extending in a direction towards the reflective surface, and wherein the patterned surface is substantially flat and horizontal apart from the plurality of channels.
2. The road stud of claim 1, wherein the patterned surface comprises three equally spaced channels.
3. The road stud of claim 1 or 2, wherein each channel widens into a delta portion adjacent the reflector.
4. The road stud of claim 3, wherein the delta portions of the one or more channels extend for at least half the width of the reflector.
5. The road stud of claim 3 or 4 wherein the delta portions are inclined downwards from the channel towards the reflector.
6. The road stud of any preceding claim, wherein the depth of the one or more channels provides an indication of the wear of the road stud.
7. The road stud of any preceding claim, further comprising a raised portion having a substantially vertical face directed towards the front of the road stud, wherein the reflector is mounted on the vertical face, and wherein the patterned surface is formed on the top of the raised portion.
8. The road stud of claim 7, wherein the raised portion comprises a central bar running transversely from one side of the road stud to the other, said bar having two opposing, substantially vertical faces directed towards the front and rear of the road stud, and wherein a reflector is mounted on each of the two substantially vertical faces.
9. The road stud of claim 8, wherein the patterned surface comprises one or more channels that extend between the two substantially vertical faces such that each end of the channel is configured to direct rainwater falling on the road stud to flow down over the reflective surface of a respective reflector.
10. The road stud of claim 9, wherein each channel widens at each end into a delta portion adjacent the

respective reflector

11. The road stud of any of claims 7 to 10, wherein the one or more channels run in a direction between the front and rear of the road stud. 5
12. The road stud of any of claims 7 to 11, wherein the vertical face includes a recess for receiving the reflector, and wherein the reflector surface is flush with the vertical face. 10
13. The road stud of any preceding claim, further comprising a substantially flat surface in front of the reflector to provide an unobstructed view of the reflector. 15
14. The road stud of claim 13, wherein the substantially flat surface slopes downwards away from the reflector. 20

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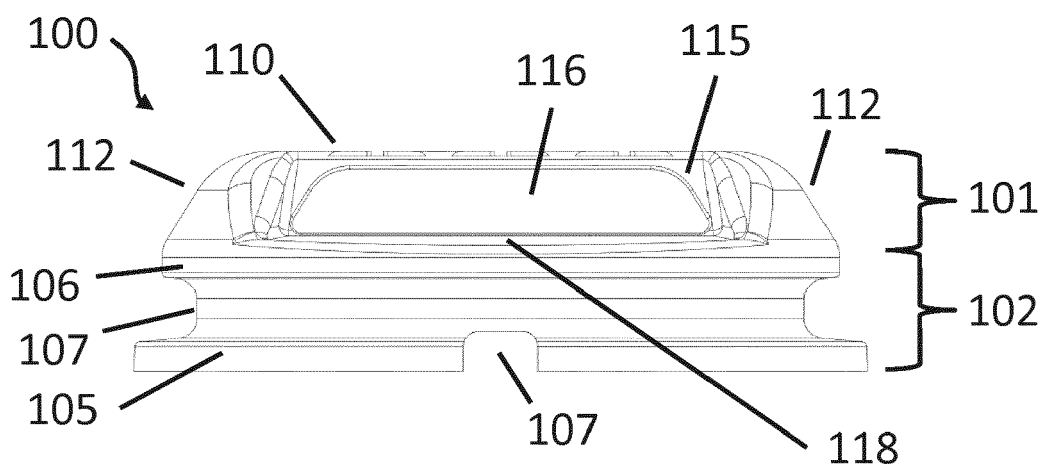


Figure 1

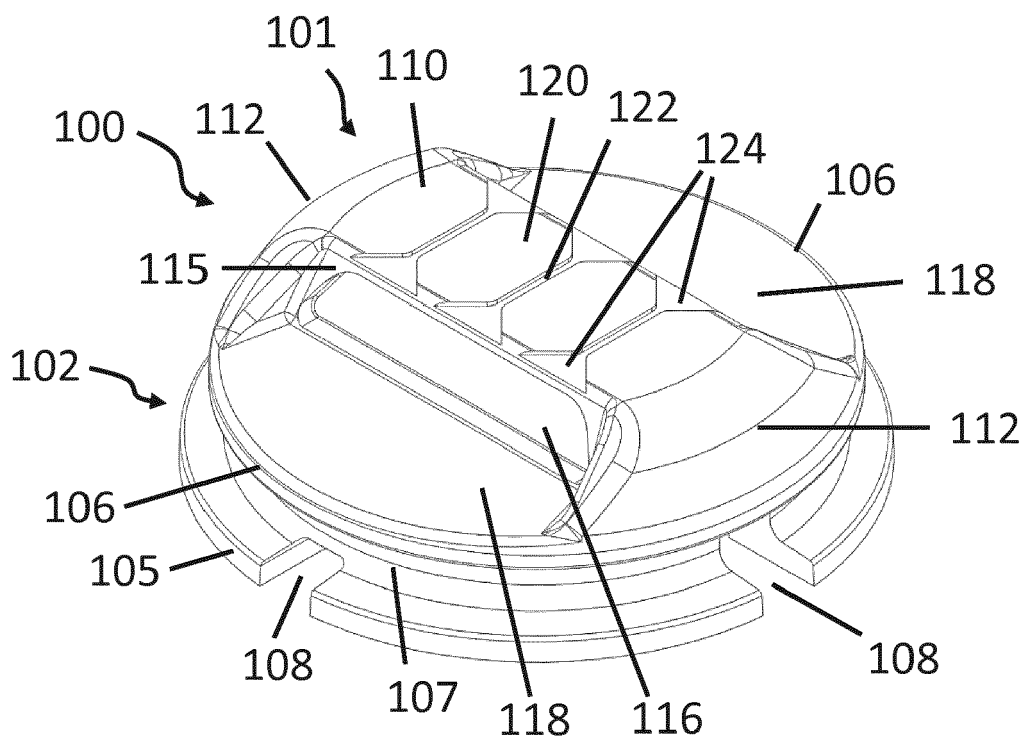


Figure 2

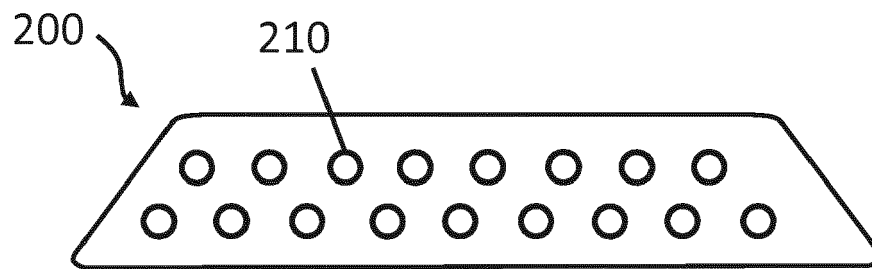


Figure 3



EUROPEAN SEARCH REPORT

Application Number
EP 19 16 3786

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Place of search Munich		Date of completion of the search 27 June 2019	Examiner Paulson, Bo
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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 19 16 3786

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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