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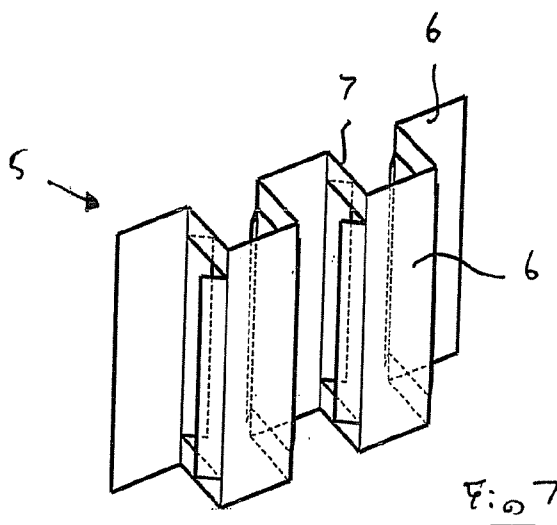
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(54) **Title:** BRAKE SHIELD



(57) **Abstract:** A brake shield (4) includes a labyrinth ventilation material (5) through which air may pass, but which resists the passage of debris. The labyrinth ventilation material may be a sheet material and may define one or more tortuous paths through the material, wherein the one or more tortuous paths do not provide a line of sight through the material.

BRAKE SHIELDTechnical Field of the Invention

The present invention relates to a brake shield, a brake installation comprising a brake shield and a vehicle comprising a brake installation with a brake shield.

5 Background to the Invention

Disc brakes are widely employed on road and other vehicles. To ensure efficient operation of disc brakes and prevent undue wear or damage it is important that they are kept clear of debris and water. To this end it is known to fit disc brakes with a shield which typically at least partially covers or encloses the disc to protect it from  
10 contamination by debris.

However, in operation disc brakes generate a great deal of heat which must be dissipated to ensure continued efficient operation of the brakes. Fitting a shield to disc brakes can reduce the flow of cooling air to the brakes.

The competing problems of protecting a disc brake from debris whilst providing  
15 adequate cooling have been addressed by a shield disclosed in WO 03/071153. This shield at least partly surrounds a brake disc and comprises a material of which the shape is influenced by heat. When the brake disc is cool the shield remains in a closed state to protect the brake disc from debris. When the brake disc heats up the shield changes shape, to an open state, and allows cooling air to flow to the disc directly.

20 This arrangement is rather complex, and only provides best protection from debris when the brake disc is cool. Indeed, in the open state there is a direct path for debris to

flow to the disc. There is a possibility that debris which reaches the disc will become trapped by the shield when the disc cools and the shield returns to the closed state.

Embodiments of the present invention have been made in consideration of these problems.

## 5 Summary of the Invention

According to the present invention there is provided a brake shield comprising a labyrinth ventilation material through which air may pass, but which resists the passage of debris, wherein the labyrinth ventilation material defines one or more tortuous paths through the material and wherein the one or more tortuous paths do not provide a line of  
10 sight through the material.

A labyrinth will tend to permit the flow of cooling air, which can easily travel along a complex path, but to resist passage of debris, such as grit, road dirt and even water droplets, which tend to travel in straight trajectories. Thus the shield conveniently facilitates brake ventilation whilst protecting a brake from contamination.

15 The labyrinth ventilation material may comprise a sheet material. The shield may be substantially formed from this material.

Where the labyrinth material is a sheet material a plurality of tortuous paths through the sheet may be distributed over the surface of the sheet.

The tortuous paths may constrain a fluid flowing from one side of a material to  
20 the other to flow along a reverse path. Where the material is a sheet material the tortuous paths may constrain fluid flowing from one side of the material to the other to flow along a path which is parallel to the plane of the sheet material.

The labyrinth ventilation material may be corrugated.

Flaps may be provided in the labyrinth ventilation material to provide ventilation paths through the material. Louvres could be provided in the labyrinth ventilation material to provide ventilation paths through the material. The louvres could be formed  
5 by pressing.

The labyrinth ventilation material may be formed from sheet material.

The brake shield may be arranged to be fitted to a disc brake installation. The brake shield could also but used with a drum brake installation. For instance, it could form part of the drum casing of a drum brake installation.

10 The labyrinth material may be corrugated or louvred, and the corrugations or louvres arranged to extend substantially vertically in use to enable water to drain from the brake shield. Alternatively, corrugations or louvres could extend substantially radially relative to a brake disc or drum.

#### Detailed Description of the Invention

15 In order that the invention may be more clearly understood an embodiment thereof will now be described, by way of example only, with reference to the accompanying drawings, of which:

Figure 1 is a front view of a brake installation for an automobile comprising a brake shield;

20 Figure 2 is a side view of the installation of figure 1;

Figure 3 is a front view of the material from which the brake shield of figures 1 and 2 is formed;

- Figure 4 is a plan view of the material of figure 3;
- Figure 5 is a sectional view along line A-A of figure 3;
- Figure 6 is a sectional view along line B-B of figure 3;
- Figure 7 is an isometric view of part of the material of figure 3; and
- 5 Figure 8 is a similar view to figure 1 of a brake installation with an alternative embodiment of a brake shield.

Referring to the drawings, a disc brake installation for an automobile comprises a substantially circular ventilated brake disc 1 mounted to a hub or drive shaft 2 and a brake calliper 3. A non-ventilated disk could be used. The brake disc 3 rotates with the  
10 hub or drive shaft 2 relative to the calliper 3. The calliper is operative to urge brake pads (not shown) into contact with the brake disc 1, gripping the disc, in order to slow or stop rotation of the disc relative to the calliper and thus slow or stop a vehicle to which the installation is mounted. All this is conventional and well understood by a person of skill in the art.

15 A brake shield 4 is mounted relative to the brake disc 1. The shield 4 is mounted to a suspension knuckle (not shown) of a vehicle to which the brake disc installation is fitted. It could, though, be mounted to any other convenient structure that remains stationary relative to the brake disc, such as the calliper 3. The brake shield 4 is formed from a sheet of labyrinth ventilation material. The shield is of a substantially circular  
20 shape, of diameter slightly larger than the brake disc, with a cut out portion to accommodate the hub or shaft 2 and calliper 3. The shield 4 is positioned on the inboard side of the brake disc which is generally more exposed to contaminants than the outboard side, and is closely spaced from and extends parallel to the disc. The outboard side of the

brake disc 1 is exposed, but will in use be protected by a wheel (not shown) mounted to the brake disc 1. Other arrangements are, of course, possible where a shield extends on both opposite sides of a brake disc. The shape, positioning and mounting of the shield relative to the brake disc is also largely conventional and will also be well understood by  
5 a person of skill in the art.

The brake shield is formed from a substantially flat sheet of labyrinth ventilation material. This material 5 is illustrated in figures 3 to 7. The sheet is perforated and tortuous paths are defined between openings on one side of the sheet and openings on the other side of the sheet. The labyrinth material comprises a corrugated sheet of metal, such  
10 as mild steel. The sheet has been formed by pressing or folding so that it includes a series of parallel, evenly spaced apart, alternating substantially right angle folds. This forms a sheet of material 5 with portions 6 extending substantially parallel to the plane of the labyrinth sheet alternating with portions 7 which extend substantially at right angles to the plane of the labyrinth sheet. Over part of the length of the each of the portions 7  
15 which extend at right angles to the plane of the labyrinth sheet pairs of flaps 8 are cut or punched out to form ventilation apertures 9. One flap 8 of each pair is bent outwards to one side of the sheet, and the other flap 8 is bent out towards the other side of the sheet. The corrugations and flaps in the sheet together define a tortuous path through the sheet. There is a fluid flow path through the sheet from one side to the other, but no line of sight  
20 through the sheet.

The brake shield is constructed from the labyrinth ventilation sheet material and installed so that the folds in the material forming the corrugations extent substantially vertically in an in use condition, when the vehicle to which the shield fitted is on level ground.

The tortuous path through the labyrinth ventilation material allows air to flow through the material, as shown at 10. Air can easily flow around the tortuous path through the material. However, the tortuous path prevents or at least usefully impedes passage of debris and water droplets from passing through the material. These will tend to travel with a straight trajectory and thus strike and then fall out of the sheet. Thus, the labyrinth material serves to protect the brake disc from debris, whilst permitting the flow of cooling air. In the event that the brake installation is partially or wholly submerged in water, or the shield is deluged with water, water will likely pass through the shield and it will also flow into the space between the shield and the brake disc. When the installation is not longer submerged, though, this water can quickly and easily drain from the disc and shield.

The brake shield could be formed from other suitable materials. An alternative configuration is shown in figure 8. In this figure, the same reference numerals are used as in figure 1 to denote corresponding components. In this arrangement substantially radially extending pressed louvers 12 are formed in a sheet of material forming the brake shield in order to provide a tortuous ventilation path through the shield.

The shield provides a convenient and economic solution to the problem of providing protection for a disc brake from debris whilst allowing air to flow onto the disc to provide cooling. It is particularly suited to installation on automobiles and other road vehicles, especially those fitted with carbon ceramic brake discs which are more sensitive to contaminants than iron discs as well as capable of generating higher temperatures. It could, however, be used on any other brake installation. It could be used on vehicles intended for off-road use where increased potential contaminants are encountered.

The above embodiment is described by way of example only. Many variations are possible without departing from the scope of the invention as defined in the appended claims.



CLAIMS

1. A disc brake shield comprising a labyrinth ventilation material though which air may pass, but which resists the passage of debris, wherein the labyrinth ventilation material defines on or more tortuous paths through the material and  
5 wherein the one or more tortuous paths do not provide a line of sight through the material.
2. A brake shield as claimed in claim 1 wherein the labyrinth ventilation material comprises a sheet material.
3. A brake shield as claimed in any preceding claim wherein the labyrinth  
10 ventilation material is corrugated.
4. A brake shield as claimed in any preceding claim wherein flaps are provided in the labyrinth ventilation material to provide ventilation paths through the material.
5. A brake shield as claimed in any preceding claim wherein the labyrinth  
15 ventilation material is formed from sheet metal.
6. A brake shield as claimed in any preceding claim arranged to be fitted to a disc brake installation.
7. A brake installation fitted with a brake shield as claimed in any preceding claim.
- 20 8. A brake installation as claimed in claim 7 wherein the labyrinth ventilation material is corrugated or louvred and the corrugations or louvres are arranged

to extend substantially vertically to enable water to drain from the brake shield.

9. A brake installation as claimed in claim 7 or claim 8, wherein the labyrinth ventilation material is corrugated or louvred and the corrugations or louvres are arranged to extend substantially radially relative to the brake disc or drum.
10. A vehicle comprising a brake installation as claimed in any of claims 7 to 9.
11. An automobile comprising a brake installation as claimed in any of claims 7 to 9.
12. A brake shield substantially as herein described with reference to the accompanying drawings.
13. A brake installation substantially as herein described with reference to the accompanying drawings.

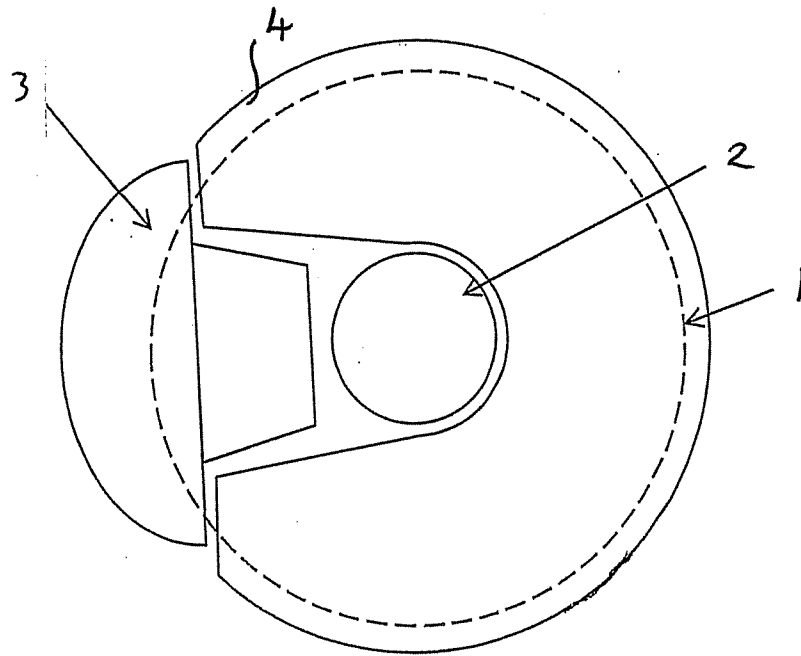


Fig 1

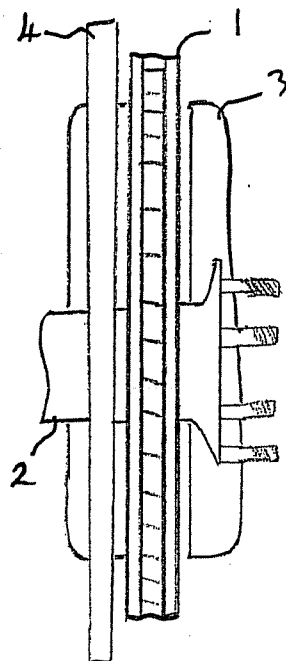


Fig 2

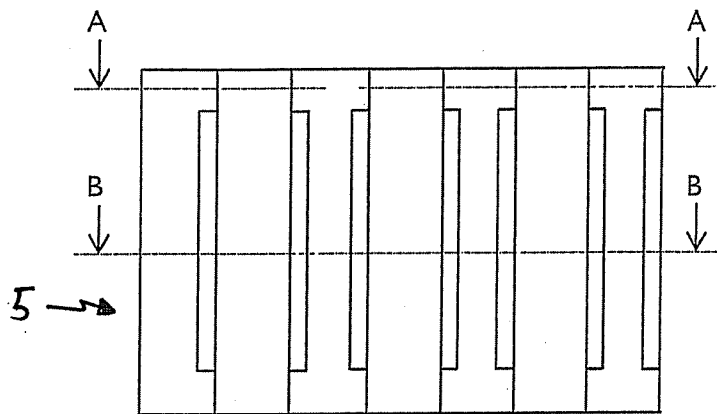


Fig. 3

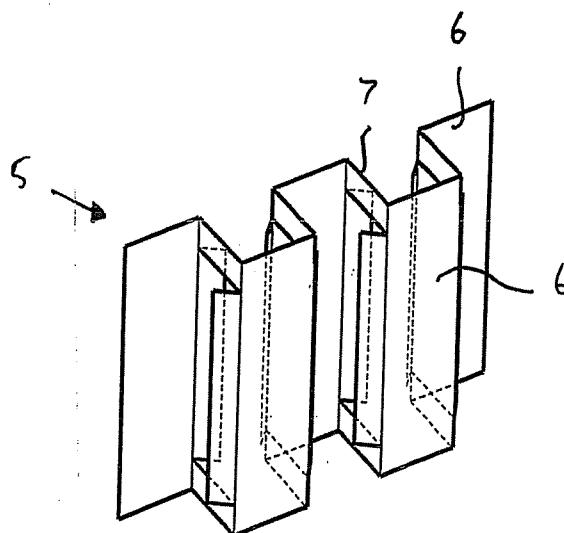
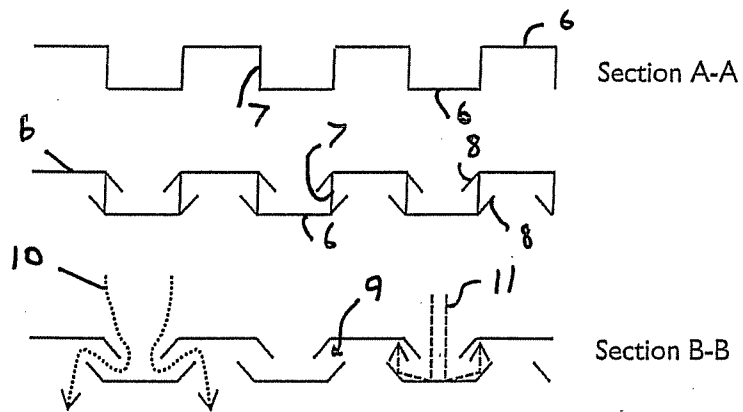


Fig. 7

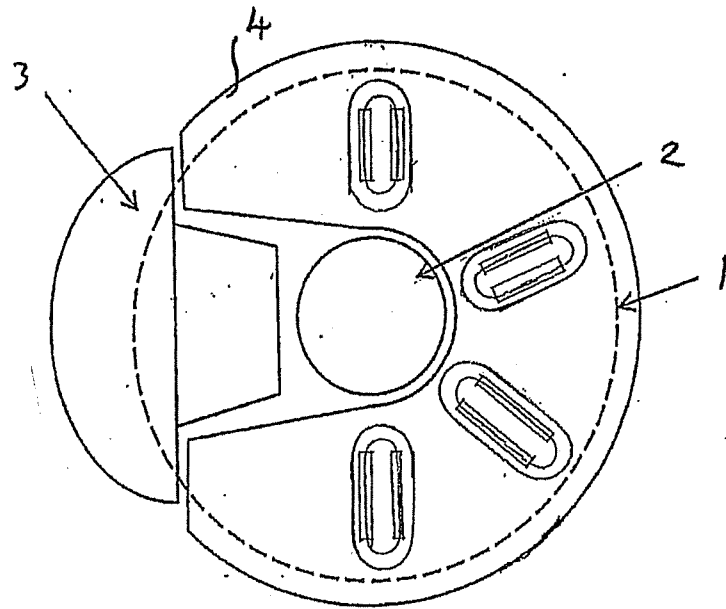


Fig 8.

# INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER  
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ADD.

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)  
F16D

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)

EP0-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages  | Relevant to claim No. |
|-----------|---|-----------------------|
| X         | DE 10 2008 022967 A1 (KNORR BREMSE SYSTEME [DE]) 12 November 2009 (2009-11-12)<br>paragraph [0052] - paragraph [0056];<br>figure 2                                    | 1,2,4-7               |
| A         | -----<br>US 6 155 650 A (BARGER ROBERT E [US])<br>5 December 2000 (2000-12-05)<br>abstract; figures   | 1-11                  |
| A         | -----<br>EP 0 555 822 A1 (GOODRICH CO B F [US])<br>18 August 1993 (1993-08-18)<br>abstract; figure 3  | 1                     |
| A         | -----<br>WO 03/071153 A1 (VOLVO LASTVAGNAR AB [SE];<br>SABELSTROEM MATS [SE]; BAGGE LARS [SE])<br>28 August 2003 (2003-08-28)<br>cited in the application<br>figure 1 | 1                     |
|           | -----   |                       |

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2014/051258

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|---|---------------------|----------------------------|---------------------|
| DE 102008022967 A1                        | 12-11-2009          | CA 2722745 A1              | 12-11-2009          |
|   |                     | CN 102016340 A             | 13-04-2011          |
|   |                     | DE 102008022967 A1         | 12-11-2009          |
|   |                     | EP 2276945 A1              | 26-01-2011          |
|   |                     | EP 2426369 A1              | 07-03-2012          |
|   |                     | ES 2387239 T3              | 18-09-2012          |
|   |                     | ES 2436245 T3              | 27-12-2013          |
|   |                     | RU 2010150357 A            | 20-06-2012          |
|   |                     | US 2011108379 A1           | 12-05-2011          |
|   |                     | WO 2009135657 A1           | 12-11-2009          |
| -----                                     |                     |                            |                     |
| US 6155650 A                              | 05-12-2000          | CA 2316132 A1              | 22-03-2001          |
|   |                     | US 6155650 A               | 05-12-2000          |
| -----                                     |                     |                            |                     |
| EP 0555822 A1                             | 18-08-1993          | DE 69301840 D1             | 25-04-1996          |
|   |                     | DE 69301840 T2             | 01-08-1996          |
|   |                     | EP 0555822 A1              | 18-08-1993          |
|   |                     | JP H05345598 A             | 27-12-1993          |
|   |                     | US 5248013 A               | 28-09-1993          |
| -----                                     |                     |                            |                     |
| WO 03071153 A1                            | 28-08-2003          | AT 416329 T                | 15-12-2008          |
|   |                     | AU 2003206558 A1           | 09-09-2003          |
|   |                     | BR 0307422 A               | 28-12-2004          |
|   |                     | EP 1478866 A1              | 24-11-2004          |
|   |                     | SE 0200493 A               | 21-08-2003          |
|   |                     | US 2005016798 A1           | 27-01-2005          |
|   |                     | WO 03071153 A1             | 28-08-2003          |
| -----                                     |                     |                            |                     |