

**PAVING ELEMENT HAVING DRAINAGE CHANNELS
AND PAVEMENT SYSTEM INCORPORATING SAME**

FIELD OF THE DESCRIPTION

[0001] The following relates generally to paving elements and pavement systems for providing drainage and filtration of liquids on a paved surface. In particular, the following relates to paving elements and systems adapted to facilitate removal of spent filter media from a paved surface.

BACKGROUND

[0002] Various types of paving stones or paving elements for use in creating a paved surface are known in the art. In particular, paving stones for creating a paved surface having drainage cavities or holes formed therein are known. Generally, such drainage cavities are provided to prevent liquids (e.g. water) from pooling on the paved surface by allowing passage of such liquids there-through.

[0003] Some attempts have also been made at providing filtering of liquids being drained through the drainage cavities. Filtering is provided, for example, by providing a filter media within the drainage cavities such that the liquid being drained through the drainage cavity is filtered by the filter media. In this way, various contaminants which may be present in the drainage liquid, such as oil, particulates and other chemicals, are retained by the filter media. Filtration of the drainage liquid is generally desirable for the purposes of reducing the amount of contaminants reaching the groundwater and soil beneath the paved surface, as well as any receiving waters that the drainage liquid may be discharged into.

[0004] For example, U.S. patent number 5,342,142 to Barth *et al.* describes an angular paving stone having a number of recesses. The recesses are configured such that when the paving stones are laid, full recesses are formed by the recesses of the adjacent stones complementing each other. The full recesses allow water to be discharged from a paved surface into the layer underneath. Barth describes that the full recesses may be filled with a suitable filling material such as sand, fine gravel, fine chips or the like, and that any "filling material plugs" which may form over time can be swept away using, for example, a motor sweeper. However, the full recesses formed by laying the paving stones are not described as being configured to facilitate cleaning of the recesses by means other than by sweeping. Furthermore, it has been found that the filling material generally cannot be easily removed

1 from the recesses, since attempting to remove such material can result in the filling material
2 being pushed deeper into the recesses in some cases, as further described below.

3 **[0005]** In another example, U.S. patent number 4,834,575 to Barth *et al.* describes a
4 paving stone for forming a paved surface by laying similarly configured paving stones
5 adjacent to one another, in which there is a free space created between adjacent paving
6 stones for discharging water. In one aspect, the paving stone is described as including a
7 protrusion having a chamfered upper face that slopes downwardly, such that when
8 neighbouring paving stones are laid adjacent to each another, the corresponding protrusions
9 of the stones face each other to create the free space there-between. While it is described
10 that the free space may be filled with water permeable filling material such as fine grained
11 gravel, the paving stones are not specifically configured to allow such filling material to be
12 readily removed once the filling material becomes contaminated or otherwise accumulates
13 pollutants.

14 **[0006]** U.S. patent number 4,997,308 to Welling, Jr. describes a paving stone having
15 four angled corners and a central hole. The edges of the upper surface of the paving stone
16 are described as being chamfered. The central hole is described as being provided for the
17 purpose of facilitating handling of the paving stones among other purposes. However, the
18 central hole is not described as being configured to be filled with any material which acts as
19 a filter media.

20 **[0007]** For pavement systems that incorporate drainage cavities and/or filter media, a
21 problem has been the challenge of maintaining the infiltration capacity, i.e. the volume of
22 water able to be captured and treated by the system. Whether planning, designing,
23 constructing and/or managing a permeable pavement installation, it is fundamentally
24 important to provide and maintain surface infiltration capacity. However, studies have
25 consistently shown reductions in infiltration capacities as such pavement systems age, due
26 to clogging of the filter media with organic and chemical particulates such as heavy metals,
27 nutrients, sediment and organic matter. Furthermore, studies have shown that employing
28 conventional street cleaners with such systems resulted in limited restoration in infiltration
29 capacity. If the infiltration capacity of a pavement system cannot be substantially restored by
30 cleaning methods, it is inevitable that the infiltration capacity will decrease with age until the
31 system is no longer able to capture and treat water effectively.

32 **[0008]** Accordingly, there remains a need for a paving element and a system that
33 addresses at least one of the deficiencies known in the art.

1 SUMMARY OF THE DESCRIPTION

2 [0009] In one aspect, there is provided a paving element comprising a plurality of
3 drainage channels that are adapted to be cleaned in an efficient manner.

4 [0010] In one aspect, there is provided a paving element comprising an upper surface, a
5 lower surface and a side wall, the paving element further comprising a plurality of drainage
6 channels extending through the element between the upper and lower surfaces, wherein
7 each of the drainage channels includes a first opening, provided on the upper surface of the
8 paving element, and in some aspects a second opening, provided on the lower surface of
9 the paving element, the first opening comprising a concave or an apex-down triangular
10 portion formed on the upper surface of the paving element. An apex-down triangular shape
11 will be referred to herein as "concave".

12 [0011] In one aspect, the drainage channels of the paving elements are provided on the
13 perimeter and/or the interior thereof. When provided on the perimeter, the drainage
14 channels are partial drainage channels formed into the side wall of the paving element,
15 wherein the complete channels are formed when two or more paving elements with partial
16 channels are placed adjacent to each other such as to form pavement.

17 [0012] In another aspect, a pavement system is provided, comprising a plurality of
18 paving stones as described herein. The pavement formed with such paving elements would
19 include a plurality of drainage channels, each of which includes a concave opening on the
20 upper surface.

21 [0013] In one aspect, each of the paving elements having partial drainage channels
22 provided on the perimeter thereof, that is, formed into the side walls of the paving elements,
23 whereby, when the paving elements are laid on a surface, the adjacent partial drainage
24 channels combine to form a complete drainage channel.

25 BRIEF DESCRIPTION OF THE DRAWINGS

26 [0014] The features of the invention will become more apparent in the following detailed
27 description in which reference is made to the appended drawings wherein:

28 [0015] Figure 1 is a perspective view of a paving element according to one aspect.

29 [0016] Figure 2 is a plan view of the paving element of Figure 1.

- 1 **[0017]** Figure 3 is an end elevation view of the paving element of Figure 1.
- 2 **[0018]** Figure 4 is a plan view illustrating two paving elements forming a drainage cavity
3 according to one aspect.
- 4 **[0019]** Figure 5A is a schematic diagram illustrating a process of removing a filter media
5 from the drainage cavity according to one aspect.
- 6 **[0020]** Figure 5B is a schematic diagram illustrating the process of Figure 5A being
7 applied to a drainage cavity formed by paving stones with beveled top edges.
- 8 **[0021]** Figure 6 is a schematic diagram illustrating another process for removing the filter
9 media from the drainage cavity.
- 10 **[0022]** Figure 7 is a perspective view of a paving element according to another aspect.
- 11 **[0023]** Figure 8 is a plan view of the paving element of Figure 7.
- 12 **[0024]** Figure 9A is an end elevation view of a paving element according to yet another
13 aspect.
- 14 **[0025]** Figure 9B is a plan view of the paving element of Figure 9A.
- 15 **[0026]** Figure 10 is a schematic diagram illustrating a process of removing a filter media
16 from the drainage cavity formed by the paving element of Figure 9A.
- 17 **[0027]** Figure 11 is a schematic diagram illustrating the process of removing filter media
18 from an asymmetric drainage cavity according to one aspect.
- 19 **[0028]** Figure 12 is an end elevation view illustrating an insert positioned inside the
20 drainage cavity.
- 21 **[0029]** Figure 13 is a plan view of the insert positioned inside the drainage cavity in
22 Figure 12.
- 23 **[0030]** Figure 14 is a plan view of a paving element according to yet another aspect.
- 24 **[0031]** Figure 15 is a plan view illustrating the paving element of Figure 14 being
25 positioned adjacent to a corresponding paving element to form a drainage cavity.

1 **[0032]** Figure 16 is a plan view illustrating an insert being positioned inside the drainage
2 cavity formed in Figure 15.

3 **[0033]** Figure 17 is a plan view of a substantially rectangular paving element according
4 to yet another aspect.

5 **[0034]** Figure 18 is a plan view of a substantially square paving element according to yet
6 another aspect.

7 **[0035]** Figure 19 is a plan view illustrating a portion of a paving element according to yet
8 another aspect.

9 **[0036]** Figure 20 is an end elevation view of the portion of the paving element of Figure
10 19.

11 **[0037]** Figure 21 is a plan view illustrating a paving element according to yet another
12 aspect.

13 **[0038]** Figure 22 is a plan view illustrating a paving element according to another aspect.

14 **[0039]** Figure 23A is a perspective view of a paving element according to yet another
15 aspect.

16 **[0040]** Figure 23B is an end elevation view of the paving element of Figure 23A.

17 **[0041]** Figure 24 is an end elevation view of a paving element according to yet another
18 aspect.

19 **[0042]** Figure 25 is an end elevation view of a paving element according to yet another
20 aspect.

21 **[0043]** Figure 26A is a perspective view of a paving element according to yet another
22 aspect.

23 **[0044]** Figure 26B is an end elevation view of the paving element of Figure 26A.

24 **[0045]** Figure 27 is an end elevation view of a paving element according to yet another
25 aspect.

26 **[0046]** Figure 28A is a plan view of a paving element according to yet another aspect.

- 1 **[0047]** Figure 28B is a perspective view of the paving element of Figure 28A.
- 2 **[0048]** Figure 29 is a plan view of a paving element according to another aspect.
- 3 **[0049]** Figure 30 is a side perspective view of the paving element shown in Figure 29.
- 4 **[0050]** Figure 31 is a plan view of a paving element according to another aspect.
- 5 **[0051]** Figure 32 is a side perspective view of the paving element shown in Figure 31.
- 6 **[0052]** Figure 33 is a plan view of a paving element according to another aspect.
- 7 **[0053]** Figure 34 is a side perspective view of the paving element shown in Figure 33.
- 8 **[0054]** Figure 35 is a plan view of a paving element according to another aspect.
- 9 **[0055]** Figure 36 is a side perspective view of the paving element shown in Figure 35.
- 10 **[0056]** Figure 37 is a plan view of an arrangement of paving elements shown in Figures
11 29 and 31.
- 12 **[0057]** Figure 38 is a front elevation of another aspect of a paving element.
- 13 **[0058]** Figure 39 is a plan view of the paving element of Figure 38.
- 14 **[0059]** Figure 40 is a plan view of another aspect of a paving element.
- 15 **[0060]** Figure 41 is a side elevation of another aspect of a paving element.
- 16 **[0061]** Figure 42 is a front elevation of the paving element of Figure 41.
- 17 **[0062]** Figure 43 is a plan view of the paving element of Figure 41.
- 18 **[0063]** Figure 44 is a plan view of another aspect of a paving element.
- 19 **[0064]** Figure 45 is a front perspective view of another aspect of a paving element.
- 20 **[0065]** Figure 46 a plan view of the paving element of Figure 45.

21 **DETAILED DESCRIPTION**

- 22 **[0066]** As used herein, the term “substantially concave” or “generally concave” will be
23 understood to mean that a portion of a cavity is formed by a curved or straight surface that

1 generally flares away from a low point in the concavity. As further described below, the term
2 “concave” or “concave portion” would be understood to mean a “cupule” as illustrated in the
3 accompanying figures.

4 **[0067]** The term “partial cavity” will be understood to mean a cavity which is adapted to
5 be positioned adjacent to a corresponding partial cavity to cooperatively form a drainage
6 cavity. For example, the corresponding partial cavity may have a mirrored profile of the
7 partial cavity. In contrast, the term “full cavity” will be understood to mean a cavity which is
8 adapted to independently form a complete drainage cavity.

9 **[0068]** The terms “comprise”, “comprises”, “comprised” or “comprising” may be used in
10 the present specification. As used herein (including the description and/or the claims), these
11 terms are to be interpreted as specifying the presence of the stated features, integers, steps
12 or components, but not as precluding the presence of one or more other feature, integer,
13 step, component or a group thereof as would be apparent to persons having ordinary skill in
14 the relevant art.

15 **[0069]** The term “paving element” will be understood to mean a paving stone or paving
16 block etc., which is used in combination with other paving elements to form pavement. This
17 may include a parking lot, a driveway, a roadway, a sidewalk or any other such surface as
18 would be known to persons skilled in the art. The terms “paving element” and “paving stone”
19 may be used interchangeably in the present description.

20 **[0070]** The terms “upper” and “lower” are used in the present description in reference to
21 the orientation of the paving element when laid on a surface to form a pavement. Thus,
22 when in used to form paved surface, the lower surface of the paving element would rest on
23 the ground or other supporting surface (typically one or more layers of a granular material,
24 as would be known in the art). The upper surface would face away from the ground.

25 **[0071]** In one aspect, a paving element is provided. The paving element generally
26 comprises an upper surface and a lower surface and formed with a number of full and/or
27 partial drainage channels. The full or partial drainage channels comprise a generally
28 concave, or cupule shaped upper portion and, in one aspect, a lower portion, or channel or
29 conduit extending from the cupule through the paving element and opening into the lower
30 surface of the paving element for allowing passage of liquid through the paving element.

31 **[0072]** Figure 1 illustrates a paving block 100 having an upper surface 113 and a lower
32 surface 115 according to one aspect. The paving block 100 is also illustrated as having a

1 partial cavity 130 formed therein. The partial cavity 130 is illustrated as being a partial cavity
2 extending between an upper orifice or opening 141 formed on the upper surface 113 and a
3 lower orifice or opening 143 formed on the lower surface 115. The partial cavity 130
4 comprises an upper, generally concave or cupule portion 132 located proximal to the upper
5 surface 113 and a lower portion, or conduit or channel 134 extending generally from the
6 base of the cupule 132, through the paving block thereby forming a channel extending
7 through to the lower orifice or opening 143 located proximal to the lower surface 115. As
8 illustrated, the upper portion or cupule 132 has a generally concave shape as illustrated by a
9 curved surface 100. It will be appreciated, and as discussed further herein, that the shape of
10 the cupule 132 or the conduit 134 is not intended to be limited by the accompanying figures.
11 The shapes shown in the figures are only intended to illustrate the general characteristics of
12 the features of the subject paving element.

13 **[0073]** In the example shown in Figure 1, both the top orifice 141 and the bottom orifice
14 143 are semicircular in shape. This is further illustrated in Figures 2 and 3, which
15 respectively show the plan view and the end elevation of the paving element 100.

16 **[0074]** Figure 4 illustrates two identical paving elements 100, 100' being laid adjacent to
17 one another to form a drainage cavity 160 according to one aspect. As shown in Figure 4, a
18 first paving element 100 is laid adjacent to a second paving element 100', such that the
19 partial cavity 130 of the first paving element 100 and the corresponding partial cavity 130' of
20 the second paving element 100' cooperatively form the drainage cavity 160. As will be
21 understood, the top and bottom orifice of the drainage cavity 160 formed by joining two
22 semicircular partial cavities 130, 130' together would be substantially circular in shape, as
23 illustrated in Figure 4. Furthermore, it would be appreciated that since each of the partial
24 cavities 130, 130' include an upper concave portion and a lower portion defined by a
25 channel, the drainage cavity 160 would include a "bowl-shaped" or "cup-shaped" upper
26 portion (also referred to as the "cupule" or "concavity") and a tubular bottom portion (also
27 referred to as the "conduit"). By laying a plurality of paving elements in the manner
28 described above, a paved surface having a plurality of drainage cavities may be formed.

29 **[0075]** In another aspect, a pavement system is provided. The pavement system
30 comprises a plurality of paving elements, as described herein, positioned adjacent to one
31 another. Each paving element comprises an upper surface and a lower surface, and a full or
32 partial cavity formed in the paving element. The full or partial cavity further comprises an
33 upper cupule and a lower channel extending to the lower surface for allowing passage of

1 liquid through the paving element. In such system, the plurality of paving elements are
2 positioned adjacent to one another to provide a paved surface having a plurality of drainage
3 cavities formed by the full or partial cavities.

4 **[0076]** The drainage cavities may be filled with filter media, such that liquid (e.g. water)
5 drained through the drainage cavities is filtered. For example, the filter media may comprise
6 gravel, sand, and various aggregates which may be treated or untreated. The presence of
7 such filter media generally reduces the amount of pollutants and various contaminants,
8 including particulates, reaching the soil or other layer beneath the paved surface, since
9 these pollutants and contaminants are filtered out to produce a residue which is retained by
10 the filter media. As a result of the filtration process, the filtered liquid (i.e. the filtrate) is
11 “cleaner” than the original liquid and thus may be discharged into the soil or ground beneath
12 the paved surface, or drained into a collection device or the like.

13 **[0077]** Over time, the filter media disposed within the drainage cavities may become
14 spent or encrusted due to the accumulation of the retentate (e.g. pollutants and
15 contaminants). In order to replenish the filter media, a cleaning apparatus may be used to
16 remove the spent filter media and refill the drainage cavities with a new or regenerated filter
17 media.

18 **[0078]** According to one aspect, the cleaning apparatus is configured to remove the filter
19 media and any residue by directing a stream of pressurized fluid(s) into the drainage
20 cavities. Specifically, the cleaning apparatus may include a jet which is configured to direct
21 a stream of pressurized fluid (e.g. water and/or air) towards the filled drainage cavities of the
22 paved surface, and may simultaneously vacuum the ejected filter media.

23 **[0079]** One potential mechanism by which the spent filter media disposed within the
24 drainage cavities can be removed using a fluid jet is explained with reference to Figure 5A.
25 In Figure 5A, a jet 310 is illustrated as being positioned and oriented such that the
26 pressurized fluid (e.g. water and/or air) discharged from the jet 310 is incident on the surface
27 of the encrusted filter media (not shown) disposed proximal to the leading edge 371 of the
28 drainage cavity 360. The encrusted filter media is broken up by the pressurized fluid striking
29 its surface. Continued application of the jet causes the pressurized fluid to be deflected by
30 the curved surface defining the upper concave portion or cupule 362 of the drainage cavity
31 360, such that the fluid, along with any entrained air and spent filter media, is forced out of
32 the cupule 362 of the drainage cavity 360. The general direction and trajectory in which the
33 fluid is discharged from the jet 310 is indicated by the arrow 311. The removal of the filter

media from the upper concave portion or cupule 362 of the drainage cavity 360 is further facilitated by the curvature of the surface defining the trailing edge 373 of the upper portion 362 of the drainage cavity 360, which deflects the fluid carrying the spent filter media upwards. The pressure of the fluid being directed towards the drainage cavity 360 may be adjusted to control the degree to which the fluid stream exiting from the trailing edge 362, which carries the spent filter media and any residue, is vertically elevated from the paved surface as it is ejected from the drainage cavity 360 and may be collected by a vacuum.

[0080] The spent filter media discharged from the drainage cavity 360 may be collected by a hopper (not shown). As would be appreciated, the hopper may be provided on the cleaning apparatus. The hopper may be positioned with respect to the jet 310 such that any spent filter media leaving the drainage cavity 360 from the trailing edge 373 is automatically collected by the hopper. In one aspect, the cleaning apparatus may further comprise a vacuum to facilitate the removal and collection of the spent filter media. Such vacuum may be, for example, positioned adjacent to the jet.

[0081] The curvature of the wall defining the upper portion 362 of the drainage cavity 360 is generally configured to facilitate bulking of the spent encrusted filter media due to the impact of the pressurized fluid, air entrained by the expanding, pressurized fluid, and the resulting turbulence. Furthermore, the profile of the drainage cavity 360, in particular the curvature of the wall defining the concave upper portion or cupule 362, may be modified according to a number of different factors such as, for example, the horizontal speed at which the cleaning apparatus is being driven, the pressure of the jet, the angle at which the fluid is being ejected by the jet, and the physical properties of the filter media and the accumulated debris and pollutants.

[0082] In the mechanism illustrated in Figure 5A, the profile of the drainage cavity 360 may reduce the likelihood of any filter media disposed within the conduit 364 of the drainage cavity from being removed. This allows only the heavily contaminated filter media contained within the cupule 362 of the drainage cavity 360 to be removed without substantially disturbing the filter media disposed within conduit 364.

[0083] For comparison purposes, Figure 5B illustrates a drainage cavity 380 formed by two adjacent paving elements 382, 382' having beveled top edges. Similar paving elements having beveled top edges are generally known in the art as described, for example, in U.S. patent numbers 5,342,142 and 4,834,575. As illustrated, the beveled edges 384, 384' are substantially linear, such that the drainage cavity 380 formed by adjacent paving elements

382, 382' is funnel-shaped. It has been observed that, in a paving surface having such "funnel-shaped" drainage cavities, the upper portion of the drainage cavities may become "clogged" due to accumulation of fine debris, which impedes passage of fluid through the drainage cavities. With reference to Figure 5B, when attempts were made to clean the drainage cavity by removing the accumulated debris using a combination of a jet 390 and a vacuum (not shown), it was found that the pressurized fluid ejected from the jet 390 caused the accumulated debris to be displaced deeper into the drainage cavity 380 in at least some cases. Accordingly, it was found that material disposed within such "funnel-shaped" drainage cavity could not be effectively removed using such cleaning method and apparatus.

[0084] Figure 6 illustrates another potential mechanism by which the spent filter media disposed within the drainage cavities can be removed. Specifically, in Figure 6, a brush 320 is used to remove the spent filter media (not shown) from the upper portion 362 of the drainage cavity 360. The brush 320 may be, for example, a rotary brush that is attached to other machinery that is adapted to rotate the brush and apply water, forced air or vacuum as needed. The arrow 322 indicates the general direction in which the spent filter media is ejected when the rotary brush is operated in a clock-wise direction.

[0085] Once the spent filter media has been removed from the drainage cavity, the drainage cavity may be refilled with new filter media. Alternatively, the spent filter media removed from the drainage cavity may be collected by the cleaning apparatus and regenerated. For example, the spent filter media may be regenerated using various known chemical, biological, and physical treatment processes, such as by heating, filtering, using disinfectants and/or enzymes, or skimming off any oils and hydrocarbons retained by the spent filter media. The regenerated filter media may then be used to refill the drainage cavity. In this way, the filter media may be recycled to reduce waste. It will be appreciated that the steps of removing the spent filter media, regenerating the spent filter media, and then refilling the drainage cavity with new and/or regenerated filter media may be performed using the cleaning apparatus in a single pass (i.e. without requiring the cleaning apparatus to travel over a drainage cavity more than once).

[0086] Figure 7 illustrates the paving element 200 according to another aspect. As shown in Figure 7, the paving element 200 comprises an upper surface 213, a lower surface 215, and a partial cavity 230 formed in the paving element 200. The partial cavity 230 includes cupule 232, defined by a substantially concave surface, and a conduit 234 extending through the paving element, which serves as a drainage opening. As shown in

Figure 7, a top orifice 241 of the cavity 230 formed on the upper surface 213 is illustrated as being an approximately elliptical or oblong orifice, and a bottom orifice 243 of the cavity 230 formed on the lower surface 215 is illustrated as being semicircular in shape. The shapes of the openings are further illustrated in Figure 8, which shows the plan view of the paving element 200.

[0087] Figure 9A illustrates the end elevation of a paving element 400 according to yet another aspect. As shown in Figure 9A, the paving element 400 comprises an upper surface 413, a lower surface 415, and a partial cavity 430 extending between the upper surface 413 and the lower surface 415. The partial cavity 430 includes a substantially concave cupule 432 and a conduit 434. Both the upper orifice formed on the upper surface 413 and lower orifice formed on the lower surface 415 are illustrated as being semicircular. The shape of the orifices is further illustrated in Figure 9B, which shows the plan view of the paving element 400. As shown in Figures 9A and 9B, the cupule 432 is illustrated as being defined by a curved surface having both a concave segment and a convex segment. However, it would be understood that the portion of the cavity formed by such surface would still be considered to be a cupule.

[0088] Figure 10 illustrates a potential mechanism for removing spent filter media from a drainage cavity formed by the paving stone 400 of Figures 9A and 9B. In Figure 10, a jet 460 is illustrated as being used to eject a stream of fluid 461 towards the drainage cavity. The fluid ejected from the jet 460 causes any spent filter media disposed within the drainage cavity to be discharged in the trajectory indicated by an arrow 470.

[0089] Figure 11 illustrates the elevation view of the paving element 550 according to yet another aspect. In Figure 11, the paving element 550 is illustrated as comprising an upper surface 533, a lower surface 535, and a partial cavity 560 extending between the upper surface 533 and the lower surface 535. The partial cavity 560 includes a concave upper portion or cupule 562 and a conduit 564.

[0090] As illustrated in Figure 11, the upper portion 562 is asymmetric about an axis extending through the height of the paving element. In this way, when the paving elements are laid to form a pavement, the drainage cavities formed on the paved surface (which may be filled with a filter media) are adapted to be cleaned in a directional manner. Specifically, as illustrated in Figure 11, the fluid ejected from a jet 510 strikes the surface of the encrusted or spent filter media proximal to the leading edge 571 to cause the spent filter media to be discharged in the general direction indicated by the arrow 512. The general direction of the

1 fluid being ejected from the jet 510 is indicated by the arrow 511. The use of such
2 asymmetrical drainage cavity may facilitate the removal and collection of the spent filter
3 media in at least some cases.

4 **[0091]** In an aspect as illustrated in Figure 12, an insert 610 is disposed inside a lower
5 portion of a drainage cavity. The cupule 620 of the drainage cavity may be filled with a filter
6 media. Specifically, as shown in Figure 12, the insert 610 is located in the conduit of the
7 drainage cavity. Once the insert 610 has been placed, the cupule 620 is filled with the filter
8 media, such that the filter media is blocked from reaching the lower portion of the drainage
9 cavity due to the presence of the insert 610. It will be appreciated that the insert 610 would
10 generally be water-permeable, such that the presence of the insert 610 does not
11 substantially impede the flow of fluid through the drainage cavity. Figure 13 illustrates the
12 top view of the insert 610 disposed inside the drainage cavity. In one aspect, the insert
13 provides an interlocking mechanism for preventing relative movement of adjacent paving
14 elements with respect to one another.

15 **[0092]** While various aspects of the paving element have been described above in which
16 a single cavity is formed therein, it will be appreciated that various parameters, such as the
17 number and configuration of the cavity provided on a pavement element may be varied.

18 **[0093]** Figure 14 illustrates an aspect of the paving element 700 wherein a plurality of
19 generally oval-shaped partial cavities 710a-f is provided at the edges of the paving element
20 700. Specifically, the paving element 700 is illustrated as having two partial cavities 710a,
21 710d formed at the short edges 715, 716 and four partial cavities 710b, 710c, 710f, 710e
22 formed at the long edges 725, 726. As shown in Figure 14, each of the cavities 710a-f is
23 identical to the cavity illustrated in Figures 7 and 8, which have been previously described
24 above.

25 **[0094]** A paving element having a plurality of cavities may be laid adjacent to
26 corresponding paving elements to create one or more drainage cavities. Figure 15
27 illustrates an aspect wherein the paving element 700 is positioned adjacent to another
28 identical paving element 700', such that a drainage aperture 760 is cooperatively formed by
29 the partial cavities 710, 710' of the adjacent paving elements 700, 700'. As will be
30 understood, a paved surface having a plurality of drainage cavities may be formed by laying
31 additional paving elements adjacent to one another. It will also be appreciated that the
32 drainage cavities formed in such manner would be oriented along different axes.
33 Specifically, in Figure 15, the longitudinal axis of at least some of the generally oval drainage

1 cavities are oriented perpendicular to the longitudinal axis of the other drainage cavities.
2 The longitudinal axes of the drainage cavities are indicated using the arrows 771, 773 for
3 reference.

4 **[0095]** In a further aspect illustrated in Figure 16, an insert 780 is disposed within the
5 drainage cavity 760 formed by the neighbouring paving elements 700, 700'. As previously
6 explained, the presence of the insert 780 blocks the filter media from reaching the lower
7 portion of the drainage cavities. The longitudinal axis of the drainage cavity 760 is indicated
8 using the arrow 775.

9 **[0096]** Figure 17 illustrates another aspect of the paving element 800 wherein a plurality
10 of partial cavities 810a-f is formed therein. In Figure 17, all of the partial cavities 810a-f are
11 formed such that when drainage cavities are formed by laying corresponding paving
12 elements adjacent to one another, the longitudinal axes of all of the drainage cavities will be
13 oriented in a single orientation indicated by the arrow 830. As would be understood, uniform
14 orientation of the drainage cavities may facilitate the cleaning of the paved surface in some
15 cases.

16 **[0097]** Figure 18 illustrates yet another aspect of the paving element 900. In Figure 18,
17 the paving element 900 is substantially square, and is provided with a plurality of generally
18 oval partial cavities 910a-h formed at the edges of the element. As illustrated, the cavities
19 910a-h are formed such the longitudinal axes of the drainage cavities created by joining the
20 cavities 910a-h with the corresponding cavities would be oriented in a single orientation.

21 **[0098]** Figure 19 illustrates a portion of the paving element 1000 according to yet
22 another aspect, wherein two partial cavities 1010a, 1010b are formed on at least one of the
23 edges of the paving element 1000. Both partial cavities 1010a, 1010b are illustrated as
24 forming semicircular openings on the top surface and the bottom surface of the paving
25 element 1000. An end elevation view of the paving element 1000 is illustrated in Figure 20.

26 **[0099]** Figure 21 illustrates a paving element 1100 according to yet another aspect. In
27 Figure 21, the paving element 1100 has a plurality of partial cavities 1110a-f formed at the
28 edges of the element 1100. The partial cavities 1110a-f are shaped such that when the
29 partial cavities are joined with corresponding partial cavities, "raindrop" shaped drainage
30 cavities are formed.

31 **[00100]** As illustrated in Figure 21 and the previous figures, the cupule of the present
32 paving block can be of any shape, either symmetrical (e.g. circular shaped) or asymmetrical

1 (e.g. raindrop shaped). It will be understood that once adjacent blocks are laid, the partial
2 openings will combine to form the final drainage cavity shapes on the pavement surface.

3 **[00101]** Figure 22 illustrates another optional aspect, wherein a paving block 1200, such
4 as the block shown in Figure 18, is provided with a plurality of interlocking ribs or nibs as
5 shown at 1210. Such ribs or nibs serve to prevent adjacent stones from sliding with respect
6 to each other and are well known in the art. As known, in the case of ribs, such ribs would
7 extend from generally the top surface of the paving element (i.e. block or stone) to the
8 bottom surface. In some cases, the ribs would not need to extend along the entire thickness
9 of the paving element.

10 **[00102]** Figure 23A illustrates a paving element 1300 according to yet another aspect,
11 wherein a partial cavity 1330 is formed on at least one of the edges of the paving element
12 1300. The partial cavity extends between an upper orifice or opening 1341 formed on the
13 upper surface 1313 and a lower orifice or opening 1343. In contrast with the embodiments
14 illustrated thus far, the upper orifice or opening 1341 has a rectangular shape when seen
15 from a plan view. Thus, when the partial cavity 1330 is joined with a corresponding partial
16 cavity, a generally rectangular drainage cavity opening may be observed on a plan view. A
17 side elevation view of the embodiment in Figure 23A is illustrated in Figure 23B. The partial
18 cavity 1330 comprises an upper portion 1332 which has a generally concave cross-section
19 when viewed from the side, and a lower portion, or conduit or channel 1334 extending from
20 the base of the upper portion 1332 through the paving block, thereby forming a channel
21 extending through to the lower orifice or opening 1343 located on the lower surface 1315, as
22 illustrated. The angle at which the upper portion 1332 slopes downwards from the upper
23 surface 1313 may be increased or decreased to form a deeper or shallower upper cavity
24 portion, respectively. Example embodiments of such angle adjustments are illustrated in
25 Figures 24 and 25.

26 **[00103]** Figure 24 illustrates a paving element 1400 according to another aspect, wherein
27 a partial cavity 1430 is formed on at least one of the edges of the paving element 1400. The
28 partial cavity 1430 comprises an upper portion 1432 which has a generally concave cross-
29 section when viewed from the side, and a lower portion, or conduit or channel 1434
30 extending from the base of the upper portion 1432 through the paving block, thereby forming
31 a channel extending through to the lower orifice or opening 1443 located on the lower
32 surface 1415, as illustrated. The angle at which the upper portion 1432 slopes downwards

1 from the upper surface 1413 is less than the corresponding angle in Figure 23, resulting in a
2 shallower upper portion 1432 in relation to the upper portion 1332 in Figure 23.

3 **[00104]** Figure 25 illustrates a paving element 1500 according to another aspect, wherein
4 a partial cavity 1530 is formed on at least one of the edges of the paving element 1500. The
5 partial cavity 1530 comprises an upper portion 1532 which has a generally concave cross-
6 section when viewed from the side, and a lower portion, or conduit or channel 1534
7 extending from the base of the upper portion 1532 through the paving block, thereby forming
8 a channel extending through to the lower orifice or opening 1543 located on the lower
9 surface 1515, as illustrated. The angle at which the upper portion 1532 slopes downwards
10 from the upper surface 1513 is less than the corresponding angles in Figures 23 and 24,
11 resulting in a shallower upper portion 1532 in relation to the upper portions 1332 and 1432 in
12 Figures 23 and 24, respectively.

13 **[00105]** In terms of cleaning of the paving elements described herein, various equipment
14 can be used, some of which have been described above. In calculating the cleaning
15 efficiency of the equipment, a cleaning ratio may be used. Such ratio, denoted herein as "S",
16 would relate the amount of matter, or filter media, captured and removed by a cleaning
17 apparatus to the original amount of filter media, wherein complete restoration of the
18 infiltration capacity of the filter media means $S = 1$. The term "substantial restoration" may
19 be understood to mean that the value of S is close or equal to 1.0. The geometries of the
20 cavities shown in Figures 23, 24, 25, 26, and 27 may facilitate the removal of particulates
21 captured by the filter media by, for example, conventional street cleaning equipment or
22 specialized equipment designed for the presently described paving elements, and thus allow
23 for the substantial restoration of the infiltration capacity of the filter media. By allowing the
24 substantial restoration of the infiltration capacity of the filter media, a pavement system may
25 continue to remain effective at removing pollutants and other contaminants for a longer
26 duration of time, than a pavement system that does not incorporate such geometries.

27 **[00106]** Figure 26A illustrates a paving element 1600 according to yet another aspect,
28 wherein a partial cavity 1630 is formed on at least one of the edges of the paving element
29 1600. The partial cavity extends between an upper orifice or opening 1641 formed on the
30 upper surface 1613 and a lower orifice or opening 1643. As with the previously described
31 paving element, the upper orifice 1641 is generally rectangular in shape when seen from a
32 plan view. The partial cavity 1630 comprises an upper portion 1632 located proximal to the
33 upper surface 1613 and a lower portion 1634 extending generally from the base of the

1 cupule 1632 through the paving block, thereby forming a channel extending through to the
2 lower orifice or opening 1643 located proximal to the lower surface 1615. In this particular
3 embodiment, the upper portion 1632 of the partial cavity includes substantially planar
4 portions 1631a and 1631b such that the upper portion 1632 is not concave in nature when
5 viewed from any perspective. The angles of the substantially planar portions 1631a and
6 1631b relative to the top surface 1613 of the paving element 1600 may be increased or
7 decreased to form a deeper or shallower upper cavity portion, respectively. Additionally, the
8 lower portion 1643 of the partial cavity 1630 may be tubular or rectangular in shape. Figure
9 26A illustrates an embodiment in which there is a rectangular shaped lower portion 1643.
10 When the partial cavity 1630 is joined with a corresponding partial cavity, a rectangular
11 shaped drainage cavity opening may be observed on the upper surface 1613 from a plan
12 view. The geometries shown in Figure 26 may facilitate the removal of residue captured by
13 the filter media by conventional regenerative-air street cleaning equipment, and thus aid in
14 the substantial restoration of the infiltration capacity of the filter media. An elevation view of
15 the embodiment in Figure 26A is illustrated in Figure 26B.

16 **[00107]** Figure 27 illustrates a paving element 1700 according to yet another aspect,
17 wherein a partial cavity 1730 is formed on at least one of the edges of the paving element
18 1700. As above, the paving stone 1700 includes having an upper surface 1713 and a lower
19 surface 1715. In this embodiment, the partial cavity 1730 may include one upper portion
20 1732 and two lower portions 1734a and 1734b which may be separated by a wall 1735. As
21 discussed further below, in other aspects, more than two lower portions may be provided in
22 the stone of Figure 27. The lower portions 1734a and 1734b of the partial cavity 1730 may
23 be tubular or rectangular in shape. According to this embodiment, when the partial cavity
24 1730 is joined with a corresponding partial cavity, the resulting drainage cavity comprises
25 one full upper portion and two full tubular or rectangular bottom portions. The geometries
26 shown in Figure 27 may facilitate the removal of residue captured by the filter media by
27 conventional regenerative-air street cleaning equipment, and thus aid in the substantial
28 restoration of the infiltration capacity of the filter media.

29 **[00108]** Figure 28A illustrates a paving element 1800 according to yet another aspect,
30 wherein the paving element 1800 is designed to have two outer sides 1810, two inner sides
31 1812, and two face sides 1814, such that the paving element 1800 possesses an overall "L"-
32 shaped outline when viewed from the top, similar to the paving element taught in US
33 5,342,142. There are a plurality of partial cavities 1830A, each of which extends between an
34 upper opening 1841A and a lower opening 1843A, wherein one set of openings 1843A is

1 characterized having a quarter circle shape. There are also a plurality of partial cavities
2 1830B, each of which extends between an upper opening 1841B and a lower opening
3 1843B, wherein the lower opening 1843B is characterized by having a semicircular shape.
4 Finally, there is at least one partial cavity 1830C which extends between an upper opening
5 1841C and a lower opening 1843C, wherein the lower opening 1843C is characterized by
6 having a three-quarter circular shape. Figure 28B shows a perspective view of the paving
7 element 1800, and further illustrates the partial cavity 1830C which comprises a cupule
8 portion 1832C and a conduit or channel portion 1834C, wherein the cupule portion 1832C is
9 substantially concave such that the upper opening 1841C on the top surface 1813, has a
10 larger diameter than the corresponding lower opening 1843C. Similarly, partial cavities
11 1832A and 1832B each comprise a substantially concave cupule portion and a conduit or
12 channel portion, such that the upper opening 1841A and 1841B has a larger diameter than
13 the corresponding lower opening 1843A and 1843B, respectively. According to this
14 embodiment, a pavement system which comprises a plurality of pavement elements 1800
15 are arranged to form a pavement such that each partial cavity 1830A, 1830B, and 1830C on
16 a paving element 1800 is joined with a corresponding partial cavity 1830C, 1830B, and
17 1830A, respectively, on an adjacent paving element 1800. More specifically, the
18 corresponding partial cavity to any partial cavity 1843A, 1843B, or 1843C, is one that allows
19 the resulting conduit opening to be a full circle.

20 **[00109]** Further aspects of the present paving stone are illustrated in Figures 29 to 36.
21 Figures 29 to 32 illustrate "L" shaped stones according to this aspect and Figures 33 to 36
22 illustrate rectangular versions of stones according to this embodiment. As shown, the stones
23 include a number of first partial cavities 1930a formed on the sides of the stones as well as
24 second partial cavities 1930b formed as slots cut into one or more ends of the stones. The
25 partial cavities 1930a are formed essentially parallel with the side of the stone on which they
26 are provided and are defined by an upper, concave portion 1932a and lower portion 1934a.
27 The partial cavities 1930b are formed essentially parallel with the side of the stone on which
28 they are provided and are defined by an upper, concave portion 1932b and lower portion
29 1934b. When the stones are arranged on a surface to form a pavement, the adjacent first
30 partial cavities 1930a combine to form complete cavities and adjacent, or abutting second
31 partial cavities 1930b combined to form complete cavities. An example of such a pavement
32 is illustrated in Figure 37. As will be understood, although Figure 37 illustrates a pavement
33 using the stones of Figures 29 and 31, the stones of Figures 33 and 35 may also be

1 arranged in a similar manner. In some cases, the "L" shaped stones may be combined with
2 the rectangular shaped stones.

3 **[00110]** Figures 38 and 39 illustrate another embodiment of the subject paving stone
4 2000, where a partial cavity 2030 is formed in a similar manner as shown in Figure 27.
5 However, in the example of Figures 38 and 39, the partial cavity includes a more elongate
6 upper portion 2032 that may extend along most of the length of the side of the paving stone
7 on which the partial cavity is formed. In the version shown in Figures 38 and 39, the partial
8 cavity 2030 is formed on a short side of a rectangular shaped paving stone 2000. It will be
9 understood that such partial cavity can be formed on one or more sides of the paving stone
10 2000, including one or both of the short and/or long sides of a rectangular paving stone. It
11 will also appreciated that a partial cavity as shown in Figures 38 and 39 may also be
12 provided in paving stones of any shape, such as the "L" shaped stones of the present
13 specification.

14 **[00111]** The partial cavity 2030 includes an upper convex portion 2032 and a plurality of
15 lower portions 2034. In the version shown in Figures 38 and 39, three lower portions 2034
16 are shown, but it will be understood that any number of such portions can be provided.

17 **[00112]** Figure 40 illustrates a version of the paving stone 2100 that is similar to that
18 shown in Figures 38 and 39, but where the partial cavity 2130 is provided on one of the long
19 sides of a rectangular shaped stone. As above, the partial cavity includes an upper,
20 concave or cupule, portion 2132 and one or more lower portions 2134.

21 **[00113]** Figures 41 to 43 illustrate another version of a paving stone 2200 similar to that
22 shown in Figures 38 and 39, but showing an example of a partial cavity having an upper,
23 concave portion 2232 that extends completely along the length of the side of the paving
24 stone 2200.

25 **[00114]** Figure 44 illustrates another aspect of a paving stone 2300, wherein the concave
26 portion 2332 of the partial cavity extends along the entire length of the side of the paving
27 stone (as also shown in Figures 41 to 43), but where a single, elongate lower portion 2334 is
28 provided.

29 **[00115]** Figures 45 and 46 illustrate another aspect of a paving stone 2400, wherein the
30 partial cavity is formed at one or more of the corners of the stone. As shown, and as
31 described above, each partial cavity is formed with an upper portion 2432 and a lower
32 portion 2434. In this version, it will be understood that each stone would include a quarter

1 portion of a complete cavity, whereby four stones, when arranged in a pavement, would
2 combine to form a complete cavity.

3 **[00116]** In another aspect, a pavement system is provided. The pavement system
4 comprises a plurality of paving elements, as described herein, positioned adjacent to one
5 another. In forming such a pavement, the paving elements are laid adjacent each other in
6 the known manner, but whereby respective openings are arranged together so as to form
7 the aforementioned drainage openings over the pavement thus formed.

8 **[00117]** It is notable to mention that the cupules discussed herein are uniquely
9 differentiable from the chamfered edges which are well known in the art and may be
10 commonly found in paving elements. Solid 90 degree edges in paving blocks become weak
11 points within a paving system – when two adjacent blocks are pressed together in such a
12 system, the load is centered on the interface between the two blocks, which exerts force
13 onto the upper edges and generally results in the pitting of the corners of the blocks. To
14 address this issue, chamfered edges, which comprise symmetrical sloping surfaces at the
15 joints at which two adjacent blocks meet, were designed and developed to help prevent such
16 pitting of corners in pavement elements. By contrast, the various designs of the cupules
17 discussed herein are not driven by the desire to prevent pitting of corners. The cupules are
18 designed in such a way to facilitate cleaning of a pavement system and aid in substantially
19 restoring the infiltration capacity of the system. Further, the cupules may be located at any
20 edge and/or the interior portion of the pavement element. Thus, although the shapes
21 resulting from chamfered edges in paving elements may in part resemble at least some of
22 the cupule shapes discussed herein, it is evident that there are clear distinctions between
23 the two.

24 **[00118]** While various aspects of the paving element have been described herein, in
25 which one or more partial cavities are formed at the edge of the paving element, a cavity
26 may also be formed at other portions of the paving element. For example, a full cavity may
27 be formed in the interior portion of the element (i.e. away from the edges), such as at the
28 center of the paving element. When paving elements having full cavities are laid adjacent to
29 one another to form a paved surface, the full cavities formed in each of the elements act as
30 the drainage cavity for allowing passage of liquid there-through.

31 **[00119]** As will be understood, the shape and relative dimensions of the paving element
32 may be varied. For example, the paving element may be square, rectangular, hexagonal, or
33 multi-sided. The shape of the partial or full cavity may also be varied. For example, the

1 partial or full cavity may be substantially circular, oblong, oval, or any other shape which
2 would allow liquid to pass there-through to be filtered. It would also be understood that, in
3 aspects wherein a plurality of partial or full drainage cavities are provided, each partial or full
4 cavity may be shaped and/or configured to be identical to one another or may be different.

5 **[00120]** As discussed above, the structure of the drainage openings described herein
6 comprise a concave, or cupule shaped opening or a planar, or triangular prism-like opening
7 on the upper surface of the paving element and a generally cylindrical or rectangular conduit
8 extending from the cupule and through the lower surface of the paving element, the conduit
9 having a smaller diameter than the cupule portion. As discussed above, the structure of the
10 opening on the upper surface of the paving element provides an advantage when cleaning
11 the drainage channels. As will also be understood, by having a narrower conduit portion (as
12 opposed to a conduit having the same diameter as the cupule opening) allows more solid
13 material to be provided in the paving element. As can be appreciated, this allows the paving
14 element to have a greater strength or integrity. In addition, with respect to drainage
15 openings provided on the outer perimeter or sides of the paving elements, the added paving
16 element material allows a greater contact area between adjacent paving elements when laid
17 on a surface. The contact area may be between the adjacent paving elements directly or via
18 the filler material provided there-between. In either case, the added contact area results in
19 greater friction and, therefore, greater resistance to movement of the element, when laid to
20 form a pavement. In addition, the increased surface area resulting from the narrower
21 conduit portions allows for more spacer nibs or ribs to be provided on the paving elements,
22 thereby further reducing the possibility of relative movement between adjacent paving
23 elements.

24 **[00121]** In the present description, the conduit portion below the concave or cupule
25 shaped opening has been described as being cylindrical or rectangular in shape, with a
26 constant diameter along its length. However, it will be appreciated that such conduit may
27 also have a conical shape, or partial conical shape in relation to drainage channels provided
28 on the sides of the paving elements. Thus, the paving elements may be provided with
29 conduits that are tapered, with diameters that increase either towards the upper or lower
30 surfaces of the paving elements. Ideally, to accommodate production equipment, the
31 conduits would taper upwards, with the upper diameter being greater than the lower
32 diameter.

1 **[00122]** It will be understood that the cavities or partial cavities that have been described
2 herein may be incorporated or formed into any shaped paving stones. The present
3 description has described rectangular or “L” shaped stones for illustration. Although any of
4 the cavity configurations can be incorporated into the described stones, they may also be
5 incorporated into paving stones of any shape and also into any of the sides thereof.

6 **[00123]** Although the invention has been described with reference to certain specific
7 aspects, various modifications thereof will be apparent to those skilled in the art. Any
8 examples provided herein are included solely for the purpose of illustrating the invention and
9 are not intended to limit the invention in any way. Any drawings provided herein are solely
10 for the purpose of illustrating various aspects of the invention and are not intended to be
11 drawn to scale or to limit the invention in any way. The scope of the claims appended hereto
12 should not be limited by the preferred aspects set forth in the above description, but should
13 be given the broadest interpretation consistent with the present specification as a whole.
14 The disclosures of all prior art recited herein are incorporated herein by reference in their
15 entirety.

WE CLAIM:

1. A paving element comprising an upper surface, a lower surface and a side wall, the paving element further comprising one or more drainage channels extending between the upper and lower surfaces,
 - wherein each of the drainage channels includes a first opening, provided at the upper surface of the paving element, and a second opening, provided on the lower surface of the paving element,
 - the first opening comprising a concave portion formed on the upper surface of the paving element,
 - the second opening including a conduit extending from a lower end of the first opening to the lower surface of the paving element, wherein the conduit has a smaller opening than the first opening,
 - and wherein the one or more drainage channels are provided on the perimeter of the paving element.
2. The paving element of claim 1, wherein the drainage channels are partial channels, formed into the side wall of the paving element, wherein, when the paving element is in use, the partial channels are adapted to cooperate with partial channels of an adjacent paving element to form complete channels when the paving elements are positioned together to form a pavement.
3. The paving element of claim 1 or 2, wherein each of the concave portions of the drainage channels is symmetrical with respect to at least one axis of the paving element.
4. The paving element of claim 1 or 2, wherein each of the concave portions of the drainage channels is asymmetrical with respect to at least one axis of the paving element.
5. The paving element of any one of claims 1 to 4, wherein the concave portions are round, oval, elongate or elliptical in shape.
6. The paving element of any one of claims 1 to 5, wherein each of the concave portions is oriented at an angle with respect to the plane of the upper surface of the paving element.

7. A paving element comprising an upper surface, a lower surface and a side wall, the paving element further comprising a plurality of drainage channels extending through the element between the upper and lower surfaces,

- wherein each of the drainage channels includes a first opening, provided on the upper surface of the paving element, and a second opening, provided on the lower surface of the paving element,

- the first opening comprising a substantially planar portion formed on the upper surface of the paving element,

- the second opening including a conduit extending from a lower end of the first opening to the lower surface of the paving element, wherein the conduit has a smaller opening than the first opening,

- and wherein the one or more drainage channels are provided on the perimeter of the paving element.

8. The paving element of claim 7, wherein the drainage channels provided on the perimeter are partial channels, formed into the side wall, wherein, when the paving element is in use, the partial channels are adapted to cooperate with partial channels of an adjacent paving element to form complete channels.

9. The paving element of claim 7 or 8, wherein each of the planar portions of the drainage channels is symmetrical with respect to at least one axis of the paving element.

10. The paving element of claim 7 or 8, wherein each of the planar portions of the drainage channels is asymmetrical with respect to at least one axis of the paving element.

11. The paving element of any one of claims 7 to 10, wherein each of the planar portions is oriented at an angle with respect to the plane of the upper surface of the paving element.

12. The paving element of claim 1, wherein the one or more drainage channels are provided on one or more corners of the paving element.

13. The paving element of any one of claims 1 to 12 further comprising a plurality of spacer ribs or nibs provided on the side wall.

14. The paving element of any one of claims 1 to 13, wherein at least one of the drainage channels includes a filter medium adapted to filter liquid passing through the channel.

15. The paving element of claim 14, wherein the filter medium is removable from the drainage channel.

16. A pavement system comprising a plurality of paving elements according to any one of claims 1 to 15, each of the paving elements being adapted to be laid adjacent each other.