

Filter element

5 The present invention relates to a filter
element for the construction of a liquid-permeable
floor area fastening, floor covering plate, manhole
cover, waste-water gully or the like, with, in the
direction of throughflow, at least one pre-filter layer
and at least one following filter layer, the free
10 throughflow cross sections of each layer increasing
from layer to layer in the direction of throughflow,
and with a casing which surrounds in a frame-like
manner, and retains, at least the filter layer or
filter layers.

15 The invention relates, furthermore, to a
filtering floor area fastening, floor covering plate,
manhole cover, waste-water gully or the like, with a
rigid plate-like basic body which is provided with a
plurality of receiving orifices opening out on the
20 underside of the basic body or opening into drainage
conduits running in the basic body, and to a method for
producing the same.

A filter element of the type mentioned in the
introduction is known from EP 0,651,835. The
25 multi-layer construction, with throughflow cross
sections increasing in layers, ensures that solids
contained in the liquid to be filtered can penetrate
only up to a specific grain size into the fine-pored
pre-filter layer. Grain sizes which are equal to or
30 smaller than the pores in the pre-filter layer can
penetrate into the filter element, but are not retained
there or do not block the filter element, and, instead,
are passed, unimpeded, through the filter body and
discharged again together with the liquid medium. Any
35 contaminations of the liquid, for example oils or
petrols, are absorbed in the filter element up to a
specific degree and are regenerated in a biological
degradation process; the porosity of the material or
the interspaces which remain free result, at the same

time, in automatic aeration and deaeration of the filter element.

In the known filter elements, the filter layers are formed from porous, firmly bound materials. Whilst this, on the one hand, provides the filter element with excellent properties of strength and load-bearing capacity which make it possible, for example, for persons or vehicles to pass directly over it, it has, on the other hand, the disadvantage that frost action may lead, for example, to bursting cracks and, consequently, to a filter element being destroyed.

The set object of the invention is to develop a filter element of the type mentioned in the introduction, in such a way that frost resistance is ensured, whilst at the same time the advantages described are preserved. This object is achieved, according to the invention, in that each filter layer is formed from granular material, the granulate grains either being in loose form or being connected to one another by means of a weak binder.

The term "granular material" refers, in the present description, to any kind of particulate material. The granulate grains (or particles of the particulate material) may have any desired shape and size, for example round or angular, and may themselves consist of any desired material, for example of porous or impermeable, rigid or elastic material. The granular material may be made up homogeneously of one type of granulate grains, but it may also consist of a mixture of different types of granulate grains which differ from one another in size, shape and/or material.

Thus, under the action of frost, mutual movement of the granulate grains becomes possible, so that they give way to the pressure of, for example, freezing water and can be correspondingly distributed or displaced within the limits of the casing and of the pre-filter layer, without the casing or the pre-filter layer being destroyed. The optional use of a weak

binder for the granulate grains serves preferably for transport purposes, for example when the clamping force of the casing is not sufficient to hold the granulate grains wedged or supported one against the other during transport. The binding force of the binder is preferably selected just so high that it is sufficient to prevent the granulate grains from falling out of the casing when the filter element is raised, transported and installed at its place of use.

After the frost action has ceased, the free moveability of the granulate grains allows them to return to their initial position. Furthermore, the vibrations occurring under frost action, or when persons or vehicles pass over the filter element, improves the self-cleaning action of the filter layer.

A preferred embodiment of the invention is distinguished in that the clear width of the casing decreases, preferably tapers conically, in the direction of throughflow. As a result, the compressive force exerted on the granulate grains under the action of force (for example, the passage of a vehicle) can be transferred to the casing. However, the invention, of course, also takes into consideration the alternative that the clear width of the casing remains the same or increases in the direction of throughflow.

In a particularly advantageous measure for allowing the displacement of the granulate grains, the pre-filter layer and the casing are manufactured from flexible, preferably elastic material. In this case, it is particularly beneficial if the pre-filter layer is designed in one piece with the casing. This variant results in a particularly simple construction of the filter element.

Alternatively, the casing could also be manufactured from rigid material and only the pre-filter layer from flexible, preferably elastic material, the advantage of this being that the filter

element has exactly predefined circumferential dimensions.

It is possible, furthermore, to manufacture both the casing and the pre-filter layer from rigid material and to connect them, so as to be relatively moveable in the direction of throughflow, via an overlapping butt joint. Instead of an overlapping butt joint, a connection via a flexible, preferably elastic gasket may also be provided. In any event, if there is frost action, there is a chamber, expandable in the direction of throughflow, for the granulate grains of the filter layer, at the same time ensuring that the filter element surface located on the liquid inlet side preserves its predefined configuration, for example plane.

In all the embodiments presented, a particularly advantageous development is distinguished in that a rigid supporting body is provided, which is arranged downstream of the filter layer or filter layers, so as to support the latter, and is provided with liquid passage orifices, the free throughflow cross sections of the supporting body being equal to or larger than the throughflow cross sections of the adjacent filter layer.

The supporting body thus closes off the casing on the side facing away from the pre-filter layer, so that an all-round cladding is obtained for the granulate grains, thus making it substantially easier to handle the filter element. Furthermore, the load-bearing capacity and capacity for the passage of persons and vehicles of the filter element do not depend on the quality of the substratum of the filter element, but are defined by the load-bearing capacity of the casing and of the supporting body.

Preferably, the outer circumference of the supporting body decreases in the direction of throughflow, thus allowing a positive anchoring of the supporting body in a corresponding receptacle in a

floor covering, manhole cover or the like, the said anchoring being load-bearing in the direction of throughflow.

According to a preferred embodiment of the invention, the supporting body may be connected to the casing, so as to be relatively moveable in the direction of throughflow, via an overlapping butt joint, in order to allow relative movement of the granulate grains.

Alternatively, the supporting body may be designed in one piece with the casing, so that it forms with the latter a pot-like receptacle for the granulate bodies which is closed off by the pre-filter layer. In this variant, the free moveability of the granulate grains must be ensured by an appropriate flexible or elastic design of the pre-filter layer or by a moveable connection of the pre-filter layer to the casing or by an elastic design of the granulate grains.

In a development of the invention, a rigid frame body, which positively surrounds the casing, may be provided additionally. The frame body increases the strength or carrying power of the filter element. Preferably, the frame body may be designed in one piece with the supporting body, so that a pot-like receptacle for the granulate grains and their casing is obtained.

At all events, it is particularly beneficial if, according to a further feature of the invention, the outer circumference of the casing or of the frame body, which, if appropriate, is present, decreases in the direction of throughflow. This measure has the advantage, described in connection with the supporting body, that the filter element can be anchored, so as to be held positively in the direction of throughflow, in a surrounding base plate, filter plate, in compacted soil etc.

An alternative embodiment of the invention, provided for another instance of use, is distinguished in that the casing or the frame body, which, if

appropriate, is present, has an outer shape suitable for being installed positively in a composite structure with identical adjacent filter elements.

5 A further possibility of use is afforded if, according to a further variant of the invention, the casing or the frame body, which, if appropriate, is present, is equipped with a circumferential flange for anchoring in the inlet of a waste-water manhole or the like.

10 At all events, it is particularly beneficial if the pre-filter layer is manufactured from wear-resistant material, specifically preferably from porous concrete or synthetic resin, asphalt or the like, porous plastic, perforated metal or plastic,
15 fabric, in particular synthetic fabric or glass-fibre-reinforced synthetic fabric or such like material.

According to a preferred feature of the invention, there is provision for the liquid-inlet-side
20 surface of the pre-filter layer to be shaped concavely. This makes it easier for the liquid to run into the pre-filter layer when the filter element is in a vertical installation position.

Preferably, the liquid-inlet-side surface of
25 the pre-filter layer is designed to be structured, preferably ribbed or bossed. The filter element can thereby be adapted more effectively to the particular instance of use, for example as a floor covering element.

30 In all the embodiments of the invention, the filter layer is preferably formed from single-grain or multi-grain granulate mixtures, specifically preferably from concrete granulate, plastic or synthetic-resin granulate or beads, or from gravel. Even an elastic
35 design of the filter grains is possible. By means of these materials, the free throughflow cross sections can be set, as desired, within wide ranges, depending on the requirement and on the instance of use. On the

other hand, these materials have appropriate strength for making it possible to transmit the forces exerted on the pre-filter layer, for example when a vehicle passes over, to the substratum or the supporting body.

5 Concrete mortar or synthetic resin, plastic or the like preferably serves as an optional binder for the granulate grains. Similar materials may, of course, also be used. The binders used can be mixed in a simple way with the granulate grains and at the points of
10 contact form bonds which can separate under frost action.

 Concrete, plastic, metal, fabric, in particular synthetic fabric or glass-fibre-reinforced synthetic fabric are preferably provided as materials for the
15 casing.

 According to a further feature of the invention, there may be provision for the outer surface of the casing to be designed to be structured, preferably ribbed or bossed, and/or to be provided with
20 an adhesive coating, bonding elements, pins or the like, for example made of polymers, this being conducive to producing a press fit or bonding fit of the filter element in a surrounding, in particular conical receptacle in a floor area fastening, floor
25 plate or compacted concrete. The adherability of filter elements, used in a floor area, under vibrations, frost action or the like can thereby be additionally improved.

 According to the invention, all high-strength
30 materials are taken into consideration for the supporting body or the frame body, which, if appropriate, is present, preferably concrete, metal, plastic or porous materials bound with high strength, such as drainage concrete, asphalt mixtures,
35 synthetic-resin-bound single-grain or multi-grain material or the like. It is particularly advantageous if the passage orifices are integrally formed or

mechanically worked, for example punched or drilled, into the supporting body.

A further aspect of the invention is the provision of a filtering floor area fastening, floor
5 covering plate, manhole cover, waste-water gully or the like, with a rigid plate-like basic body which is provided with a plurality of receiving orifices opening out on the underside of the basic body or opening into
10 drainage conduits running in the basic body, and which, according to the invention, are distinguished by filter elements of the type presented here which are inserted into the receiving orifices. It is particularly advantageous if the receiving orifices are tapered in the direction of throughflow, so that the filter
15 elements are held in the direction of throughflow, specifically, in the case of an appropriately complementary design, by positive connection, with the result that loads of any magnitude are possible.

According to a further feature of the
20 invention, the supporting bodies of the filter elements are preferably designed in one piece with the basic body, thus dispensing with the design of separate supporting bodies.

Yet a further aspect of the present invention
25 is a method for producing a liquid-permeable floor area fastening, floor covering plate, manhole cover, waste-water gully or the like, having the steps

Production of a rigid plate-like basic body from in-situ concrete, asphalt, bitumen or the like,
30 there being integrally formed a plurality of preferably conical receiving orifices opening out on the underside of the basic body or opening into drainage conduits running in the basic body, and

Insertion of filter elements of the type
35 presented here into the receiving orifices formed.

An alternative embodiment consists of a method for producing a liquid-permeable floor area fastening,

floor covering plate, manhole cover, waste-water gully or the like, having the steps

Provision of a rigid plate-like basic body made from in-situ concrete, asphalt, bitumen or the like,

5 Working-in of a plurality of preferably conical receiving orifices opening out on the underside of the basic body or opening into drainage conduits running in the basic body, and

10 Insertion of filter elements of the type presented here into the receiving orifices formed.

A further variant is a method for producing a liquid-permeable floor area fastening, having the steps

Provision of a basic body which consists of a compacted or sealed floor area and below which a
15 non-compacted porous substratum is located,

Working-in of a plurality of receiving orifices opening into the substratum into the compacted or sealed floor area, and

20 Insertion of filter elements of the type presented here into the receiving orifices formed.

The invention is explained in more detail below with reference to exemplary embodiments illustrated in the accompanying drawings in which:

25 Figures 1 to 13 show various embodiments of the filter element according to the invention in longitudinal section,

Figures 14 to 17 show various forms of use according to the invention of the filter element in longitudinal section,

30 Figures 18 to 20 show diagrammatically various cross-sectional shapes of the filter element, and

Figures 21 to 26 show examples of grouping patterns of filter elements in the instances of use of Figures 15 to 17 in a top view.

35 Figures 1 and 2 show a filter element 1 according to the invention in its simplest forms. According to Figure 1, as seen in the direction of throughflow 2, the filter element 1 is composed of a

pre-filter layer 3 and of a following filter layer 4 which are surrounded by a frame-like casing 5. The term "frame-like" is not tied to any special inner or outer shape of the casing 5, but defines that the casing 5 laterally surrounds the filter layer 4 according to the illustration. The thickness of the pre-filter layer 3 is substantially smaller than the thickness of the filter layer 4 and, for example, is only 1 to 30%, preferably 1 to 10%, of the thickness of the filter layer 4.

The pre-filter layer 3 is manufactured from a porous or perforated material, the minimum or averaged free throughflow cross sections of which are marked diagrammatically as the dimension "a".

The filter layer 4 is formed from granular material, the averaged free throughflow cross sections between the diagrammatically illustrated granulate grains being marked diagrammatically as the dimension "b". It is critical that the free throughflow cross sections b of the filter layer 4 be larger than the free throughflow cross sections a of the pre-filter layer 3, so that any foreign substances which have passed through the pre-filter layer 3 do not block the filter layer 4, but are discharged. However, contaminations, such as oils or petrols, are absorbed in the filter layer 4 and regenerated in a biological degradation process, the porosity of the filter layer 4 at the same time ensuring automatic aeration and deaeration of the filter element.

The clear width of the casing 5 decreases in the direction of throughflow 2, with the result that the loose granulate grains of the filter layer 4 are non-positively wedged one against the other due to their own weight and are thus prevented from falling out of the casing 5 when the filter element is transported, on the assumption that vibrations are not excessive. This measure may be assisted by producing the casing 5 from flexible, in particular elastic

material, for example in the manner of a clamping ring. Alternatively or additionally, the filter layer 4 may be bound by means of a weak binder, the binding force of which is just sufficient to hold the granulate
5 bodies during transport and installation, but loosens them under vibrations, frost action, the action of salt spread for de-icing purposes or the like, so that free relative movement of the granulate grains in the filter layer 4 is possible.

10 The casing 5 does not necessarily have to be tapered on the inside; it could also have a virtually constant cross section or widen in the direction of throughflow. This also applies to its outer circumference.

15 So that the expansion of the filter layer 4 in the event of frost action or the like can be absorbed, it is sufficient, in the simplest instance, to mount the entire filter element 1 in the surrounding floor plate, floor area fastening, etc. so as to be moveable
20 in the direction of throughflow, so that granulate grains emerging on the open side of the casing 5 can lift the filter element slightly out of its seat. Preferably, however, an expandable chamber for the filter layer 4 is provided. For this purpose, the
25 pre-filter layer 3 is connected to the casing 5 via an overlapping butt joint 6, so that the pre-filter layer 3 can move parallel to the direction of throughflow 2 in relation to the casing 5. Additionally or alternatively, a flexible, preferably elastic gasket 7
30 between the pre-filter layer 3 and casing 5 may be provided and/or the pre-filter layer 3 or the casing 5 may be designed flexibly or elastically, as also described later.

35 Figure 2 shows a similar embodiment to that of Figure 1, the difference being that the pre-filter layer 3 and the casing 5 are designed in one piece, and a further filter layer 4', following the filter layer 4, is provided. The free throughflow cross sections of

the filter layer 4' are marked diagrammatically as the dimension b' and are larger than the free throughflow cross sections b of the filter layer 4. More than two filter layers 4, 4' may also be arranged in succession, the free throughflow cross sections of all the layers 3, 4, 4', etc. increasing from layer to layer in the direction of throughflow 2 (not illustrated).

Figure 3 shows an embodiment similar to that of Figure 2, a rigid supporting body 8, which is provided with liquid passage orifices 9, being provided downstream of the last filter layer 4'. The free throughflow cross sections of the supporting body 8 have the dimension c and are equal to or larger than the free throughflow cross sections b' of the adjacent filter layer 4' (not illustrated in the correct proportions in the drawing). In general, the following is true:

$$a \ll b < b' \leq c$$

According to Figure 4a, the supporting body 8 can be connected to the casing 5 via an overlapping butt joint 9' so as to be relatively moveable in the direction of throughflow, in order to form an expandable chamber for the filter layer or filter layers 4, 4' etc.

Figure 4b shows an embodiment, in which the clear width of the casing 5 increases in the direction of throughflow and the casing 5 also surrounds the supporting body 8. Here too, the expandable chamber may again be formed by means of a flexible or elastic design of the casing and/or of the pre-filter layer, in which case the supporting body 8 can be connected, for example pressed or adhesively bonded, to the casing 5, or the expandable chamber is formed by the relatively moveable overlap interface 9'' between the casing 5 and supporting body 8.

According to Figure 5, the supporting body 8 may also be of hollow design.

Figure 6 shows that the casing 5 may also laterally surround and retain the supporting body 8. In this example, the casing 8 [sic] is equipped with a circumferential flange 10, the purpose of which is also explained later in connection with the embodiment of Figure 11.

According to Figure 7, the supporting body 8 may also be designed in one piece with the casing 5, so that a pot-like receptacle for the filter layer or filter layers 4, 4' etc. is obtained.

Figure 8 shows an embodiment, in which, in addition to the casing 5, a rigid frame body 11 is provided, which surrounds the casing 5 and, in the example shown, the supporting body 8 with bearing contact. The frame body 11 may serve for giving the entire filter element 1 a defined circumferential shape if a flexible or elastic casing 5 is used. On the other hand, it allows or reinforces cohesion between the pre-filter layer 3, casing 5 and supporting body 8. Finally, as is evident from Figures 9a-9c and 10, the frame body 11 may be provided with an outer shape or circumferential shape of this kind, so that the entire filter element 1 can be installed in a positive composite structure with identical adjacent filter elements 1. Alternatively, the frame body 11 may be provided, in the same way as the casing 5 in the embodiment of Figure 6, with a circumferential flange 12 which makes it possible to anchor the filter element 1 in the inlet 13 of a waste-water manhole 14 or the like (Figure 11).

As regards the embodiments in Figures 9b and 9c, it may also be noted that, here, the clear width of the casing 5 increases in the direction of throughflow. In Figure 9c, the supporting body 8 is designed in two parts, specifically from an inner part 8', which consists, for example, of porous material and which is provided with passage orifices 9 and is inserted into a frame-like second part 8'' in such a way that the said

inner part is held positively in the direction of throughflow.

Figures 12a and 12b show embodiments, in which the frame body 11 is designed in one piece with the supporting body 8. In Figure 12b, the clear width of the casing 5 remains approximately constant in the direction of throughflow.

Figure 13 shows a combination of the embodiments of Figures 11 and 12a, the frame body 11 being designed in one piece with the supporting body 8 and having a circumferential flange 12 for anchoring in the inlet 13 of a waste-water manhole 14.

According to Figure 14a, the frame body 11 may also be formed in two parts from an upper part 11' and a lower part 11'', the parting line running level with the supporting body 8 and forming an inner shoulder 11''' for supporting the latter.

Figure 14b shows a floor area fastening element 15, for example a floor tile, floor plate, paving stone or the like, which is equipped with a filter element 1 having a supporting body 8 and frame body 11. A floor area fastening element of this kind may, of course, also be fitted with a plurality of filter elements 1, and an example of a manhole cover equipped with nine filter elements 1 is shown in longitudinal section in Figure 15.

Figure 16 shows a floor area fastening 17 which, in principle, can be of continuous design, with a rigid basic body 18 which is provided with a plurality of receiving orifices 20 which open out on the underside 19 of the basic body and into which filter elements 1 are inserted. The receiving orifices 20 are tapered in the direction of throughflow 2 and retain the filter elements 1 positively. Alternatively (not illustrated), the supporting bodies 8 of the filter elements 1 could be formed in one piece with the basic body 18.

Figure 17 shows a variant of the floor area fastening of Figure 16, transversely running drainage conduits 21, into which the receiving orifices 20 open, being cut out inside the basic body 18.

5 The production of the floor covering plate or manhole cover plate 15 or floor area fastening is carried out either by first producing the basic body 18, with the receptacles 20 being integrally formed in it, and by subsequently inserting the filter elements 1
10 into the receiving orifices 20, or by starting from an existing basic body 18, subsequently working in, for example drilling, milling or the like, the receiving orifices 20, and then inserting the filter elements 1. The filter elements 1 could, of course, also be cast
15 directly into the material of the basic body 18. The basic body 18 may also be formed by compacting or sealing the surface layer of a porous floor, a non-compacted porous substratum 22 remaining below the basic body 18.

20 In order to design the supporting bodies 8 of the filter elements 1 in one piece with the basic body 18, it is sufficient to provide or work in pocket-like receiving orifices 20 and equip the base of the receiving orifices with passage orifices 9.

25 The filter elements 1 may have any desired cross section, for example round, oval, angular, square, polygonal, as is evident from the examples of Figures 18 to 20. A plurality of filter elements 1 in a floor area fastening, floor area fastening element,
30 manhole cover or the like may be arranged in any desired pattern, for example as illustrated in Figures 21 to 26.

 It goes without saying that those features of the various embodiments which are illustrated in the
35 Figures may be combined in any desired way; illustrating all the possible combinations would go beyond the scope of the present invention. It is essential that, when the filter element 1 is in the

installed state, the granulate grains of the filter layer 4 be freely moveable, in order to be capable of giving way to the pressure of, for example, freezing water, without the multi-layer construction and the outer structural intactness of the filter element being impaired.

Any materials highly resistant to abrasion are suitable as materials for the pre-filter layer 3, whether they be rigid, flexible or elastic, for example porous concrete, asphalt, porous plastic, perforated metal sheets or plastic films, synthetic fabric, glass-fibre-reinforced synthetic fabric, etc. The liquid-inlet-side surface 3' (Figure 3) of the pre-filter layer 3 may be shaped concavely, ribbed, bossed or otherwise structured. Suitable materials for the filter layer 4 are single-grain or multi-grain granulate mixtures of concrete granulate, plastic or synthetic resin granulate or beads or gravel. The granulate grains may be rigid or elastic, porous or impermeable. The modulus of elasticity and/or the degree of porosity may also be selected differently for each component of a multi-grain granulate mixture. Low-strength concrete mortar, synthetic resin, etc. are suitable as binders for the filter layer 4.

The casing 5 may be manufactured from the same material as the pre-filter layer 3, preferably from metal (for example, steel) or plastic, but also porous concrete, concrete with integrally formed conduits, or else from wear-resistant fabrics, synthetic fabrics or glass-fibre-reinforced synthetic fabrics. The outer surface 5' (Figure 3) of the casing 5 may be ribbed, bossed or otherwise structured or be provided with an adhesive coating or bonding elements.

The supporting body 8 and the frame body 11 consist of high-strength material, preferably concrete, metal, plastic or materials bound with high strength, such as drainage concrete or the like. The passage

orifices 9 are either integrally formed or mechanically worked in, for example punched or drilled.

The free relative moveability of the granulate grains is also advantageous when there is no
5 possibility of frost action, for example in countries with a climate which is warm without exception, because it allows the forces exerted on the pre-filter layer to be transmitted non-destructively to the substratum.

Patent Claims:



1. Filter element for the construction of a
5 liquid-permeable floor area fastening, floor covering
plate, manhole cover, waste-water gully or the like,
with, in the direction of throughflow, at least one
pre-filter layer and at least one following filter
10 layer, the free throughflow cross sections of each
layer increasing from layer to layer in the direction
of throughflow, and with a casing which surrounds in a
frame-like manner, and retains, at least the filter
layer or filter layers, characterized in that each
15 filter layer (4, 4') is formed from granular material,
the granulate grains either being in loose form or
being bonded to one another by means of a weak binder.

2. Filter element according to Claim 1,
characterized in that the clear width of the casing (5)
decreases, preferably tapers conically, in the
20 direction of throughflow.

3. Filter element according to Claim 1 or 2,
characterized in that the pre-filter layer (3) and the
casing (5) are manufactured from flexible, preferably
elastic material.

25 4. Filter element according to one of Claims 1 to
3, characterized in that the pre-filter layer (3) is
designed in one piece with the casing (5).

5. Filter element according to Claim 1 or 2,
characterized in that the casing (5) is manufactured
30 from rigid material and the pre-filter layer (3) is
manufactured from flexible, preferably elastic
material.

6. Filter element according to Claim 1 or 2,
characterized in that the casing (5) and the pre-filter
35 layer (3) are manufactured from rigid material and are
connected, so as to be relatively moveable in the
direction of throughflow, via an overlapping butt joint
(6).



7. Filter element according to Claim 1 or 2, characterized in that the casing (5) and the pre-filter layer (3) are manufactured from rigid material and are connected to one another via a flexible, preferably elastic gasket (7).

8. Filter element according to one of Claims 1 to 7, characterized in that a rigid supporting body (8) is provided, which is arranged downstream of the filter layer or filter layers (4, 4'), so as to support the latter, and is provided with liquid passage orifices (9), the free throughflow cross sections (c) of the supporting body (8) being equal to or larger than the free throughflow cross sections (b, b') of the adjacent filter layer (4, 4').

9. Filter element according to Claim 8, characterized in that the outer circumference of the supporting body (8) decreases in the direction of throughflow (2).

10. Filter element according to Claim 8 or 9, characterized in that the supporting body (8) is connected to the casing (5), so as to be relatively moveable in the direction of throughflow (2), via an overlapping butt joint (9).

11. Filter element according to Claim 8 or 9, characterized in that the supporting body (8) is designed in one piece with the casing (5).

12. Filter element according to one of Claims 1 to 11, characterized in that a rigid frame body (11), which positively surrounds the casing (5), is provided.

13. Filter element according to Claim 12 in conjunction with one of Claims 8 to 11, characterized in that the frame body (11) is designed in one piece with the supporting body (8).

14. Filter element according to one of Claims 1 to 13, characterized in that the outer circumference of the casing (5) or of the frame body (11), which, if appropriate, is present, decreases in the direction of throughflow (2).



15. Filter element according to one of Claims 1 to 13, characterized in that the casing (5) or the frame body (11), which, if appropriate, is present, has an outer shape suitable for being installed positively in a composite structure with identical adjacent filter elements (1).

16. Filter element according to one of Claims 1 to 13, characterized in that the casing (5) or the frame body (11), which, if appropriate, is present, is equipped with a circumferential flange (10, 12) for anchoring in the inlet (13) of a waste-water manhole (14) or the like.

17. Filter element according to one of Claims 1 to 16, characterized in that the pre-filter layer (3) is manufactured from wear-resistant material.

18. Filter element according to one of Claims 1 to 17, characterized in that the pre-filter layer (3) is manufactured from porous concrete or synthetic resin, asphalt or the like.

19. Filter element according to one of Claims 1 to 17, characterized in that the pre-filter layer (3) is manufactured from porous plastic.

20. Filter element according to one of Claims 1 to 17, characterized in that the pre-filter layer (3) is manufactured from perforated metal or plastic.

21. Filter element according to one of Claims 1 to 17, characterized in that the pre-filter layer (3) is manufactured from fabric, in particular synthetic fabric or glass-fibre-reinforced synthetic fabric.

22. Filter element according to one of Claims 1 to 21, characterized in that the liquid-inlet-side surface (3') of the pre-filter layer (3) is shaped concavely.

23. Filter element according to one of Claims 1 to 22, characterized in that the liquid-inlet-side surface (3') of the pre-filter layer (3) is designed to be structured, preferably ribbed or bossed.

24. Filter element according to one of Claims 1 to 23, characterized in that the filter layer (4, 4') is



formed from single-grain or multi-grain granulate mixtures.

25. Filter element according to one of Claims 1 to 24, characterized in that the filter layer (4, 4') is
5 formed from concrete granulate.

26. Filter element according to one of Claims 1 to 24, characterized in that the filter layer (4, 4') is formed from preferably elastic plastic or synthetic-resin granulate or beads.

10 27. Filter element according to one of Claims 1 to 24, characterized in that the filter layer (4, 4') is formed from gravel.

28. Filter element according to one of Claims 1 to 27, characterized in that the binder, which, if
15 appropriate, is used, is concrete mortar.

29. Filter element according to one of Claims 1 to 27, characterized in that the binder, which, if appropriate, is used, is synthetic resin, plastic or the like.

20 30. Filter element according to one of Claims 1 to 29, characterized in that the casing (5) is manufactured from concrete, plastic or metal.

31. Filter element according to one of Claims 1 to 29, characterized in that the casing (5) is
25 manufactured from fabric, in particular synthetic fabric or glass-fibre-reinforced synthetic fabric.

32. Filter element according to one of Claims 1 to 31, characterized in that the outer surface (5') of the casing (5) is designed to be structured, preferably
30 ribbed or bossed.

33. Filter element according to one of Claims 1 to 32, characterized in that the outer surface (5') of the casing (5) is provided with an adhesive coating, bonding elements, pins or the like, for example made of
35 polymers.

34. Filter element according to one of Claims 8 to 33, characterized in that the supporting body (8) and/or the frame body (11), which, if appropriate, is



present, are/is manufactured from high-strength material, preferably concrete, metal, plastic or porous materials bound with high strength, such as drainage concrete, asphalt mixtures, synthetic-resin-bound
5 single-grain or multi-grain material or the like.

35. Filter element according to one of Claims 8 to 34, characterized in that the passage orifices (9) are integrally formed or mechanically worked, for example punched or drilled, into the support body (8).

10 36. Filtering floor area fastening, floor covering plate, manhole cover, waste-water gully or the like, with a rigid plate-like basic body (18) which is provided with a plurality of receiving orifices (20) opening out on the underside (19) of the basic body
15 (18) or opening into drainage conduits (21) running in the basic body (18), characterized by filter elements (1) according to one of Claims 1 to 35 which are inserted into the receiving orifices (20).

37. Floor area fastening according to Claim 36,
20 characterized in that the receiving orifices (20) are tapered in the direction of throughflow (2).

38. Floor area fastening according to Claim 35 or 36, with filter elements according to one of Claims 8 to 35, characterized in that the supporting bodies (8)
25 of the filter elements (1) are designed in one piece with the basic body (18).

39. Method for producing a liquid-permeable floor area fastening, floor covering plate, manhole cover, waste-water gully or the like, having the steps

30 Production of a rigid plate-like basic body (18) from in-situ concrete, asphalt, bitumen or the like, there being integrally formed in the latter a plurality of preferably conical receiving orifices (20) opening out on the underside (19) of the basic body
35 (18) or opening into drainage conduits (21) running in the basic body (18), and



Insertion of filter elements (1) according to one of Claims 1 to 35 into the receiving orifices (20) formed.

40. Method for producing a liquid-permeable floor area fastening, floor covering plate, manhole cover, waste-water gully or the like, having the steps

Provision of a rigid plate-like basic body (18) made from in-situ concrete, asphalt, bitumen or the like,

Working-in of a plurality of preferably conical receiving orifices (20) opening out on the underside (19) of the basic body (18) or opening into drainage conduits (21) running in the basic body (18), and

Insertion of filter elements (1) according to one of Claims 1 to 35 into the receiving orifices (20) formed.

41. Method for producing a liquid-permeable floor area fastening, having the steps

Provision of a basic body (18) which consists of a compacted or sealed floor area and below which a non-compacted porous substratum (22) is located,

Working-in of a plurality of receiving orifices (20) opening into the substratum (22) into the compacted or sealed floor area, and

Insertion of filter elements (1) according to one of Claims 1 to 35 into the receiving orifices (20) formed.