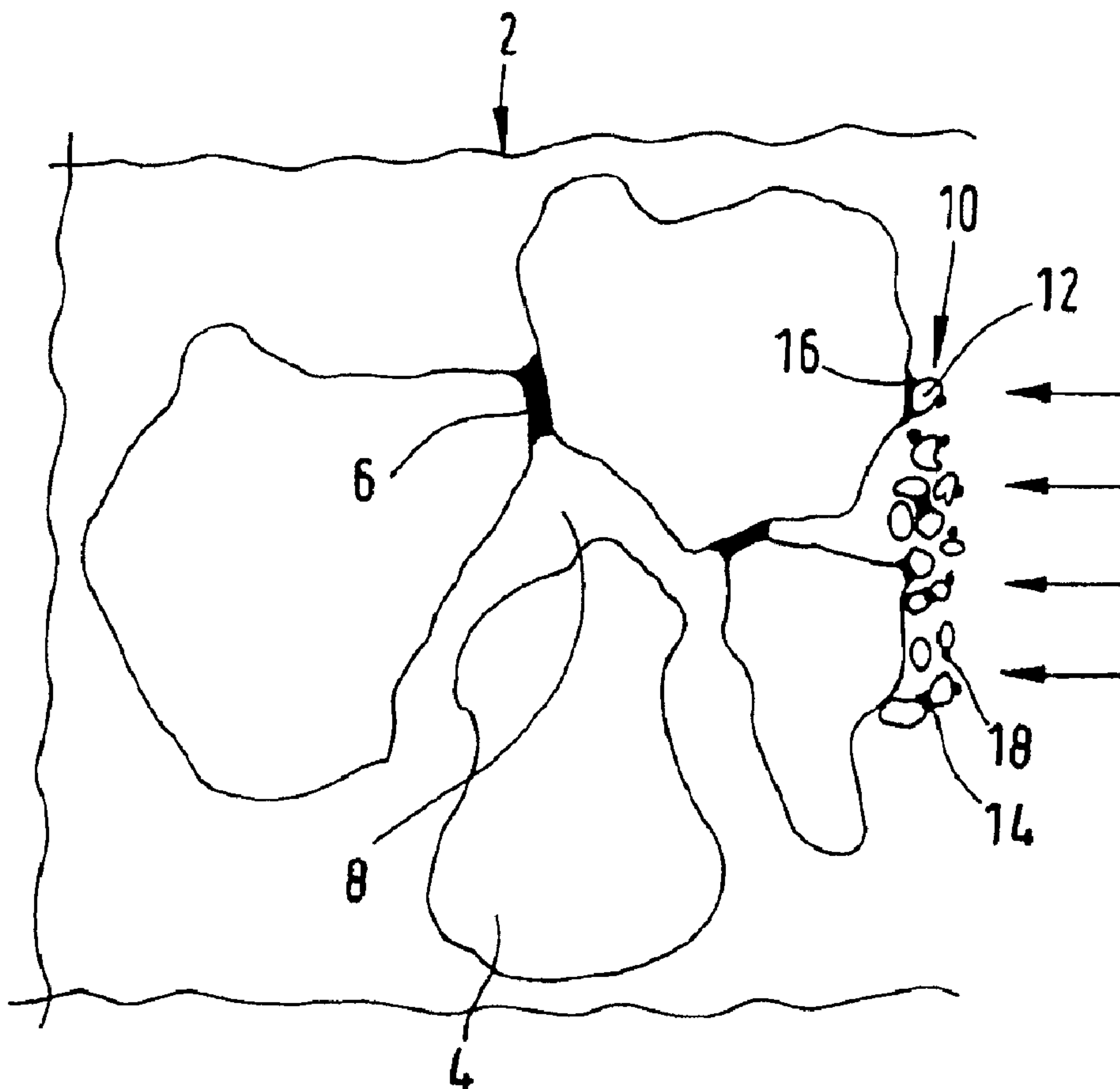




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(54) Titre : ELEMENT FILTRE A REVETEMENT UTILISE POUR UNE FILTRATION DE SURFACES
 (54) Title: FILTER ELEMENT WITH COATING FOR SURFACE FILTRATION



(57) Abrégé/Abstract:

An inherently stable, flow-porous filter element (2) having a porous coating (10) for surface filtration on its afflux surface, said coating (10) comprising: (a) a main component of particles (12) and/or fibers (22); (b) an inorganic binder component (14; 24)



(57) **Abrégé(suite)/Abstract(continued):**

binding the particles (12) and/or the fibers (22) of the main component to each other; (c) an adhesive (16; 26) binding the porous coating (10) to the remainder of the filter element; (d) and an anti-adhesion component (18; 28) mitigating the adhesion of filtered out material to the porous coating and facilitating cleaning of the filter element.

Abstract

An inherently stable, flow-porous filter element (2) having a porous coating (10) for surface filtration on its afflux surface, said coating (10) comprising:

- (a) a main component of particles (12) and/or fibers (22);
- (b) an inorganic binder component (14; 24) binding the particles (12) and/or the fibers (22) of the main component to each other;
- (c) an adhesive (16; 26) binding the porous coating (10) to the remainder of the filter element;
- (d) and an anti-adhesion component (18; 28) mitigating the adhesion of filtered out material to the porous coating and facilitating cleaning of the filter element.

Filter Element with Coating for Surface Filtration

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The invention relates to an inherently stable, flow-porous filter element having a porous coating for surface filtration on its afflux surface.

Such filter elements are known with a number of coatings of different construction.

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It is the object of the invention to make available a filter element with a surface filtration coating that is useful also for increased temperatures and/or increased resistance to chemical attack.

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To meet this object, the coating of the filter element comprises:

- (a) a main component of particles and/or fibers;
- (b) an inorganic binder component binding the particles and/or fibers of the main component to each other;
- 20 (c) an adhesive binding the porous coating to the remainder of the filter element;
- (d) and an anti-adhesion component mitigating the adhesion of filtered out material to the porous coating and facilitating cleaning of the filter element.

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The binding of the coating to the remainder of the filter element need not be effected exclusively by the adhesive, but the adhesive has a considerable share in effecting this binding. On the other hand, the adhesive may participate in addition also in binding the particles and/or fibers of the main component to each other.

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Preferred particles for the main component are kieselguhr particles, zeolite particles, polyvinyl pyrrolidone particles and mixtures thereof; among these, kieselguhr particles are particularly preferred. Preferred fibers for the main component are ceramic fibers. The preferred substances mentioned do not have to form 100 % of the main component; it is sufficient when the main component contains one or more of the substances referred to as preferred ones to a considerable share. On the other hand, it is preferred that the main component consists in essence of only one of the preferred substances mentioned or mixtures thereof. As an alternative,

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however, it is preferred as well to use a mixture of ceramic fibers and one type of particles referred to as preferred or several types of particles referred to as preferred.

5 The binder component may comprise or consist of water glass. However, it is preferred that the binder component is not water glass. The binder component preferably is sol-based. The binder component preferably comprises crosslinked SiO_2 or crosslinked SiO_2 derivative or crosslinked TiO_2 or crosslinked TiO_2 derivative or crosslinked ZrO_2 or crosslinked ZrO_2 derivative or a mixture of several of the
10 afore-mentioned substances. Crosslinked SiO_2 is very much preferred. Also as regards the binder component, it is not necessary for the same to consist to 100 % of one of the substances referred to as preferred or of a mixture of several of these substances. However, it is preferred that the binder component consists in essence of one of the substances referred to as preferred or of a mixture of several of these substances. SiO_2 derivative is understood to be a substance which,
15 apart from the silicon atoms and the oxygen atoms, still contains some organic material. The same holds analogously for TiO_2 and ZrO_2 .

Preferably, the adhesive is an organic dispersion adhesive. Aqueous dispersions
20 are particularly preferred.

Preferably, the anti-adhesion component is polytetrafluoroethylene - in the following briefly referred to as PTFE - and/or silicone. Very much preferred is PTFE. Moreover, the case very much preferred is that the anti-adhesion component in
25 essence consists of PTFE only. A particularly expedient embodiment of the invention provides for the application of the coating pursuant to the sol-gel process.

A further expedient embodiment of the invention consists in that the coating (in essence) contains kieselguhr (only) as main component and (in essence) PTFE
30 (only) as anti-adhesion component in a weight ratio of 1:1 to 1:2.

The main body of the filter element, i.e. the basic structure of the filter element located underneath the coating, preferably is composed of sintered plastics particles. Polyethylene particles are particularly favorable.

The modification of the filter element according to the invention in which particles are present as main component of the coating, can be used in particularly favorable manner for liquid filtration or for separating oil mists from a gas stream. The filtration of cooling lubricant is envisaged in particular in this regard; cooling lubricants are oily liquids or emulsions of lubricating substances in particular in water that are used in mechanical or abrasive or cutting or other material-removing (e.g. spark erosion) working (machining) of workpieces. The cooling lubricant as a rule is pumped in circulating manner and contains, when leaving the place of workpiece machining, abraded, cut or removed particles of the machined workpiece. These particles need to be filtered out before the cooling lubricant again reaches the workpiece in the circulation. Preferably, the filtration is performed by means of the filter element according to the invention which is simply immersed into a bath of the cooling lubricant. The filtered out foreign particles adhere to the coating on the outer surface of the filter element, the filtered cooling lubricant is sucked off from inside of the filter element. For periodic cleaning of the filter element, the pump circulation is briefly interrupted at suitable intervals in time and replaced by a brief liquid stream of cleaned cooling lubricant in the opposite direction, so that the filtered out foreign particles accumulated on the outside of the coating drop down into the cooling lubricant bath and may be removed from there e.g. by means of a sludge discharge means.

On the basis of the teaching of the invention it is possible to produce filter elements which in essence completely filter out foreign particles of a size of more than 5 μm , more preferably more than 3 μm , from a liquid. In case of cooling lubricant, the effect achieved is that the machining accuracy of the workpiece is very high as there is extremely clean cooling lubricant flowing to the machining site. It is possible to produce filter elements according to the invention for gas filtration which filter out foreign particles of a size of more than 3 μm , more preferably of a size of more than 1 μm , in essence completely.

The variant of the filter element according to the invention in which fibers are present as main component of the coating (to a by far predominant extent or in essence as sole component) can be used in particularly expedient manner for gas filtration.

All in all, the filter element according to the invention can be used in particularly advantageous manner in situations in which resistance to increased temperatures and/or resistance to chemical attack is important. The filter element may be designed to resist a temperature of permanent use of up to 180 °C, or it may be designed to resist a temperature of permanent use of up to 150 °C, or it may be designed to resist a temperature of permanent use of up to 120 °C. Chemical attack occurs e.g. in case of the afore-mentioned cooling lubricant. Another application involving chemical attack is the filtering of combustion exhaust gas. As examples for applications involving temperature resistance, there can be named the filtering of combustion exhaust gas, filtering for product separation from a gas stream (e.g. spray drier, drier in foodstuff industry) and materials recycling from a gas stream (e.g. catalyst in fluidized bed reactors).

The invention and preferred developments of the invention will be explained in more detail in the following by way of embodiments.

Fig. 1 shows a sectional view of a fragment of a filter element;

5 Fig. 2 shows a sectional view of a fragment of a filter element according to a another embodiment.

In the filter element 2 shown as a fragment in Fig. 1, the main component consists of polyethylene particles 4 that are sintered together at their contact locations 6.

10 The pores 8 between the particles 4 have an average size of e.g. 10 to 60 μm .

The coating 10 of the filter element in essence consists of kieselguhr particles 12 that are bonded to each other via crosslinked SiO_2 14 and, at their contact locations with polyethylene particles 4, are bonded to the main body by means of an organic dispersion adhesive 16, and of PTFE particles 18. The kieselguhr particles 12 are so small that the pores between them in the average have a size of less than 3 μm . In producing the filter element 2 of Fig. 1, the main body is produced first and thereafter the coating is applied to the afflux surface of the same either with the consistence of a rather thin liquid or with the consistence of a rather thick liquid to a pasty consistence, e.g. by spraying, rolling on, brush application, etc. The coating mass to be applied in essence consists of kieselguhr particles, an SiO_2 sol, PTFE particles, organic dispersion adhesive, water and a small amount of tenside, wetting aid or foam prevention means. All of these components are available on the market without any problem. The coating mass is emulsion-stable. Upon application of the coating mass, there is a sol-gel reaction, using as a rule a slightly increased temperature, and after evaporation of all water, the coating is formed in the solid aggregate state. During the sol-gel reaction and evaporation of the water, crosslinking of the SiO_2 phase and thus binding of the kieselguhr particles to each other takes place.

30 The weight ratio of kieselguhr to PTFE is in the range from 1:1 to 1:2 for obtaining particularly good results.

The filter element 2 shown in a fragment in Fig. 2 differs from the filter element according to Fig. 1 by a different coating 10. In this case, the finished coating 10 in

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essence consists of ceramic fibers 22, crosslinked SiO_2 24, organic dispersion adhesive 26 and PTFE particles 28. Kieselguhr particles 12 in a smaller amount than in Fig. 1 are present as well. As regards the coating mass in the state to be applied, the statements (additional components, consistence etc.) made in connection with the embodiment according to Fig. 1 are applicable again.

The pores between the ceramic fibers 22 have substantially the same size as the pores between the kieselguhr particles 12 in the embodiment according to Fig. 1. The ceramic fibers 22 typically have a diameter of a few μm and a length of 10 to 30 μm ; chemically, they consist typically in essence of $\text{SiO}_2/\text{Al}_2\text{O}_3$.

Kieselguhr is a common designation for a material consisting typically to 70 to 90 % of amorphous silicic acid and to 3 to 12 % of water.

In case of silicone as anti-adhesion component, the drawing figures would have a substantially unchanged appearance. In case of water glass as inorganic binder component, the drawing figures would have a substantially unchanged appearance.

CLAIMS:

1. An inherently stable, flow-porous filter element having a porous coating for surface filtration on its afflux surface, said coating comprising:
 - (a) a main component of particles and/or fibers;
 - (b) an inorganic binder component binding the particles and/or the fibers of the main component to each other;
 - (c) an adhesive binding the porous coating to the remainder of the filter element;
 - (d) and an anti-adhesion component mitigating the adhesion of filtered out material to the porous coating and facilitating cleaning of the filter element, said anti-adhesion component being polytetrafluoroethylene (PTFE) and/or silicone.
2. A filter element according to claim 1, characterized in that the main component comprises one material of the group consisting of kieselguhr particles, zeolite particles, polyvinyl pyrrolidone particles and mixtures thereof.
3. A filter element according to claim 2, characterized in that the main component comprises kieselguhr particles.
4. A filter element according to any one of claims 1 to 3, characterized in that the main component comprises ceramic fibers.
5. A filter element according to any one of claims 1 to 4, characterized in that the binder component comprises one material of the group consisting of crosslinked SiO₂, crosslinked SiO₂ derivative, crosslinked TiO₂, crosslinked TiO₂ derivative, crosslinked ZrO₂, crosslinked ZrO₂ derivative and mixtures thereof.

6. A filter element according to claim 5, characterized in that the binder component comprises crosslinked SiO₂.
7. A filter element according to any one of claims 1 to 6, characterized in that the adhesive is an organic dispersion adhesive.
8. A filter element according to any one of claim's 1 to 7, characterized in that said coating results from an emulsion-stable coating mass.
9. A filter element according to any one of claims 1 to 8, characterized in that the coating is applied in accordance with the sol-gel process.
10. A filter element according to any one of claims 1 to 9, characterized in that the coating contains kieselguhr as main component and PTFE as anti-adhesion component in a weight ratio of 1:1 to 1:2.
11. A filter element according to any one of claims 1 to 10, characterized in that a main body of the filter element is composed of sintered plastics particles.
12. The use of the filter element according to any one of claims 1 to 11, comprising particles as main component of the coating, for liquid filtration or for oil mist separation.

13. The use according to claim 12 for filtration of cooling lubricant.
14. The use according to claim 12 or 13, wherein foreign particles of a size of more than 5 μm are filtered out in essence completely.
15. The use of the filter element according to any one of claims 1 to 11, comprising fibers as main component of the coating, for gas filtration.
16. The use according to claim 15, wherein foreign particles of a size of more than 2 μm are filtered out in essence completely.
17. A method for producing an inherently stable, flow-porous filter element having a porous coating for surface filtration on its afflux surface, said coating comprising:
 - (a) a main component of particles and/or fibers;
 - (b) an inorganic binder component binding the particles and/or the fibers of the main component to each other;
 - (c) an adhesive binding the porous coating to the remainder of the filter element;
 - (d) and an anti-adhesion component mitigating the adhesion of filtered out material to the porous coating and facilitating cleaning of the filter element, said anti-adhesion component being polytetrafluoroethylene (PTFE) and/or silicone,

wherein the main component of particles and/or fibers, the inorganic binder component, the adhesive and the anti-adhesion component are added together to form a coating mass and the coating mass is applied to the remaining filter element such as to form the coating on its afflux surface.

18. The method according to claim 17, wherein the main component of particles and/or fibers, the inorganic binder component, the adhesive and the anti-adhesion component are added together to form an emulsion-stable coating mass and the emulsion-stable coating mass is applied to the remaining filter element such as to form the coating on its afflux surface.

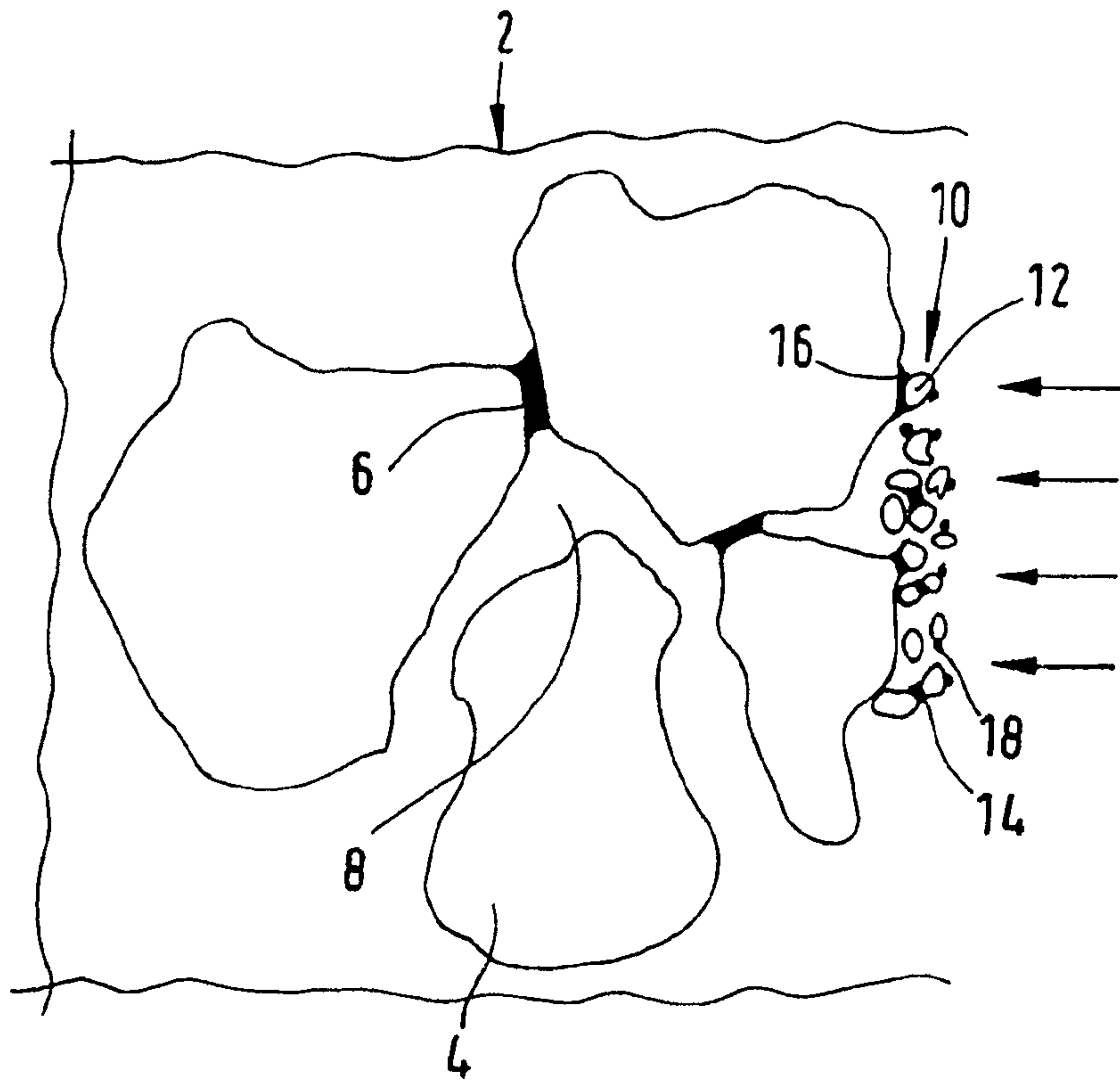


FIG. 1

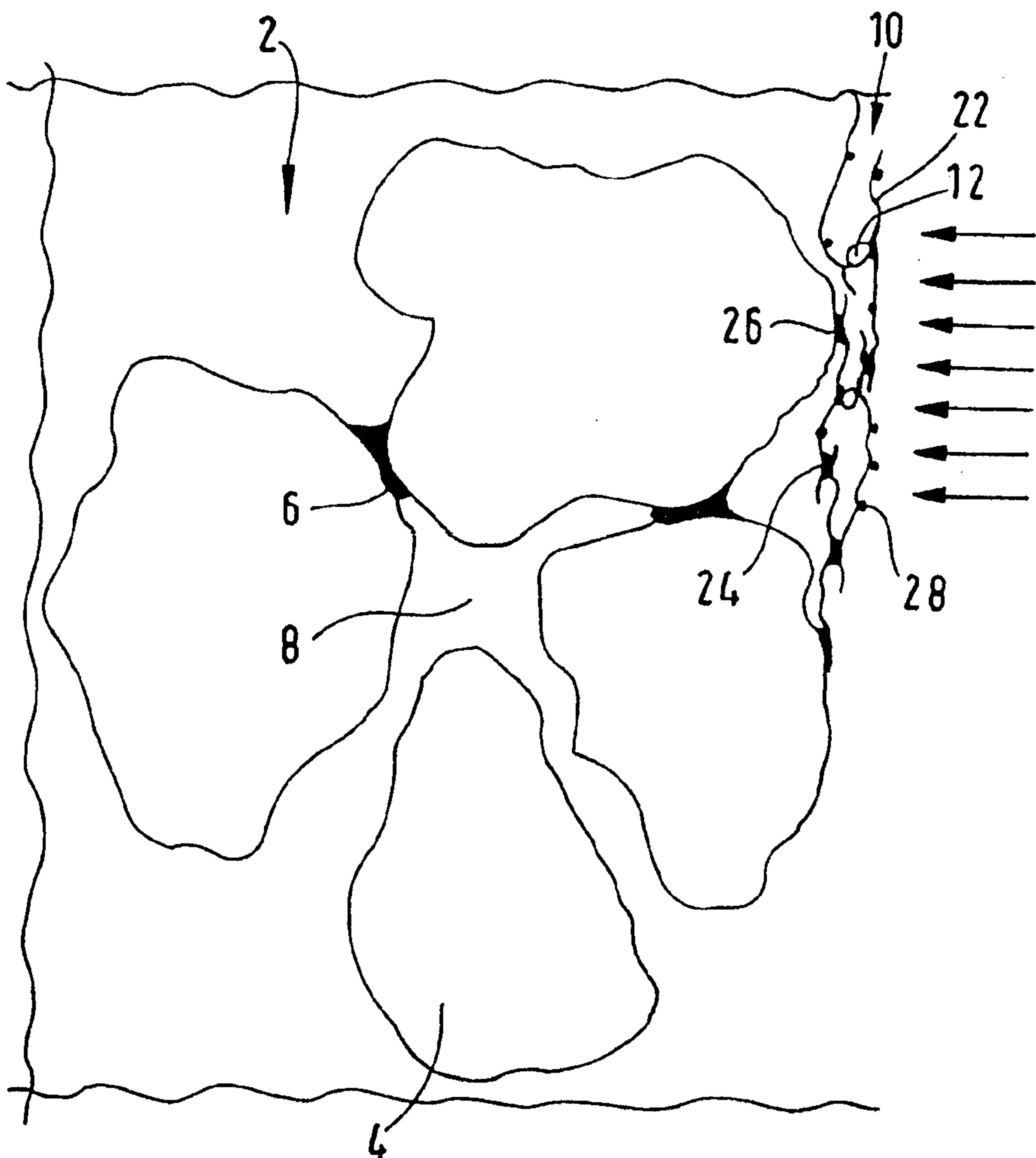


FIG. 2

