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(54) **Regenerable filter for exhaust gases of an internal-combustion engine.**

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Description

This invention relates to a regenerable filter in the exhaust gases of an internal-combustion engine. In particular, this invention relates to a filter suited to be placed into an exhaust pipe of an internal-combustion engine, comprising a filtering member suited to intercept the residual combustion products contained in the exhaust gases and further comprising means suited to produce the combustion of said residues.

Filters are known in which said means suited to produce the combustion of the residues are of the kind that uses a catalyst for the starting of the combustion at low temperatures, or of the kind that heats the exhaust gases, upstream of the filtering member, to the combustion temperature of said residues.

Said filters suffer from certain drawbacks.

In the case of the entirely catalytic filters, it is not uncommon the so-called "poisoning" of the catalyst, due to the presence in the exhaust gases of chemicals that impair their catalytic activity to the point of completely discontinue the combustion of the residues; this originates a gradual clogging of the filter, with the resulting attainement of an unacceptable back-pressure on the engine exhaust.

In the case of heating filters, one of which is disclosed in the US-A-4455 823, the heating of the exhaust gases usually takes place by means of resistive elements positioned upstream of the filtering member, which, supplied with an electric current, generate thermal power through Joule effect and rise the temperature of the gases that affect then the filtering surface. This solution entails a high consumption of electric power, with the risk of extreme charge losses of the vehicle battery.

A further drawback of the known heating filters is the fact that the filter temperature can increase exceedingly, since the regeneration usually takes place upon rather wide surfaces and so in a scarcely controlled manner; as a result there is the possibility of serious damages or the destruction due to exaggerated heatings.

For the double object of limiting the average temperature of the filter and reducing the electric power used, filters have been realized in which the filtering member is cyclically heated in relation with consecutive portions; the continuity of the filtering member nevertheless can allow the starting of wide and intense combustions. Furthermore, since in the known filters of this kind the heating of the consecutive portions of the filtering member is obtained through convection and radiation, the electric power overall supplied, is always substantially higher than the equivalent of the thermal power actually needed to locally start the combustion of the residues.

It has been also disclosed in the EP-A-244061 a filter formed of a few tubular elements having filtering walls made of an electrically conductive material provided of randomly arranged fibers of silicon carbide, which provide the elements with a predetermined resistance. The elements are selectively electrically supplied, thus being heated to regenerate the filter.

Solutions in which diesel oil or other fuel burners in substitution for said resistive elements are used, are also known; said solutions have however high costs and dimentions together with said problems connected with the regeneration.

An object of the present invention is to realize a regenerable filter for the exhaust gases of an internal-combustion engine, that lacks in the in the drawbacks connected with the above-mentioned and known filters, and is particularly simple, practical, and removes the risks of clogging or self-destruction due to exaggerated heating.

Said object is attained by the regenerable filter according to claim 1, which comprises an outer casing provided with at least one inlet duct and at least one outlet duct, a filtering layer made of fiber filtering material, said layer being housed into said outer casing between said inlet duct and said outlet duct to intercept the residual combustion products of said gases, electric heating means associated with said filtering layer for raising the temperature of said products, and selectively and/or cyclically operable control means for electrically supplying said heating means, and is characterized in that said layer is in form of a filtering fabric, said heating means comprising electrically conductive fibers included in said filtering fabric, said filtering fabric being arranged in such a way as to define a plurality of elongated portions electrically insulated from each other by elongated insulating elements and selectively and/or cyclically electrically supplied by the intermediary of said control means.

For a better understanding of the present invention, some preferred embodiments are described below, as a non limiting example and referring to the accompanying drawings, in which:

figure 1 is an elevation and partial view of a first embodiment of a regenerable filter according to the present invention;

figure 2 is a partial cross-section and in enlarged scale of the filter of figure 1;

figure 3 illustrates a cross-section of a partial arrangement of the filter of figure 1;

figure 4 is a cross-section of a second embodiment of a filter according to the present invention; and

figure 5 is a partial cross-section of a filtering member of a further embodiment according to the present invention.

Referring in particular to figures 1 and 2, it is

designated generally by 21 a portion of a filtering member realized in electrically conductive fabric. In particular, fabric 21 comprises an intervening layer 22, forming the actual filtering member, suitably obtained from non-conducting ceramic fibers having a substantial heat-resistance. Upon a surface 23 of the intervening layer 22, facing in use the inflow of the exhaust gases, a second fabric layer 24 is arranged, formed by bundles 25 of microthreads (afterwards named shortly "threads") in non-conductive ceramic fiber, arranged longitudinally, and by conductive threads 26 alternate with non-conductive threads 27 arranged transversally. Conductive threads 26 are suitably produced from metallic materials (for instance stainless steel, Ni-Cr or other alloys) or conductive ceramics (for instance SiC), resistant to high temperatures, or ceramics plated with oxidation-resistant metals. The fabric 21 further comprises a layer 28 having the role of simple support, applied on the opposite surface 29 of the intervening layer 22.

Conductive threads 26 are connected adjacent an edge 30 of the fabric 21 to an electrode 31 formed by a plurality of metal foils 32 arranged perpendicularly to the threads 26 and in turn connected to a pole of the battery of the vehicle or directly to the alternator; the conductive threads 26 are connected in groups, at an opposite end, to another pole of the vehicle battery, through a control device including switch means 15, for instance controlled diodes, controlled by a conventional control exchange 16.

In figure 3, an example of an embodiment of a filter 35 using the fabric 21 of the kind described is shown. Filter 35 comprises an outer casing formed by two coaxial tubular bodies 36, 37, defining an annular chamber 38 inbetween. The fabric 21, the surface provided with the conductive layer 24 of which is shown in phantom, is arranged into the annular chamber 38 substantially according to a closed polygonal line, the corners of which, angularly equidistant, are alternately joined to the tubular bodies 36 and 37. The fabric 21 forms with the tubular body 36 and with the tubular body 37, a plurality of spaces 39, 40, respectively communicating, in a not shown way, with an inlet aperture and with an outlet aperture of filter 35.

In figure 4 a second example of an embodiment of a filter 50 using the fabric 21 of the kind described is partially illustrated. The fabric 21 is pleated and is fixed on a support layer 51 spiral wound into a not shown cylindric casing. The fabric 21 forms with the support layer 51 a plurality of spaces 52, 53 respectively communicating, in a not shown way, with an inlet aperture and with an outlet aperture of filter 50.

In figure 5, a further embodiment of the conductive fabric is illustrated. The fabric 43 is subdivided in a plurality of portions 44, separated one another by insulating elements 45, formed for instance by strips of fabric from non conductive and oxidation resistant ceramic fibers. Portions 44 are realized from non conductive fibers, into which conductive fibers 46 schematically shown in phantom and arranged at random are incorporated. The fabric 43 has at an edge a plurality of electrodes 47, for instance metal foils, insulated each other by the elements 45 and apt to be connected through a control device of the kind described to a pole of the vehicle battery; fabric 43 further has, at an opposite edge, a further electrode 48 connecting portions 45 to the other pole of the battery.

The operation of the filter is as follows.

The exhaust gases emitted by the engine enter the filter 35 (figure 3) through an inlet aperture, not illustrated, and enter the spaces 39 included between the outher body 36 and the fabric 21. The gases pass then through the fabric 21, which intercepts the residual combustion products, and enter the spaces 40 included between said fabric 21 and the inner tubular body 37, from which they exit through a not shown outlet aperture.

As relates the filter 50 (figure 4), the exhaust gases enter through an inlet aperture, not illustrated, and enter the spaces 52; they pass then through the fabric 21, that intercepts the residual combustion products, and enter the spaces 53 from which they exit through a not shown outlet aperture.

The build-up of residues in the fabric 21 originates a gradual clogging of the filter, creating a back-pressure in the engine exaust. The control exchange 16, as a result of a signal received, for instance, from a pressure sensor detecting the pressure difference of the exhaust gas between inlet and outlet from the filter 35 or 50, causes the closing of one of the switches 15, whereby one of the groups of threads 26 is electrically supplied. The flow of electric current through the threads 26 and the electrode 31 gives rise to a heating by Joule effect of the group of threads 26, till the combustion temperature of the residues is attained, which are oxidized and gassified freeing the porosity of the fabric 21.

Subsequently, the control exchange 16 disconnects the supply to the group of threads 26 and supplies the subsequent group of threads 26. All the groups are supplied in sequence, according to an order and for a time predetermined or governed from time to time by the control exchange 16. For instance, the exchange 16 can control the intensity of current and the heating time of each group of threads 26 as a function of the revolutions of the engine and of the rare of flow of the air passing through the filter by the action of an approprite device, for instance a fan or a positive-displace-

ment pump.

The conductive threads 26 of the fabric 21 can be supplied by groups according to a predetermined program, so as to assure in use the combustion of the residues accumulated in a well defined portion of the fabric 21; while this portion is regenerated, the residues build-up in other portions of the fabric 21, which will be regenerated in sequence. At the end of the regeneration of the last portion, the cycle starts again with the regeneration of the first regenerated portion, which in the meantime will have intercepted new residues.

It should be noted, in particular, that the "meshes" of the conductive layer 24 are suitably wide enough to allow the passage of the residues, that are intercepted, as schematically illustrated in figure 4, by the filtering layer 22. The concentration of the residues results substantially distributed around the conductors 26, which provide for the heating by direct conduction of those residues.

In the fabric 43 illustrated in figure 5, the conduction between the opposite electrodes 47, 48, is assigned not to conductors having a definite geometry, such as the threads 26, but to conductive fibres 46 irregularly scattered in portions 44 mutually insulated of non-conductive fabric.

From an examination of the features of the filters realized according to the present invention, the advantages they allow to attain are obvious.

First of all, the conductive portions (26; 44) of the filtering members (21; 43) are mutually insulated. This enables to obtain a selective and cyclic heating of the portions, with the advantage of reducing the electric power used and keeping under control the temperature of the filtering elements (21; 43), without any risk of clogging or of destruction due to over-heating. Further, the heating of the residues takes place through conduction, that is through direct contact between the residues themselves and the conductive portions (26; 44), which enables to exploit the most of the power supplied for the starting of the combustion, without great losses due to convection. Lastly, the filtering fabric elements (21; 43), thanks to their deformability, are particularly resistant to thermal shocks produced due to the sudden temperature variations during the heating and the cooling of the conductive portions (26; 44).

In this connection, the fibres used are suitably subjected to pre-tratments apt to avoid the embrittlement and/or the possible breakage due to phase transformation or anyway to other phenomena produced by thermal shocks. The pre-treatments can be of chemical and/or physical nature, and depending on the type of fiber used said treatments consist in the introduction or extraction of ions through diffusion in the material of the fiber.

It is then obvious that to the filters 35, 50 described can be introduced changes or variations, without departing from the scope of the present invention. In particular, the shape, the arrangement and the composition of the conductive portions (26; 44) and of the relative insulating portions (27; 45) can change.

The filtering member can be produced with a combination of ceramic fabrics, felts or boards. For instance, the filtering member can comprise a series of stratified felt members; in particular, the single layers of the filtering member can be provided with pores having a geometric distribution, different dimensions and shapes, and arranged according to a porosity gradient. The electrification of the various elements can be carried out introducing in such elements electrically conductive fibres or threads. This solution enables to reduce the effect of the thermal shocks, in that the thermal conductivity is increased.

It can further be fixed upon a sliding element substantially arranged on a central plane of an inner chamber of the filter, in this case suitably formed with a quadrangular cross-section, and which can readily be introduced and extracted from the outer casing of the filter.

It is possible to change the logic of the control of the exchange 16, that can control the switches 15 in response to signals received from the user and/or from process sensors (for instange temperature or pressure sensors) arranged inside or outside the filter; the electric current supplying the conductive portions (26; 44) can be modulated according to the temperature levels established in the filter.

Means for the introduction of air into the filter can be provided, in order to assure a sufficient partial pressure of oxygen in the exhaust gases and so a complete combustion of the residues.

At last catalysing additives can be provided suited to aid and optimise the combustion of the solid unburned particles. In particular said additives can suitably comprise a mixture of one or more metal-oxides, for instance CuO, Cu_2O, MnO_2, Mn_3O_4, PbO, CeO_2 or the respective oxygenated salts, for instance $Cu(NO_3)_2$, $CuSO_4$, and of one or more chlorides of an alkaline or alkaline-earth metal for instance NaCl, KCl, LiCl, CuCl, $CuCl_2$, $MgCl_2$, $BaCl_2$, possibly also in the hydrated form; preferably said mixture comprises CuO and NaCl. Said mixture can be in a solid form (powder) or in the form of a solution in water or other solvent, and is deposited on the filtering member in the more convenient manner, such as insufflation, spraying or immersion.

Claims

1. A regenerable filter in the exhaust gases of an

internal-combustion engine, comprising an outer casing provided with at least one inlet duct and one outlet duct, a filtering layer (21, 43) made of fiber filtering material, said layer being housed into said outer casing between said inlet duct and said outlet duct to intercept the residual combustion products of said gases, electric heating means (26, 44) associated with said filtering layer for raising the temperature of said products, and seleclively and/or cyclically operable control means (15, 16) for electrically supplying said heating means, characterized in that said layer is in form of a filtering fabric (21, 43), said heating means comprising electrically conductive fibers (26, 46) included in said filtering fabric (21, 43), said filtering fabric being arranged in such a way as to define a plurality of elongated portions (26, 46) electrically insulated from each other by elongated insulating elements (27, 45) and selectively and/or cyclically electrically supplied by the intermediary of said control means (15, 16).

2. A filter as claimed in claim 1, characterized in that said conductive fibers are in form of transversal conductive threads (26) woven with non-conductive longitudinal threads (25) to form a woven thread (24), said insulating elements being in form of transversal non- conductive threads (27) also woven with said longitudinal threads (25) alternately with said conductive threads (24) in said woven thread (24).

3. A filter as claimed in claim 2, characterized in that said fabric (21) includes a layer (22) of non- conductive ceramic filter fibers having a substantial heating resistance and having one face (23) in contact with said woven thread (24), the other face (29) of said non-conductive layer (22) being in contact with a support thread layer (28).

4. A filter as claimed in claim 2 or 3, characterized in that said conductive thread (26) are arranged in groups, the conductive threads of each group being electically connected in parallel with said control means (15, 16) for being electrically supplied simulaneously.

5. A filter as claimed in claim 4, characterized in that said conductive threads (26) are metallic.

6. A filter as claimed in claim 4, characterized in that said conductive threads (26) are of conductive ceramic material.

7. A filter as claimed in claim 6, characterized in that said conductive threads (26) are of non-conductive ceramic material plated with a conductive material.

8. A filter as claimed in anyone of the claims 2 to 7, characterized in that said transversal threads (26, 27) comprise a plurality of microthreads.

9. A filter as claimed in claim 3, characterized in that said conductive fibers (46) are dispersed in a non-conductive material of said fabric.

10. A filter as claimed in claim 9, characterized in that said non-conductive material comprises a ceramic fabric.

11. A filter as claimed in claim 9, characterized in that said non-conductive material comprises a ceramic felt.

12. A filter as claimed in claim 9, characterized in that said non-conductive material comprises a plurality of felt layers superimposed and having porosities progressively differing.

13. A filter as claimed in claim 9, characterized in that said non-conductive material comprises a ceramic based paper.

14. A filter as claimed in anyone of the preceding claims, characterized in that said fabric (21; 43) is arranged inside an annular chamber (38) of said filter (35) according to a closed polygonal line, the corners of which are angularly equidistant and are alternatively fixed to an inner wall (37) and an outer wall (35) of said annular chamber (38).

15. A filter as claimed in anyone of the preceding claims, characterised in that said fabric (21) is pleated and fixed on a support element (51).

16. A filter as claimed in claim 15, characterized in that said support element (51) is spiral wound.

17. A filter as claimed in claim 15, characterized in that said support element is a slide arranged substantially on a central plane of an inner chamber of said filter.

18. A filter as claimed in any one of the preceding claims, characterized in that said filtering fabric (21, 43) is scattered with a mixture of at least a metallic oxide or an oxygenated salt suited to produce said metallic oxide and of at least a cloride of an alkaline or alcaline-earth metal.

Revendications

1. Un filtre régénérable dans les gaz échappement d'un moteur à combustion interne, comprenant une enveloppe extérieure pourvue au moins d'une conduite d'entrée et d'une conduite de sortie, une couche filtrante (21, 43) réalisée en matériau filtrant en fibres, ladite couche étant logée dans ladite enveloppe extérieure, entre ladite conduite d'entrée et ladite conduite de sortie, pour intercepter les produits de combustion résiduels desdits gaz, des moyens de chauffage électriques (26, 46) associés à ladite couche filtrante pour élever la température desdits produits, et des moyens de commande fonctionnant sélectivement et/ou cycliquement (15, 16) pour alimenter en énergie électrique lesdits moyens de chauffage, caractérisé en ce que ladite couche est en forme de tissu filtrant (21, 43), lesdits moyens de chauffage comprenant des fibres électroconductrices (26, 26) incorporées dans ledit tissu filtrant (21, 43), ledit tissu filtrant étant des éléments isolants allongés (27, 45) et alimentées électriquement, sélectivement et/ou cycliquement par l'intermédiaire desdits moyens de commande (15, 16).

2. Un filtre selon la revendication 1, caractérisé en ce que lesdites fibres conductrices sont en forme de fils conducteurs transversaux (26) tissés avec des fils longitudinaux non-conducteurs (25), de manière à former un tissu (24), lesdits éléments isolants étant en forme de fils transversaux, non-conducteurs, (27) tissés également avec lesdits fils longitudinaux (25) en alternance avec lesdits fils conducteurs (26) dans ledit tissu tissé (24).

3. Un filtre selon la revendication 2, caractérisé en ce que ledit tissu (21) comprend une couche (22) de fibres filtrantes en céramique non-conductrice possédant une haute résistance à la chaleur et dont une face (23) est en contact avec ledit tissu tissé (24), l'autre face (29) de ladite couche non-conductrice (22) étant en contact avec la couche de fils de support (28).

4. Un filtre selon la revendication 2 ou 3, caractérisé en ce que lesdits fils conducteurs (26) sont disposés par groupes, les fils conducteurs de chaque groupe étant connectés électriquement en parallèle avec lesdits moyens de commande (15, 16), de manière à être alimentés électriquement de façon simultanée.

5. Un filtre selon la revendication 4, caractérisé en ce que lesdits fils conducteurs (26) sont métalliques.

6. Un filtre selon la revendication 4, caractérisé en ce que lesdits fils conducteurs (26) sont en matériau de céramique conductrice.

7. Un filtre selon la revendication 6, caractérisé en ce que lesdits fils conducteurs (26) sont en matériau de céramique non-conductrice doublé d'un matériau conducteur.

8. Un filtre selon l'une quelconque des revendications 2 à 7, caractérisé en ce que lesdits fils transversaux (26, 27) comprennent une pluralité de microfilaments.

9. Un filtre selon la revendication 3, caractérisé en ce que lesdites fibres conductrices (46) sont dispersées dans un matériau non-conducteur dudit tissu.

10. Un filtre selon la revendication 9, caractérisé en ce que ledit matériau non-conducteur comprend un tissu de céramique.

11. Un filtre selon la revendication 9, caractérisé en ce que ledit matériau non-conducteur comprend un feutre de céramique.

12. Un filtre selon la revendication 9, caractérisé en ce que ledit matériau non-conducteur comprend une pluralité de couches de feutre superposées et dont les porosités diffèrent progressivement.

13. Un filtre selon la revendication 9, caractérisé en ce que ledit matériau non-conducteur comprend un papier à base de céramique.

14. Un filtre selon l'une quelconque des précédentes revendications, caractérisé en ce que ledit tissu (21; 43) est disposé à l'intérieur d'une chambre annulaire (38) dudit filtre (35) suivant une ligne polygonale formée, dont les angles sont angulairement équidistants et sont fixés alternativement sur une paroi intérieure (37) et une paroi extérieure (36) de ladite chambre annulaire (38).

15. Un filtre selon l'une quelconque des précédentes revendications, caractérisé en ce que ledit tissu (21) est plissé et fixé sur un élément de support (51).

16. Un filtre selon la revendication 15, caractérisé en ce que ledit élément de support (51) est enroulé hélicoïdalement.

17. Un filtre selon la revendication 15, caractérisé en ce que ledit élément de support est une

glissière montée sensiblement sur un plan central d'une chambre intérieure dudit filtre.

18. Un filtre selon l'une quelconque des précédentes revendications, caractérisé en ce qu'un mélange d'au moins un oxyde métallique ou d'un sel oxygéné apte à produire ledit oxyde métallique, et, au moins, d'un chlorure d'un métal alcalin ou d'un métal terreux alcalin est réparti sur ledit tissu filtrant (21, 43).

Patentansprüche

1. Regenerierbares Filter in den Auspuffgasen einer Brennkraftmaschine, mit einem äußeren Gehäuse, das wenigstens eine Einlaßleitung und eine Auslaßleitung aufweist, einer Filterschicht (21,43) aus Faser-Filtermaterial, welche Schicht in dem äußeren Gehäuse zwischen der Einlaßleitung und der Auslaßleitung liegt und die zurückgebliebenen Verbrennungsprodukte der Gase auffängt, einer elektrische Heizeinrichtung (26,46) in Verbindung mit der Filterschicht zum Anheben der Temperatur des Produkts, und einer selektiv und/oder zyklisch betätigbaren Steuereinrichtung (15,16) zur elektrischen Versorgung der Helzeinrichtung, dadurch **gekennzeichnet**, daß die Schicht die Form eines Filterstoffes (21,43) aufweist, daß die Heizeinrichtung elektrisch leitende Fasern (26,46) umfaßt, die in dem Filterstoff (21,43) eingeschlossen sind, daß der Filterstoff derart angeordnet ist, daß er eine Anzahl von langgestreckten Bereichen (26,46) aufweist, die elektrisch gegeneinander durch langgestreckte Isolierelemente (27,45) Isoliert sind und selektiv und/oder zyklisch elektrisch über die Steuereinrichtung (15,16) versorgt werden.

2. Filter nach Anspruch 1, dadurch **gekennzeichnet**, daß die leitenden Fasern die Form von quergerichteten leitenden Fäden (26) aufweisen, die mit nichtleitenden längsgerichteten Fäden (25) verwebt sind und ein gewebtes Band (24) bilden, welche isolierenden Elemente die Form von quergerichteten, nichtleitenden Fäden (27) aufweisen, die ebenfalls mit den längsgerichteten Fäden (25) alternativ zu den leitenden Fäden (26) in dem gewebten Band (24) verwebt sind.

3. Filter nach Anspruch 2, dadurch **gekennzeichnet**, daß der Stoff (21) eine Schicht (22) aus nichtleitenden keramischen Filterfasern enthält, die einen erheblichen Heizwiderstand aufweisen und mit einer Oberfläche (23) in Berührung mit dem gewebten Band (24) stehen, während die andere Oberfläche (29) der nichtleitenden Schicht (22) in Berührung mit einer Stützfadenschicht (28) steht.

4. Filter nach Anspruch 2 oder 3, dadurch **gekennzeichnet**, daß die leitenden Fäden (26) in Gruppen angeordnet sind und daß die leitenden Fäden jeder Gruppe elektrisch parallel zueinander mit der Steuereinrichtung (15,16) verbunden sind und zugleich durch diese elektrisch versorgt werden.

5. Filter nach Anspruch 4, dadurch **gekennzeichnet**, daß die leitenden Fäden (26) metallisch sind.

6. Filter nach Anspruch 4, dadurch **gekennzeichnet**, daß die leitenden Fäden (26) aus leitendem keramischen Material bestehen.

7. Filter nach Anspruch 6, dadurch **gekennzeichnet**, daß die leitenden Fäden (26) aus nichtleitendem keramischen Material bestehen, das mit einem leitenden Material beschichtet ist.

8. Filter nach einem der Ansprüche 2 bis 7, dadurch **gekennzeichnet**, daß die quergerichteten Fäden (26,27) eine Anzahl von Mikrofäden umfassen.

9. Filter nach Anspruch 3, dadurch **gekennzeichnet**, daß die leitenden Fasern (46) in einem nichtleitenden Material des Stoffes verteilt sind.

10. Filter nach Anspruch 9, dadurch **gekennzeichnet**, daß das nichtleitende Material ein Keramikstoff ist.

11. Filter nach Anspruch 9, dadurch **gekennzeichnet**, daß das nichtleitende Material ein keramischer Filz ist.

12. Filter nach Anspruch 9, dadurch **gekennzeichnet**, daß das nichtleitende Material eine Anzahl von Filzschichten umfaßt, die übereinander liegen und progressiv sich ändernde Porositäten aufweisen.

13. Filter nach Anspruch 9, dadurch **gekennzeichnet**, daß das nichtleitende Material ein auf Keramikbasis hergestelltes Papier ist.

14. Filter nach einem der vorhergehenden Ansprüche, dadurch **gekennzeichnet**, daß der Stoff (21,43) innerhalb einer ringförmigen Kammer (38) des Filters (35) entsprechend einer geschlossenen, polygonalen Linie angeordnet ist, deren Ecken gleiche Winkelabstände aufweisen, und daß der Stoff alternativ mit einer

inneren Wand (37) und einer äußeren Wand (36) der ringförmigen Kammer (38) verbunden ist.

15. Filter nach einem der vorhergehenden Ansprüche, dadurch **gekennzeichnet**, daß der Stoff (21) gefaltet und an einem Trägerelement (51) befestigt ist.

16. Filter nach Anspruch 15, dadurch **gekennzeichnet**, daß das Trägerelement (51) spiralförmig gewickelt ist.

17. Filter nach Anspruch 15, dadurch **gekennzeichnet**, daß das Trägerelement als Schlitten ausgebildet ist, der im wesentlichen auf einer zentralen Ebene der inneren Kammer des Filters angeordnet ist.

18. Filter nach einem der vorhergehenden Ansprüche, dadurch **gekennzeichnet**, daß der Filterstoff (21,43) mit einer Mischung besprüht ist, die wenigstens ein Metalloxid oder ein oxygeniertes Salz, das zur Bildung eines Metalloxids geeignet ist, und wenigstens ein Chlorid eines alkalischen oder erdalkalischen Metalls enthält.

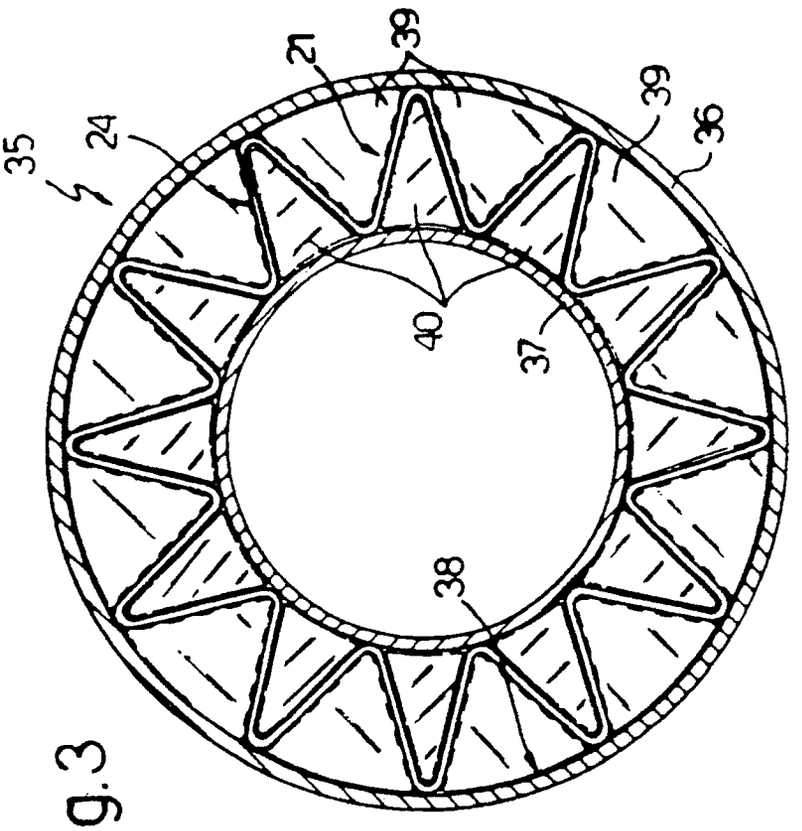

Fig.3

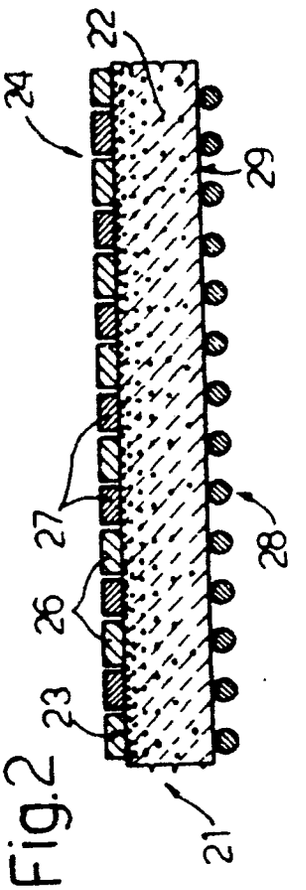

Fig.2

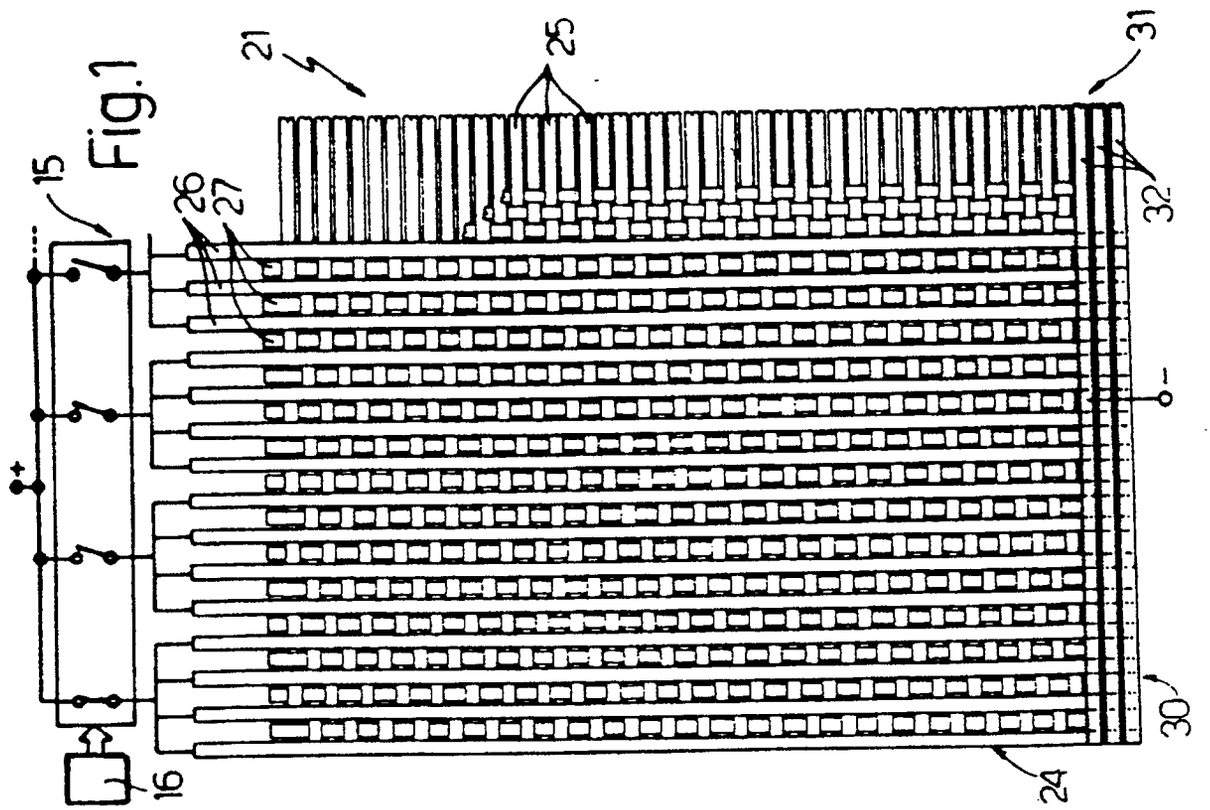

Fig.1

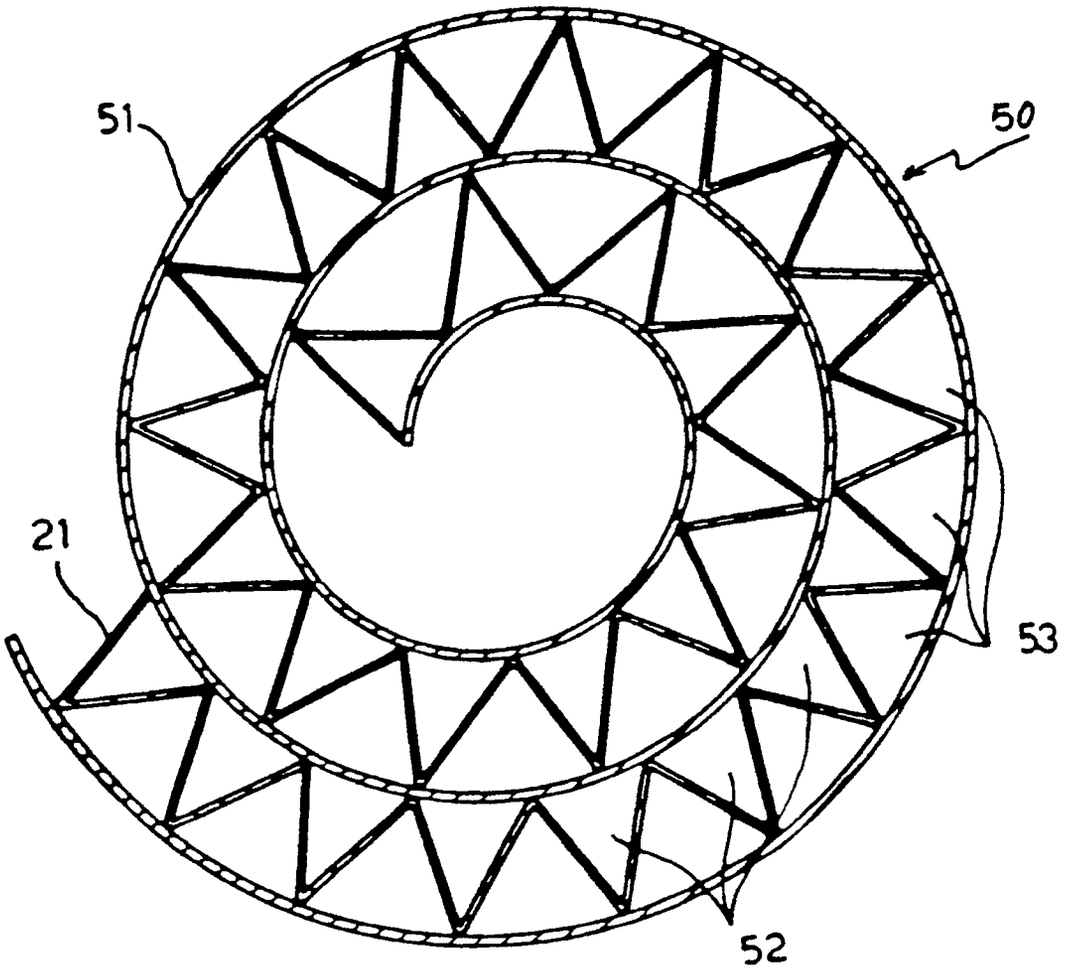

Fig.4

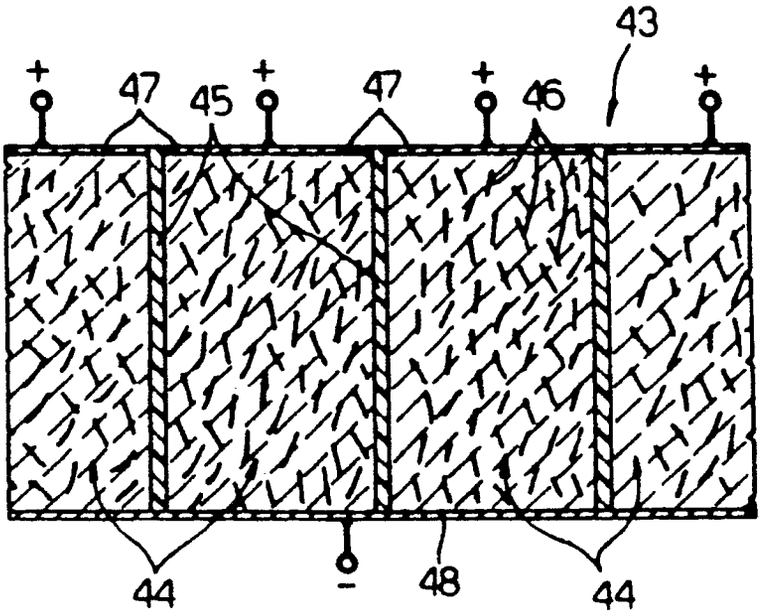

Fig.5