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(71) Applicant: **Johs. Tandrup Metalvarefabrik APS**
3450 Alleroed (DK)

(72) Inventor: **Tandrup, Andreas,**
Johs.Tandrup Metalvarefabrik ApS
3450 Allerod (DK)

(74) Representative: **Nielsen, Henrik Sten**
Budde, Schou & Ostenfeld A/S,
Vester Soegade 10
1602 Copenhagen V (DK)

(54) Filter device for water outlet

(57) A filter device (10) for use in a water outlet in combination with an aeration device having a central water stream restricting body creating the aeration of the water, the filter device comprises a cylindrical housing defining an inlet and an outlet, which inlet has a seat for receiving and maintaining the aeration device relative to the cylindrical housing. The device further comprises a filter element comprising at least two concentric ring elements (20,22) and a plurality of radial pin elements (26) for interconnecting the concentric ring elements, which filter element is positioned at the outlet of the cylindrical housing at a specific distance from the water stream restricting body of the aeration device. The concentric ring elements and the pin elements of the filter element are integrally moulded with the cylindrical housing from a water and lime repellent plastics material. A major ring element of the concentric ring elements defines an aperture of a diameter somewhat smaller than the inner diameter of the cylindrical housing for the creation of a recess at the inner cylindrical housing wall of the cylindrical housing at the outlet for preventing droplets from being expelled from the outlet along the inner cylindrical wall of the cylindrical housing, and a minor ring element of the concentric ring elements is positioned below the water stream restricting body of the aeration device constituting a water stream breaker for preventing the water stream supplied from the water stream restricting body from accumulating into a non-aerated water stream.

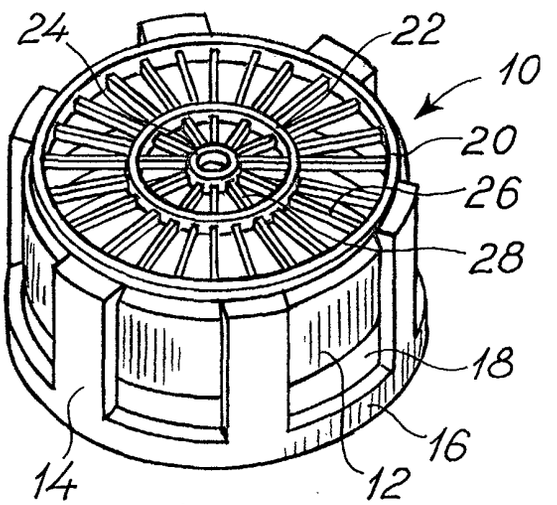

Fig. 6

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Description

[0001] The present invention relates to a filter device for use in a water outlet in combination with an aeration device having a central water stream restricting body creating the aeration of the water.

[0002] Within the technical field of water supply, in particular the supply of drinking water, filter devices have been used for decades in the outlet from a water tap or similar application. The conventional filter device comprises a cylindrical housing defining an inlet and an outlet and is cast from a plastics material. At the output end, a metal mesh is fixated to the cylindrical plastics housing serving the purpose of filtering the water supplied from the water tap or similar application.

[0003] As stated above, the filter device is commonly used in combination with an aeration device which may be made in accordance with different techniques described in several patent publications, however all based on a technique of creating the aeration of the water by mixing air to the water stream through restricting the supply of water passing a central water restricting body of the aeration device.

[0004] As far as aeration and filtering is concerned, the prior art devices, including the filter device and aeration device have proven to be fairly well functioning since an adequate aeration of the water at varying water supply volumes has been achieved and since an adequate filtering has also been achieved, at least for a short period of time until the metal mesh of the filter device be clocked by limestone or impurities contained within the water stream.

[0005] Apart from the functioning of filtering out impurities from the water stream, the filter device has, in the prior art metal mesh structure, served the additional purpose of maintaining the aerated water stream supplied from the water stream restricting body of the aeration device due to the small mesh size of the metal mesh. Provided the prior art filter element having a small mesh size, such as a mesh size of approximately 1 mm^2 be removed from the air stream supply from the water stream is not maintained as a soft aerated water stream irrespective of the water supply rate.

[0006] It is contemplated that the small mesh size of the metal mesh of the prior art filter devices have, in combination with the aeration device, provided an additional restricting effect and in doing so, provided an aeration effect in addition to the aeration effect created by the aeration device itself.

[0007] It is an object of the present invention to provide an improved filter device of the above described kind eliminating the drawbacks of the prior art metal mesh filter element containing filter devices, as to increasing the useful lifetime of the filter device by reducing the risk of clocking due to limestone or accumulation of impurities within the filter element of the filter device.

[0008] It is a further object of the present invention to provide an integral moulded or integral cast unitary filter device improving the water stream controlling properties of the filter device in combination with the aeration device as compared to the prior art combination of the aeration device and the prior art filter device including a metal mesh filter element.

[0009] The above objects, together with numerous other objects, advantages and features which will be evident from the below detailed description of the presently preferred embodiments of the filter device according to the present invention, are, according to the teachings of the present invention, obtained by a filter device for use in a water outlet in combination with an aeration device having a central water stream restricting body creating the aeration of the water, said filter device comprising:

a cylindrical housing defining an inlet and an outlet, said inlet having a seat for receiving and maintaining said aeration device relative to said cylindrical housing,

a filter element comprising at least two concentric ring elements and a plurality of radial pin elements for interconnecting said at least two concentric ring elements,

said filter element being positioned at said outlet of said cylindrical housing at a specific distance from said water stream restricting body of said aeration device of said aeration device,

said concentric ring elements and said pin elements of said filter element being integrally moulded with said cylindrical housing from a water and lime repellent plastics material,

a major ring element of said at least two concentric ring elements defining an aperture of a diameter somewhat smaller than the inner diameter of said cylindrical housing for the creation of a recess at the inner cylindrical housing wall of said cylindrical housing at said outlet for preventing droplets from being expelled from said outlet along said inner cylindrical wall of said cylindrical housing, and a minor ring element of said at least two concentric ring elements being positioned below said water stream restricting body of said aeration device constituting a water stream breaker for preventing the water stream supplied from said water stream restricting body from accumulating into a non-aerated water stream.

[0010] According to the basic teachings of the present invention, it has been realised that the filter device in combination with the aeration device need to fulfil certain functions for preserving or maintaining the aerated water stream delivered or supplied from the water stream restricting body of the aeration device, as the water supply volume or water supply pressure varies. Thus, it has been realised that the water stream from the water stream restricting body of the aeration device tends, at certain low flow rates or low water pressure levels, to accumulate into a single non-aerated water

stream rather than preserving the aerated and soft water stream character as intended. Further, it has been realised that the water stream restricting body at any water supply level randomly and in any angular orientation tends to deliver the aerated supply stream and in particular, as a spreading of the water stream beyond the intentional homogeneous and aerated water stream.

[0011] Based on the above realisations, the present invention, apart from providing an improved anti-blocking feature due to the selection of the material for the integrally cast filter device as a water repellent and lime repellent material, the filter device according to the present invention provides two distinct ring elements for preventing on the one hand the accumulation of the aerated water stream at low water supply levels, as the minor ring element characteristic of the filter device according to the present invention serves as a kind of water stream breaker for preventing the accumulation as discussed above. The major ring element characteristic of the present invention, serves the purpose of maintaining the aerated water supply stream as a homogeneous water supply stream of a specific cross sectional diametric size by eliminating the randomly spreading of droplets or drops of water from the water stream restricting body of the aeration device, which spreading is eliminated through the provision of the recess provided by the major ring element at the junction from the inner cylindrical wall of the cylindrical housing to the major ring element.

[0012] The pin elements constituting an integral part of the filter element along with the major and minor ring elements serve the dual purpose of on the one hand, maintaining the minor ring element in its intentional position relative to the major ring element and also the water stream restricting body of the aeration device and on the other hand of providing a filter mesh of a specific mesh size by the spacing between the pin elements. For providing an adequate, fairly small mesh size of the filter element, the filter element further preferably comprises an additional ring element having a diameter even smaller than the diameter of said minor ring element and being positioned concentric within said minor ring element and fixated relative thereto by means of additional pin elements as the provision of the additional ring element together with the additional pin elements provides an overall adequate mesh size of the filter element.

[0013] For the elimination of the unintentional or randomly spreading of droplets from the outlet of the cylindrical housing of the filter device by the presence of the additional major ring element characteristic of the present invention, the major ring element preferably defines, at the inner cylindrical surface, a recess of the order of 0.1-1 mm, such as 0.2-0.6 mm.

[0014] For domestic use, the major concentric ring element may define an aperture of a diameter of approximately 16 mm, providing an overall diametric size of the water supply from the filter device of approximately 16mm. In connection with the water stream restricting body having a diameter of the order of 10-12 mm, the diameter of the minor ring element serving the above described water stream accumulation preventing feature may appropriately be of a width of less than 1 mm, such as 0.5 mm and may define a diameter of approximately 8 mm.

[0015] As will be evident to a person having ordinary skill in the art, a variation in the overall diameter of the water outlet stream and also a variation in the size of the water restricting body dimensions alter the dimensions of the major and minor ring elements in dependency of these variations, still, it is contemplated that the above realisations, are universally applicable and further that the randomly spreading of droplets from the water stream restricting body and also the prevention of accumulation of the aerated water stream from the aeration device may universally be prevented by the presence of the major and minor ring elements, respectively, characteristic of the present invention.

[0016] As distinct from the prior art metal mesh filter element of the filter devices previously known, the filter element of the filter device according to the present invention may advantageously and preferably have a larger aperture or mesh size still maintaining the soft aerated water stream irrespective of the water supply rate. Consequently, according to advantageous embodiments of the filter device according to the present invention, the major ring element and the minor ring element together with the pin elements define apertures of the filter element of the order of 2-8 mm^2, such as 3-6 mm^2.

[0017] Provided an additional ring element be provided as discussed above, the minor ring element and the additional ring element together with the additional pin elements preferably define apertures of the filter element of the order of 1-6mm^2, such as 2-4mm^2.

[0018] For obtaining the water repellent and lime repellent effect characteristic of the present invention which effect is obtained through the integral casting of the ring elements, the pin elements and the cylindrical housing of the filter device according to the present invention, the filter device according to the present invention is preferably cast from ABS, PP, PE or preferably POM.

[0019] Alternative relevant plastics materials will be obvious to a person having ordinary skill in the art and the presently preferred material being POM may for alternative purposes be substituted by any other relevant material.

[0020] The present invention is now to be further described with reference to the drawings in which;

Figs. 1a and 1b are photographs illustrating the water spray from the outlet of an assembly including an aeration device and a first filter device at a low flow rate or water pressure level and a high flow rate or water pressure level, respectively,

Figs. 2a and 2b are photographs similar to the photographs of Figs. 1a and 1b of the aeration device

and filter device assembly including, as compared to Figs. 1a and 1b, a differently configurated filter device,

Figs. 3a and 3b are photographs similar to the photographs of Figs. 1a and 1b, respectively, illustrating the water spray from the outlet of the assembly including the same aeration device as used in Figs. 1a, 1b, 2a and 2b and including a differently configurated filter device,

Figs. 4a and 4b are photographs similar to the photographs of Figs. 1a and 1b illustrating the water stream from the outlet of an assembly including the aeration device also used in the previous figures and including a filter device according to the present invention illustrating the well aerated and homogeneous water stream from the assembly at the same low flow rate or water pressure level and the same high flow rate or pressure level as used for the above Figs. 1a, 2a, 3a and Figs. 1b, 2b and 3b, respectively,

Figs. 5a and 5b are photographs similar to the photographs of Figs. 1 a and 1b, illustrating the water outlet from an assembly including the same aeration device as used in the previous figures and also including a conventional combined plastic housing and metal mesh filter device,

Fig. 6 is a first and presently preferred embodiment of the filter device according to the present invention as used in the assembly in the combined aeration device and filter device used in the photographs of Figs. 4a and 4b,

Fig. 7 is a perspective and schematic view similar to the view of Fig. 6 of the filter device used in the photographs 1a and 1b,

Fig. 8 is a perspective and schematic view similar to the view of Fig. 6 illustrating the filter device used for the photographs of Figs. 2a and 2b,

Fig. 9 is a perspective and schematic view similar to the view of Fig. 6 illustrating the filter device used in the photographs of Figs. 3a and 3b,

Fig. 10 is a vertical sectional view illustrating the outlet of the combined aeration device and filter device shown in Fig. 6 according to the present invention, and

Fig. 11 is a perspective and schematic view illustrating the filter device according to the present invention shown in Fig. 6 in combination with the aeration device mounted in the aeration device and filter device assembly, also shown in Fig. 10, which aeration device includes a funnel-shaped fixed part and a freely movable part having a bulb body mounted below the outlet of the funnel-shaped part.

[0021] In Fig. 6, a presently preferred embodiment of the filter device according to the present invention is shown. The filter device is basically of a structure resembling the prior art filter devices having a circumferential skirt part and a bottom metal mesh. According to the teachings of the present invention, the filter device is integrally cast from a plastics material preferably a lime repellent plastics material, such as ABS, POM, PVC, PP or PE.

[0022] The filter device is designated the reference numeral 10 in its entirety and comprises a cylindrical wall 12 which is delimited within a total if 6 equally circumferentially spaced tabs 14 which are connected through a circumferentially bottom rim 16. Between the bottom rim 16 and the cylindrical wall 12, a total of six aeration apertures or air access apertures 18 are provided. The filter element of the filter device 10 is constituted by the following components. Basically, the filter element is composed of three ring parts constituting an outer ring part 20, an intermediate ring part 22 and an inner ring part 24, which ring parts are interconnected through pins as a first plurality of pins, one of which is designated the reference numeral 26 interconnect the outer ring 20 to the intermediate ring 22, whereas a further plurality of pins, one of which is designated the reference numeral 28, interconnects the intermediate ring part 22 to the inner ring part 24.

[0023] The three ring parts 20, 22 and 24 serve specific purposes in accordance with the teachings of the present invention, as investigations, in particular investigations of various embodiments of integrally cast filter elements have revealed that specific characteristics may be deduced which the filter device need to fulfil for providing an adequate and satisfactory function in combination with the aeration device, which aeration device is shown in Figs. 10 and 11 and will be described in greater details below.

[0024] Basically, in the function of the filter element, apart from the overall function of restricting the outlet of large size bodies from the water outlet, the filter element has to serve the purpose of moderating the spray generated by the aeration device for providing a smooth and well-aerated water stream, irrespective of the water pressure or water supply rate input to the aeration device. As is clearly illustrated in Figs. 1a, 1b, 2a, 2b, 3a and 3b, the alternative embodiments of the filter device illustrated in Figs. 7, 8 and 9 do not provide and adequate and smooth water stream irrespective of the water pressure or water supply rate.

[0025] It has been realised that two major factors influence the generation of a soft, well-aerated and homogeneous water outlet from a combined aeration device and filter device. Firstly, at a fairly low water pressure level, the streams from the aeration device tend to reassemble below the aeration device rather than be maintained divided into separate aerated water streams. Consequently, according to the basic teachings of the present invention, the filter element has to include a stream breaking part such as a wall component positioned in and intended to counteract the tendency of the aerated water stream supplied from the aeration device at a fairly low water pressure level to recombine into a single non-aerated water stream. The

above described intermediate ring part 22 of the filter device 10 shown in Fig. 6, serves the purpose of counteracting the reassembling or recombining tendency of the aerated water stream supplied from the outlet of the aeration device at the low water pressure levels or equivalent low water supply rates, such as a water supply rate of the order of 2-3 litres/min.

[0026] In Figs. 1a, 2a and 3a, the effect of accumulation of the aerated water stream and also an additional undesired effect is shown for the three filter devices shown in Figs. 7, 8 and 9, respectively. The three filter device embodiments shown in Figs. 7, 8 and 9 are designated the reference numerals 10', 10" and 10"', respectively. Throughout the figures 7-9, an element or a component identical to or fulfilling the same purpose as the element or the component previously described with reference to Fig. 6 is designated the same reference numeral, however added an additional marking, a single marking in Fig. 7, a double marking in Fig. 8 and a triple marking in Fig. 9.

[0027] Thus, in Fig. 7, the embodiment 10' basically differs from the above described first and presently preferred embodiment 10 shown in fig. 6 in that the intermediate ring 22' and the inner ring 24' are somewhat enlarged as compared to the intermediate ring 22 and the inner ring 24 shown in Fig. 6. Also, the outer ring 20' differs from the above described outer ring 20 shown in Fig. 6 as the outer ring 20' shown in Fig. 7 constitutes a straight continuation of the cylindrical wall 12 and provides no inner reset as will be discussed in greater details below. The third embodiment 10" shown in Fig. 8 differs from the above described second embodiment 10' shown in Fig. 7 in that an additional intermediate ring 21 is provided, which intermediate ring is positioned protruding inwardly relative to the pins 26' and is intended to provide an additional stream separation or stream accumulation preventing effect.

[0028] In Fig. 9, the fourth embodiment 10"' is shown, which embodiment so to say constitutes a combination of the features of the first and second embodiment as the outer ring 20"' in the fourth embodiment 10"' shown in Fig. 9 provides the same recess as the outer ring 20 of the first embodiment 10 shown in Fig. 6. The intermediate ring 22"' and the inner ring 24"' of the fourth embodiment 10"' shown in Fig. 9 are of the same size as the intermediate ring and the inner ring 22' and 24', respectively, of the second embodiment 10' shown in Fig. 7. Also, in Fig. 9, the number of pins 26"' and 28"' interconnecting the outer ring 20"' and the intermediate ring 22"' and interconnecting the intermediate ring 22"' and the inner ring 24"', respectively, is larger than the number of pins provided in the second embodiment shown in Fig. 7 and resembling the pins provided in the first embodiment 10 shown in Fig. 6.

[0029] The position of the intermediate ring 22' and the inner ring 24' are, as is understood from the above description, critical as to the provision of the effect of preventing accumulation of the aerated stream at the outlet of the aeration device at the fairly low water pressure levels or equivalent water supply rates. The additional critical effect, namely the effect provided by the recess defined behind the outer ring 20 and 20"' shown in Figs. 6 and 9 is to prevent the water outlet from the aeration device from spraying which may occur at any water pressure level or any water volume supply rate. These undesired effects and the elimination of these effects are illustrated in the photographs 1a - 5b. In Figs. 1a and 1b, the output from the second embodiment 10' shown in Fig. 7 is shown at a low water supply rate of the order of 2½ - 3l/min. and a large water supply rate at the order 16l/min., respectively. In Fig. 1a, the uncontrolled splashing or spraying is clearly illustrated and the uncontrolled spraying at a large spraying angle is also illustrated in Fig. 1b. Apart from the uncontrolled splashing illustrated in Fig. 1a, the water outlet shown in Fig. 1a suffers from the drawback in that the central water stream is extremely low aerated.

[0030] In Fig. 2a and 2b, the same illustrations as compared to the illustrations or photographs shown in Fig. 1a are presented utilising the second embodiment 10" shown in Fig. 8. The highly uncontrolled splashing is still present in spite of the presence of the additional ring 21, which ring tends to make the high water supply rate less homogeneous, as compared to the stream illustrated in Fig. 1b.

[0031] In Fig. 3a and 3b, corresponding illustrations of the use of the fourth embodiment 10"' shown in Fig. 9 are presented. The high water supply rate illustrated in Fig. 3b is almost perfect, since no uncontrolled side spray droplets are present, whereas the low water supply rate, in spite of the lack of side sprayed droplets suffer from being fairly inhomogeneous and rather splashing, rather than constituting a homogeneous and well-aerated water stream.

[0032] In Fig. 4a and 4b, the output from the first and presently preferred embodiment 10 shown in Fig. 6 is illustrated for the same conditions as prevailing in Figs. 1a, 1b, 2a, 2b and 3a, 3b. The first photograph illustrates the output from the filter device 10 at a water supply rate of 2½-3l min., at which level the water stream from the filter device constitutes a homogeneous single stream, in which a high number of water bubbles is present, providing the aeration of the water. In Fig. 4b, an almost perfect high water supply rate stream having a large number of aeration droplets is illustrated.

[0033] For comparison, the photographs 5a and 5b were made for the existing prior art filter devices having a metal mesh filter, which metal filter provides a highly aerated water stream at the high water supply rate shown in Fig. 5b, whereas at the low water supply rate level shown in Fig. 5a, the aeration is somewhat less sufficient as compared to the photograph of Fig. 4a.

[0034] In Fig. 11, the first embodiment of the filter device is shown together with the aeration device, which device is designated the reference numeral 30 in its entirety. The aeration device 30 is composed of two parts,

an outer fixed part 32 and an inner movable part 34. The outer fixed part 32 has its skirt resting at the bottom circumferential flange of the ring part 16 and extends into a funnel-shaped inlet which is illustrated in fig. 10 and designated the reference numeral 33. The movable inner part 34 is integrally cast comprising a tooth wheel top part shown in Fig. 11 which is resting within the funnel-shaped interior space defined within the funnel-shaped wall 33 of the outer fixed part 32 and is integrally cast with a bottom bulb part 35 illustrated in Fig. 10. The bulb part 35 constitutes a stream redirecting and aeration element which brings about the aeration of the water stream, as the water stream is guided by the funnel-shaped wall 36 into a restriction defined between the outlet of the funnel-shaped wall 33 and the adjacent wall of the bulb part 35.

[0035] In Fig. 10, the filter device 10 together with the aeration device 30 is mounted within a tube 40 and fixated relative to the tube 40 by means of a fitting 42 which is received on the tube 40 by means of a thread meshing with a corresponding mesh of the tube 40.

[0036] Although the present invention has above been described with reference to a set of specific presently preferred embodiments, the present invention is by no means limited to the above described embodiments, but rather to be considered in the broad sense of the scope of the appending claims, as equivalences or modifications, which are obvious to a person having ordinary skill in the art deducible on the basis on the present specification, are also to be considered part of the present invention as defined in the appending claims.

Claims

1. A filter device for use in a water outlet in combination with an aeration device having a central water stream restricting body creating the aeration of the water, said filter device comprising:

   a cylindrical housing defining an inlet and an outlet, said inlet having a seat for receiving and maintaining said aeration device relative to said cylindrical housing,
   a filter element comprising at least two concentric ring elements and a plurality of radial pin elements for interconnecting said at least two concentric ring elements,
   said filter element being positioned at said outlet of said cylindrical housing at a specific distance from said water stream restricting body of said aeration device of said aeration device,
   said concentric ring elements and said pin elements of said filter element being integrally moulded with said cylindrical housing from a water and lime repellent plastics material,
   a major ring element of said at least two concentric ring elements defining an aperture of a diameter somewhat smaller than the inner diameter of said cylindrical housing for the creation of a recess at the inner cylindrical housing wall of said cylindrical housing at said outlet for preventing droplets from being expelled from said outlet along said inner cylindrical wall of said cylindrical housing, and
   a minor ring element of said at least two concentric ring elements being positioned below said water stream restricting body of said aeration device constituting a water stream breaker for preventing the water stream supplied from said water stream restricting body from accumulating into a non-aerated water stream.

2. The filter device according to claim 1, said filter element further comprising an additional ring element having a diameter even smaller than the diameter of said minor ring element and being positioned concentric within said minor ring element and fixated relative thereto by means of additional pin elements.

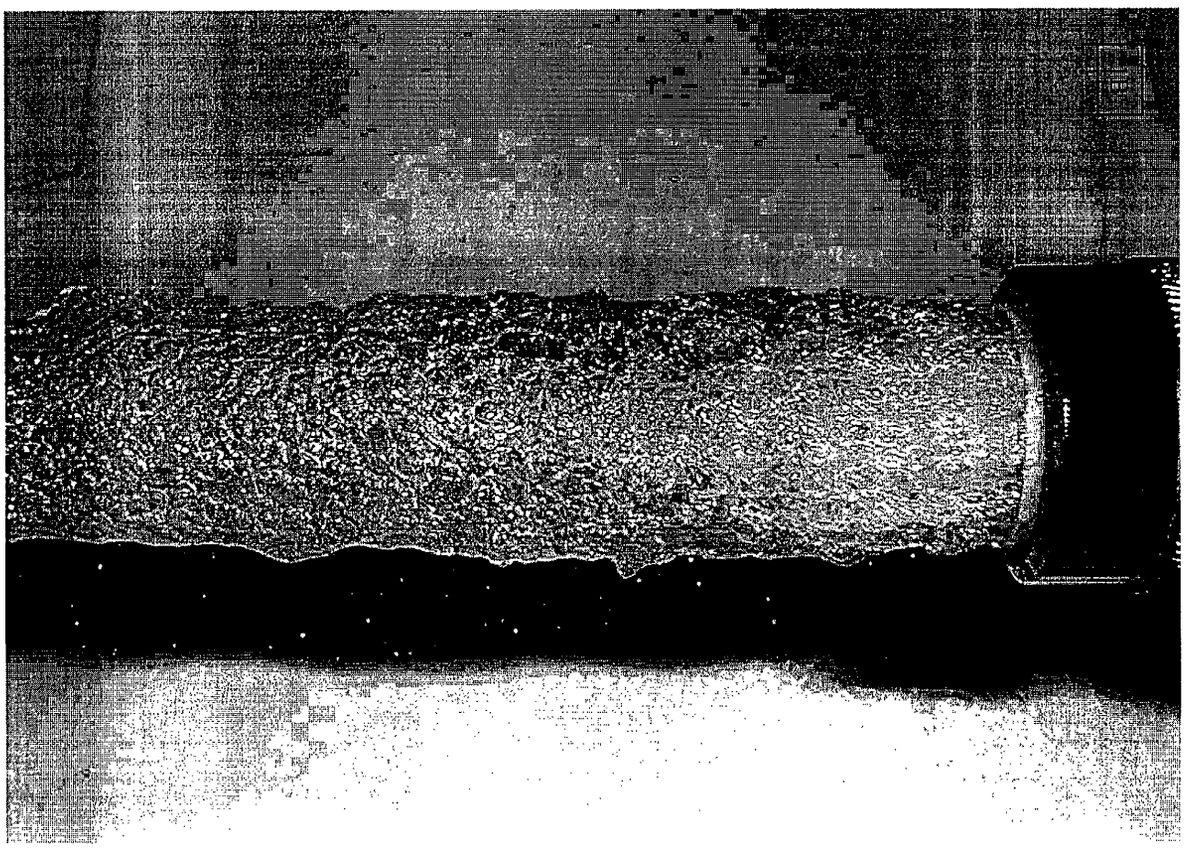
3. The filter device according to any of the claims 1 or 2, said major ring element defining at said inner cylindrical surface a recess of the order of 0.1-1 mm, such as 0.2-0.6 mm.

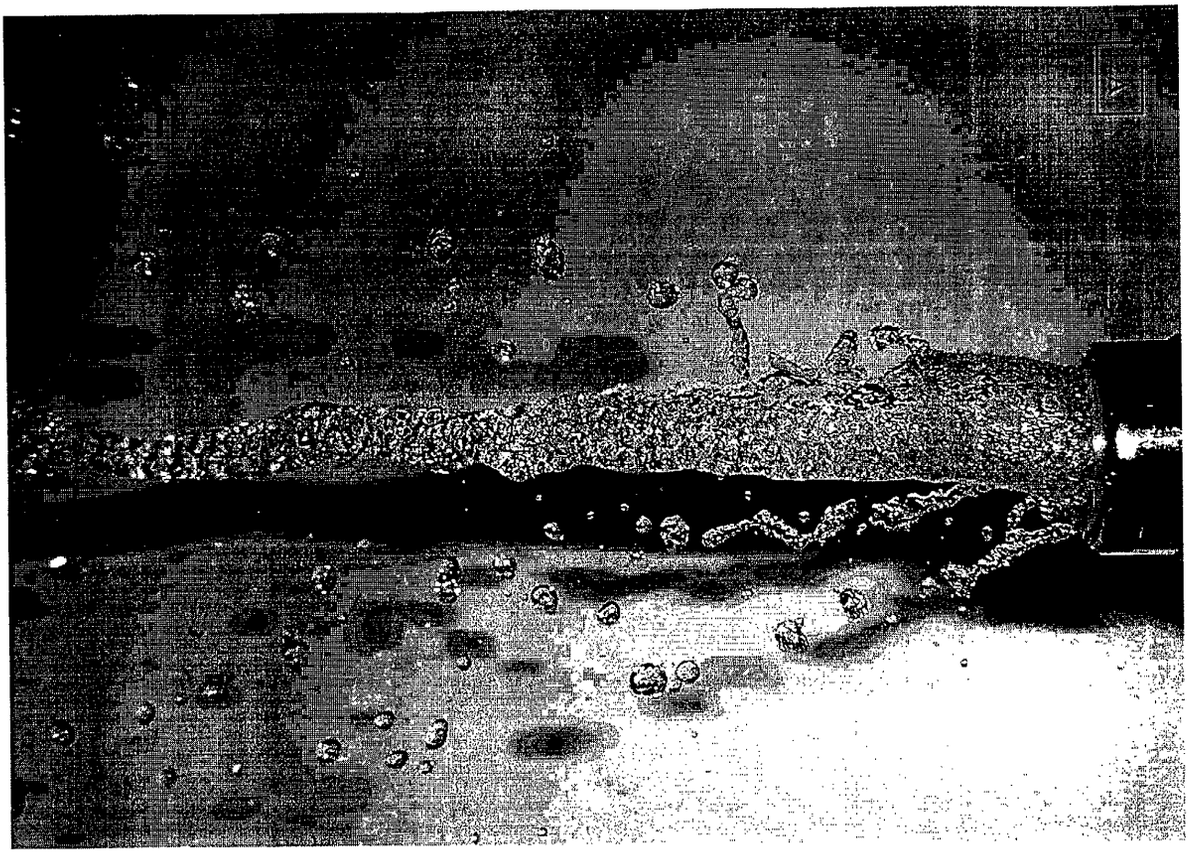
4. The filter device according to any of the claims 1-3, said major concentric ring element defining an aperture of a diameter of approximately 16mm, and said minor ring element being of a width of less than 1 mm, such as 0.5 mm and defining a diameter of approximately 8 mm.

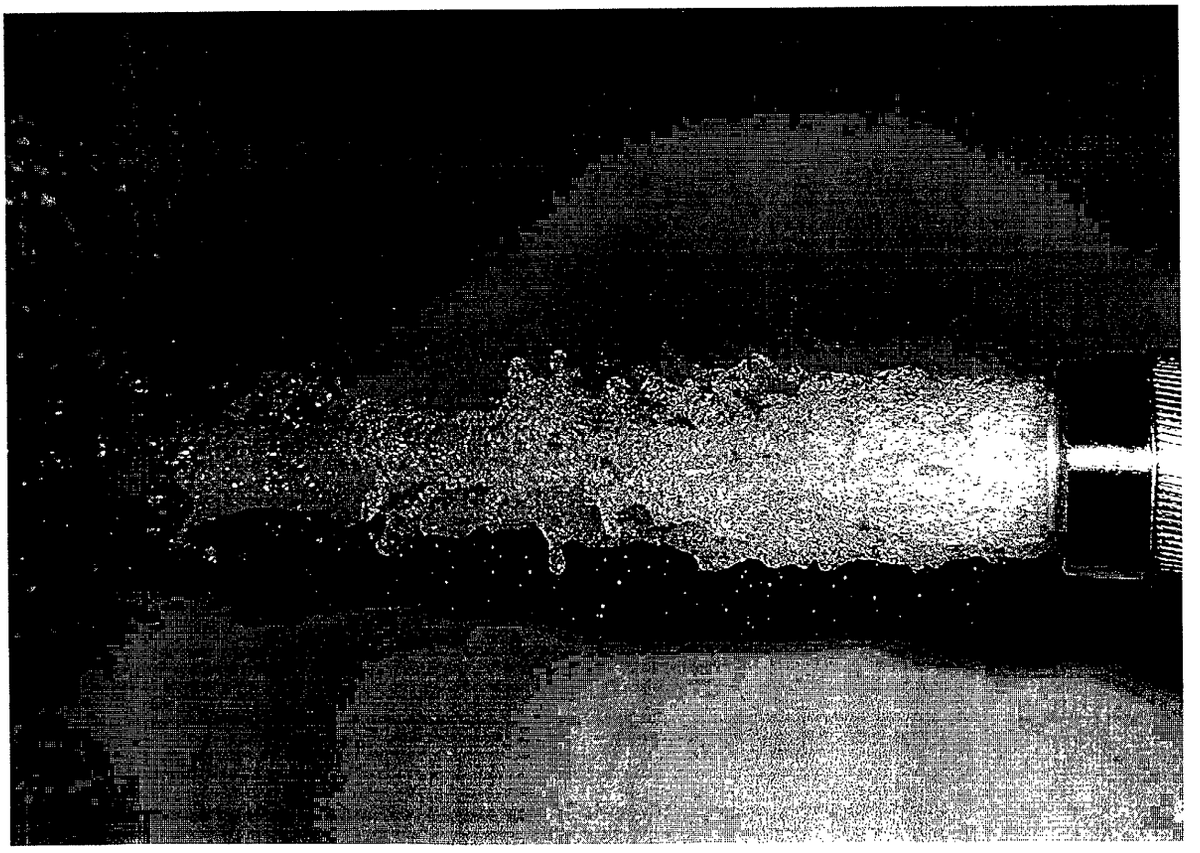
5. The filter device according to any of the claims 1-4, said major ring element and said minor ring element together with said pin elements defining apertures of said filter element of the order of 2-8 mm^2, such as 3-6 mm^2.

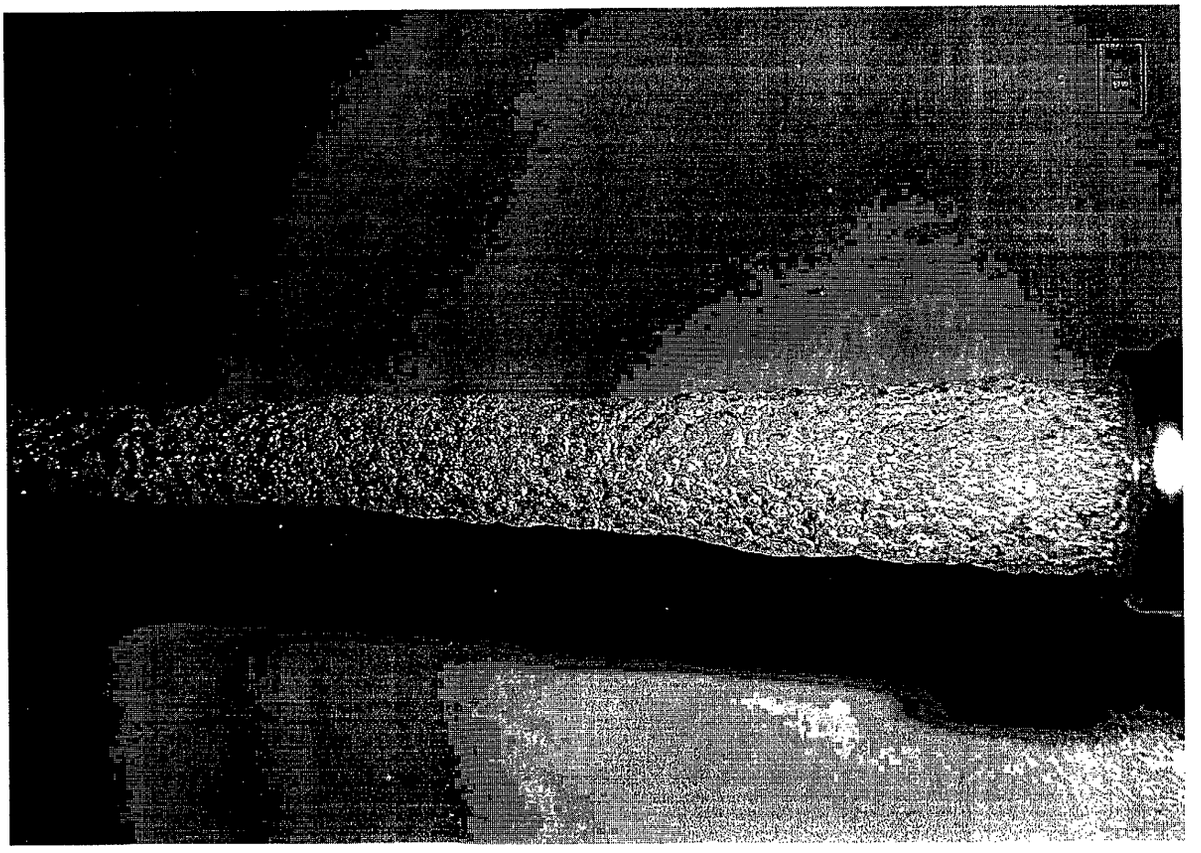
6. The filter device according to claim 2 and any of the claims 3-5 referring to claim 2, said minor ring element and said additional ring element together with said additional pin elements defining apertures of said filter element of the order of 1-6 mm^2, such as 2-4 mm^2.

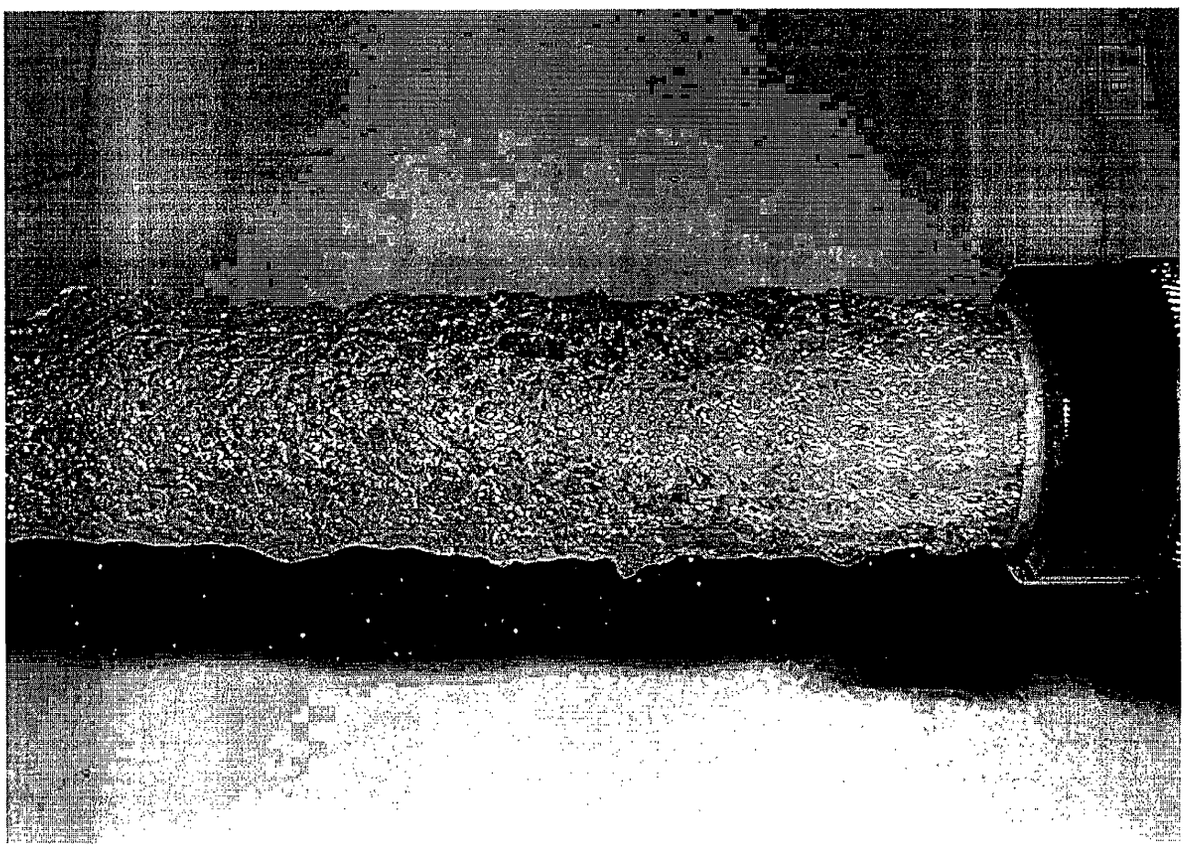
7. The filter device according to any of the claims 1-6, said filter device being cast from ABS, PP, PE or preferably POM.

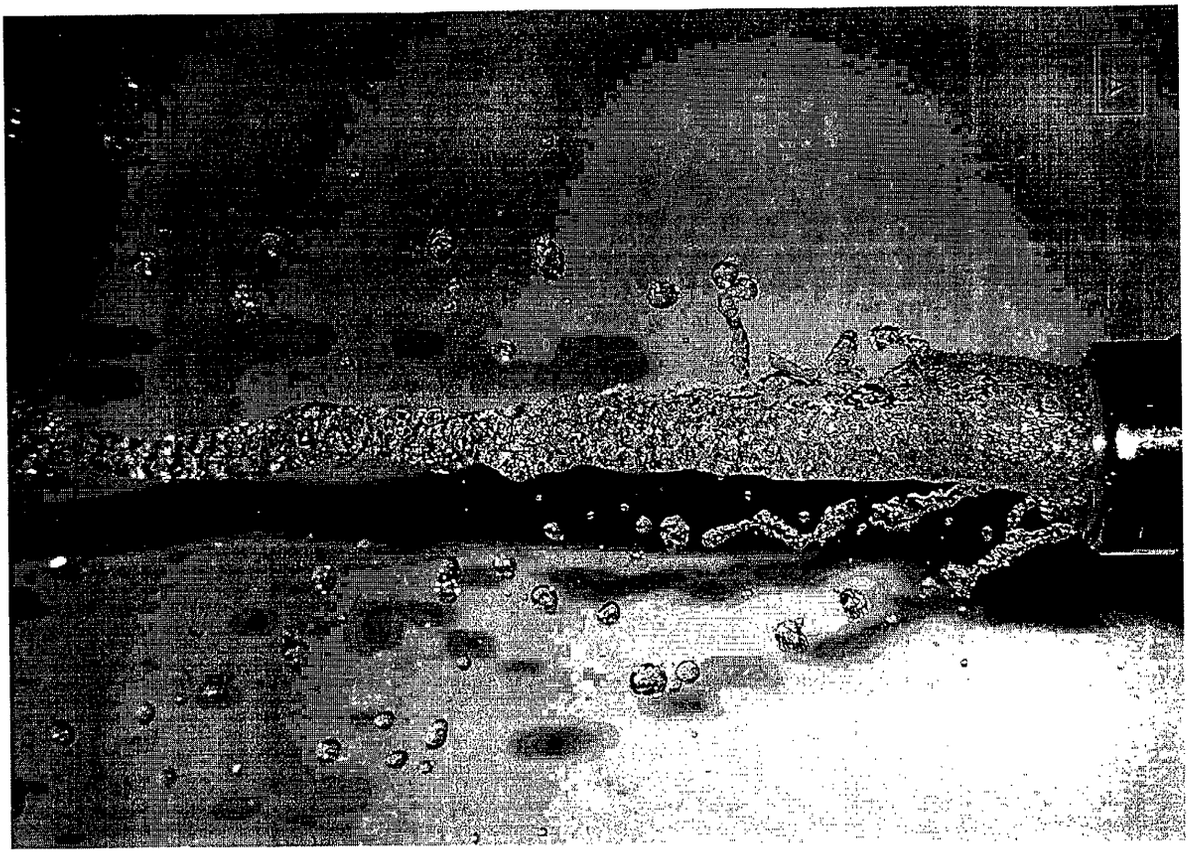


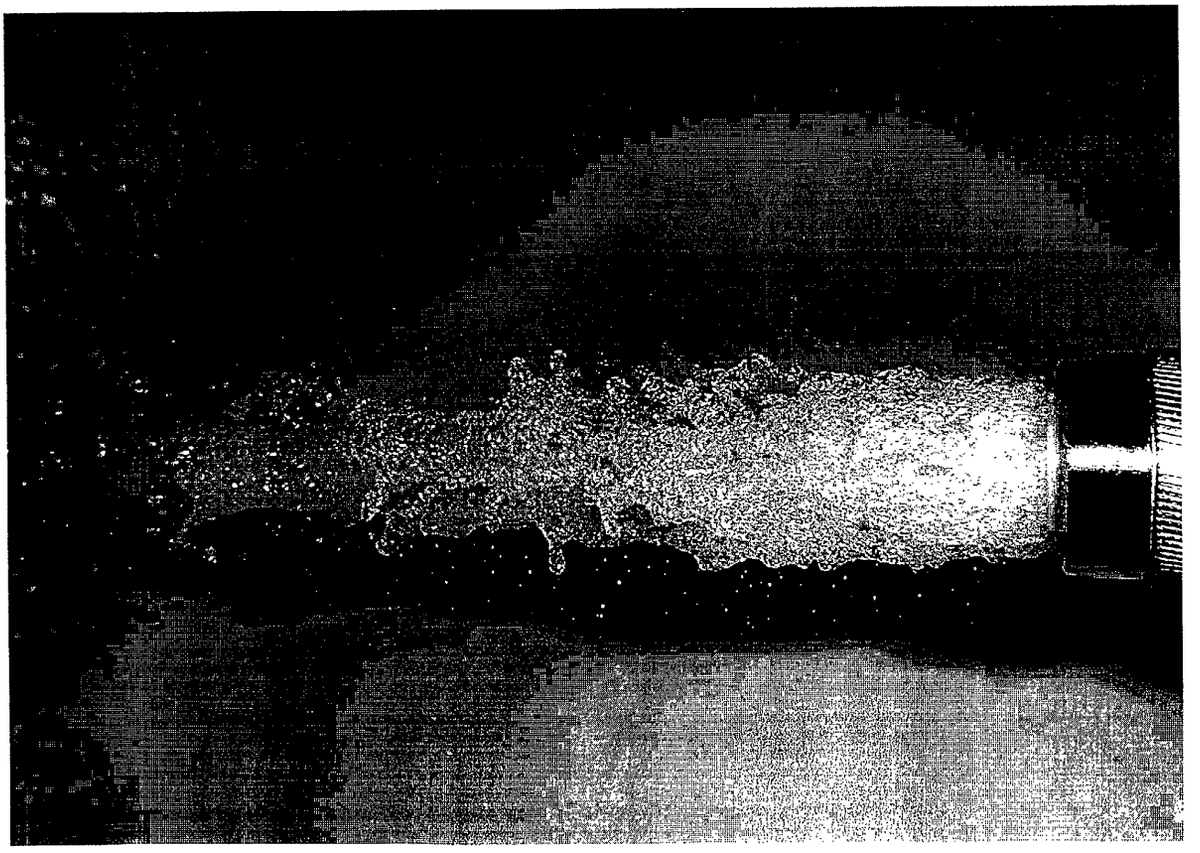


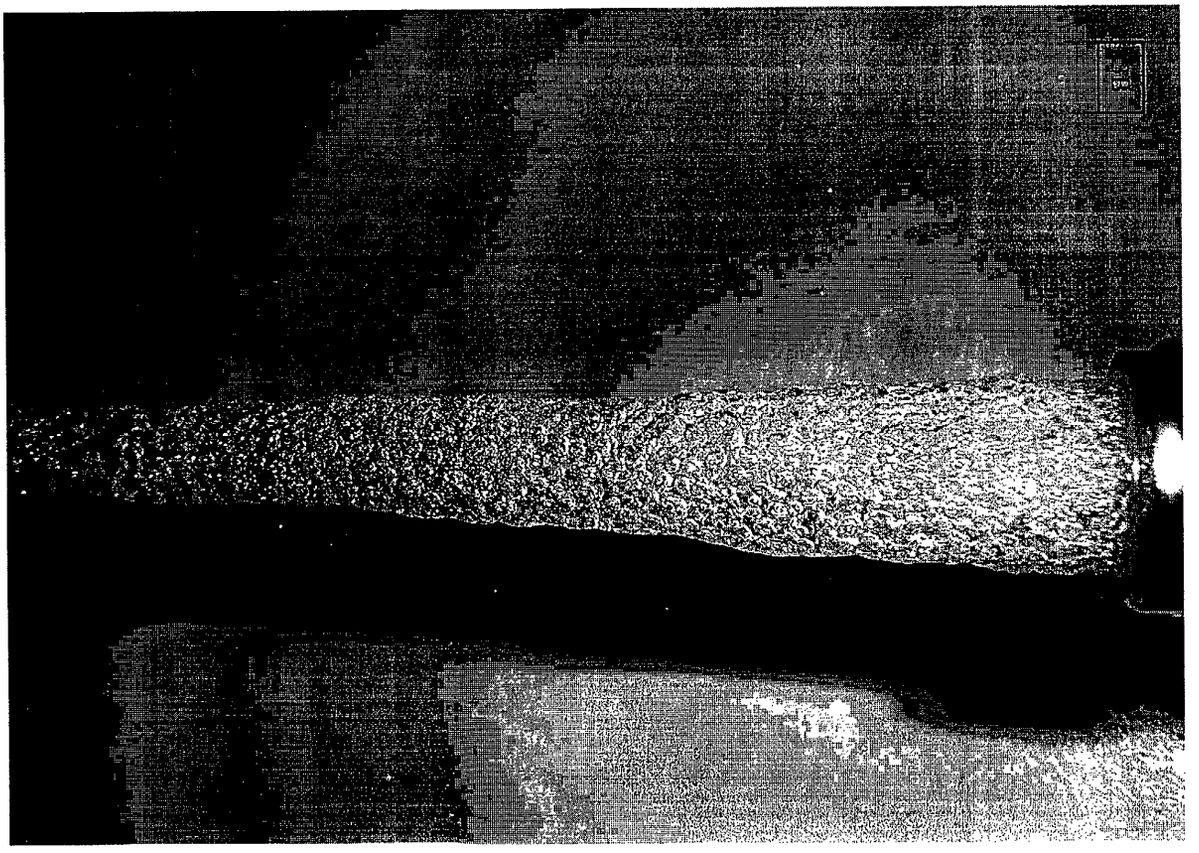


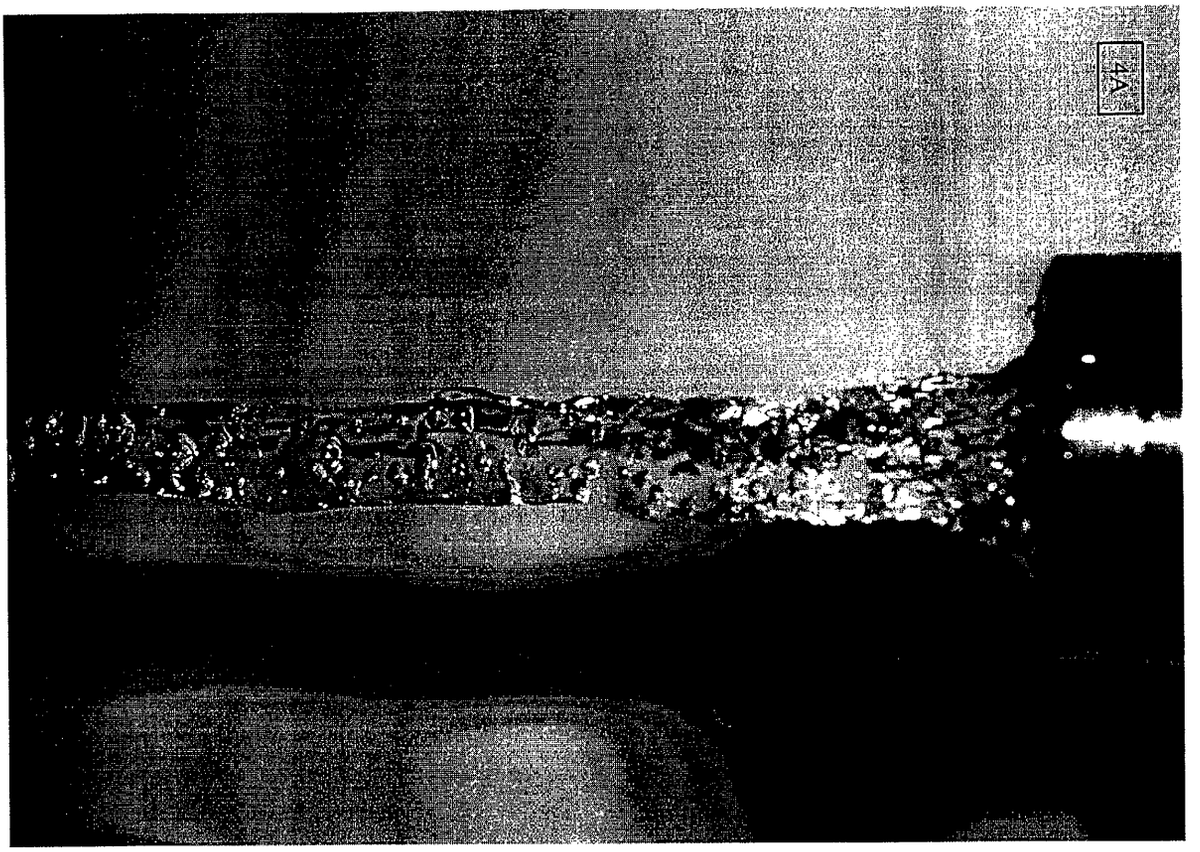








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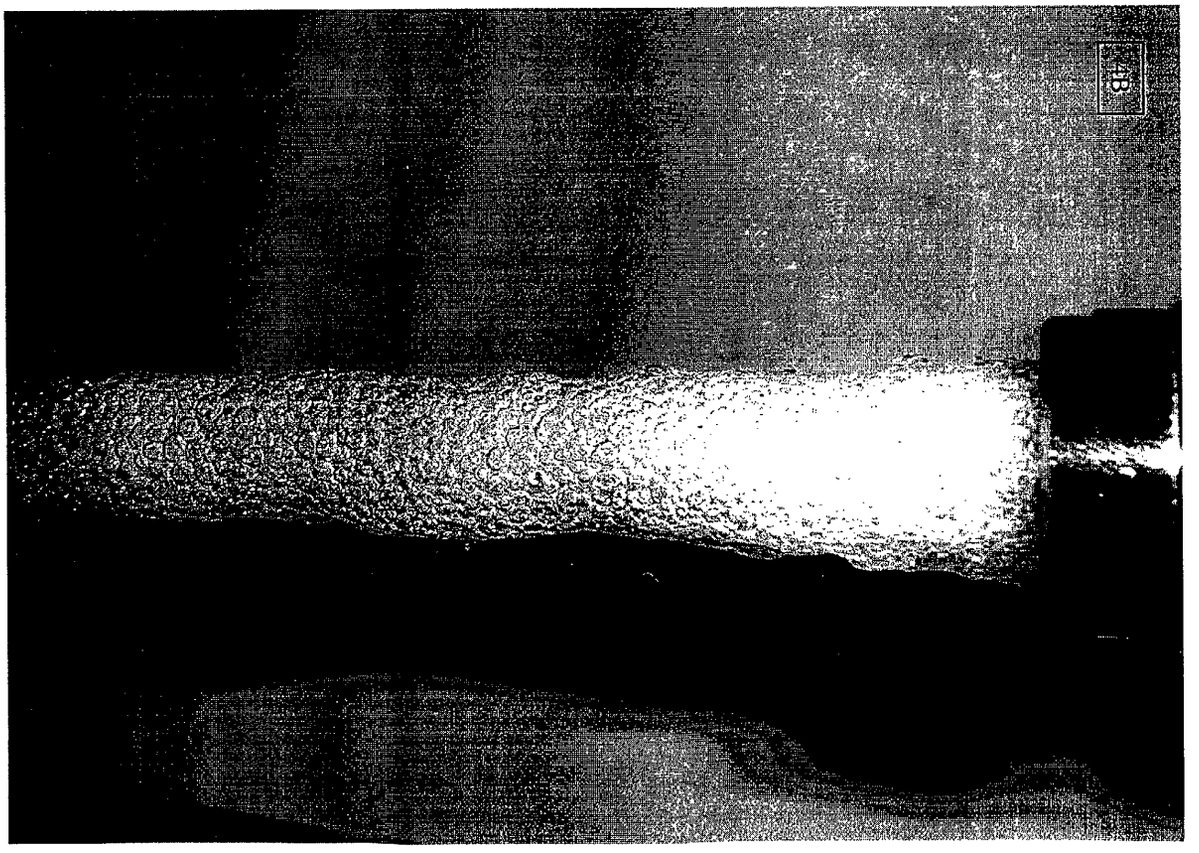
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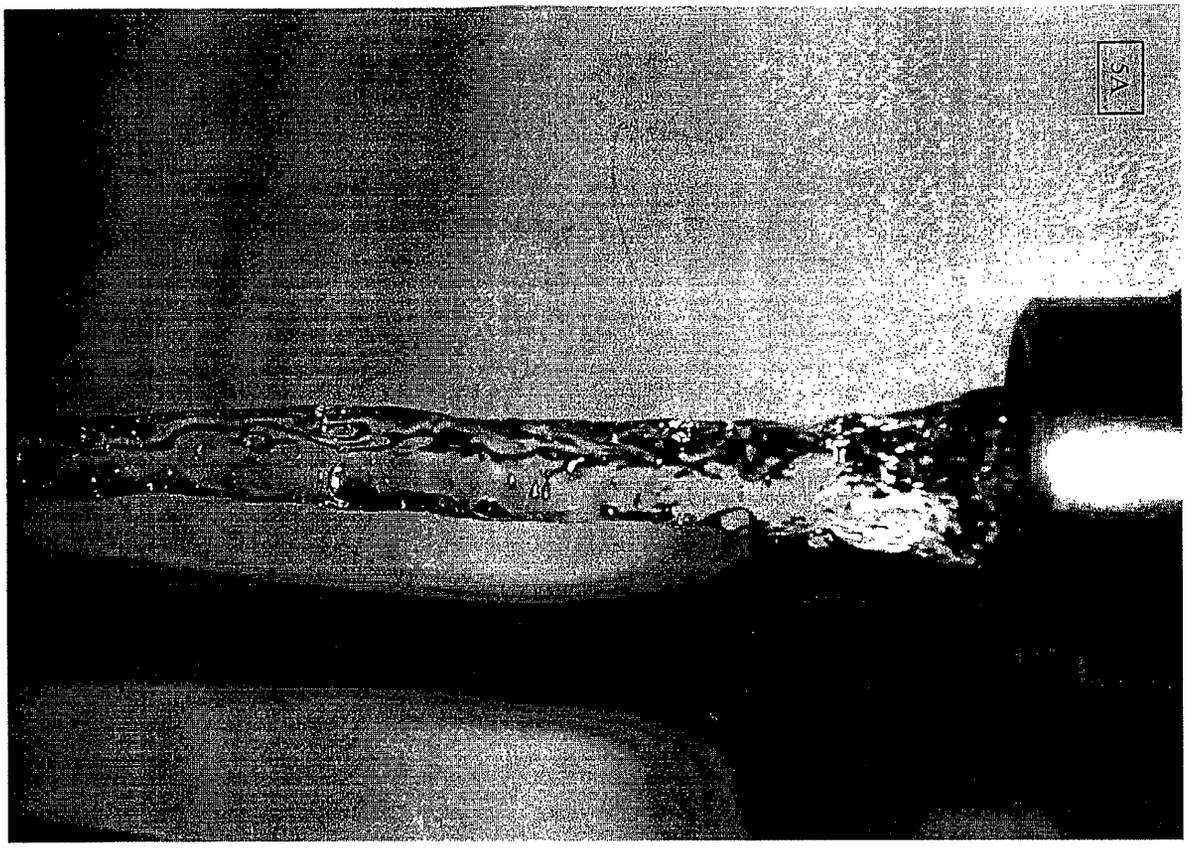
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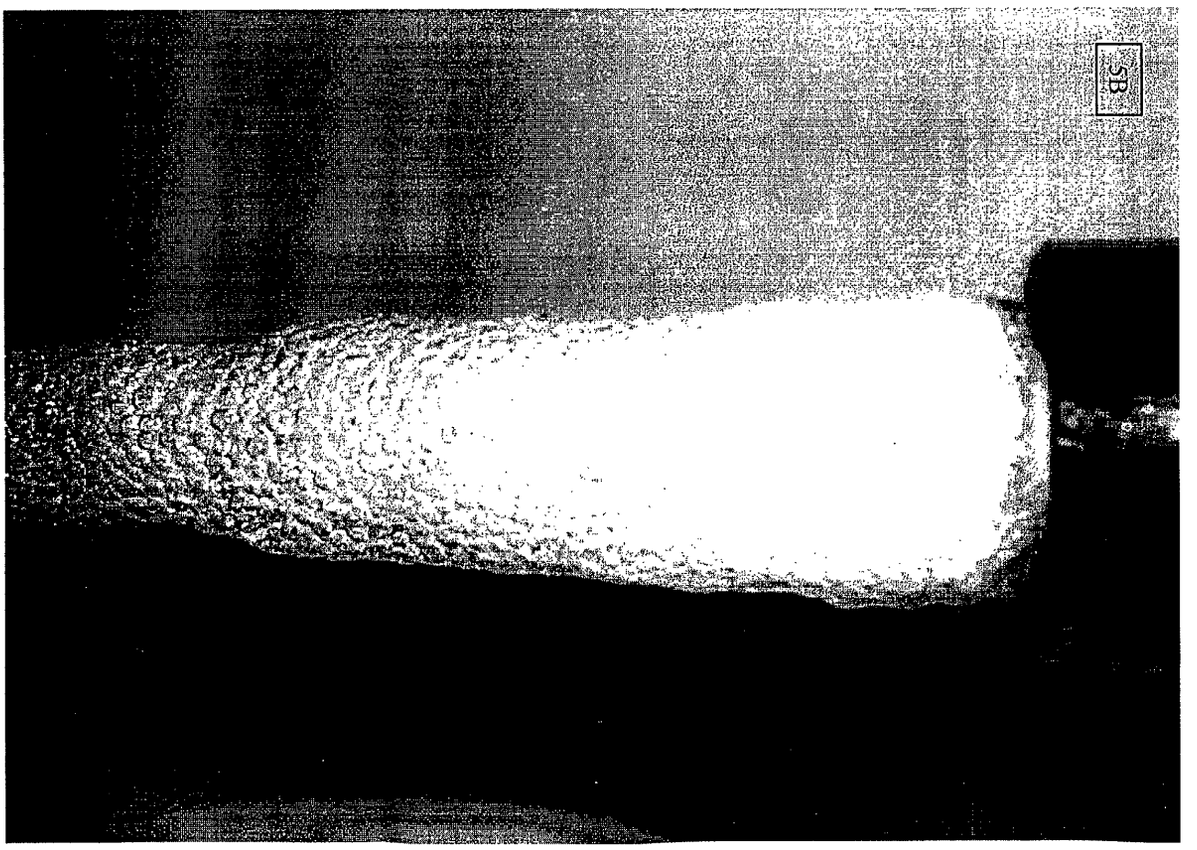
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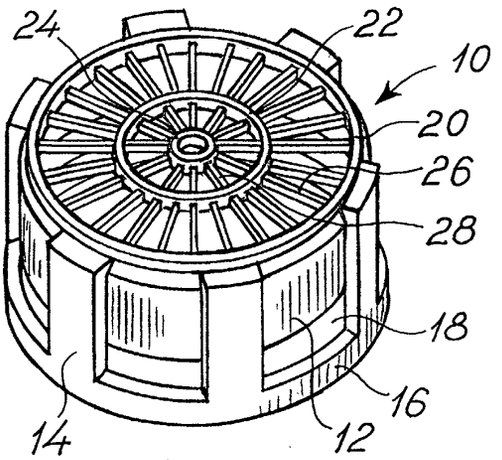

Fig. 6

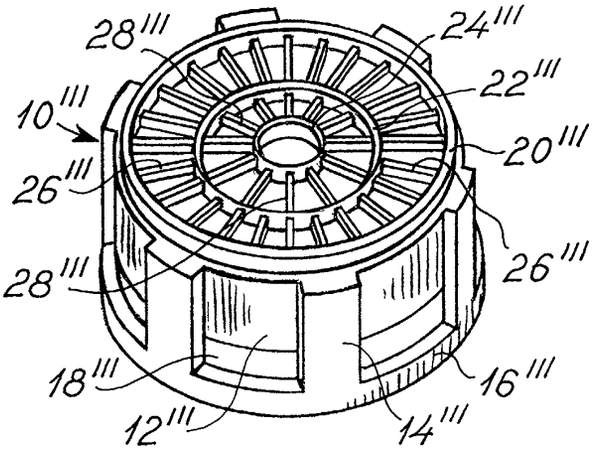

Fig. 9

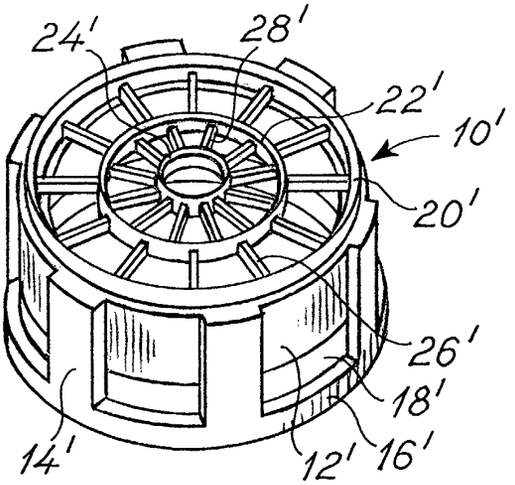

Fig. 7

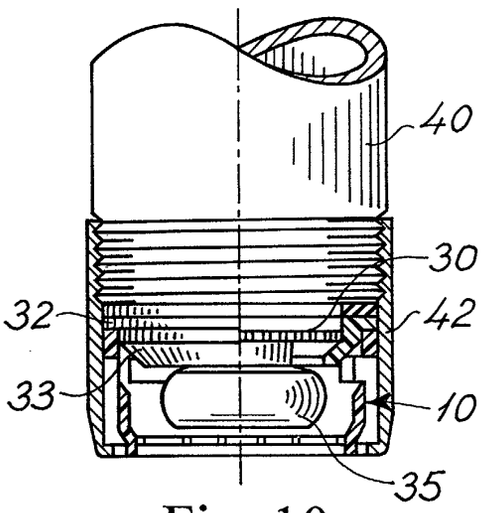

Fig. 10

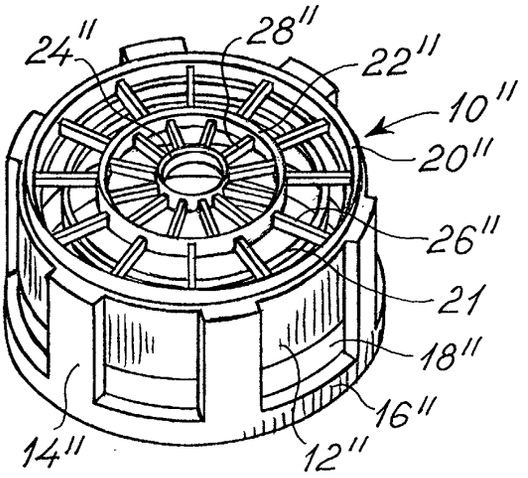

Fig. 8

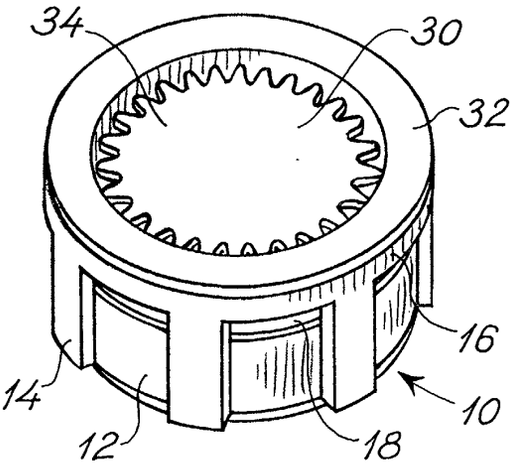

Fig. 11

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EUROPEAN SEARCH REPORT

Application Number
EP 02 38 8026

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	18 June 2002	Bilo, E

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