

Filter Device with Filter Disks

The invention relates to a filter device, especially for filtering melt-like fluids, such as polymer melts, having at least one filter disk made up of two filter disk halves which are connected with one another along one edge and are fitted with a fabric or cloth fabric filter material aligned on the exterior, which disk halves are held at some distance from one another by means of a support arrangement and which between them define a hollow space having essentially open flow-through passage and in the interior an outlet opening for the melt-like fluid.

From US 4,902,420 is known such a filter arrangement with a multi-layer construction, whereby between the fabric or cloth fabric filter materials lying facing one another is inserted a drainage plate as support device, with longitudinal slots running from the exterior to the interior, which define a hollow space of small volume between the fabric or cloth fabric filter materials. The medium to be filtered, for example a polymer melt, in this application is subjected by this known solution to increased flow resistance, so that the filter capacity is correspondingly decreased. Then, because of the complicated construction and the multiplicity of parts the manufacturing costs are higher. Furthermore, the separation of the fluid streams in the filter disk occurring by the separation into various longitudinal slots causes the so-called memory-effect, which, if for instance there is subsequent formation of blowholes or such phenomena out of the polymer melts, lead to undesired formations of strips or lamina.

From DE-AS 1,096,331 is known a filter device having at least one filter disk consisting of two filter disk halves connected with one another, which between them limit an essentially open passage allowing flow-through in the hollow space and which is provided with a fabric or cloth

fabric filter material which is aligned on the exterior, whereby the filter disk half consists of a metal disk with discharge openings or is constructed of spoke-like fillets. Coiled ribs or fins or fillets are used as support arrangement in the case of this known solution, and they extend radially inward and at some distance from one another over the entire hollow space, which tapers conically outward to the exterior periphery. This known solution allows only insufficient support for the filter disk halves with their fabric or cloth fabric filter material, so that the known solution can be used only in a limited manner, and, especially when high pressures are present, cannot be used without danger of breakdown. Besides, the ribs or fins used in this known solution separate the hollow space which is preferably open to flow-through into individual chambers, so that here too the flow resistance is increased, so that such a known solution does not suffice for the filtering of melt-like fluids.

Starting from this state of the art the object of the invention is to improve the presently described filter arrangements so that a filter device is disclosed which can be manufactured at low cost and which also allows an increased filtering capacity during operation, whereby especially in consideration of its use for the filtering of melt-like fluids, such as polymer melts, it can be designed for use under high pressures. Such an object is attained by a filtering device with the features disclosed in Claim 1.

Owing to the fact that the characterizing part of Claim 1 includes the support arrangement of individual supporting cams with essentially identical exterior dimensions, which extend outward from the discharge opening, arranged in a plurality of groups and separated from one another radially, and which are securely connected with at least one of the two filter disk halves and pass through the hollow space in such a manner that each filter disk half is in contact with the other filter disk half, and the entire hollow space is available as an essentially open flow-through passage, whereby the above-described drainage plates can be deleted in such a manner as to be a

cost-saving arrangement. Consequently the flow volume of the melt-like fluid to be filtered, such as polymer melts, and consequently also the filtering capacity, are increased.

As a result of having the plurality of supporting cams arranged in groups which extend between the two filter disk halves of a filter disk and support this disk assembly, a high resistance to pressure stresses on the filter disk halves as well as on their fabric or cloth fabric filter materials is attained, so that overall a highly pressure-stable filter disk is realized for use in the filter device. Simultaneously the offset arrangement of the supporting cams causes mixing of the melt flow, which thus counters the memory-effect.

With one preferred embodiment of the filter device according to the invention the individual group arrangements of supporting cams are arranged at different radial distances from the outlet opening aligned along concentric circles around this outlet opening. It has been shown that such an arrangement allows a high degree of support for the filter disk halves and accordingly such an arrangement has only a slightly negative influence on the dimensions of the opening of the hollow space for flow-through between the filter disk halves in the sense of causing only a slight increase of flow resistance. Also, a favorable means of manufacturing the filter disk and consequently the entire filter device can be attained in this manner.

In another preferred embodiment of the filter device according to the invention, the two filter disk halves of a filter disk are provided with supporting cams of identical dimensions on their adjacent and facing sides, which either engage along a longitudinal separation line of the filter disk halves where they abut one another and/or, with contact with the relevant other filter disk half, they engage in the free spaces between the supporting cams of each relevant facing filter disk half. With such described arrangements, to save on outlay, the filter disk can be composed of identically constructed filter disk halves.

The outlay for the manufacture can be further decreased insofar as the supporting cams are connected tightly with the relevant filter disk halves by means of weld points produced by a projection-weld method.

With another preferred embodiment of the filter device according to the invention the two filter disk halves run parallel to one another and define a disk-shaped hollow space of identical dimensions. It has been shown that a favorable flow-through of the melt-like fluid is attained in this manner, without increasing the wall shearing or thrust stresses when it comes to the flow resistance with the flow of the melt through the filter disk.

With one especially preferred embodiment of the filter device according to the invention the supporting cams form fillet-like solid box section profiles, which in turn can be mounted on the filter disk halves in such a manner that they free the discharge openings in the filter disk halves. As a result of the use of the solid box section profiles, the fabric or cloth fabric filter materials on the outside of the two filter disk halves of a filter disk can be securely supported and are not drawn into the box section profile of the supporting cams, which would for example be the case if these would be shaped out of the filter disk halves by a deep-drawing method or the like. Since the box section profiles are embodied as fillet-like, they can be used beneficially in the intermediate spaces between the openings of a filter disk half, wherein they do not have the capacity to negatively influence the open flow-through through these discharge openings. The arrangement can especially avoid the generation of flow shadows, since the discharge openings are grouped without any side spacing directly around the supporting cams and are left free.

With another especially preferred embodiment of the filter device according to the invention the discharge openings are formed in the filter disk halves by means of circular cutouts, which in groups of different magnitudes extend along concentric circles around the outlet opening. By a

certain selection of the grouping with discharge openings in the form of rows of holes, the flow ratios within the filter disk can improve for the melt-like fluid and thus the filter capacity can be increased. Preferably the filter disk halves and the supporting cams are formed of top-grade steel, so that these are not inclined to corrode and consequently also cannot pollute the melt-like fluid. Insofar as spacing cams are arranged on the top and bottom of the filter disk, especially in the peripheral side border area where the filter disk halves are connected with one another by a border welding joint, then in a cost-saving manner the traditional so-called spacer can be deleted, which with the known filter device would serve to hold the filter disks inside the assembly at some spacing from one another. Such a spacing is now to be realized by means of the spacing cams arranged directly on the filter disks.

Hereinafter the filter device according to the invention is to be explained in greater detail relative to one embodiment.

The representations of the drawings show in principal :

- Fig. 1 a longitudinal section through a filter disk;
- Fig. 2 a plan view of a filter disk half, formed of a metal disk with discharge openings,
- Figs. 3 and 4 magnified representations of the image sections shown in Fig. 1 with "X" and "Y".

A filter disk 10 is shown in longitudinal section in Fig. 1. Filter disk 10 is made up of two filter disk halves 12, 14 which can be connected with one another, which between them limit a cylindrical hollow space 16 having essentially open flow-through passage and which are each provided with a fabric or cloth fabric filter material 18 of predetermined mesh or pore dimensions, aligned on the exterior.

As shown particularly in Fig. 2, filter disk halves 12, 14 are each formed of a metal disk 20 with discharge openings, of identical construction, preferably of top-grade steel. In turn the metal disk 20 has a plurality of discharge openings 22, through which can flow the melt-like fluid, especially the polymer melts. Discharge openings 22, especially in the form of circular openings, can make up the metal disk 20 by using different cross sectional widths of openings as shown in the representation of Fig. 3, brought together to form individual radial groups 24, 26, 28 and 30. The individual groups 24, 26, 28, 30 of discharge openings 22 then incorporate different frequency arrangements of discharge openings 22 and are oriented along concentric circles around the vertically oriented longitudinal midline of filter disk 10. Thus the innermost group 24, 64 has discharge openings 22 on five concentric circles aligned one behind the other. And likewise the following group 26, 88 having discharge openings 22, the group 28, 120 having discharge openings 22, and finally the group 30, 160 having discharge openings 22.

In some detail, on the interior of metal disk 20 with discharge openings as shown in Fig. 2, projecting ribs or fins or web-like fillets forming supporting cams 32 run along defined concentric circles aligned outward, formed into groups 34, 36, 38, 40, 42, whereby the supporting cams 32 of innermost group 34, 12 as seen in the alignment of Fig. 2 has supporting cams 32, the subsequent group 36, 10 has supporting cams 32, the subsequent group 38, 16 has supporting cams 32 and the following group 40, 20 and finally the last group 42, 24 each have supporting cams 32. In some detail, filter disk halves 12, 14 in the form of the metal disk 20 with discharge openings in the interior defines a circular outlet chamber 44. The cited supporting cams are thus parts of a supporting arrangement 46 which holds the filter disk halves 12, 14 at a certain, defined distance from one another and pressure-stable. Outlet chamber 44 in turn represents a circular outlet opening, through which the melt-like filtered fluid is discharged from the filter device.

The two filter disk halves 12, 14 of filter disk 10 are provided with supporting cams 32 of identical height and identical dimensions on their sides facing one another. Supporting cams 32 can thus be arranged, in an embodiment not shown in greater detail, along the longitudinal separation line 48 of Fig. 1, or, as shown in Figs. 1 and 2, on different plate halves, whereby supporting cams 32 then extend into the open hollow space following the superpositioning of the filter disk halves 12, 14, and the hollow space in turn is limited by the other filter disk half, either 14 or 12, only in laminar configuration. With a different and not shown embodiment the distribution of supporting cams 32 can be arranged appropriately for the filter disk halves 12, 14 in such a manner that they engage alternating according to a predeterminable pattern in the intermediate spaces produced between supporting cams 32 of the other filter disk half, either 14 or 12. An especially low-cost method of manufacture however is when the supporting cam arrangement 32 is arranged as is represented for the two filter disk halves 12, 14 in Fig. 2. The filter disk halves 12, 14, identical with one another, then need only be pivoted around the longitudinal midline 48 of filter disk 10 and be superimposed one on the other, in order to obtain the disk assembly as in Fig. 1. At this point let it also be repeated that the filter disk 10 is to be referred to in technical terminology as 'disk' or 'filter disk'.

As is shown further in Figs. 1 and 3, the metal disk 20 incorporating discharge openings opens to the exterior through a supporting ring 50, which is offset from the longitudinal midline of metal disk 20 and terminates on the longitudinal midline 48 of filter disk 10. As is shown particularly by the enlarged depiction of Fig. 3, the adjacent, facing supporting rings 50 of a filter disk 10 are superposed one over the other and are connected tightly with one another around the exterior periphery by means of a circumferential welding joint 52. Likewise by means of an annular welding joint 54 the fabric or cloth fabric filter material disks 18 are connected tightly on the exterior periphery with the exterior peripheral edge of metal disk 20 having discharge openings. Possible fluid flow directions are shown in Figs. 3 and 4 with arrows. The melt-like medium or

fluid to be filtered, especially in the form of polymer melts, comes under high pressure (above 100 bar) from the outside inward through the fabric or cloth fabric filter material 18 and is conducted through discharge openings 22 in metal disk 20 into open hollow space 16 which has been thus defined. Since no flow resistance in hollow space 16 is provided before reaching supporting cams 32, the overall flow resistance is considerably diminished, and the flow velocity of the medium through the filter device and consequently also the filtration capacity are commensurately increased.

The sectional enlargement indicated with "Y" from Fig. 1 and shown in Fig. 4 shows the possible flow direction of filter disk 10 to outlet opening 44 with arrows. The relevant discharge chamber or the relevant outlet opening 44 in the interior of each filter disk 10 is limited by an interior supporting ring 56 on each filter disk half 12, 14, whereby the disk thickness in this area is maintained essentially identical. The interior supporting rings 56 of each filter disk 10 arranged opposite and adjacent to one another are held at a predetermined distance from one another by means of a spacing disk or washer 58, especially in the form of a type of flow gasket. The fabric or cloth fabric filter material 18 is then tightly connected by means of an interior welding joint 60 with the associated interior supporting ring 56. Especially the outward-projecting part of supporting ring 56 forms a contact surface for the interior edge of the fabric or cloth fabric filter material 18 to be supported.

The individual supporting cams 32 are tightly connected with the relevant filter disk halves 12 and/or 14 by welding points 62 produced by means of a projection weld method. By means of other welding points 64 produced by a projection weld method, then, the interior of metal disk 20 facing and adjacent to outlet opening 44 is tightly welded with the already cited interior supporting rings 56. On the top 66 and bottom 68 of each filter disk 10, spacing cams 70 are then arranged in uniform, radial spacings around the exterior periphery spaced from one another

on filter disk 10, whereby these elements are likewise mounted securely by means of projection weld points 72 and undertake the function of a spacer for individual filter disks 10. Such spacing cams 70, as also shown in Fig. 1, could be distributed over the filter disk top surface, or especially could be arranged in the middle area.

A plurality of filter disks 10 arranged one over the other then provide the complete filter device arranged in a housing, not shown completely. With the relevant filter disk 10, a considerably lower pressure is required for overcoming interior resistance, and additionally the manufacturing costs are considerably lowered by the simplified construction. Considering that the individual supporting cams 32 are terminated at their open ends in a circular sealing off, the flow behavior for the melt-like fluid which is to be filtered is improved. Furthermore, considering that the relevant supporting cam 32 is limited by each group of six circular discharge openings 22, the discharge openings 22 are not covered and are completely accessible for input of the medium.

Patent Claims

1. Filter device, especially for the filtering of melt-like fluids, such as polymer melts, having at least one filter disk (10), which has two filter disk halves (12, 14) connected with one another along one edge, which are provided with a fabric or cloth fabric filter material (18) aligned on the exterior, which are held at some distance from one another by a support arrangement (46), and which between them define a hollow space (16) having essentially open flow-through passage and in the interior limit a outlet opening (44) for the melt-like filtered fluid, **characterized in that** the supporting arrangement (46) includes individual supporting cams (32) with essentially identical exterior dimensions, which, arranged in a plurality of groups (34, 36, 38, 40, 42) and separated from one another, extend radially outward to the exterior from the outlet opening (44) and are tightly connected with at least one of the two filter disk halves (12, 14) and pass through

on filter disk 10, whereby these elements are likewise mounted securely by means of projection weld points 72 and undertake the function of a spacer for individual filter disks 10. Such spacing cams 70, as also shown in Fig. 1, could be distributed over the filter disk top surface, or especially could be arranged in the middle area.

A plurality of filter disks 10 arranged one over the other then provide the complete filter device arranged in a housing, not shown completely. With the relevant filter disk 10, a considerably lower pressure is required for overcoming interior resistance, and additionally the manufacturing costs are considerably lowered by the simplified construction. Considering that the individual supporting cams 32 are terminated at their open ends in a circular sealing off, the flow behavior for the melt-like fluid which is to be filtered is improved. Furthermore, considering that the relevant supporting cam 32 is limited by each group of six circular discharge openings 22, the discharge openings 22 are not covered and are completely accessible for input of the medium.

Patent Claims

1. Filter device, especially for the filtering of melt-like fluids, such as polymer melts, having at least one filter disk (10), which has two filter disk halves (12, 14) connected with one another along one edge, which are provided with a fabric or cloth fabric filter material (18) aligned on the exterior, which are held at some distance from one another by a support arrangement (46), and which between them define a hollow space (16) having essentially open flow-through passage and in the interior limit a outlet opening (44) for the melt-like filtered fluid, characterized in that the supporting arrangement (46) includes individual supporting cams (32) with essentially identical exterior dimensions, which, arranged in a plurality of groups (34, 36, 38, 40, 42) and separated from one another, extend radially outward to the exterior from the outlet opening (44) and are tightly connected with at least one of the two filter disk halves (12, 14) and pass through



the hollow space (16) in such a manner that each is in contact with the relevant other filter disk half (14, 12).

2. Filter device as in Claim 1, characterized in that the individual groups (34, 36, 38, 40, 42) of supporting cams (32) are grouped at different radial distances from the outlet opening (44) along concentric circles around this opening.
3. Filter device as in Claim 1 or 2, characterized in that the two filter disk halves (12, 14) of a filter disk (10) on their sides turned facing one another are both provided with supporting cams (32) of identical dimensions, which abut one another either along a longitudinal separation line (48) between the filter disk halves (12, 14) and/or when in contact with the relevant other filter disk half (14, 12) engage in the free spaces between the supporting cams (32) of these filter disk halves (12, 14).
4. Filter device as in one of the Claims 1 to 3, characterized in that the two filter disk halves (12, 14) of a filter disk (10) with their supporting cams (32) are identical to one another.
5. Filter device as in one of the Claims 1 to 4, characterized in that the supporting cams (32) are connected by means of welding points (62) produced by a projection weld method with the relevant filter disk half (12, 14).
6. Filter device as in one of the Claims 1 to 5, characterized in that the two filter disk halves (12, 14) are arranged running parallel to one another and limit a disk-like hollow space (16) of identical dimensions.
7. Filter device as in one of the Claims 1 to 6, characterized in that the supporting cams (32) are constructed as fillet-like solid box section profiles, which can be offset on the filter disk halves (12, 14) in such a manner that they free the discharge openings (22) in the filter disk halves (12, 14).
8. Filter device as in Claim 7, characterized in that the relevant discharge openings (22) in the filter disk halves (12, 14) are formed of circular cutouts, which, arranged in groups (24, 26, 28, 30) of different magnitudes of frequency, extend along concentric circles



around the outlet opening (44).

9. Filter device as in one of the Claims 1 to 8, characterized in that the filter disk halves (12, 14) and the supporting cams (32) are formed of top-grade steel.
10. Filter device as in one of the Claims 1 to 9, characterized in that spacing cams (70) are arranged on the top (66) and the bottom (68) of the filter disk (10), especially in the exterior border area, where the filter disk halves (12, 14) are connected with one another by means of a border welding joint (52).

