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(54) METHOD FOR OPERATING A FILTER DEVICE AND FILTER DEVICE

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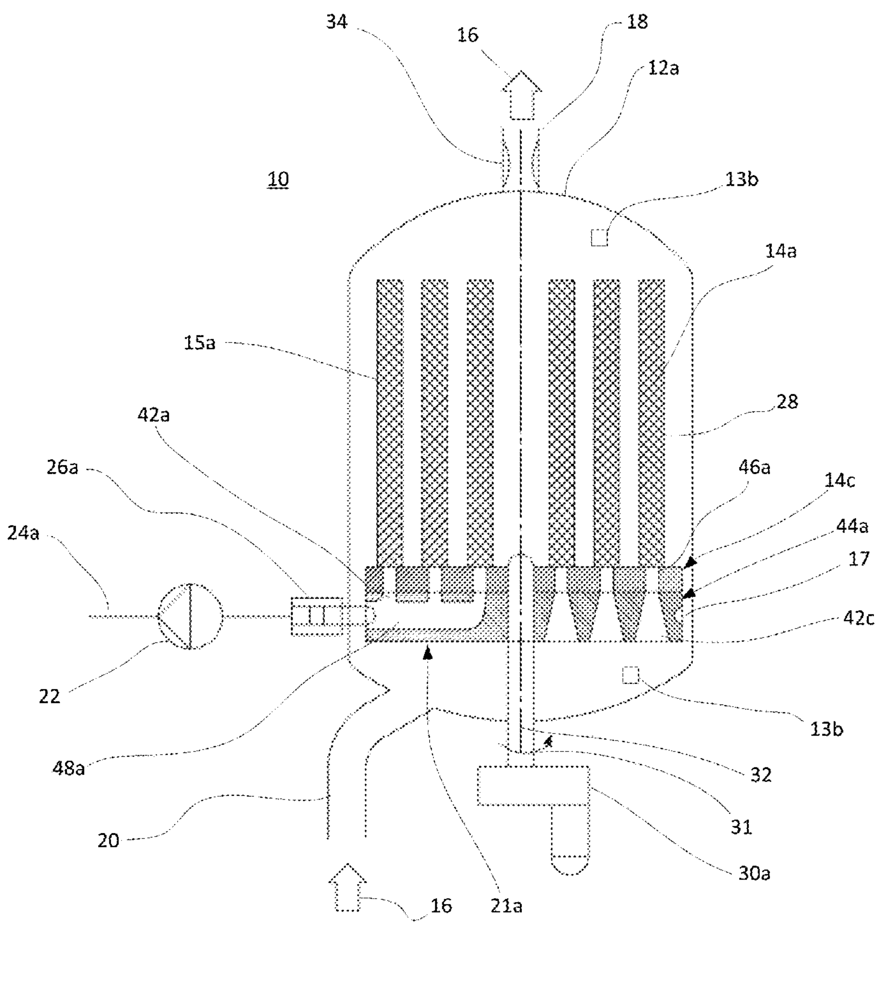
(57) **ABSTRACT**

A method for operating a filter device for polymer melt to be filtered, said filter device incorporating at least one first large-area filter, which has a plurality of filter elements, in a first filter chamber; and a first drain for the filtered polymer melt from the first filter chamber. The polymer melt to be filtered is conveyed under pressure through the filter device. The polymer melt to be filtered is fed to the first large-area filter in the filter direction, and filtering is continuously performed via the first large-area filter. During a backflushing operation, at least one filter element is cleaned of impurities and backflushed by reversing the flow direction of the filtered polymer melt and passing it through the filter element.



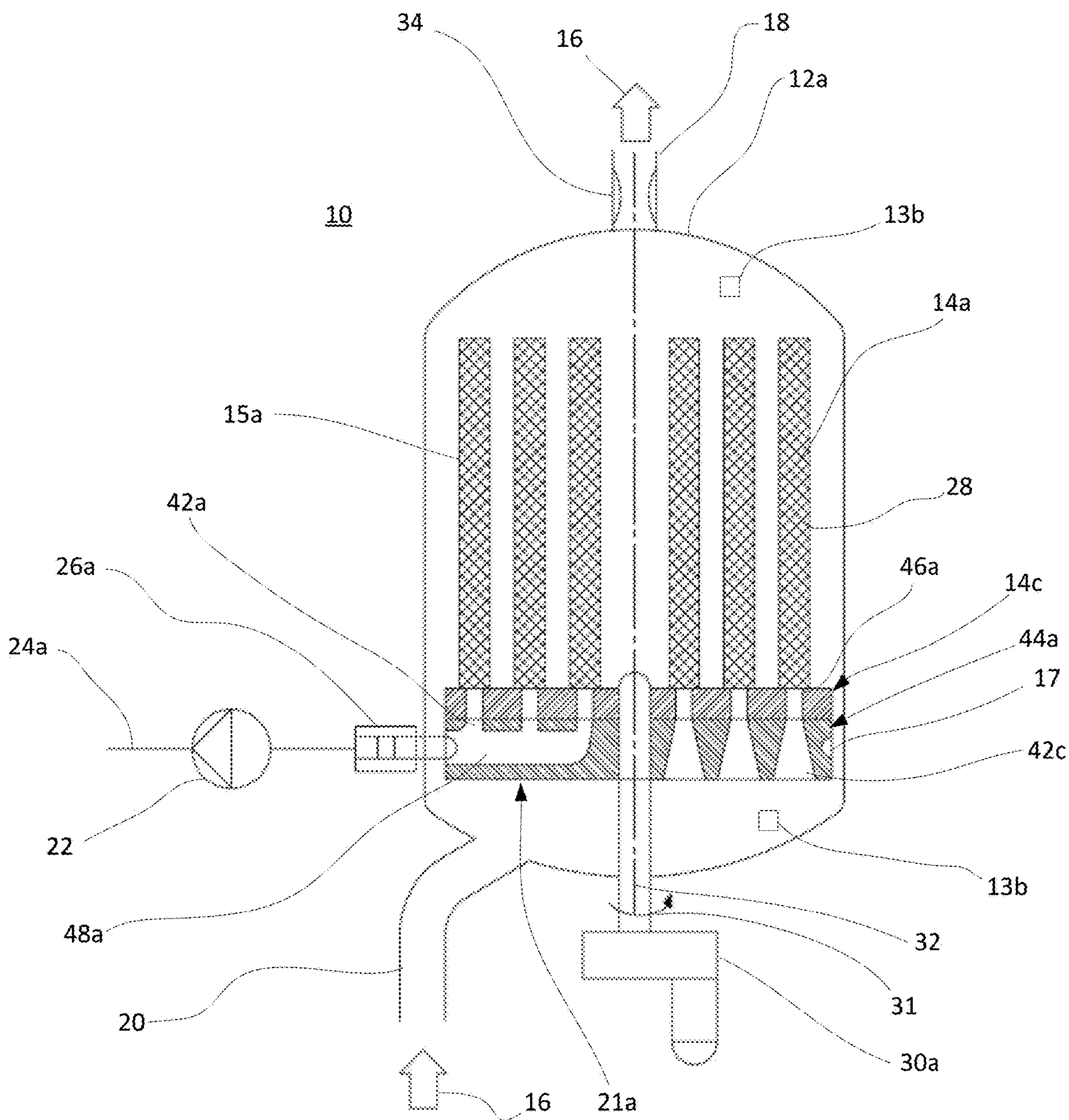
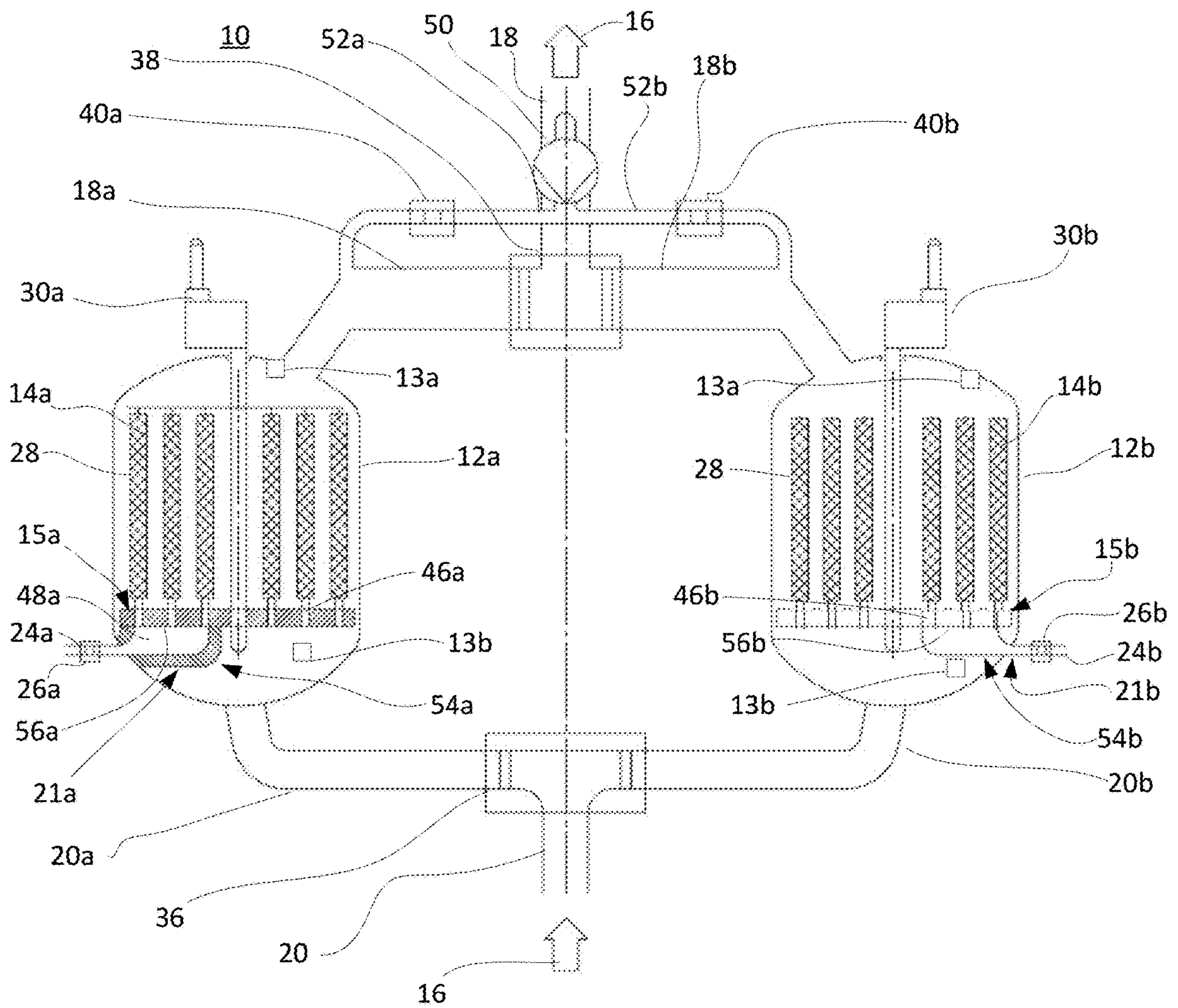

34
16
18
12a
10
13b
14a
15a
28
42a
26a
46a
14c
24a
44a
17
42c
22
13b
48a
32
31
20
30a
16
21a

Fig. 1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38
40a
52a
50
18
16
18b
52b
40b
18a
30a
30b
13a
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14a
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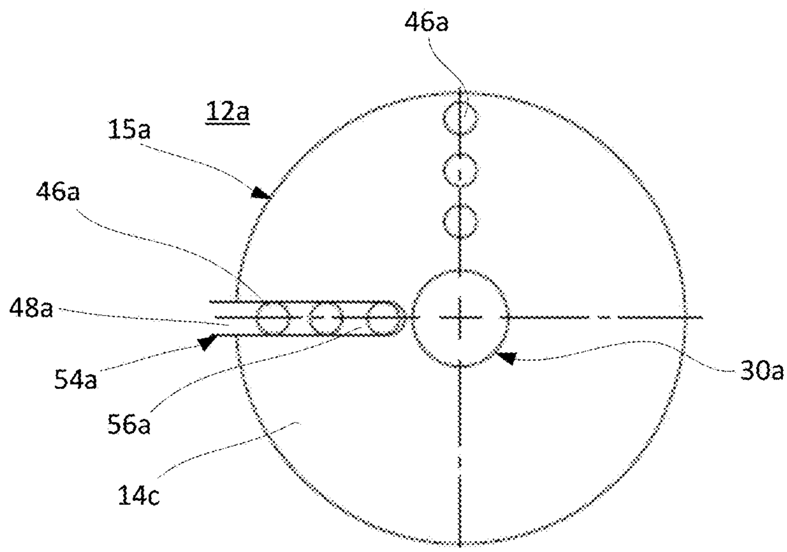
28
12a
28
12b
15a
15b
48a
46a
46b
24a
26b
13b
56b
24b
26a
54a
13b
21b
56a
54b
21a
20b
20a
36
20
16

Fig. 2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12a
15a
46a
48a
30a
54a
56a
14c

Fig. 3

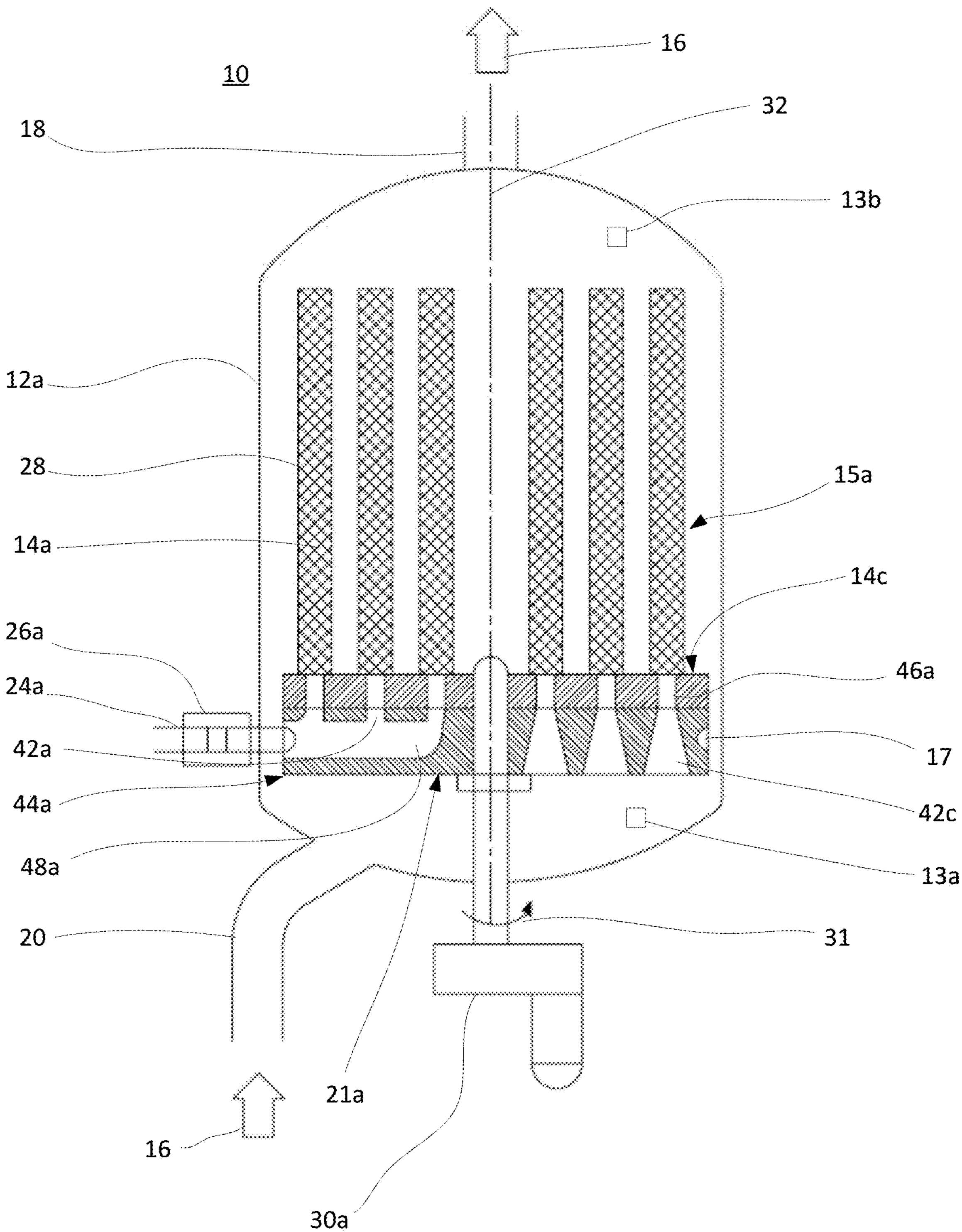
16
10
32
18
13b
12a
28
15a
14a
14c
26a
46a
24a
42a
17
44a
42c
48a
13a
20
31
21a
16
30a

Fig. 4

METHOD FOR OPERATING A FILTER DEVICE AND FILTER DEVICE

[0001] This application is a national stage application filed under 35 U.S.C 371 of PCT Application No. PCT/EP2022/079202 filed Oct. 20, 2022, which claims priority to German Patent Application No. 10 2021 128 195.4 filed Oct. 28, 2021. The disclosures of the above-referenced applications are incorporated herein by reference in their entireties.

[0002] The invention relates to a method for operating a filter device, and to a filter device for carrying out the method.

[0003] In particular in the production of thermoplastics, it is common practice to remove foreign matter from the polymer melt by filtering it. Large-area filters are generally used for this purpose, which comprise a filter chamber having plural filter candles arranged therein, usually between 37 and 169. The large number of filter candles ensures that a large filter surface is available. In this process, the material to be filtered flows through the filter candles from the outside to the inside. The polymer melt to be filtered is filtered via the side walls of the filter candles. The side walls usually have a filter rating of between 3 μm and 20 μm.

[0004] For this purpose, it is common practice to use so-called duplex filter units. These duplex filter units have two identical filter means. Each filter means has a cylindrical filter chamber in which a large-area filter each is installed. The filter chamber and the large-area filter installed in it are preferably aligned vertically, with the material to be filtered flowing through them from bottom to top. The large-area filter is a filter that comprises several filter candles arranged on a distributor. The filter candles and the distributor divide the filter chamber into an inlet zone and an outlet zone. Polymer melt is fed to the filter candles via an inlet to the filter chamber. The supply of the polymer melt is controlled via an inlet valve, which is arranged in the respective inlet to the filter chamber. The side walls of the filter candles constitute the filter. More specifically, the side walls can be corrugated, or shaped in any other way, in the circumferential direction so as to increase the filter surface. The filter surfaces used are between 45 m^2 and 255 m^2, for example, which is the total of the side wall surfaces of all the filter candles. The filtered polymer melt exits through the side walls downstream of the distributor into the drain zone of the filter chamber and then into a drain from the filter chamber. The polymer melt is fed to the filter device via a pump. Stacked disk filters can also be used instead of filter candles.

[0005] Both filter means of the duplex filter device are always operated alternately, so that in the event of contamination of the one filter chamber with the contaminated large-area filter, it is possible to switch to the other filter chamber having the other large-area filter which is clean. This ensures continuous operation at all times.

[0006] For changing over from the one filter means to the other filter means, the valves in the inlet and drain are switched accordingly. The valve in the inlet to the filter chamber containing the contaminated large-area filter is closed, as is the drain valve in the drain from the filter chamber containing the contaminated large-area filter. At the same time, the inlet valve to the other filter chamber containing the clean large-area filter is opened, as is the drain valve in the drain from the filter chamber containing the clean large-area filter. The polymer melt in the filter chamber containing the contaminated large-area filter is drained via a drain valve in the inlet. The entire filter chamber containing the contaminated large-area filter is then removed from the filter device, or the filter chamber is opened and the distributor with the filter candles is removed and taken away for cleaning. Depending on the polymer type, pyrolysis processes, chemical solutions, ultrasonic baths and high-pressure cleaners are used for cleaning, which remove the plastic and the filtered-out foreign matter from the side walls of the filter candles.

[0007] A drawback of the method for operating the prior art filter devices, however, is that, because of the unused parallel filter unit of the duplex filter device, the total filter surface is always twice as large as is used in a basic mode of operation of the duplex filter device. As a result, investment costs are very high and capital is tied up. Cleaning is also very labor-intensive and time-consuming, especially if the filter means has to be transported to a specialist company for cleaning. The cleaning processes required to date are also disadvantageous from an environmental point of view.

[0008] It is the object of the invention, therefore, to further develop a method for operating a filter device of the type specified in the preamble of claim **1** in such a way that the efficiency of the filter device is increased and continuous operation is nevertheless ensured, whilst avoiding the above mentioned drawbacks.

[0009] This object is accomplished for the method for operating a filter device by the characterizing features of claim **1** in conjunction with the features of its preamble.

[0010] The dependent claims relate to advantageous further embodiments of the invention.

[0011] The invention is based on the insight that parallel operation of both filter chambers reduces the total filter surface and thus the overall size of a duplex filter device to half the amount, yielding a considerable cost advantage, and, upon contamination of one large-area filter, filtering is continued using only one large-area filter, whilst the other one is being cleaned by backflushing it with the polymer melt already filtered in the other large-area filter. Continuous operation is also maintained during backflushing.

[0012] The invention therefore provides for polymer melt to be filtered to be fed simultaneously to both the first large-area filter and the second large-area filter in the filter direction. Parallel and simultaneous filtering via the first and second large-area filters takes place continuously in a basic mode of operation. Filtering the polymer melt to be filtered is performed in a backflushing mode of operation using only one large-area filter. The backflushing mode of operation is initiated when both large-area filters have reached a predefined degree of contamination meaning that it is necessary to clean the first large-area filter using a backflushing mode of operation.

[0013] After cleaning the first large-area filter, the second large-area filter can be cleaned by backflushing. Backflushing one large-area filter always requires backflushing of the other large-area filter.

[0014] Preferably, one large-area filter is cleaned of contaminants during the backflushing mode of operation by reversing the flow direction of the filtered polymer melt and passing it through this one large-area filter. This is a simple way of eliminating the need for complex multi-stage cleaning processes, thereby increasing the efficiency of the filter device.

[0015] In particular once predetermined parameters for one large-area filter are met, the backflushing operation will be initiated for this large-area filter. These predetermined parameters are related to the degree of contamination of this large-area filter.

[0016] After cleaning one large-area filter, preferably followed by cleaning the other large-area filter, the duplex filter device is back in its basic mode of operation with parallel filter operation of both large-area filters until the backflushing parameters are met again, triggering the next backflushing cycle. Alternating between the basic and backflushing modes of operation can take place several times, which multiplies the service life of the duplex filter device.

[0017] In a particular embodiment of the invention, during the backflushing mode of operation, the inflow to this one large-area filter is interrupted, at least part of the filtered polymer melt of the other large-area filter is fed via the drain of the one large-area filter against the filter direction, is made to pass through the one large-area filter for cleaning the one large-area filter by backflushing and is then discharged. The already filtered polymer melt is thus used for cleaning the contaminated large-area filter. The filtered polymer melt, which then absorbs the contaminants from the large-area filter, is discharged and disposed of.

[0018] For discharging the contaminated polymer melt from the one large-area filter, the valve arranged in the inlet area can be opened, and the polymer melt filtered by the other large-area filter and then backflushed through the one large-area filter can be discharged via the valve.

[0019] Preferably, in the backflushing mode of operation, at least 1 time, preferably 1.5 times, preferably 2 times the volume of the filter chamber of the one large surface filter is discharged via the valve in the inlet. A predetermined quantity of backflushed polymer melt is used to ensure sufficient cleaning of the large-area filter.

[0020] In order to ensure that the polymer melt is also conveyed continuously in the backflushing mode of operation, the drain of this one large-area filter is partially closed via the associated drain valve for backflushing, for example by ⅔, by ⅓ or by ½, so that only part of the filtered polymer melt from the other large-area filter is fed to the one large-area filter for cleaning.

[0021] The cleaning effect in the backflushing mode of operation can be improved by briefly opening and closing the inlet valve or the drain valve of the one large-area filter, thus causing filtered polymer melt to flow through the one large-area filter, preferably several times in intervals, in particular intermittently.

[0022] Preferably, the polymer melt to be filtered is a low-viscosity polymer melt of 100 mPas, for example, which in particular comprises plastic raw materials, preferably molten plastics from chemical recycling.

[0023] Large-area filters with a filter rating of up to 3 μm can be used. This filters out particularly small contaminants from the polymer melt.

[0024] A method according to the invention preferably uses large-area filters having a filter surface of between 45 m^2 and 255 m^2.

[0025] The method according to the invention in particular uses large-area filters for differential pressures of between 1 bar and 100 bar.

[0026] For determining the degree of contamination on the large-area filter, the predetermined parameters for a large-area filter for the backflushing mode of operation are constituted by the pressure in the polymer melt to be filtered upstream of the large-area filter. Alternatively or additionally, the predetermined parameters can also be constituted by the differential pressure prevailing in the polymer melt to be filtered upstream of the large-area filter and in the filtered polymer melt downstream of the large-area filter. Pressure measurement is a particularly suitable means of determining the degree of contamination of the large-area filter, as the large-area filters become increasingly clogged over time, which directly affects the pressure increase upstream of the large-area filter and the differential pressure. This makes it easy to determine the degree of contamination and initiate the backflushing mode of operation, if necessary.

[0027] It is also possible for the predetermined parameters to be constituted by the operating time of a large-area filter. The predetermined operating time reflects in particular the experience with polymer melts to be filtered, namely how long on average it takes for a large-area filter to become contaminated.

[0028] In the method according to the invention, there is a laminar flow in the filter direction through the large-area filter in the basic mode of operation, and a pulsed flow against the filter direction through the large-area filter in the backflushing mode of operation.

[0029] Preferably, the pressure in the polymer melt on the drain side of the filter chamber to be backflushed is generated in a backflushing mode of operation by a melt pump arranged downstream of the drain side of the filter chambers.

[0030] On the drain side of the filter chamber to be backflushed, there is a higher pressure in the polymer melt in the backflushing mode of operation compared to the differential pressure on the large-area filter shortly before the backflushing mode of operation is initiated.

[0031] The pressure in the polymer melt on the drain side of the filter chamber with the large-area filter to be backflushed can be created in the backflushing mode of operation by pipelines and/or system components arranged downstream thereof, such as a throttle or a melt pump.

[0032] For example, it is then possible to completely close the throttle arranged downstream of the large-area filter in a backflushing mode of operation and use the entire filtered polymer melt from the first large-area filter for backflushing the second large-area filter.

[0033] In particular, the filter device for carrying out a method comprises: a first filter chamber in which a first large-area filter is located and a second filter chamber in which a second large-area filter is located; a first inlet including a first inlet valve to the first filter chamber; a second inlet including a second inlet valve to the second filter chamber; a first drain from the first filter chamber; a second drain from the second filter chamber; a first drain valve in the first drain and a second drain valve in the second drain. Preferably, the inlet and drain valves are designed to be hydraulically and/or electrically actuated, and a control device is provided which controls the inlet and drain valves for setting the basic mode of operation and for setting the backflushing mode of operation.

[0034] Pressure sensors can be provided upstream and downstream of the filter chambers for determining the pressure in the polymer melt, which may be necessary to determine the degree of contamination of a large-area filter in the respective filter chamber.

[0035] More specifically, pressure sensors for determining the pressure in the polymer melt can be provided upstream and downstream of the large-area filter in the melt lines, thus allowing detection of the differential pressure acting on the large-area filter.

[0036] In one embodiment of the invention, the filter surface of the large-area filter in the filter chamber comprises stacked disk filters or filter candles.

[0037] To simplify manufacture and maintenance, the respective filter chambers, large-area filters, inlet valves and/or drain valves are all identical in design.

[0038] For example, a melt pump can be arranged in a common drain line and/or in the left- and right-hand drain lines, which can be used to control both the basic and the backflushing modes of operation.

[0039] Additional advantages, features and possible applications of the present invention will be apparent from the description which follows, in which reference is made to the embodiments illustrated in the drawings.

[0040] Throughout the description, the claims and the drawings, those terms and associated reference signs are used as are stated in the list of reference signs below. In the drawings,

[0041] FIG. **1** is a schematic view of the filter device according to a first embodiment of the invention, in the basic mode of operation;

[0042] FIG. **2** is a schematic view of the filter device of FIG. **1**, in the backflushing mode of operation;

[0043] FIG. **3** is a schematic view of the filter device of FIG. **1**, in a prior art mode of operation;

[0044] FIG. **4** is a schematic view of the filter device of a second embodiment of the invention, in the basic mode of operation;

[0045] FIG. **5** is a schematic view of the filter device of FIG. **4**, in the backflushing mode of operation;

[0046] FIG. **6** is a schematic view of the filter device of a third embodiment of the invention, in the basic mode of operation;

[0047] FIG. **7** is a schematic view of the filter device of FIG. **6**, in the backflushing mode of operation;

[0048] FIG. **8** is a schematic view of the filter device of a fourth embodiment of the invention, in the basic mode of operation;

[0049] FIG. **9** is a schematic view of the filter device of FIG. **8**, in the backflushing mode of operation; and

[0050] FIG. **10** is a schematic view of the filter device in a fifth embodiment of the invention in its basic operation mode.

[0051] Illustrated in FIGS. **1** to **2** is a filter device **10** for polymer melts to be filtered, according to a first embodiment of the invention. The filter device **10** comprises a left-hand filter chamber **12** and a right-hand filter chamber **14**. The lower region **12***a* of filter chamber **12** and the lower region **14***a* of filter chamber **14** are each designed as a distributor. An inlet line **16**, **18** is connected to the lower region **12***a*, **14***a*, with the left inlet line **16** ending in the lower region **12***a* of the left-hand filter chamber **12**, and the right inlet line **18** ending in the lower region **14***a* of the right-hand filter chamber **14**.

[0052] On the side of the inlet line **16**, **18** remote from the filter chamber **12**, **14**, these lines are connected to a common inlet line **20**. In the region of the common inlet line **20**, the left inlet line **16** has a left-hand shut-off valve **22** and the right-hand inlet line **18** has a right-hand shut-off valve **24**. The left-hand shut-off valve **22** can be used to control the flow of polymer melt to be filtered to the left-hand filter chamber **12**, and the right-hand shut-off valve **24** can be used to control the flow of polymer melt to be filtered to the right-hand filter chamber **14**.

[0053] A left-hand drain valve **26** is connected downstream of the left-hand shut-off valve **22** and a right-hand drain valve **28** is connected downstream of the right-hand shut-off valve **24** in the direction of flow of the polymer melt in a basic mode of operation. Polymer melt can be discharged from the respective inlet line **16**, **18** as required via the left and right drain valves **26**, **28**.

[0054] In the left-hand filter chamber **12**, a left-hand large-area filter **30** with a plurality of filter candles **30***a* is arranged. A right-hand large-area filter **32** with a plurality of filter candles **32***a* is arranged in the right-hand filter chamber **14**. The filter candles **30***a*, **32***a* are aligned vertically parallel to one another and end in the upper region in a left distributor **34** or a right distributor **36**, resp. Each large-area filter comprises, for example, 169 filter candles.

[0055] The filter candles **30***a* end in the left distributor **34**, so that the polymer melt made to pass through the filter candles **30***a* from the outside to the inside is merged in the left-hand distributor **34** and discharged via a left-hand drain line **38** connected to the top of the filter chamber **12**.

[0056] The filter candles **32***a* end in the right-hand distributor **36**, so that the polymer melt made to pass through the filter candles **32***a* from the outside to the inside is merged in the right-hand distributor **36** and discharged via a right-hand drain line **40** connected to the top of the filter chamber **14**.

[0057] The left-hand drain line **38** and the right-hand drain line **40** merge into a common drain line **42**.

[0058] Upstream of the common drain line **42**, the left-hand drain line **38** has a left-hand shut-off valve **44** installed therein, and the right-hand drain line **40** has a right-hand shut-off valve **46** installed therein. The left-hand shut-off valve **44** and the right-hand shut-off valve **46** can be used to shut off and open the left-hand drain line **38** and the right-hand drain line **40**, respectively.

[0059] A left-hand vent valve **48** is connected upstream of the left-hand shut-off valve **44** in relation to the flow direction of the polymer melt in the basic mode of operation. In the same way, a right-hand vent valve **50** is connected upstream of the right-hand shut-off valve **46** in relation to the flow direction of the polymer melt in the basic mode of operation. These vent valves can be used to vent the respective side of the filter device **10**.

[0060] The polymer melt to be filtered is forced through the large-area filters **30**, **32** in the filter chambers **12**, **14** to the common drain line **42** by a melt pump (not shown in detail in the figures) or by melt pressure caused by the process and acting on the common inlet line **20**, and is thus conveyed through the filter device **10**. There are different pressures prevailing in the polymer melt upstream and downstream of the large-area filter **30**, **32**. To detect this differential pressure, pressure sensors **56** are provided upstream of the respective large-area filter **39**, **32**, and pressure sensors **58** are provided downstream of the respective large-area filter **30**, **32**.

[0061] Both sides of the filter device **10** have the same components, i.e. filter chamber **12** corresponds to filter chamber **14**, large-area filter **30** corresponds to large-area filter **32**, etc.

[0062] Filter ratings of up to 3 μm are used for the large-area filter **30**, **32**. Preferably, the filter surface of one large-area filter **30**, **32** is in a range of between 45 m^2 and 255 m^2. The differential pressures acting on the large-area filter **30**, **32** are between 1 bar and 100 bar.

[0063] In a basic mode of operation, polymer melt to be filtered is fed simultaneously to both the left large-area filter **30** and the right large-area filter **32** in the filter direction, as indicated by the arrows **52** in FIG. **1**. Parallel filtering is thus performed continuously by the left- and right-hand large-area filters **30**, **32**. The basic mode of operation is illustrated in FIG. **1**.

[0064] In this case, the left-hand shut-off valve **22** in the left-hand inlet line **16** and the right-hand shut-off valve **24** in the right-hand inlet line **18** as well as the left-hand shut-off valve **44** in the left-hand drain line **38** and the right-hand shut-off valve **46** in the right-hand drain line **40** are all open. Via the common inlet line **20**, the polymer melt to be filtered flows in equal proportions into the left-hand inlet line **16** and the right-hand inlet line **18**.

[0065] From the left-hand inlet line **16**, the polymer melt to be filtered contained in the distributor **12*a*** spreads into the filter chamber **12** and penetrates the filter wall of the filter candles **30*a***. The now filtered polymer melt from the filter candles **30*a*** is recombined via the distributor **34** and flows via the left-hand drain line **38** through the open left-hand shut-off valve **44** into the common drain line **42**.

[0066] In the same way, the polymer melt to be filtered supplied through the right-hand inlet line **18** in the distributor **14*a*** flows into the filter chamber **14** and penetrates the filter wall of the filter candles **32*a***. The now filtered polymer melt from the filter candles **32*a*** is recombined via the distributor **36** and flows via the right-hand drain line **40** through the open right-hand shut-off valve **46** into the common drain line **42**.

[0067] Illustrated in FIG. **2** is a backflushing mode of operation, namely the backflushing and thus cleaning of the right-hand large-area filter **32**. By reversing the flow direction of the filtered polymer melt and passing the polymer melt through the right-hand large-area filter **32**, the filter is cleaned of contaminants using filtered polymer melt. In the backflushing mode of operation, filtration continues using only the left-hand large-area filter **30**. During backflushing and thus cleaning of the left-hand large-area filter **30**, the polymer melt is filtered by means of the right-hand large-area filter **32** only.

[0068] The backflushing mode of operation is initiated as soon as the two large-area filters **30** and **32** have reached a predefined degree of contamination, i.e. it has become necessary to clean the large-area filters **30**, **32** using a backflushing mode of operation.

[0069] In the example illustrated in FIG. **2**, such a level of contamination has been reached and the backflushing mode of operation for the right-hand large-area filter **32** is initiated.

[0070] For initiating the backflushing mode of operation on the right-hand side, the right-hand shut-off valve **24** is first closed, thus blocking the right-hand inlet line **18**. The right-hand shut-off valve **46** is closed next, blocking the right-hand drain line **40**. Subsequently, the right-hand drain valve **28** is opened, allowing polymer melt to exit from the right-hand inlet line **18**. The right-hand shut-off valve **46** is then opened again so as to cause backflushing through the right-hand large-area filter **32**. The opening and closing of the right-hand shut-off valve **46** can take place at predetermined time intervals, resulting in a pulsating backflushing mode of operation. Alternatively, the shut-off valve **46** can also be open during the entire backflushing process, causing a laminar flow of the backflushed polymer melt through the right large-area filter **32**.

[0071] Once backflushing has been completed, the right-hand drain valve **28** is closed and then the right-hand shut-off valve **24** is opened. The filter device **10** is now back in its basic mode of operation.

[0072] In the backflushing mode of operation of the right-hand large-area filter **32**, the flow direction of the filtered polymer melt is reversed and the filtered polymer melt is passed through the right-hand large-area filter **32** and thus cleaned of contaminants. The polymer melt is filtered exclusively via the left large-area filter **30**. The filtered polymer melt is made to flow against the filter direction as indicated by the arrow **54** for as long as required to fully clean the large-area filter **32** with its filter candles **32*a***. In doing so, 1 to 2 times the volume of the right-hand filter chamber **14** is discharged as a rule.

[0073] Once the backflushing mode of operation of the right-hand large-area filter **32** has been completed and the basic mode of operation has been restarted, the backflushing mode of operation is automatically initiated for the left-hand large-area filter **30**.

[0074] To initiate the backflushing mode of operation on the left-hand side, the left-hand shut-off valve **22** is first closed, thus blocking the left-hand inlet line **16**. The left-hand shut-off valve **44** is then closed, blocking the left-hand drain line **38**. Subsequently, the left-hand drain valve **26** is opened, allowing polymer melt to exit from the left-hand inlet line **16**. The left-hand shut-off valve **44** is then reopened, causing backflushing through the left-hand large-area filter **30**. Opening and closing of the left-hand shut-off valve **44** can take place at predetermined time intervals, resulting in a pulsating backflushing mode through the left large-area filter **30**. Alternatively, the shut-off valve **44** can also be open for the entire backflushing operation, causing the backflushed polymer melt to pass through the left-hand large-area filter **30** in a laminar flow.

[0075] During backflushing of the left large-area filter **30**, the polymer melt is filtered exclusively via the right large-area filter **32**. The filtered polymer melt is made to flow against the filter direction as indicated by the arrow **54** for as long as it takes to fully clean the large-area filter **30** with its filter candles **30*a***. In doing so, 1 or 2 times the volume of the left filter chamber **12** is discharged as a rule.

[0076] Once the left-hand large-area filter **30** has been cleaned, the backflushing mode of operation and thus a backflush cycle, in which both large-area filters **30** and **32** are cleaned the one after the other, is terminated and the basic mode of operation, as described above, starts again.

[0077] The backflushing cycle is initiated as soon as predetermined parameters for the backflushing mode of operation have been met. These parameters can be constituted by the pressure prevailing in the polymer melt to be filtered upstream of the large-area filter **30**, **32**, which is detected by the pressure sensor **56**. In addition or alternatively, these parameters can be constituted by the differential pressure which prevails in the polymer melt to be filtered upstream of the large-area filter **30**, **32** and in the filtered polymer melt downstream of the large-area filter, which pressure is measured in each case by the pressure sensors **56** and **58**. In addition and alternatively, the parameters can also be constituted by the operating time since commissioning and/or the last backflushing for this large-area filter **30**, **32**.

[0078] The shut-off valves **22**, **24** in the inlet lines **16**, **18**, the drain valves **26**, **28** in the inlet lines **16**, **18**, the shut-off valves **44**, **46** in the drain lines **38**, **40** and the vent valves **48**, **50** in the drain lines **38**, **40** are hydraulically and/or electrically actuated and are controlled by a control device **60**. For this purpose, the control unit **60** is connected to corresponding actuators. For reasons of clarity, the line connections and the valve actuators are not shown. In addition, the control device **60** is connected to the pressure sensors **56** and **58** to detect the respective pressures in the polymer melt.

[0079] As has already been explained, instead of a constant setting of the shut-off valve **44**, **46** in the backflushing mode of operation in the drain line **38**, **40**, for example ⅓ closed, an intermittent flow of filtered polymer melt through this large-area filter **30**, **32** can be caused by continuously opening and closing the shut-off valve **44**, **46** in the drain line **38**, **40** of the large-area filter **30**, **32** to be backflushed for a short time. Both the basic and the backflushing modes of operation are controlled via the control unit.

[0080] Illustrated in FIGS. **4** and **5** is yet another embodiment of the invention. It essentially corresponds to the embodiment described with reference to FIGS. **1** and **2**. Therefore, the same reference signs were used to designate the same parts. The only difference is that an adjustable throttle **62** is installed in the common drain line **42**. FIG. **4** shows the basic mode of operation, and FIG. **5** shows of the backflushing mode of operation on the right-hand side. In the backflushing mode of operation on the right-hand side, the adjustable throttle **62** is used to ensure that the pressure upstream of the throttle **62** increases and the polymer melt is thus backflushed into the right-hand large-area filter **32**.

[0081] Illustrated in FIGS. **6** and **7** is yet another embodiment of the invention. It essentially corresponds to the embodiment described with reference to FIGS. **1** and **2**. Therefore, the same reference signs were used to designate the same parts. The only difference is that an adjustable throttle **64** is installed in the common drain line **42**. FIG. **6** shows the basic mode of operation and FIG. **7** shows the backflushing mode of operation on the right-hand side. In the backflushing mode of operation on the right-hand side, the adjustable throttle **64** is used to ensure that the pressure upstream of the throttle **64** increases and the polymer melt is thus backflushed into the right-hand large-area filter **32**.

[0082] Illustrated in FIGS. **8** and **9** is yet another embodiment of the invention. It essentially corresponds to the embodiment described with reference to FIGS. **1** and **2**. Therefore, the same reference signs were used to designate the same parts. The only difference is that a controllable left-hand melt pump **66** is installed in the left-hand drain line **38**, and a controllable right-hand melt pump **68** is installed in the right-hand drain line **40**. FIG. **8** shows the basic mode of operation, and FIG. **9** shows the backflushing mode of operation on the right-hand side. In the backflushing mode of operation on the right-hand side, the controllable melt pumps **66** and **68** are used to ensure that the polymer melt is backflushed into the right-hand large-area filter **32**.

[0083] FIG. **10** shows yet another embodiment of the invention. It essentially corresponds to the embodiment described with reference to FIGS. **1** and **2**. Therefore, the same reference signs were used to designate the same parts. The view illustrates a backflushing mode of operation with the throttle **62** closed, whereby the entire cleaned polymer flow from the left large-area filter **30** flows into the right large-area filter **32** and flows backwards through it for cleaning.

[0084] The invention is characterized by providing a simple way of using already filtered polymer melt for cleaning large-area filters **30**, **32**. This cuts costs significantly, and the size of the filter device **10** can be reduced considerably by running both large-area filters **30**, **32** simultaneously in a basic mode of operation.

LIST OF REFERENCE SIGNS

[0085] **10** filter device
[0086] **12** left-hand filter chamber
[0087] **12*a*** lower region of left-hand filter chamber **12**
[0088] **14** right-hand filter chamber
[0089] **14*a*** lower region of right-hand filter chamber **14**
[0090] **16** left-hand inlet line
[0091] **18** right-hand inlet line
[0092] **20** common inlet line
[0093] **22** left-hand shut-off valve
[0094] **24** right-hand shut-off valve
[0095] **26** left-hand drain valve
[0096] **28** right-hand drain valve
[0097] **30** left-hand large-area filter
[0098] **30*a*** filter candle of left-hand large area filter **30**
[0099] **32** right-hand large-area filter
[0100] **32*a*** filter candle of right-hand large-area filter **32**
[0101] **34** left-hand distributor
[0102] **36** right-hand distributor
[0103] **38** left-hand drain line
[0104] **40** right-hand drain line
[0105] **42** common drain line
[0106] **44** left-hand shut-off valve
[0107] **46** right-hand shut-off valve
[0108] **48** left-hand vent valve
[0109] **50** right-hand vent valve
[0110] **52** arrows indicating the polymer melt flow direction in basic operation
[0111] **54** arrows indicating the polymer melt flow direction in backflushing operation
[0112] **56** pressure sensors upstream of large-area filter **30**, **32**
[0113] **58** pressure sensors downstream of large-area filter **30**, **32**
[0114] **60** control device
[0115] **62** adjustable throttle
[0116] **64** controllable melt pump
[0117] **66** controllable left-hand melt pump
[0118] **68** controllable right-hand melt pump

1. A method for operating a filter device for polymer melt to be filtered, comprising at least one first large-area filter, which has a plurality of filter elements in a first filter chamber, and a first drain line for the filtered polymer melt from the first filter chamber, the polymer melt to be filtered being conveyed under pressure through the filter device, wherein, during a basic mode of operation, polymer melt to be filtered is fed to the first large-area filter in the filter direction, and filtering is continuously performed via the first large-area filter, in that, during a backflushing mode of operation, at least one filter element is cleaned of contaminants and backflushed by reversing the flow direction of the filtered polymer melt and passing it through the filter element.

2. A method according to claim **1**, wherein, during the backflushing mode of operation, the basic mode of operation is also active.

3. A method according to claim **1**, wherein the backflushing mode of operation is on when the basic mode of operation is off, and vice versa.

4. A method according to claim **1**, wherein a plurality of filter elements are backflushed simultaneously in the backflushing mode of operation.

5. A method according to claim **1**, wherein the backflushing operation is started when the large-area filter has reached a predetermined degree of contamination, meaning that the large-area filter needs to be cleaned by a backflushing mode of operation.

6. A method according to claim **1**, wherein, in particular immediately following the backflushing of the at least one filter element or of the plurality of filter elements, at least one other filter element is backflushed or a plurality of other filter elements are backflushed.

7. A method according to claim **6**, wherein the changeover from the at least one filter element to the other filter element, or from the plurality of filter elements to the other filter elements, takes place as a function of the pressure upstream of the one or plural backflushed filter element, of the volume of the filtered melt passed through during backflushing, and/or as a function of the time.

8. A method according to claim **1**, wherein the polymer melt to be discharged during backflushing is discharged via a backflushing device which can be connected as required to the one or plural filter element to be backflushed.

9. A method according to claim **1**, wherein, in the backflushing mode of operation, the filtered polymer melt flows intermittently and in intervals through the one or plural filter element.

10. A method according to claim **1**, characterized in that the backflushing operation in the large-area filter is terminated when all the filter elements of the large-area filter have been backflushed.

11. A method according to claim **1**, wherein at least one second large-area filter with a second filter chamber is provided, with a second inlet line to the second filter chamber for controlling the polymer melt to be filtered, with a second drain line for the filtered polymer melt from the second filter chamber, wherein the first inlet line and the second inlet line are connected to a common inlet line, and the first drain line and the second drain line are connected to a common drain line, wherein, in the basic mode of operation, both the first large-area filter and the second large-area filter are simultaneously supplied with polymer melt to be filtered in the filter direction, and parallel filtering is performed continuously via the first and second large-area filters.

12. A method according to claim **11**, wherein the backflushing mode of operation is carried out on only one of the two large-area filters.

13. A method according to claim **11**, wherein no additional polymer melt to be filtered is fed to the large-area filter in which the backflushing operation takes place, but only to the other large-area filter, so that the one large-area filter is in the basic mode of operation, and in the other large-area filter only the backflushing mode of operation is active.

14. A method according to claim **11**, wherein, after cleaning the first large-area filter by running a backflushing mode of operation on it, the backflushing mode of operation is started on the second large-area filter.

15. Filter A filter device, comprising: a first filter chamber in which a first large-area filter with a plurality of filter elements is located, a first inlet line to the first filter chamber, a first drain line from the first filter chamber, characterized in that a backflushing device is provided, which can be connected as required to an inlet side of a single filter element or to inlet sides of a plurality of filter elements, via which the filtered and backflushed polymer melt can be discharged from the filter chamber during a backflushing mode of operation, the filter device carrying out a method wherein during a basic mode of operation, polymer melt to be filtered is fed to the first large-area filter in the filter direction, and filtering is continuously performed via the first large-area filter, in that, during a backflushing mode of operation, at least one filter element is cleaned of contaminants and backflushed by reversing the flow direction of the filtered polymer melt and passing it through the filter element.

16. A filter device according to claim **15** wherein the backflushing device is designed to be rotatable with respect to the large-area filter.

17. A filter device according to claim **15**, wherein the large-area filter is designed to be rotatable with respect to the backflushing device.

18. A filter device according to claim **15**, wherein the backflushing device is finger-shaped and has at least one inlet port associated with a filter element.

19. A filter device according to claim **15**, wherein the backflushing device can be fluidically connected via the inlet port to an inlet side of a filter element, or to plural inlet sides of plural filter elements or plural inlet ports to plural inlet sides of plural filter elements.

20. A filter device according to claim **18**, wherein the large-area filter with the filter elements has an associated closed parking area on the inlet side to the filter element and the backflushing device, in which parking area the backflushing device is arranged when no backflushing operation is running, in which case the inlet port is closed or the inlet ports are closed and/or the region on the feed side between filter elements, that are arranged at a distance from one another in the direction of movement of the large-area filter and/or the backflushing device, is of a closed design, so that the inlet port or the inlet ports of the backflushing devices are closed during the relative movement of the backflushing device with respect to the large-area filter from one backflushing process to the next.

21. A filter device according to claim **15**, wherein the backflushing device is designed and controllable in such a way that the filter element that has just been backflushed is no longer connected to the backflushing device when the filter element to be backflushed next, or the filter elements to be backflushed next, are connected to the backflushing device.

22. A filter device according to claim **15**, wherein the backflushing device and the large-area filter interact with a rotary actuator each, or that either the backflushing device or the large-area filter interacts with a rotary actuator.

23. A filter device according to claim **15**, wherein the backflushing device includes a shut-off valve which can be used to close and release a drain port via which the backflushed polymer melt can be discharged, and/or interacts with a pump, which is used to convey out the polymer melt conveyed during backflushing via the backflushing device.

24. A filter device according to claim **15**, wherein the backflushing device includes an adjustable and/or connectable throttle.

25. A filter device according to claim **15**, wherein pressure sensors are provided for determining the pressure prevailing in the polymer melt, in particular upstream and downstream of the filter chamber, and/or upstream of the large-area filter and downstream of the large-area filter each in the filter chamber.

26. A filter device according to claim **15**, wherein a second filter chamber is provided, in which a second large-area filter with a plurality of filter elements is located, and that a second inlet line to the second filter chamber, a second drain line from the second filter chamber are provided.

27. A filter device according to claim **15**, wherein a filter element is constituted by a filter candle through which the polymer melt to be filtered flows, in particular from the inside to the outside, during the basic mode of operation.

28. A filter device according to claim **15**, wherein all the filter chambers, the large-area filters, the drain lines and/or the drainage valves are each of identical construction.

29. A filter device according to claim **15**, wherein a melt pump is arranged in a common drain line or in the left and right drain lines.

30. A filter device according to claim **15**, wherein a throttle, in particular an adjustable and/or connectable throttle, is arranged in a common drain line or in the first and second drain lines.

31. A filter device according to claim **15**, wherein the valves and/or the rotary actuator are designed to be hydraulically and/or electrically actuated, that a control device is provided, which controls the valves, the rotary actuator, the melt pump, the throttle and/or the backflushing device for setting the basic and backflushing modes of operation, respectively.

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