

Pipework arrangement for a filtration system

Technical field

The invention relates to a pipework arrangement for a filtration system for filtering liquids.

Background art

5 Various filter systems are known which, for example, filter fluids for industrial purposes and drain away the filtered fluid again. Since a large amount of filtrate often has to be provided for industrial purposes, it is advantageous to use several filter modules and thereby increase the amount of filtrate. Such a filter system is, for example, disclosed in WO 2013/048801 A1. This comprises a filter module arrangement comprising a container
10 with a filter cartridge disposed therein and a collector coupled to one end of the container, the head containing a housing with an open top end and a bottom end and an end cap. A portion fitting onto a complementary structure, which is defined by the interior of the entire open top end of the housing, so that it removably engages the housing and end cap defines a passage through which liquid can flow out of the container. The filter module
15 arrangement allows for a manifold arrangement used to convey fluids to and from a filtration system that comprises several of such modules. The disadvantage, however, is that the pipework for discharging the liquid is and must be arranged at a distance from the filter cartridge, because otherwise there is a risk of the filter being damaged by the flow. This is also the case when dead-end filters are to be cleaned, i.e., flow-through filters
20 that occupy the entire cross-section of the feed pipe and where there is no transverse pipe that then removes the filtered components from the filter by means of a side flow. Because during cleaning, the fluid flow is reversed and the filter is “washed through” in the opposite direction. So, when the cleaning fluid is pressed into the filter from the opposite direction, this is also heavily stressed. For this reason, the pipe for discharging
25 the liquid must be further away from the filter, which is why the filter system requires a relatively large amount of space.

Presentation of the invention

The object of the invention is to provide a space-saving filter module in which damage to the filter by the flow suction of the main flow pipe is avoided at the same time. This object is achieved by a pipework arrangement according to claim 1. Further features embodying the invention are contained in the dependent claims.

5 A pipework arrangement according to the invention for a filtration system for filtering liquids comprises at least one feed pipe having a filter through which the fluid transported in the feed pipe is filtered and which splits the feed pipe into a raw fluid region and a filtrate region, wherein the feed pipe in the filtrate region has an outlet portion formed by one or more outlet openings in a pipe wall of the feed pipe, a filtrate collector pipe, which receives
10 and drains away the filtrate from the filtrate region of the feed pipe, wherein the filtrate collector pipe is arranged at the level of the filtrate region of the feed pipe; and a connecting element, which connects the filtrate collector pipe to the outlet portion of the feed pipe, wherein the filtrate passes from the filtrate region through the connecting element into the filtrate collector pipe, and wherein the connecting element has a gap
15 region and the outlet openings are provided exclusively in the gap region. On the one hand the arrangement of the filtrate collector pipe in the filtrate region saves space, and on the other hand the filter is protected, by the connecting element by means of shielding the outlet openings, from the flow in the filtrate collector pipe or from the flow when cleaning the filter by rinsing in the opposite direction.

20 The flow direction of the fluid in the filter collector pipe at the connecting element is preferably arranged transversely, in particular perpendicularly, to the filtrate region of the feed pipe. This allows for a space-saving arrangement for a plurality of pipework arrangements.

The outlet portion encloses at least a quarter of the circumference of the filtrate region, in
25 particular half or three quarters.

The connecting element can be designed integrally both with the filtrate region of the feed pipe and with the filtrate collector pipe. However, it is particularly preferred if the

connecting element is designed as separate element. As a result, the connecting element can be adapted more easily for different embodiments of the invention (e.g., symmetrical, asymmetrical).

5 The feed pipe may further comprise a plurality of filtrate portions each connected in series to the filtrate collector pipe. This increases the throughput of filtrate production. The filtrate regions can be connected to just one or more raw fluid feed pipes in order to convey the raw fluid to the filters and the filtrate regions.

10 The cross-section of the filtrate collector pipe preferably overlaps with the filtrate region of the feed pipe, in particular in such a way that the central axes of the filtrate collector pipes and the feed pipe intersect. As a result, the space required for the filter system can be further reduced.

In particular, the outlet portion of the filtrate region is arranged adjacent to the filter. This also allows for further reducing the space requirement because the filtrate can be discharged immediately after filtering.

15 The pipework arrangement can also comprise at least one second filtrate collector pipe and a second outlet portion, which is arranged at a distance from the first outlet portion in the filtrate region, the second filtrate collector pipe being connected to the second outlet portion. As a result, the throughput can be increased, or the filtrate collector pipes can be designed with a smaller diameter, which in turn supports a more compact design.

20 The pipework arrangement also preferably comprises at least one second filtrate collector pipe, which is connected to the outlet portion via the connecting element of the first filtrate collector pipe.

The gap region of the connecting element preferably tapers at least at the outlet portion. The taper is designed in particular towards the filter so that the majority of the filtrate is
25 drained further away from the filter into the filtrate collector pipe and the filter is subjected to a lower flow force.

At least a part of the recesses at the outlet portion can be designed in the form of slots.

The outlet opening or the outlet openings in the filtrate region is/are preferably offset inwards. This facilitates assembly and attachment of the connecting element.

Brief description of the drawings

Figure 1a shows an isometric view of a cross-section through the connecting element and
5 through the outlet portion of an embodiment of the invention;

Figure 1b shows a longitudinal section through the connecting element and through the outlet portion of Figure 1a;

Figure 1c shows a cross-section through the connecting element and through the outlet portion of Figure 1a;

10 Figure 2 shows an isometric view of a cross-section through the connecting element and through the outlet portion of an embodiment of the invention;

The Figures 3a and 3b show an isometric view of a feed pipe with two different outlet portions;

The Figures 4a to 4g show schematic representations of various arrangements of the raw
15 fluid region of the feed pipe and the filtrate collector pipe(s);

Figure 5a shows a schematic representation of a partial overlap of the cross-section of a filtrate collector pipe with the filtrate region of the feed pipe;

Figure 5b shows a schematic representation without overlap of the cross-section of a filtrate collector pipe with the filtrate region of the feed pipe;

20 The Figures 6a to 6d show the arrangements of the outlet portions in the feed pipe depending on the arrangement of the filtrate collector pipe;

Figure 7 shows an example of a combination of various embodiments of Figure 6a to 6d; and

The Figures 8a and 8b show arrangements of connecting elements with a different
25 number of filtrate collector pipes on a feed pipe.

Description of the preferred embodiments

A pipework arrangement 10 according to the invention comprises a feed pipe, a filtrate collector pipe 80 and a connecting element 60 that connects the feed pipe to the filtrate collector pipe 80. The feed pipe comprises a raw fluid line 12 in which the unfiltered fluid such as water is transported to the filter portion 40 of the feed pipe. In the filter portion,
5 the raw fluid is then filtered through the filter 20 and brought into the filtrate region 40. The feed pipe may comprise one or also more raw fluid lines 12 which are then attached to one or more filtrate regions 40. The raw fluid line 12 and also all other pipes are designed as pipework in the illustrated embodiments, which can include one or more tubes.

The filter 20 preferably comprises a plurality of wound flat membranes placed one on top
10 of each other or hollow-fiber membranes arranged next to each other through which the fluid is pressed and which then absorb the components to be filtered from the water. Hollow-fiber membranes are particularly preferred. Therefore, the filter 20 is usually provided specifically for the respective purpose and can be designed finer or coarser. In particular, a filter 20 made of a plurality of membranes is susceptible to damage from the
15 suction created by the main flow in the filtrate collector pipe header 80 or by rinsing the filter during cleaning. In the feed pipe, the filter 20 separates the raw fluid region 12 from the filtrate region 40, in which the filtered fluid is located after filtering.

The filtrate region 40 is the part of the feed pipe 10 that is arranged after the filter and from which the filtrate is then conducted into the filtrate collector pipe 60. An embodiment
20 of the filtrate region is illustrated in Figure 1. Figure 1a shows an isometric view of a cross-section through the connecting element, Figure 1b illustrates a longitudinal section in which the filter 20 is also shown, and Figure 1c is a plan view of the filter 20. At least one outlet opening 42 is provided in the filtrate region 40, through which the filtrate is drained away. In the embodiment shown in Figure 1, there are a large number of outlet openings
25 42 which are designed as slit-shaped elongated holes. However, it is also possible to provide only one larger outlet opening 42. The outlet openings 42 are preferably arranged

adjacent to the filter 20. Furthermore, several outlet openings 42 may also be provided at a greater spacing so that a filtrate region 40 can fill several filtrate collector pipes 80.

A connecting element 60 is arranged on the filtrate region 40 in the region of the outlet opening 42. The connecting element 60 connects the outlet opening 42 to the filtrate collector pipe 80. In the illustrated embodiment, the connecting element 60 is a separate element, but it may also be part of the filtrate region 40, part of the filtrate collector pipe 80, or part of the raw fluid line, and may be formed integrally therewith. In the embodiment of Figure 1, the connecting element 60 has two connecting flanges or connecting points 62 to which pipes of the filtrate collector pipe 80 can be attached. The connecting element 60 encloses the filtrate region 40 at the outlet openings 42 in such a way that a wall in front of the outlet opening(s) 42 forms a comparatively narrow gap 46. With the usual dimensions of such pipework arrangements, the gap 46 measures preferably 10 cm to 20 cm or less at the widest point, possibly only 7 cm or less. Furthermore, the gap 46 preferably tapers, in particular from the position further away from the filter 20 towards the filter, i.e., the gap is narrower in the vicinity of the filter so that, directly at the filter 20, less fluid from the filtrate region 40 can flow into the connecting element 60. The gap 46 is provided throughout the outlet openings 42. However, at the points where there is no gap, no outlet openings 42 are provided. In Figure 1a, this can be seen clearly in the connecting element 60, which has been cut open. The pipe wall 41 of the filtrate region 40, which is directed into the diameter of the connecting element 60 connected to the filtrate collector pipe 80 and in which the flow is greatest, has no outlet openings 42.

The filtrate collector pipe 80 is arranged at the level of the filtrate region 40, in particular at the level of the outlet opening 40. The filtrate collector pipe 80 preferably runs horizontally in the Figures, i.e., perpendicularly to the filtrate region 40. The filtrate collector pipe 80 takes the filtrate that emerges from the outlet openings 42 via the connecting element 60 and then drains away the filtrate for further use or storage into corresponding tanks.

Figure 2 shows another embodiment of the outlet openings 40 and the connecting element 60. The principle is the same, but the arrangement of the central axis of the filtrate collector pipe 80 and the shape of the outlet openings are different. Here, the outlet openings are designed as circular holes which, as in all other embodiments, are arranged exclusively on the sides that are not directed towards the central axis of the filtrate collector pipe 80. Here, these are two surfaces 41 (one in front, one behind) since the filtrate collector pipe 80 is arranged centrally with respect to the filtrate region 40 (the central axes of the filtrate collector pipe 80 and the filtrate region 40 intersect). Accordingly, the filtrate region 40 lies exactly in the main flow of the filtrate flowing through the filtrate collector pipe 80, and the gap between the outlet openings 42 and the connecting element 60 is only present on the sides.

Two further options for the outlet openings are illustrated in Figures 3a and 3b. In Figure 3a, the outlet openings are designed as circular holes like in Figure 2. In Figure 3b, rows of circular holes and slit-shaped elongated holes are arranged alternately, wherein circular and slit-shaped holes can be mixed alternately or arbitrarily within a row. Another difference in these designs of the outlet openings 42 is that they are offset slightly inwards. This can facilitate assembly and fastening of the connecting element 60 at a firmly defined position; it can be placed against upper and lower stops.

Various embodiments of the pipework arrangement are shown in Figures 4a to 4g, which differ in number and arrangement of the filtrate collector pipes 80 and the raw fluid feed lines 12, which are each provided at the filtrate region 40. Here, the raw fluid lines 12 are illustrated at the top and bottom, respectively. The two ends of the filtrate region 40 are each provided with a cover 30 which can also be designed integrally with the connecting element 60. The filtrate region 40 is then provided with a filter 20 both above and below. A filter 20 can also be provided for each raw fluid line 12. Figure 4a shows an arrangement in which the raw fluid line 12 of the feed pipe is at the outer ends, and the filtrate collector pipe 80 further inwards. This arrangement is an asymmetrical arrangement, as the filtrate

collector pipe 80 also rests tangentially to the filtrate region, in which case the cross-section of the filtrate collector pipe 80 overlaps the filtrate region only partially or not at all.

On the contrary, Figure 4b is arranged symmetrically because the cross-section of the filtrate collector pipe 80 completely overlaps with the filtrate region 40, in particular the two central axes of the filtrate collector pipe 80 and filtrate region 40 even intersect. Figure 4c is again an asymmetrical arrangement, and Figure 4d is a symmetrical arrangement with the filtrate collector pipe 80 being at the outer ends and the raw fluid line 12 of the feed pipe being further inwards at the filtrate region.

Only asymmetrical arrangements are illustrated in Figure 4e, 4f and 4g, each having only one filtrate collector pipe 80 (Fig. 4e), two filtrate collector pipes 80 (Fig. 4f) or three filtrate collector pipes 80 (Fig. 4g). It is obvious that these arrangements can also be designed symmetrically.

The Figures 5a and 5b show two possible designs of asymmetrical arrangements. In Figure 5a, the filtrate collector pipe 80 has an overlap with the filtrate region. On the one hand, this restricts the formation of the outlet openings 42 in the filtrate region 40 or forces a stronger formation of the connecting element 60 in order to form a sufficiently resistant protective wall for the gap. On the other hand, much less space is required, especially for larger systems. In the embodiment shown in Figure 5b, in which the filtrate collector pipe 80 passes laterally at the filtrate region with its entire cross-section, it is just the other way around. The region in which the outlet openings 42 can be formed without problems increases, but the space requirement of the system also increases. The more centrally the filtrate collector pipe 80 is arranged, the less space it requires, but the less area is provided for the outlet openings 41. It is obvious that this also applies to the symmetrical arrangement.

The Figures 6a to 6d illustrate schematic cross-sections of the portion of the filtrate region 40 in which the outlet openings 42 can be provided. These embodiments relate to the symmetrical design, in which the filtrate collector pipes 80 meet the filtrate region 40 in

the center. The dark regions are in the flow, which is why there are no outlet openings 42 at these locations or the connecting element 60 must be reinforced to prevent the flow from directly affecting the filter 20. Figure 7 shows a schematically illustrated pipework arrangement 10, which is formed from a plurality of filtrate collector pipes 80 and filtrate regions 40 of the Figures 6a to 6d.

Figure 8a shows an asymmetrical arrangement of the filtrate collector pipes 80 and the filtrate region 40 in a cross-sectional view. This asymmetrical arrangement is duplicated in Figure 8b, i.e., it is provided on both sides of the filtrate region (from a technical point of view it would then also be symmetrical).

10 List of reference numerals:

pipework arrangement 10

raw fluid line 12

filter 20

cover 30

15 filtrate region 40

tube wall without opening 41

outlet openings 42

gap 46

connecting element 60

20 connection flange 62

filtrate collector pipe 80

Claims

1. A pipework arrangement (10) for a filtration system for filtering liquids, comprising:
at least one feed pipe having a filter (20) through which the fluid transported in the feed
pipe is filtered and which splits the feed pipe into a raw fluid line (12) and a filtrate region
5 (40), wherein the feed pipe in the filtrate region (40) has an outlet portion formed by one
or more outlet openings (42) in a wall of the filtrate region (40);
a filtrate collector pipe (80), which receives and drains away the filtrate from the filtrate
region (40) of the feed pipe, wherein the filtrate collector pipe (80) is arranged at the level
of the filtrate region (40) of the feed pipe; and
10 a connecting element (60), which connects the filtrate collector pipe (80) to the outlet
portion of the feed pipe, wherein the filtrate passes from the filtrate region (40) through
the connecting element (60) into the filtrate collector pipe (80), and wherein the connecting
element (60) has a gap region (46) and the outlet openings (42) are provided exclusively
in the gap region (46).
- 15 2. The pipework arrangement (10) according to claim 1, wherein the flow direction of the
fluid in the filter collector pipe (80) is arranged at the connecting element (60) transversely
to the filtrate region (40) of the feed pipe.
3. The pipework arrangement (10) according to any of the preceding claims, wherein the
at least one outlet opening (42) encloses at least a quarter of the circumference of the
20 filtrate region (40).
4. The pipework arrangement (10) according to any of the preceding claims, wherein the
connecting element (60) is designed as a separate element.
5. The pipework arrangement (10) according to any of the preceding claims, wherein the
feed pipe further comprises a plurality of filtrate regions (40) each connected in series to
25 the filtrate collector pipe (80).

6. The pipework arrangement (10) according to any of the preceding claims, wherein the cross-section of the filtrate collector pipe (80) at least partially overlaps with the filtrate region (40) of the feed pipe.
7. The pipework arrangement (10) according to any of the preceding claims, wherein the outlet portion of the filtrate region (40) is arranged adjacent to the filter (20).
8. The pipework arrangement (10) according to any of the preceding claims, further comprising at least one second filtrate collector pipe (80) and a second outlet portion, which is arranged at a distance from the first outlet portion in the filtrate region (40), wherein the second filtrate collector pipe (80) with the second outlet portion is connected via a second connecting element (60).
9. The pipework arrangement (10) according to any of the preceding claims, further comprising at least one second filtrate collector pipe (80), which is connected to the outlet portion via the connecting element (60) of the first filtrate collector pipe (80).
10. The pipework arrangement (10) according to any of the preceding claims, wherein the gap region (46) tapers at least at the outlet portion.
11. The pipework arrangement (10) according to any of the preceding claims, wherein at least some of the outlet openings (42) are slot-shaped at the outlet portion.
12. The pipework arrangement (10) according to any of the preceding claims, wherein the feed pipe comprises a plurality of raw fluid lines (12).
13. The pipework arrangement (10) according to any of the preceding claims, wherein the outlet portion on the filtrate region (40) is offset inwards.
14. The pipework arrangement (10) according to any of the preceding claims, wherein the filter comprises hollow-fiber membranes.