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FILTER DEVICE

The invention relates to a filter device according to the preamble to the Main Claim. Such devices form part of laboratory, technical and industrial filters. They range in length from a few centimetres up to about a metre. The media may be
5 air or liquids. They are used in the manufacture of pharmaceutical products, nutrient products, high-purity water, dielectric oil, chemicals, cosmetics, solvents, galvanising solutions, resins, greases and oils, radio-active waste, paints and varnishes, inks, air and gas, vapour, acids, lique-
10 fied gases, syrup, cellulose solutions, hydraulic oils and fluids, polymers, adhesives, resins, lubricants, fuels, lubricating oils, crude water, condensate return, light oils, operating water.

According to the application, so the filter fineness may
15 range from 1 to 500 μ .

In about 80% of cases, the outside surface of the filter cartridge is the inlet surface and the inner surface constitutes the outlet surface.

In the other cases, the filter cartridge is traversed from
20 the inside outwardly such as, for example, in the case of filtering compressed air. In that case, then, the water runs

off the outer surface of the filter cartridge. If the filter is traversed from the inside outwardly, then the filter cartridge may also take the form of a filter bag which fits into a metal cartridge, the walls of which are perforated. Filter devices of this type, although in most cases without the disc-shaped adapter, are described for example in Catalogue G 120.5 G entitled "Industrial Filters" of Messrs. AMF Deutschland GmbH, Cuno Filter, 6200 Wiesbaden, Konradinstrasse. The disc-shaped adapter mentioned in the preamble to the Main Claim is used in those cases where the filter cartridges are closed at their free end. Then, the adapter holds the filter cartridges and has the necessary apertures that the medium can flow in on one side and flow out on the other.

Mostly, the filter device has a head which is separable from the adapter. However, it may also be that the adapter is in one piece with the head.

According to the application, the known filter devices may have the following disadvantages:

- a) Taking house water filtration as an example and even more so the example of germ-free filtration, the filter cartridges ought not to be touched by hand. For example, of course the pressure on the surface of beer in beer storage vats is created by pure compressed air. But also in connection with the pharmaceuticals industry, the food-stuffs production industry, etc., sterility does not play a major part. It is true that the manufacturers enclose plastic gloves with what they supply so that the filter

cartridges which are delivered sterile can remain sterile. However, it is on the one hand burdensome to put on plastic gloves but even if one puts on plastic gloves, then of course the filter cartridges can come in contact with the impure ambient air.

- b) In the case of filtration, filter cake becomes deposited on the inlet surface in course of time. Thus also in course of time the filter cartridges become exhausted. When changing the filter cartridges, no-one ever succeeds in avoiding filter cake falling from the filter cartridges into the cup. But now the filter cup has to be washed. Furthermore, it is also necessary to wash the filter cartridge, whether because one wishes to use it again or because one cannot throw it away with the filter cake clinging to it.

At the same time, the adapter will also have to be washed. Almost always the filter head will need to be washed because filter cake can also find its way into it.

This washing is extremely unpleasant. In most cases, solvent is needed which means that large volumes of solvent are involved and that the people doing the washing have to wear respiratory masks. Thus cleansing is very difficult.

- c) The filter cups not only have to withstand the pressure.

They also have to withstand attack from the media. This means that the materials for the filter cups have to be chosen not only according to the anticipated pressure. Instead, special materials will often be

required. For instance, sea water resistant quality steel will be required if it is intended to filter sea water. Naturally, the same also applies in the case of acids, lyes or other more or less aggressive media.

- d) Often it is desired to recover from the concentrated filter cake materials such as, for example, metals or rare metals. In themselves, these substances will already have become deposited in concentrated form on the filter cartridge. When changing the cartridge, however, it is inevitable that at least parts of the filter cake will float back or plop back or in some other way enter the filter cup so that concentration has to be carried out again.
- e) In the case of such materials which have to be graded as hazardous, such as for example radio-active materials, the filter cup comes in contact with them and also has to be thrown away.
- f) Because changing takes a long time, washing takes a long time and also the time involved on other jobs is considerable, the length of working time lost is also considerable. This means that filter plants have to be over-dimensioned if they are intended to operate continuously.

The object of the invention is to indicate a solution in which the above-mentioned disadvantages - according to the application - are avoided. The solution ought to be inexpensive. It is not intended to make re-thinking obligatory. In principle, it should be possible to retain the previous principle, i.e. a new type of filter cartridge need not be

necessary. The solution should also be simple and thus inexpensive.

According to the invention, this problem is resolved by the features shown in the characterising part of the Main Claim.

Thus, the filter cake never comes in contact with the filter housing and this latter can then be dimensioned only according to its mechanical loading; nor is it necessary to pay attention to its chemical properties. The time required for changing is reduced by more than the factor 10. The costs are minimal because such sleeve material and in most cases also the tube itself can already be obtained as a mass produced product. Also in cases where the inlet surface is on the inside of the filter cartridge, the invention has proved successful: for example, when filtering compressed air, the water runs off the outside of the filter cartridge and remains in the sleeve.

The effect of the features according to Claim 2 is that an absolutely tight connection exists between the adapter and the sleeve.

The features of Claim 3 make it possible to obtain a particularly simple connection in that the sealing ring does not only seal but also clamps and maintains the sleeve. In this way, a plurality of filter devices can be "converted" without additional technical complication. Certainly, the sealing ring must have sufficient retaining force that it reliably holds the sleeve even if the contents of the sleeve are heavy.

The features of Claim 4 ensure that regardless of the internal pressure, the sleeve nowhere has to accommodate peripheral stresses, which means that it can be made thinner while it is ensured that the sleeve material does not flow under the constant pressure.

By virtue of the features according to Claim 5, no longitudinal forces occur in the sleeve. The term "second end zone" refers to the effective end zone regardless of whether the sleeve extends further in any way whatsoever.

By combining the features of Claims 4 and 5, the sleeve can be made from very thin film which may be paper thin. It can then consist, for instance, of PVC, polyethylene, polypropylene or the like.

The effect of the features of Claim 6 is that the (effective) second end zone reliably rests on the bottom zone. Furthermore, the filter cartridge can then be more easily removed together with the adapter and the sleeve: first of all (with the filter housing fixed), the adapter together with the filter cartridge and the upper part of the sleeve will be held in the hand so that the part of the sleeve which is filled with filter cake can then be removed separately. If the filter head stays rigid so that the filter housing has to be unscrewed, then the reverse will apply.

The features of Claim 7 ensure that this end zone always remains closed. However, this end zone could also be closed by a band, a clip or the like, as in the case of a bag neck. However, it could be left completely open

and can be left to project open beyond the edge of the housing. It could then be sealed by the sealing device. Upon removal, then, care would have to be taken that the sleeve remained closed.

The features according to Claim 8 make it possible to see from outside what is happening in the region of the filter cartridge. For example, one can see how much filter cake has formed, what the colour is and so on. This feature has point particularly in connection with glass filter housing.

The features according to Claim 9 make it possible to avoid the sleeve tearing. This could happen particularly if the filter cake is heavy, if the filter is large and also if the tube is sufficiently long that it rests on the bottom part of the filter housing.

By reason of the features of Claim 10, it is possible to avoid an air cushion forming between the outer surface of the tube and the inner wall of the housing. This could excessively stress the sleeve material. If the sleeve material is however sufficiently capable of withstanding stresses, then the air cushion which would form if the pressure equalising device were not provided could also be used to dissipate pressure peaks in the medium.

The features of Claim 11 per se make it possible to permit the pressure equalising device to be mounted other than on the sleeve so that a quite simple and circularly cylindrical sleeve can still be used.

The features of Claim 11 further make it possible indeed to carry out pressure equalisation but then, for safety reasons, again to make the wall of the housing medium-tight by switching off the valve.

By reason of the features in Claim 12, it is possible to prevent pressure equalisation not taking place if by accident the valve has not been opened, for example, or if subsequently air cushions can form or pressure differences arise. Indeed, the porous piece lets the air in and out but continues to support the soft hose.

Preferred examples of embodiment of the invention are described hereinafter. In the accompanying drawings:

Figure 1 is a partially exploded and broken-away side view of a filter device;

Figure 2 is a view similar to that in Figure 1 but in the assembled state;

Figure 3 is a perspective view of the adapter, of the thin film sleeve fixed thereon (partially) and of the filter cartridge (partially);

Figure 4 is a partial section through a housing wall with a pressure equalising valve; and

Figure 5 is a partial section through a housing wall with an inserted porous piece.

A filter device 11 comprises substantially a head 12, an adapter 13, a cartridge 14, a sleeve of thin film-like material 16 and a cup-like housing 17. In conventional manner the head 12 serves for attachment of the

filter device 11, whether a holder is provided as with flexible supply and discharge lines or the head 12 is supported by being screwed to rigid lines, etc. At the head 12, the medium can be fed horizontally in a (not shown) connector according to the arrow 18 and discharged horizontally according to the arrow 19. There are also heads 12 wherein the feed occurs at a right-angle according to the arrow 21, discharge also taking place at a right-angle according to the arrow 22. The housing 17 is substantially rotationally symmetrical and coaxial with the geometrical longitudinal axis 23. It has a side wall 24 which has an inner face 26 and an upper marginal zone 27. In operation, there are provided on the upper marginal zone 27 means which connect the housing 17 to the head 12 in medium-tight fashion. The said means may be a screwthread and a threaded ring, or nuts with threaded bolts or the marginal zone on the head 12 may be screwthreaded. Technical possibilities may be ascertained from the catalogue mentioned at the outset. Where this attachment is concerned, also the adapter 13 is pressed against the head 12 from below, in fact likewise in a medium-tight fashion and in such a position that the apertures provided in it and as yet to be discussed are correctly aligned with the charged media fed to the filter and the cleansed media discharged from it. Except for its apertures - where they are not coaxial - the adapter 13 is substantially rotationally symmetrical. It has a circular outer face 28 which, in the assembled state, is close to the rim 27.

At the bottom of the adapter 13 is the cartridge 14. It has a coaxial, central, cylindrical bore 25 closed at the bottom by a cover 30. The upper surface of the cartridge 14 is rigidly secured to the adapter 13, in the correct position. This attachment can be achieved by adhesion and will be inseparable. It can, however, also be made to permit of dismantling so that in the case of high quality adapter material, the cartridge can subsequently be separated from the adapter 13.

The upper first end zone 29 of the sleeve 16 is held on the outer face 28 in a manner which will be explained in detail hereinafter. At the bottom end zone 31, the sleeve 16 is closed in medium-tight fashion by a welded seam. It consists of a film which may be a few hundredths to a few tenths of a millimetre thick. It is glass clear, colourless and may be strengthened by a fibre braid 32 as shown in the bottom right-hand part of Fig. 1, on the sleeve 16.

As can be seen from Fig. 1, the sleeve 16 is substantially longer than the cartridge 14. In the assembled state shown in Fig. 2, therefore, roughly the bottom third of the sleeve 16 can run upwards again in the housing 17 like the neck 35 of a bag, if prior to assembly the sleeve 16 has been laid upwards in the bottom half. If this part of the sleeve 16 is not laid upwards, then the sleeve 16 may become creased on the top of the bottom

33 of the housing 17. However, in the manner of films, this is very flexible and it will adapt to the contours inside the bottom 33. The sleeve may in some cases be formed integrally with the adapter 13. In some arrangements the sleeve may have a greater circumference than the inner circumference of the housing over the length of the filter cartridge.

According to Fig. 3 which is more accurate where the adapter

13 is concerned, the adapter has a coaxial circularly cylindrical outer face 28 in which is machined a coaxial and continuous semi-circular groove. Resting under a certain initial tension in this semi-circular groove is an O-ring 34. Between the inside of the O-ring 34 and the annular groove is clamped the first end zone 29 of the sleeve 16. In the assembled state, the O-ring 34 provides a seal in respect of the inside of the rim zone 27 of the housing 17. Since this presses the O-ring 34 even more into its groove, the end zone 29 is held even better. According to Fig. 3, to the left of the outer face 28, there is at a right-angle a protruding circular coaxial rib 36 which, in the assembled state, bears on the upper end face of the side wall 24 under the pressure of a clamping device, not shown. According to Fig. 3, the first end zone 29 of the sleeve 16 is pulled sufficiently to project beyond this rib 36. The adapter 13 is of conventional form which means that it has a coaxial leftwardly (in Fig. 3) projecting connector 37 which is flush with the bore in the cartridge 14. Emanating from the coaxial central hub ring 38 are spokes 39 which merge outwardly into an outer ring 41, the outside of which takes the form described above. Between the hub ring 38, the spokes 39 and the outer ring 41, kidney-shaped holes 42 result and communicate with the space between the outside face of the cartridge 14 and the inside face of the sleeve 16.

In contrast to the form conventional for adapters 13, this has on the outside of the connector 37 a continuous coaxial annular groove in which rests an O-ring 43.

If the head 12 is connected to the housing 17, then the connector 37 is positioned in a corresponding line for carrying the supply medium according to the arrows 18 or 21. The holes 42, on the other hand, communicate with a hollow space from which the cleansed medium flows as indicated by the arrows 19 or 22.

So that no lasting air cushion forms between the sleeve 16 and the inside face of the housing 17, the side wall 24 according to Fig. 4 has a screwthreaded bore 44. On the left, towards the sleeve 16, this is covered by a very fine mesh grid 46 so that the sleeve 16 cannot be forced into the threaded bore 44 and stretched. Screwed into the threaded bore 44 is a valve 47 which can be opened or closed by a lever 48. According to a further example of embodiment, the side wall 24 incorporates a bore 49 into which a porous insert 51 is rigidly glued and for that portion of the sleeve 16 which lies above the bore 49, exerts both a supporting effect and also makes it possible for air to escape. Great care must be taken that the entire inner surface of the housing 17 actually lies very flat and has no sharp points or edges because these would puncture a sleeve 16 which consists of very thin film. The thicker the film used for the sleeve 16, the coarser may be the internal finish of the housing 17. With regard to the bore 49 and also the threaded bore 44, this means that on the inner corner zones there must be a very plane transition to the inner surface 26.

The additional O-ring 43 according to Fig. 3 is designed to allow the adapter 13 to be withdrawn from the head 12 as a whole assembly.

It is however also possible to construct the adapter 13 as a part of the head 12 so that these are one unit and can remain one unit and be either used again or thrown away.

The invention can also be applied to filter devices comprising a plurality of filter cartridges disposed in a circle within a single sleeve.

CLAIMS:

1. Filter device for media such as air and liquids, comprising
a filter head (12) connectable to a supply line and a discharge line,
a disc-shaped adapter (13) attached in a medium-tight fashion to said filter head and comprising at least one first orifice for the in-flowing unfiltered medium from said supply line and at least one second orifice for the outflowing filtered medium to said discharge line,
at least one filter cartridge (14) attached to said adapter and having an inlet surface in communication with said first orifice and an outlet surface in communication with said second orifice, ^{and} a cup-like housing (17) having a side wall (24) and a closed bottom zone (33) for enclosing said adapter and filter cartridge
characterised by the following features:

a) a medium-tight thin sleeve of film-like material (16) with its first end zone connected in sealing/tight fashion to such a face of said adapter (13), which is at least adjacent to the marginal zone (27) of the side wall (24) of the cup-like housing (17);

b) at least a part of the length of the sleeve (16) encloses



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the filter cartridge or cartridges (14);

c) the second end zone of the sleeve (16) is closed at least during operation of the filter device;

d) the sleeve material is of such a strength that when the cup-like housing (17) and filter cartridge (14) are separated, it does not tear in spite of filter cake and medium which may be contained in the sleeve (16).

2. Filter device according to Claim 1, characterised in that one end zone of the sleeve is integrally connected to the adapter.



* C L M S *

3. Filter device according to Claim 1, characterised in that one end zone of the sleeve is connected to the adapter by a sealing ring provided in a peripheral face of the adapter and which maintains this end zone between it and the peripheral face.

4. Filter device according to Claim 1, characterised in that at least the part of the sleeve which corresponds in length to the filter cartridge has a greater outer circumference than the inner circumference of the housing.

5. Filter device according to Claim 1, characterised in that the sleeve is at least long enough for its second end zone to rest on the inside face of the bottom area of the filter housing when the filter device is in a pressureless condition.

6. Filter device according to Claim 1, characterised in that the sleeve is substantially longer than the filter cartridge.

7. Filter device according to Claim 1, characterised in that the second end zone of the sleeve is constantly and materially closed.

8. Filter device according to Claim 1, characterised in that the sleeve is of at least translucent material.

9. Filter device according to Claim 1 characterised in that the sleeve has reinforcing inlays.

10. Filter device according to Claim 1, characterised in that a pressure equalising device is provided in the



wall (24) of said cup-like housing which in operation connects the volume between the sleeve (16) and the cup-like housing (17) to the outside of the housing.

11. Filter device according to claim 10, characterised in that the pressure equalising device is a valve on the housing wall.

12. Filter device according to claim 10, characterised in that the pressure equalising device is a porous piece in the housing wall.

13. Filter device according to claim 1, characterised in that the inner face of the housing is circularly cylindrical.

14. Filter device according to claim 1, characterised in that each such filter cartridge has a circularly cylindrical circumference.

15. Filter device according to claim 1 and 14, characterised in that when a plurality of filter cartridges is present, these are disposed in a circle.

16. A filter device as claimed in claim 1, substantially as described herein with reference to the accompanying drawings.



* C L N S *