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(54) Title: FLUID FILTER HOUSING ASSEMBLY

(57) Abstract: A fluid filter housing assembly includes a filter housing that receives a filter cartridge and is secured in the housing with a hoop handle.

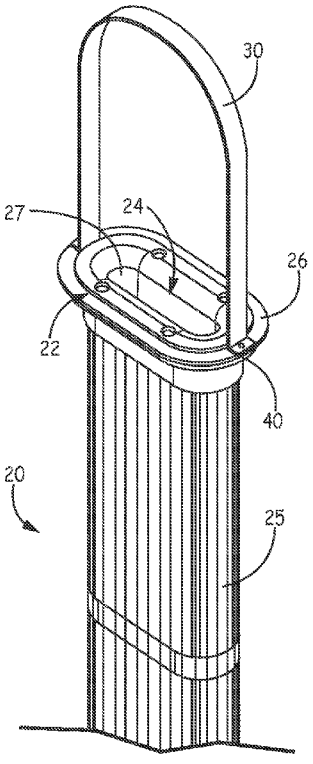


FIG. 5

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MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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FLUID FILTER HOUSING ASSEMBLY

FIELD

[0001] The disclosure relates to a fluid filter housing assembly and, in particular to a fluid filter housing that receives a filter cartridge that is secured in the housing with a hoop handle.

BACKGROUND

[0002] Fluid streams often carry particulate material therein. In many instances, removal of some or all of the particulate material from a fluid flow stream is needed. For example, fluids may contain particulate material, for example, those generated by processes that included mining, milling, chemical processing, sintering, painting, energy production, etc. Before such fluids can be, or should be, directed through various downstream equipment and/or to the environment, a substantial removal of particulate material from those streams is important.

BRIEF SUMMARY

[0003] The disclosure relates to a fluid filter housing assembly and, in particular to a fluid filter housing that receives a filter cartridge that is secured in the housing with a hoop handle. The housing can hold a plurality of oval filter cartridges that can be circumferentially pleated filtration media and each filter cartridge is held in place in the housing with individual hoop handles.

[0004] In many embodiments, a fluid filter housing assembly includes a filter housing and a filter cartridge. The filter housing includes a cartridge plate separating an inlet chamber from an outlet chamber. A fluid outlet is in fluid communication with the outlet chamber. A fluid inlet is in fluid communication with the inlet chamber. A hinged cover is in parallel relation to the cartridge plate when the hinged cover is in the closed

position. The filter cartridge is disposed through the cartridge plate. The filter cartridge extends between an open end seated onto the cartridge plate and an opposing closed end. A hoop handle is fixed to the open end and contacts the hinged cover. The hinged cover deflects the hoop handle when the hinged cover is in the closed position.

[0005] In further embodiments, a fluid filter housing assembly includes a cylindrical filter housing and an oval filter cartridge. The cylindrical filter housing includes a cartridge plate separating an inlet chamber from an outlet chamber, a fluid outlet in fluid communication with the outlet chamber, a fluid inlet in fluid communication with the inlet chamber, and a hinged cover being in parallel relation to the cartridge plate in the closed position. The oval filter cartridge is disposed through the cartridge plate. The oval filter cartridge extends between an oval open end seated onto the cartridge plate and an opposing closed end. A hoop handle is fixed to the oval open end and contacting the hinged cover. The hinged cover deflects the hoop handle when the hinged cover is in the closed position.

[0006] The details of one or more embodiments of the disclosure are set forth in the accompanying drawings and the description below. Other features, objects, and advantages of the disclosure will be apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The disclosure may be more completely understood in consideration of the following detailed description of various embodiments of the disclosure in connection with the accompanying drawings, in which:

[0008] **FIG. 1** is a schematic diagram of an illustrative fluid filter housing assembly;

[0009] **FIG. 2** is a cross-sectional schematic diagram view of an illustrative inlet portion of the fluid filter housing assembly shown in **FIG. 1**;

[0010] **FIG. 3** is a schematic diagram view of an illustrative pleated filter cartridge;

[0011] **FIG. 4** is a perspective schematic diagram view of an illustrative cartridge plate receiving two filter cartridges each with a hoop handle;

[0012] **FIG. 5** is a perspective schematic diagram view of an illustrative filter cartridge with hoop handle; and

[0013] **FIG. 6** is a perspective cross-sectional view of the filter cartridge shown in **FIG. 5**.

[0014] The schematic drawings presented herein are not necessarily to scale. Like numbers used in the figures refer to like components, steps and the like. However, it will be understood that the use of a number to refer to a component in a given figure is not intended to limit the component in another figure labeled with the same number. In addition, the use of different numbers to refer to components is not intended to indicate that the different numbered components cannot be the same or similar.

DETAILED DESCRIPTION

[0015] In the following detailed description, reference is made to the accompanying drawings that form a part hereof, and in which are shown by way of illustration several specific embodiments of devices and systems. It is to be understood that other embodiments are contemplated and may be made without departing from the scope or spirit of the present disclosure. The following detailed description, therefore, is not to be taken in a limiting sense.

[0016] All scientific and technical terms used herein have meanings commonly used in the art unless otherwise specified. The definitions provided herein are to facilitate understanding of certain terms used frequently herein and are not meant to limit the scope of the present disclosure.

[0017] As used in this specification and the appended claims, the singular forms “a”, “an”, and “the” encompass embodiments having plural referents, unless the content clearly dictates otherwise.

[0018] As used in this specification and the appended claims, the term “or” is generally employed in its sense including “and/or” unless the content clearly dictates otherwise.

[0019] As used herein, “have”, “having”, “include”, “including”, “comprise”, “comprising” or the like are used in their open ended sense, and generally mean “including, but not limited to.” It will be understood that the terms “consisting of” and “consisting essentially of” are subsumed in the term “comprising,” and the like.

[0020] Any direction referred to herein, such as “top,” “bottom,” “left,” "right," "upper," "lower," “above,” below,” and other directions and orientations are described herein for clarity in reference to the figures and are not to be limiting of an actual device or system or use of the device or system. Many of the devices, articles or systems described herein may be used in a number of directions and orientations.

[0021] The disclosure relates to a fluid filter housing assembly and, in particular to a fluid filter housing that receives a filter cartridge that is secured in the housing with a hoop handle. The housing can hold a plurality of oval filter cartridges that can be circumferentially pleated filtration media. The oval filter cartridge can have an obround shape where the hoop handle is fixed to the semicircle ends of the obround shape. The hoop handle can be the primary holding force to maintain the filter cartridge in the cartridge plate of the filter housing. In many embodiments the filter cartridge is not fastened to the cartridge plate, for example with bolts or screws or clips even when the filter is oriented horizontally. Thus, the filter cartridge can be replaced without the need for tools to remove the filter cartridge from the cartridge plate. In addition the housing can contain a plurality or two or more filter cartridges each having a separate hoop handle fixed to them. Each filter cartridge is secured in the housing with its hoop handle and each hoop handle being the

primary holding force to maintain each filter cartridge in the cartridge plate of the filter housing. While the present disclosure is not so limited, an appreciation of various aspects of the disclosure will be gained through a discussion of the examples provided below.

[0022] **FIG. 1** is a schematic diagram of an illustrative fluid filter housing assembly **10**. **FIG. 2** is a cross-sectional schematic diagram view of an illustrative inlet portion of the fluid filter housing **10** assembly shown in **FIG. 1**. **FIG. 3** is a schematic diagram view of an illustrative pleated filter cartridge **20**.

[0023] In many embodiments the fluid filter housing assembly **10** includes a filter housing **12** and a filter cartridge **20**. The filter housing **12** includes a cartridge plate **18** separating an inlet chamber **14** from an outlet chamber **16**. A fluid outlet **15** is in fluid communication with the outlet chamber **16**. A fluid inlet **13** is in fluid communication with the inlet chamber **14**. A hinged cover **11** is in parallel relation to the cartridge plate **18** when the hinged cover **11** is in the closed position. The filter cartridge **20** is disposed through the cartridge plate **18**. The filter cartridge **20** extends between an open end **22** seated onto the cartridge plate **18** and an opposing closed end **21**. A hoop handle **30** is fixed to the open end **22** and contacts the hinged cover **11**. The hinged cover **11** deflects the hoop handle **30** when the hinged cover **11** is in the closed position.

[0024] The fluid filter housing assembly **10** can include a filter housing **12** and a plurality of filter cartridges **20** disposed through the cartridge plate **18**, each filter cartridge **20** includes a hoop handle **30** fixed to the open end **22** and contacting the hinged cover **11**. In one embodiment, the fluid filter housing assembly **10** has a filter housing **12** and two filter cartridges **20** disposed through the cartridge plate **18**, each filter cartridge **20** includes a hoop handle **30** fixed to the open end **22** and contacting the hinged cover **11**, thus two hoop handles **30** contact the hinged cover **11**.

[0025] In further embodiments, a fluid filter housing assembly **10** includes a cylindrical filter housing **12** and an oval filter cartridge **20**. The cylindrical filter housing **12** includes a cartridge plate **18** separating an inlet chamber **14** from an outlet chamber **16**, a fluid outlet

15 in fluid communication with the outlet chamber **16**, a fluid inlet **13** in fluid communication with the inlet chamber **14**, and a hinged cover **11** in parallel relation to the cartridge plate **18** in the closed position. The oval filter cartridge **20** is disposed through the cartridge plate **18**. The oval filter cartridge **20** extends between an oval open end **22** seated onto the cartridge plate **18** and an opposing closed end **21**. A hoop handle **30** is fixed to the oval open end **22** and contacting the hinged cover **11**. The hinged cover **11** deflects the hoop handle **30** when the hinged cover **11** is in the closed position.

[0026] Fluid piping is not illustrated but readily appreciated by those with skill in the art. Fluid enters the inlet chamber **14** through the fluid inlet **13**. This fluid then enters the inlet **24** of the filter cartridge **20** and passes through the filtration media **25**. Particulate material remains within the filter cartridge **20** and filtered fluid enters the outlet chamber **16** passes out of the fluid filter housing assembly **10** via the fluid outlet **15**.

[0027] The filter cartridge **20** can optionally include an inner support structure or inner core (not shown) extending between the open end **22** and the opposing closed end **21**. The filter housing **12** can optionally include an outer support structure (not shown) disposed about the filter cartridge **20**.

[0028] The filter cartridge **20** can have any useful cross-sectional shape. Preferably the filter cartridge **20** can have an oval cross-sectional shape as illustrated in the figures. Oval shaped filter cartridges **20** have been found to provide an increased filtration surface area as compared to round or cylindrical shaped filter cartridges. In particular, circumferentially pleated oval filter cartridge **20** have been found to provide an increased filtration surface by at least five times as compared to round or cylindrical shaped filter cartridges. Utilizing the pleated oval filter cartridge **20** has been found to decrease pressure drop, increase flow rate or capacity through the filter cartridge **20**, as compared to standard round filter cartridges. For example, a standard 10 inch housing with a round 6 inch filter cartridge is rated for 100 to 200 gpm (gallons per minute) of flow rate. In contrast, two oval pleated filter cartridges can be received in the same standard 10 inch housing and operate to filter 300 to 500 gpm.

[0029] In many embodiments the oval filter cartridge **20** has an obround shape. The obround filter cartridge **20** shape is a closed figure having two parallel sides and two semicircular ends. The hoop handle **30** is preferably fixed to semicircle ends of the obround filter cartridge **20**. In many embodiments the hoop handle **30** is fixed to the midpoint of each semicircle end of the obround filter cartridge **20**. The hinged cover **11** deflects the hoop handle **30** when the hinged cover **11** is in the closed position.

[0030] In many embodiments the oval filter cartridge **20** has a hoop handle **30** that defines a hoop handle opening. The fluid inlet **13** is aligned with the hoop handle opening. This allows fluid to flow from the fluid inlet **13** to the first open end **22** of the filter cartridge **20** with minimum flow disruption from the hoop handle **30**.

[0031] The filter cartridge **20** includes a length of filtration media **25** that can be circumferentially pleated. The length of filtration media **25** extends between a first open end **22** and an opposing closed end **21**. An end cap **26** can be formed of an elastomer material and define a fluid inlet **24** and can be molded to the first open end **22**. The closed end **21** can include a metal or rigid pan sealed to the filtration media with a useful adhesive, for example.

[0032] The end cap **26** can directly bond to the filtration media **25**. The end cap **26** can mechanically maintain the circumferentially pleated first open end **22**. In many embodiments the end cap **26** can be injection molded to the first open end **22** of the filter cartridge **20**. The filtration media **25** can be formed of any useful filtration material.

[0033] The filter cartridge **20** can includes a gasket **40** separating an inlet surface of the cartridge plate **18** from the filter cartridge end cap **26**. The gasket **40** can be disposed between the end cap **26** and the tube sheet **18** to aid in sealing the upper chamber **14** from the lower chamber **16**. In some embodiments the end cap **26** includes a rigid collar. The rigid collar can be any useful material such as metal.

[0034] **FIG. 4** is a perspective schematic diagram view of an illustrative cartridge plate **18** receiving a two filter cartridges **20** each with a hoop handle **30**. **FIG. 5** is a perspective

schematic diagram view of an illustrative filter cartridge **20** with hoop handle **30**. **FIG. 6** is a perspective cross-sectional view of the filter cartridge **20** shown in **FIG. 5**.

[0035] The end cap **26** can optionally include a plenum **27** that extends into the inlet **24** of the filter cartridge **20**. The end cap **26** can be unitary element or include a rigid collar. The hoop handle **30** can be fixed to the end cap **26** or rigid collar of the end cap **26**. In embodiments where the end cap **26** defines an oval cross-sectional shape, the hoop handle **30** can be fixed to opposing narrow end sides of the end cap **26**. The hoop handle **30** defines a strip of material that has two opposing ends that are fixed to the end cap **26** and form a loop extending away from the end cap **26**.

[0036] The hoop handle **30** can be formed of any useful resilient material, for example a metallic material. The hoop handle **30** can have two linear extending legs fixed together by an curved portion. In many embodiments, the hoop handle **30** can have two parallel extending legs fixed together by an semi-circle portion. At the end of each linear extending leg is a lip element that can extend orthogonally to the linear extending leg. The lip element can be fixed to the end cap **26** or rigid collar of the filter cartridge **20** as illustrated in **FIG. 4**, **FIG. 5** and **FIG. 6**.

[0037] In many embodiments the hoop handle can deflect when a force is applied to the loop portion of the hoop handle **30**. For example the parallel extending legs of the hoop handle **30** can deflect away from each other and/or the loop portion of the hoop handle **30** can defect toward the end cap **26** of the filter cartridge **20.** In many embodiments the hoop handle **30** deflects at least about 5 mm or at least about 10 mm or at least about 20 mm or at least about 30 mm or in a range from 1 to 30 mm. In particular the hoop handle **30** deflects in these ranges when the hinged cover **11** is closed against the hoop handle **30**.

[0038] Surprisingly the hoop handle **30** has been found to secure the open end **22** or end cap **26** of the filter cartridge **20** against the cartridge plate **18** primarily by the force applied to the hoop handle **30** by the hinged cover **11**. Even when the filter housing **10** and filter

cartridge **20** is oriented in a horizontal direction, the open end **22** or end cap **26** of the filter cartridge **20** against the cartridge plate **18** primarily by the force applied to the hoop handle **30** by the hinged cover **11**. Thus a fastener is not needed to secure the filter cartridge **20** against the cartridge plate **18**.

[0039] The filter cartridge **20** can be replaced by opening the hinged cover **11** and grasping the hoop handle and pulling the used filter cartridge **20** out of the housing **12** without use of any other tools. Then a clean filter cartridge **20** can be inserted into the housing **12** and secured into the housing **12** simply by closing the hinged cover **11**. The hinged cover **11** deflects the hoop handle **30** and applies a spring force to the end cap **26** of the filter cartridge **20** against the cartridge plate **18** and thus sealing the filter cartridge **20** into the housing **12**. Tools are not needed to seal the filter cartridge **20** into the housing **12**.

[0040] The hoop handle **30** can extend a distance beyond the inlet chamber **14** height when the filter cartridge **20** is initially placed into the filter housing **12**. Then the cover **11** (that can be pivotally attached to the housing **12**) can be moved into a closed position sealing the inlet chamber **14**. Thus the cover **11** contacts the hoop handle **30** just before the cover **11** moves into the closed position. In many embodiments the hoop handle **30** extends out of the inlet chamber **14** at least about 5 mm or at least about 10 mm or at least about 20 mm or at least about 30 mm or in a range from 1 to 30 mm. Thus, the hoop handle **30** deflects at least about 5 mm or at least about 10 mm or at least about 20 mm or at least about 30 mm or in a range from 1 to 30 mm by the cover **11** moving into the closed position.

[0041] Thus, embodiments of FLUID FILTER HOUSING ASSEMBLY are disclosed. One skilled in the art will appreciate that the optical films and film articles described herein can be practiced with embodiments other than those disclosed. The disclosed embodiments are presented for purposes of illustration and not limitation.

What is claimed is:

1. A fluid filter housing assembly comprising:

a filter housing comprising:

a cartridge plate separating an inlet chamber from an outlet chamber;

a fluid outlet in fluid communication with the outlet chamber;

a fluid inlet in fluid communication with the inlet chamber;

a hinged cover being in parallel relation to the cartridge plate in the closed position;

a filter cartridge disposed through the cartridge plate, the filter cartridge extending between an open end seated onto the cartridge plate and an opposing closed end the filter cartridge comprises circumferentially pleated filtration media; and

a hoop handle fixed to the open end and contacting the hinged cover, the hinged cover deflects the hoop handle when the hinged cover is in the closed position.

2. The fluid filter housing assembly according to claim 1, wherein the open end is held in place against the cartridge plate primarily by the force applied to the hoop handle by the hinged cover.

3. The fluid filter housing assembly according to claim 1, wherein the open end is not fastened to the cartridge plate.

4. The fluid filter housing assembly according to any of the preceding claims, wherein the hoop handle deflects in a range from 1 to 30 mm when the hinged cover is closed against the hoop handle.

5. The fluid filter housing assembly according to any of the preceding claims, further comprising a plurality of filter cartridges disposed through the cartridge plate, each filter cartridge includes a hoop handle fixed to the open end and contacting the hinged cover.

6. The fluid filter housing assembly according to any of the preceding claims, wherein the filter cartridge open end defines an oval shaped opening.

7. The fluid filter housing assembly according to any of the preceding claims, wherein the hoop handle is metallic.

8. The fluid filter housing assembly according to any of the preceding claims, wherein the filter housing further comprises an outer support structure disposed about the filter cartridge.

9. The fluid filter housing assembly according to any of the preceding claims, wherein the cartridge plate outer circumference defines a circular shape.

10. The fluid filter housing assembly according to any of the preceding claims, wherein the filter cartridge comprises an inner support structure or inner core extending between the open end and the opposing closed end.

11. The fluid filter housing assembly according to any of the preceding claims, further comprising a gasket separating an inlet surface of the cartridge plate from the open end of the filter cartridge.

12. A fluid filter housing assembly comprising:

a cylindrical filter housing comprising:

a cartridge plate separating an inlet chamber from an outlet chamber;

a fluid outlet in fluid communication with the outlet chamber;

a fluid inlet in fluid communication with the inlet chamber;

a hinged cover being in parallel relation to the cartridge plate in the closed position;

an oval filter cartridge disposed through the cartridge plate, the oval filter cartridge extending between an oval open end seated onto the cartridge plate and an opposing closed end, the oval filter cartridge comprises circumferentially pleated filtration media; and

a hoop handle fixed to the oval open end and contacting the hinged cover, the hinged cover deflects the hoop handle when the hinged cover is in the closed position.

13. The fluid filter housing assembly according to claim 12, further comprising a plurality of oval filter cartridges disposed through the cartridge plate, each oval filter cartridge includes a hoop handle fixed to the open end and contacting the hinged cover.

14. The fluid filter housing assembly according to claims 12 to 13, wherein the oval open end is held in place against the cartridge plate primarily by the force applied to the hoop handle by the hinged cover.

15. The fluid filter housing assembly according to claims 12 to 14, wherein the oval open end is not fastened to the cartridge plate.

16. The fluid filter housing assembly according to claims 12 to 15, wherein the hoop handle deflects in a range from 1 to 30 mm when the hinged cover is closed against the hoop handle.

17. The fluid filter housing assembly according to claims 12 to 16, wherein the hoop handle defines a hoop handle opening and the fluid inlet is aligned with the hoop handle opening allowing fluid to flow from the fluid inlet to the first open end of the filter cartridge with minimum flow disruption from the hoop handle.

18. The fluid filter housing assembly according to claims 12 to 17, wherein the filter cartridge comprises an oval inner support structure extending between the oval open end and the opposing closed end and the housing comprises an oval outer support structure disposed about the oval filter cartridge.

19. The fluid filter housing assembly according to claims 12 to 18, further comprising a gasket separating an inlet surface of the cartridge plate from the oval open end of the filter cartridge.

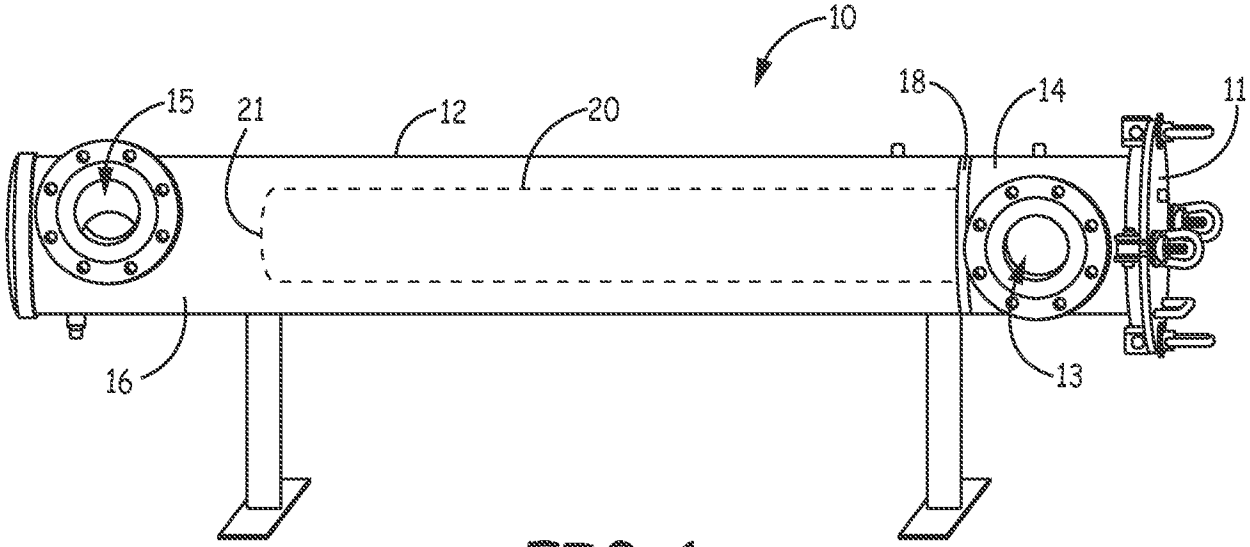


FIG. 1

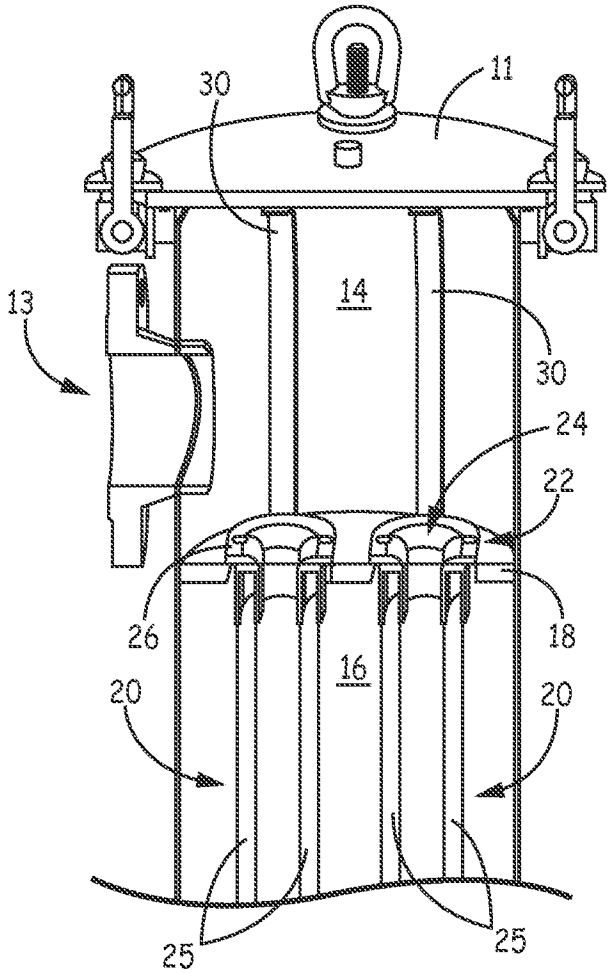


FIG. 2

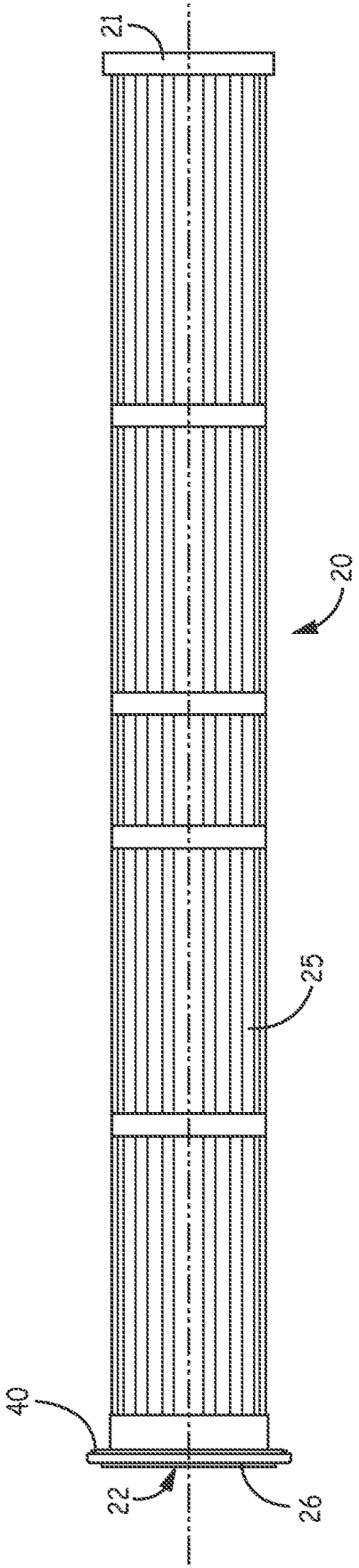


FIG. 3

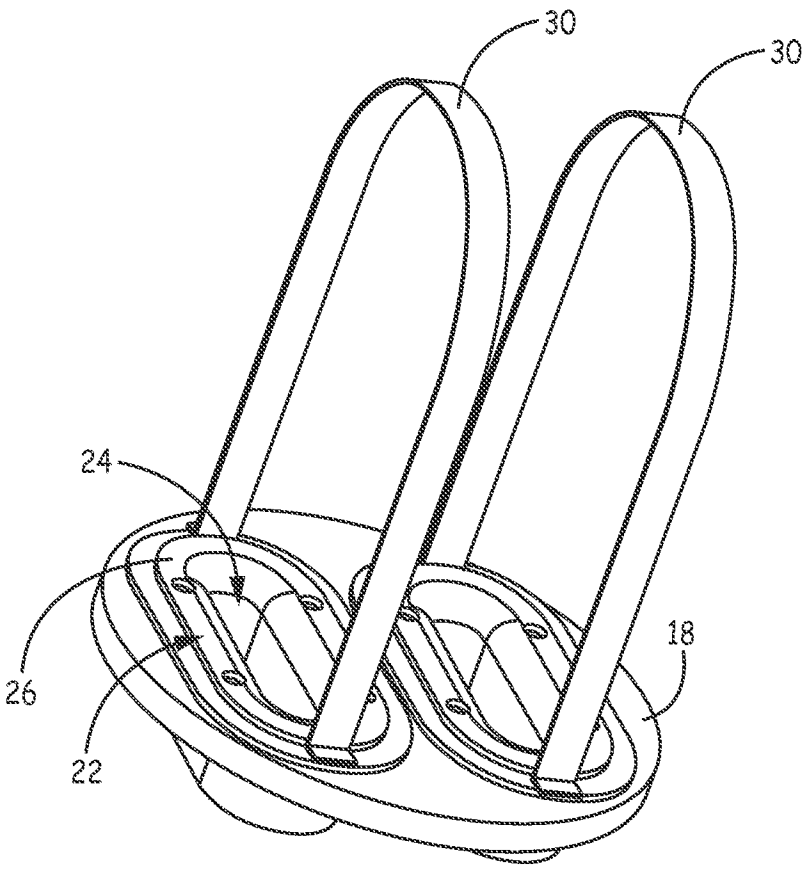


FIG. 4

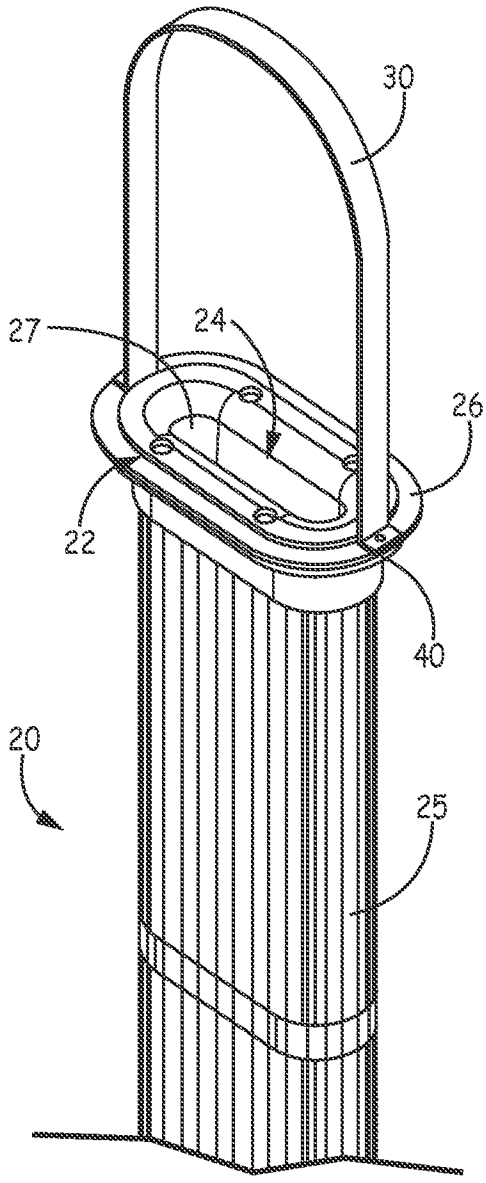


FIG. 5

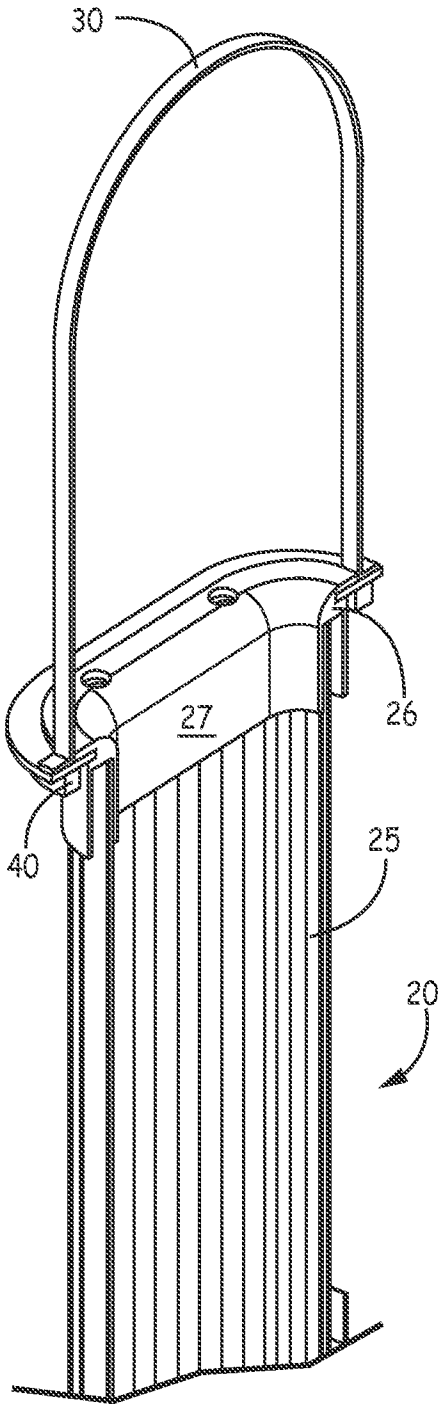


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/028714

A. CLASSIFICATION OF SUBJECT MATTER
INV. B01D29/21 B01D29/52
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2012/152820 A1 (SAKAIRI SHIGEMITSU [JP]) 21 June 2012 (2012-06-21) paragraph [0005] paragraph [0029]; figures 2a,3	1-19
Y	US 4 419 240 A (ROSAEN BORJE O [US]) 6 December 1983 (1983-12-06) figures 1,2	1-19
Y	US 8 580 004 B1 (CLEMENTS JACK T [US]) 12 November 2013 (2013-11-12) column 2, line 25 - line 28; figures 13,14	6,12-19
A	US 3 720 322 A (HARMS J) 13 March 1973 (1973-03-13) the whole document	1-19

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
20 July 2015	31/07/2015

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Hilt, Daniel

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2015/028714

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