(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 108 455 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
14.10.2009 Bulletin 2009/42

(51) Int Cl.:
B03C 1/28 *(2006.01)*

(21) Application number: **08251356.5**

(22) Date of filing: **08.04.2008**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR
Designated Extension States:
AL BA MK RS

(71) Applicant: **BP Oil International Limited**
Sunbury on Thames
Middlesex
TW16 7BP (GB)

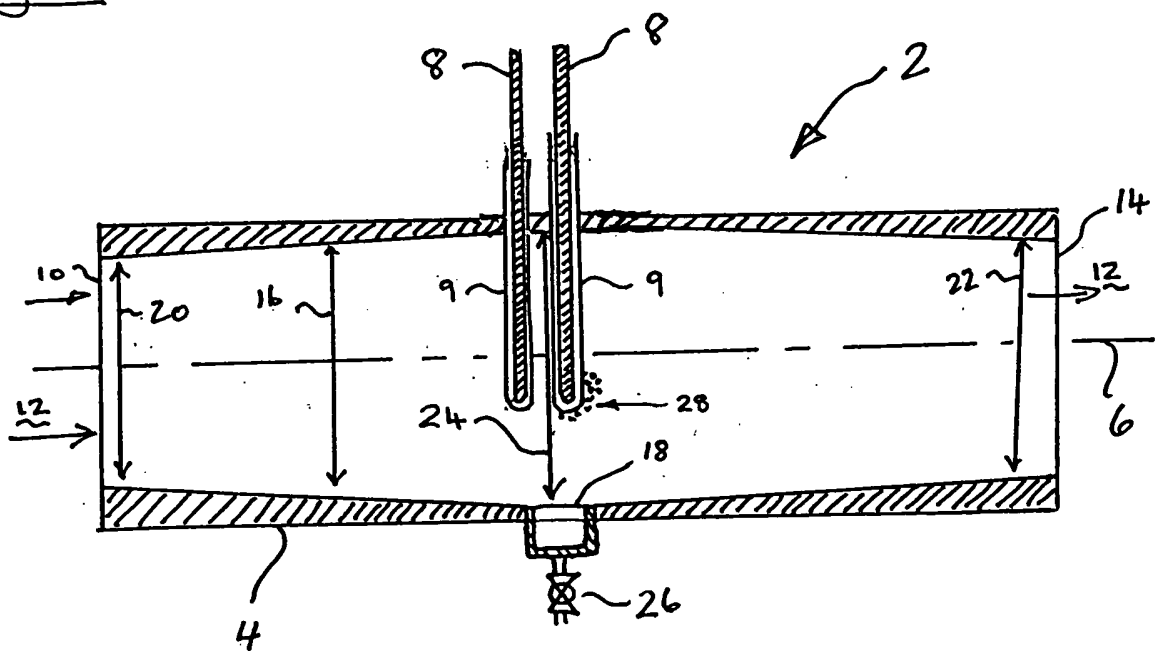
(72) Inventor: **The designation of the inventor has not yet been filed**

(74) Representative: **Perkins, Nicholas David et al**
BP International Limited
Global Patents & Technology Law (Central)
Bldg 200, 1st floor
Chertsey Road
Sunbury-on-Thames, Middlesex TW16 7LN (GB)

(54) Improvements in or relating to filters

(57) A filter device for removing particles from a liquid which device comprises a cylindrical vessel through which the liquid to be filtered may be passed, the vessel having a longitudinal axis and in use being positioned with said axis generally horizontal characterised in that the vessel has a continuously varying internal bore which provides a low point drain. Suitably, the filter device is a magnetic filter device having one or more magnets suspended in the vessel.

Fig. 1



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Description

[0001] This invention relates to filters and in particular, but not exclusively, to a magnetic filter device for removing ferromagnetic particles from liquids and to a method of using said device.

[0002] Magnetic filter devices are known for removal of ferromagnetic particles from liquids.

[0003] In order to clean a filter device it is desirable to drain the device of liquid and/or contaminants.

[0004] There remains a need for a vessel for a filter device which can be easily drained of liquid and/or contaminants.

[0005] Thus, according to the present invention there is provided a filter device for removing particles from a liquid which device comprises a cylindrical vessel through which the liquid to be filtered may be passed, the vessel having a longitudinal axis and in use being positioned with said axis generally horizontal **characterised in that** the vessel has a continuously varying internal bore which provides a low point drain.

[0006] The vessel may have a bore which increases progressively from each end of the vessel to provide at the widest bore, a low point drain. The low point drain may be provided with a drain valve.

[0007] The continuously varying internal bore may also provide a high point vent. The vessel may have a bore which increases progressively from each end of the vessel to provide at the widest bore, a high point vent. The high point vent may be provided with a valve. The high point vent may provide for removal of vapour and/or gas from the vessel, for example during charging of the vessel with liquid. The high point vent may allow for ingress of gas and/or vapour, for example during emptying of the vessel. The high point vent may allow ingress or egress of gas and/or vapours emptying and/or charging of the vessel with liquid and/or during cleaning of the vessel.

[0008] The vessel may be fabricated by machining a progressively increasing bore from each end of a cylindrical pipe. The vessel may be fabricated in two parts each with increasing bore from one end to the other and the parts joined together at the ends having the widest bore.

[0009] The vessel of the present invention provides for easy removal of liquid and/or contaminants from the vessel during cleaning.

[0010] The vessel may be connected to associated inlet and outlet pipe-work at least one of which may have a diameter which is different to that of the vessel. The vessel and the pipe-work may be connected by eccentric reducers mounted such that the vessel and associated pipe-work have similarly aligned lower internal horizontal surfaces with the low point drain of the vessel being the lowest point. This may help in avoiding low points at the connections.

[0011] The vessel may be connected to associated inlet and outlet pipe-work at least one of which may have a diameter which is different to that of the vessel. The vessel and the pipe-work may be connected by eccentric reducers mounted such that the vessel and associated pipe-work have similarly aligned upper internal horizontal surfaces with the high point vent of the vessel being the highest point. This may help in avoiding high points at the connections.

[0012] Preferably, according to a first embodiment of the present invention, the filter device is a magnetic filter device having one or more magnets suspended in the vessel, an inlet to allow liquid to flow into the vessel, and an outlet to allow the liquid to flow out of the vessel.

[0013] Suitably, the vessel is a horizontal pipe with an inlet at one end and an outlet at the other end, with the one or more magnets suspended transverse to the longitudinal axis of the pipe. The one or more magnets may be vertically mounted transverse to the longitudinal axis of the pipe. If there is a plurality of magnets these may be mounted along the longitudinal axis of the pipe. This can facilitate removal of the magnets from the vessel, for example for cleaning. This is beneficial if the magnets are heavy and require lifting tackle to be removed.

[0014] The vessel may have a high point vent. This may be provided with a valve. The high point vent may be used to allow ingress of egress of vapours and/or gas for example during charging, draining or cleaning of the vessel.

[0015] The one or more magnets may be permanent magnets, for example rare earth permanent magnets. Each magnet may be mounted within a sleeve, for example, a stainless steel, austenitic stainless steel, ceramic or anodised aluminium sleeve. The sleeves may have a smooth surface, which may facilitate cleaning.

[0016] In use, the ferromagnetic particles accumulate on the magnets or on the sleeves, if the magnets are mounted in sleeves.

[0017] According to a further aspect of the present invention there is provided a method for removing ferromagnetic particles from a liquid which comprises passing the liquid through the device according to the first embodiment of the present invention and cleaning the device by interrupting the flow of liquid and draining liquid and/or accumulated ferromagnetic particles from the vessel at the low point drain.

[0018] As part of the cleaning process, the magnets may be removed from the vessel.

[0019] Preferably, the magnets are mounted in sleeves and as part of the cleaning process the magnets are removed from the sleeves. This may facilitate removal of accumulated ferromagnetic particles from the sleeves.

[0020] The liquid may be a fuel for example liquefied petroleum gas, automotive gasoline, aviation gasoline, kerosine, jet fuel, diesel fuel, marine fuel oil, residual fuel oil or other liquid fuel. The ferromagnetic particles may comprise iron oxide or 'rust'. Iron or 'rust' may be formed by corrosion for example, of pipe-work, vessels and the like through which the liquid is passed, for example, during its manufacture, storage and/or distribution.

[0021] The present invention will now be illustrated by way of example only with reference to the accompanying drawings in which Figure 1 and Figure 2 show in longitudinal cross section, magnetic filter devices according to the present invention. Figures 3 and 4 show in cross-section, a vessel according to the present invention connected to associated pipe-work.

[0022] In Figures 1 and 2, a magnetic filter device 2 according to the present invention comprises a cylindrical vessel 4 having a longitudinal axis 6, one or more magnets 8 suspended in the vessel, an inlet 10 to allow liquid 12 to flow into the vessel, and an outlet 14 to allow the liquid 12 to flow out of the vessel 4. The magnets are mounted in sleeves 9.

[0023] In use, the vessel is positioned with its longitudinal axis 6 generally horizontal.

[0024] The vessel has a continuously varying internal bore 16 which provides a low point drain 18. In particular, the end bore (20, 22) at each of the ends (10, 14) of the vessel is smaller than the middle bore 24 in the middle of the vessel to provide at the widest bore a low point drain 18, which may be provided with a drain valve 26.

[0025] In use liquid 12 such a fuel is passed through the device 2 from the inlet 10 to the outlet 14, passing into contact with the sleeves 9 of the magnets 8. The ferromagnetic particles 28 accumulate on the sleeves 9.

[0026] The device may be cleaned by interrupting the flow of liquid and draining liquid and/or accumulated ferromagnetic particles 28 from the vessel at the low point drain 18 through drain valve 26. To facilitate cleaning, the magnets 8 may be removed from the sleeves 9. This facilitates removal of accumulated ferromagnetic particles 28 from the sleeves 9.

[0027] The device in Figure 2 is similar to that in Figure 1, with common features having common reference numerals. The device in Figure 2 may for example be fabricated in two parts each with increasing bore from one end to the other and the parts joined together at the ends having the widest bore by flanges 30. The continuously varying internal bore in the device in Figure 2 provides a high point vent 19, which is provided with a valve 27. The high point vent may provide for removal of vapour and/or gas from the vessel, for example during charging of the vessel with liquid. The high point vent may allow for ingress of gas and/or vapour, for example during emptying of the vessel.

[0028] Figure 3 shows in side view how a vessel 4 of the device may be connected to associated inlet or outlet pipe-work 32 which has a diameter which is different to that of the vessel 4. In this embodiment, low points at the connections may be avoided by using eccentric reducers 34 mounted such that the vessel 4 and associated pipe-work 32 have a commonly aligned lowest horizontal surface 36, for example using flanges 38.

[0029] Figure 4 shows in side view how a vessel 4 of the device may be connected to associated inlet or outlet pipe-work 32 which has a diameter which is different to that of the vessel 4. In this embodiment, high points at the connections may be avoided by using eccentric reducers 34 mounted such that the vessel 4 and associated pipe-work 32 have a commonly aligned highest horizontal surface 37, for example using flanges 38.

Claims

1. A filter device for removing particles from a liquid which device comprises a cylindrical vessel through which the liquid to be filtered may be passed, the vessel having a longitudinal axis and in use being positioned with said axis generally horizontal **characterised in that** the vessel has a continuously varying internal bore which provides a low point drain.

2. A filter device as claimed in Claim 1 in which the vessel has a bore which increases progressively from each end of the vessel to provide at the widest bore, a low point drain.

3. A filter device as claimed in Claim 2 in which the low point drain is provided with a drain valve.

4. A filter device as claimed in any one of Claims 1 to 4 in which the continuously varying internal bore may also provide a high point vent.

5. A filter device as claimed in any one of the preceding claims in which the filter device is magnetic filter device having one or more magnets suspended in the vessel, an inlet to allow liquid to flow into the vessel, and an outlet to allow the liquid to flow out of the vessel.

6. A filter device as claimed in Claim 5 in which the vessel is a horizontal pipe with an inlet at one end and an outlet at the other end, with the one or more magnets suspended transverse to the longitudinal axis of the pipe.

7. A filter device as claimed in Claim 6 in which the one or more magnets are vertically mounted transverse to the longitudinal axis of the pipe.

8. A filter device as claimed in any one of the preceding claims in which the vessel is connected to associated inlet and outlet pipe-work at least one of which has a diameter which is different to that of the vessel, the vessel and the pipe-work being connected by eccentric reducers mounted such that the vessel and associated pipe-work have similarly aligned lower internal horizontal surfaces with the low point drain of the vessel being the lowest point.

9. A filter device as claimed in any Claims 1 to 7 in which the vessel is connected to associated inlet and outlet pipe-work at least one of which has a diameter

which is different to that of the vessel, the vessel and the pipe-work being connected by eccentric reducers mounted such that the vessel and associated pipe-work have similarly aligned upper internal horizontal surfaces with the low point drain of the vessel being the highest point.

10. A method for removing ferromagnetic particles from a liquid which comprises passing the liquid through a device as claimed in any one of claims 5 to 9 and cleaning the device by interrupting the flow of liquid and draining liquid and/or accumulated ferromagnetic particles from the vessel at the low point drain.

11. A method as claimed in Claim 10 in which the liquid is a fuel.

12. A method as claimed in Claim 11 in which the fuel is liquefied petroleum gas, automotive gasoline, aviation gasoline, kerosine, jet fuel, diesel fuel, marine fuel oil or residual fuel oil.

Fig. 1

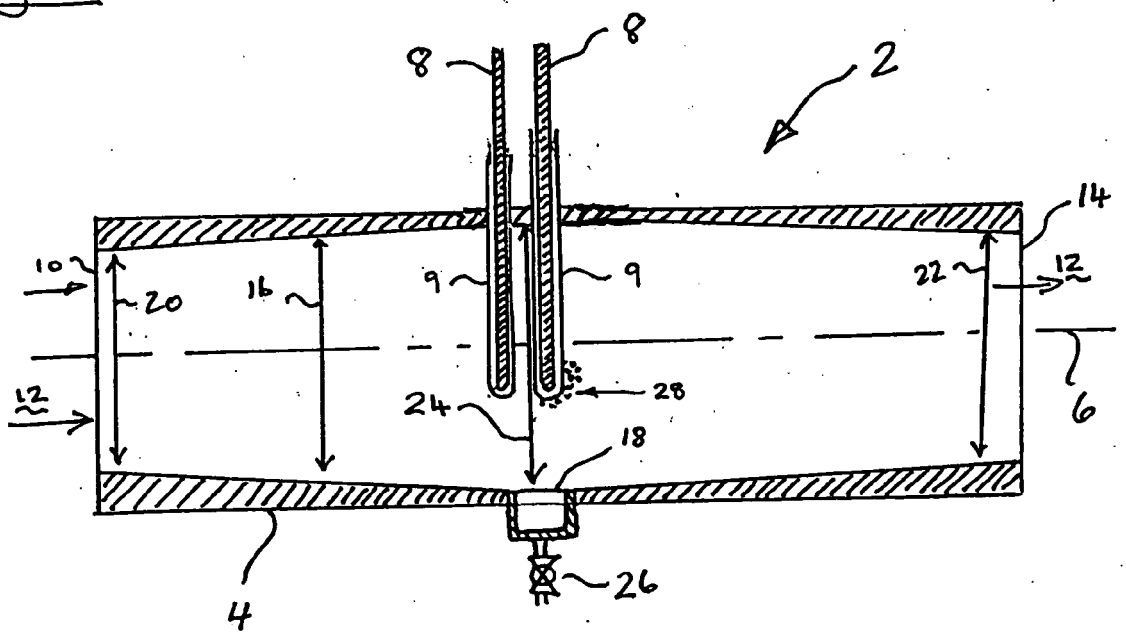
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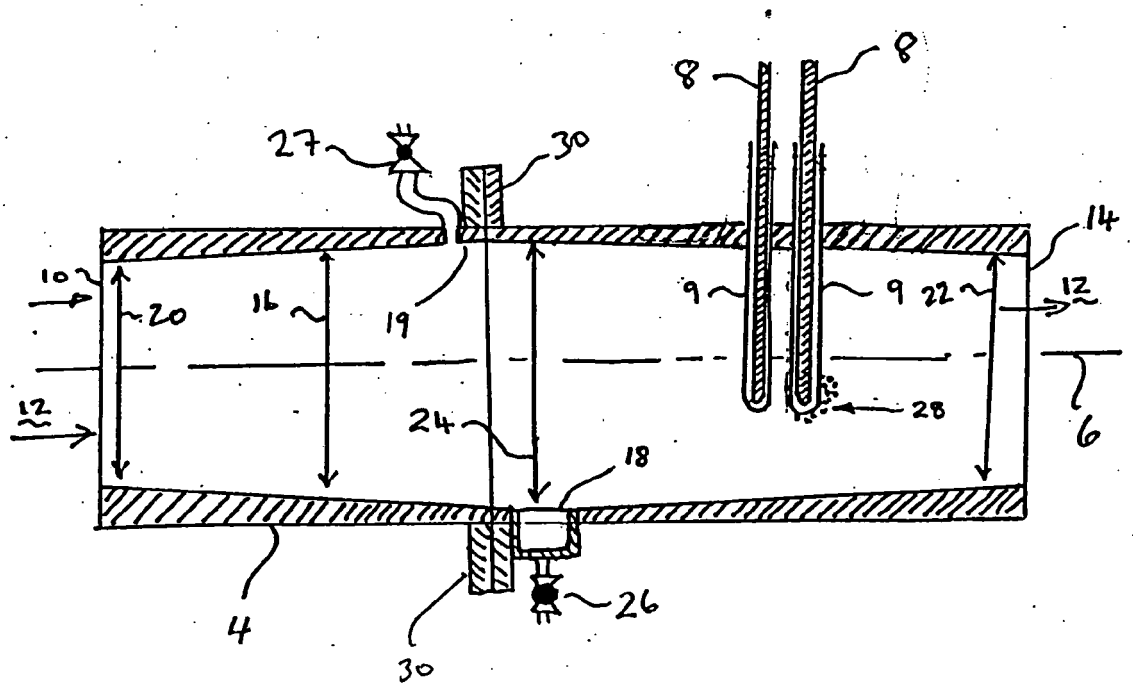
Fig 2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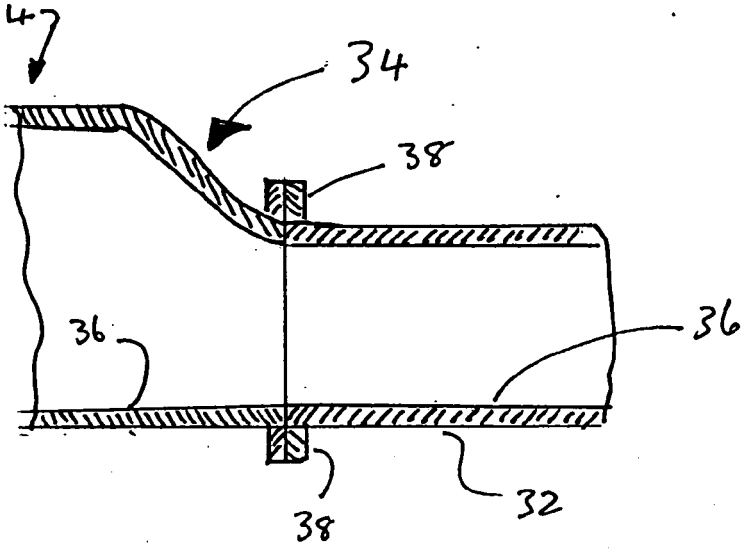

Fig. 3

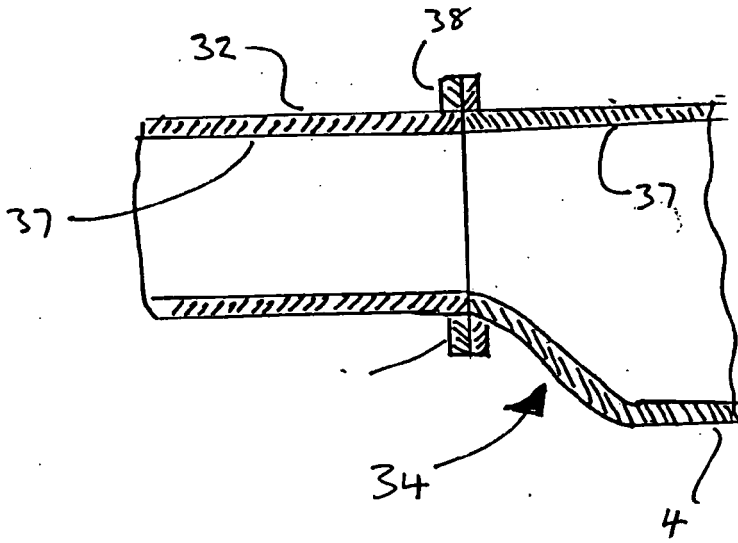

Fig 4

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EUROPEAN SEARCH REPORT

Application Number
EP 08 25 1356

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 2005/103728 A1 (ABDELQADER ALI H H [SA] ABDELQADER ALI HASAN HAMDAN [SA]) 19 May 2005 (2005-05-19) * paragraphs [0036], [0037] *	1-12	INV. B03C1/28
Y	FR 2 784 980 A (SATO KYOKO [FR]) 28 April 2000 (2000-04-28) * page 2, paragraph 8 *	1-12	
Y	WO 02/26292 A (AFFINA IMMUNTECHNIK GMBH [DE]; KUNZE RUDOLF [DE]) 4 April 2002 (2002-04-04) * page 19, line 10 - line 14 *	1-12	
D,A	GB 2 417 439 A (BALDWIN ERIC [GB]; WILCOX SHAN-MARIE JUNE [GB]) 1 March 2006 (2006-03-01) * abstract *	1-12	

TECHNICAL FIELDS SEARCHED (IPC)

B03C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	31 October 2008	Demol, Stefan

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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31-10-2008

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82