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(71) Applicant(s):
Scalemaster Limited
Unit 6 Emerald Way, Stone Business Park, Stone, Staffordshire, ST15 0SR, United Kingdom

(72) Inventor(s):
Carl Jasper
Glyn Morgan

(74) Agent and/or Address for Service:
Hepworth Browne
Alcester House, Unit 1, 23 Newcastle Drive, The Park, Nottingham, NG7 1AA, United Kingdom

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(54) Title of the Invention: **Magnetic sludge filter**
Abstract Title: **Magnetic sludge filter**

(57) A magnetic sludge filter 1 for a wet central heating system, the filter comprises a vessel 2 with a recess 3 extending internally within a cavity of the vessel and a magnetic element 4 located in the recess wherein it is external of the vessel. The filter has a means to direct fluid flow into the cavity about the recess whereby magnetic particulate matter in the fluid is attracted to the recess. A manifold (lid / cover / top) 6 is securable to and separable from the vessel wherein upon separation of the manifold from the vessel the magnet is retained with the recess. The manifold comprises a valve arrangement 9, 10 connected to and isolates the filter from the heating system. A seal may be between the vessel and manifold. The recess may be centrally within the vessel and may be rectangular. Detents 11 may interlock the magnet in the recess. The magnet may comprise a plurality of stacked magnets. A vent valve 14 may permit air and/or fluid pressure to be removed or relieved from the vessel.

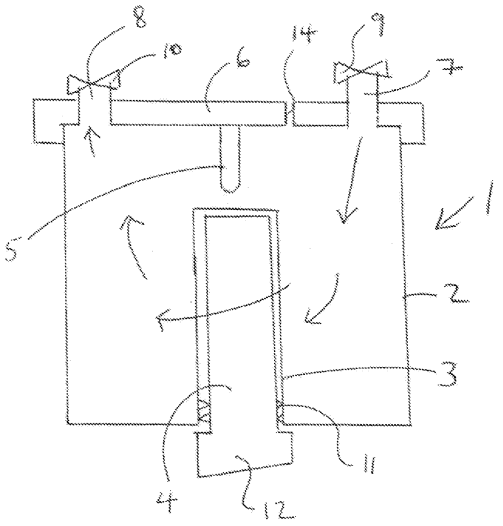

Figure 1

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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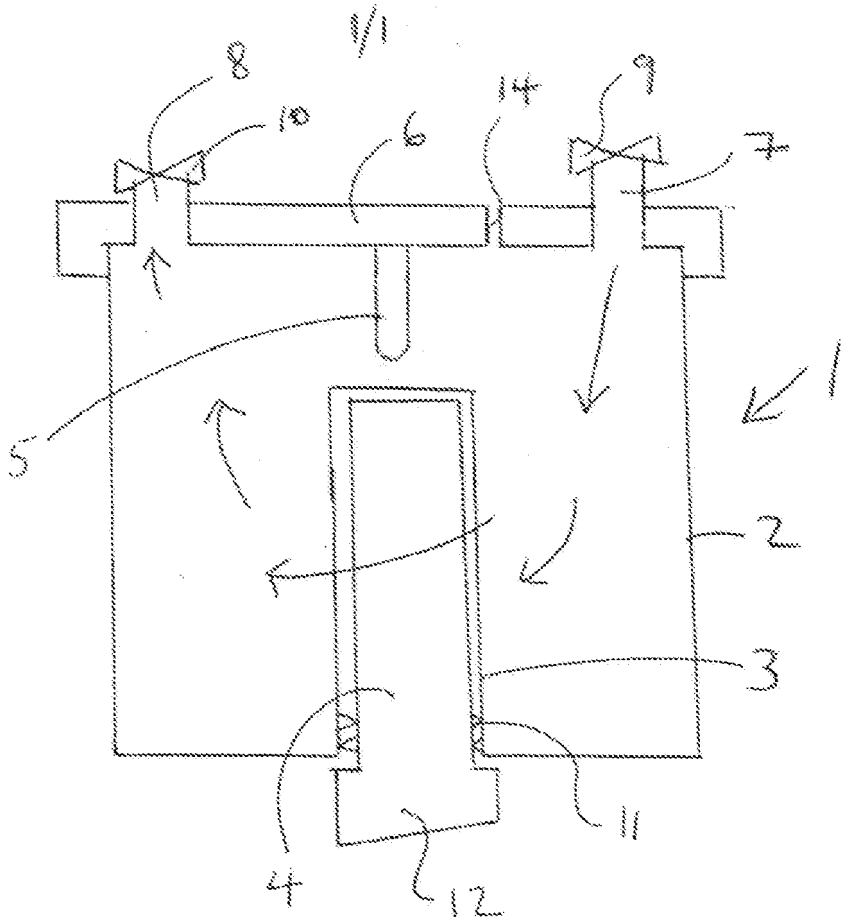

Figure 1

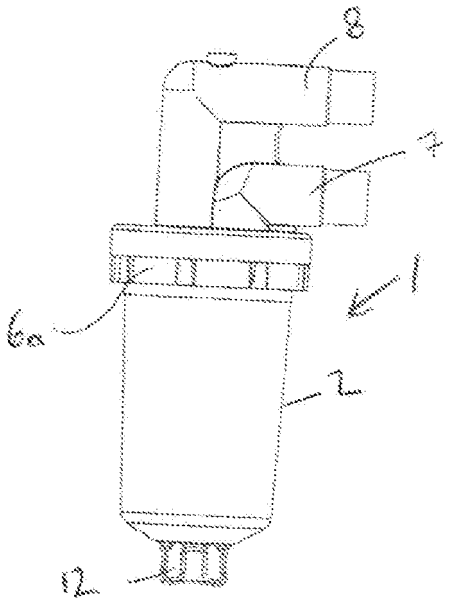

Figure 2

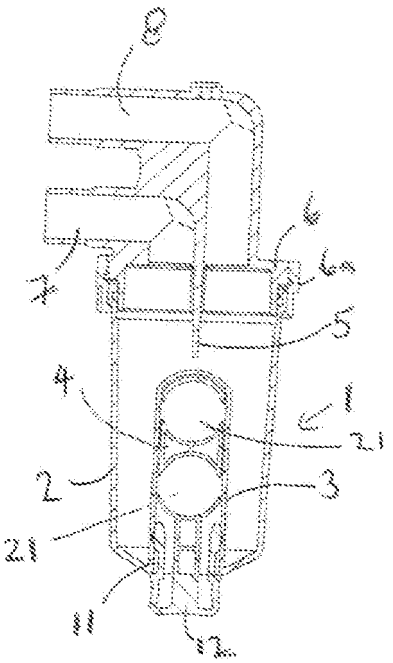

Figure 3

Magnetic sludge Filter

The present invention relates generally to magnetic sludge filters and more particularly to magnetic sludge filters for wet central heating systems.

Wet central heating systems are well-known and use water has medium to take heat from a boiler to radiators using gravity and normally a pump to drive flow. Some wet central heating systems use a header tank to ensure a head of water is maintained in the system but more recently closed systems have been provided with for example a combi-boiler. Whether an open system or a closed system it will be appreciated that the water in the wet system is subject to fouling for example from installation materials such as solder flux and corrosion products of pipes, joints, radiators etc. in the system. The particulate matter in the central heating flow can be referred to collectively as magnetic sludge. A significant proportion of such magnetic sludge at least is susceptible to magnetic interaction so a range of magnetic sludge filters or collectors have been provided in which a magnet is located in a vessel so that the magnetic sludge is attracted to the magnet and so removed from the flow.

The magnets are integral within a prior magnetic sludge filter so typically the whole filter or magnetic assembly needs to be removed from the system so that the magnetic sludge can be disposed of by flushing the magnet directly and it has been difficult to tune or provide magnets for particular situations or dosing with particular dosing agents to act as inhibitors to corrosion within the wet central heating system.

In accordance with first aspects of the present invention there is provided a magnetic sludge filter for a wet heating system, the filter comprising a vessel with a recess extending internally within a cavity of the vessel and a separable magnetic element located externally within the recess, the filter having means to direct a fluid flow in use into the cavity about the recess whereby magnetically inducible particulate matter in the flow is attracted to the surface of the recess.

In accordance with second aspects of the present invention there is provided a magnetic sludge filter for a wet heating system, the filter comprising a vessel with a recess extending internally within a cavity of the vessel and a magnetic element comprising a probe to extend from the exterior into the recess, the probe having apertures to receive magnetic elements edge to edge in a stack in the direction of the probe.

In accordance with third aspects of the present invention there is provided a magnetic sludge filter for a wet heating system, the filter comprising a vessel with a recess extending internally within a cavity of the vessel and a magnetic element, the filter having a vane extending towards the recess across the vessel and in association with a manifold for closure of the vessel, the manifold having an inlet and an outlet with the vane extending between them to act as a baffle to direct flow of a fluid in use between the inlet and the outlet.

Further in accordance with some aspects of the present invention the filter may have a separable vessel and manifold. The manifold may have an inlet valve and outlet valve with each valve operable in use to isolate the filter from the heating system. The separable vessel and manifold may have a seal between them. The seal may comprise an inner seal and outer seal. The seals may be O rings or gasket seals. The manifold is associated with the vessel by a screw thread. The vessel may be a canister or cartridge with a transportation and/or storage seal to retain a dosing portion within and the seal removable or displaceable prior to and/or upon association with the manifold.

Further in accordance with some aspects of the present invention the recess may be central within the vessel. The recess may be reciprocally shaped to envelope the magnetic element. The recess may have a rectangular cross-section. The recess and the magnetic element may have an interference inter-lock association to retain location of the magnetic element within the recess. An inner surface of the recess may be shaped to increase surface area exposed to a fluid flow in use. The inner surface may be undulating or ribbed or have castellations. The inner surface of the recess may have a separable removable disposable cover to help cleaning, protection and/or to facilitate retention of sludge. The disposable cover may be adhesive to further capture particulate matter. The disposable cover is removable from the recess. The recess may be transparent. The disposable cover may be transparent. The disposable cover may be arranged to sag in use as particulate matter is associated with the disposable cover and/or recess under attraction to the magnetic element

Further in accordance with some aspects of the present invention the magnetic element may comprises a frame to receive a plurality of magnetic parts edge to edge. The magnetic parts may be discs. The magnetic parts may be made from rare earth Neodymium magnets. The magnetic element may have different combinations of magnetic parts associated with the element to provide a desired magnetic performance for the magnetic element in use within

the recess and the vessel. The poles of the magnetic elements may be orientated so that the axis of the magnets is perpendicular to the axis of the vessel so that the effect of the magnetic field in attracting magnetic particulate matter is maximised. A plurality of magnetic elements may be provided as a kit for a magnetic sludge filter, each magnetic element having a different performance in use. The recess and magnetic element may be matched by configuration and/or size for a particular combination. The magnetic element may be matched by colour to a type of filter, a vessel type, a heating system type and/or size or a chemical/inhibitor type. The magnetic parts may be stacked edge to edge in pairs with juxtaposition of opposite magnetic poles. Typically, two magnetic parts may be provided with opposite poles next to each other in a stack for magnetic attraction with particulate matter in a fluid flow through the filter and for location in the frame.

Further in accordance with some aspects of the present invention the vessel may include markings indicative of volume. The vessel may include an insert to vary the volume of the vessel. The insert may include a pocket to receive a solid element. The insert may float within the vessel. The insert may float when the solid element has dissolved.

The magnetic element may be configured by parts orientated so that the magnetic axis of each part is perpendicular to the axis of the vessel whereby the magnetic field for attracting magnetic particulate mater is provide about the recess and maximised.

In accordance with a fourth aspect of the present invention there is provided a magnetic sludge filter for a wet heating system, the filter comprising a vessel and a magnetic element externally mounted with a recess of the vessel, the vessel associated with a manifold having a valve operable to remove air from the vessel.

The valve may be a pressure relief valve. The pressure relief valve may be arranged to operate to open one way when a pre-determined pressure is reached in the vessel. The valve may be manually operable and/or automatic.

Embodiments of the invention will now be described by way of example only with reference to the accompanying drawings in which:

Figure 1 is a schematic illustration of a magnetic sludge filter in accordance with aspects of the present invention;

Figure 2 is a front elevation of a magnetic sludge filter; and

Figure 3 is a cross-section of a magnetic sludge filter in accordance with particular aspects of the present invention.

Wet central heating systems generally use water as a fluid pumped or driven around pipe work to radiators from a boiler with a thermostat and other controls to regulate operation. Various parts of the heating system may result in particulate matter in the system. For example parts of the radiators and boiler may be ferrous so that corrosion may create a characteristic magnetic sludge in the heating system. It is normal to add an inhibitor generally in the form of a solution or liquid chemical portion to a desired dosing level but such inhibitors are not absolute and a certain level of magnetic sludge is inevitable particularly with waters having certain characteristics including hardness values and acidity levels, the use of dissimilar metals in contact, and some dissolved oxygen from adventitious air ingress. The magnetic sludge should be removed to maintain the efficiency of the system and life of components.

Being ferrous it will be appreciated that it is known to provide a magnetic element which extends through a header cap into a flow vessel of a prior magnetic sludge filter in order to attract the magnetically inducible particulate matter to it. The vessel is connected to the heating system with an inlet and an outlet with a cumbersome process needed to remove the magnetic sludge or particulate matter involving releasing the magnetic element with the cap and then draining the vessel thorough a drain valve at the bottom of the vessel. The process is messy, time consuming and it will be understood that once the magnetic element is removed the magnetic sludge is released into the vessel rather than kept in a light concentration near to the magnetic element. In such circumstances a part of the released magnetic sludge may be returned to the heating system by gravity and siphoning effects.

Aspects of the present invention provide a magnetic sludge filter for a wet central heating system in which the magnetic sludge can be retained within a flow vessel until disposal and flushing of the vessel. Figure 1 provides a schematic illustration of a cross-section of a magnetic sludge filter 1 in accordance with aspects of the present invention. A first aspect is the provision of a readily detachable flow vessel 2 with a recess or pocket 3 extending into the vessel 2. The recess 3 accommodates a magnetic element 4 externally but which also extends into the vessel 2. A second aspect of the present invention is that the magnetic element 4 comprises a frame with a plurality of magnetic parts in an edge to edge stack in a pole to opposite pole orientation. By the second aspect the magnetic element 4 can have a much greater magnetic flux density in comparison with prior magnetic elements. A third

aspect of the invention relates to provision of a vane 5 which extends across the vessel generally aligned with the recess 3 and extending towards the recess 3. The vane 5 is generally part of or associated with a manifold 6 such that a fluid flow shown by arrowheads can flow from an inlet 7 to an outlet 8 past the recess 3 rather than directly between them. As seen normally the vane 5 does not extend completely to contact the recess 3 as this is unnecessary to urge desired flow past the recess 3 such that by magnetic attraction inducible particulate matter can become associated and adhere to an inner surface of the recess. All of these aspects along with other features as described below may be included together or separately in a magnetic sludge filter in accordance with aspects of the present invention.

The manifold 6 and the vessel 2 are associated together in operation with normally a screw thread and seals, an inner O ring seal and an outer gasket seal as described later. The inlet 7 and the outlet 8 have a respective valve 9, 10 which can be shut or closed to fluid flow and so effectively isolate the magnetic sludge filter 1 from the remainder of the heating system. In such circumstances it will be appreciated that with the valves closed then the vessel 2 can be detached from the manifold 6 with the magnetic element 4 still within the recess 3. In such circumstances the magnetic element 4 will ensure that magnetically induced particulate matter remains adhered to the inner surface of the recess 3 under the attraction of the magnetic element 4. The liquid in the vessel 2 can be poured away, then the magnet element 4 removed and the vessel 2 then flushed in an appropriate manner to remove the now less adhered particulate matter (magnetic attraction from the magnetic element has been removed) from the inner surface of the recess 3.

The recess 3 and the magnetic element 4 are shaped and sized so that there is a reciprocal association. The magnetic element 4 will normally be a close fit within the recess 3 to maximise the magnetic field and flux for attraction of particulate matter and so that there is interference for retention of location of the magnetic element in the recess 3 and so the magnetic sludge filter 1. Orientation of the magnetic element 4 and magnet parts therein is key to maximizing use of the field to catch as much magnetic sludge as possible. The magnet parts and magnet element will generally be aligned with the major longitudinal direction of the major part of the recess and typically the vessel so that the parts are edge to edge, pole to opposite pole to maximise magnetic flux substantially perpendicular to that axis for attraction of sludge particles in the fluid flow. To ensure or further ensure appropriate location and retention of that location in the recess 3 normally some form of inter-lock is provide so in the example illustrated in figure 1 respective detents 11, 12 are provided to

inter-engage with each other unless a displacement force is applied to push the magnetic element 4 into the recess 3 or pull the magnetic element 4 out of the recess 3. The magnet element 4 will be formed with parts such that the edges of adjacent and so poles of the magnet parts are aligned pole to opposite pole in line to increase available magnetic flux for sludge attraction in the filter.

The recess 3 is normally centrally located within the vessel 2 and so in the main fluid flow between the inlet 7 and the outlet 8. However, it will be appreciated that more than one recess and so magnetic element could be provided in the same vessel for respective interaction with the fluid flow.

It will be appreciated that there may be situations where different levels of magnetic interaction with the fluid flow may be desirable. For example at initial heating system set up or when the system has been subject to a flush with a flushing solution then more rapid removal of magnetic sludge may be desirable. In such circumstances the magnetic element 4 may be pushed further into the recess 3 than normally so a greater part of the inner surface of the recess is then available for adhesion of particulate matter under the influence of the magnetic element or simply a more powerful magnetic element, or a greater number of magnetic elements introduced. In either event it will be appreciated on a like for like basis more magnetic sludge will be removed in a quicker time returning the heating system to equilibrium.

In the normal course of events the vessel 2 and the magnetic element 4 will be matched for a particular heating system. The vessel 2 will have a size adequate to act as a magnetic sludge filter for the associated heating system; it will be understood that a four radiator system will generally not generate as much magnetic sludge as a twelve radiator system. The size of the magnetic sludge filter may be a drag on the pump for the heating system. In such circumstances the recess for each vessel will be sized and shaped so at it will only accommodate and retain in position magnetic elements of a particular size and configuration so ensuring that the correct magnetic element is used. Furthermore the vessel 2 and the magnetic element 4 could be matched by colour so that the correct combination is used.

The vessel 2 will normally have a volume in the order of a 250ml or 500ml as a definition of a desired single dose of inhibitor chemicals and so may provides a convenient means of access to dose the heating system with an inhibitor chemical. This could be particularly useful in systems which do not have a header tank. The vessel 2 as indicated acts to allow a

through flow when associated with the manifold. The vessel 2 could be canister or cartridge pre-loaded with an inhibitor chemical.

A magnetic sludge filter 1 in accordance with aspects of the present invention as indicated above will have the manifold 6 associated with the vessel 2 with a head unit to connect them. The manifold 6 allows the filter 1 to be secured through the inlet 7 and outlet 8 to the heating system pipe work. The vessel 2 in the form of a canister provides means for flow about the recess 3 and hence the externally associated magnetic element 4. A fluid tight association must be provided between the head unit of the manifold 6 and the vessel 2 and this is generally done with a screw thread and appropriate seals. The magnetic element 4 is generally a plastic frame or tray to receive magnetic parts such as pairs or stacks of disc magnets formed from a suitable material e.g. Neodymium rare earth magnets. The discs are edge to edge, pole to opposite pole.

It will be understood that the magnetic sludge filter 1 by necessity needs to be robust so an appropriate material will be used for the manifold 6, the vessel 2 and any retaining ring (not shown in figure1). Suitable materials include a cast austenitic stainless steel, for example steel number 1.4301 listed in BS10088-1:2005 or an equivalent (such as the former designation 304). An all metal structure is preferred to a plastic structure to provide greater durability and long term integrity. However, the magnetic element 4 will tend to be a plastic frame to allow easy of mounting and presentation of the magnetic elements in the recess 3.

The inlet 7 and the outlet 8 as indicated above generally have valves 9, 10 respectively to allow isolation of the filter 1 so that the vessel 2 can be readily removed. These valves 9, 10 may be integral within the inlet 7/outlet 8 or separate but in either arrangement provide normally through compression type fittings connections to the remainder of the heating system.

The vessel 2 and the magnetic element 4 are removable from the manifold 6/header together so that the magnetic sludge particles remain enthralled with the magnet element 4 through the walls of the recess 3. The element 4 remains in place through an interference fit and/or an interlock arrangement 11 so it can be separated. It will also be understood that a handle or knob 12 will normally be provided at one end of the magnetic element 4 to allow manipulation of the element 4 into and out of the recess. Such a handle 12 may also allow the element 4 to be turned periodically and/or adjusted in and out of the recess if necessary.

The vessel 2 is moulded or cast or shaped to provide an internal central rectangular recess 3 for reception of the magnetic element 4 though an opening in the base of the vessel 2.

By provision of an internally extending recess it will be noted that the recess can be centrally located with the magnet compared to prior arrangements where the magnet element was attached to and protruded from the side of the bowl. Such external mounting of the magnetic element into a pocket recess allows magnetic filtering out of the magnetic sludge to adhere to the inner surface of the recess without direct contact with a fixed magnetic element. Such an association allow dis-assembly with the magnetic element and then flushing along with greater flexibility with respect to magnetic element design along with other elements of the magnetic sludge filter. The magnetic element traps magnetic material in the fluid flow but the magnetic element may be rectangular or at least the frame for magnetic parts can be rectangular with those magnetic parts assembled in a variety of magnetic forms. The magnetic element can therefore be designed in a rectangular form or otherwise so that the magnetic parts and hence the magnetic field is presented to a fluid (water) flow in the heating system to optimise magnetic attraction of suspended magnetic particles with magnetic fields orthogonal to fluid flow.

A rectangular magnet housing for the magnetic element allows options for presenting the magnetic field to the fluid flow with restricted flow past the short side and unrestricted flow past the long side. Thus, as described in a preferred embodiment and in accordance with second aspects of the present invention a magnetic element 4 is provided comprising two pairs of magnetic parts in the form of discs. It will be appreciated that other forms and numbers of magnetic parts is possible. The magnetic parts are aligned in a frame or housing with opposite poles side by side or edge to edge in order to enhance and amplify the magnetic attraction and also as opposite poles attract a light plastic frame is all that is need to retain the magnetic parts together as they are attracted to each other.

It will be understood that whilst it is advantageous to render the vessel 2 separable from the manifold 6 it is important to maintain the integrity and operation of the filter 1. In such circumstances as described above the vessel 2 is either attached directly by a screw thread association. Alternatively, a screw thread collar is provided to extend between the vessel 2 and the manifold 6 over external threads. By such a configuration the screw thread collar will ensure that the screw thread does not come into contact with the fluid of the central heating system and so will not suffer problems of seizure after long periods. To further restrict such seizure problems as described previously a double seal approach is advantageous in that a

gasket seal is provide about an outer association between the head or manifold 6 and the screw thread retaining collar and an O ring seal provided as an inner seal in contact with or wetted by the fluid of the wet central heating system. It will also be understood that by using a retaining collar the rather than applying force to the vessel itself to demount the vessel 2 the releasing forces are applied to the collar or retaining ring causing less disturbance of the vessel 2 and of scattering or release of adhered/trapped magnetic particles taken from the fluid flow. The vessel 2 and the magnetic element 4 are removed together with the fluid/trapped magnetic sludge. The fluid is removed by inverting the vessel 2 with the magnetic element 4 still in place within the recess 3. The magnetic element 4 can then be withdrawn from the recess 3 in the vessel 2. The trapped magnetic sludge can then be rinsed from the vessel 2 with the magnet element 4 withdrawn and under better controlled conditions reducing mess and waste.

The provision of valves 9, 10 allows the filter 1 to be isolated in a heating system or possibly fluid flow in the heating system to be diverted into a by-pass. In either event the vessel 2 can be removed and magnetic sludge flushed out. Furthermore in accordance with aspects of the present invention the vessel 2 can seen as a convenient way of dosing an effectively closed wet heating system such as used for example with combination boilers. As background it will be understood that traditional gravity fed boiler arrangements have a header tank and so this header tank has provide a convenient if inefficient means of introducing inhibitor chemicals to a heating systems. In modern systems generally the header tank is replaced with an expansion tank as the heating system is closed. In such circumstances it is quite normal to introduce the inhibitor chemical through any convenient means such as identifying the highest radiator and partially draining the system so that inhibitor chemicals can be introduced through a funnel into the bleed plug of the radiator. Clearly this is not ideal but avoids a more substantial drain down of the system.

With a separable vessel 2 it will be understood that this vessel 2 may be loaded or filled with a dosing portion of inhibitor chemical after removal of magnetic sludge. Thus, by rendering the vessel 2 separable through the valves 9, 10 an easy approach to introducing inhibitor chemical is achieved. Furthermore, more surety that the correct dosage has been introduced can be achieved. The dosage can be measured into the vessel dependent upon the size of the heating system and with more specification along with accuracy to the particular fluid volumes in the system reducing use of chemicals and costs. Alternatively, the vessel itself can be a measure either through graduations or markings for volume in the vessel or the vessel having a known volume so when fully filled that volume of chemical is introduced to

the system. Typically the vessel 2 will be designed to have a volume at least greater than 250 ml so that the vessel 2 can facilitate dosing of inhibitor chemicals in 250ml quantities.

It will also be understood that an insert may be provided within the vessel 2 which changes its volume to that required in terms of a dose of inhibitor chemical or provides a means to present inhibitor chemical in a solid form to dissolve as required and possibly to an extent necessary for the heating system when the filter is re-attached to the heating system and fluid flows again.

A vent 14 is typically provided within the header part of the manifold 6 for venting any air within the vessel 2. Furthermore the vent 14 may be used to extract small samples of heating system fluid for testing in terms of condition and inhibitor effectiveness by laboratory analysis, on site chemical testing or dipping of electronic test devices. The vent will normally be a valve which may also be pressure relieving with manual or automatic control.

By providing the recess 2 and the magnetic element 4 towards the bottom of the vessel 2 it will be understood that means are needed to ensure the recess 3 is 'washed' by a substantial proportion of the heating system fluid flow. In accordance with third aspects of the present invention the vane 5 protrudes towards the recess 3 to direct flow over the central recess 3 and so near to the magnetic element 4. Magnetic particles in flow will then be attracted by the element 4 so that these magnetic particles adhere to the inner surface of the recess 3. The vane 5 is typically flat and rectangular across the vessel 2. The vane 5 acts as a flow divider or baffle to inhibit direct flow between the inlet 7 and the outlet 8 so diverting some flow at least towards the recess 3.

The vane 5 may be associated with fittings to facilitate a power flushing action within the vessel 2 when the inlet 7 and outlet 8 are closed. The vane 5 could be attach to a suitably designed fitting in place of the canister and the vane 5 employed as a blanking plate separating the in and out flow channels. The fitting would have hose or other attachments for connecting with a power flushing machine, and hence provide a simple and effective means of connecting the system with a power flushing machine for cleansing the system (not the canister or vessel of the filter).

Figures 2 and 3 show further aspects of the present invention in a more practical form with consistent reference nomenclature used for comparison with figure 1. In such circumstance is will be noted in the front elevation depicted in figure 2 a vessel 2 in the form of a canister

or cartridge is provided and secured in association with a manifold through a retaining ring or collar 6a. The manifold 6 has an inlet 7 and an outlet 8 to allow the magnetic sludge filter 1 to be secured to a wider heating system (not shown). The retaining ring or collar 6a acts through a screw thread to bridge external screw threads in the respective vessel 2 and manifold 6. A handle or knob 12 part of a magnetic element (not fully shown) extends below the vessel 2. The knob 12 allows insertion and retraction of the magnetic element 4 as required. The manifold 6 includes a pressure relief and air and sampling vent 14 in the outlet part 8 of the manifold.

Figure 3 provides a cross-section of the magnetic sludge filter 1 shown in figure 2. Thus, the vessel 2 is secured to the manifold 6 by a retaining collar or ring 6a with a vane 5 extending into the vessel 2 towards a recess 3 in the vessel 2. Within the recess 3 a magnetic element 4 is located and secured by an interference fit and/or an interlock detent 11 towards an opening end of the recess 3. As described previously a fluid flows from the inlet 7 to the outlet 8 through the vessel 2. The vane 5 ensures that a more significant proportion of the flow is forced near to recess 3 and so the magnetic element 4.

The magnetic element 4 comprises a frame made of plastic with apertures 21 to receive respective magnetic parts (not shown) in opposite pole to opposite pole configuration to maximise the magnetic field. In the example illustrated the apertures are circular to accept magnetic parts in the form of discs. In use the heating system fluid will flow about the recess 3 so that with the element 4 within the recess 3 it will be appreciated those magnetic particles will be attracted and adhere to the inner surface 3a of the recess 3 and will remain attracted whilst the element 4 remains within the recess 3.

It will be appreciated by those skilled in the art that any number of combinations of the aforementioned features and/or those shown in the appended drawings provide clear advantages over the prior art and are therefore within the scope of the invention described herein.

Claims

1. A magnetic sludge filter for a wet heating system, the filter comprising a vessel with a recess extending internally within a cavity of the vessel and a separable magnetic element located externally within the recess, the filter having means to direct a fluid flow in use into the cavity about the recess whereby magnetically inducible particulate matter in the flow is attracted to the surface of the recess.

2. A magnetic sludge filter for a wet heating system, the filter comprising a vessel with a recess extending internally within a cavity of the vessel and a magnetic element comprising a probe to extend from the exterior into the recess, the probe having apertures to receive magnetic elements edge to edge in a stack in the direction of the probe.

3. A magnetic sludge filter for a wet heating system, the filter comprising a vessel with a recess extending internally within a cavity of the vessel and a magnetic element, the filter having a vane extending towards the recess across the vessel and in association with a manifold for closure of the vessel, the manifold having an inlet and an outlet with the vane extending between them to act as a baffle to direct flow of a fluid in use between the inlet and the outlet.

4 A filter as claimed in any of claims 1 to 3 wherein the filter the vessel and the manifold are separable with the separable magnetic element within the recess.

5. A filter as claimed in claim 3 or claim 4 wherein the manifold has an inlet valve and an outlet valve with each valve operable in use to isolate the filter from the heating system.

6. A filter as claimed in any of claims 3 to 5 wherein the separable vessel and manifold have a seal between them.

7. A filter as claimed in claim 6 wherein the seal comprises an inner seal and outer seal.

8. A filter as claimed in claim 7 wherein the seals are O rings or gasket seals.

9. A filter as claimed in any of claims 3 to 8 wherein the manifold is associated with the vessel by a screw thread.

10. A filter as claimed in any proceeding claim wherein the vessel is a canister or cartridge with a transportation and/or storage seal to retain a dosing portion within and the seal removable or displaceable prior to and/or upon association with the manifold.

11. A filter as claimed in any proceeding claim wherein the recess is central within the vessel.

12. A filter as claimed in any proceeding claim wherein the recess may be reciprocally shaped to envelope the magnetic element.

13. A filter as claimed in any proceeding claim wherein the recess has a rectangular cross-section.

14. A filter as claimed in any proceeding claim wherein the recess and the separable magnetic element have an interference inter-lock association to retain location of the magnetic element within the recess.

15. A filter as claimed in any proceeding claim wherein an inner surface of the recess is shaped to increase surface area exposed to a fluid flow in use.

16. A filter as claimed in claim 15 wherein the inner surface is undulating or ribbed or have castellations.

17. A filter as claimed in any proceeding claim wherein the inner surface of the recess has a disposable cover.

18. A filter as claimed in claim 17 wherein the disposable cover is removable from the recess.

19. A filter as claimed in any proceeding claim wherein the recess is transparent.

20. A filter as claimed in claim 17 or claim 18 wherein the disposable cover is transparent.

21. A filter as claimed in any of claims 17, 18 or 20 wherein the disposable cover is arranged to sag in use as particulate matter is associated with the disposable cover and/or recess under attraction to the magnetic element

22. A filter as claimed in any proceeding claim wherein the magnetic element comprises a frame to receive a plurality of magnetic parts edge to edge.

23. A filter as claimed in claim 22 wherein the magnetic parts are discs.

24. A filter as claimed in claim 22 or claim 23 wherein the magnetic parts are made from Neodymium rare earth magnets.

25. A filter as claimed in any of claims 22 to 23 wherein the magnetic element can be configured to have different combinations of magnetic parts associated with the element to provide a desired magnetic performance for the magnetic element in use within the recess and the vessel.

26. A filter as claimed in any proceeding claim wherein a plurality of magnetic elements can be provided as a kit for a magnetic sludge filter, each magnetic element having a different performance in use.

27. A filter as claimed in proceeding claim wherein the recess and magnetic element are matched by configuration and/or size for a particular combination.

28. A filter as claimed in claim 27 wherein the magnetic element is matched by colour to a type of filter, a vessel type, a heating system type and/or size or a chemical/inhibitor type.

29. A filter as claimed in claim 22 and any claim dependent thereon wherein the magnetic parts are stacked edge to edge in pairs or more and with juxtaposition of opposite magnetic poles to amplify the magnetic flux available for magnetic attraction with particular matter in a fluid flow through the filter.

30. A filter as claimed in claim 29 wherein two magnetic parts are provided with opposite poles next to each other in a stack for magnetic attraction with particulate matter in a fluid flow through the filter and for location in the frame.

31. A filter as claimed in any proceeding claim wherein the vessel includes markings indicative of volume

32. A filter as claimed in claim 31 wherein the vessel includes an insert to change the volume of the vessel for an inhibitor chemical.

33. A filter as claimed in claim 31 or claim 32 wherein the insert includes a pocket to receive a solid element.

34. A filter as claimed in any of claims 31 to 33 wherein the insert is buoyant and floats within the vessel when full of fluid in use.

35. A filter as claimed in claim 34 wherein the insert floats when the solid element has dissolved.

36. A filter as claimed in any proceeding claim wherein the magnetic element is configured by parts orientated so that the axis of each part is perpendicular to the axis of the vessel whereby the magnetic field for attracting magnetic particulate mater is provide about the recess.

37. A filter as claimed in any proceeding claim wherein the vessel includes a valve to allow air and/or fluid pressure to be removed or relieved in the vessel and/or a heating system in use.

38. A sludge filter for a wet heating system, the filter comprising a vessel and a magnetic element externally mounted with a recess of the vessel, the vessel associated with a manifold having a valve operable to remove air from the vessel.

39. A filter as claimed in claim 38 wherein the valve is a pressure relief valve.

40 A filter as claimed in claim 39 wherein the pressure relief valve is arranged to operate to open one way when a pre-determined pressure is reached in the vessel.

41. A filter as claimed in any of claims 38 to 40 wherein the valve is manually operable and/or automatic.

42. A magnetic sludge filter for a wet heating system substantially as hereinbefore described with reference to the accompanying drawings.

Application No:	GB1208551.0	**Examiner:**	Stephen Hart
Claims searched:	1 at least	**Date of search:**	21 November 2013

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1, 11 & 29 at least	GB 2500908 A (ECLIPSE MAGNETICS LTD) see figs 2 & 3, noting magnetic filtration device 105 comprising a plurality of stacked magnets inside a tube (recess) 303.
X	1, 11 & 29 at least	GB 2486172 A (ADEY HOLDINGS 2008 LTD) see whole document, noting a plurality of stacked magnets 58 inside a sleeve (recess) 56.
X	1, 11 & 29 at least	GB 2491246 A (ADEY HOLDINGS 2008 LTD) see whole document, noting a plurality of stacked magnets inside a central section (recess) 36.
X	1 & 11 at least	GB 2490898 A (LETTERGOLD PLASTICS LTD) see whole document, noting a magnet 47 located in a tube 35 (recess).
X	1 & 11 at least	EP 1445024 A (PROGALVA NET ET 9) 11.08.04 (see figs 1 & 2, EPODOC Abstract and also WPI Abstract Accession No. 2004-470307).

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

Worldwide search of patent documents classified in the following areas of the IPC

B01D; C02F; F24D

The following online and other databases have been used in the preparation of this search report

Online: WPI, EPODOC, TXTE

International Classification:

Subclass	Subgroup	Valid From
F24D	0019/00	01/01/2006
B01D	0021/00	01/01/2006
C02F	0001/48	01/01/2006